Quantifying Replenish Benefits in Community Water Partnership Projects

Prepared for:

The Coca-Cola Company

in collaboration with GETF

March 30, 2015
March 27, 2015

Mr. Joe Rozza, PE, BCEE
Global Water Resource Sustainability Manager
The Coca-Cola Company
PO Box 1734
Atlanta, Georgia 30301

RE: 2014 Replenish Validation

Dear Mr. Rozza:

Deloitte Consulting LLP is pleased to submit this letter report summarizing our 2014 replenish validation efforts for The Coca-Cola Company (TCCC). As further described below, based on our review of fact sheets prepared by LimnoTech quantifying water-related replenish benefits for new and updated Community Water Partnership (CWP) activities as well as the TCCC 2014 replenish report and associated water quantity, water quality, and quantification of full access to water benefit summary tables prepared by LimnoTech and the Global Environment & Technology Foundation (GETF), Deloitte has determined that the current estimate that projects implemented by the end of 2014 will provide a replenish benefit of approximately 153.6 billion liters per year (BL/yr), representing 94 percent of the 162.6 BL/yr sales volume generated by TCCC facilities in 2014, is valid.

Background
TCCC is committed to balancing the water used in its finished products by 2020 through participation in locally relevant projects that support communities and nature. TCCC quantifies water-related “replenish” benefits derived through three categories of CWP projects: 1) Watershed Protection, 2) Water for Productive Use, and 3) Water Access and Sanitation. Deloitte was engaged to review and validate 65 fact sheets quantifying water-related replenish benefits for new and updated CWP activities, as well as TCCC’s 2014 replenish report and associated water quantity, water quality, and quantification of full access to water benefit tables summarizing the results of all projects, including projects implemented in prior years with continuing benefits, contributing to global progress for the calendar year ending December 31, 2014. The fact sheets, replenish report, and benefit summary tables were prepared by LimnoTech (Watershed Protection and Water for Productive Use activities) and GETF (Water Access and Sanitation activities) on behalf of TCCC.

Methodology
Deloitte conducted its review in accordance with the strategic framework for water mass balance at the enterprise level outlined in the “Corporate Water Stewardship: Achieving a Sustainable Balance” paper published in the Journal of Management and Sustainability in November 2013.1 Within this framework, quantification of CWP project benefits is achieved either through metering or standard methods known and accepted by the engineering, conservation, and social science professions. According to the approach outlined in the paper, a 100 percent

sustainable balance is achieved when an enterprise implements a portfolio of locally relevant CWP projects that collectively produce an annual volumetric benefit equivalent to the annual volume of consumptive water use for that particular enterprise.

The quantification approach for Watershed Protection and Water for Productive Use projects is also described in a January 2010 “Quantifying Watershed Restoration Benefits in Community Water Partnership Projects” report, and the methods for replenish benefits generated through Water Access and Sanitation projects are provided in a 2009 “Quantifying Water Access Benefits in Community Water Partnership Projects” report. Additional details on quantification methodologies for CWP projects are provided in a May 2010 “Replenish Project Guidelines: Community Water Partnerships (CWP)” report and Replenish Program Policy documents. TCACC’s annual Water Stewardship and Replenish Reports provide details on the Company’s water stewardship goals and key partnerships, and include summaries of ongoing CWP projects.

Scope
Our review of fact sheets prepared by LimnoTech primarily consisted of evaluating the completeness of fact sheet information, confirming the appropriateness of the methodology used for calculating project benefits, checking the fact sheet benefit calculations (e.g., total estimated benefit adjusted according to the implementation timeline, and TCACC’s percent contribution to the project based on the estimated cost share), working with TCACC and LimnoTech to incorporate additional data requirements and fact sheet revisions, and accepting or rejecting the final fact sheet. Deloitte primarily reviewed the replenish report and associated benefit summary tables for completeness and accuracy.

Deloitte did not conduct a peer or technical review; rather, the decision to accept or reject the results was based on the replenish concept and methodologies described above. Our approach is not considered to be verification (defined as evaluating whether or not a product, service, or system complies with a regulation, requirement, specification, or imposed condition), assurance services (defined as independent professional services that improve the quality or context of information for decision makers to reduce risks associated with incorrect information), or an examination (the objective of which would be to express an opinion on the replenish report). Accordingly, Deloitte’s review is not intended to provide assurance of the replenish report or TCACC’s compliance with laws or regulations, and Deloitte does not express an opinion of the replenish report.

Preparation of the replenish report requires identifying new projects that generate replenish benefits, verifying that projects implemented in prior years continue to generate the reported benefits, identifying previously reported projects with updated information that may affect quantification results, identifying data and information needs, developing estimates and assumptions that affect reported information, quantifying replenish benefits for projects with sufficient data for calculations, evaluating whether or not projects that generate exceptionally high benefits

3 GETF and Dr. Albert Wright, “Quantifying Water Access Benefits in Community Water Partnership Projects,” prepared for The Coca-Cola Company. September 2009. ([http://assets.coca-cola.company.com/84/39/629ba3ea446f78b60f8ce7f7726a9/water_access_benefits.pdf](http://assets.coca-cola.company.com/84/39/629ba3ea446f78b60f8ce7f7726a9/water_access_benefits.pdf))
should be adjusted in accordance with TCCC’s formal policy on benefit capping, and determining the relevancy of information to be included. Each project may make different, but acceptable interpretations and determinations.

The replenish report prepared by LimnoTech and GETF includes information regarding TCCC’s water stewardship goals, sales volumes, actual and forecasted replenish benefits, and the estimated impact of CWP projects on TCCC’s water stewardship goals. The 2014 estimate of benefits represents current performance. The 2014 replenish benefits are anticipated to continue to be generated through the year 2020 provided that the projects remain in productive service, but actual results in the future may differ materially from TCCC’s current assessment since projects and circumstances may not develop as expected. Projected benefits will be validated before being reported as actual benefits.

Results

The final report for 2014 prepared by LimnoTech and GETF estimates that 94 percent of the sales volume generated by TCCC facilities in 2014 has been replenished through CWP projects, 48 activities are reducing sediment loads by approximately 4 million metric tonnes/year (water quality benefits of Watershed Protection projects primarily focus on reduction in sediment yield associated with erosion control), approximately 88 metric tonnes of other pollutants, such as nutrients and pathogens, are no longer released to waterways as a result of the activities, and 1,119,887 beneficiaries are provided with full access to water through Water Access and Sanitation projects. All 65 new and updated fact sheets, the replenish report, and benefit summary tables have been reviewed, and Deloitte has determined that the stated benefits are valid. Nothing came to our attention that caused us to believe: that the replenish report does not include the required elements to quantify CWP project benefits through either metering or standard methods known and accepted by the engineering, conservation, and social science professions; that the quantified replenish benefits have not been accurately derived; or that the underlying information, determinations, estimates, and assumptions utilized do not provide a reasonable basis for the disclosures contained in the replenish report.

In 2013, Deloitte was also engaged to review and validate the quantification of water-related replenish benefits for 54 new and updated CWP activities and to prepare TCCC’s 2013 replenish report. Deloitte did not review comparative disclosures for 2010 through 2012 and, accordingly, Deloitte does not express any form of validation on them. However, prior disclosures were reported to be validated by other third parties (e.g., The Nature Conservancy).

Will Sarni
Director and Practice Leader, Enterprise Water Strategy
Deloitte Consulting LLP

---

# TABLE OF CONTENTS

1 Introduction ................................................................. 1  
   1.1 Previous Studies .................................................... 1  
   1.2 Quantification Approach ........................................ 2  

2 Quantification Results ............................................. 3  
   2.1 Combined Replenish Benefits ................................. 3  
   2.2 Benefits of Watershed Protection Activities .......... 4  
      2.2.1 Water Quantity Benefits ............................... 4  
      2.2.2 Water Quality Benefits ................................. 4  
   2.3 Benefits of Water for Productive Use Activities ...... 4  
   2.4 Benefits of Water Access and Sanitation Activities .. 5  

3 References ................................................................. 7  

APPENDICES

Appendix A. Quantification Results: Watershed Protection Projects  
Appendix B. Quantification Results: Water for Productive Use Projects  
Appendix C. Quantification Results: Water Access and Sanitation Projects  
Appendix D. Fact Sheets for Watershed Protection Projects  
Appendix E. Fact Sheets for Water for Productive Use Projects  
Appendix F. Fact Sheets for Water Access and Sanitation Projects  
Appendix G. Fact Sheets for Continuing Projects Previously Validated by Others
Introduction

The Coca-Cola Company is quantifying the water-related “Replenish” benefits derived through its Community Water Partnership (CWP) projects. The work described in this report builds on previous efforts, and provides a current status of quantification results for three categories of CWP projects: Watershed Protection; Water for Productive Use; and Water Access and Sanitation. The Coca-Cola Company’s “Water Stewardship and Replenish Report” (TCCC, 2014) describes these projects as follows:

- **Watershed Protection**: These projects vary greatly in scope and scale, but all support the sustainable and equitable use of water, conserve or restore water quantity or quality, and yield measurable benefits for nature and communities.
- **Water for Productive Use**: These projects promote the efficient and sustainable use of water to protect the environment and provide economic community benefits, such as rainwater harvesting or water reuse for irrigation.
- **Water Access and Sanitation**: Often referred to as WASH (water, sanitation and hygiene) projects, these generate social and economic benefits through improved access to safe drinking water (e.g., installing wells, purification systems, or water storage facilities) and sanitation (e.g., providing pit latrines or septic systems).

### 1.1 Previous Studies

During previous phases of work, the types of activities that generate Replenish benefits were identified, and past and ongoing CWP projects were reviewed and categorized. Methodologies for quantifying Replenish benefits and associated data needs were identified, and the methods were applied to projects with sufficient data for the calculations. The quantification approach and results for Watershed Protection and Water for Productive Use projects are described in a January 2010 report (LimnoTech and TNC, 2010a) and updated results including water access benefits are provided in a December 2010 report (LimnoTech and TNC, 2010b), a 2011 report (LimnoTech and TNC, 2012), a 2012 report (LimnoTech and TNC, 2013), and a 2013 report (Deloitte, LimnoTech and GETF, 2014). The methods for Replenish benefits generated through Water Access projects are provided in a 2009 report (GETF and Wright, 2009). The Replenish quantification methodology has also been described in a peer-reviewed journal paper (Rozza et al., 2013).

The Coca-Cola Company’s “Water Stewardship and Replenish Report” (TCCC, 2014) provides details on the Company’s water stewardship goals and key partnerships, and includes summaries of ongoing CWP projects.
1.2 Quantification Approach

The results provided in this report represent an update of previous quantification results, and also include carry-over benefits from projects that have not changed, but which are still contributing. The updated results are the outcome the following steps:

1. New project activities that are generating Replenish benefits were identified;
2. Updated project information that may affect previous quantification results was identified;
3. Key data and information needed to quantify benefits were obtained and reviewed;
4. Replenish benefits were calculated for new activities, and updated where needed for activities that were evaluated previously; and
5. Replenish benefits for new and updated activities were reviewed and validated.
Quantification Results

2.1 Combined Replenish Benefits

The current estimate is that projects implemented by the end of 2014 provide a Replenish benefit of approximately 153.6 billion liters per year (BL/yr), representing approximately 94% of the 162.6 BL/yr sales volume generated by TCCC facilities. This estimate of benefits for 2014 represents current performance. The 2014 Replenish benefits are anticipated to continue to be generated through the year 2020 provided that the projects remain in productive service, but benefits will be verified before they are reported as actual benefits.

There are several projects that generate exceptionally high benefits that, if unadjusted, would have a disproportionate effect on global progress that would be inconsistent with the goals of the program. In 2012, The Coca-Cola Company developed a formal policy on benefit capping. This policy sets a cap for exceptionally large projects in a way that supports TCCC’s continued commitment to the credibility of Replenish benefits reported, yet still recognizes a fair accounting of Replenish benefits from the largest-benefit projects. Implementation of the capping policy adjusts benefits for four projects.

The pollution reduction benefits of Watershed Protection projects were also estimated. The primary focus of most of the CWP projects that address water quality problems is erosion control, so the reduction in sediment yield was estimated where relevant. The current estimate is that in 2014, 41 activities are reducing sediment loads by over 3.8 million metric tons/year. These reductions are significantly improving the quality of receiving waters in those watersheds.

1 Please also note that in accordance with the previously established methodology, benefits reported for each year are the benefits generated at the end of that calendar year. When an activity was reported to be completed during a given year, it “counted” toward the end-of-year benefit for that year.
2.2 Benefits of Watershed Protection Activities

The information obtained through this phase of work was sufficient to quantify new and updated benefits from 51 Watershed Protection activities.

Water quantity and water quality benefits are presented separately below. Additional details are provided in Tables A1 and A2 in Appendix A. For each activity that was quantified, the tables present the total estimated benefit, Coca-Cola’s percent contribution to the project, and the activity timeline. For projects that TCCC did not solely fund, the total benefit was adjusted based on the estimated cost share. The total benefit is also adjusted according to the timeline for implementation.

The supporting documentation for each new or updated Watershed Protection project that was quantified is provided in individual fact sheets, which are included in Appendix D. Each fact sheet includes a basic description of the activity with watershed protection/restoration benefits, contact information, the water quantity and/or water quality benefit that was estimated, the approaches used to make the estimates, and the source of data and information used to compute the quantity/quality benefits.

2.2.1 Water Quantity Benefits

The current estimate is that the Watershed Protection projects implemented by the end of 2014 are providing a TCCC benefit of approximately 121.1 BL/yr. This reflects an adjustment for four large-scale projects, as described in Section 2.1.

2.2.2 Water Quality Benefits

The water quality benefits of watershed protection projects were also estimated. Erosion control was the primary focus of almost every CWP project that addresses water quality. Therefore, the reduction in sediment yield was estimated for relevant projects. The CWP activities evaluated are estimated to reduce sediment yield in 2014 by over 3.8 million metric tons/year (adjusting for TCCC cost share). These reductions are significantly improving the quality of receiving waters as a result of these activities.

Many watershed protection activities are also reducing other pollutant loads, including nutrients and pesticides. The current estimate is that approximately 88 metric tons of other pollutants are no longer released to waterways as a result of the activities (adjusting for TCCC cost share).

2.3 Benefits of Water for Productive Use Activities

The information obtained through this phase of work was sufficient to quantify new and updated benefits from 9 Water for Productive Use activities, for a total of 26 activities quantified to date. The current estimate is that projects implemented by the end of 2014 are providing a TCCC benefit of approximately 25.6 BL/yr.

Additional details are provided in Table B1 in Appendix B. For each activity that was quantified, the table presents the total estimated benefit, Coca-Cola’s percent contribution to the project, and the activity timeline. For projects that TCCC did not solely fund, the total benefit was adjusted based on the estimated cost share. The total benefit is also adjusted according to the timeline for implementation.

The supporting documentation for each Water for Productive Use activity that was quantified is provided in individual fact sheets, which are included in Appendix E. Each fact sheet includes a basic description of the activity with the water for productive use benefits, contact information, the water quantity benefit that was estimated, the approaches used to make the estimates, and the source of data and information used to compute the quantity benefits.
2.4 Benefits of Water Access and Sanitation Activities

The benefits of 75 Water Access and Sanitation activities have been quantified to date. A total 1,119,887 beneficiaries are provided with access to water through these projects. Replenish benefits by project are provided in Appendix C, and Appendix F provides fact sheets for selected Water Access and Sanitation projects, including all projects with new or updated activities in 2014.

The current estimate is that the Water Access and Sanitation projects implemented by the end of 2014 are providing a TCCC benefit of over 6.8 BL/yr.
References


Appendix A
Quantification Results:
Watershed Protection Projects

Table A1. Water quantity benefits for watershed protection projects

Table A2. Water quality benefits for watershed protection projects
<table>
<thead>
<tr>
<th>CMP Category</th>
<th>TCCC Operating Group</th>
<th>TCCC Business Unit</th>
<th>LTI ID</th>
<th>TCCC ID</th>
<th>Country</th>
<th>Partner / Lead</th>
<th>Project Name</th>
<th>Description of Activity</th>
<th>New (T) (‘confirmed’ or ‘confirmed’ (C) (C) in 2014</th>
<th>Activity Timeline</th>
<th>% TCCC Contribution (2014)</th>
<th>Type of Benefit Quantified</th>
<th>Quantity Change (million L/yr)</th>
<th>TCCC Ultimate Water Quantity Benefit, Capped (millions L/yr)</th>
<th>TCCC Adjusted Benefit (2014)</th>
<th>Goals / Problems Addressed</th>
<th>Beneficiaries</th>
<th>Capped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watershed North America USA 1 153 U.S. WA TNC Paw Pau River Watershed Restoration Implement best management practices for crop land in the Paw Pau River watershed, including: 1) conservation tillage practices, 2) conservation cover, and 3) filter strips</td>
<td>R 2009 - ongoing</td>
<td>Variable by year (70.0% - 100%)</td>
<td>Runoff (decrease)</td>
<td>248.20</td>
<td>231.50</td>
<td>231.50</td>
<td>Reduce runoff and sediment from agricultural lands, increase recharge/seepage</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 2 154 U.S. TX TNC Tallgrass Prairie Watershed Restoration in North Texas Conservation of native prairie land (130 acres)</td>
<td>2008 - ongoing</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>42.40</td>
<td>42.40</td>
<td>42.40</td>
<td>Increase infiltration, reduce sediment erosion/runoff</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 2 154 U.S. TX TNC Tallgrass Prairie Watershed Restoration in North Texas Restoring tallgrass prairie via removal of invasive plant species and revegetation with native grassland species (1,164 acres)</td>
<td>2008 - ongoing</td>
<td>90%</td>
<td>Runoff (decrease)</td>
<td>144.00</td>
<td>138.20</td>
<td>138.20</td>
<td>Increase infiltration, reduce sediment erosion/runoff</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 3 155 U.S. GA TNC Lower Flint River Watershed Restoration Variable rate irrigation and advanced irrigation scheduling</td>
<td>R 2012 - 2014</td>
<td>100%</td>
<td>GW usage (decrease)</td>
<td>282.67</td>
<td>282.67</td>
<td>282.67</td>
<td>Provide demonstration projects for decreasing irrigation water usage</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 4 156 U.S. GA TNC Etowah River Watershed Conservation Partnership Floodplain restoration</td>
<td>2012 - 2013</td>
<td>31%</td>
<td>Sediment accumulation (decrease)</td>
<td>6.12</td>
<td>1.90</td>
<td>1.90</td>
<td>Re-establish floodplain connectivity</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Eurasia Middle East and North Africa 5 42 Oman, Iraq, Coast GETT Transboundary Community Water Management Reformation of riparian zones (15.5 hectares)</td>
<td>R 2007 - 2009</td>
<td>18%</td>
<td>Runoff (decrease)</td>
<td>6.00</td>
<td>2.00</td>
<td>2.00</td>
<td>Protect biodiversity, reduce sediment &amp; other pollutant load</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 15 91 U.S. PA Wildlands Conserves Wildlands Conservation Lymph Heart River Restoration Abandoned mine drainage treatment (Tawnee Tunnel)</td>
<td>2006 - 2008</td>
<td>1.5%</td>
<td>Volume Treated</td>
<td>3,979.00</td>
<td>61.20</td>
<td>61.20</td>
<td>Treat acid mine drainage</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 16 478 U.S. PA ClearWater Conservancy ClearWater Community Watershed Partnership: the Scotts Barnett Conservancy Project’s Halfmoon Wetland Corridor Aquifer protection and restoration</td>
<td>2009 - 2010</td>
<td>0.73%</td>
<td>Runoff (decrease)</td>
<td>11.90</td>
<td>0.08</td>
<td>0.08</td>
<td>Conservation/protective buffer for wildlife passage</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Latin America Mexico 21 18 Mexico WWF TCCC-WWF Partnership: Rio Grande / Rio Bravo Basin Rio Concho – Delicate Irrigation District Modification</td>
<td>2012 - ongoing</td>
<td>0.03%</td>
<td>GW usage (decrease)</td>
<td>396,000.00</td>
<td>118.80</td>
<td>118.80</td>
<td>Reduce irrigation water usage</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Latin America Mexico 21 18 Mexico WWF TCCC-WWF Partnership: Rio Grande / Rio Bravo Basin Rio Concho – Acquisition of water rights, and conservation of spring and its watershed blots</td>
<td>2007 - ongoing</td>
<td>51%</td>
<td>GW pumping (decrease)</td>
<td>2,570.00</td>
<td>1,208.70</td>
<td>1,208.70</td>
<td>Secure flows to re-establish local population of.extension bee</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Latin America Mexico 21 18 Mexico WWF TCCC-WWF Partnership: Rio Grande / Rio Bravo Basin Rio Concho – Reformation in headwaters (123.5 ha)</td>
<td>2007 - ongoing</td>
<td>35%</td>
<td>Runoff (decrease)</td>
<td>14.40</td>
<td>5.11</td>
<td>5.11</td>
<td>Reduce sediment erosion/runoff and sedimentation</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 21 18 U.S. NM WWF TCCC-WWF Partnership: Rio Grande / Rio Bravo Basin Rio Rio – Removal of invasive plants and natural features, beneficial vegetation restoration, and other restoration activities</td>
<td>2007 - 2011</td>
<td>1%</td>
<td>Sediment accumulation (increase)</td>
<td>133.35</td>
<td>1.23</td>
<td>1.23</td>
<td>Re-establish channel morphology</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 21 18 U.S. NM WWF TCCC-WWF Partnership: Rio Grande / Rio Bravo Basin Rio Rio – Cobble Dam to American Dam (New Mexico) – Removal of invasive plants and natural features, increasing high flow, creating a wetland, beneficial vegetation restoration, and other restoration activities</td>
<td>2007 - ongoing</td>
<td>30%</td>
<td>Direct streamflow</td>
<td>3,764.93</td>
<td>1,129.38</td>
<td>372.69</td>
<td>Re-establish channel morphology and floodplain connectivity</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 21 18 U.S. TX WWF TCCC-WWF Partnership: Rio Grande / Rio Bravo Basin Rio Rio – Rio Bravo Waterway – Reestablishment of channel morphology and floodplain connectivity</td>
<td>R 2009 - ongoing</td>
<td>Variable</td>
<td>Infiltration (decrease)</td>
<td>4,140.00</td>
<td>2,371.40</td>
<td>1,874.60</td>
<td>Re-establish channel morphology and floodplain connectivity</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 21 18 U.S. TX WWF TCCC-WWF Partnership: Rio Grande / Rio Bravo Basin Rio Rio – Rio Bravo Waterway – Acquisition of water rights to support environmental flows</td>
<td>2007 - ongoing</td>
<td>50%</td>
<td>Direct streamflow</td>
<td>740.00</td>
<td>370.00</td>
<td>370.00</td>
<td>Secure water supply to sustain habitat</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Latin America Latin Center 25 221 Honduras WWF Rio Chamelecón River Watershed Protection Initiative Implementation of improved agricultural practices: crop land/farmland management</td>
<td>2008 – 2009</td>
<td>11%</td>
<td>Runoff (decrease)</td>
<td>18.00</td>
<td>5.49</td>
<td>5.49</td>
<td>Reduce sediment erosion/wastewater</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Pacific Association of Southeast Asian Nations 28 140 Vietnam / Thailand WWF Conserving the Mekong CH-RIver subcatchment: Rehabilitation</td>
<td>2008 - ongoing</td>
<td>95%</td>
<td>Runoff (decrease)</td>
<td>128.00</td>
<td>121.60</td>
<td>121.60</td>
<td>Reduce sediment erosion/runoff; improve biodiversity</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Pacific Association of Southeast Asian Nations 28 195 Vietnam / Thailand WWF Conserving the Mekong Flood of Reeds (From Chon N.P.): Water use management</td>
<td>2008 - 2011</td>
<td>90%</td>
<td>Direct streamflow</td>
<td>11,400.00</td>
<td>8,127.90</td>
<td>8,127.90</td>
<td>Mitigate flood and drought impacts</td>
<td>n/a</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Europe Central and Southern Europe 31 Croatia / Serbia WWF Reconnecting the Lifeline Kupkove R.: wetland restoration</td>
<td>C 2010 – 2013</td>
<td>100%</td>
<td>Increase in storage volume</td>
<td>8,550.00</td>
<td>8,127.90</td>
<td>8,127.90</td>
<td>Increase wetland storage volume</td>
<td>n/a</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Europe Central and Southern Europe 31 Croatia / Serbia WWF Reconnecting the Lifeline Gornje Papukije: wetland restoration</td>
<td>C 2011 – 2012</td>
<td>95%</td>
<td>Increase in storage volume</td>
<td>110.00</td>
<td>104.50</td>
<td>104.50</td>
<td>Increase wetland storage volume</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRF Category</td>
<td>TCCC Operating Group</td>
<td>CRF Business Unit</td>
<td>ID</td>
<td>TCCC</td>
<td>ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Note (NL, Revised (R), or Confirmed (C)) in 2014</td>
<td>Activity Timeline</td>
<td>% TCCC Contribution (2014)</td>
<td>Type of Benefit Quantified</td>
<td>Quantity Change (million L/yr)</td>
<td>TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)</td>
<td>TCCC Adjusted Benefit (2014)</td>
<td>Goal / Problems Addressed</td>
<td>Beneficiaries</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------</td>
<td>------------------</td>
<td>----</td>
<td>------</td>
<td>----</td>
<td>---------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------------------------</td>
<td>------------------------</td>
<td>-----------------</td>
<td>---------------------</td>
<td>------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>------------------</td>
<td>----------------</td>
<td>--------</td>
</tr>
<tr>
<td>Watershed</td>
<td>Eurasia</td>
<td>India and Saudi Asia</td>
<td>51</td>
<td>375</td>
<td>India, Nepal</td>
<td>TCCC</td>
<td>Rainwater Harvesting and Aquifer Recharge</td>
<td>Rainwater harvesting structures and recharge shafts</td>
<td>R 2002 – 2014</td>
<td>Variable (60-100%)</td>
<td>Decrease</td>
<td>5,481.80</td>
<td>5,321.56</td>
<td>5,321.56</td>
<td>Recharge aquifer and enhance water supply</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Europe</td>
<td>Iberia</td>
<td>70</td>
<td>259</td>
<td>Spain, Portugal</td>
<td>WWF</td>
<td>Restoration Project Guadiano River Basin</td>
<td>Restoration of forest areas impacted by fire (Phase 1); Reafforestation of agricultural crop fields (Phase 2)</td>
<td>R 2008– ongoing</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>37.25</td>
<td>37.25</td>
<td>37.25</td>
<td>Reduce runoff / increase infiltration; reduce sediment erosion/runoff</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Pacific South Pacific</td>
<td>73</td>
<td>227</td>
<td>Australia</td>
<td>Reef Catchments</td>
<td>Great Barrier Reef Project</td>
<td>Project Catalog</td>
<td>2009 - 2013</td>
<td>Variable (&gt;50%)</td>
<td>Runoff (decrease)</td>
<td>19,177.00</td>
<td>3,745.00</td>
<td>3,745.00</td>
<td>Reduction of runoff and sediment and pesticide loadings to the Great Barrier Reef</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Eurasia Russia, Ukraine and Belarus</td>
<td>74</td>
<td>323</td>
<td>Belarus</td>
<td>TCCC</td>
<td>Let’s Save Yekiy Together!</td>
<td>Blockage of artificial drainage canals</td>
<td>2007 - 2010</td>
<td>100%</td>
<td>Infiltration (increase)</td>
<td>8,127.90</td>
<td>8,127.90</td>
<td>Reduce forest fires</td>
<td>n/a Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Pacific Southeast Asia</td>
<td>77</td>
<td>190</td>
<td>Philippines</td>
<td>Boy Scouts of the Philippines</td>
<td>Go Green! Go For the Real Thing!</td>
<td>Reafforestation / reclamation (35.5 ha)</td>
<td>2009 - 2010</td>
<td>57%</td>
<td>Runoff (decrease)</td>
<td>19.20</td>
<td>10.94</td>
<td>10.94</td>
<td>Reduce sediment erosion/runoff</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Pacific Southeast Asia</td>
<td>80</td>
<td>308</td>
<td>Philippines</td>
<td>Haroon Foundation</td>
<td>Colfass Native Tree Nursery</td>
<td>Reafforestation (10 ha)</td>
<td>2010 - 2013</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>Improve biodiversity</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin America Brazil</td>
<td>85</td>
<td>410</td>
<td>Brazil</td>
<td>FAS</td>
<td>Belo Floresta Program</td>
<td>Conservation of tropical forests to maintain environmental services</td>
<td>2010 - 2013</td>
<td>33%</td>
<td>Runoff (decrease)</td>
<td>119,585.00</td>
<td>11,367.88</td>
<td>11,367.88</td>
<td>Prevent loss of rainforest in the Amazon</td>
<td>n/a Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin America Costa Rica</td>
<td>38</td>
<td>365</td>
<td>Costa Rica</td>
<td>EARTH University</td>
<td>Sierra de Arriba</td>
<td>Reafforestation of 5.5 acres of livestock pasture</td>
<td>2010 - 2013</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>0.60</td>
<td>0.60</td>
<td>0.60</td>
<td>Increase biodiversity</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Greater China and Korea</td>
<td>91</td>
<td>175</td>
<td>China</td>
<td>WWF</td>
<td>Improving River Management Practices in the Yangtze</td>
<td>Construction of treatment wetlands</td>
<td>2009 - 2011</td>
<td>100%</td>
<td>Volume Treated</td>
<td>15.30</td>
<td>15.20</td>
<td>15.20</td>
<td>Improve water quality</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Greater China and Korea</td>
<td>91</td>
<td>175</td>
<td>China</td>
<td>WWF</td>
<td>Improving River Management Practices in the Yangtze</td>
<td>Irrigation improvement for ecosystem (Ailing Village)</td>
<td>2010 - 2011</td>
<td>100%</td>
<td>Streamflow</td>
<td>286.16</td>
<td>286.16</td>
<td>286.16</td>
<td>Ecosystem improvement</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Greater China and Korea</td>
<td>91</td>
<td>175</td>
<td>China</td>
<td>WWF</td>
<td>Improving River Management Practices in the Yangtze</td>
<td>Wetland restoration (Yunapas Village)</td>
<td>2011</td>
<td>100%</td>
<td>Increase in storage volume</td>
<td>504.90</td>
<td>504.90</td>
<td>504.90</td>
<td>Wetland restoration</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Greater China and Korea</td>
<td>91</td>
<td>175</td>
<td>China</td>
<td>WWF</td>
<td>Improving River Management Practices in the Yangtze</td>
<td>Reafforestation - Hibbashan (150 ha)</td>
<td>2011 - 2012</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>66.00</td>
<td>66.00</td>
<td>66.00</td>
<td>Reduce sediment erosion/runoff</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>96</td>
<td>549</td>
<td>U.S. CA</td>
<td>TRC</td>
<td>Southern Riff Riparian Habitat Restoration at La Barranca</td>
<td>Riparian habitat restoration</td>
<td>2011 - 2011</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>581.00</td>
<td>61.70</td>
<td>61.70</td>
<td>Improve biodiversity of riparian habitat</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Mexico</td>
<td>101</td>
<td>448</td>
<td>Mexico</td>
<td>TCCC</td>
<td>River Water Harvesting Program in Mexico for Artificial Aquifer Recharge</td>
<td>Rainwater harvesting and artificial aquifer recharge</td>
<td>2004 - 2010</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>54.80</td>
<td>54.80</td>
<td>54.80</td>
<td>Aquifer recharge</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>Canada</td>
<td>103</td>
<td>345</td>
<td>Canada</td>
<td>TCCC</td>
<td>North America Rain Barrel Donation Program</td>
<td>Rain barrel distribution for community household and school/business use</td>
<td>N 2008 - ongoing</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>38.80</td>
<td>38.80</td>
<td>38.80</td>
<td>Reduce stormwater runoff</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>103</td>
<td>345</td>
<td>U.S.</td>
<td>TCCC</td>
<td>North America Rain Barrel Donation Program</td>
<td>Rain barrel distribution for community household and school/business use</td>
<td>R 2008 - ongoing</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>513.20</td>
<td>513.20</td>
<td>513.20</td>
<td>Reduce stormwater runoff</td>
<td>n/a No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Japan</td>
<td>105</td>
<td>Japan</td>
<td>TCCC</td>
<td>Protecting Forests from Land Development</td>
<td>Prevent additional runoff &amp; sediment erosion/runoff</td>
<td>R 2006 - ongoing</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>5,867.00</td>
<td>5,867.00</td>
<td>5,867.00</td>
<td>Prevent additional runoff &amp; sediment erosion/runoff</td>
<td>n/a No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRP Category</td>
<td>TCCC Operating Group</td>
<td>TCCC Business Unit</td>
<td>LTI ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Size (NI: Million (A) or Confirmed (C) in 2014)</td>
<td>Activity Timeline</td>
<td>Activity Objective (2014)</td>
<td>Type of Benefit Quantified</td>
<td>Quantity Change (million L/yr)</td>
<td>TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)</td>
<td>TCCC Adjusted Benefit (2014)</td>
<td>Goals / Problems Addressed</td>
<td>Beneficiaries</td>
<td>Capped?</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>-------</td>
<td>---------</td>
<td>---------------</td>
<td>---------------</td>
<td>-------------------------</td>
<td>-----------------</td>
<td>-------------------------</td>
<td>--------------------------</td>
<td>------------------------</td>
<td>-----------------------------</td>
<td>---------------------------</td>
<td>--------------------------</td>
<td>----------------</td>
<td>--------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>106</td>
<td>Indonesia</td>
<td>TCCC</td>
<td>Restoration of Water Resources as an Adaptation to Climate Change</td>
<td>Infiltration wells for aquifer recharge</td>
<td>2012 - 2013</td>
<td>88% Recharge (increase)</td>
<td>845.00</td>
<td>746.00</td>
<td>746.00</td>
<td>increase groundwater recharge</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>South Latin</td>
<td>107</td>
<td>Argentina</td>
<td>AVINA</td>
<td>Conservation and Restoration of Ramsar Site Laguna de Guanacache, Desaguadero, and del Babado</td>
<td>Wetland restoration (1,000 ha)</td>
<td>R 2011 - 2015</td>
<td>73.5% Increase in storage volume</td>
<td>5,000.00</td>
<td>3,675.00</td>
<td>3,308.00</td>
<td>Wetland restoration</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>South Latin</td>
<td>108</td>
<td>Argentina</td>
<td>AVINA</td>
<td>Reserves in La Calera, Province of Cordoba - Management as a Tool for Basin Recovery</td>
<td>Suppression of fire within the La Calera Reserve (15,500 ha)</td>
<td>R 2012 - 2015</td>
<td>55% Infiltration (increase)</td>
<td>6,086.40</td>
<td>5,762.00</td>
<td>5,204.00</td>
<td>Prevent additional runoff &amp; sediment erosion/runoff</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>Canada</td>
<td>109</td>
<td>Canada</td>
<td>WWF</td>
<td>St. Lawrence Restoration (St. Eugene Marsh)</td>
<td>Wetland restoration (14 ha)</td>
<td>2012</td>
<td>32% Increase in storage volume</td>
<td>23.70</td>
<td>7.60</td>
<td>7.60</td>
<td>Wetland restoration</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>110</td>
<td>U.S. AZ</td>
<td>Borrows Environmental Foundation</td>
<td>Verde River Program</td>
<td>In-stream flow restoration</td>
<td>R 2012 - 2014</td>
<td>Variable Direct streamflow</td>
<td>2,475.00</td>
<td>1,906.00</td>
<td>1,906.00</td>
<td>Increase in stream flow</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>111</td>
<td>U.S. MT</td>
<td>Borrows Environmental Foundation</td>
<td>Priddy Poor Creek Re-wetting Project</td>
<td>In-stream flow restoration through water hauling and exchange agreements</td>
<td>R 2011 - 2014</td>
<td>Variable Direct streamflow</td>
<td>3,918.00</td>
<td>1,894.00</td>
<td>1,894.00</td>
<td>Increase in stream flow</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>112</td>
<td>U.S. CO</td>
<td>U.S. Forest Service</td>
<td>Trail Creek Restoration, Colorado</td>
<td>Construction of sediment detention basins and rehabilitation of alluvial fans</td>
<td>R 2012 - 2014</td>
<td>Runoff (decrease)</td>
<td>232.00</td>
<td>232.00</td>
<td>232.00</td>
<td>Reduce runoff &amp; sediment erosion/runoff</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>113</td>
<td>U.S. CA</td>
<td>U.S. Forest Service</td>
<td>Indian Valley High Mountain Meadow Restoration</td>
<td>Re-wetting high-mountain meadows through hydrologic restoration</td>
<td>2012</td>
<td>100% Infiltration (increase)</td>
<td>305.00</td>
<td>305.00</td>
<td>305.00</td>
<td>Increase aquifer recharge/erosion</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>South America</td>
<td>Canada</td>
<td>119</td>
<td>Ecuador</td>
<td>TNC</td>
<td>Changna-Colocche - Cerro Blanco Ecodigical Corridor</td>
<td>Re-wetting (32.6 ha)</td>
<td>2011 - 2012</td>
<td>47.4% Runoff (decrease)</td>
<td>11.78</td>
<td>5.60</td>
<td>5.60</td>
<td>Reduce runoff &amp; sediment erosion</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>South America</td>
<td>Japan</td>
<td>120</td>
<td>Japan</td>
<td>TCCC</td>
<td>Forest Conservation in Japan</td>
<td>Forest maintenance to ensure healthy forest ecosystem (52.8 ha)</td>
<td>2012</td>
<td>2013 100% Volume treated</td>
<td>3,629.50</td>
<td>3,629.50</td>
<td>3,629.50</td>
<td>Increase groundwater recharge</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>122</td>
<td>U.S. MN</td>
<td>TNC</td>
<td>Mississippi River Basin Treatment Watershed</td>
<td>Construction of treatment wetland in (the Red River basin, Minnesota)</td>
<td>2012 - 2013</td>
<td>100% Volume Treated</td>
<td>53.28</td>
<td>53.28</td>
<td>53.28</td>
<td>Reduce pollutants in runoff from agricultural land</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>123</td>
<td>U.S. IA</td>
<td>TNC</td>
<td>Mississippi River Basin Treatment Watershed</td>
<td>Construction of treatment wetland in (the Red River basin)</td>
<td>2012 - 2013</td>
<td>78% Volume Treated</td>
<td>838.00</td>
<td>654.00</td>
<td>654.00</td>
<td>Reduce pollutants in runoff from agricultural land</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Eurasia</td>
<td>Turkey and CCA</td>
<td>130</td>
<td>Turkey</td>
<td>TNC</td>
<td>Life+ Youth Program</td>
<td>Four seasons water to Goldhorn Life+ Youth Program</td>
<td>In-stream flow restoration</td>
<td>2011 - 2012</td>
<td>34% Increase in storage volume</td>
<td>687.50</td>
<td>577.50</td>
<td>577.50</td>
<td>Reduce flow to lake / wetland</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Eurasia</td>
<td>Turkey and CCA</td>
<td>131</td>
<td>Turkey</td>
<td>TNC</td>
<td>Caper Forests Lover (Life+ Youth Program)</td>
<td>Revegetation of eroded slopes</td>
<td>2012</td>
<td>2013 100% Volume Treated</td>
<td>75.40</td>
<td>75.40</td>
<td>75.40</td>
<td>Reduce runoff &amp; sediment erosion</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>India and Southeast Asia</td>
<td>136</td>
<td>India</td>
<td>TCCC</td>
<td>Construction of Check Dams in Rajpeth, Himatnath Pradeh and Uttar Pradeh, India</td>
<td>Check dam construction for recharge</td>
<td>R 2010 - 2013</td>
<td>100% Infiltration (increase)</td>
<td>3,629.50</td>
<td>3,629.50</td>
<td>3,629.50</td>
<td>Increase groundwater recharge</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>137</td>
<td>U.S. CA</td>
<td>TNC</td>
<td>Construction of Check Dams in Rajpeth, Himatnath Pradeh and Uttar Pradeh, India</td>
<td>Check dam construction for recharge</td>
<td>C 2013</td>
<td>67% Direct streamflow</td>
<td>225.00</td>
<td>150.00</td>
<td>150.00</td>
<td>Reduce flooding and re-establish ecological function</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>138</td>
<td>U.S. IL</td>
<td>USFS</td>
<td>Drainage Removal, Minkaw National Tallgrass Prairie, Kansas</td>
<td>Drainage removal</td>
<td>R 2013 - 2014</td>
<td>Variable Decrease in political drainage</td>
<td>436.10</td>
<td>392.20</td>
<td>392.20</td>
<td>Reduce wetland function</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>139</td>
<td>U.S. CA</td>
<td>USFS</td>
<td>Invasive Species Removal – Angeles National Forest, California</td>
<td>Invasive species removal</td>
<td>R 2013 - 2014</td>
<td>10% Runoff (decrease)</td>
<td>9.70</td>
<td>6.60</td>
<td>6.60</td>
<td>Re-establish native vegetation</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>140</td>
<td>U.S. LA</td>
<td>TNC</td>
<td>Floodplain Restoration and Wetland Restoration - Mollicy Farms, Louisiana</td>
<td>Floodplain reconnection and wetland restoration (3,180 ha)</td>
<td>R 2010 - 2015</td>
<td>3.9% Topographic elevation increase</td>
<td>157,886.00</td>
<td>6,157.50</td>
<td>6,157.50</td>
<td>Reduce wetland function</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>South Latin</td>
<td>141</td>
<td>Chile</td>
<td>AVINA</td>
<td>Wetland restoration in highland indigenous communities of Atacama Temuco, La Region, Chile</td>
<td>Vegetation management to restore or improve wetland function (200 ha)</td>
<td>N 2014-ongoing</td>
<td>85% Increase in storage volume</td>
<td>1,892.20</td>
<td>1,698.10</td>
<td>52.30</td>
<td>Reduce &amp; improve hydrology in wetlands</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>142</td>
<td>U.S. GA</td>
<td>TNC</td>
<td>Bayou Island Acquisition (Georgia for Generations)</td>
<td>Conservation of Bayles island</td>
<td>2012 - 2015</td>
<td>0.6% Runoff (decrease)</td>
<td>1,187.40</td>
<td>7.12</td>
<td>7.12</td>
<td>Restore natural hydrology regime</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRP Category</td>
<td>TCCC Operating Group</td>
<td>TECC Business Unit</td>
<td>LTI ID</td>
<td>TECC ID</td>
<td>Country / Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>CRP Metric</td>
<td>Metric (A) or Confirmed (C) in FY 2020</td>
<td>Activity Timeline</td>
<td>% TCCC Contribution (2014)</td>
<td>Type of Benefit Quantified</td>
<td>Quantity Change (million L/yr)</td>
<td>TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)</td>
<td>TCCC Adjusted Benefit (2014)</td>
<td>Goals / Problems Addressed</td>
<td>Beneficiaries</td>
<td>Capped?</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>-------</td>
<td>---------</td>
<td>--------------------------</td>
<td>--------------</td>
<td>-------------------------</td>
<td>------------</td>
<td>---------------------------------</td>
<td>-----------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>--------------------------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>-------------------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>Watershed Latin America South Latin America 143 Peru, Argentina</td>
<td>Province of Oxapampa</td>
<td>Oxapampa-Andinistica Yanahua (RBOAY) Biosphere Reserve, Central Forest</td>
<td>Revegetation and native forest conservation</td>
<td>R</td>
<td>2014 - 2017</td>
<td>80%</td>
<td>Runoff (decrease)</td>
<td>3,268.00</td>
<td>2,614.00</td>
<td>307.70</td>
<td>Reduce runoff and sedimentation</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Europe Iberia 144 Spain</td>
<td>WWF</td>
<td>Redispersing Upper Guadiana Aquifers - &quot;Mudor Poible&quot;</td>
<td>Irrigation water management</td>
<td>R</td>
<td>2012 - 2017</td>
<td>100% SW usage (decrease)</td>
<td>2,126.00</td>
<td>2,126.00</td>
<td>626.10</td>
<td>Aquifer restoration</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Europe Iberia 146 Spain</td>
<td>TCCC</td>
<td>Aquifer recharge in Valencia &quot;Pinar&quot;</td>
<td>Establishment of infiltration wells for artificial aquifer recharge</td>
<td>C</td>
<td>2011 - 2014</td>
<td>100%</td>
<td>Recharge (increase)</td>
<td>500.00</td>
<td>500.00</td>
<td>265.00</td>
<td>Improved groundwater quality</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Europe Iberia 147 Spain</td>
<td>SOS / Birdlife</td>
<td>Torcal de la Pina</td>
<td>Restoration of constructed wetland</td>
<td>R</td>
<td>2013 - 2015</td>
<td>100%</td>
<td>Volume Traveled</td>
<td>1,245.00</td>
<td>1,245.00</td>
<td>712.00</td>
<td>Improved groundwater quality</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 149 U.S. UT</td>
<td>Bonneville Environmental Foundation</td>
<td>Chell Creek Flood-Relocation</td>
<td>Instream flow restoration</td>
<td>R</td>
<td>2013 - ongoing</td>
<td>3.8%</td>
<td>Direct streamflow</td>
<td>129.50</td>
<td>4.90</td>
<td>4.90</td>
<td>Streamflow restoration</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Africa Southern Africa 153 Malawi</td>
<td>GETF</td>
<td>Centenary Flood-Relocation Project (C-EFAS) Malawi</td>
<td>Rehabilitation (544 ha)</td>
<td>2011 - 2013</td>
<td>50%</td>
<td>Runoff (decrease)</td>
<td>313.00</td>
<td>156.20</td>
<td>156.20</td>
<td>Reduce degradation associated with deforestation</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Pacific Association of Southeast Asian Nations 155 Indonesia</td>
<td>TCCC</td>
<td>Construction of infiltration wells in Megapoles, Indonesia</td>
<td>Establishment of infiltration wells for artificial aquifer recharge of rainwater</td>
<td>2011 - 2013</td>
<td>85%</td>
<td>Recharge (increase)</td>
<td>461.70</td>
<td>192.00</td>
<td>369.00</td>
<td>Increase recharge of local aquifers</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Eurasia Turkey and CCA 156 Turkey</td>
<td>Nature Conservation Centre</td>
<td>Life Plus Environment Program</td>
<td>Conservation agriculture</td>
<td>R</td>
<td>2013 - 2015</td>
<td>100%</td>
<td>Usage (decrease)</td>
<td>514.20</td>
<td>514.20</td>
<td>514.20</td>
<td>Improve water-holding capacity of soil</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 158 U.S. ID</td>
<td>Bonneville Environmental Foundation</td>
<td>Jessa Creek Restoration</td>
<td>Instream flow restoration</td>
<td>C</td>
<td>2011 - 2014</td>
<td>36%</td>
<td>Direct streamflow</td>
<td>748.47</td>
<td>267.20</td>
<td>267.20</td>
<td>Streamflow restoration</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Eurasia Russia, Ukraine and Belarus 160 Russian Federation</td>
<td>UNDP</td>
<td>Restoration of native forests in the Viga-Akhtuba Biosphere</td>
<td>Restoration of natural flooding regime of Rivers to enhance biodiversity</td>
<td>2011 - 2012</td>
<td>40%</td>
<td>Increase in storage volume</td>
<td>103.00</td>
<td>40.70</td>
<td>40.70</td>
<td>Restore hydrologic regime</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Latin America Latin Center 161 Ecuador</td>
<td>TNC</td>
<td>Adaptation to the Impact of the Accelerated Retreat of Glaciers in the Tropical Andes Region - PIARA</td>
<td>Revegetation (150 ha)</td>
<td>2013 - 2014</td>
<td>37%</td>
<td>Runoff (decrease)</td>
<td>82.30</td>
<td>30.10</td>
<td>30.10</td>
<td>Restore native vegetation &amp; protect natural hydrology</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Europe Northwest Europe and Nordics 162 Great Britain</td>
<td>WWF</td>
<td>River Nant Management Improvements</td>
<td>Land management best practices by farmers and in small wetland rehabilitation</td>
<td>R</td>
<td>2012 - 2014</td>
<td>Variable</td>
<td>Runoff (decrease)</td>
<td>517.00</td>
<td>297.00</td>
<td>188.00</td>
<td>Restore hydrology &amp; natural biodiversity</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Europe Northwest Europe and Nordics 163 Great Britain</td>
<td>WWF</td>
<td>River Croy Habitat Improvements</td>
<td>Modifying stream flows for habitat improvement</td>
<td>C</td>
<td>2012 - 2014</td>
<td>100%</td>
<td>Direct streamflow</td>
<td>1.00</td>
<td>1.00</td>
<td>0.00</td>
<td>Restore hydrology &amp; natural biodiversity</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 164 U.S. TX TNC</td>
<td>Brass Watershed - North Prine Stewardship and Seed Increase Project</td>
<td>Restoring native prairie via removal of invasive plant species and reversion with native grassland species (33.5 ha)</td>
<td>2013 - 2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>17.00</td>
<td>17.00</td>
<td>17.00</td>
<td>Reduce runoff</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Pacific Japan 165 Japan</td>
<td>Ass-Grassland Restoration Committee</td>
<td>Conservation of existing land cover</td>
<td>Conservation of grassland (300 ha)</td>
<td>R</td>
<td>2011 - 2020</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>117.00</td>
<td>117.00</td>
<td>117.00</td>
<td>Source water protection &amp; grassland preservation</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 167 U.S. MT</td>
<td>Trout Unlimited</td>
<td>Improving Fort Shaw Irrigation District Water Efficiency to Improve Sun River Flow</td>
<td>Irrigation flow restoration</td>
<td>N</td>
<td>2012-2014</td>
<td>31%</td>
<td>Direct streamflow</td>
<td>11,329.00</td>
<td>3,512.00</td>
<td>3,512.00</td>
<td>Improve water availability for trout culture</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed North America USA 168 U.S. CA</td>
<td>Sustainable Conservation</td>
<td>Laguna Irrigation District Groundwater Recharge Project</td>
<td>Development of a groundwater recharge site (32 acres)</td>
<td>N</td>
<td>2014</td>
<td>81.3%</td>
<td>Recharge (increase)</td>
<td>5,215.00</td>
<td>2,605.70</td>
<td>2,605.70</td>
<td>Recharge aquifer and improve groundwater quality</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Latin America Latin Center 169 Ecuador</td>
<td>TNC</td>
<td>Protection and Restoration of Natural Paramo Areas in the Guambito Watershed - Quito Water Fund (FWQ)</td>
<td>Conservation and restoration (167 hectares), reforestation (316 hectares)</td>
<td>N</td>
<td>2014</td>
<td>Variable (30-50%)</td>
<td>Runoff (decrease)</td>
<td>395.80</td>
<td>359.10</td>
<td>359.10</td>
<td>Facilitate conservation and regeneration of natural vegetation cover</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Latin America Latin Center 170 Ecuador</td>
<td>TNC</td>
<td>Forest conservation in the Daipe River watershed</td>
<td>Conservation (159 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>140.20</td>
<td>140.20</td>
<td>140.20</td>
<td>Protect forest and associated ecosystem services, including water supply</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Latin America Latin Center 171 Colombia</td>
<td>TNC</td>
<td>Forest Protection in the Rio Sichu Watershed - Agua Somos Water Fund</td>
<td>Conservation (493.67 hectares total, among 3 properties)</td>
<td>N</td>
<td>2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>496.70</td>
<td>496.70</td>
<td>496.70</td>
<td>Conserve natural vegetative cover, and improve water availability</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Latin America Latin Center 172 Colombia</td>
<td>TNC</td>
<td>Forest Conservation in the Rio Grande - Rio Chico Watershed, Corporacion Cuence Verde</td>
<td>Conservation/forest protection (392 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>87.90</td>
<td>87.90</td>
<td>87.90</td>
<td>Maintain forest cover to protect ecosystem services</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed Latin America Latin Center 173 Panama</td>
<td>TNC</td>
<td>Forest conservation in the Panama Canal Watershed</td>
<td>Forest conservation/forest protection (315 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>178.80</td>
<td>178.80</td>
<td>178.80</td>
<td>Protect forest and associated ecosystem services</td>
<td>n/a</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRP Category</td>
<td>TCCC Operating Group</td>
<td>TCCC Business Unit</td>
<td>LTI ID</td>
<td>TECC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Low (N, Material (Y) or Confirmed (C)) in 2014</td>
<td>Activity Timeline</td>
<td>% TCCC Contribution (2014)</td>
<td>Type of Benefit Quantified</td>
<td>Quantity Change (million L/yr)</td>
<td>TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)</td>
<td>TCCC Adjusted Benefit (2014)</td>
<td>Goals / Problems Addressed</td>
<td>Beneficiaries</td>
<td>Capped?</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>-------</td>
<td>---------</td>
<td>---------</td>
<td>---------------</td>
<td>---------------</td>
<td>-------------------------</td>
<td>-----------------------------------------------</td>
<td>-----------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------</td>
<td>-----------------------------</td>
<td>--------------------------</td>
<td>----------------</td>
<td>--------</td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>174</td>
<td>Costa Rica</td>
<td>TNC</td>
<td>Forest Conservation in the Greater Tarcoles River Watershed – Aguacita Water Fund</td>
<td>Conservation (151.3 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>166.40</td>
<td>166.40</td>
<td>166.40</td>
<td>Protect native forest and associated ecosystem services</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>175</td>
<td>Guatemala</td>
<td>TNC</td>
<td>Forest Protection, Agroforestry Promotion, and Restoration in the Noja Flaxea Watershed</td>
<td>Conservation and restoration (64 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>51.10</td>
<td>51.10</td>
<td>51.10</td>
<td>Protect native forest and associated ecosystem services</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>176</td>
<td>Dominican Republic</td>
<td>TNC</td>
<td>Forest Conservation in the Viquio River Watershed – Yaque del Norte Water Fund</td>
<td>Conservation (86 hectares) and restoration (4.56 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>106.60</td>
<td>106.60</td>
<td>106.60</td>
<td>Protect native forest and associated ecosystem services</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Greater Asia and Europe</td>
<td>177</td>
<td>China</td>
<td>WWF</td>
<td>Wetland Restoration in the Xaya River Basin</td>
<td>Green identification for poor production (32.3 hectares)</td>
<td>N</td>
<td>2013 – 2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>156.00</td>
<td>156.00</td>
<td>156.00</td>
<td>Protect downstream wetlands</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Greater China and Korea</td>
<td>177</td>
<td>China</td>
<td>WWF</td>
<td>Wetland Restoration in the Xaya River Basin</td>
<td>Creation and lake creation and restoration</td>
<td>N</td>
<td>2012 – 2014</td>
<td>Variable</td>
<td>Increase in storage volume</td>
<td>758.30</td>
<td>555.80</td>
<td>555.80</td>
<td>Protect drinking water supply</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>178</td>
<td>U.S. WA</td>
<td>USFS</td>
<td>Upper Methow River Restoration</td>
<td>Restoring groundwater storage through beaver reintroduction</td>
<td>N</td>
<td>2008 – 2013</td>
<td>13.6%</td>
<td>Increase in storage volume</td>
<td>182.00</td>
<td>24.70</td>
<td>24.70</td>
<td>Increase groundwater storage</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Eurasia</td>
<td>Turkey and CCA</td>
<td>179</td>
<td>Turkey</td>
<td>Nature Conservation Centre</td>
<td>Night Irrigation Project for Harston Plain</td>
<td>Night irrigation</td>
<td>N</td>
<td>2014 – 2015</td>
<td>100%</td>
<td>SW/GW usage (decrease)</td>
<td>540.60</td>
<td>540.60</td>
<td>540.60</td>
<td>Improve water use efficiency</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Greater China and Korea</td>
<td>180</td>
<td>China</td>
<td>UNDP</td>
<td>Wetland treatment to improve quality of Lake Wukang</td>
<td>Construction of a pilot pond for wetland treatment and aquaculture development</td>
<td>N</td>
<td>2014</td>
<td>47.1%</td>
<td>Volume Treated</td>
<td>332.00</td>
<td>138.00</td>
<td>138.00</td>
<td>Improve water quality in Lake Wukang</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Africa</td>
<td>Southern Africa</td>
<td>182</td>
<td>South Africa</td>
<td>WWF</td>
<td>Project to protect wetland resources while improving the livelihoods of disadvantaged and previously disadvantaged sugarcane growers in South Africa</td>
<td>Invasive species removal</td>
<td>N</td>
<td>2010 – ongoing</td>
<td>74.8%</td>
<td>SW/GW usage (decrease)</td>
<td>82.20</td>
<td>61.50</td>
<td>61.50</td>
<td>Increase water availability through invasive species removal</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>183</td>
<td>U.S. NE</td>
<td>TNC</td>
<td>WCWWA's Irrigation Project</td>
<td>Variable rate irrigation and advanced irrigation scheduling</td>
<td>N</td>
<td>2013 – 2015</td>
<td>80.0%</td>
<td>WS usage (decrease)</td>
<td>2,038.00</td>
<td>1,643.00</td>
<td>695.00</td>
<td>Decrease irrigation use of groundwater</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Eurasia</td>
<td>Russia, Ukraine, and Belarus</td>
<td>185</td>
<td>Russian Federation</td>
<td>TCCC</td>
<td>Restoration of Lake Sozaie in the Ugde Altitude Floccipan</td>
<td>Restoration of the natural flooding regime of Lake Sozaie and nearby wetlands</td>
<td>N</td>
<td>2013 – 2014</td>
<td>49.4%</td>
<td>Increase in storage volume</td>
<td>855.00</td>
<td>422.00</td>
<td>422.00</td>
<td>Restore hydrologic regime of Lake Sozaie and nearby wetlands</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>Canada</td>
<td>186</td>
<td>Canada</td>
<td>TRCA</td>
<td>Tommy Thompson Park Wetland Regeneration</td>
<td>Capping of contaminated sediments</td>
<td>N</td>
<td>2014 – 2015</td>
<td>50%</td>
<td>Volume Treated</td>
<td>1,040.80</td>
<td>520.40</td>
<td>520.40</td>
<td>Eliminate transport of contaminants from sediments to water column</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>187</td>
<td>U.S. CO</td>
<td>Colorado State University</td>
<td>South Platte River Sustainable Irrigation</td>
<td>Sustainable Irrigation in the lower South Platte River Basin</td>
<td>N</td>
<td>2013 – 2014</td>
<td>100%</td>
<td>SW/GW usage (decrease)</td>
<td>152.79</td>
<td>152.79</td>
<td>152.79</td>
<td>Reduce irrigation water usage</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>189</td>
<td>Costa Rica</td>
<td>TNC</td>
<td>Forest Conservation in the Greater Tarcoles River Watershed – Aguacita Water Fund</td>
<td>Conservation (9.9 hectares) and restoration (54.2 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>22.20</td>
<td>22.20</td>
<td>22.20</td>
<td>Improve hydrologic condition and reduce runoff</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>190</td>
<td>Guatemala</td>
<td>TNC</td>
<td>Forest Protection and Restoration in the El Zapote Watershed, Cortesia Aman Forest Reserve</td>
<td>Conservation (22.66 hectares) and restoration (12.29 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>15.50</td>
<td>15.50</td>
<td>15.50</td>
<td>Protect forested areas and associated ecosystem services</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>191</td>
<td>Dominican Republic</td>
<td>TNC</td>
<td>Forest Protection and Restoration in the Maria-Duray Subwatershed – Santo Domingo Water Fund</td>
<td>Conservation (17 hectares) and restoration (8.87 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>54.80</td>
<td>54.80</td>
<td>54.80</td>
<td>Protect forested areas and associated ecosystem services</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>192</td>
<td>Dominican Republic</td>
<td>TNC</td>
<td>Forest Protection and Restoration in the Mahoumi Microwatershed – Santo Domingo Water Fund</td>
<td>Conservation (11 hectares) and restoration (8.53 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100%</td>
<td>Runoff (decrease)</td>
<td>17.10</td>
<td>17.10</td>
<td>17.10</td>
<td>Protect forested areas and associated ecosystem services</td>
<td>n/a</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>CWP Category</td>
<td>TCCC Operating Group</td>
<td>TCCC Business Unit</td>
<td>LTI ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>New (%) or Revised (R) in 2014</td>
<td>Activity Timeline</td>
<td>Target Pollutant</td>
<td>Loading Change (MT/yr)</td>
<td>TCCC Ultimate Water Quality Benefit (MT/yr)</td>
<td>TCCC Adjusted Benefit (End 2014)</td>
<td>Goals / Problems Addressed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------</td>
<td>-------------------</td>
<td>-------</td>
<td>---------</td>
<td>---------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>-------------------------------</td>
<td>-------------------</td>
<td>------------------</td>
<td>-------------------------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>1</td>
<td>153</td>
<td>U.S. MI</td>
<td>TNC</td>
<td>Paw Paw River Watershed Restoration</td>
<td>Implement best management practices for cropland in the Paw Paw River watershed, including: 1) conservation tillage practices, 2) conservation cover, and 3) filter strips</td>
<td>R</td>
<td>2009 - ongoing</td>
<td>Variable by year (76.9% - 100%)</td>
<td>Sediment 1,102.00</td>
<td>1,035.0</td>
<td>Reduce runoff and sediment from agricultural lands; increase recharge / baseflow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>2</td>
<td>154</td>
<td>U.S. TX</td>
<td>TNC</td>
<td>Tallgrass Prairie Watershed Restoration in North Texas</td>
<td>Conservation of native prairie land (130 acres)</td>
<td>2008 - ongoing</td>
<td>100%</td>
<td>Sediment 163.70</td>
<td>163.7</td>
<td>Maintain hydrologic condition of prairie lands</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>2</td>
<td>154</td>
<td>U.S. TX</td>
<td>TNC</td>
<td>Tallgrass Prairie Watershed Restoration in North Texas</td>
<td>Restoring tallgrass prairie via removal of invasive plant species and revegetation with native grassland species (1,164 acres)</td>
<td>2008 - ongoing</td>
<td>96%</td>
<td>Sediment 669.00</td>
<td>642.2</td>
<td>Increase infiltration, reduce sediment erosion/runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>4</td>
<td>156</td>
<td>U.S. GA</td>
<td>TNC</td>
<td>Etowah River Watershed</td>
<td>Riparian buffer (Raccoon Creek)</td>
<td>Apr 2009 - May 2012</td>
<td>100%</td>
<td>Sediment 100.00</td>
<td>100.0</td>
<td>75.0</td>
<td>Stabilize stream bank (reduce bank erosion)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>4</td>
<td>156</td>
<td>U.S. GA</td>
<td>TNC</td>
<td>Etowah River Watershed Conservation Partnership</td>
<td>Stormwater management (tributary ditch improvements)</td>
<td>Apr 2009 - May 2012</td>
<td>100%</td>
<td>Sediment 32.60</td>
<td>32.6</td>
<td>24.5</td>
<td>Stabilize stream bank (reduce instream sediment erosion); increase infiltration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Eurasia</td>
<td>Middle East and North Africa</td>
<td>5</td>
<td>42</td>
<td>Ghana, Ivory Coast</td>
<td>GETF</td>
<td>Transboundary Community Watershed Management</td>
<td>Restorations of riparian zones (13.5 hectares)</td>
<td>R</td>
<td>2007 - 2009</td>
<td>38%</td>
<td>Sediment 26.50</td>
<td>10.1</td>
<td>10.3</td>
<td>Protect biodiversity, reduce sediment &amp; other pollutant loads</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>15</td>
<td>91</td>
<td>U.S. PA</td>
<td>Wildlands Conservancy</td>
<td>Wildlands Conservancy Lehigh River Restoration</td>
<td>Abandoned mine drainage treatment (Kausanne Tunnel)</td>
<td>2004 - 2009</td>
<td>1.5%</td>
<td>Iron 20.00</td>
<td>0.9</td>
<td>0.3</td>
<td>Reduce sediment runoff to streams; stabilize stream bank</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>15</td>
<td>91</td>
<td>U.S. PA</td>
<td>Wildlands Conservancy</td>
<td>Wildlands Conservancy Lehigh River Restoration</td>
<td>Jordan Creek stream stabilization project</td>
<td>2009</td>
<td>50%</td>
<td>Sediment 207.00</td>
<td>103.5</td>
<td>103.5</td>
<td>Stabilize stream bank (reduce erosion)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>15</td>
<td>91</td>
<td>U.S. PA</td>
<td>Wildlands Conservancy</td>
<td>Wildlands Conservancy Lehigh River Restoration</td>
<td>Little Lehigh stream bank stabilization project</td>
<td>2008</td>
<td>50%</td>
<td>Sediment 33.00</td>
<td>16.5</td>
<td>16.5</td>
<td>Stabilize stream bank (reduce erosion)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>15</td>
<td>91</td>
<td>U.S. PA</td>
<td>Wildlands Conservancy</td>
<td>Wildlands Conservancy Lehigh River Restoration</td>
<td>Monocacy Creek stream restoration projects (Edgewood Valley Farm, just Enuff Angus Farm)</td>
<td>2008</td>
<td>50%</td>
<td>Sediment 502.00</td>
<td>251.0</td>
<td>251.0</td>
<td>Reduce sediment runoff to streams; stabilize stream bank</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>16</td>
<td>478</td>
<td>U.S. PA</td>
<td>ClearWater Conservancy</td>
<td>Clearwater Community Watershed Partnership - the Scotia Barrens Conservation Project’s Hallowin Wildlife Corridor</td>
<td>Land protection and conservation</td>
<td>2009 - 2010</td>
<td>0.71%</td>
<td>Sediment 223.20</td>
<td>1.6</td>
<td>1.6</td>
<td>Conservation/protection of a corridor for wildlife passage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Mexico</td>
<td>21</td>
<td>18</td>
<td>Mexico</td>
<td>WWF</td>
<td>TCCC-WWF Partnership: Rio Grande / Rio Bravo Basin</td>
<td>Rio Conchos - reforestation in headwaters (122.5 ha)</td>
<td>2007 - ongoing</td>
<td>35%</td>
<td>Sediment 220.00</td>
<td>77.0</td>
<td>77.0</td>
<td>Reduce sediment erosion/runoff and sedimentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DWP Category</td>
<td>TCCC Operating Group</td>
<td>TCCC Business Unit</td>
<td>LT ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>New (N) or Revised (R) in 2014</td>
<td>Activity Timeline</td>
<td>% TCCC Contribution (2014)</td>
<td>Water Quality Benefits (ultimate)</td>
<td>TCCC Ultimate Water Quality Benefit (MT/yr)</td>
<td>TCCC Adjusted Benefit (End 2014)</td>
<td>Goals / Problems Addressed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>------</td>
<td>---------</td>
<td>---------</td>
<td>----------------</td>
<td>---------------</td>
<td>------------------------</td>
<td>-----------------------------</td>
<td>----------------------</td>
<td>------------------------</td>
<td>---------------------------------</td>
<td>------------------------------------------</td>
<td>---------------------------------</td>
<td>---------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>25</td>
<td>221</td>
<td>Honduras</td>
<td>WWF</td>
<td>Rio Chamelecon River Watershed Protection Initiative</td>
<td>Implementation of improved agricultural practices: cropland/farmland management</td>
<td>2008 - 2009</td>
<td>31%</td>
<td>Sediment 14,571.00</td>
<td>4,444.2</td>
<td>4,444.2</td>
<td>Reduce sediment erosion/washoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>28</td>
<td>340</td>
<td>Vietnam / Thailand</td>
<td>WWF</td>
<td>Conserving the Mekong</td>
<td>Chi River subcatchment: Reforestation</td>
<td>2008 - ongoing</td>
<td>95%</td>
<td>Sediment 170.70</td>
<td>162.2</td>
<td>162.2</td>
<td>Demonstration project for improved agricultural practices to reduce sediment, nutrient, and chemical runoff.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>28</td>
<td>340</td>
<td>Vietnam / Thailand</td>
<td>WWF</td>
<td>Conserving the Mekong</td>
<td>Chi River subcatchment: Agricultural practices</td>
<td>2008 - 2009</td>
<td>95%</td>
<td>Sediment 2,856.00</td>
<td>2,713.2</td>
<td>2,713.2</td>
<td>Reduce sediment erosion/runoff; improve biodiversity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Eurasia</td>
<td>Middle East and North Africa</td>
<td>33</td>
<td>185</td>
<td>Pakistan</td>
<td>WWF</td>
<td>Environment Conservation &amp; Watershed Management</td>
<td>Afforestation, forest conservation, treatment of eroding streams, improved agricultural lands</td>
<td>2008 - 2010</td>
<td>100%</td>
<td>Sediment 0.00</td>
<td>0.0</td>
<td>0.0</td>
<td>Reduce sedimentation due to land use changes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Mexico</td>
<td>38</td>
<td>120</td>
<td>Mexico</td>
<td>TCCC</td>
<td>Mexico Restoration &amp; Reforestation Program</td>
<td>Reforestation (54,432 ha)</td>
<td>2008 - 2013</td>
<td>Variable</td>
<td>Sediment 1,279,984.00</td>
<td>611,397.0</td>
<td>611,397.0</td>
<td>Reduce runoff / increase infiltration; reduce sediment erosion/runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Mexico</td>
<td>39</td>
<td>130</td>
<td>Mexico</td>
<td>TCCC</td>
<td>Reforestation Efforts at the Monarcha Butterfly Bioserve</td>
<td>Reforestation (2,000 ha)</td>
<td>2007 - 2009</td>
<td>100%</td>
<td>Sediment 0.00</td>
<td>0.0</td>
<td>0.0</td>
<td>Rehabilitation degraded forest areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>40</td>
<td>247</td>
<td>Philippines</td>
<td>WWF</td>
<td>Iligan Watershed Conservation Project</td>
<td>Afforestation and rehabilitation of the Ilong – Yan Watershed in Surat Thani</td>
<td>2009 - 2010</td>
<td>72%</td>
<td>Sediment 11,200.00</td>
<td>8,097.6</td>
<td>8,097.6</td>
<td>Reduce sediment erosion/runoff from degraded grassland areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>43</td>
<td>261</td>
<td>Thailand</td>
<td>HAI</td>
<td>Conservation and Rehabilitation of the Mekong – Yan Watershed</td>
<td>Conservation of forest land</td>
<td>2008</td>
<td>100%</td>
<td>Sediment 2,679,600.00</td>
<td>2,679,600.0</td>
<td>2,679,600.0</td>
<td>Conservation of existing forest land; decrease runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Australia</td>
<td>73</td>
<td>227</td>
<td>Australia</td>
<td>Reef Catchments</td>
<td>Great Barrier Reef Project (Project Catalyst)</td>
<td>Improved agricultural practices</td>
<td>2009 - 2013</td>
<td>Variable (&gt;50%)</td>
<td>Nitrogen 121.00</td>
<td>25.8</td>
<td>25.8</td>
<td>Reduction of runoff and nutrient, sediment and erosion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>76</td>
<td>21</td>
<td>Guatemala</td>
<td>Programa de Agua Dulce</td>
<td>Protecting the Polochic River Watershed</td>
<td>Communities of Pueblo Viejo, Concepcion</td>
<td>2007 - 2009</td>
<td>30%</td>
<td>Sediment 1,954.00</td>
<td>586.2</td>
<td>586.2</td>
<td>Reduction of sediment loadings to the Polochic and Rio Dulce</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>77</td>
<td>190</td>
<td>Philippines</td>
<td>Boy Scouts of the Philippines</td>
<td>Go Green! Go for the Real Thing!</td>
<td>Reforestation / revegetation (39.5 ha)</td>
<td>2009 - 2010</td>
<td>57%</td>
<td>Sediment 1,348.00</td>
<td>768.4</td>
<td>768.4</td>
<td>Reduce sediment erosion/runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>80</td>
<td>308</td>
<td>Philippines</td>
<td>Harbin Foundation</td>
<td>Calbayo Native Tree Nursery</td>
<td>Reforestation (10 ha)</td>
<td>2010 - 2012</td>
<td>100%</td>
<td>Sediment 1,123.00</td>
<td>1,123.0</td>
<td>1,123.0</td>
<td>Improve biodiversity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>82</td>
<td>134</td>
<td>Thailand</td>
<td>HAI</td>
<td>Village that Learns and Earns</td>
<td>Water supply for community use</td>
<td>2006 - 2008</td>
<td>95%</td>
<td>Sediment 308.00</td>
<td>292.6</td>
<td>292.6</td>
<td>Provide water for irrigation use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Brazil</td>
<td>85</td>
<td>410</td>
<td>Brazil</td>
<td>FAS</td>
<td>Bosia Floresta Program</td>
<td>Conservation of tropical forests to maintain environmental services (124,538 hectares in 2013)</td>
<td>2010 - 2013</td>
<td>33%</td>
<td>Sediment 173,535.00</td>
<td>57,845.0</td>
<td>42,156.4</td>
<td>Prevent loss of rainforests in the Amazon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>88</td>
<td>365</td>
<td>Costa Rica</td>
<td>EARTH University</td>
<td>Siembla de Arboles</td>
<td>Reforestation of 25 acres of livestock pasture</td>
<td>2010</td>
<td>100%</td>
<td>Sediment 18.50</td>
<td>18.5</td>
<td>18.5</td>
<td>Increase biodiversity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Greater China and Korea</td>
<td>91</td>
<td>175</td>
<td>China</td>
<td>WWF</td>
<td>Improving River Management Practices in the Yangtze</td>
<td>Construction of three biogas digesters</td>
<td>2009</td>
<td>100%</td>
<td>Phosphorus 0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>Reduce nutrient loads</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Nitrogen 0.08</td>
<td>0.08</td>
<td>0.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CWP Category</td>
<td>TCCC Operating Group</td>
<td>TCCC Business Unit</td>
<td>LT ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>New (N) or Revised (R) in 2014</td>
<td>Activity Timeline</td>
<td>% TCCC Contribution (2014)</td>
<td>Water Quality Benefits (ultimate)</td>
<td>TCCC Ultimate Water Quality Benefit (MT/yr)</td>
<td>TCCC Adjusted Benefit (End 2014)</td>
<td>Goals / Problems Addressed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>-------</td>
<td>---------</td>
<td>---------</td>
<td>---------------</td>
<td>--------------</td>
<td>------------------------</td>
<td>-----------------------------</td>
<td>----------------</td>
<td>---------------------------</td>
<td>------------------------</td>
<td>----------------------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Greater China and Korea</td>
<td>91</td>
<td>175</td>
<td>China</td>
<td>WWF</td>
<td>Improving River Management Practices in the Yangtze</td>
<td>Construction of treatment wetlands</td>
<td>2009 - 2011</td>
<td>100% Phosphorus</td>
<td>0.26</td>
<td>0.26</td>
<td>0.26</td>
<td>Improve water quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>114</td>
<td></td>
<td>U.S. CO</td>
<td>U.S. Forest Service</td>
<td>Trail Creek Restoration, Colorado</td>
<td>Construction of sediment detention basins and rehabilitation of alluvial fans</td>
<td>2012</td>
<td>100% Sediment</td>
<td>871.5</td>
<td>871.5</td>
<td>871.5</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>North America</td>
<td>USA</td>
<td>115</td>
<td></td>
<td>U.S. GA</td>
<td>TNC</td>
<td>Dawson Forest Acquisition</td>
<td>Conservation of forest land (190 ha)</td>
<td>2008 - 2012</td>
<td>14% Sediment</td>
<td>1,409.00</td>
<td>197.3</td>
<td>197.3</td>
<td>Reduce runoff / increase infiltration; reduce sediment erosion/runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Japan</td>
<td>165</td>
<td></td>
<td>Japan</td>
<td>Aso Grassland Restoration Committee</td>
<td>Conservation of existing land cover</td>
<td>Conservation of grassland (500 ha)</td>
<td>R</td>
<td>2011 - 2020</td>
<td>100% Sediment</td>
<td>2,652.0</td>
<td>2,652.0</td>
<td>Source water protection &amp; grassland preservation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>169</td>
<td></td>
<td>Ecuador</td>
<td>TNC</td>
<td>Protection and Restoration of Natural Paramo Areas in the Guambí Watershed – Quito Water Fund (FONAG)</td>
<td>Conservation and restoration (147 hectares); revegetation (151.26 hectares)</td>
<td>N</td>
<td>2014</td>
<td>Variable (80-100%) Sediment</td>
<td>125,827.00</td>
<td>118,201.0</td>
<td>118,201.0</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>170</td>
<td></td>
<td>Ecuador</td>
<td>TNC</td>
<td>Forest conservation in the Daule River watershed</td>
<td>Conservation (159 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100% Sediment</td>
<td>1,068.00</td>
<td>1,068.0</td>
<td>1,068.0</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>171</td>
<td></td>
<td>Colombia</td>
<td>TNC</td>
<td>Forest Protection in the Rio Seco - Watershed - Aigua Somosi Water Fund</td>
<td>Conservation (409.67 hectares total, among 3 properties)</td>
<td>N</td>
<td>2014</td>
<td>100% Sediment</td>
<td>87,882.00</td>
<td>87,882.0</td>
<td>87,882.0</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>172</td>
<td></td>
<td>Colombia</td>
<td>TNC</td>
<td>Forest Conservation in the Rio Grande - Los Chicos Watershed, Corporación Cuenca Verde</td>
<td>Conservation/forest protection (89.2 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100% Sediment</td>
<td>23,476.00</td>
<td>23,476.0</td>
<td>23,476.0</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>173</td>
<td></td>
<td>Panama</td>
<td>TNC</td>
<td>Tropical Rainforest Conservation in the Panama Canal Watershed</td>
<td>Forest conservation/protection (135 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100% Sediment</td>
<td>84,691.00</td>
<td>84,691.0</td>
<td>84,691.0</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>174</td>
<td></td>
<td>Costa Rica</td>
<td>TNC</td>
<td>Forest Conservation in the Greater Taculco River Watershed – Agua Tica Water Fund</td>
<td>Conservation (151.3 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100% Sediment</td>
<td>108,696.00</td>
<td>108,696.0</td>
<td>108,696.0</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>175</td>
<td></td>
<td>Guatemala</td>
<td>TNC</td>
<td>Forest Protection, Agroforestry Promotion, and Reforestation in the Xaya-Pixcaya Watershed</td>
<td>Conservation and restoration (64 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100% Sediment</td>
<td>783.0</td>
<td>783.0</td>
<td>783.0</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>176</td>
<td></td>
<td>Dominican Republic</td>
<td>TNC</td>
<td>Forest Conservation in the Higua River Watershed - Yaqué del Norte Water Fund</td>
<td>Conservation (86 hectares) and restoration (4.56 hectares)</td>
<td>N</td>
<td>2014</td>
<td>100% Sediment</td>
<td>1,627.5</td>
<td>1,627.5</td>
<td>1,627.5</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CWP Category</td>
<td>TCCC Operating Group</td>
<td>TCCC Business Unit</td>
<td>LT/ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>New (N) or Revised (R) in 2014</td>
<td>Activity Timeline</td>
<td>% TCCC Contribution (2014)</td>
<td>Water Quality Benefits (ultimate)</td>
<td>TCCC Ultimate Water Quality Benefit (MT/yr)</td>
<td>TCCC Adjusted Benefit (End 2014)</td>
<td>Goals / Problems Addressed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------</td>
<td>--------------------</td>
<td>-------</td>
<td>---------</td>
<td>---------</td>
<td>----------------</td>
<td>--------------</td>
<td>--------------------------</td>
<td>-----------------------------</td>
<td>-----------------</td>
<td>-----------------------------</td>
<td>-------------------------------</td>
<td>---------------------------------</td>
<td>---------------------------------</td>
<td>-------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Pacific</td>
<td>Greater China and Korea</td>
<td>177</td>
<td></td>
<td>China</td>
<td>WWF</td>
<td>Wetland Restoration in Jialing River Basin</td>
<td>Green Certification for pear production (333.3 hectares)</td>
<td>N 2013-2014</td>
<td>100%</td>
<td>Sediment 555.50</td>
<td>555.5</td>
<td>555.5</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>189</td>
<td></td>
<td>Costa Rica</td>
<td>TNC</td>
<td>Forest Conservation in the Greater Tarcoces River Watershed – Agua Tica Water Fund</td>
<td>Conservation (9.9 hectares) and restoration (14.2 hectares)</td>
<td>N 2014</td>
<td>100%</td>
<td>Sediment 15,741.00</td>
<td>15,741.0</td>
<td>15,741.0</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>190</td>
<td></td>
<td>Guatemala</td>
<td>TNC</td>
<td>Forest Protection and Restoration in the El Zapote Watershed – Cordillera Alux Forest Reserve</td>
<td>Conservation (22.66 hectares) and restoration (0.29 hectares)</td>
<td>N 2014</td>
<td>100%</td>
<td>Sediment 10,241.20</td>
<td>10,241.2</td>
<td>10,241.2</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>191</td>
<td></td>
<td>Dominican Republic</td>
<td>TNC</td>
<td>Forest Protection and Restoration in the Haina-Duey Subwatershed – Santo Domingo Water Fund</td>
<td>Conservation (37 hectares) and restoration (8.87 hectares)</td>
<td>N 2014</td>
<td>100%</td>
<td>Sediment 22,138.30</td>
<td>22,138.3</td>
<td>22,138.3</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watershed</td>
<td>Latin America</td>
<td>Latin Center</td>
<td>192</td>
<td></td>
<td>Dominican Republic</td>
<td>TNC</td>
<td>Forest Protection and Restoration in the Mahomita Microwatershed – Santo Domingo Water Fund</td>
<td>Conservation (11 hectares) and restoration (8.33 hectares)</td>
<td>N 2014</td>
<td>100%</td>
<td>Sediment 19,325.30</td>
<td>19,325.3</td>
<td>19,325.3</td>
<td>Reduce sediment runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B
Quantification Results:
Water for Productive Use Projects

Table B1. Water quantity benefits for water for productive use projects
| CWP Category | TCCC Operating Group | TCCC Business Unit | LTID | TCCC ID | Country | Partner / Lead | Project Name | Description of Activity | New ( unleashed, confirmed (C)) in 2016 | Activity Timeline | % TCCC Contribution (2014) | Type of Benefit Quantified | Quantity Change (million L/yr) | TCCC Ultimate Water Quantity Benefit, Capped (million L/yr) | TCCC Adjusted Benefit (2014) | Goals / Problems Addressed | Beneficiaries | Capped? |
|-------------|----------------------|-------------------|------|---------|---------|--------------|--------------|------------------------|----------------------|----------------|------------------------|--------------------------|-----------------------------|-----------------------------|--------------------------|----------------|--------|
| WPU Africa | Southern Africa | GETF | 8 10 | Africa Southern Africa | GETF | Supply with Waterways:  | 1. Waterway Program: Fixing the Leaks, 2. School Plumbing Repair and Energy Savings | drip irrigation of drinking water and sanitary plumbing systems | R 1907 - 2006 | 31% | Water supply for productive use | 407.52 | 126.30 | 126.30 | Increase water use efficiency | n/a | Yes |
| WPU North America | USA | 14 71 | U.S. PA | Borough of Belleville | Big Spring Water Protection | Big Spring Water Protection | Water supply for productive use | R 2016 - pending Variable by year | Water supply for productive use | 4,680.00 | 637.00 | 637.00 | Increase water use efficiency | n/a | Yes |
| WPU Latin America | Mexico | 21 18 | Mexico | Waterway | Protecting the Rio Grande / Rio Bravo River | Rio Grande / Rio Bravo River | Water supply for drip irrigation | 2007 - ongoing | 35% | Water supply for productive use | 0.01 | 0.00 | 0.00 | Augment domestic & irrigation water supplies | n/a | Yes |
| WPU Eurasia | Turkey and CCA | TCCC | 41 358 | Turkey | Every Drop Matters – in Saraybilik and Beyazeci | Every Drop Matters – in Saraybilik and Beyazeci | Wastewater reuse | 2006 - 2008 | 89% | Water supply for productive use | 45.38 | 40.39 | 40.39 | Increase water use efficiency | n/a | Yes |
| WPU Latin America | Latin Center | Guatemala | 76 21 | Guatemala | Programa de Agua Dulce | Programa de Agua Dulce | Drought subwatersheds: Drip irrigation | 2008 - 2009 | 30% | Water supply for productive use | 98.00 | 29.40 | 29.40 | Reduction of sediment loads to the Pacifico and Motope Rivers and the Mesoamerican Reef (Caribbean Sea). | n/a | Yes |
| WPU Pacific | Association of Southeast Asian Nations | 8 134 | Thailand | NAKI | Village that Learns and Earns | Village that Learns and Earns | Water supply for community use | 2006 - 2008 | 95% | Water supply for productive use | 152.95 | 145.30 | 145.30 | Provide water for irrigation use | n/a | Yes |
| WPU Eurasia | Turkey and CCA | TCCC | 90 435 | Turkmenistan | Turkmenistan's Forest Irrigation Project | Turkmenistan's Forest Irrigation Project | Irrigation of forest lands | 2006 - ongoing | 100% | Water supply for productive use | 9.94 | 9.94 | 9.94 | Provide water for irrigation use | n/a | Yes |
| WPU Pacific | Greater China and Korea | China | 94 427 | China | Guanxi Sustainable Sugarcane Initiative: Phase I and II | Guanxi Sustainable Sugarcane Initiative: Phase I and II | Conversion of flood irrigation to drip irrigation | 2010 - 2011 | 50% | Water supply for productive use | 1,016.00 | 508.00 | 508.00 | Provide water for irrigation use | n/a | Yes |
| WPU Pacific | Greater China and Korea | China | 94 427 | China | Guanxi Sustainable Sugarcane Initiative: Phase I and II | Guanxi Sustainable Sugarcane Initiative: Phase I and II | Water for productive use: new irrigation supply and improved irrigation efficiency | 2011 - 2012 | 50% | Water supply for productive use | 1,299.90 | 650.00 | 650.00 | Provide water for irrigation use | n/a | Yes |
| WPU Pacific | Greater China and Korea | China | 94 427 | China | Guanxi Sustainable Sugarcane Initiative: Phase I and II | Guanxi Sustainable Sugarcane Initiative: Phase I and II | Conversion of flood irrigation to spray irrigation (Fuxiu County) | 2011 - 2013 | 50% | Water supply for productive use | 1,830.60 | 915.30 | 915.30 | Provide water for irrigation use | n/a | Yes |
| WPU Pacific | Greater China and Korea | China | 94 427 | China | Guanxi Sustainable Sugarcane Initiative: Phase I and II | Guanxi Sustainable Sugarcane Initiative: Phase I and II | Conversion of flood irrigation to drip irrigation (Chengxi County) | N 2014 | Variable | Water supply for productive use | 2,024.50 | 662.60 | 662.60 | Increase water use efficiency | n/a | Yes |
| WPU Pacific | India and Southeast Asia | India | 104 456 | India | TCCC | TCCC | Irrigation water image through Improved Irrigation Techniques | R 2005 - pending | 100% | Water supply for productive use | 4,650.70 | 4,650.70 | 4,650.70 | Provide water for irrigation use | n/a | Yes |
| WPU Pacific | India and Southeast Asia | India | 117 170 | India | TCCC | TCCC | Rehabilitation of Farm Ponds Across India | R 2010 - 2014 Variable (0-100%) | Water supply for productive use | 3,144.60 | 3,064.60 | 3,064.60 | Provide water for irrigation use | n/a | Yes |
| WPU Europe | Spain | Spain | 104 30 | Spain | TCCC | TCCC | Wastewater reuse for conservation | C 2008 - ongoing | 100% | Wastewater reuse | 9.40 | 9.40 | 9.40 | Maintain ecological flows to increase habitat & biodiversity | n/a | Yes |
| WPU Eurasia | Turkey and CCA | Turkey | 132 80 | Turkey | Life Plus Youth Program | Life Plus Youth Program | Soil improvement to reduce irrigation demand | 2010 - 2012 | 100% | Water supply for productive use | 2.00 | 2.00 | 2.00 | Reduce irrigation water use | n/a | Yes |
| WPU Eurasia | Turkey and CCA | Turkey | 133 80 | Turkey | TCCC | TCCC | Rainwater harvesting for Geldi Basin | Rainwater harvesting | 2011 - 2012 | 10% | Water supply for productive use | 7.00 | 6.47 | 6.47 | Provide water for irrigation use | n/a | Yes |
| WPU Pacific | Greater China and Korea | China | 148 80 | China | Urban Wetland Restoration in Donghehu City | Urban Wetland Restoration in Donghehu City | Wastewater reuse for conservation | 2013 | 100% | Water supply for productive use | 213.00 | 213.00 | 213.00 | Wastewater reuse | n/a | Yes |
| WPU Africa | Central, East and West Africa | Kenya | 151 75 | Kenya | GETF | Supplying Irrigation Water to Maximize Food Security in the Mara River Basin, Kenya | Supplying Irrigation Water to Maximize Food Security in the Mara River Basin, Kenya | Irrigation water supply for vegetable cultivation (0.4 ha) | 2009 - 2010 | 50% | Water supply for productive use | 0.14 | 0.09 | 0.09 | Provide water for irrigation use | n/a | Yes |
## Table B1. Water Quantity Benefits for Water for Productive Use Projects

<table>
<thead>
<tr>
<th>CMP Category</th>
<th>TCCC Operating Group</th>
<th>TCCC Business Unit</th>
<th>LTI ID</th>
<th>TCCC ID</th>
<th>Country</th>
<th>Partner / Lead</th>
<th>Project Name</th>
<th>Description of Activity</th>
<th>New (N), Revised (R), or Confirmed (C) in 2014</th>
<th>Activity Timeline</th>
<th>% TCCC Contribution (2014)</th>
<th>Type of Benefit Quantified</th>
<th>Quantity Change (million L/yr)</th>
<th>TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)</th>
<th>TCCC Adjusted Benefit (2014)</th>
<th>Goals / Problems Addressed</th>
<th>Beneficiaries</th>
<th>Capped?</th>
</tr>
</thead>
<tbody>
<tr>
<td>WPU Africa</td>
<td>Central, East and West Africa</td>
<td>152</td>
<td>Niger</td>
<td>GETF</td>
<td>Supplying Irrigation Water to Strengthen Human-Capacity for Income-Generation</td>
<td></td>
<td></td>
<td>Irrigation water supply for vegetable cultivation (2.78 ha)</td>
<td></td>
<td>2009 - 2010</td>
<td>18%</td>
<td>Water supply for productive use</td>
<td>4.72</td>
<td>0.83</td>
<td>0.83</td>
<td>Provide water for irrigation use</td>
<td>n/a</td>
<td>No</td>
</tr>
<tr>
<td>WPU Africa</td>
<td>Southern Africa</td>
<td>154</td>
<td>Swaziland</td>
<td>GETF</td>
<td>Swaziland: Water for a Generation</td>
<td></td>
<td></td>
<td>Irrigation water supply for vegetable cultivation (131.5 ha)</td>
<td></td>
<td>R</td>
<td>2009 - 2013</td>
<td>77%</td>
<td>Water supply for productive use</td>
<td>21.60</td>
<td>16.60</td>
<td>16.60</td>
<td>Provide water for irrigation use</td>
<td>n/a</td>
</tr>
<tr>
<td>WPU Eurasia</td>
<td>Turkey and CCA</td>
<td>157</td>
<td>Kyrgyzstan</td>
<td>NDBMD</td>
<td>Rehabilitation of Canal Kure Talaa and Canal Kysyl-Chy in Naryn Region, Kyrgyzstan</td>
<td></td>
<td></td>
<td>Rehabilitation of two man-made canals to enhance water supply for regional irrigation</td>
<td></td>
<td></td>
<td></td>
<td>Water supply for productive use</td>
<td>4,186.00</td>
<td>2,478.00</td>
<td>2,478.00</td>
<td>Provide water for irrigation use</td>
<td>n/a</td>
<td>No</td>
</tr>
<tr>
<td>WPU Eurasia</td>
<td>Middle East and North Africa</td>
<td>166</td>
<td>Morocco</td>
<td>L'ALCESDAM</td>
<td>RAIN Project for the Rehabilitation of Palm Plantations in Southern Morocco</td>
<td></td>
<td></td>
<td>Irrigation improvements (122 ha)</td>
<td></td>
<td>N</td>
<td>2012 - 2014</td>
<td>86%</td>
<td>Water supply for productive use</td>
<td>934.00</td>
<td>803.00</td>
<td>803.00</td>
<td>Increase water use efficiency</td>
<td>n/a</td>
</tr>
<tr>
<td>WPU Pacific</td>
<td>Greater China and Korea</td>
<td>181</td>
<td>China</td>
<td>UNDP</td>
<td>Flood Utilization and Ecosystem Management in the Han River Basin</td>
<td></td>
<td></td>
<td>Flood utilization and ecosystem management</td>
<td></td>
<td>N</td>
<td>2012 - 2014</td>
<td>100%</td>
<td>Water supply for productive use</td>
<td>10,000.00</td>
<td>10,000.00</td>
<td>10,000.00</td>
<td>Floodwater management</td>
<td>n/a</td>
</tr>
<tr>
<td>WPU Eurasia</td>
<td>Turkey and CCA</td>
<td>194</td>
<td>Kyrgyzstan</td>
<td>Aga Khan Foundation and Ministry of Agriculture</td>
<td>Enhancing Opportunities for Youth in Income-generation, Entrepreneurship, and Education in Kyrgyzstan and Afghanistan</td>
<td></td>
<td></td>
<td>Rehabilitation of two man-made canals to enhance water supply for regional irrigation</td>
<td></td>
<td>N</td>
<td>2013</td>
<td>Variable (53.0-69.1%)</td>
<td>Water supply for productive use</td>
<td>608.70</td>
<td>397.00</td>
<td>397.00</td>
<td>Provide water for irrigation use</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Appendix C
Quantification Results:
Water Access and Sanitation Projects

Table C1. Water quantity benefits for water access and sanitation projects
March 26, 2015

2014 Replenish Quantification for Water Access and Sanitation Projects

Scope of Review

The Global Environment and Technology Foundation (GETF) has completed the 2014 review and quantification of The Coca-Cola Company system’s 2014 water access and sanitation project benefits. GETF’s review involved the following:
- Identifying new water access project activities that are generating Replenish benefits and
- Updating details for projects that were previously quantified

Methodology

GETF verified estimates of replenish benefits for water access and sanitation projects from a number of sources for all WASH projects included in this report. While site visits and verifications were conducted at several project sites, GETF also relied on information provided by Coca-Cola Company system representatives and implementing partners on many projects and activities across the globe. All projects managed by GETF or completed after 2013 have fact sheets. Other projects have been confirmed through interviews and documentation shared by the Coca-Cola System. Details on the methods for replenish benefits generated through Water Access and Sanitation projects are provided in the 2009 “Quantifying Water Access Benefits in Community Water Partnership Projects” report. These methods include using the WHO/UNICEF estimate of 20 liters of water per person per day over 365 days in a year and reporting benefits from systems that are metered.

Benefits of Water Access and Sanitation Activities

The benefits of 75 water access and sanitation projects have been quantified to date. A total of 1,119,887 beneficiaries are provided with access to water through these projects. The current estimate is that the water access and sanitation projects implemented by the end of 2014 are providing a benefit of over 6.8 billion liters per year.
<table>
<thead>
<tr>
<th>Country</th>
<th>Partner / Lead</th>
<th>Project Name</th>
<th>Description of Activity</th>
<th>New (R, Revised or Confirmed) (C) in 2014</th>
<th>Activity Timeline</th>
<th>% TCCC Contribution (2014)</th>
<th>Type of Benefit Quantified</th>
<th>Quantity Change (million L/yr)</th>
<th>TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)</th>
<th>TCCC Adjusted Benefit (2014)</th>
<th>Goals / Problems Addressed</th>
<th>Beneficiaries</th>
<th>Capped?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>GETR/Betran-</td>
<td>Water Supply, Sanitation, and Hygiene Education in the Rural Bujumbura (BMLA)</td>
<td>The main goal of this project is to improve the health and well-being of 11,880 community members by providing sustained and improved access to safe water supply in the three targeted villages of rural Bujumbura Province.</td>
<td>R 2014 50% Water, sanitation, and hygiene</td>
<td>86.72 43.28 43.28</td>
<td>Water access / sanitation</td>
<td>11,880 No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11,880 No</td>
</tr>
<tr>
<td>Africa</td>
<td>Burkina Faoo</td>
<td>Improving Access to Water in the Bujumbura (BMLA)</td>
<td>This project provided water supply services and hygiene education to residents of Bujumbura, an informal settlement in peri-urban Bujumbura, Burkina Faoo.</td>
<td>N 2014 83% Water, sanitation, and hygiene</td>
<td>53.95 44.71 44.71</td>
<td>Water access / sanitation</td>
<td>7,990 No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7,990 No</td>
</tr>
<tr>
<td>India</td>
<td>Atmakaru Village</td>
<td>Creation of Protected Water Supply in Atmakaru, Andhra Pradesh</td>
<td>The incoming source of inferior quality with turbidity and not potable is treated through appropriate designed water treatment technology and serves as safe drinking water source for the local population of about 8,000</td>
<td>R 2012 100% Water, sanitation, and hygiene</td>
<td>328.50 328.50 328.50</td>
<td>Water access / sanitation</td>
<td>Benefits provided through monitoring of system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>58,385 No</td>
</tr>
<tr>
<td>Philippines</td>
<td>Alternative Indigenous Development Foundation (AIDFI) Earth Day Network, Philippines</td>
<td>AGS Hydraulic Ram-Pump Project</td>
<td>The project provides poor-urban and rural communities with accessible and reliable community water systems using hydraulic ram pumps and ferrocement storage tanks. These benefits are metered.</td>
<td>R 2014 100% Water, sanitation, and hygiene</td>
<td>556.25 556.25 556.25</td>
<td>Water access / sanitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>58,385 No</td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>GETR/CARE Egypt</td>
<td>Community Water Connections and Health Improvement</td>
<td>This project provided full access to water to 3,703 people through household connections.</td>
<td>R 2012 80% Water, sanitation, and hygiene</td>
<td>54.79 43.50 43.50</td>
<td>Water access / sanitation</td>
<td>7,505 No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7,505 No</td>
</tr>
<tr>
<td>Egypt</td>
<td>GETR/UNICEF</td>
<td>Raising Healthy Children with Safe Household Water Supply and Sanitation</td>
<td>This project provided access to household water (and potentially waste water) connections for 5,825 children, men, and women, thereby positively affecting hygiene and health results in the short and long term in Assiut, one of the most deprived areas in Egypt.</td>
<td>R 2014 52% Water, sanitation, and hygiene</td>
<td>82.52 21.96 21.96</td>
<td>Water access / sanitation</td>
<td>5,825 No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5,825 No</td>
</tr>
<tr>
<td>Ghana</td>
<td>GETR/WaterHeal</td>
<td>Safe Water for Africa</td>
<td>To date, this project has constructed 13 WaterHealth Centers in Ghana and provided WASH education to the community. Each WHC is a decentralized water treatment facility comprising a prefabricated structure that houses the water treatment equipment, pumps, and tanks and employs sedimentation, filtration, ultraviolet and other appropriate technologies to purify and distribute contaminated waters. The centers charge an affordable fee for the water and provide employment of three to five community members who operate the system.</td>
<td>R 2014 100% Water, sanitation, and hygiene</td>
<td>166.08 166.08 166.08</td>
<td>Water access / sanitation</td>
<td>22,750 No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22,750 No</td>
</tr>
<tr>
<td>Kenya</td>
<td>WorldVision</td>
<td>Safe Water in Kenya</td>
<td>This project will provide 500,000 people with full access to water through the building and renovation of wells, extension of water pipelines, and provision of water storage tanks.</td>
<td>R 2010 3% Water, sanitation, and hygiene</td>
<td>874.84 28.64 28.64</td>
<td>Water access / sanitation</td>
<td>119,841 No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>119,841 No</td>
</tr>
<tr>
<td>Kenya</td>
<td>GETR/Water and Sanitation for the Urban Poor</td>
<td>Water &amp; Sanitation for Nakuru's peri-Urban Poor Project, Kenya</td>
<td>This project will establish water treatment, storage, and distribution networks in Nakuru's peri-urban settlements. Water kiosks and storage tanks will be constructed with a fluoride filtration system. The project will also rehabilitate boreholes, increasing the area's water supply and expand access to clean and affordable water to low-income inhabitants.</td>
<td>N 2014 46% Water, sanitation, and hygiene</td>
<td>327.32 150.34 150.34</td>
<td>Water access / sanitation</td>
<td>44,834 No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>44,834 No</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Raleigh Inter-</td>
<td>Clean Water for Communities</td>
<td>This project gave full access to water to 10,000 people through a basic gravity water feed system. (Updated 2013)</td>
<td>R 2011 100% Water, sanitation, and hygiene</td>
<td>64.53 64.53 64.53</td>
<td>Water access / sanitation</td>
<td>10,000 No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10,000 No</td>
</tr>
<tr>
<td>WASH</td>
<td>Eurasia</td>
<td>Middle East and North Africa</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>GETW/WaterHealth International</td>
<td>Safe Water for Africa</td>
<td>This project has constructed WaterHealth Centers in Liberia and provided WASH education to the community. Each WHC is a decentralized water treatment facility comprising a pre-fabricated structure that houses the water treatment equipment, pumps, and tanks and employs sedimentation, filtration, ultraviolet, and other appropriate technologies to purify and disinfect contaminated waters. The centers charge an affordable fee for the water and provide employment of three to five community members who operate the system.</td>
<td>N</td>
<td>2014</td>
<td>100% Water, sanitation, and hygiene</td>
<td>71.18</td>
<td>71.18</td>
</tr>
<tr>
<td>WASH</td>
<td>Africa</td>
<td>Central, East and West Africa</td>
<td>416</td>
<td>Mozambique</td>
<td>GETW/CAME Mozambique</td>
<td>Strengthening Communities through Integrated WASH Activities</td>
<td>This project gave over 93,000 people full access to water through construction of well points and household connections.</td>
<td>R</td>
<td>2014</td>
<td>50% Water, sanitation, and hygiene</td>
<td>681.80</td>
<td>340.40</td>
<td>340.40</td>
</tr>
<tr>
<td>WASH</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>517</td>
<td>Philippines</td>
<td>Wroclaw AKORE</td>
<td>Sarangani and Sultan Kudarat Community Water Access Project</td>
<td>This project provided 16,804 people with improved access to potable water &amp; sanitation through the construction of spring boxes and rainwater harvesting basins.</td>
<td>R</td>
<td>2012</td>
<td>100% Water, sanitation, and hygiene</td>
<td>122.67</td>
<td>122.67</td>
<td>122.67</td>
</tr>
<tr>
<td>WASH</td>
<td>Europe</td>
<td>Central and Southern Europe</td>
<td>n/a</td>
<td>n/a</td>
<td>Greece</td>
<td>Global Water Partnership Mediterranean (GWP-Med)</td>
<td>Rainwater Harvesting Program</td>
<td>The Rainwater Harvesting Program (RWH) is part of the broader &quot;Mission:Water&quot; Environmental Program by the Coca-Cola Company in Greece. The RWH Program aims at reintroducing rainwater harvesting as a cost effective practice for water availability in the water scarce Greek islands and a tool for climate change adaptation at the local level.</td>
<td>N</td>
<td>2013</td>
<td>100% Water, sanitation, and hygiene</td>
<td>39.10</td>
<td>39.10</td>
</tr>
<tr>
<td>WASH</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>610</td>
<td>Malaysia</td>
<td>Yayasan Kemanusiaan Muslim Aid Malaysia</td>
<td>Water for Humanity</td>
<td>This project construct 3 underground water supplies with 4-stage filtration processes.</td>
<td>R</td>
<td>2012</td>
<td>100% Water, sanitation, and hygiene</td>
<td>34.31</td>
<td>34.31</td>
<td>34.31</td>
</tr>
<tr>
<td>WASH</td>
<td>Africa</td>
<td>Central, East and West Africa</td>
<td>n/a</td>
<td>n/a</td>
<td>Nigeria</td>
<td>GETW/WaterHealth International</td>
<td>Safe Water for Africa</td>
<td>This project is constructing three WaterHealth Centers in Nigeria and providing WASH education to the community. Each WHC is a decentralized water treatment facility comprising a pre-fabricated structure that houses the water treatment equipment, pumps, and tanks and employs sedimentation, filtration, ultraviolet and other appropriate technologies to purify and disinfect contaminated waters. The centers charge an affordable fee for the water and provide employment of three to five community members who operate the system.</td>
<td>N</td>
<td>2014</td>
<td>100% Water, sanitation, and hygiene</td>
<td>47.45</td>
<td>47.45</td>
</tr>
<tr>
<td>WASH</td>
<td>Africa</td>
<td>Central, East and West Africa</td>
<td>n/a</td>
<td>n/a</td>
<td>Rwanda</td>
<td>GETW/Water for People</td>
<td>Water and Sanitation in Gahanga and Musaka</td>
<td>This project provided 31,255 people with access to clean water.</td>
<td>R</td>
<td>2014</td>
<td>35% Water, sanitation, and hygiene</td>
<td>228.89</td>
<td>80.90</td>
</tr>
<tr>
<td>WASH</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>n/a</td>
<td>n/a</td>
<td>Philippines</td>
<td>Northern Luzon Access Center, Inc.</td>
<td>Community-based Portable Water System Management Project</td>
<td>This project gave 52,742 people full access to water.</td>
<td>R</td>
<td>2012</td>
<td>100% Water, sanitation, and hygiene</td>
<td>34.27</td>
<td>34.27</td>
</tr>
<tr>
<td>WASH</td>
<td>Africa</td>
<td>Central, East and West Africa</td>
<td>47</td>
<td>Rwanda</td>
<td>Blood Water Mission</td>
<td>Community Development through Sustainable Water Supply</td>
<td>This project gave 52,742 people full access to water.</td>
<td>R</td>
<td>2008</td>
<td>25% Water, sanitation, and hygiene</td>
<td>385.01</td>
<td>87.47</td>
<td>87.47</td>
</tr>
<tr>
<td>WASH</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>n/a</td>
<td>n/a</td>
<td>Cambodia</td>
<td>Cambodian Women for Peace and Development</td>
<td>Community Clean Water Supply and Sanitation 2013</td>
<td>This project provided full water access to 8,750 people.</td>
<td>N</td>
<td>2012</td>
<td>100% Water, sanitation, and hygiene</td>
<td>27.38</td>
<td>27.38</td>
</tr>
<tr>
<td>WASH</td>
<td>Africa</td>
<td>Central, East and West Africa</td>
<td>562</td>
<td>Senegal</td>
<td>Research Triangle Institute</td>
<td>Community Water, Sanitation, and Hygiene</td>
<td>This project provided 11,100 people with full access to water through installation and rehabilitation of water access infrastructure in villages.</td>
<td>R</td>
<td>2013</td>
<td>36% Water, sanitation, and hygiene</td>
<td>81.03</td>
<td>30.51</td>
<td>30.51</td>
</tr>
<tr>
<td>WASH</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>654</td>
<td>Cambodia</td>
<td>Cambodian Women for Peace and Development</td>
<td>Community Clean Water Supply and Sanitation 2011</td>
<td>This project provides clean water to 2,800 people.</td>
<td>R</td>
<td>2012</td>
<td>97% Water, sanitation, and hygiene</td>
<td>20.64</td>
<td>19.83</td>
<td>19.83</td>
</tr>
<tr>
<td>CRP Category</td>
<td>WASH Operating Group</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>New (I, Net) (V), or (C) in 2014</td>
<td>Activity Timeline</td>
<td>% TCCC Contribution (2014)</td>
<td>Type of Benefit (Quantity)</td>
<td>Quantity Change (million Lyr)</td>
<td>TCCC Ultimate Water Quantity Benefit, Capped (million Lyr)</td>
<td>TCCC Adjusted Benefit (2014)</td>
<td>Goals / Problems Addressed</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------</td>
<td>---------</td>
<td>----------------</td>
<td>--------------</td>
<td>------------------------</td>
<td>-------------------------------</td>
<td>-----------------</td>
<td>--------------------------</td>
<td>--------------------------</td>
<td>---------------------------</td>
<td>--------------------------------</td>
<td>-------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>WASH Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>n/a</td>
<td>n/a</td>
<td>Thailand</td>
<td>HAI Village that learns and earns</td>
<td>This project has been implemented in villages - Linthong, Moe Than Noi, and Namdong and is providing water to nearly 1,000 people.</td>
<td>R 2011</td>
<td>92%</td>
<td>Water, sanitation, and hygiene</td>
<td>18.07</td>
<td>18.07</td>
<td>18.07</td>
<td>Water access / sanitation</td>
</tr>
<tr>
<td>WASH Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>n/a</td>
<td>n/a</td>
<td>Cambodia and Vietnam</td>
<td>UN Habitat</td>
<td>Mekong Region Water and Sanitation Initiative</td>
<td>This project gave full access to water to 12,481 people.</td>
<td>R 2012</td>
<td>20%</td>
<td>Water, sanitation, and hygiene</td>
<td>91.11</td>
<td>17.86</td>
<td>17.86</td>
</tr>
<tr>
<td>WASH Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>n/a</td>
<td>n/a</td>
<td>Vietnam</td>
<td>CEFACOM</td>
<td>Clean Water for School and Communities 2012</td>
<td>This project will give 1,086 people full access to water through construction of wells</td>
<td>R 2012</td>
<td>100%</td>
<td>Water, sanitation, and hygiene</td>
<td>14.50</td>
<td>14.50</td>
<td>14.50</td>
</tr>
<tr>
<td>WASH Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>n/a</td>
<td>n/a</td>
<td>Indonesia</td>
<td>Yasaen-Bina Usaha Ulingkungan</td>
<td>Water and Sanitation for a Sustainable Community</td>
<td>This project will give 4,100 people full access to water through the installation of an improved water system in the community.</td>
<td>R 2012</td>
<td>100%</td>
<td>Water, sanitation, and hygiene</td>
<td>13.87</td>
<td>13.87</td>
<td>13.87</td>
</tr>
<tr>
<td>WASH Africa</td>
<td>Southern Africa</td>
<td>n/a</td>
<td>n/a</td>
<td>Swaziland</td>
<td>GETI/MCH</td>
<td>Water for a Generation</td>
<td>This project provided 13,140 people with full access water through the construction and rehabilitation of 75 water points.</td>
<td>R 2013</td>
<td>77%</td>
<td>Water, sanitation, and hygiene</td>
<td>95.92</td>
<td>73.88</td>
<td>73.88</td>
</tr>
<tr>
<td>WASH Pacific</td>
<td>Greater China and Korea</td>
<td>n/a</td>
<td>n/a</td>
<td>China</td>
<td>UNDP</td>
<td>Zhejiang Rivers Project</td>
<td>[No description available]</td>
<td>N 2010</td>
<td>3%</td>
<td>Water, sanitation, and hygiene</td>
<td>210.00</td>
<td>7.47</td>
<td>7.47</td>
</tr>
<tr>
<td>WASH Africa</td>
<td>Central, East and West Africa</td>
<td>n/a</td>
<td>n/a</td>
<td>Tanzania</td>
<td>GETI/Women for Water Partnership (WfWP)</td>
<td>Improving Access to Water in Mavera Village</td>
<td>This project provided access to safe sustainable drinking water through a gravity fed water supply scheme in Mavera village and a rainwater harvesting unit at Mvuvo Primary School.</td>
<td>N 2014</td>
<td>77%</td>
<td>Water, sanitation, and hygiene</td>
<td>14.60</td>
<td>11.18</td>
<td>11.18</td>
</tr>
<tr>
<td>WASH Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>n/a</td>
<td>553</td>
<td>Philippines</td>
<td>SUNCODC, Inc.</td>
<td>Community Managed Potable Water Supply through Creek Development and Rain Harvesting in Barangan San Fernando and Dauyong, Del Carmen, Sanga-sanga del Norte</td>
<td>The primary focus of the project is the installation of a Rainwater Harvesting Facility and the rehabilitation / improvement of a creek-based water source towards operationalization of a Level II Potable Water System in each of the two barangays.</td>
<td>R 2013</td>
<td>100%</td>
<td>Water, sanitation, and hygiene</td>
<td>8.56</td>
<td>8.56</td>
<td>8.56</td>
</tr>
<tr>
<td>WASH Latin America</td>
<td>South Latin</td>
<td>n/a</td>
<td>652</td>
<td>Argentina</td>
<td>AIUDIA</td>
<td>Extension of the Drinking Water Network at EFA Neighborhood, Villa Occupo Santa Fe</td>
<td>This initiative entails the extension of the drinking water network for 40 families in the E.F.A. neighborhood.</td>
<td>R 2012</td>
<td>53%</td>
<td>Water, sanitation, and hygiene</td>
<td>1.46</td>
<td>0.77</td>
<td>0.77</td>
</tr>
<tr>
<td>WASH Africa</td>
<td>Central, East and West Africa</td>
<td>n/a</td>
<td>389</td>
<td>Uganda</td>
<td>GETI/Water and Sanitation for the Urban Poor</td>
<td>Bebwe Urban Water Access Program</td>
<td>This project provided 15,015 people full access to safe, affordable water through the rehabilitation of the water distribution network.</td>
<td>R 2013</td>
<td>63%</td>
<td>Water, sanitation, and hygiene</td>
<td>114.00</td>
<td>69.51</td>
<td>69.51</td>
</tr>
<tr>
<td>WASH Eurasia</td>
<td>Russia, Ukraine and Belarus</td>
<td>n/a</td>
<td>n/a</td>
<td>Ukraine</td>
<td>UNDP</td>
<td>Every Drop Matters - 3rd Generation</td>
<td>The project aimed to improve waste water treatment in the local communities (residential municipal housing) through implementation of partnership community project on water replenishment to ameliorate environmental, hygiene and sanitation situations. The project has achieved its goal through mobilization of municipal community members through involving them in community projects on water implementation. The project was built upon the successful experience of the previous activities and established network of partnerships with regional and local government, communities and municipalities.</td>
<td>N 2014</td>
<td>40%</td>
<td>Water, sanitation, and hygiene</td>
<td>50.46</td>
<td>20.18</td>
<td>20.18</td>
</tr>
<tr>
<td>WASH Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>n/a</td>
<td>n/a</td>
<td>Vietnam</td>
<td>CEFACOM</td>
<td>Clean Water for Communities (2014)</td>
<td>The project aims to sustainably increase and improve access to clean water to underserved communities in Thu Duc, Hoa Vung and Thu Thiem districts in Vietnam. The civil works such as Household connection by extending water pipe, water meter will also be provided to the beneficiaries in Thu Duc district and Hoa Vung district; drilling wells, pump and filtration box will be provided to the beneficiaries in Thu Thiem district. The beneficiaries are Poor households in the surrounding areas of three Coca-Cola Vietnam factories who have difficulties in access to clean water and sanitation improvements.</td>
<td>N 2014</td>
<td>100%</td>
<td>Water, sanitation, and hygiene</td>
<td>159.08</td>
<td>159.08</td>
<td>159.08</td>
</tr>
<tr>
<td>CMP Category</td>
<td>TCCE Operating Group</td>
<td>Water Access and Sanitation</td>
<td>ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Type of Benefit</td>
<td>Quantity Change (million L/yr)</td>
<td>TCCC Ultimate Water Quantity Benefit, Capped (million L/yr)</td>
<td>TCCC Adjusted Benefit (2014)</td>
<td>Goals / Problems Addressed</td>
<td>Beneficiaries</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------</td>
<td>-----------------------------</td>
<td>----</td>
<td>---------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------------------------</td>
<td>-----------------</td>
<td>---------------------------------</td>
<td>--------------------------------</td>
<td>----------------------</td>
<td>--------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>WASH</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>n/a</td>
<td>Cambodia</td>
<td>Cambodian Women for Peace and Development</td>
<td>Communities Clean Water Supply and Sanitation 2014</td>
<td>This project intends to improve access to safe drinking water and increase the sanitation behavior through a water pipe connection to a clean water supply and sanitation/personal hygiene education.</td>
<td>Water, sanitation, and hygiene</td>
<td>55.89</td>
<td>55.89</td>
<td>Water access / sanitation</td>
<td>2,013</td>
<td>No</td>
</tr>
<tr>
<td>WASH</td>
<td>Eurasia</td>
<td>Middle East and North Africa</td>
<td>n/a</td>
<td>Egypt</td>
<td>Egyptian Food Bank</td>
<td>Egypt Livelihood Program</td>
<td>Connecting 1,122 clean water connections to houses in 8 villages benefiting a total of 6,357 beneficiaries (including 508 limited access beneficiaries at a primary school) as a part of the 100 Villages project that aims to develop 100 villages in Egypt by the year 2020.</td>
<td>Water, sanitation, and hygiene</td>
<td>42.70</td>
<td>42.70</td>
<td>Water access / sanitation</td>
<td>5,049</td>
<td>No</td>
</tr>
<tr>
<td>WASH</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>n/a</td>
<td>Thailand</td>
<td>The Forest and Sea for Life Foundation</td>
<td>Enhancing the Capability of Community Organization and Klong Yan Watershed Resource Conservation and Rehabilitation Network</td>
<td>This project provided water supply systems for 460 households.</td>
<td>Water, sanitation, and hygiene</td>
<td>13.51</td>
<td>13.51</td>
<td>Water access / sanitation</td>
<td>1,850</td>
<td>No</td>
</tr>
<tr>
<td>WASH</td>
<td>Eurasia</td>
<td>Middle East and North Africa</td>
<td>33</td>
<td>Pakistan</td>
<td>WWF-Pakistan</td>
<td>Environment Conservation &amp; Watershed Management</td>
<td>81 roof water harvesting schemes were established in three sites: Nampi-Mara, Kundla and Tashkabad where there was shortage of spring and stream water. Each roof water harvesting scheme consists of collection channels around the roof and a storage tank connected with a wash room or a washing tap.</td>
<td>Water, sanitation, and hygiene</td>
<td>7.90</td>
<td>7.90</td>
<td>Water access / sanitation</td>
<td>Benefits provided through monitoring of system</td>
<td>No</td>
</tr>
<tr>
<td>WASH</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>n/a</td>
<td>Philippines</td>
<td>Philippine Rural Reconstruction Movement</td>
<td>AGDS Gravity Fed Water Access</td>
<td>PRMM and (CCP) jointly facilitate the project for the construction of spring development gravity fed water systems in selected five (5) rural communities in the provinces of Aklan, Camarines Norte, Camarines Sur, Eastern Samar, and Nueva Ecuja</td>
<td>Water, sanitation, and hygiene</td>
<td>54.75</td>
<td>54.75</td>
<td>Water access / sanitation</td>
<td>1,699</td>
<td>No</td>
</tr>
<tr>
<td>WASH</td>
<td>Pacific</td>
<td>Association of Southeast Asian Nations</td>
<td>n/a</td>
<td>Philippines</td>
<td>Habitat for Humanity</td>
<td>Agos - Habitat Rebuild Water Project</td>
<td>Partnership project of Coca-Cola Foundation and Habitat for Humanity (HH) in the rebuilding of water systems of seven (7) project sites (covering several barangay from adjacent provinces) destroyed by Bohol Earthquake in 2013.</td>
<td>Water, sanitation, and hygiene</td>
<td>25.40</td>
<td>25.40</td>
<td>Water access / sanitation</td>
<td>34,790</td>
<td>No</td>
</tr>
</tbody>
</table>
Appendix D
Fact Sheets for Watershed Protection Projects

Fact sheets for updated and new activities quantified
# Appendix D Table of Contents

<table>
<thead>
<tr>
<th>LTI ID</th>
<th>TCCC ID</th>
<th>Country</th>
<th>Partner / Lead</th>
<th>Project Name</th>
<th>Description of Activity</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>153</td>
<td>U.S. MI TNC</td>
<td></td>
<td>Paw Paw River Watershed Restoration</td>
<td>Cropland management</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>155</td>
<td>U.S. GA TNC</td>
<td></td>
<td>Lower Flint River Watershed Restoration</td>
<td>Variable rate irrigation and advanced irrigation scheduling</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>42</td>
<td>Ghana, Ivory Coast GETF</td>
<td></td>
<td>Transboundary Community Water Management</td>
<td>Reforestation</td>
<td>14</td>
</tr>
<tr>
<td>21</td>
<td>18</td>
<td>U.S. TX WWF</td>
<td></td>
<td>Protecting the Rio Grande / Rio Bravo River</td>
<td>Rio Grande (Big Bend) - Reestablishment of channel morphology and floodplain connectivity</td>
<td>20</td>
</tr>
<tr>
<td>38</td>
<td>120</td>
<td>Mexico TCCC</td>
<td></td>
<td>Mexico Restoration and Reforestation Program</td>
<td>Ground restoration (infiltration trenches)</td>
<td>25</td>
</tr>
<tr>
<td>51</td>
<td>375</td>
<td>India, Nepal TCCC</td>
<td></td>
<td>Rainwater Harvesting and Aquifer Recharge in India</td>
<td>Rainwater harvesting structures and recharge shafts</td>
<td>32</td>
</tr>
<tr>
<td>70</td>
<td>259</td>
<td>Spain, Portugal WWF</td>
<td></td>
<td>Restoration Project Guadiana River Basin</td>
<td>Reforestation</td>
<td>36</td>
</tr>
<tr>
<td>103</td>
<td>345</td>
<td>Canada U.S. TCCC</td>
<td></td>
<td>North America Rain Barrel Donation Program</td>
<td>Rain barrel distribution</td>
<td>42</td>
</tr>
<tr>
<td>105</td>
<td>Japan TCCC</td>
<td></td>
<td></td>
<td>Protecting Forests from Land Development</td>
<td>Forest protection</td>
<td>50</td>
</tr>
<tr>
<td>107</td>
<td>Argentina Avina</td>
<td></td>
<td></td>
<td>Conservation and Restoration of Ramsar Site Lagunas de Guanacache Desaguadero and del Bebedero</td>
<td>Wetland restoration</td>
<td>58</td>
</tr>
<tr>
<td>108</td>
<td>Argentina Avina</td>
<td></td>
<td></td>
<td>Reserves in La Calera, Province of Cordoba: Management as a Tool for Basin Recovery</td>
<td>Fire suppression</td>
<td>68</td>
</tr>
<tr>
<td>110</td>
<td>U.S. AZ BEF</td>
<td></td>
<td></td>
<td>Verde River Program</td>
<td>Instream flow restoration</td>
<td>77</td>
</tr>
<tr>
<td>111</td>
<td>U.S. MT BEF</td>
<td></td>
<td></td>
<td>Prickly Pear Creek Re-Watering Project</td>
<td>Instream flow restoration</td>
<td>83</td>
</tr>
<tr>
<td>116</td>
<td>India TCCC</td>
<td></td>
<td></td>
<td>Construction of Check Dams in Rajasthan, Himachal Pradesh and Uttar Pradesh</td>
<td>Check dam construction</td>
<td>88</td>
</tr>
<tr>
<td>121</td>
<td>Japan TCCC</td>
<td></td>
<td></td>
<td>Forest Maintenance in Japan</td>
<td>Forest maintenance</td>
<td>94</td>
</tr>
<tr>
<td>139</td>
<td>U.S. CA USFS</td>
<td></td>
<td></td>
<td>Invasive Species Removal in Angeles National Forest, California</td>
<td>Invasive species removal</td>
<td>104</td>
</tr>
<tr>
<td>140</td>
<td>U.S. LA TNC</td>
<td></td>
<td></td>
<td>Floodplain Reconnection and Wetland Restoration Mollicy Farms, Louisiana</td>
<td>Floodplain reconnection and wetland restoration</td>
<td>109</td>
</tr>
<tr>
<td>141</td>
<td>Chile Avina</td>
<td></td>
<td></td>
<td>Wetland restoration in highland indigenous communities of Alto Tarapacá, I Region, Chile</td>
<td>Vegetation management to restore or improve wetland function</td>
<td>114</td>
</tr>
</tbody>
</table>
## Appendix D Table of Contents

<table>
<thead>
<tr>
<th>LTI ID</th>
<th>TCCC ID</th>
<th>Country</th>
<th>Partner / Lead</th>
<th>Project Name</th>
<th>Description of Activity</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>143</td>
<td></td>
<td>Peru, Argentina</td>
<td>Province of Oxapampa</td>
<td>Oxapampa Ashaninca Yanesha (RBOAY) Biosphere Reserve, Central Forest</td>
<td>Revegetation and native forest conservation</td>
<td>121</td>
</tr>
<tr>
<td>144</td>
<td></td>
<td>Spain</td>
<td>WWF</td>
<td>Replenishing Upper Guadiana Aquifers: “Misión Posible”</td>
<td>Irrigation water management</td>
<td>130</td>
</tr>
<tr>
<td>147</td>
<td></td>
<td>Spain</td>
<td>SEO / Birdlife</td>
<td>Tancat de la Pipa</td>
<td>Restoration of constructed wetland</td>
<td>137</td>
</tr>
<tr>
<td>149</td>
<td></td>
<td>U.S. UT</td>
<td>BEF</td>
<td>Chalk Creek Flow Restoration</td>
<td>Instream flow restoration</td>
<td>144</td>
</tr>
<tr>
<td>156</td>
<td></td>
<td>Turkey</td>
<td>Nature Conservation Centre</td>
<td>Life Plus Environment Program</td>
<td>Conservation agriculture</td>
<td>148</td>
</tr>
<tr>
<td>162</td>
<td></td>
<td>Great Britain</td>
<td>WWF</td>
<td>River Nar Land Management Improvements</td>
<td>Land management best practices by farmers and silt-trap/small wetland installations</td>
<td>156</td>
</tr>
<tr>
<td>165</td>
<td></td>
<td>Japan</td>
<td>Aso Grassland Restoration Committee</td>
<td>Conservation of Existing Land Cover</td>
<td>Conservation of grassland</td>
<td>165</td>
</tr>
<tr>
<td>167</td>
<td></td>
<td>U.S. MT</td>
<td>Trout Unlimited</td>
<td>Improving Fort Shaw Irrigation District Water Efficiency to Improve Sun River Flow</td>
<td>Instream flow restoration</td>
<td>171</td>
</tr>
<tr>
<td>168</td>
<td></td>
<td>U.S. CA</td>
<td>Sustainable Conservation</td>
<td>Laguna Irrigation District Groundwater Recharge Project</td>
<td>Development of a groundwater recharge site</td>
<td>178</td>
</tr>
<tr>
<td>169</td>
<td></td>
<td>Ecuador</td>
<td>TNC</td>
<td>Protection and Restoration of Natural Paramo Areas in the Guambi Watershed – Quito Water Fund</td>
<td>Conservation, restoration and revegetation</td>
<td>183</td>
</tr>
<tr>
<td>170</td>
<td></td>
<td>Ecuador</td>
<td>TNC</td>
<td>Forest conservation in the Daule River watershed</td>
<td>Conservation</td>
<td>194</td>
</tr>
<tr>
<td>171</td>
<td></td>
<td>Colombia</td>
<td>TNC</td>
<td>Forest Protection in the Rio Siecha Watershed - Agua Somos Water Fund</td>
<td>Conservation</td>
<td>200</td>
</tr>
<tr>
<td>172</td>
<td></td>
<td>Colombia</td>
<td>TNC</td>
<td>Forest Conservation in the Rio Grande – Rio Chico Watershed, - Corporación Cuenca Verde</td>
<td>Conservation/forest protection</td>
<td>208</td>
</tr>
<tr>
<td>173</td>
<td></td>
<td>Panama</td>
<td>TNC</td>
<td>Tropical Rainforest Conservation in the Panama Canal Watershed</td>
<td>Forest conservation/protection</td>
<td>214</td>
</tr>
<tr>
<td>174</td>
<td></td>
<td>Costa Rica</td>
<td>TNC</td>
<td>Forest Conservation in the Greater Tarcoles River Watershed – Agua Tica Water Fund</td>
<td>Conservation</td>
<td>220</td>
</tr>
</tbody>
</table>
## Appendix D Table of Contents

<table>
<thead>
<tr>
<th>LTI ID</th>
<th>TCCC ID</th>
<th>Country</th>
<th>Partner / Lead</th>
<th>Project Name</th>
<th>Description of Activity</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>175</td>
<td></td>
<td>Guatemala</td>
<td>TNC</td>
<td>Forest Protection, Agroforestry Promotion, and Reforestation in the Xaya-Pixcaya Watershed</td>
<td>Conservation and restoration</td>
<td>226</td>
</tr>
<tr>
<td>176</td>
<td></td>
<td>Dominican Republic</td>
<td>TNC</td>
<td>Forest Conservation in the Higua River Watershed - Yaque del Norte Water Fund</td>
<td>Conservation and Restoration</td>
<td>236</td>
</tr>
<tr>
<td>177</td>
<td></td>
<td>China</td>
<td>WWF</td>
<td>Wetland Restoration in Jialing River Basin</td>
<td>Green Certification for Pear Production</td>
<td>244</td>
</tr>
<tr>
<td>178</td>
<td></td>
<td>U.S. WA</td>
<td>USFS</td>
<td>Upper Methow River Restoration</td>
<td>Restoring groundwater storage through beaver reintroduction</td>
<td>257</td>
</tr>
<tr>
<td>179</td>
<td></td>
<td>Turkey</td>
<td>Nature Conservation Centre</td>
<td>Night Irrigation Project for Harran Plain</td>
<td>Night irrigation</td>
<td>263</td>
</tr>
<tr>
<td>180</td>
<td></td>
<td>China</td>
<td>UNDP</td>
<td>Wetland treatment to improve quality of Lake Wuliangsu</td>
<td>Construction of a pilot pond for wetland treatment and aquaculture development</td>
<td>267</td>
</tr>
<tr>
<td>182</td>
<td></td>
<td>South Africa</td>
<td>WWF</td>
<td>Project Khula: Protecting Freshwater Resources while Improving the Livelihoods of Disadvantaged and Previously Disadvantaged Sugarcane Growers in South Africa</td>
<td>Invasive species removal</td>
<td>272</td>
</tr>
<tr>
<td>183</td>
<td></td>
<td>U.S. NE</td>
<td>TNC</td>
<td>Western Nebraska Irrigation Project</td>
<td>Variable rate irrigation and advanced irrigation scheduling</td>
<td>277</td>
</tr>
<tr>
<td>185</td>
<td></td>
<td>Russian Federation</td>
<td>TCCC</td>
<td>Restoration of Lake Sazanie in the Volga-Akhtuba Floodplain</td>
<td>Restoration of natural flooding regime</td>
<td>282</td>
</tr>
<tr>
<td>186</td>
<td></td>
<td>Canada</td>
<td>TRCA</td>
<td>Tommy Thompson Park Wetland Regeneration</td>
<td>Capping of contaminated sediments</td>
<td>287</td>
</tr>
<tr>
<td>187</td>
<td></td>
<td>U.S. CO</td>
<td>CSU</td>
<td>South Platte River Sustainable Irrigation</td>
<td>Sustainable Irrigation in the Lower South Platte River Basin</td>
<td>292</td>
</tr>
<tr>
<td>189</td>
<td></td>
<td>Costa Rica</td>
<td>TNC</td>
<td>Forest Conservation in the Greater Tarcoles River Watershed – Agua Tica Water Fund</td>
<td>Conservation and restoration</td>
<td>298</td>
</tr>
<tr>
<td>190</td>
<td></td>
<td>Guatemala</td>
<td>TNC</td>
<td>Forest Protection and Restoration in the El Zapote Watershed, Cordillera Alux Forest Reserve</td>
<td>Conservation and restoration</td>
<td>305</td>
</tr>
<tr>
<td>191</td>
<td></td>
<td>Dominican Republic</td>
<td>TNC</td>
<td>Forest Protection and Restoration in the Haina-Duey Subwatershed – Santo Domingo Water Fund</td>
<td>Conservation and restoration</td>
<td>313</td>
</tr>
</tbody>
</table>
### Appendix D Table of Contents

<table>
<thead>
<tr>
<th>LTI ID</th>
<th>TCCC ID</th>
<th>Country</th>
<th>Partner / Lead</th>
<th>Project Name</th>
<th>Description of Activity</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>192</td>
<td></td>
<td>Dominican Republic</td>
<td>TNC</td>
<td>Forest Protection and Restoration in the Mahomita Microwatershed – Santo Domingo Water Fund</td>
<td>Conservation and restoration</td>
<td>321</td>
</tr>
</tbody>
</table>

Notes:
- BEF = Bonneville Environmental Foundation
- CSU = Colorado State University
- GETF = Global Environment & Technology Foundation
- SEO/Birdlife = Spanish Ornithological Society
- TCCC = The Coca-Cola Company
- TRCA = Toronto and Region Conservation Authority
- TNC = The Nature Conservancy
- UNDP = United Nations Development Program
- USFS = United States Forest Service
- WWF = World Wildlife Fund
**PROJECT NAME:** Paw Paw River Watershed Restoration  
**PROJECT ID #:** 01

**DESCRIPTION OF ACTIVITY:** Implement best management practices for cropland in the Paw Paw River watershed, including: 1) conservation tillage practices, 2) conservation cover, and 3) filter strips.

**LOCATION:** Paw Paw River watershed (located near the city of Paw Paw in southwest lower Michigan)

**PRIMARY CONTACTS:**

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Director</td>
<td>Mary Fales</td>
<td><a href="mailto:mfales@tnc.org">mfales@tnc.org</a></td>
</tr>
<tr>
<td>Conservation Technician</td>
<td>Colleen Forestieri</td>
<td><a href="mailto:colleen.forestieri@mi.na.net">colleen.forestieri@mi.na.net</a></td>
</tr>
<tr>
<td>Contract Ecologist</td>
<td>Rena Ann Stricker</td>
<td><a href="mailto:rstricker@coca-cola.com">rstricker@coca-cola.com</a></td>
</tr>
<tr>
<td>Water Resources Manager</td>
<td>Jon Radtke</td>
<td><a href="mailto:jradtke@coca-cola.com">jradtke@coca-cola.com</a></td>
</tr>
<tr>
<td>Van Buren</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conservation District</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environment &amp; Sustainability</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**OBJECTIVES:**
- Reduce runoff and increase infiltration/baseflow
- Reduce sediment erosion/runoff

**BACKGROUND & ACTIVITY DESCRIPTION:** Implementing conservation tillage (e.g., no till) practices (1,149.2 acres) for agricultural fields that are currently subject to conventional tillage is expected to: 1) reduce runoff quantities and enhance groundwater baseflow, and 2) reduce sediment erosion and runoff from agricultural fields. The implementation of conservation cover (30 acres) and filter strips (15 acres) are expected to have similar benefits on a smaller scale. Figure 1 shows conservation tillage and a riparian buffer.

![Figure 1. Conservation tillage and a riparian buffer in the Paw Paw River watershed](image-url)
SUMMARY OF REPLENISH BENEFIT:
• 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 231.5 ML/yr

ACTIVITY TIMELINE:
• The project was originally intended to be implemented during roughly a 3-year period extending from September 2009 to 2012. However, additional tillage and filter strip practices were implemented in 2013, and additional no-till fields were enrolled in the program during 2014 to replace fields that had been removed from the program for various reasons.
• The conservation tillage activities associated with TCCC funding have been largely completed following best management practices (BMP) implementation in 2013 and 2014.
• The conservation cover was implemented in 2011, and filter strips were implemented in both 2012 and 2013.

COCA-COLA CONTRIBUTION: 76.9% to 100% (depending on implementation year)
• Project would not have occurred without TCCC funding.
• For activities implemented in 2010 and 2011, the TCCC cost share is estimated to be 76.9%. Coca-Cola had contributed grant money totaling $133,000 for studies and planning, and USDA and The Nature Conservancy had contributed a total of $40,035 to support activities implemented during these years.
• For activities implemented in 2012, 2013, and 2014, the TCCC cost share is 100% because TCCC funding is serving as direct payment to the farmers involved.

WATERSHED BENEFITS CALCULATED:
1. Increase in groundwater recharge
2. Decrease in sediment erosion/runoff

1. INCREASE IN GROUNDWATER RECHARGE

Approach & Results:
The Institute for Water Resources (IWR) at Michigan State University has developed a Soil & Water Assessment (SWAT) model (Neitsch et al., 2005) to simulate the hydrology of the Paw Paw River watershed in southwest Michigan. The goals of this watershed modeling study included: 1) estimating the water balance of the watershed under current land uses, and 2) developing an estimate of the change in groundwater recharge under potential land use scenarios and management practices. The model utilizes typical watershed datasets, including the National Hydrography Dataset (NHD), a digital elevation model (DEM), county-based SSURGO soil datasets, and the 2001 National Land Cover Dataset (NLCD) for defining land use/cover conditions. More detailed documentation of the SWAT model is provided in the IWR (2010) modeling report.

The calibrated SWAT model for the Paw Paw River watershed was used to estimate the increase in groundwater recharge resulting from three different management practices implemented in the watershed. These benefits are described below and summarized in Table 1.
• Conservation tillage – reduced-till and no-till practices implemented from 2010–2014 for 1,149.2 acres:
  o Water quantity benefit: 236.0 ML/yr
Note: The water quantity benefit for conservation tillage activities lasts for a total of three years. After the 3-year funding cycle has been completed, a partial benefit of 75% is claimed for conservation tillage activities (e.g., the benefit for a project starting in 2011 is pro-rated beginning in 2014 to account for a 3-year lifetime of activities).

- Water quantity benefit after scaling for implementation schedule: 223.1 ML/yr

- **Filter strips** – implemented in 2012 and 2013 for a total area of 15 acres:
  - Water quantity benefit: 8.2 ML/yr
  Note: Filter strips result in a permanent change to the landscape. Therefore, pro-rating of benefits is not necessary.

- **Conservation cover** – implemented in 2011 for 30 acres:
  - Water quantity benefit: 11.8 ML/yr
  Note: Conservation cover results in a permanent change to the landscape. Therefore, pro-rating of benefits is not necessary.

- The maximum project water quantity benefit for the tillage, filter strips, and conservation cover activities, without schedule adjustment, is 256.0 ML/yr. After this benefit is scaled for implementation schedule, the total maximum water quantity benefit is 243.2 ML/yr.

Table 1. Summary of Water Quantity Benefits

<table>
<thead>
<tr>
<th>Year</th>
<th>Total BMP Area (acres)</th>
<th>Conservation Tillage Benefit (ML/yr)</th>
<th>Filter Strips and Conservation Cover Benefit (ML/yr)</th>
<th>TCCC Cost Share</th>
<th>Total Cumulative Benefit* (ML/yr)</th>
<th>Total Cumulative Benefit Adjusted for TCCC Cost Share** (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>23.7</td>
<td>1.7</td>
<td>0.0</td>
<td>76.9%</td>
<td>1.7</td>
<td>1.3</td>
</tr>
<tr>
<td>2011</td>
<td>380.0</td>
<td>49.7</td>
<td>11.8</td>
<td>76.9%</td>
<td>63.2</td>
<td>48.6</td>
</tr>
<tr>
<td>2012</td>
<td>440.0</td>
<td>74.8</td>
<td>4.8</td>
<td>100.0%</td>
<td>142.8</td>
<td>128.2</td>
</tr>
<tr>
<td>2013</td>
<td>122.5</td>
<td>63.0</td>
<td>3.4</td>
<td>100.0%</td>
<td>208.8</td>
<td>194.3</td>
</tr>
<tr>
<td>2014</td>
<td>228</td>
<td>46.8</td>
<td>0.0</td>
<td>100.0%</td>
<td>243.2</td>
<td>231.5</td>
</tr>
</tbody>
</table>

* The water quantity benefit for conservation tillage activities lasts for a total of three years. After the 3-year funding cycle has been completed, a partial benefit of 75% is claimed for conservation tillage activities. Filter strips and conservation cover result in a permanent change to the landscape. Therefore, pro-rating of benefits is not necessary.

** To account for implementation schedule (i.e., pro-rating of conservation tillage water quantity benefits after three years), the total cumulative benefit adjusted for TCCC cost share is calculated by multiplying the conservation tillage benefit by the TCCC cost share (and then multiplying by a partial benefit of 75% three years after implementation), and adding the filter strips and conservation cover benefit multiplied by the TCCC cost share.

The total (maximum) benefit is: 243.2 ML/yr

TCCC total (maximum) benefit taken as a function of cost share is: 231.5 ML/yr
The current (2014) benefit and projected benefits are based on the total maximum benefit for the tillage management practice area (1,149.2 acres), filter strips (15 acres), and conservation cover (30 acres), adjusted to account for implementation schedule and TCCC cost share.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 243.2 ML/yr, and TCCC’s benefit (adjusted for cost share) is 231.5 ML/yr.

**Projected Replenish Benefits**

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column (based on an expected 25% reduction in benefit after a 3-year funding cycle has ended for individual farmers who are being funded for conservation tillage activities), and scaled further for TCCC cost share in the third column. Note that the results in Table 2 reflect the aggregate benefits for 2014 across more than 30 individual fields that have a variety of implementation schedules. A spreadsheet containing the information and calculations to support the benefit estimate is available upon request (LimnoTech, 2014).

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>224.5</td>
<td>212.8</td>
</tr>
<tr>
<td>2016</td>
<td>208.7</td>
<td>197.1</td>
</tr>
<tr>
<td>2017</td>
<td>197.0</td>
<td>185.4</td>
</tr>
<tr>
<td>2018</td>
<td>197.0</td>
<td>185.4</td>
</tr>
<tr>
<td>2019</td>
<td>197.0</td>
<td>185.4</td>
</tr>
</tbody>
</table>

**Data Sources & Assumptions:**

- For this study, a SWAT model was used to simulate the hydrology of the Paw Paw River Watershed in Southwest Michigan. A primary objective of this study was to create an estimate of groundwater recharge on the individual soils within the watershed under different potential land use categories and management practices. Datasets used to support the SWAT model development included the county-level SSURGO soils dataset, land use information from the Michigan Center for Geographic Information, and weather data obtained from the Michigan Climate Office. Additional modeling details are provided in the IWR modeling report (IWR, 2010).

- Key assumptions regarding implementation schedule include:
  - Tillage practices will be carried forward by farmers for 75% of the implementation area after the 3-year funding cycle is completed for a given area (Van Buren County Conservation District, personal communication); and
  - Although the original objective of the project was to place 2,000 acres of land into reduced-till or no-till, the current total area for tillage practices through 2014 is only 1,149.2 acres (taking into account originally enrolled fields that have been removed from the program). Therefore, it is very likely that the original 2,000 acre goal for the project will not be fully met.
2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

To complement the SWAT model described above, IWR is also developing a “High-Impact Targeting” (HIT) tool that is designed to focus conservation resources on the most significant erosion problems in the Paw Paw River watershed. This tool is based on two underlying models, the Revised Universal Soil Loss Equation (RUSLE) and the Spatially Explicit Delivery Model (SEDMOD). The data used to drive these models includes digital elevation models (DEMs), land cover, soil surveys, climate data, and crop/tillage practices. Ultimately, the HIT tool will be used to estimate sediment erosion/runoff reduction benefits for the management practices implemented in the Paw Paw River watershed. However, this tool was still under development as of the writing of this fact sheet, and thus could not be used immediately to develop these estimates.

In lieu of estimates from the HIT tool, the calculations included in the original (January 2010) fact sheet are used as placeholder estimates. The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model was used to estimate daily runoff volume for the pre-project (conventionally-tilled straight row cropland) and post-project (conservation tillage) conditions (Neitsch et al., 2005). Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **Pre-project: Conventional tillage**
  - Row crops, straight rows in “poor” condition (CN = 81)
  - Hydrologic soil group (HSG) “B”

- **Post-project: Reduced-tillage or “no-till”**
  - Row crops, straight rows and crop residue cover in “good” condition, >20% cover (CN = 75)
  - Hydrologic soil group (HSG) “B”

Hourly meteorological data for local weather stations were obtained from the database provided as part of USEPA’s BASINS 4 watershed modeling software package (USEPA, 2010). Hourly data were used to compute total daily precipitation, maximum hourly rainfall intensity, daily average and maximum air temperature, and daily total potential evapotranspiration (PET).

Curve numbers and processed meteorological data were used to compute daily runoff for the pre- and post-project cases for a 29-year period (1970-1998), including the effects of seasonal snow accumulation and melt. Estimates of runoff volume were based on the Curve Number method, and daily maximum hourly rainfall intensities were calculated based on hourly precipitation data for the 1970-1998 time period. Total annual average runoff volumes were estimated as follows:

- **Pre-project (conventional tillage)** runoff depth: 324 mm/yr
- **Post-project (reduced-tillage or “no-till”)** runoff depth: 303 mm/yr

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting conventionally tilled cropland to conservation tillage or “no-till”. The Cover/Management Factors (C_{slee}) for the MUSLE were estimated as 0.20 and 0.062 for pre-project and post-project conditions, respectively, based on information provided in Haith (1992).
• **Pre-project (conventional tillage):** Corn (residue left on field)-Wheat (residue left on field, spring turn plowed), 2-year rotation cycle, high productivity (e.g., long-term yield averages greater than 75 bu/ac corn) ($C_{usle} = 0.20$)

• **Post-project (reduced-tillage or “no-till”):** Corn (no-till plant in chemically killed wheat, 90-70% residue cover after new crop seeding, high productivity) ($C_{usle} = 0.062$)

Total annual sediment yields for the cropland were estimated as follows:

• **Pre-project (conventional tillage):** 1,684 MT/yr (3.62 MT/ha/yr)

• **Post-project (reduced-tillage or “no-till”):** 484 MT/yr (1.04 MT/ha/yr)

Water quality benefits are summarized in Table 3 based on the difference between pre-project and post-project total annual sediment yields.

### Table 3. Summary of Water Quality Benefits

<table>
<thead>
<tr>
<th>Year</th>
<th>Conservation Tillage Area (acres)</th>
<th>Conservation Tillage Sediment Reduction (MT/yr)</th>
<th>TCCC Cost Share</th>
<th>Total Cumulative Benefit* (MT/yr)</th>
<th>Total Cumulative Benefit Adjusted for TCCC Cost Share** (MT/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>23.7</td>
<td>24.7</td>
<td>76.9%</td>
<td>24.7</td>
<td>19.0</td>
</tr>
<tr>
<td>2011</td>
<td>350.0</td>
<td>365.4</td>
<td>76.9%</td>
<td>390.2</td>
<td>300.0</td>
</tr>
<tr>
<td>2012</td>
<td>430.5</td>
<td>449.5</td>
<td>100.0%</td>
<td>839.7</td>
<td>749.5</td>
</tr>
<tr>
<td>2013</td>
<td>117.0</td>
<td>122.2</td>
<td>100.0%</td>
<td>955.6</td>
<td>866.9</td>
</tr>
<tr>
<td>2014</td>
<td>228.0</td>
<td>238.1</td>
<td>100.0%</td>
<td>1102.3</td>
<td>1034.7</td>
</tr>
</tbody>
</table>

* The water quality benefit for conservation tillage activities lasts for a total of three years. After the 3-year funding cycle has been completed, a partial benefit of 75% is claimed for conservation tillage activities.

** To account for implementation schedule (i.e., pro-rating of conservation tillage water quantity benefits after three years), the total cumulative benefit adjusted for TCCC cost share is calculated by multiplying the conservation tillage benefit by the TCCC cost share (and then multiplying by a partial benefit of 75% three years after implementation).

The total water quality benefit for the tillage management area, without schedule adjustment, is estimated as the difference in the pre-project and post-project load, and equals 1,200 MT/yr. After this benefit is scaled for implementation schedule, the total maximum water quality benefit is 1,102 MT/yr.

• **The total (maximum) benefit (reduced sediment yield) is:** 1,102 MT/yr

• **TCCC total (maximum) benefit taken as a function of cost share is:** 1,035 MT/yr

### 2014 Water Quality Benefit

The 2014 water quality benefit (reduced sediment yield) is 1,102 MT/yr. The 2014 water quality benefit taken as a function of cost share is 1,035 MT/yr.
Data Sources:

- **Size of area targeted for conservation tillage:** up to 2,000 acres (809.4 Ha), but currently at 1,149.2 acres at the end of 2014. Additional water quality benefits are expected to be generated by filter strip and conservation cover activities. There is insufficient information to estimate benefits for those activities at present; however, the HiT tool results may ultimately provide estimates of these benefits.

- **Slope:** 1% (estimated based on a digital elevation model)

- **Soil type:** predominantly hydrologic soil group (HSG) “B”
  - Characterized by moderate to high infiltration rates
  - Based on STATSGO soils database available through USEPA’s BASINS version 4 software

- **Meteorological data:** All meteorological data obtained via USEPA’s BASINS version 4 software
  - Hourly precipitation data were obtained for Coloma, MI for the 1970-1998 period
  - Hourly air temperature and evapotranspiration rates were obtained for Berrien Springs, MI for the 1970-2006 period

- **STATSGO soils data obtained from USEPA BASINS 4** were used to estimate a soil erodibility factor (K) of 0.17 for use in the MUSLE equation.

Assumptions:

- Land slope was assumed to be 1% on average for the agricultural areas of interest.

- SWAT model parameter “CNCOEF” was set to 1.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

- The Cover Factor (C_{usle}) was assumed to remain constant through time (both seasonally and among years).

- The USLE “Practice Factor” (P) was assumed to be 1.0, corresponding to no contouring or terracing of the land surface.

Key assumptions regarding implementation schedule include:

- Tillage practices will be carried forward by farmers for 75% of the implementation area after the 3-year funding cycle is completed for a given area (Van Buren County Conservation District, personal communication).

OTHER BENEFITS NOT QUANTIFIED

- None

NOTES

- This fact sheet is an update of the January 2014 fact sheet and reflects current information on the status of the program. It includes preliminary estimates of water quantity/quality benefits resulting from reductions in runoff/sediment. Monitoring and modeling continue to be conducted as part of the project and will be used to report final estimates of benefits.
• The January 2014 fact sheet reported that filter strips were implemented for a total area of 17 acres. However, filter strips were removed for some fields, so this fact sheet has been revised to reflect an updated area of 15 acres.
• Although funding for this project began in 2009, implementation of activities did not actually begin until 2010.
• The effective cost share for the TCCC water quality benefits in 2014 (93.9%) is lower than the effective cost share for the water quantity benefits (95.2%). The difference in effective cost share is an expected and correct result in this case because, at this time, water quality benefits have not been estimated for every conservation management practice that generates water quantity benefits.

REFERENCES
PROJECT NAME: Lower Flint River Watershed Restoration
PROJECT ID #: 03

DESCRIPTION OF ACTIVITY: Variable Rate Irrigation and Advanced Irrigation Scheduling

LOCATION: Flint River Watershed, Georgia

PRIMARY CONTACTS:
Casey Cox  Brian Wills  Rena Stricker  Jon Radtke
Flint River SWCD  The Nature Conservancy  Contract Ecologist  Water Resources Manager
Flint River SWCD  The Nature Conservancy  Water Resources Manager
229-669-9889  404-253-7206  404-395-6250  404-676-9112
caseycox@teamflint.us  bwills@tnc.org  rstricker@coca-cola.com  jradtke@coca-cola.com

OBJECTIVE:
• Provide demonstration project for decreasing irrigation water use

BACKGROUND & DESCRIPTION OF ACTIVITY: This project is focused on improved irrigation practices through variable rate irrigation (VRI) and advanced irrigation scheduling (AIS). Water savings through VRI are generated by using upgraded GPS technology to remove non-crop areas (e.g., ditches, rocks, wetlands) from irrigation, coordinating application amounts with variations in soil type and field topography, and eliminating double application due to pivot overlap. VRI reduces water use by an average of 15% (Reckford et al., 2010). AIS includes the use of objective field data to better schedule irrigation and includes remote soil moisture monitoring (RSMM) which relies on GPS technology and soil sensors that gather temperature and soil moisture data from different soil depths and at multiple locations in real-time. A RSMM radio relays the soil moisture value to the internet, where the data is reviewed and analyzed to inform optimal application of irrigation water. Research shows that use of AIS including RSMM results in the reduction of 1-2 irrigation applications per season. VRI technology was developed at the University of Georgia, and rolled out in a partnership between the Flint River Soil and Water Conservation District, Natural Resources Conservation Service and The Nature Conservancy.

Figure 1. VRI optimizes irrigation application with center pivot irrigation systems
Many large-scale producers have adopted soil moisture sensors, supporting decisions regarding large plantings of a single crop. However, this technology has not been adopted by smaller vegetable producers because they often grow 10-20 different crops at a time, making the use of the technology prohibitively expensive and unwieldy. Instead, irrigation is often managed by the “feel method,” where irrigation is initiated when the soil “feels” dry. In 2014, soil probes and telemetry equipment were installed for one producer growing okra, and one producer growing olives. The okra producer received services that included installation of the technology and training to access and use the soil moisture data. The olive producer received a monitoring station to help prevent the over-irrigation of young trees. In addition, a soil probe and telemetry were installed for cotton at the Sunbelt Ag Expo (continuing the program from 2013). The Expo farm manager has received training in the technology and continued technical support. Outreach has included participation in a field day where 200 farmers were introduced to the water conserving technology and the sharing of data with University of Georgia scientists who are researching row crop water conservation.

**SUMMARY OF REPLENISH BENEFIT:**
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 282.67 ML/YR

**ACTIVITY TIMELINE:**
- Project initiation: January 2012
- Project completion: October 2014 (ongoing)

**COKE CONTRIBUTION:** 100%
- Total cost: $138,250 ($88,250 in 2012 and $50,000 in 2013)
- TCCC cost contribution: $138,250

**WATERSHED BENEFITS CALCULATED:**
1. Decrease in groundwater withdrawal
1. **DECREASE IN GROUNDWATER WITHDRAWAL**

**Approach and Results:**
AIS and VRI techniques are complementary, but water savings are estimated using different methods for each because VRI reduces the volume of water applied per irrigation cycle by controlling “where/how” the center pivot will irrigate while AIS reduces the total number of irrigations by addressing “when” to apply irrigation.

**Variable Rate Irrigation**
The volume of water savings was calculated as the volume of water that is not withdrawn during an average year as a result of the use of VRI. This is a conservative estimate and savings are larger during drought years when more irrigation water is required. The pivot irrigation systems used are already the most efficient available for the particular crops and land conditions (Evans, 1998), so losses through runoff and leaching are minimal and were not explicitly accounted for in the calculations.

In the Lower Flint River Watershed, the average volume of irrigation applied to supplement rainfall per season during an average precipitation year is approximately 10 acre-inches, or 10 irrigations to apply 1 acre-inch of water per irrigation. This value is derived from both in-field and remote meter readings on a subset of center pivots in the Flint River Basin from 2007-2010.

One acre-inch of applied water is equal to 27,154 gallons. Therefore the total water conserved (i.e., not withdrawn) during an average year is based on the number of acres removed from irrigation as follows:

VRI water savings = # acres removed from irrigation x 27,154 gallons/acre x 10 irrigations

**GPS Upgrade for 9 VRIs:** 150 acres removed from irrigation
Water savings = 150 acres x 27,154 gallons/acre x 10 applications = 40,731,000 gallons = 154,183,607 liters = 154.18 ML/yr

**VRI Demonstration CP1:** 20 acres removed from irrigation
Water savings = 20 acres x 27,154 gallons/acre x 10 irrigations = 5,430,800 gallons = 20,557,814 liters = 20.56 ML/yr

**VRI Demonstration CP2:** 40 acres removed from irrigation
Water savings = 40 acres x 27,154 gallons/acre x 10 applications = 10,861,600 gallons = 41,115,628 liters = 41.12 ML/yr

**Advanced Irrigation Scheduling**
The water savings are calculated differently because the goal of AIS is to reduce the total number of irrigations. Research shows that use of AIS results in the reduction of up to 2 irrigation applications per season. Therefore the total water conserved (i.e., not withdrawn) during an average year is based on the reduced number of irrigation applications as follows:

AIS water savings = # acres x 27,154 gallons/acre x reduced number of 1 acre-inch irrigation applications

**AG Expo RSMM:** Reduced irrigation by 1 out of 10 applications on 115 acres of cotton and corn
Water savings = 115 acres x 27,154 gallons/acre x 1 application = 3,122,710 gallons = 11,820,700 liters = 11.82 ML/yr
RSMM Demonstration: Reduced irrigation by 1 out of 10 applications on 35 acres (20 acres of olives in 2014 and 15 acres of diversified vegetable crops in 2014)
Water savings = 35 acres x 27,154 gallons/acre x 1 application = 950,390 gallons = 3,597,617 liters = 3.60 ML/yr

AIS w/ Remote Rain Gauges: Reduced irrigation by .5 out of 10 applications on 1,000 acres
Water savings = 1000 acres x 27,154 gallons/acre x .5 application = 13,577,700 gallons = 51,394,535 liters = 51.39 ML/yr

The total water savings from all projects is calculated as the sum of the water savings from VRI and AIS demonstration projects:

Water savings = 154.18 + 20.56 + 41.12 + 11.82 + 3.60 + 51.39 = 282.67 million L/yr

The total (ultimate) water quantity benefit is: 282.67 ML/yr.
TCCC total (ultimate) benefit taken as a function of cost share is: 282.67 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit
The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 282.67 ML/yr and TCCC’s benefit (adjusted for cost share) is 282.67 ML/yr.

Projected Replenish Benefits
Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in this table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>282.67</td>
<td>282.67</td>
</tr>
<tr>
<td>2016</td>
<td>282.67</td>
<td>282.67</td>
</tr>
<tr>
<td>2017</td>
<td>282.67</td>
<td>282.67</td>
</tr>
<tr>
<td>2018</td>
<td>282.67</td>
<td>282.67</td>
</tr>
<tr>
<td>2019</td>
<td>282.67</td>
<td>282.67</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>282.67</td>
<td>282.67</td>
</tr>
</tbody>
</table>
Data sources:
- Acreage and supporting materials provided by David Reckford, Flint River Basin Partnership and Casey Cox, Flint River Soil and Water Conservation District and David Wills, TNC.

Assumptions:
- Average conditions were assumed. Some years will have smaller or larger savings depending on the amount of rainfall during the growing season.

OTHER BENEFITS NOT QUANTIFIED
- Energy savings and associated cost savings

NOTES
- This fact sheet is an update of the January 2014 fact sheet.
- This fact sheet includes new activities that were implemented in 2014, some of which are continuations of previous investments and projects from 2013 (VRI upgrades).
- The AIS w/ Remote Rain Gauges project was reinstalled in 2014 as in 2013.
- The Ag Expo RSMM acreage has been reduced from 200 acres to 115 acres.
- The 20 acres enrolled in the RSMM demonstration program in 2013 are no longer in the program. That project has been replaced with the new RSMM Demonstration project (olives and diversified crops).
- Weather conditions in 2014 included a very wet spring, dry summer, and moderate fall. The Lower Flint experienced a period of drought during the month of July, receiving only an average of 1.44 inches of rainfall for the month.

REFERENCES

PROJECT NAME: Transboundary Community Water Management
PROJECT ID #: 05

DESCRIPTION OF ACTIVITY: Reforestation of riparian zones (13.5 hectares)

LOCATION: Ghana and Ivory Coast - Tano River Basin Watershed (Western Region of Ghana and Aboisso Prefecture of Ivory Coast)

PRIMARY CONTACTS:
Tara Varghese Naabia Ofosu-Amaah
Global Environment & Technology Foundation Global Environment & Technology Foundation
(GETF) (GETF)
Tara.Varghese@getf.org naabia.ofosu-amaah@getf.org

OBJECTIVES:
• Reduce erosion
• Reduce sedimentation in river
• Restore riparian forest habitat

BACKGROUND & ACTIVITY DESCRIPTION: Deforestation can contribute to increased soil erosion, reduced soil fertility, reduced receiving water quality, and decreased biodiversity (both terrestrial and aquatic). The Water Research Institute of Ghana has noted that in the Transboundary project area, annual rainfall and discharge rates have been decreasing during the past few decades. Although there is no scientific evidence to support that deforestation has been a factor, these trends are generally attributed to widespread deforestation and land use changes. Deforestation may also contribute to flooding problems. A program to reverse degradation of the Tano River watershed area includes:

• Creation of 100 meter buffer strips along the banks of Tano River and 30 meter buffer strips along all tributaries;
• Initiation of agro-forestry activities in the buffer strips;
• Prohibition of farming close to the river and its tributaries;
• Prevention of wild fires;
• Public awareness campaigns.

There are approximately 20 tributaries that feed the Tano River at its headwaters. Some are severely threatened from land clearing and associated erosion. The effects of environmental degradation in the headwaters are felt downstream. This part of the Tano River watershed is also proximate to the Newmont Gold Ghana (NGG) operations.

This program addresses a need to restore riparian zones. Technical studies were conducted, and the estimated area of riparian zone identified for rehabilitation was 1,000 hectares (according to the final contractor workplan). Combating wildfires was another key activity.
In Ghana, the project focused on two regions: Brong Ahafo Region and Western Region (Brong Ahafo is located directly north of Western Region). In the Ivory Coast, the project focused on the Aboisso Prefecture and the Sous-Prefectures.

**SUMMARY OF REPLENISH BENEFIT:**
- **2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE:** 2.3 ML/YR

**ACTIVITY TIMELINE:** 100% Complete
- **April 2008:** Five community nurseries in place with a total of about 8,000 seedlings of 4 indigenous species (Edinam, Emire, Ofram and Mahogany). Tree planting (2,300 seedlings of Mahogany, Cedrela, Ofram, Emire, Edinam and Kola) in five communities along the Tano River began mid-May 2008 in Ghana and July 2008 in Ivory Coast (*April 2008 Quarterly Report*).
- **September 2008:** Cumulative total of 10,000 trees (Mahogany, Cedrela, Ofram, Emire, Edinam and Kola) planted along the Tano River (*September 2008 Quarterly Report*).
- **March 2009:** Cumulative total of 13,544 indigenous timber trees (Mahogany, Cedrela, Ofram, Emire, Edinam and Kola) planted along the Tano River in Ghana as of February 2009 (*CWP, 2009*).

**COCA-COLA CONTRIBUTION:** 38%
- Total project cost: $662,140 USD
- TCCC contribution: $254,357 USD

**WATERSHED BENEFITS CALCULATED:**
1. Decrease in runoff
2. Decrease in sediment erosion runoff

**1. DECREASE IN RUNOFF**

**Approach & Results:**
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al., 2005) was used to estimate the decrease in runoff for the conversion of unforested (e.g., pasture/range) land to forested land. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of
runoff are more certain than predictions for changes in baseflow for relatively small land areas (13.5 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **Pre-project:**
  - Hydrologic soil group (HSG) “C”
  - Pasture/grassland in “fair” to “good” condition: > 50-75% vegetative cover (CN = 76.5)

- **Post-project:**
  - Hydrologic soil group (HSG) “C”
  - Woodland in “good” condition: woods are protected from grazing, and litter and brush adequately cover the soil (CN = 70)

Daily precipitation and air temperature data were obtained for Adiake, Cote D'Ivoire from TuTiempo.net for the 2003-2008 period. Data for this time period are generally representative of the long-term annual average meteorological conditions for the region. The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963). Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases for years 2003-2008. Total annual runoff volumes and the resulting water quantity benefit were estimated as follows:

- **Pre-project (open space):** 49.4 ML/yr (runoff depth: 366 mm/yr)
- **Post-project (reforested land):** 43.4 ML/yr (runoff depth: 322 mm/yr)
- **Benefit (runoff reduction):** 6.0 ML/yr (runoff depth: 44 mm/yr)

The total (ultimate) benefit is: 6 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share is: 2.3 ML/yr.

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

### 2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 6 ML/yr and TCCC’s benefit (adjusted for cost share) is 2.3 ML/yr.

### Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the second column and are adjusted for TCCC cost share in the third column.
Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>6</td>
<td>2.3</td>
</tr>
<tr>
<td>2016</td>
<td>6</td>
<td>2.3</td>
</tr>
<tr>
<td>2017</td>
<td>6</td>
<td>2.3</td>
</tr>
<tr>
<td>2018</td>
<td>6</td>
<td>2.3</td>
</tr>
<tr>
<td>2019</td>
<td>6</td>
<td>2.3</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>6</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Data Sources:
- **Size of reforested land area**: 13.5 ha (estimated based on 13,500 trees planted, assuming 1,000 trees per hectare)
- **Slope**: assumed to be 5% (conservative estimate)
- **Soil type**: “Available water content” of 3 mm per meter of soil depth (Batjes, 1996) – consistent with hydrologic soil group “C” characteristics. Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.
- **Meteorological data**: Daily precipitation data for years 2003-2008 were obtained for Adiake, Cote D'Ivoire (station ID: 655850) from TuTiempo.net (http://www.tutiempo.net/en/Climate/Adiake/655850.htm).

Assumptions:
- Reforested land area is estimated to equal 13.5 ha (based on 13,500 trees planted and an assumed tree density of 1,000 trees per hectare).
- Precipitation data obtained for Adiake, Cote D'Ivoire for years 2003-2008 are generally representative of average annual precipitation conditions for the areas where reforestation is occurring. (Average precipitation for Adiake for 2003-2008 is 1,301 mm/yr.)
- The pre-project land cover can be appropriately characterized as open pasture/rangeland with approximately 50-75% or more vegetative cover. (Note that this provides a conservative estimate of Curve Number for areas that have been utilized as crop land.)
- The average slope conditions for the reforested area are approximately 5% (conservative estimate).
- SWAT model parameter “CNCOEF” was set to 0.5 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).
2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting unforested land to forested land. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for the 2003-2008 period.

The Cover/Management Factors ($C_{usle}$) used in the MUSLE were estimated as follows based on Haith et al. (1992):

- **Pre-project (pasture/rangeland):** Pasture, 80% ground cover as grass ($C_{usle} = 0.01$)
- **Post-project (forested):** Managed woodlands, 75-100% tree canopy ($C_{usle} = 0.001$)

Total annual sediment yields for the unforested and forested land areas were estimated as follows:

- **Pre-project (pasture/rangeland):** 29.1 MT/yr (sediment unit area yield: 2.2 MT/ha/yr)
- **Post-project (forested):** 2.6 MT/yr (sediment unit area yield: 0.2 MT/ha/yr)
- **Benefit (reduced sediment yield):** 26.5 MT/yr

The total benefit (sediment yield reduction) is: 26.5 MT/yr

The total benefit (reduced sediment yield) is: 26.5 MT/yr and TCCC’s benefit (adjusted for cost share) is 10.1 MT/yr.

The 2014 benefit is: 26.5 MT/yr and TCCC’s benefit (adjusted for cost share) is 10.1 MT/yr.

Data Sources:

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:

- The tree canopy in the reforested areas was assumed to be mature.
- The Cover/Management Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and across years).
- The soil erodibility factor ($K$) was assumed to be 0.24 for use in the MUSLE equation. Soil erodibility factor was estimated for sandy loam with approximately 1 – 2% organic matter content based on Haith et al. (1992).

OTHER BENEFITS NOT QUANTIFIED
- Habitat improvements benefiting terrestrial wildlife
- Shading of streams lowers water temperatures and improves fishery
NOTES

- This fact sheet updates the August 2009 version to report final cost share based on the project close-out report.
- The project workplan states 1,000 ha will be replanted, but the CWP, 2009 stated the area restored is unknown. The area replanted was therefore estimated to equal 13.5 ha based on the number of trees planted (13,500 and the assumption of 1,000 trees/ha).

REFERENCES

**PROJECT NAME:** TCCC-WWF Partnership: Rio Grande/Rio Bravo Basin  
**PROJECT ID #:** 21

**DESCRIPTION OF ACTIVITY:** Reestablishment of channel morphology and floodplain connectivity

**LOCATION:** Rio Grande, Texas (Big Bend)

**PRIMARY CONTACTS:**
- Mark Briggs  
  Hydrologist, Tucson, Arizona  
  Chihuahuan Desert Program, World Wildlife Fund  
  mark.briggs@wwfus.org  
  520-548-4045
- Rena Ann Striker  
  Contract Ecologist  
  CCNA Group Environment & Sustainability  
  rstricker@coca-cola.com  
  404-395-6250
- Jon Radtke  
  Manager, Water Resources  
  CCNA Group Environment & Sustainability  
  jradtke@coca-cola.com  
  404-676-9112

**OBJECTIVES:**
- Reestablish channel morphology and river-floodplain connectivity  
- Enhance replenishment rates by providing greater active channel surface area contact with flow  
- Improve quality of habitat for a variety of native aquatic and terrestrial species, including the threatened Rio Grande silvery minnow  
- Decrease frequency that riverside towns and infrastructure are flooded

**BACKGROUND & DESCRIPTION OF ACTIVITY:** WWF is working along the Big Bend reach of the Rio Grande to reestablish the floodplain. The main objective of the current treatments is to reestablish wide and shallow channel morphologic conditions that will increase active floodplain surface areas and enhance replenishment under the current hydrologic regime of the river. This is being accomplished by working with Mexican water management agencies on developing channel maintenance flows, and removing dense stands of non-native species in selected locations, which is seen as important for increasing the vulnerability of underlying sediments to mobilization and evacuation (i.e., removing non-native stands reduces channel narrowing processes, decreases accretion, and increases widening, fostering desirable channel conditions that offer enhanced replenishment). Work is ongoing to maintain the floodplain and prevent reestablishment of invasive species in the floodplain areas that have been restored. Channel morphology is being monitored to assess the change in both the accumulation and evacuation of sediment over time. The treated areas are being monitored through establishment and measurement of vegetation plots, allowing a robust before-and-after database as well as the means to routinely identify areas requiring re-treatment. Sites where giant cane (Arundo donax) has resprouted are being retreated. Finally, the saltcedar leaf beetle has been released and has greatly reduced the likelihood of saltcedar invading sites formerly occupied by giant cane.

**SUMMARY OF REPLENISH BENEFIT:**
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 1,874.6 ML/YR

**ACTIVITY TIMELINE:**
- Implementation through 2020, with annual increased area of newly established floodplain surfaces conducive to replenishment  
- 2009-2011: 7 km length of floodplain treated
• 2012: Average length of floodplain treated = 28 km (30 km length treated on US side; 26 km length treated on Mexico side, with average length equaling 28 km)
• 2013: 5 km length of floodplain treated on both sides of the river
• 2014: 5 km length of floodplain treated on both sides of the river
• 2015-2020: an additional 5 km/yr planned for treatment.

**COKE CONTRIBUTION:** Variable, see below

- 2009 through 2011
  - Coca-Cola cost share = 50% US and Mexico sides of the river
  - 50% NOAA, National Park Service, BOR, and private foundations
- 2012
  - Coca-Cola cost share = 100% US side of the river
  - Coca-Cola cost share = 53% Mexico side of the river (53% TCCC, 47% CEC)
- 2013
  - Coca-Cola cost share = 100% US and Mexico sides of the river
- 2014
  - Coca-Cola cost share = 70% US and Mexico sides of the river
  - 30% Commission for Environmental Cooperation
- 2015 through 2020
  - Coca-Cola cost share conservatively projected to be 30%, but will be confirmed for future calculations

**WATERSHED BENEFITS CALCULATED:**
1. Increased floodplain infiltration

---

**1. INCREASED FLOODPLAIN INFILTRATION**

**Approach and Results:**
The benefit was calculated as an estimate of transmission rates through floodplain surfaces that have been hydrologically reconnected to the river via conservation activities. The calculation is based on the area of newly established floodplain surfaces conducive to replenishment, the average number of days per year that newly established floodplain surfaces will be inundated, and the estimated seepage rate per day of inundation for the newly established active floodplain surfaces.

WWF and its partners in Big Bend have been working since 2009 to remove non-native species from the floodplain to restore a more natural hydrology to the floodplain area. In addition to treating new floodplain areas, WWF and its partners also revisit previously treated areas to prevent reestablishment of invasive species.

Ultimately, WWF expects to treat a cumulative length of 75 km of floodplain along Big Bend. Depending on the magnitude and duration of future high flow events, the eradication is expected to reestablish active floodplain surfaces along the treated reach that average 6 meters wide on each side of the channel.

WWF anticipates in the foreseeable future that they will be able to treat on average an approximately 5 km length of river channel per year (6 meters width on each side of the river, for a total width of 12
meters). In the current hydrologic regime, the newly reestablished active floodplain surfaces have been and are anticipated to be inundated on average about five days per year, which is based on observations of channel wetted perimeter over the past three years.

Floodplain alluvium along the Big Bend reach varies considerably, but is generally sandy loam to sandy, which equates to a seepage rate (or replenishment rate) of about 0.92 m$^3$ per m$^2$ per day of inundation for the newly established active floodplain surfaces (Chow, 1964).

The ultimate water quantity benefit is calculated as the sum of the increased floodplain infiltration at the end of 2020, assuming work is completed as planned, and equals 4,140 ML/yr.

The total (ultimate) benefit is: 4,140 ML/yr
TCCC total (ultimate) benefit is: 2,371.4 ML/yr

The 2014 benefit is calculated based on additional work completed by the end of the 2014 calendar year, and is added to benefits generated in previous years for a cumulative benefit generated by this project, through 2014.

- In 2014, five additional kilometers of floodplain were treated, resulting in an annual increased floodplain infiltration of 276 ML/yr.
- Based on the results of monitoring and evaluation conducted by WWF in 2014, some assumptions supporting the benefit calculations were revised to reflect conditions observed in the field. The net effect of this new information on cumulative benefits is reflected in the cumulative benefits reported through 2014 in this fact sheet.

Table 1 shows how the variable cost share is considered in the calculation of the TCCC benefit for work completed to date.

Table 1. Cost Share and Calculation of TCCC Benefit per Year

<table>
<thead>
<tr>
<th>Time period</th>
<th>Replenishment during period indicated (ML/yr)</th>
<th>TCCC cost share (%)</th>
<th>TCCC benefit as a function of cost share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-2011</td>
<td>386.4</td>
<td>50%</td>
<td>193.2</td>
</tr>
<tr>
<td>2012 (US side)</td>
<td>828</td>
<td>100%</td>
<td>828</td>
</tr>
<tr>
<td>2012 (Mexican side)</td>
<td>717.5</td>
<td>53%</td>
<td>380.3</td>
</tr>
<tr>
<td>2013 (US &amp; Mexican sides)</td>
<td>276</td>
<td>100%</td>
<td>276</td>
</tr>
<tr>
<td>2014 (US &amp; Mexican sides)</td>
<td>276</td>
<td>71%</td>
<td>197.1</td>
</tr>
<tr>
<td>Cumulative Total</td>
<td>2,484</td>
<td></td>
<td>1,874.6</td>
</tr>
</tbody>
</table>

Numbers may not sum exactly due to rounding.

Due to field verification conducted in 2014, some of the benefit calculation inputs were revised, including cost share. Past benefits are updated in this table, but only to support calculation of the cumulative 2014 benefits. The net effect of the revisions is reflected in the cumulative 2014 and ultimate benefits reported in this fact sheet.

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.
2014 Replenish Benefit
The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit (cumulative over the 2009 -2014 period) is 2,484 ML/yr and TCCC’s benefit (adjusted for cost share) is 1,874.6 ML/yr.

Projected Replenish Benefits
Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. The benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Cumulative benefit (ML/yr)</th>
<th>Cumulative benefit adjusted for TCCC cost share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>2,760.0</td>
<td>1,957.4</td>
</tr>
<tr>
<td>2016</td>
<td>3,036.0</td>
<td>2,040.2</td>
</tr>
<tr>
<td>2017</td>
<td>3,312.0</td>
<td>2,123.0</td>
</tr>
<tr>
<td>2018</td>
<td>3,588.0</td>
<td>2,205.8</td>
</tr>
<tr>
<td>2019</td>
<td>3,864.0</td>
<td>2,288.6</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>4,140.0</td>
<td>2,371.4</td>
</tr>
</tbody>
</table>

*Projections assume 6 meter treatment width on each side of the river and 30% cost share.
**Benefits shown are projected cumulative benefits resulting from additional lengths treated (annual replenishment benefit projected to be 276 ML/yr for the 2015-2020 period).

Data sources:
- All data and calculations provided by M. Briggs, WWF: 21_US_TX_RioGrande_BigBend_floodplain_2014_Nov.xlsx.
- Updated information regarding floodplain inundation frequency, and length and width of floodplain treated was provided by M. Briggs, WWF based on field observations.
- Updated cost share information was provided by M. Briggs, WWF based on a review of funding information.

Assumptions:
- Eradication of dense stands of non-native salt cedar and Arundo enhances channel widening processes, leading to enhanced replenishment opportunities (impact of eradicating near-channel non-native plants is being evaluated).
- Field observations of the newly created floodplains showed that inundation occurs on average five days per year under the current hydrological regime. This inundation frequency is used in the benefit calculations, updating the previous assumption regarding inundation frequency.
- Projections assume 6 meter treatment width on both the US and Mexican side of the river and 30% TCCC cost share for treatments on both sides of the river.

OTHER BENEFITS NOT QUANTIFIED
- Removal of invasive plants and revegetation with native species will expand habitat availability and quality, and lead to increased abundance of native birds, mammals, reptiles, and fish.
• Reduction of fire risk associated with dense salt cedar stands.
• Reduced flood frequency and flood hazard to streamside towns and infrastructure.

NOTES
• This fact sheet updates the January 2013 fact sheet to include additional floodplain treatments completed in 2014.
• As noted in previous fact sheet updates, “replenishment estimates are based on a variety of assumptions (summarized above) whose validity will be assessed as additional monitoring data are collected and model refinements are completed.” In 2014, the validity of these assumptions was assessed and benefit calculations were updated to reflect observations and monitoring results. The following updates to the calculations were implemented:
  1. Floodplain inundation frequency changed from 3 days/yr to 5 days/yr.
  2. Width of the floodplain treated changed from 8 meters/side to 6 meters/side.
  3. The 2009-2011 length of floodplain treated changed from 23 km to 7 km due to extensive retreatment required during this early phase of the replenishment program (i.e., as treatment methods were adjusted to improve effectiveness).
  4. The cumulative length treated through 2014 was measured and this length is reflected in this fact sheet update.
• The updated floodplain width of 6 meters per side of river, the floodplain inundation frequency of 5 days/yr and the cumulative length treated to date will be used for future calculations.
• New information regarding floodplain frequency, and length and width of floodplain treated will be provided by M. Briggs, WWF as additional work is completed and additional channel morphologic monitoring data are collected by WWF and WWF’s partners in Big Bend.
• Analysis of in-stream flow rates has not been conducted due to the complexities and cost of directly monitoring changes in stream flow due to floodplain replenishment, which would require installation and maintenance of a series of piezometers and additional streamflow gauges.
• Agreements with Comisión Nacional del Agua (CONAGUA) on channel maintenance flow releases (as part of treaty obligations) are in development. If successful, agreements could enhance replenishment rates thus far put forward.
• In partnership with Big Bend NP, USGS, and Sul Ross State University, channel cross-sections have been completed, but data remain unanalyzed. Initial analysis of all collected channel cross-section data is slated for 2015. New cross-sections are also being surveyed to improve robustness of the data set and provide control sites for comparing treated reaches with non-treated reaches.

REFERENCES
PROJECT NAME: México Restoration and Reforestation Program
PROJECT ID #: 38

DESCRIPTION OF ACTIVITY: Ground restoration (infiltration trenches)

LOCATION: A total of 69 sites located throughout 16 Mexican states

PRIMARY CONTACTS:
Oscar Martinez  
Sustentabilidad Ambiental  
Coca-Cola de México  
Tel. 555-262-2663  
osmartinez@coca-cola.com

Dr. Luis E. Marin  
Instituto de Geofísica-UNAM  
Tel. 555-622-4122  
lmarin@geofisica.unam.mx

OBJECTIVE:
• Increase infiltration

BACKGROUND & DESCRIPTION OF ACTIVITY: This ground restoration project has involved the digging of infiltration trenches at sixty-nine (69) different sites throughout México under four phases of work. The trenches are hand dug in deforested areas to maintain the humidity of the ground, increase infiltration, and reduce ground erosion. The trenches are 6.6 feet long, 1.6 feet wide, and 1.6 feet deep (two meters long, half a meter wide, and half a meter deep). An average of 1,300 trenches were installed per hectare. Trenches are shown in Figure 1.

Figure 1. Photos of infiltration trenches, taken by Pronatura

SUMMARY OF REPLENISH BENEFIT:
• 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 12,056 ML/yr

ACTIVITY TIMELINE:
Infiltration trenches have been constructed on a total of 3,878 hectares in four phases of work conducted during the 2008-2014 period:
- **Phase I (2008-2011)**: 2,789 ha
- **Phase II (2012)**: 120 ha
- **Phase III (2013)**: 208 ha
- **Phase IV (2014)**: 760 ha

Construction of the infiltration trenches was associated and jointly funded with reforestation activities carried out by Pronatura within each phase of work.

**Coca-Cola Contribution (2008-2014)**: varies by phase, as outlined below:

- **Phase I (2008-11)**: 65.24%
  - Total cost: $12,169,588 USD
  - TCCC contribution: $7,939,069 USD
- **Phase II (2012)**: 26.40%
  - Total cost: $6,438,996 USD
  - TCCC contribution: $1,700,000 USD
- **Phase III (2013)**: 11.03%
  - Total cost: $11,555,147.10 USD
  - TCCC contribution: $1,274,698.10 USD
- **Phase IV (2014)**: 100%
  - Total cost: $886,232.59 USD
  - TCCC contribution: $886,232.59 USD

Coca-Cola’s cost contribution for this activity has been calculated based on the total Coca-Cola funding contributions and the total combined funding provided by all of the project partners for each of the four phases of the reforestation / infiltration trench program. The funding sources associated with the individual phases of the reforestation / infiltration trench project are provided in Tables 1-4 below.

**Table 1. Project Funding for Phase I (2008-2011 reforestation and infiltration trenches, plus maintenance)**

<table>
<thead>
<tr>
<th>Partner</th>
<th>Funding Contribution (USD)</th>
<th>% Contribution for Phase I</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONAFOR (including in-kind)</td>
<td>4,020,377.00</td>
<td>33.04%</td>
</tr>
<tr>
<td>CONANP</td>
<td>123,016.00</td>
<td>1.01%</td>
</tr>
<tr>
<td>SEDESOL</td>
<td>43,150.00</td>
<td>0.35%</td>
</tr>
<tr>
<td>INDESOL</td>
<td>30,570.00</td>
<td>0.25%</td>
</tr>
<tr>
<td>Disney</td>
<td>13,406.00</td>
<td>0.11%</td>
</tr>
<tr>
<td>Coca-Cola de México</td>
<td>7,939,069.00</td>
<td>65.24%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12,169,588.00</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

**Table 2. Project Funding for Phase II (2012 reforestation and infiltration trenches)**

<table>
<thead>
<tr>
<th>Partner</th>
<th>Funding Contribution (USD)</th>
<th>% Contribution for Phase II</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONAFOR (including in-kind)</td>
<td>4,738,996.00</td>
<td>73.60%</td>
</tr>
<tr>
<td>Coca-Cola de México</td>
<td>1,700,000.00</td>
<td>26.40%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,438,996.00</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>
Table 3. Project Funding for Phase III (2013 reforestation and infiltration trenches, and 2014 reforestation)

<table>
<thead>
<tr>
<th>Partner</th>
<th>Funding Contribution (USD)</th>
<th>% Contribution for Phase III</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONAFOR (including in-kind)</td>
<td>10,045,594.67</td>
<td>86.94%</td>
</tr>
<tr>
<td>INDESOL</td>
<td>11,778.00</td>
<td>0.10%</td>
</tr>
<tr>
<td>Coca-Cola de México</td>
<td>1,274,698.10</td>
<td>11.03%</td>
</tr>
<tr>
<td>Coca-Cola FEMSA</td>
<td>23,077.00</td>
<td>0.20%</td>
</tr>
<tr>
<td>Municipalities (in-kind)</td>
<td>200,000.00</td>
<td>1.73%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11,555,147.77</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

Table 4. Project Funding for Phase IV (2014 infiltration trenches)

<table>
<thead>
<tr>
<th>Partner</th>
<th>Funding Contribution (USD)</th>
<th>% Contribution for Phase IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coca-Cola de México</td>
<td>886,232.59</td>
<td>100.00%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>886,232.59</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

**Watershed Benefits Calculated:**

1. Increase in infiltration

1. **Increase in Infiltration**

**Approach and Results:**

The total infiltration (or total volume captured) was calculated as the sum of direct infiltration (the quantity of water that falls directly in each trench each year; evaporation/evapotranspiration assumed to be negligible) plus infiltration of runoff from untrenched areas of the catchment (or “capture areas”).

Direct infiltration (precipitation directly captured in trenches) = (surface area of trenches) x (annual precipitation)

Runoff volume captured = (surface area of “capture area”) x (average precipitation) x (runoff capture coefficient). (Runoff capture coefficient estimated based on slope and soil type.)

Total infiltration (total volume captured) = (direct infiltration) + (runoff volume captured)

Average annual rainfall varies as a function of location and ranges from 230 to 2,911 mm/yr (“Mexico-BU_infiltration_trench_calculations_2015-02-12.xlsx”). A runoff capture coefficient of 0.6 was used for all calculations because the infiltration trench sites are dominated by fine-grained soils and slopes that typically fall in the 11-30% range (see TCCC 2009, and the “Forest” and “Grasslands” sections of Table 4.1 in SAGARPA). The catchment drainage area (or “capture area”) was assumed to be the difference between the total area and the total surface area of the infiltration trenches.
The total water quantity benefit calculated for Phase I is 14,035 ML/yr (see Table 5), the total benefit for Phase II is 565 ML/yr (see Table 6), the benefit for Phase III is 879 ML/yr (see Table 7), and the benefit calculated for Phase IV is 2,653 ML/yr (see Table 8).

<table>
<thead>
<tr>
<th>State</th>
<th>No. of Sites</th>
<th>Total Trench Area $^1$ (m²)</th>
<th>Catchment Drainage Area $^2$ (m²)</th>
<th>Runoff Volume Captured (m³/yr)</th>
<th>Precip. Directly Captured in Trenches (m³/yr)</th>
<th>Total Volume Captured (m³/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tlaxcala</td>
<td>10</td>
<td>898,469</td>
<td>12,924,138</td>
<td>5,732,877</td>
<td>664,237</td>
<td>6,397,114</td>
</tr>
<tr>
<td>Queretaro</td>
<td>1</td>
<td>10,281</td>
<td>147,885</td>
<td>66,548</td>
<td>7,711</td>
<td>74,259</td>
</tr>
<tr>
<td>Puebla</td>
<td>5</td>
<td>337,738</td>
<td>4,858,254</td>
<td>2,914,881</td>
<td>337,730</td>
<td>3,252,611</td>
</tr>
<tr>
<td>Veracruz</td>
<td>2</td>
<td>11,673</td>
<td>167,906</td>
<td>162,902</td>
<td>18,875</td>
<td>181,778</td>
</tr>
<tr>
<td>Morelos</td>
<td>1</td>
<td>98,152</td>
<td>1,411,885</td>
<td>1,005,544</td>
<td>116,506</td>
<td>1,122,051</td>
</tr>
<tr>
<td>México</td>
<td>12</td>
<td>239,716</td>
<td>3,448,217</td>
<td>1,588,623</td>
<td>184,066</td>
<td>1,772,689</td>
</tr>
<tr>
<td>Hidalgo</td>
<td>3</td>
<td>40,595</td>
<td>583,942</td>
<td>212,865</td>
<td>24,664</td>
<td>237,529</td>
</tr>
<tr>
<td>Guerrero</td>
<td>2</td>
<td>44,203</td>
<td>635,841</td>
<td>355,723</td>
<td>41,216</td>
<td>396,939</td>
</tr>
<tr>
<td>Guanajuato</td>
<td>3</td>
<td>132,224</td>
<td>1,901,991</td>
<td>537,598</td>
<td>62,289</td>
<td>599,887</td>
</tr>
<tr>
<td>Totals:</td>
<td>39</td>
<td>1,813,051</td>
<td>26,080,059</td>
<td>12,577,563</td>
<td>1,457,293</td>
<td>14,034,856</td>
</tr>
</tbody>
</table>

1 Represents the total, cumulative surface area of the individual infiltration trenches, which will capture and infiltrate ~100% of precipitation falling directly on these areas.

2 Represents the total, cumulative surface area of the catchment areas that drain to the individual infiltration trenches (excluding the surface area of the trenches themselves). It is assumed that 60% (0.6) of the precipitation that falls on these areas will be captured and infiltrated by the “downstream” infiltration trench. The 0.6 capture coefficient accounts for estimated losses due to evapotranspiration and infiltration in the catchment areas.
Table 8. Infiltration Trench Areas and Captured Volume for Phase IV (2014)

<table>
<thead>
<tr>
<th>State</th>
<th>No. of Sites</th>
<th>Total Trench Area $^1$ (m²)</th>
<th>Catchment Drainage Area $^2$ (m²)</th>
<th>Runoff Volume Captured (m³/yr)</th>
<th>Precip. Directly Captured in Trenches (m³/yr)</th>
<th>Total Volume Captured (m³/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chihuahua</td>
<td>8</td>
<td>289,931</td>
<td>4,170,560</td>
<td>1,155,553</td>
<td>133,887</td>
<td>1,289,440</td>
</tr>
<tr>
<td>México</td>
<td>1</td>
<td>3,972</td>
<td>57,139</td>
<td>28,901</td>
<td>3,348</td>
<td>32,249</td>
</tr>
<tr>
<td>Guanajuato</td>
<td>5</td>
<td>110,367</td>
<td>1,587,594</td>
<td>534,888</td>
<td>61,974</td>
<td>596,862</td>
</tr>
<tr>
<td>Guerrero</td>
<td>1</td>
<td>3,192</td>
<td>45,919</td>
<td>38,434</td>
<td>4,453</td>
<td>42,887</td>
</tr>
<tr>
<td>Michoacan</td>
<td>1</td>
<td>3,192</td>
<td>45,919</td>
<td>22,206</td>
<td>2,573</td>
<td>24,779</td>
</tr>
<tr>
<td>Nayarit</td>
<td>1</td>
<td>18,012</td>
<td>259,099</td>
<td>224,950</td>
<td>26,063</td>
<td>251,013</td>
</tr>
<tr>
<td>Oaxaca</td>
<td>1</td>
<td>7,287</td>
<td>104,824</td>
<td>34,215</td>
<td>3,964</td>
<td>38,179</td>
</tr>
<tr>
<td>Sinaloa</td>
<td>1</td>
<td>10,472</td>
<td>150,639</td>
<td>83,514</td>
<td>9,676</td>
<td>93,190</td>
</tr>
<tr>
<td>Queretaro</td>
<td>1</td>
<td>5,467</td>
<td>78,644</td>
<td>28,265</td>
<td>3,275</td>
<td>31,539</td>
</tr>
<tr>
<td>Tlaxcala</td>
<td>1</td>
<td>3,192</td>
<td>45,919</td>
<td>19,699</td>
<td>2,282</td>
<td>21,982</td>
</tr>
<tr>
<td>Puebla</td>
<td>1</td>
<td>22,042</td>
<td>317,069</td>
<td>165,510</td>
<td>19,177</td>
<td>184,687</td>
</tr>
<tr>
<td>Durango</td>
<td>1</td>
<td>3,452</td>
<td>49,659</td>
<td>15,047</td>
<td>1,743</td>
<td>16,790</td>
</tr>
<tr>
<td>BCS</td>
<td>1</td>
<td>13,346</td>
<td>191,977</td>
<td>26,493</td>
<td>3,070</td>
<td>29,562</td>
</tr>
<tr>
<td><strong>Totals:</strong></td>
<td><strong>24</strong></td>
<td><strong>493,924</strong></td>
<td><strong>7,104,961</strong></td>
<td><strong>2,377,675</strong></td>
<td><strong>275,485</strong></td>
<td><strong>2,653,160</strong></td>
</tr>
</tbody>
</table>

The total (ultimate) benefit is: 18,132 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share is: 12,056 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 18,132 ML/yr, and TCCC’s benefit (adjusted for cost share) is 12,056 ML/yr.

**Projected Water Quantity Benefits Summary**

Table 9 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 9. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>18,132</td>
<td>12,056</td>
</tr>
<tr>
<td>2016</td>
<td>18,132</td>
<td>12,056</td>
</tr>
<tr>
<td>2017</td>
<td>18,132</td>
<td>12,056</td>
</tr>
<tr>
<td>2018</td>
<td>18,132</td>
<td>12,056</td>
</tr>
<tr>
<td>2019</td>
<td>18,132</td>
<td>12,056</td>
</tr>
<tr>
<td>Ultimate Benefit</td>
<td>18,132</td>
<td>12,056</td>
</tr>
</tbody>
</table>

Data Sources:
- Project information was obtained from Pronatura and calculated by the National Autonomous University of Mexico (UNAM) in 2014.
- This fact sheet documents the construction of infiltration trenches at 69 sites located throughout various states in Mexico. Each of the sites has been assigned a unique identifier that is included in the supporting spatial (i.e., shapefile) dataset. A supporting spreadsheet (“Mexico-BU_infiltration_trench_calculations_2015-02-12.xlsx”) provides information, calculations, and results for individual sites where infiltration trenches have been constructed.
- Updated information regarding cost share and implementation schedule was obtained via e-mail communication with Luis E Marin (with financial data from Oscar Martinez).

Assumptions:
- The capture coefficient for precipitation that falls on areas that drain to the individual infiltration trenches is assumed to be 0.6. The remaining 40% of the precipitation that falls in the “capture area” for a trench is assumed to be “lost” by a combination of evaporation, absorption by vegetation, and infiltration within the capture area itself.
- It is assumed that ~100% of the water that enters into an infiltration trench (either directly as precipitation or indirectly via runoff from upslope areas) is infiltrated. Losses from the trench due to evaporation/evapotranspiration are assumed to be negligible.
- The surface area of the “capture areas” (i.e., the total area that drains to the infiltration trench) was assumed to be the difference between the total area and the total surface area of the infiltration trenches. This assumption is appropriate because the infiltration trenches were constructed in a staggered configuration that allows for runoff from all (untrenched) upslope areas to be captured by a trench.
- The current benefit calculations are based on the assumption that there is no overlap in area between the “infiltration trench” activities and the “reforestation” activities. The water quantity and quality benefits for the “reforestation” activity were quantified separately and are reported in a separate Fact Sheet.

OTHER BENEFITS NOT QUANTIFIED
- Decreased sediment erosion/runoff.
NOTES

- The infiltration trenches are expected to have a lifetime of at least 10 years based on studies conducted by Pronatura. Therefore, the benefits for all infiltration trenches are assumed to be 100% maintained through 2019, as indicated in Table 9.

REFERENCES


“Mexico-BU_infiltration_trench_calculations_2015-02-12.xlsx” – Microsoft Excel spreadsheet containing area and volume estimates for individual sites where infiltration trenches have been constructed during the 2008-2014 period.

PROJECT NAME: Rainwater Harvesting and Aquifer Recharge

PROJECT ID #: 51

DESCRIPTION OF ACTIVITY: Rainwater harvesting structures and recharge shafts

LOCATION: Locations throughout India and a few locations in Nepal

PRIMARY CONTACT:
Sunil Gulati
Director Technical Services
Coca-Cola India Pvt Limited
Gurgaon, India
sgulati@coca-cola.com

OBJECTIVE:
- Improve groundwater supply reliability for community use

BACKGROUND & ACTIVITY DESCRIPTION: Coca-Cola India and its partners are installing and maintaining rainwater harvesting (RWH) and artificial aquifer recharge (AAR) structures to improve groundwater supply reliability for local communities. Currently rainwater harvesting structures have been constructed and are fully operational at hundreds of locations in communities throughout India and a few locations in Nepal. Rooftop structures, check dams and farm ponds collect water for infiltration to recharge aquifers and/or for storage and distribution. Some structures are located inside bottling plants and others are located at schools and other external locations in the local communities. Maintenance activities are conducted by TCCC, communities and NGOs to promote efficient operation and a prolonged lifespan.

SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 5,342.9 ML/YR

ACTIVITY TIMELINE:
- Construction, restoration and maintenance activities were initiated in 2002
- All projects were completed and were fully operational in 2014

COCA-COLA CONTRIBUTION: Variable, with an effective cost share of 97.5% in 2014
- RWH projects inside the plant premises are fully funded by Coca-Cola.
- Most of the projects in the community are fully funded by Coca-Cola. For a small number of outside projects, the community/NGO contribution cost share ranges from 8% to 63%.

WATERSHED BENEFITS CALculated:
1. Increase in recharge
1. **INCREASE IN RECHARGE**

**Approach & Results:**

The Coca-Cola India Division has estimated the rainwater harvesting potential and estimated recharge of RWH and AAR projects using the following equation and coefficients:

\[
\text{Supply (m}^3\text{)} = \text{Catchment Surface Area (m}^2\text{)} \times \text{Annual Precipitation (m)} \times \text{Catchment Coefficient}
\]

These are defined as follows:

- **Catchment Surface Area** – The area of the catchment(s) used to harvest precipitation for a given project, measured in square meters. The Division uses three categories of catchments within calculations: Roof; Paved; and Open.

- **Annual Precipitation** – The best available annual average rainfall data for a given location, measured in meters (m).

- **Catchment Coefficient** – A coefficient representing the estimated efficiency for each catchment type. The Division utilizes the following coefficients for projects involving rooftop structures:
  - Roof: 0.80
  - Paved: 0.60
  - Open: 0.30

For projects involving check dams and farm ponds, the supply from the catchment is compared to the storage potential (check dams) or available storage (farm ponds) of the storage structures. Storage potential is estimated by calculating the number of times the storage structures will fill to maximum volume. The volume of water available for recharge is estimated as the minimum of supply and storage potential (check dams) or available storage (farm ponds). India Division suggested that for catchments in their natural state, a conservative catchment coefficient of up to 30% can be used in the calculations. However, a more conservative catchment coefficient of 7.5% (or 0.075) was utilized in the calculations to account for any evaporation or usage loss during storage of water in the structures. Therefore, when the supply is less than the storage potential/available storage, evaporation and usage losses are considered implicitly in the supply calculations. In cases where the conservative estimation of “supply” is in excess of the storage potential/available storage, evaporation and usage losses are accounted explicitly by assuming a fraction of storage potential is lost (40-50% for check dams, 40-65% for farm ponds). The remaining volume is considered to be the benefit.

Replenishment benefits for 2014 were calculated for RWH projects that have been fully implemented on the plant premises and in the local community. The 2014 benefit is also the total (ultimate) benefit because, until data are available for future years, it is assumed that the projected benefits will remain the same as 2014 in each future year. For projects in the local community, the estimates are adjusted for any cost share by the community.

Of the 2014 total TCCC benefits, 15% (819.8 ML/yr) account for RWH projects within the plant premises and the remaining 85% (4,662.0 ML/yr) account for projects in the local community. The water collected on plant premises is for aquifer recharge only and it is not used inside the plant. A breakdown of the benefit from different categories is provided below.

- Rooftop (within plant premises): 819.8 ML/yr
- Rooftop (in the community): 3,092.5 ML/yr
Check dam (in the community): 900.7 ML/yr
Farm ponds (in the community): 668.8 ML/yr

Total (ultimate) benefit: 5,481.8 ML/yr.
TCCC total (ultimate) benefit taken as a function of cost share is: 5,342.9 ML/yr.

The current (2014) benefit and projected benefits are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 5,481.8 ML/yr and TCCC’s benefit (adjusted for cost share) is 5,342.9 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. If additional projects are added or projects are expanded, the future benefits will increase. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>5,481.8</td>
<td>5,342.9</td>
</tr>
<tr>
<td>2016</td>
<td>5,481.8</td>
<td>5,342.9</td>
</tr>
<tr>
<td>2017</td>
<td>5,481.8</td>
<td>5,342.9</td>
</tr>
<tr>
<td>2018</td>
<td>5,481.8</td>
<td>5,342.9</td>
</tr>
<tr>
<td>2019</td>
<td>5,481.8</td>
<td>5,342.9</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>5,481.8</td>
<td>5,342.9</td>
</tr>
</tbody>
</table>

Data Sources:

All calculations were performed by the Coca-Cola India Division. For projects inside the bottling plants, Coca-Cola India provided data on catchment areas and rainfall. For projects outside the bottling plants, input data were not available and Coca-Cola provided the estimated benefits to LimnoTech.

The following information on validation was provided by Coca-Cola India: “Coca-Cola India has developed comprehensive requirements and guidelines for approaching the above-mentioned water replenishment (WR) initiatives, technically pre-validating the proposed intervention, maintaining the developed structures/projects and establishing efficiency of the developed WR initiatives. These guidelines are applicable to all operations present in India South West Asia Business Unit (INSWA BU) including manufacturing/bottling entities. A brief summary of guidelines and requirements setup by Coca-Cola India to approach water replenishment initiatives is provided in Water Replenish Requirements (WRR) document (2011). The document contains appendices that provide a sample template of data needed to develop various WR initiatives. The existing WR initiatives are required to undergo field validation. The elements of field validation include documentation status review; design record sufficiency review; ownership record status review; maintenance record status review; and field validation...
level physical verification. The field validation involves a score based Data Quality Assessment (DQA) process. If the overall DQA score resulted in less than 60% for any particular project location, then the replenish benefits are not accounted. An example DQA calculation is provided by Coca-Cola India as an appendix to WRR (2011).”

Assumptions:
- It is assumed that projects have been field validated in India as described above.

OTHER BENEFITS NOT QUANTIFIED
- Reduction in stormwater runoff and associated pollutant load

NOTES
- All calculations were performed by Coca-Cola India according to the methodology described above, and Coca-Cola India reports that they were independently validated by a third party in India. LimnoTech has verified the calculations for most of the rooftop collection systems inside the bottling plants. Detailed inputs for outside projects are not available to LimnoTech at this time.
- None of the projects would have been implemented without TCCC funding. TCCC has also provided appropriate technology, community mobilization, communication and (for most projects) post-project maintenance.
- This fact sheet updates a 2013 fact sheet to include new projects and cost information and new information on data validation. Previously, check dams and farm ponds were included with RWH/AAR projects in one fact sheet. Beginning in 2012, a subset of these projects is now described in separate fact sheets where detailed information about the projects was provided.
- For check dams, the recharge volume is the minimum of supply and storage potential, and if supply is greater than storage potential, then evaporative and usage losses are factored in. For farm ponds, the recharge volume is the minimum of supply and available storage (after accounting for evaporative and usage losses).
- The project benefit total presented in this fact sheet was decreased slightly based on field confirmation of a benefit change. 2014 benefits reported by TCCC reflect this adjustment.

REFERENCES

Water Replenish Requirements (2011). Document provided by Dr. Murthy on November 02, 2011, describing the requirements of approaching developing, maintaining and understanding efficiency of the WR interventions initiated by INSWA BU. This includes a DQA example in the following appendix: annexure_7_DQA_worked_out_example.xlsx.

Excel file named: final_list_of_projects_types_classification_INSWA_BU_2014.xlsx was provided by Nilesh Jha on November 29, 2014. The file contains India Division’s estimates of rainwater harvesting potential and estimated recharge for all RWH and AAR projects.
PROJECT NAME: Restoration Project Guadiana River Basin
PROJECT ID #: 70

DESCRIPTION OF ACTIVITY: Reforestation of forest areas impacted by fire (Phase 1); Reforestation of agricultural crop fields (Phase 2)

LOCATION: The Guadiana River Basin located in Spain and Portugal

PRIMARY CONTACTS:

Juan José Litran
Director Public Affairs & Communications
Coca-Cola Iberia
Ribera del Loira 20
Madrid, Spain
jlitrana@coca-cola.com
+34-91 396 9369

Susana Pliego
Environment and Safety Manager
Coca-Cola Iberia
Ribera del Loira 20-22
28042 Madrid, Spain
spliego@coca-cola.com
+34-91-396-93-34

Eva Hernández
World Wildlife Fund, Spain
Gran Vía de San Francisco 8-D; 28005 Madrid, Spain
ehernandez@wwf.es

Clorinda Maldonado
World Wildlife Fund, Spain
Gran Vía de San Francisco 8-D; 28005 Madrid, Spain
cmaldonado@wwf.es
+34 91 354 0578

OBJECTIVES:

• Reduce runoff and associated sedimentation
• Recover native vegetation
• Improve habitat and increase biodiversity
• Improve the scientific and technical knowledge regarding ecosystems restoration within the Guadiana River Basin
• Involve the local population and key stakeholders in the project, while also improving the knowledge of the importance of rivers

BACKGROUND & ACTIVITY DESCRIPTION: The Guadiana River Basin is located in Spain and Portugal. The basin covers an area of 67,000 km², which is approximately 12% of the Iberian Peninsula (Hernandez, 2012). The Guadiana River Basin serves as a source of water supply to some of the most biodiverse regions of Spain and provides habitat for numerous species of fauna and flora. Portions of the basin are highly impacted by intensive flow regulation, groundwater extraction, water contamination, loss of
biodiversity and territory fragmentation (Coca Cola España, 2009).

Coca-Cola Spain and WWF Spain have been working together to restore areas in the Guadiana River Basin. During the first phase of the project, Coca-Cola Spain and WWF Spain worked together for three years (2008-2010) in the “Bajo Guadiana” and “Medio Guadiana” to restore four different areas impacted by fire (Table 1). For the second phase of the project, Coca-Cola Spain and WWF Spain worked together for another three years (2011-2013) in the Alto Guadiana to restore areas impacted by agriculture. The second phase of the project was focused on restoring Mediterranean forests around the protected "Las Tablas de Daimiel" wetland and reducing water demand from surrounding irrigated lands. The restoration activities have and will continue to improve water infiltration and runoff processes, improve soil conditions, restore native vegetation, and promote creation of ecological corridors in the basin.
Reforestation activities were conducted at five locations in the Guadiana River Basin as shown in Table 1 below.

Table 1. Reforestation Activities at Five Locations in the Guadiana Basin

<table>
<thead>
<tr>
<th>Location</th>
<th>Phase</th>
<th>Pre-Project Impact</th>
<th>Area Reforested (hectares)</th>
<th># Plants/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerro Belén (Cáñamero, Cáceres, Spain)</td>
<td>1</td>
<td>Fire</td>
<td>8</td>
<td>800</td>
</tr>
<tr>
<td>Higuereolas y valles (Cáñamero, Cáceres, Spain)</td>
<td>1</td>
<td>Fire</td>
<td>5</td>
<td>650</td>
</tr>
<tr>
<td>Ruecas river (Cáñamero, Cáceres, Spain)</td>
<td>1</td>
<td>Fire</td>
<td>2.63</td>
<td>400</td>
</tr>
<tr>
<td>Ribera do Vascao, Vale do Guadiana National Park (Moinho de Alferes, Portugal)</td>
<td>1</td>
<td>Fire</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Tablas de Daimiel National Park (Ciudad Real, Castilla la Mancha, Spain)</td>
<td>2</td>
<td>Agriculture</td>
<td>167</td>
<td>400</td>
</tr>
<tr>
<td><strong>Total area reforested (Phase 1 + Phase 2)</strong></td>
<td></td>
<td></td>
<td><strong>194.63</strong></td>
<td></td>
</tr>
</tbody>
</table>

**SUMMARY OF REPLENISH BENEFIT:**
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 37.25 ML/YR
**ACTIVITY TIMELINE:**

**Phase 1 (2008-2010)**
- Cerro Belén (reforestation of 8 ha): 2008-2010
- Higuerruelas y valles (reforestation of 5 ha): 2008-2010
- Ruecas river (reforestation of 2.63 ha): 2008-2010
- Ribera do Vascao, Vale do Guadiana National Park (reforestation of 12 ha): 2008-2010

**Phase 2 (2011-2013)**
- Tablas de Daimiel National Park
  - 2011: 15 ha reforested
  - 2012: 142 ha reforested
  - 2013: 10 ha reforested

**COCA-COLA CONTRIBUTION: 100%**
- Overall Project Funding: 742,751.85 USD
- Coca-Cola Cost Contribution: 742,751.85 USD

**WATERSHED BENEFITS CALCULATED:**
- Decrease in runoff

### 1. **DECREASE IN RUNOFF**

**Approach & Results:**

The water quantity benefit was calculated using the “Alternative Annual Method” as described in Redder and Larson (2012). This conservative method is appropriate for land use/land cover activities that are expected to generate water quantity benefits of less than 150 ML/yr. The water quantity benefit is calculated as the difference in the estimated “pre-project” and “post-project” runoff depths multiplied by the total surface area:

\[
\text{[Water quantity benefit (m}^3/\text{yr}]) = [\Delta \text{Runoff (m/yr)}] \times \text{[Surface Area (m}^2)]
\]

where the change in runoff (\(\Delta \text{Runoff}\)) is calculated as follows:

\[
[\Delta \text{Runoff (m/yr)}] = [\text{Pre-project Runoff Depth (m/yr)}] – [\text{Post-project Runoff Depth (m/yr)}]
\]

“Pre-project” is defined as the deforested condition of the land that existed prior to reforestation, while “post-project” is defined as the reforested condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

\[
[\Delta \text{Runoff (m/yr)}] = \Delta K \times \text{[Annual Rainfall Depth (m/yr)]}
\]

where \(\Delta K\) is the difference between the pre- and post-project annual runoff coefficients due to changes in the vegetation condition.
For a typical reforestation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition ($\Delta K$) is solely due to a change in the vegetation condition. A conservative value of 0.04 was selected for $\Delta K$ (Redder and Larson, 2012).

Calculated water quantity benefits are provided in Table 2 below.

The total ultimate benefit (runoff reduction) for the five projects is: 37.25 million liters per year (ML/yr).

Table 2. Summary of Water Quantity Benefits

<table>
<thead>
<tr>
<th>Location</th>
<th>Description of Activity</th>
<th>Time Period</th>
<th>Annual Precipitation (m/yr)</th>
<th>Surface Area (m$^2$)</th>
<th>Ultimate Water Quantity Benefit (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerro Belén</td>
<td>Reforestation</td>
<td>2008-2010</td>
<td>0.689</td>
<td>80,000</td>
<td>2.20</td>
</tr>
<tr>
<td>Higueruelas y valles</td>
<td>Reforestation</td>
<td>2008-2010</td>
<td>0.723</td>
<td>50,000</td>
<td>1.45</td>
</tr>
<tr>
<td>Ruecas river</td>
<td>Reforestation</td>
<td>2008-2010</td>
<td>0.648</td>
<td>26,300</td>
<td>0.68</td>
</tr>
<tr>
<td>Ribera do Vascao, Vale do Guadiana National Park</td>
<td>Reforestation</td>
<td>2008-2010</td>
<td>0.500</td>
<td>120,000</td>
<td>2.40</td>
</tr>
<tr>
<td>Tablas de Daimiel National Park</td>
<td>Reforestation</td>
<td>2011</td>
<td>0.457</td>
<td>150,000</td>
<td>2.74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2012</td>
<td>0.457</td>
<td>1,420,000</td>
<td>25.95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2013</td>
<td>0.457</td>
<td>100,000</td>
<td>1.83</td>
</tr>
<tr>
<td>Totals &gt;&gt;</td>
<td></td>
<td></td>
<td></td>
<td>1,946,300</td>
<td>37.25</td>
</tr>
</tbody>
</table>

The total (ultimate) benefit is: 37.25 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 37.25 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 37.25 ML/yr and TCCC’s benefit (adjusted for cost share) is 37.25 ML/yr.

Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 3. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>37.25</td>
<td>37.25</td>
</tr>
<tr>
<td>2016</td>
<td>37.25</td>
<td>37.25</td>
</tr>
<tr>
<td>2017</td>
<td>37.25</td>
<td>37.25</td>
</tr>
<tr>
<td>2018</td>
<td>37.25</td>
<td>37.25</td>
</tr>
<tr>
<td>2019</td>
<td>37.25</td>
<td>37.25</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>37.25</td>
<td>37.25</td>
</tr>
</tbody>
</table>

Data Sources:
- Size of reforested land areas provided by Susana Pliego.
- Schedule for reforestation provided by Susana Pliego.
- Average annual precipitation provided in the Basic Project Information Template CWP Project inf Template June 2011 GUADIANA CCSpain.doc.

Assumptions:
- A conservative value of 0.04 was selected for \( \Delta K \), consistent with the recommendations made in the “Alternative Annual Method” memorandum (Redder and Larson 2012).”

OTHER BENEFITS NOT QUANTIFIED
- Improved water quality, including sedimentation
- Improved habitat and increased biodiversity
- Recuperation of native vegetation
- Education of local stakeholders on conservation of the Guadiana River Basin

NOTES
- This fact sheet updates the February 2013 fact sheet to report project completion and resulting benefits.

REFERENCES
**PROJECT NAME:** North America Rain Barrel Donation Program  
**PROJECT ID #:** 103  

**DESCRIPTION OF ACTIVITY:** Rain barrel distribution for community household and school/business use  

**LOCATION:** Locations throughout Canada  

**PRIMARY CONTACT:**  
Rena Ann Stricker  
Contract Ecologist  
CCNA Group Environment & Sustainability  
Rstricker@coca-cola.com  
Tel. 404-395-6250  

Jon Radtke  
Manager, Water Resources  
CCNA Group Environment & Sustainability  
Jradtke@coca-cola.com  
Tel. 404-676-9112  

**OBJECTIVE:**  
- Reduction in stormwater runoff  

**BACKGROUND & DESCRIPTION OF ACTIVITY:** The Coca-Cola Company is partnering with watershed conservation organizations, municipalities, universities, and community groups throughout North America to distribute 55-gallon syrup drums for reuse as rain barrels. The partner organizations are primarily supporting rain barrel use for residential properties. The use of collected water ranges from use for light gardening work to exterior household cleaning needs (vehicle washing). By collecting rainwater that normally flows off a property, rain barrels save money on water bills, conserve water during dry periods and prevent polluted runoff. The reuse of these 55-gallon barrels not only helps in watershed protection through decreased stormwater runoff, but also eliminates the energy Coca-Cola would have expended recycling the plastic barrels. Since 2008, a total of 6,112 rain barrels have been donated from 8 Coca-Cola facilities in Canada, creating ongoing community watershed partnerships throughout Canada. This fact sheet describes the replenish benefits generated through rain barrels in Canada.  

**SUMMARY OF REPLENISH BENEFIT:**  
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 38.8 ML/YR  

**ACTIVITY TIMELINE:**  
- 2008 through 2014: 6,112 rain barrels were donated.  

**COCA-COLA CONTRIBUTION:** 100%  
- Project is fully funded by Coca-Cola  

**WATERSHED BENEFITS CALCULATED:**  
1. Decrease in stormwater runoff
1. DECREASE IN STORMWATER RUNOFF

Approach & Results:
A Microsoft Excel-based rain barrel calculator was developed to estimate the water benefit from the use of donated rain barrels. The calculator is based on a supply and demand methodology and includes geography-specific input data, as follows:

Supply Calculations:
To calculate the potential rainwater available for harvest, the calculator utilizes the following formula and variables:

\[
\text{Catchment Size} \times \text{Number of Barrels} \times \text{Total Precipitation} \times \text{Catchment Efficiency Coefficient}
\]

**Catchment Size** – Based upon an assigned percentage of the average single family home and school. For example, the average single family roof size is 1,200 square feet with most houses having a peaked roof. Therefore, the calculator conservatively utilizes 600 square feet as the catchment size to account for portions of the roof that may not have rain gutters to capture water.

**Number of Barrels** – An estimate of the number of donated barrels actually distributed and in use.

**Total Precipitation** – Combined monthly rainfall and snowfall. Snowfall is converted to Snow Water Equivalent using a 0.20 density coefficient. Precipitation data is pre-loaded for select geographic locations.

**Catchment Efficiency Coefficient** – An 85% runoff coefficient was selected; meaning 85% of the rain falling on the catchment will run off to the gutter and rain barrel. The other 15% will be lost to evaporation, wind, leaks, infiltration into the catchment surface, etc.

Demand Calculations:
To calculate the demand or estimated barrel water use, the calculator utilizes the following formula and variables for both households and schools/businesses.

\[
((\text{Evapotranspiration} \times \text{Landscape Coefficient} \times \text{Landscape Area}) + \text{Estimated Other Use}) \times \text{Overflow Loss}
\]

**Evapotranspiration** – Data is pre-loaded for select geographic locations.

**Landscape Coefficient** – Also commonly referred to as the "Plant Factor" and the functional equivalent of the "Crop Coefficient." A factor of 0.50 was selected, which is an average value for moderate watering needs. Turf grasses are commonly 0.6-0.8, whereas gardens and shrubs are closer to 0.40 on average. For locations where evapotranspiration was 0-25% greater than total precipitation, a factor of 0.30 was utilized, and for locations where evapotranspiration was more than 25% greater than total precipitation, a factor of 0.20 was utilized.

**Landscape Area** – The estimated square footage of the landscape are serviced by the rain barrel. The household average is 300 square feet and the school/business is 700 square feet. The larger landscape area for schools/businesses accounts for designated grounds personnel.
**Estimated Other Use** – Estimates for the amount of water utilized in each given month for purposes other than landscaping or gardening (e.g., washing a vehicle at home can use up to 100 gallons/wash; the calculator conservatively utilizes a 25 or 50 gallon estimate in months where landscape/garden water use is greater than 0).

**Overflow Loss** – A percentage reduction based upon the month-to-month probability of receiving more than 0.30” precipitation in a single day. This represents the approximate amount to fill a rain barrel. Data are pre-loaded for select geographic locations.

Total (ultimate) benefit: 38.8 ML/yr  
TCCC total (ultimate) benefit taken as a function of cost share is: 38.8 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 38.8 ML/yr and TCCC’s benefit (adjusted for cost share) is 38.8 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>38.8</td>
<td>38.8</td>
</tr>
<tr>
<td>2016</td>
<td>38.8</td>
<td>38.8</td>
</tr>
<tr>
<td>2017</td>
<td>38.8</td>
<td>38.8</td>
</tr>
<tr>
<td>2018</td>
<td>38.8</td>
<td>38.8</td>
</tr>
<tr>
<td>2019</td>
<td>38.8</td>
<td>38.8</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>38.8</td>
<td>38.8</td>
</tr>
</tbody>
</table>

**Data Sources/Site-specific characteristics:**

- Rain Barrel Replenish Tally 12nov2014.xls
- The various data sources used are listed in the “Original References” and “Data References” tabs of the rain barrel calculator excel spreadsheet (barrelman ca CCNA Rain Barrel Calculator Update 11-2012.xlsx)
Assumptions:

- Homeowners and school/business representatives that attend a workshop and receive a rain barrel through the donation program will use it consistently to collect rainwater from roofed areas and use the collected water for gardening, cleaning, and other outdoor uses.
- Additional assumptions are incorporated into the calculator formulas and coefficients.
- For plant locations not listed in the rain barrel calculator, an EPA estimated value of 1,300 gallons/drum over the peak summer months was used.

OTHER BENEFITS NOT QUANTIFIED

- Reduction in municipal water usage due to use of water collected in rain barrels for gardening, and other activities.
- Energy savings resulting from reusing plastic barrels instead of recycling them.
- Decreased stormwater pollution load.

NOTES

- This fact sheet updates the January 2014 fact sheet to provide benefits through 2014. Furthermore, it presents the replenish benefits of rain barrels in Canada as a separate activity from rain barrels in the US. Previously, United States and Canadian rain barrel benefits have been reported together.

REFERENCES

The various references related to the rain barrel calculator are listed in the “Original References” and “Data References” tabs of the rain barrel calculator excel spreadsheet (barrelman ca CCNA Rain Barrel Calculator Update 11-2012.xlsx).

U.S. Environmental Protection Agency (Region 3). Estimates that one barrel can save the average household approximately 1,300 gallons over the three peak summer months. http://www.epa.gov/region3/p2/what-is-rainbarrel.pdf
PROJECT NAME: North America Rain Barrel Donation Program
PROJECT ID #: 103

DESCRIPTION OF ACTIVITY: Rain barrel distribution for community household and school/business use

LOCATION: Locations throughout the United States

PRIMARY CONTACT:
Rena Ann Stricker
Contract Ecologist
CCNA Group Environment & Sustainability
Rstricker@coca-cola.com
Tel. 404-395-6250

Jon Radtke
Manager, Water Resources
CCNA Group Environment & Sustainability
Jradtke@coca-cola.com
Tel. 404-676-9112

OBJECTIVE:
- Reduction in stormwater runoff

BACKGROUND & DESCRIPTION OF ACTIVITY: The Coca-Cola Company is partnering with watershed conservation organizations, municipalities, universities, and community groups throughout North America to distribute 55-gallon syrup drums for reuse as rain barrels. The partner organizations are primarily supporting rain barrel use for residential properties. The use of collected water ranges from use for light gardening work to exterior household cleaning needs (vehicle washing). By collecting rainwater that normally flows off a property, rain barrels save money on water bills, conserve water during dry periods and prevent polluted runoff. The reuse of these 55-gallon barrels not only helps in watershed protection through decreased stormwater runoff, but also eliminates the energy Coca-Cola would have expended recycling the plastic barrels. Since 2008, a total of 64,300 rain barrels have been donated from 82 Coca-Cola facilities in the United States, creating ongoing community watershed partnerships throughout the United States. This fact sheet describes the replenish benefits generated through rain barrels in the United States.

SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 513.2 ML/YR

ACTIVITY TIMELINE:
- 2008 through 2014: 64,300 rain barrels were donated.

COCA-COLA CONTRIBUTION: 100%
- Project is fully funded by Coca-Cola

WATERSHED BENEFITS CALCULATED:
1. Decrease in stormwater runoff
1. **DECREASE IN STORMWATER RUNOFF**

**Approach & Results:**
A Microsoft Excel-based rain barrel calculator was developed to estimate the water benefit from the use of donated rain barrels. The calculator is based on a supply and demand methodology and includes geography-specific input data, as follows:

**Supply Calculations:**
To calculate the potential rainwater available for harvest, the calculator utilizes the following formula and variables:

\[
\text{Catchment Size} \times \text{Number of Barrels} \times \text{Total Precipitation} \times \text{Catchment Efficiency Coefficient}
\]

**Catchment Size** – Based upon an assigned percentage of the average single family home and school. For example, the average single family roof size is 1,200 square feet with most houses having a peaked roof. Therefore, the calculator conservatively utilizes 600 square feet as the catchment size to account for portions of the roof that may not have rain gutters to capture water.

**Number of Barrels** – An estimate of the number of donated barrels actually distributed and in use.

**Total Precipitation** – Combined monthly rainfall and snowfall. Snowfall is converted to Snow Water Equivalent using a 0.20 density coefficient. Precipitation data is pre-loaded for select geographic locations.

**Catchment Efficiency Coefficient** – An 85% runoff coefficient was selected; meaning 85% of the rain falling on the catchment will run off to the gutter and rain barrel. The other 15% will be lost to evaporation, wind, leaks, infiltration into the catchment surface, etc.

**Demand Calculations:**
To calculate the demand or estimated barrel water use, the calculator utilizes the following formula and variables for both households and schools/businesses.

\[
((\text{Evapotranspiration} \times \text{Landscape Coefficient} \times \text{Landscape Area}) + \text{Estimated Other Use}) \times \text{Overflow Loss}
\]

**Evapotranspiration** – Data is pre-loaded for select geographic locations.

**Landscape Coefficient** – Also commonly referred to as the "Plant Factor" and the functional equivalent of the "Crop Coefficient." A factor of 0.50 was selected, which is an average value for moderate watering needs. Turf grasses are commonly 0.6-0.8, whereas gardens and shrubs are closer to 0.40 on average.

For locations where evapotranspiration was 0-25% greater than total precipitation, a factor of 0.30 was utilized, and for locations where evapotranspiration was more than 25% greater than total precipitation, a factor of 0.20 was utilized.

**Landscape Area** – The estimated square footage of the landscape are serviced by the rain barrel. The household average is 300 square feet and the school/business is 700 square feet. The larger landscape area for schools/businesses accounts for designated grounds personnel.
**Estimated Other Use** – Estimates for the amount of water utilized in each given month for purposes other than landscaping or gardening (e.g., washing a vehicle at home can use up to 100 gallons/wash; the calculator conservatively utilizes a 25 or 50 gallon estimate in months where landscape/garden water use is greater than 0).

**Overflow Loss** – A percentage reduction based upon the month-to-month probability of receiving more than 0.30” precipitation in a single day. This represents the approximate amount to fill a rain barrel. Data are pre-loaded for select geographic locations.

Total (ultimate) benefit: 513.2 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 513.2 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 513.2 ML/yr and TCCC’s benefit (adjusted for cost share) is 513.2 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>513.2</td>
<td>513.2</td>
</tr>
<tr>
<td>2016</td>
<td>513.2</td>
<td>513.2</td>
</tr>
<tr>
<td>2017</td>
<td>513.2</td>
<td>513.2</td>
</tr>
<tr>
<td>2018</td>
<td>513.2</td>
<td>513.2</td>
</tr>
<tr>
<td>2019</td>
<td>513.2</td>
<td>513.2</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>513.2</td>
<td>513.2</td>
</tr>
</tbody>
</table>

**Data Sources/Site-specific characteristics:**

- Rain Barrel Replenish Tally 12nov2014.xls
- The various data sources used are listed in the “Original References” and “Data References” tabs of the rain barrel calculator excel spreadsheet (barrelman ca CCNA Rain Barrel Calculator Update 11-2012.xlsx)
Assumptions:

- Homeowners and school/business representatives that attend a workshop and receive a rain barrel through the donation program will use it consistently to collect rainwater from roofed areas and use the collected water for gardening, cleaning, and other outdoor uses.
- Additional assumptions are incorporated into the calculator formulas and coefficients.
- For plant locations not listed in the rain barrel calculator, an EPA estimated value of 1,300 gallons/drum over the peak summer months was used.

OTHER BENEFITS NOT QUANTIFIED

- Reduction in municipal water usage due to use of water collected in rain barrels for gardening, and other activities.
- Energy savings resulting from reusing plastic barrels instead of recycling them.
- Decreased stormwater pollution load.

NOTES

- This fact sheet updates the January 2014 fact sheet to provide benefits through 2014. Furthermore, it presents the replenish benefits of rain barrels in the United States as a separate activity from rain barrels in Canada. Previously, United States and Canadian rain barrel benefits have been reported together.

REFERENCES

The various references related to the rain barrel calculator are listed in the “Original References” and “Data References” tabs of the rain barrel calculator excel spreadsheet (barrelman ca CCNA Rain Barrel Calculator Update 11-2012.xlsx).

U.S. Environmental Protection Agency (Region 3). Estimates that one barrel can save the average household approximately 1,300 gallons over the three peak summer months.

http://www.epa.gov/region3/p2/what-is-rainbarrel.pdf
PROJECT NAME: Protecting Forests from Land Development

PROJECT ID #: 105

DESCRIPTION OF ACTIVITY: Maintenance of 3,494 ha forest in combination with protection from development

LOCATIONS: Fifteen locations in Japan

PRIMARY CONTACTS:
Mitsuru Shibata Yukihiro Nakamura
Coca-Cola Japan Coca-Cola Japan
Technical Stewardship, Supply Chain & Commercialization, EOSH Governance
Tel. 81 3 5466 8325
mitshibata@coca-cola.com yuknakamura@coca-cola.com

OBJECTIVES:
- Source water protection
- Promote undergrowth and the healthy growth of trees
- Decrease runoff

BACKGROUND & ACTIVITY DESCRIPTION: Coca-Cola West, Coca-Cola East Japan and other Coca-Cola Bottling companies have entered into long-term agreements with local governments and forestry cooperatives to protect a total of 3,494 hectares of forest from development at fifteen different locations in Japan. The length of the land protection agreements varies from 10 to 50 years and local partners also vary for the different sites. These areas are currently forested, however, they all are expected to be impacted by recreational, commercial and/or tourism-related development in the next few years if they are not protected. Project locations and agreement end dates are provided in Table 1.

Maintenance activities are also being implemented at these protected sites to promote a healthy forest, increase the capacity of the soil to hold water, decrease runoff and increase infiltration to groundwater. Activities consist of thinning, mowing, reforestation and maintenance of the undergrowth. Figure 1 shows forest maintenance activities at two of the project locations and Figure 2 shows an example of the forest maintenance benefit. This fact sheet describes the benefits of both forest maintenance and forest protection. Forest maintenance benefits are counted up until the time when the land is expected to have been developed in the absence of protection. At that point, only forest protection benefits are calculated.

Figure 1. Forest maintenance at site #2, Uji @ Kyoto (left) and site #7 Aiso @ Shiga (right)
Figure 2. Photos showing the increased undergrowth resulting from project activities at site #11, Komatsu, Saijyo @ Ehime as the result of forest maintenance activities.

Table 1. Locations and areas being protected and maintained

<table>
<thead>
<tr>
<th>Location</th>
<th>Area (ha)</th>
<th>Agreement End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mt. Shirahata, Sapporo @ Hokkaido</td>
<td>26</td>
<td>2060</td>
</tr>
<tr>
<td>2. Uji @ Kyoto</td>
<td>106</td>
<td>2020</td>
</tr>
<tr>
<td>3. Hongo @ Hiroshima</td>
<td>713</td>
<td>2020</td>
</tr>
<tr>
<td>4. Tosu @ Saga</td>
<td>17</td>
<td>2035</td>
</tr>
<tr>
<td>5. Daisen @ Tottori</td>
<td>427</td>
<td>2020</td>
</tr>
<tr>
<td>6. Ono @ Hyogo</td>
<td>10</td>
<td>2018</td>
</tr>
<tr>
<td>7. Aiso @ Shiga</td>
<td>11</td>
<td>2017</td>
</tr>
<tr>
<td>8. Ena @ Gifu</td>
<td>140</td>
<td>2020</td>
</tr>
<tr>
<td>9. Atugi @ Kanagawa</td>
<td>700</td>
<td>2020</td>
</tr>
<tr>
<td>10. Nanto @ Toyama</td>
<td>6.3</td>
<td>2023</td>
</tr>
<tr>
<td>11. Komatsu, Saijyo @ Ehime</td>
<td>100</td>
<td>2020</td>
</tr>
<tr>
<td>12. Yokomine-ji, Saijyo @ Ehime</td>
<td>2</td>
<td>2020</td>
</tr>
<tr>
<td>13. Myounokuchi, Saijyo @ Ehime</td>
<td>46</td>
<td>2020</td>
</tr>
<tr>
<td>14. Ojahara, Ebino @ Miyazaki</td>
<td>243</td>
<td>2020</td>
</tr>
<tr>
<td>15. Marunuma, Katashina @ Gunma</td>
<td>946.46</td>
<td>2020</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>3,494</strong></td>
<td></td>
</tr>
</tbody>
</table>

SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 3,911 ML/yr

ACTIVITY TIMELINE:
- Agreements for protection and maintenance were signed and expire on varying dates. These are described below by site.
  1. Mt. Shirahata, Sapporo at Hokkaido: 2011-2060
  2. Uji at Kyoto: 2007-2020
  3. Hongo at Hiroshima: 2009-2020
  4. Tosu at Saga: 2006-2035
  5. Daisen at Tottori: 2007-2020
  6. Ono at Hyogo: 2008-2018
8. Ena at Gifu: 2013-2020
11. Komatsu, Saijyo at Ehime: 2012-2020
12. Yokomine-ji, Saijyo at Ehime; 2012-2020
15. Marunuma, Katashina @ Gunma: 2014-2020

Note: Agreements may be expanded to continue through 2020.

- The schedule for maintenance activities at the project locations is provided in Table 2.

**Table 2. Schedule for maintenance activities at the fifteen project locations**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency (e.g., annually, quarterly, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of dead trees</td>
<td>Annually - Combine with other activities schedule that will use heavy machines or equipment such as tree thinning</td>
</tr>
<tr>
<td>Tree thinning</td>
<td>Once a year</td>
</tr>
<tr>
<td>Reforestation</td>
<td>Dependent on forest conditions, if this activity is necessary from a soil protection &amp; biodiversity point of view</td>
</tr>
<tr>
<td>Maintenance of undergrowth</td>
<td>Annually</td>
</tr>
<tr>
<td>Pruning redundant branch</td>
<td>Annually</td>
</tr>
</tbody>
</table>

**Coca-Cola Contribution:** 100%
- Total cost: $268,989 USD annually
- Coca-Cola Cost: $268,989 USD annually - Coca-Cola is funding the local Forestry Cooperatives which conduct the forest maintenance

**Watershed Benefits Calculated:**
1. Decrease in runoff

1. **Decrease in Runoff**

**Approach & Results:**
The water quantity benefit was calculated using a two-step approach that first considers the benefits of forest maintenance on the sites up until the point that the land would have been developed. As part of the second step, the benefits of forest protection are calculated for the estimated area that would have been developed in the absence of this project. The development schedule was provided by the contact, based on development patterns in the vicinity of the project sites. This information was used to determine when benefits of forest maintenance and forest protection apply at each site, and the area to apply each (Tables 3 and 4). As the development schedule in the various areas matures, the benefits of protection are included in the overall project benefits.

Forest maintenance benefits occurring today are calculated using a site-specific method that was developed by the Japanese government and proposed for use by the Japan Business Unit. This same method is used for forest protection benefits. This method is similar to the “Alternative Annual Method” as described in Redder and Larson (2012), but uses site-specific coefficients for forest maintenance and forest protection in Japan, based on studies by the Yamaguchi Prefecture (2009) for
forest maintenance, and the Technical Standards on Regulating Reservoirs for Disaster Prevention: Part I for forest protection.

For both maintenance and protection, the water quantity benefit is calculated as the difference in the estimated “pre-project” and “post-project” runoff depths multiplied by the total surface area:

\[
\text{[Water quantity benefit (m}^3/\text{yr})] = [\Delta \text{ Runoff (m/yr)}] \times [\text{Surface Area (m}^2)]
\]

where the change in runoff (\(\Delta \text{ Runoff}\)) is calculated as follows:

\[
[\Delta \text{ Runoff (m/yr)}] = \{ [\text{Pre-project Runoff Depth (m/yr)}] – [\text{Post-project Runoff Depth (m/yr)}] \}
\]

For forest maintenance, “Pre-project” is defined as the unhealthy condition of the land that existed prior to forest maintenance. “Post-project” is defined as the healthy forested condition resulting from the maintenance activities.

For forest protection, “Pre-project” is defined as the developed condition of the land that would result if it were not protected. “Post-project” is defined as the forested condition that is protected as a result of the agreements.

Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

\[
[\Delta \text{ Runoff (m/yr)}] = \Delta K \times [\text{Annual Rainfall Depth (m/yr)}]
\]

where \(\Delta K\) is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical forest maintenance activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (\(\Delta K\)) is solely due to a change in the vegetation condition. A conservative value of 0.05 was selected for \(\Delta K\), consistent with the delta K (0.06 to 0.08) documented in a 2009 research report describing forest maintenance in Japan (Yamaguchi Prefecture, 2009).

Similarly, for a typical land protection activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (\(\Delta K\)) is solely due to a change in the vegetation condition. A conservative value of 0.1 was selected for \(\Delta K\) for all locations, based on information provided in the Technical Standards on Regulating Reservoirs for Disaster Prevention: Part I.

Forest maintenance benefits are calculated as: \([0.05 \times \text{precipitation (m/yr)}] \times [\text{Area maintained (m}^2)]\)

Forest protection benefits are calculated as: \([0.1 \times \text{precipitation (m/yr)}] \times [\text{Area protected (m}^2)]\)

The maintained and protected areas used in the benefit calculation are shown in Tables 3 and 4 and precipitation is shown in Table 5.
Table 3. Area (ha) maintained each year, by site

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mt. Shirahata, Sapporo @ Hokkaido</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>16</td>
<td>16</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2. Uji @ Kyoto</td>
<td>79</td>
<td>53</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>3. Hongo @ Hiroshima</td>
<td>713</td>
<td>713</td>
<td>713</td>
<td>624</td>
<td>446</td>
<td>178</td>
<td>178</td>
</tr>
<tr>
<td>4. Tosu @ Saga</td>
<td>17</td>
<td>17</td>
<td>14</td>
<td>14</td>
<td>10</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5. Daisen @ Tottori</td>
<td>427</td>
<td>427</td>
<td>256</td>
<td>256</td>
<td>85</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>6. Ono @ Hyogo</td>
<td>10</td>
<td>10</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>7. Aiso @ Shiga</td>
<td>11</td>
<td>11</td>
<td>8</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>8. Ena @ Gifu</td>
<td>112</td>
<td>84</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>9. Atugi @ Kanagawa</td>
<td>670</td>
<td>585</td>
<td>470</td>
<td>140</td>
<td>140</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>10. Nanto @ Toyama</td>
<td>6.3</td>
<td>6.3</td>
<td>6.3</td>
<td>4.3</td>
<td>4.3</td>
<td>2.3</td>
<td>2.3</td>
</tr>
<tr>
<td>11. Komatsu, Saijyo @ Ehime</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>85</td>
<td>70</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>12. Yokomine-ji, Saijyo @ Ehime</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13. Myounokuchi, Saijyo @ Ehime</td>
<td>46</td>
<td>46</td>
<td>46</td>
<td>39</td>
<td>32</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>14. Ojahara, Ebino @ Miyazaki</td>
<td>243</td>
<td>243</td>
<td>243</td>
<td>207</td>
<td>170</td>
<td>97</td>
<td>97</td>
</tr>
<tr>
<td>15. Marunuma, Katashina @ Gunma</td>
<td>946.5</td>
<td>946.5</td>
<td>946.5</td>
<td>946.5</td>
<td>946.5</td>
<td>946.5</td>
<td>946.5</td>
</tr>
</tbody>
</table>

Table 4. Area (ha) protected each year, by site

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mt. Shirahata, Sapporo @ Hokkaido</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>10</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>2. Uji @ Kyoto</td>
<td>27</td>
<td>53</td>
<td>71</td>
<td>71</td>
<td>71</td>
<td>71</td>
<td>71</td>
</tr>
<tr>
<td>3. Hongo @ Hiroshima</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>89</td>
<td>267</td>
<td>535</td>
<td>535</td>
</tr>
<tr>
<td>4. Tosu @ Saga</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>5. Daisen @ Tottori</td>
<td>0</td>
<td>0</td>
<td>171</td>
<td>171</td>
<td>342</td>
<td>342</td>
<td>342</td>
</tr>
<tr>
<td>6. Ono @ Hyogo</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>7. Aiso @ Shiga</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>8. Ena @ Gifu</td>
<td>28</td>
<td>56</td>
<td>112</td>
<td>112</td>
<td>112</td>
<td>112</td>
<td>112</td>
</tr>
<tr>
<td>9. Atugi @ Kanagawa</td>
<td>30</td>
<td>115</td>
<td>230</td>
<td>560</td>
<td>560</td>
<td>560</td>
<td>560</td>
</tr>
<tr>
<td>10. Nanto @ Toyama</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>11. Komatsu, Saijyo @ Ehime</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>30</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>12. Yokomine-ji, Saijyo @ Ehime</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>13. Myounokuchi, Saijyo @ Ehime</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>14</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>14. Ojahara, Ebino @ Miyazaki</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>36</td>
<td>73</td>
<td>146</td>
<td>146</td>
</tr>
<tr>
<td>15. Marunuma, Katashina @ Gunma</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Notes: These areas equal the hectares expected to be developed each year, in the absence of this project, assuming there is no protection after the current protection agreements end.

Site 15 is located in a restricted area for large scale additional development & construction in Nikko National Park, and therefore protection from development is not considered for this site.
Maintenance and protection benefits were calculated following the method described in this section, and using the areas in Tables 3 and 4, and the precipitation totals in Table 5. These benefits are summed to calculate the total (ultimate) benefit. In 2020, the maintenance and protection benefits for the entire project area equal to 1,806.4 ML/yr + 4,060.2 ML/yr = 5,867 ML/yr.

The total (ultimate) benefit is: 5,867 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 5,867 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 3,911 ML/yr and TCCC’s benefit (adjusted for cost share) is 3,911 ML/yr.

Projected Replenish Benefits

Table 6 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.
Table 6. Projected water quantity benefits summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>4,036</td>
<td>4,036</td>
</tr>
<tr>
<td>2016</td>
<td>4,463</td>
<td>4,463</td>
</tr>
<tr>
<td>2017</td>
<td>4,952</td>
<td>4,952</td>
</tr>
<tr>
<td>2018</td>
<td>5,441</td>
<td>5,441</td>
</tr>
<tr>
<td>2019</td>
<td>5,867</td>
<td>5,867</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>5,867</td>
<td>5,867</td>
</tr>
</tbody>
</table>

Data Sources:

- Size of maintained and protected land area: 3,494 hectares (provided by contact)
- Development schedule and anticipated type of development: provided by contact
- Average annual precipitation (2004-2013) provided by contact, who obtained the data from the Japan Meteorological Agency (government section) survey and selected the nearest Weather Observation Station for each project location. [http://www.jma.go.jp/jma/indexe.html](http://www.jma.go.jp/jma/indexe.html)

Assumptions:

- For forest maintenance, the $\Delta K$ (difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition) is assumed to be 0.05 as a conservative and simplifying assumption which is consistent with Yamaguchi Prefecture, 2009.
- For forest protection, the $\Delta K$ (difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition) is assumed to be 0.1 as a conservative and simplifying assumption which is consistent with Technical Standards on Regulating Reservoirs for Disaster Prevention: Part I.
- If not protected, the forests would be developed for residential, commercial or tourist uses following the development schedule provided in Table 4.

OTHER BENEFITS NOT QUANTIFIED

- Water quality improvements, including reduced sedimentation
- Protection and improvement of habitat and biodiversity
- Improved outdoor recreation for local residents

NOTES

- This fact sheet updates the January 2014 fact sheet to include an additional location (Marunuma, Katashina @ Gunma), account for expansion of the project scope at four sites to increase the area protected and maintained, and to include more recent precipitation data in the benefit calculation.

REFERENCES

Technical Standards on Regulating Reservoirs for Disaster Prevention: Part I. The Japan Housing Corporation (March 1974, December 1979); The Japan River Association (March 1974, December 1979, March 1987); The Japan Regional Development Corporation (December 1979, March 1987); The Housing and Urban Development Corporation (March 1987).

**PROJECT NAME:** Conservation and Restoration of Ramsar Site Lagunas de Guanacache, Desaguadero, and del Bebedero

**PROJECT ID #:** 107

**DESCRIPTION OF ACTIVITY:** Wetland restoration (1,000 hectares)

**LOCATION:** Lagunas de Guanacache, Desaguadero, and del Bebedero, in the provinces of San Juan, Mendoza and San Luis, Argentina. Located between 32.415889°S, – 67.362278°W and 32.414358°S, -67.295033°W

**PRIMARY CONTACTS:**
- Emilio Lopez
- Florenci alacopetti y Anibal Manzur
- Daniel Blanco (Bs.As.) and Heber Sosa (Mendoza)
- SLBU – Environment and Occupational Health and Safety Manager
- Coca-Cola de Argentina
- Paraguay 733 C1057AAI
- Buenos Aires, Argentina
- +54 11 4319 2033/2156
- emilopez@coca-cola.com
- +54 11 5739 7549
- anibal.manzur@gmail.com
- florenziaiacopetti@avina.net
- 25 de Mayo 758 10 I, (1002)
- Buenos Aires, Argentina
- +54 11 4313 4543
- deblanco@humedales.org.ar
- www.wetlands.org/lac

**OBJECTIVES:**
- Increase water storage and infiltration in the wetlands
- Restore wetland services for the local communities
- Control receding erosion

**BACKGROUND & ACTIVITY DESCRIPTION:** Lagunas de Guanacache, Desaguadero, and del Bebedero, a Ramsar site, protects a system of chained lagoons and marshlands. This site has a surface area of 962,370 hectares and is fed by the Mendoza and San Juan Rivers (and sporadically by Bermejo effluent), which are tributaries to the Desaguadero River. These wetlands are inhabited by approximately 2,000 people that historically relied on the Guanacache wetlands for water supply, fishing, subsistence farming in the floodplains, goat farming, and for the natural resources provided by the wetland such as cattail, rush, and reeds (Figure 1).

Between 1950 and 1960, the Guanacache wetlands suffered from drying due to natural and anthropogenic alterations. The result was a reduced surface area of the wetland that affected traditional activities of the local population and resulted in the loss of water for irrigation. Local flooding was also caused by these alterations. The primary natural

---

**Figure 1. Guanacache Wetland Site Map**

*Red circles show the zones of intervention*
causes of degradation were long periods of drought, receding erosion, and the formation of gullies at the headwaters of the Desaguadero River. Anthropogenic causes included construction of channels to reroute the river for roads, and increased water use upstream for crop irrigation.

This project restores the wetlands by constructing embankments on the unnatural gullies that are draining the wetlands. These embankments trap sediments and help retain water in the gullies, where the water infiltrates to replenish nearby wetlands. Additionally, as the sediment accumulates behind the embankments, the base level in the gullies is elevated, thereby allowing the wetland to be restored in the area around the embankments. Finally, the project areas are also revegetated to prevent erosion, and they are maintained and adjusted annually. In 2012 and 2013, there was a severe drought due to lack of snow in the mountains. During this drought period, the embankments have prevented rainfall runoff from draining via the gullies, and the water captured in the gullies has benefited wildlife, livestock and people.

This work is being implemented in partnership with Fundación Humedales (Wetlands Foundation), Tecnicatrua en Conservación de la Naturaleza (Technical Specialization in Nature Conservation) (Mendoza), the Dirección Provincial de Hidráulica (Provincial Hydraulics Bureau, Government of Mendoza), and the Dirección de Recursos Naturales Renovables (Bureau of Renewable Natural Resources, Government of Mendoza).

**Progress of Implementation**

In 2011 and 2012, embankments were completed in four locations (Figure 2). Figure 3 shows photos of the work conducted in 2012 at various stages of completion. Figure 4 shows the location of the 2012 work (El Retamo) in comparison to work conducted at El Forzudo in 2013. Figure 5 shows the gullies in El Retamo both prior to completion of the projects and after these gullies were blocked to retain water.

![Figure 2. Locations of work completed through 2012 including construction of dams at: a) Palo Seco (2011), b) La Pasarela and c) LaPuertita](image)

*Light blue discontinuous lines indicate the drainage system and the location of gullies. El Chayito is not shown in this figure.*
La Puertita Embankment

Embankment construction

Geotextile placed blankets and coating

Embankment construction completed at La Puertita

El Chayito Embankment

Embankment construction to redirect the channel

Geotextile blankets fastened and secured with bags

Embankment construction completed at El Chayito

El Chayito embankment after the project completion (Photo taken February, 2013)

Figure 3. Photos of Work Completed in 2012
In 2013, three additional embankments were constructed in El Forzudo, at Pedernal Sur. The location of these embankments is shown in Figure 6. Photos showing the original Pedernal Sur project site before and after construction of these embankments are shown in Figure 7. Photos of the near-completed embankments at the Pedernal Sur 2 and Pedernal Sur 3 sites are shown in Figure 8.
Figure 6. Location of three embankments (yellow polygons) in El Forzudo completed at Pedernal Sur in 2013.

Pedernal Sur embankment

Figure 7. Photos showing the wetland before (left) and after (right) the embankments in process of construction in El Forzudo area (Pedernal Sur site), in 2013.

Figure 8. Construction of embankments at Pedernal Sur 2 (left) and Pedernal Sur 3 (right).
Hydrological benefits of the restoration.
The main goal of these restoration undertakings is to control the system’s backward erosion and to raise the base level of the modified areas by building embankments equipped as sediment traps. The restoration work is being conducted on several gullies (created by erosion) that serve as the drainage paths for the water that gathers in the local wetlands. Raising the base water level, which is a key objective of the restoration effort, allows the hydrological management of the accumulated water, avoiding the loss of water to absorption and making it easier to funnel and flood large areas of the Ramsar site wetlands, which results in benefits for the ecosystem and for the productive sector of local communities (Figure 9).

![Figure 9. Drainage area for the La Pasarela site. The dotted line illustrates a sector that will be under water if the base level is raised by building the embankments.](image)

Hydrometeorology information presented in the year 2012 showed the area was subject to extreme cycles of hydrology, with very dry and wet periods of time. In the seasons between 2012 and 2014, the San Juan River has not contributed water loads due to the lack of snow in the high areas of the mountain. It is worth noting the wetlands are located at the end of the river basin, and droughts have a higher impact than in any other areas because whatever water is available is used for the San Juan province productive sector. Figure 10 provides a sequence of pictures showing the San Juan River in a reach close to the project area, and it is evident that between the years 2012 and 2014 permanent water is virtually non-existent. The first picture, taken in the year 2008, shows a regular volume whereas from 2011 onwards the volume shrinks or is entirely lacking.
SUMMARY OF REPLENISH BENEFIT:

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 3,308 ML/yr

ACTIVITY TIMELINE:

- **2011:** Embankment in Palo Seco
  - Initiation of the project and restoration at one site.

- **2012:** Embankment in El Retamo
  - Restoration conducted at 3 sites (La Pasarela, La Puertita and El Chayito).

- **2013:** Embankment in El Forzudo. Restoration occurred for 300 additional hectares of wetlands across three new sites (Pedernal Sur 1, 2, 3), for a cumulative total of 600 hectares restored through 2013. Activities completed in 2013 include:
  - Completed embankments to block unnatural gully drainage of the wetland at three locations in Pedernal Sur.
  - Organized workshops with local decision-makers, technicians and affected communities to plan the design of the restoration works for 2013-2014, and for 2014-2015, to agree on the new sectors to be worked upon.
  - Planned restoration works design for the 2013-2014 period.
  - Monitored and adjusted the embankments completed in 2012 (La Pasarela, La Puertita and El Chayito).
  - Began new restoration works at the sites proposed during 2012 (additional to those already completed), including design and planning workshops and technical studies to survey new works (topography, hydrology).
• **2014**: 300 additional hectares of wetlands were restored, for a cumulative total of 900 hectares restored through 2014. Activities completed in 2014 include:
  o Organized workshops with local decision makers, experts and impacted communities to plan maintenance and modifications on the 2011-2013 works, as well as reaching agreements in terms of what sectors to work on next.
  o Maintained and modified (fencing and cattle paths) the restoration works from the period 2011-2013.
  o Started and completed restoration works on the sites agreed in 2013 (in addition to the ongoing works), including technical studies needed (topography, hydrology).
  o Implemented a program to monitor the project’s works and results; focusing on the accumulated water in the new facilities (chemical and limnological analysis), sediment accumulation and ecological parameters.

• **2015**: 100 additional hectares of wetlands will be restored, for a cumulative total of 1,000 hectares through 2015. Following restoration efforts in 2015, 100% of the target wetland area will be restored.

**Coca-Cola Contribution**: 73.5%
- Total project cost: $467,115 USD
- Coca-Cola cost: $343,329 USD

**Table 1. Summary of Annual Project Costs and Coca-Cola Costs.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Costs provided by Coca-Cola (including maintenance)</th>
<th>Total Project Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>$34,333</td>
<td>$46,712</td>
</tr>
<tr>
<td>2013</td>
<td>$80,110</td>
<td>$108,993</td>
</tr>
<tr>
<td>2014</td>
<td>$114,443</td>
<td>$155,705</td>
</tr>
<tr>
<td>2015</td>
<td>$114,443</td>
<td>$155,705</td>
</tr>
<tr>
<td>Cumulative totals</td>
<td>$343,329</td>
<td>$467,115</td>
</tr>
</tbody>
</table>

**Note**: Coca-Cola’s cost contribution is calculated based on the total cost for the Project carried out by Avina and Coca-Cola for the 2012-2015 period. The 2011 restoration works were carried out by FVS (Fundación Vida Silvestre)/WWF and Coca-Cola; currently, the total investment and the participation percentage of Coca-Cola for this 2011 work is unknown.

**Watershed Benefits Calculated:**
1. Increase in wetland soil water storage and deep infiltration

1. **Increase in Wetland Soil Water Storage & Deep Infiltration**

**Approach & Results:**
The water quantity benefit is calculated as the total annual volume of water that: 1) is stored in the shallow surface soils; and 2) infiltrates to deep subsurface soils, as a direct result of the restoration of flooding to approximately 1,000 hectares of floodplain/wetland area annually. The actual area of
flooding in a given year will depend on the watershed hydrology for that year; for example, in wet years the total area flooded will be approximately 2,000 hectares. For the purpose of this calculation a flooded area of 1,000 hectares (10,000,000 m²) is conservatively assumed for any given year (Fundación Humedales, 2012).

**Component #1 – Wetland Storage**

When wetland flooding occurs, the upper soil zone is conservatively estimated to become saturated with approximately 0.20 meter of water over the area of inundation (Fundación Humedales, 2012). Therefore, the total water volume stored in the wetland system for each year can be calculated as:

\[ \text{[Wetland Storage Volume]} = (0.20 \text{ m}) \times (10,000,000 \text{ m}^2) = 2,000,000 \text{ m}^3 = 2,000 \text{ ML/yr} \]

**Component #2 – Deep Infiltration**

In addition to the water volume that enters and is retained in the shallow soil zone of the wetland, additional water volume infiltrates deeper into subsurface soils. This deep infiltration volume represents the second component of the water quantity benefit estimated for the project. Infiltration rates for the soils present throughout the wetland system are estimated to be 10 mm/day (0.01 m/day) under saturated conditions (Fundación Humedales, 2012).

Deep infiltration of water will occur during time periods when the wetland is inundated by floodwaters and the surficial soils are saturated. Therefore, the time period of inundation must also be estimated to calculate the total volume of water that is captured via deep infiltration. Inundation of the 1,000 ha of the wetland system will occur when combined flows from upstream rivers exceed 3.0 m³/s (Fundación Humedales, 2012). Flow rates for the system vary seasonally and year-to-year, but average flows are greater than the 3.0 m³/s threshold for several months in an average year (Fundación Humedales, 2012). Conservatively, inundation of the wetland system is assumed to occur for a total of 30 days in each year. Based on this assumption, the water volume captured via deep infiltration can be estimated as follows:

\[ \text{[Deep Infiltration Volume]} = (0.01 \text{ m/day}) \times (30 \text{ days}) \times (10,000,000 \text{ m}^2) = 3,000,000 \text{ m}^3 = 3,000 \text{ ML/yr} \]

The total water quantity benefit is calculated as the sum of the “water storage“ and “deep infiltration” volumes. The total benefit for this project is: 5,000 million liters per year (ML/yr).

Total (ultimate) benefit: 5,000 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 3,675 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 4,500 ML/yr, and TCCC’s benefit (adjusted for cost share) is 3,308 ML/yr.

**Projected Replenish Benefits**

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 2. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>5,000</td>
<td>3,675</td>
</tr>
<tr>
<td>2016</td>
<td>5,000</td>
<td>3,675</td>
</tr>
<tr>
<td>2017</td>
<td>5,000</td>
<td>3,675</td>
</tr>
<tr>
<td>2018</td>
<td>5,000</td>
<td>3,675</td>
</tr>
<tr>
<td>2019</td>
<td>5,000</td>
<td>3,675</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>5,000</td>
<td>3,675</td>
</tr>
</tbody>
</table>

Assumptions:
- On average, approximately 1,000 hectares of the wetland system will flood annually following completion of the project.
- A representative infiltration rate for soils in the wetland system is 10 mm/day under saturated conditions (Fundación Humedales, 2012).
- The wetland system will be inundated for at least 30 days each year (but not necessarily for 30 consecutive days).
- Other assumptions for the project are documented in Fundación Humedales (2012).

Data Sources:
- Data were obtained from Fundación Humedales (2012) and provided by the Emilio Lopez.
- Hydrometeorology information provided by the Emilio Lopez in 2014.

OTHER BENEFITS NOT QUANTIFIED
- Development of natural pastures (livestock service)
- Development of native marsh plants (cattails, rushes, reeds)
- Habitats for aquatic birds
- New troughs for wildlife

NOTES
- This fact sheet updates the February 2014 fact sheet to reflect increased benefits resulting from additional progress on restoring the wetlands, as well as updated cost share information.

REFERENCES
PROJECT NAME: Reserves in La Calera, Province of Cordoba: Management as a Tool for Basin Recovery
PROJECT ID #: 108

DESCRIPTION OF ACTIVITY: Suppression of fire within the 13,500 hectare La Calera Reserve

LOCATION: La Calera Reserve, Province of Cordoba, Argentina W 64.3500°; S 31.3500°

PRIMARY CONTACT:
Emilio Lopez
Florencia Iacopetti
Aníbal Manzur
Javier Bernasconi
SLBU – Environment and Occupational Health and Safety Manager
Coca-Cola de Argentina
Paraguay 733 C1057AAI
Buenos Aires, Argentina
emilopez@coca-cola.com
Aníbal Manzur
anibal.manzur@gmail.com
Javier Bernasconi
El Cuenco
Fundación Avina
Institucional and Technical Coordinators
Parera 15, Piso 10
Buenos Aires
Córdoba, Argentina.

OBJECTIVE:
• Improve hydrology
• Reduce fire risk

BACKGROUND & ACTIVITY DESCRIPTION: A 13,500-hectare Military Natural Reserve, La Calera is located west of the city of Cordoba, on the eastern slope of the Sierras Chicas. This reserve is located in a recharge area for the City of Cordoba’s water supply, and located just east of San Roque Lake. The reserve is important for the conservation of native ecosystems and woodlands and is under severe water stress. It is comprised of roughly 8,500 hectares of woodlands, 2,000 hectares of grasslands and 3,000 hectares of cropland, which are located in two ecoregions (Figure 1). As a result of fire and grazing dynamics, the woodlands are characterized as a mosaic of woodlands, shrublands and grasslands. Within the reserve, there are also islands of native espinal forest.

This project involves a wide range of activities aimed at fire suppression within La Calera Reserve, including development of a Fire Management Plan, training of military and civil staff on the use of firefighting equipment and compliance with safety standards, and acquisition of firefighting equipment for the reserve, specific to the topography of the area.

Figure 1. Photos of Different Areas within La Calera Reserve
There are many pressures on the reserve that are affecting hydrology. These include: agriculture and livestock/ranching, exotic species encroachment along waterways, historical deforestation, recurring forest fires, mining, military training activities (for ~65 years) and urbanization pressure.

Work in this reserve is part of a larger four-year, multi-country initiative to make a significant impact on issues related to water resource conservation and access to drinking water in Argentina, Chile and Peru. In La Calera Reserve, a number of different activities are underway or have been completed. These include characterization of vegetation, seasonal hydrology monitoring of waterways that enter the reserve, development of management guidelines for livestock and agriculture, protection of native espinal forest patches for reforestation of 3,000 agricultural hectares, development of a germ plasm bank to guarantee the spread of native trees, control of exotic species, revegetation, and fire suppression. The benefit of fire suppression is described in this fact sheet. It should be noted that forest fire in this ecosystem is mainly due to anthropogenic activities and not as part of the natural cycle.

Additional activities described above are not being quantified to avoid double counting of benefits.

**Fire suppression**

The risk of fires is very high in the Province of Cordoba, and the fires are caused mainly by human activities. Examples illustrating the varied causes of fire in the region include:

- Burning parrot nests for power line maintenance (1.4 ha fire) (Arnulphi et al., 2014)
- A tenant farmer in the agricultural grassland area (10 ha fire)
- Fire originating in the city of La Calera (5 ha fire in the reserve)
- Espinal areas of research by the provincial police (50 ha fire)
- Fires associated with a rubbish dump that borders the city of Cordoba, where a low income population uses fire for heating purposes
- Natural causes, but to a lesser extent

From June to August 2012, there were seven fires in the reserve affecting a total of 250 hectares (Source: La Calera Firemen). Computer simulations for La Calera Reserve indicate that if fire suppression measures are not taken, approximately 3,500 ha may be affected by fire within 8 hours of a fire starting (assumes 36% grassland and 64% dry bushland-grassland). Without fire suppression measures, it is estimated that the entire 13,500 ha of the La Calera Reserve could be affected by fire in a given year. For comparison, in 2011, over 70% (4,200 ha) of a similar reserve (La Quebrada) was affected by fire.

Figures 2, 3 and 4 illustrate fire effects in the reserve.

![Figure 2. Woodlands (left) and grasslands (right) after a fire](image)
The ecosystems within the reserve are not adapted to the effect of fires. Fire effects include the degradation of soil structure which reduces infiltration, and excess runoff, erosion and associated nutrient load, contributing to eutrophication downstream (Rodriguez et al., 2005), and loss of biodiversity (Verzino et al., 2005) especially herbaceous species level. The rate of recovery of these ecosystems depends on the initial status and the intensity of the fire, which is related to the rate of biomass accumulation. Based on preliminary studies by the technical team, the infiltration capacity is shown to be drastically reduced in burnt areas (Figure 5); however, the data are still being analyzed by El Cuenco (former mountain classroom – Marcos Karlin), together with the University of Cordoba.

In 2014, a number of activities were completed to support fire suppression. Main roads and paths next to the La Calera-Yocsina road were cleared to make way for fire trucks. All 19.6 km of main roads and their adjacent fire ditches were completely cleared in a joint effort with military and firefighting personnel and are now accessible to 2-wheel drive vehicles (Figure 6).

In addition, a variety of firefighting equipment was acquired for use by the Army to fight fires, including two firefighting trailers, 10 backpacks and a WICK 250 pump (Table 1, Figure 7). Another weather station was also purchased to forecast fire risk.
Table 1. Firefighting equipment acquired

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Provided to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4x4 Fire Truck</td>
<td>La Calera firefighters</td>
</tr>
<tr>
<td>4x4 Fire Truck</td>
<td>Malagueño firefighters</td>
</tr>
<tr>
<td>Brand new double cabin truck</td>
<td></td>
</tr>
<tr>
<td>Forest kit and ditch clearing tools</td>
<td>El Cuenco - Army</td>
</tr>
<tr>
<td>250 Quadbike</td>
<td>La Calera firefighters</td>
</tr>
<tr>
<td>Uniforms and gear, 2-way radios and 10 forest</td>
<td>II Division Command</td>
</tr>
<tr>
<td>backpacks</td>
<td></td>
</tr>
<tr>
<td>Uniforms and gear and a thermogravimetric scale</td>
<td>El Cuenco</td>
</tr>
</tbody>
</table>

*additional equipment was also purchased to study the impact of fires and support future recovery and prevention.

Figure 6. The location of ditches that were redug and cleared for transit are marked in yellow, red and purple. The ditches planned for clearing in the future are marked in green, bright green and light blue. The photo on the right shows clearing of the reserve’s roads.

Figure 7. Firefighting trailer and WICK pump in action. On the left hand side you can see the water stream generated by the wick pump at the top of the hill.

Additional activities completed include: opening a line of communication between the Calera firefighters and the military staff and implementing use of common names for boundaries, geographical features, gates and roads and coordinating access to the reserve. Activities also included: assessment and mapping of flammable biomass, vegetation type, accessibility, high-risk areas, slope orientation, etc. to identify areas most at risk of fire; release of cattle into the southeast area of the reserve to reduce the flammable biomass load (calculated at 6,500 kg/ha of pasture); and initiation of a trial compost recovery project.
As a result of ongoing fire management efforts, there were 4 fire sources throughout the reserve but the main ones were located in the central area. The response times ranged from 15 to 30 minutes for a joint effort by the La Calera and Malagueño firefighters along with military personnel. The working group actively participated in the operation.

The vegetation survey has been completed and hydrology surveys are being carried out according to plan (5 waterways are surveyed every four months). Infiltration measurements using disc infiltrometers have been taken and preliminary results indicate that infiltration in burned sampling grounds was reduced to half when compared to unaffected areas. Additional activities that are complete or well underway include foreign species control, native species pruning and thinning, endemic seed harvesting and communication to raise awareness on the reserve (publication of articles, posting of posters, presentation of papers and a workshop.

SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 5,204 ML/yr

ACTIVITY TIMELINE:
- **2012. 50% of the reserve was protected from fire.**
  Activities: Production of Plan for Managing the Native Forest, prevention and fight against fires (training, implementation of firefighting strategies, equipment procurement and development of outreach materials, purchase of equipment and planning for fight against fires). During 2012 the initial actions focused on fire management, both in terms of the engagement of local stakeholders with decision-making powers on the area and with those directly responsible for firefighting. Field visits were also made to identify water courses and measure flows, identify vegetation types, conduct native forest zoning and select areas for replanting.

- **2013. 80% of the reserve was protected from fire.**
  Activities: Within the framework for Fire Prevention and Management within the La Calera Natural Military Reserve, the strategy was to continue providing local stakeholders with the materials required for firefighting. This included development of a firebreak through pruning and thinning and water trucks, conducting workshops for military staff and procuring equipment. Additional actions were conducted to identify water courses, measure flow rates and survey and control non-native species. Furthermore, the potential cattle load was calculated, forest seeds were harvested and adaptive management tests were conducted.

- **2014. 90% of the reserve was protected from fire.**
  Activities: Forest fire prevention and management; and management of equipment to improve firefighting. This included maintenance of the ditches inside the park, road clearing to improve response time, forest fire management and prevention training workshops for local residents and military staff and development of a fire risk map based on multiple criteria. Equipment was provided for fire control to the Regional 6 Firefighter brigade which includes the Malagueño and La Calera volunteer firefighters. Additional work is ongoing to assess rehabilitation of burned areas, monitor regrowth, monitor waterways, evaluate infiltration and expand the endemic seed bank program.

- **2015. 100% of the reserve will be protected from fire.**
  Activities: Control and maintenance, complementary equipment, and general adjustments to management.
Coca-Cola Contribution: 95%
- Total project cost: $702,661 USD
- TCCC contribution: $667,529 USD

Watershed Benefits Calculated:
1. Increase in infiltration water quantity

1. Increase in Infiltration Water Quantity

Approach & Results:
The water quantity benefit for this project was calculated based on the estimated difference between the annual infiltration volumes for each land component (i.e., forest, grasslands, and old agricultural lands) for 1) pre-project (i.e., fire-affected) conditions, and 2) post-project conditions (i.e., after fire suppression achieved). For both the pre-project and post-project cases, the following equation was used to calculate the total annual infiltration volume ($I_{nf}$, m$^3$/yr):

$$I_{nf} = P \times (1 - IntFrac) \times (1 - C) \times Area \quad (\text{Eqn. 1})$$

where $P$ is the mean annual precipitation (m/yr) for the region, $IntFrac$ is the fraction of precipitation that is captured by the canopy, $C$ is the fraction of precipitation reaching the ground that is lost to surface runoff, and $Area$ is the land surface area (m$^2$). The mean annual precipitation for the entire 13,500 hectare La Calera Reserve was assumed to be 715 mm/yr (0.715 m/yr) based on Vicario (2008). Table 2 provides a list of the parameters selected for the analysis based on Ramirez (1984); the parameters are also summarized below:

- Interception is estimated to be 10% for native forest, 5% for grasslands, and 0% for old agricultural areas.
- The runoff factor ($C$) for the area that has not been disturbed by fire is estimated to be 0.25 for native forest and grassland, and 0.45 for old agricultural areas.
- Based on Ramirez (1984), the runoff factor ($C$) is increased by a factor of 1.3 for native forest and grasslands and 1.1 for old agricultural areas to represent fire-disturbed conditions.

<table>
<thead>
<tr>
<th>Land Area Type</th>
<th>Surface Area (ha)</th>
<th>Interception Fraction (“IntFrac”)</th>
<th>Runoff Factor, “C” (with no fire disturbance)</th>
<th>Runoff Factor Multiplier</th>
<th>Runoff Factor, “C” (with fire disturbance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native forest</td>
<td>8,500</td>
<td>0.10</td>
<td>0.25</td>
<td>1.3</td>
<td>0.325</td>
</tr>
<tr>
<td>High grasslands</td>
<td>2,000</td>
<td>0.05</td>
<td>0.25</td>
<td>1.3</td>
<td>0.325</td>
</tr>
<tr>
<td>Old agricultural</td>
<td>3,000</td>
<td>0.00</td>
<td>0.45</td>
<td>1.1</td>
<td>0.495</td>
</tr>
</tbody>
</table>

Based on the parameters described above, annual infiltration volumes for each land area type were estimated as follows using Equation 1:

- “Without fire suppression” (fire-disturbed condition):
  - Native forest: $I_{nf} = (0.715 \text{ m/yr}) \times (1 - 0.10) \times (1 - 0.325) \times (8.5 \times 10^7 \text{ m}^2)$
    $= 36,920,813 \text{ m}^3/\text{yr} \quad (36,920.8 \text{ ML/yr})$
  - High grasslands: $I_{nf} = (0.715 \text{ m/yr}) \times (1 - 0.05) \times (1 - 0.325) \times (2.0 \times 10^7 \text{ m}^2)$
    $= 9,169,875 \text{ m}^3/\text{yr} \quad (9,169.8 \text{ ML/yr})$
  - Old agricultural: $I_{nf} = (0.715 \text{ m/yr}) \times (1 - 0.00) \times (1 - 0.495) \times (3.0 \times 10^7 \text{ m}^2)$
\[ = 10,832,250 \text{ m}^3/\text{yr} \ (10,832.2 \text{ ML/yr}) \]

- **“With fire suppression” (no fire disturbance condition):**
  - **Native forest:** \[ \text{Inf} = (0.715 \text{ m/yr})*(1 – 0.10)*(1 – 0.25)*(8.5 \times 10^7 \text{ m}^2) \]
    \[ = 41,023,125 \text{ m}^3/\text{yr} \ (41,023.1 \text{ ML/yr}) \]
  - **High grasslands:** \[ \text{Inf} = (0.715 \text{ m/yr})*(1 – 0.05)*(1 – 0.25)*(2.0 \times 10^7 \text{ m}^2) \]
    \[ = 10,188,750 \text{ m}^3/\text{yr} \ (10,188.7 \text{ ML/yr}) \]
  - **Old agricultural:** \[ \text{Inf} = (0.715 \text{ m/yr})*(1 – 0.00)*(1 – 0.45)*(3.0 \times 10^7 \text{ m}^2) \]
    \[ = 11,797,500 \text{ m}^3/\text{yr} \ (11,797.5 \text{ ML/yr}) \]

The water quantity benefit is then calculated as the difference between the total infiltration volume across the three land area types for the “fire-disturbed” condition (i.e., current condition) and the “no fire disturbance” condition (i.e., after fire suppression activities have occurred):

- **Runoff volume “without fire suppression” (land disturbed by fire):** 56,922.9 ML/yr
- **Runoff volume “with fire suppression” (land not disturbed by fire):** 63,009.4 ML/yr
- **Benefit (infiltration increase):** 6,086.4 ML/yr

The total benefit (runoff reduction) for this project is: 6,086.4 million liters per year (ML/yr).

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

### 2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 5,478 ML/yr and TCCC’s benefit (adjusted for cost share) is 5,204 ML/yr.

### Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>6,086</td>
<td>5,782</td>
</tr>
<tr>
<td>2016</td>
<td>6,086</td>
<td>5,782</td>
</tr>
<tr>
<td>2017</td>
<td>6,086</td>
<td>5,782</td>
</tr>
<tr>
<td>2018</td>
<td>6,086</td>
<td>5,782</td>
</tr>
<tr>
<td>2019</td>
<td>6,086</td>
<td>5,782</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>6,086</td>
<td>5,782</td>
</tr>
</tbody>
</table>
Assumptions:

- This calculation assumes that the full 13,500 hectares in the reserve would be affected (i.e., high-intensity burn) by wildfires in a given year, without implementation of the fire suppression activities planned for this project.
- Estimates of runoff factors available from Ramirez (1984) were assumed to apply to land areas within the La Calera Reserve.

Data Sources:

- Area and land cover within the reserve: provided by El Cuenco and Avina.
- Area affected by fire, in the absence of fire suppression activities: provided by El Cuenco and Avina.
- Precipitation data: provided by Emilio Lopez, “Mean annual precipitation in the project area totals 715 mm (Vicario, L. 2008). The rate considered for the assessment is 715 mm.”
- Runoff coefficients were determined based on Ramirez (1984).
- Information regarding project costs and confirmation of work complete: provided by El Cuenco and Avina.

OTHER BENEFITS NOT QUANTIFIED

- Improved wildlife habitat resulting from conservation of native forest, espinal and romerilla.
- Other benefits related to carbon dioxide (CO2) fixation, local livestock grazing, landscape, tourism, and quality of life.
- Characterization of vegetation, seasonal hydrology monitoring of waterways that enter the reserve, development of management guidelines for livestock and agriculture, protection of native espinal forest patches for reforestation of 3,000 agricultural hectares, development of a germ plasm bank to guarantee the spread of native trees, control of exotic species, revegetation, and fire suppression and/or protection against degradation of soil structure which reduces infiltration, and excess runoff, erosion and associated nutrient load, contributing to eutrophication downstream (Rodriguez et al, 2005), and loss of biodiversity (Verzino et al, 2005) especially herbaceous species level.

NOTES

- This fact sheet updates the January 2014 fact sheet to reflect increased benefits resulting from additional progress on protecting the reserve from fires.
- In 2014, there were 4 fires in the reserve and response times ranged from 15 to 30 minutes for a joint effort by the La Calera and Malagueño firefighters along with military personnel.
- Preliminary infiltration results indicate that infiltration in burned sampling grounds was **reduced to half** when compared to unaffected areas.

REFERENCES


**PROJECT NAME:** Verde River Program  
**PROJECT ID #:** 110  

**DESCRIPTION OF ACTIVITY:** In-stream flow restoration  

**LOCATION:** Verde River, Arizona  

**PRIMARY CONTACTS:**  
Todd Reeve, CEO  
Bonneville Environmental Foundation  
240 SW 1st Avenue  
Portland, OR 97204  
541-760-6658  
treeve@b-e-f.org  

Rena Ann Striker  
Contract Ecologist  
CCNA Group Environment & Sustainability  
404-395-6250  
rstricker@coca-cola.com  

Jon Radtke  
Manager, Water Resources  
CCNA Group Environment & Sustainability  
404-676-9112  
jradtke@coca-cola.com  

**OBJECTIVES:**  
- Install new irrigation infrastructure to reduce irrigation diversion of water and restore connectivity and stream flow through a reach of the upper Verde River to support fish, wildlife and recreation.  
- Provide incentives, monitoring data, and improvements to irrigation laterals to reduce water diversion from the river.  
- Allow local irrigators to use less water and maintain full production on irrigated acreage.  

**BACKGROUND & DESCRIPTION OF ACTIVITY:** The Verde River is Arizona’s only designated wild and scenic river and it is a critical Colorado River tributary, providing many ecological benefits to imperiled desert fishes and wildlife. The Verde River also provides 40% of the surface water for the metropolitan Phoenix area.  

Between Clarkdale and Camp Verde, AZ, Verde River flows are diverted by seven major irrigation canals, leaving sections of the Verde River dry and chronically dewatered. The Nature Conservancy’s Verde River Program has launched a long-term strategy to work with local irrigators to improve irrigation infrastructure and design water efficiency solutions that can restore significant flow to the Verde River.  

Many opportunities for increasing efficiency and restoring flows through collaboration with ditch companies (irrigators) are being explored and developed. The first flow restoration project to emerge is the Diamond-S Flow Restoration Project. This project has several phases: Phase 1 was a test phase, completed in summer 2012, Phases 2 and 3 were conducted in 2013 and 2014 and include full implementation of the project. The benefits of these phases are described below.  

The Diamond-S ditch is located in Camp Verde, Arizona. It is approximately 5 miles long and has nearly 60 users and one large production farming operation. The pre-project diversion structure for this ditch diverted the majority of the river’s flow (typically more than 30 cfs) into the ditch throughout the low flow period of the year. Much of this water was not used by irrigators, in large part because the headgates and lateral turnouts on the ditch system could not be practically adjusted to control how much water was diverted and delivered. Under pre-project conditions, the irrigators typically left the headgates open, diverting most of the river water through their canal system, annually removing more...
than 9 billion liters of water from the river, in general of which over 1.5 billion liters was in excess of the amount needed for agricultural production.

Diverted water that was not used by irrigators was returned to the river at the end of the ditch, approximately 5 miles downstream from the initial diversion. This resulted in chronic dewatering of more than 4.5 miles of the Verde River typically during dry periods of the summer between May 15 and September 15. Figure 1 shows the Diamond-S ditch (filled with water) and the river (forested section with little visible water).

A phased solution has been implemented that invests in new irrigation infrastructure allowing the Diamond-S irrigators to better control and manage the water they divert from the river. This solution has facilitated the restoration of flows to an approximately 4.5 mile reach of the mainstem Verde River, which is adjacent to the Wild and Scenic River section of the Verde River. As a result, this project extended viable habitat for several at risk and endangered fish species, including the Razorback Sucker, Pike Minnow, Loach Minnow and the Round Tail Chub. It is hoped that this project will set a precedent for collaborative flow restoration solutions in Arizona and will facilitate the restoration of other dewatered sections of the upper Verde River, including West Clear Creek and Eureka Ditch.

**Diamond-S Flow Restoration, Phase 1**

In summer 2012, the Phase 1 test phase was completed. This included installation of automated headgate diversion structures (Figure 2) and associated monitoring systems, and testing of the new diversion structures. The amount of water restored to the Verde River was monitored and documented. Phase 1 resulted in the total restoration of 170 million liters of water to the mainstem of the Verde River.
Diamond-S Flow Restoration, Phase 2 and 3

New turnout structures on lateral ditches of the Diamond-S ditch were installed in 2013 and 2014. In addition, water elevation structures were installed near the ditch tail water sections to facilitate water distribution to end users using lower flows in the ditch. Finally, the project partner (TNC) entered into an agreement with the irrigators to refine and manage the new automated headgate and point of diversion through the 2014 season to further increase flows in the Verde River.

Figure 2. New automated headgate diversion structure (left) and the Verde River (right), which provides critical habitat to myriad fish and wildlife species

SUMMARY OF REPLENISH BENEFIT:

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 1,906 ML/YR

ACTIVITY TIMELINE:

- May-June 2012: Installation of automated headgate diversion structures and associated monitoring systems.
- Summer 2012: Irrigators tested the new diversion structures, refined management actions, and monitored and documented water restored to the river. Irrigators successfully diverted less water than had been diverted during baseline conditions, resulting in water being restored to a dewatered reach of the Verde River.
- Fall 2012-Winter 2013: Additional infrastructure and automated management upgrades in the Diamond-S ditch and lateral turnouts, and implementation of a first-year contract with irrigators to secure flow restoration for 2013.
- Spring-Fall 2014: Full implementation of the project with irrigators deploying new infrastructure and monitoring capacity to achieve benchmark flow restoration targets.
COCA-COLA CONTRIBUTION: Variable

2012: 100%
Total Cost: $10,000 USD (Phase 1)
• Coca-Cola Foundation: $10,000 USD

2013: 78%
Total Cost: $60,000 USD (Phase 2)
• Coca-Cola contribution: $46,588 USD

2014: 77%
Total Cost: $38,900 USD (Phase 3)
• Coca-Cola Contribution: $30,000 USD

WATERSHED BENEFITS CALCULATED:
1. Increase in streamflow, resulting from reduced water being diverted from the Verde River

1. INCREASE IN STREAMFLOW

Approach & Results:

2014 Benefit Calculation

• **Pre-project:** Without this project, more than 30 cfs from the Verde River would have been diverted to irrigators from May 15 through September 15, 2014, resulting in a de-watered stream.

• **Post-project:** For the May 15 through September 15, 2014 period, measured flows indicate an average of 21.8 cfs was diverted. As further described below, this resulted in a total of 2,007 acre-feet, or 2,475 ML/year, remaining in the river.

The project used several years of data to assess the baseline diversion rate of the Diamond-S irrigation diversion. Using several calculation methods, the historical Diamond-S diversion rate was established at 30 cfs. Automated stage telemetry systems were used to gage the ditch diversion rates, and data from the continuous stage recorders show that the average flow achieved for the 2014 season was 21.8 cfs. To estimate the volume of water “returned” to the river during 2014 as a result of this project, the daily average flow was subtracted from the baseline diversion rate of 30 cfs. This amount was converted into acre-feet per day and summed up for the entire season. This results in 2014 restoration savings of 2,007 acre-feet, or 2,475 ML/yr.

The total (ultimate) benefit is: 2,475 ML/yr

The total (ultimate) benefit taken as a function of cost share is: 1,906 ML/yr

The current (2014) TCCC benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 2,475 ML/yr and TCCC’s benefit (adjusted for cost share) is 1,906 ML/yr.
Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. Projected benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

### Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)*</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>2,475</td>
<td>1,906</td>
</tr>
<tr>
<td>2016</td>
<td>2,475</td>
<td>1,906</td>
</tr>
<tr>
<td>2017</td>
<td>2,475</td>
<td>1,906</td>
</tr>
<tr>
<td>2018</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>2019</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>unknown</td>
<td>unknown</td>
</tr>
</tbody>
</table>

* Table 1 benefits are based on an estimated 77% Coke cost-share for 2015-2017. This project implements long-term infrastructure improvements and agreements which should generate future benefits beyond 2017.

Data Sources/Site-specific characteristics:

- Bonneville Environmental Foundation (undated).

Assumptions:

- The benefit calculation uses 30 cfs as a very conservative estimate of historical water diversion for irrigation. However, records show that irrigators historically diverted varying amounts (between 30-45 cfs) prior to project implementation. As a result, the reported replenish benefits are very conservative.

OTHER BENEFITS NOT QUANTIFIED

- Improved habitat for fish and other wildlife, including several at risk and endangered fish species.
- Increased recreational opportunities

NOTES

- This fact sheet updates the January 2014 fact sheet to describe the 2014 Phase 3 activities.
- The benefit estimate is a conservative estimate for two reasons. First, if daily flow measurements were unavailable, no volume of savings was estimated for that day. In some cases, flow data were unavailable due to equipment malfunction. In addition, there were periods when the ditch was turned off due to high flows in the river. If the agreement had not been in place, the ditch would likely have remained on and flowed at a high rate. However, as a
result of the agreement, the irrigation company chose to turn off the ditch when water was not needed.

REFERENCES
**PROJECT NAME:** Prickly Pear Creek Re-Watering Project  
**PROJECT ID #:** 111

**DESCRIPTION OF ACTIVITY:** In-stream flow restoration through water leasing and exchange agreements

**LOCATION:** Prickly Pear Creek, Montana

**PRIMARY CONTACTS:**
- Todd Reeve, CEO  
  Bonneville Environmental Foundation  
  240 SW 1st Avenue  
  Portland, OR 97204  
  541-760-6658  
  treeve@b-e-f.org
- Rena Ann Stricker  
  Contract Ecologist  
  CCNA Group Environment & Sustainability  
  404-395-6250  
  rstricker@coca-cola.com
- Jon Radtke  
  Manager, Water Resources  
  CCNA Group Environment & Sustainability  
  404-676-9112  
  jradtke@coca-cola.com

**OBJECTIVES:**
- Enhance stream flows in a de-watered reach to allow the creek to regain a more natural hydrograph
- Restore instream fish habitat, and restore and maintain the integrity of the aquatic system
- Improve water quality (temperature, nutrients, sediment and metals)

**BACKGROUND & DESCRIPTION OF ACTIVITY:** Prickly Pear Creek is the largest tributary in the Helena Valley, flowing into Lake Helena and ultimately into the Missouri River. It provides one of the only major wetland and riparian corridors for many miles and offers critical habitat for migratory songbirds, raptors and wild fish.

The water in Prickly Pear Creek is heavily over appropriated, and historically a portion of the creek dries up each year as irrigators divert the entire flow during late summer months. For roughly 100 years, this portion of the creek has been a largely non-functional aquatic ecosystem with poor water quality, limited habitat and no connectivity or passage for fish. Section MT41I006_030 of this creek, from Wylie Drive to the Helena Wastewater Treatment Plant Discharge is identified by Montana Fish Wildlife and Parks as being chronically dewatered. In addition, Montana Department of Environmental Quality has identified this segment of Prickly Pear Creek as being impaired due to metals, nutrients, siltation and thermal modifications.

In 2008, the Montana Water Trust worked with stakeholders to develop and test a potential project to re-water Prickly Pear Creek, using funds from a 319 grant. As a result of this pilot project, a Helena Valley Irrigation District (HVID) canal was filled with water delivered from a large flood control reservoir on the mainstem Missouri River, which then served as an alternate water source for irrigators withdrawing from Prickly Pear Creek. The new withdrawals do not impact the alternate water source, which is a very large Bureau of Recreation reservoir. Contracts were signed to ensure 3,000 acre-feet of water would be made available to Prickly Pear water users (PPWU) via this canal, under the condition that the irrigators would cease diverting water from the creek during late summer low-flow periods.

In 2010, Bonneville Environmental Foundation’s Water Certificate Project program provided funding to restore the natural flow of Prickly Pear Creek throughout the dry, late summer months. As a result of
this project, approximately two miles of Prickly Pear Creek that were previously dry or critically dewatered were re-watered, reconnecting habitat throughout the Prickly Pear watershed, and augmenting low flows across 2 to 4 additional miles of lower Prickly Pear Creek.

(Before) Prickly Pear Creek in the historically dewatered reach affected by the project (below PPWU Point of diversion).

(After) Prickly Pear Creek in the same location of the historically dewatered reach (below PPWU Point of diversion).

The 2011-2013 Prickly Pear Creek Montana Water Restoration Certificate Project employed a split season lease agreement with local irrigators to restore all natural flow to lower Prickly Pear Creek during the critical low flow period (July through September). Supplementary water from a Bureau of Reclamation reservoir was purchased, transferred and delivered to Prickly Pear irrigators during the late summer, ensuring that they have ample water for irrigation, while leaving all natural flow in Prickly Pear Creek during the critical summer and fall months when it was historically de-watered. The same approach was employed in 2014, resulting in the restoration of all natural flow to lower Prickly Pear Creek during the critical low flow period in 2014.

The re-watered reach of Prickly Pear Creek extends from the Prickly Pear Water User’s Point of Diversion (PPWU POD) downstream (northwest) past site #4 and off the map.
This project has been independently reviewed by the National Fish and Wildlife Foundation (NFWF) and met the independent criteria for environmental flow restoration developed by NFWF (and which was based largely on criteria developed by the Independent Scientific Advisory Board for the Columbia Basin).

The project has been funded by Coca Cola in 2011, 2012, 2013, and 2014 with some additional funding provided by other partners.

SUMMARY OF REPLENISH BENEFIT:

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 1,894 ML/YR

ACTIVITY TIMELINE:

- Project initiation: 2011
- Project end date: Project is funded by TCCC through 2014
- BEF is working with project partners to ensure this project continues to generate benefits in the future, however all future benefits will be confirmed before they are reported.

COCA-COLA CONTRIBUTION: Variable

2012 TCCC cost share: 54.6%
- 2012 Total Cost of Project: $27,472 USD
  - Coca-Cola Foundation: $15,000 USD
  - Bonneville Environmental Foundation and other Montana WRC customers: $12,472 USD

2013 TCCC cost share: 49.7%
- 2013 Total Cost of Project: $23,745 USD
  - Coca-Cola Foundation: $11,800 USD
  - Bonneville Environmental Foundation, WRC customers, State of Montana: $11,945 USD

2014 TCCC cost share: 48.1%
- 2014 Total Cost of Project: $20,800 USD
  - Coca-Cola contribution: $10,000 USD
  - Bonneville Environmental Foundation, Farm Stream Solutions, Montana Fish Wildlife and Parks: $10,800 USD

WATERSHED BENEFITS CALCULATED:

1. Increase in stream flow

1. INCREASE IN STREAMFLOW

Approach & Results

Stream discharge for this project is recorded at two locations to quantify the benefit of the Prickly Pear flow restoration project. Flow measurements are taken downstream of the Prickly Pear water users point of diversion (site 1) and at the lower end of the enhanced reach, near Canyon Ferry Road (site 2). Flow, which without this restoration project would have been diverted to irrigators, is measured and quantified during the irrigation season. During the six year period from 2009-2014, Prickly Pear Creek typically hit its low flow trigger (20 cfs at site 1 or 40 cfs at site 2) in late June or early July—this flow trigger initiates the flow agreements between Farm Stream Solutions LLC, Bonneville Environmental Foundation (BEF), Helena Valley Irrigation District (HVID), Prickly Pear Creek Water User Association (PPWU) and the Bureau of Reclamation (BOR). In all years this results in the PPWU diversion being shut
down through the end of the irrigation season, and the water being transferred instream. The flow restoration project is typically in effect for approximately 90 days each year (average over a 6-year period) and restores a substantial amount of flow to Prickly Pear Creek during the period from late June/early July through October 1. As a result of this project, Prickly Pear Creek flowed all year in 2009-2014. If this project were not in place, much/all of the volume of the creek would be diverted to irrigators from mid-July, at the latest, through the end of the irrigation season into October.

2014 Benefit Calculation:
The total water quantity benefit is the volume of flow kept instream in 2014 as a result of the project. This replenish benefit is based on average flow measurements over the 2009-2014 period (6 years), although specific details are provided below for 2014 for reference.

- **Pre-project:** Irrigation withdrawals would have removed water from Prickly Pear Creek from July 1 through the end of the irrigation season. Based on 2014 flows, this would have resulted in much of the volume of the creek being diverted to irrigators from early-July, through the end of the irrigation season on October 1.

- **Post-project:** The flow agreements between FSS, BEF, HVID, PPWU and the BOR were initiated on July 1. The flow restoration project was in effect for 92 days in 2014, keeping a substantial volume of flow in Prickly Pear Creek.

The amount of water kept instream as a result of this project was calculated by applying a conservative approach using gage readings over the course of six summers (2009-2014). The flow restoration project is typically in effect for 90 days each year. During this period, the average amount of flow restored to Prickly Pear Creek (six year average) is 3,193 acre-feet. **This produces an annual average benefit of 3,938 Million Liters/year.**

- **The total (ultimate) benefit is:** 3,938 ML/yr
- **TCCC total (ultimate) benefit is:** 1,894 ML/yr

The current (2014) TCCC benefit and projected benefits are based on the total benefit, adjusted to account for TCCC cost share. These are presented below.

**2014 Replenish Benefit**
The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 3,938 ML/yr and TCCC’s benefit (adjusted for cost share) is 1,894 ML/yr.

**Projected Replenish Benefits**
Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. Projected benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>3938</td>
<td>unknown</td>
</tr>
<tr>
<td>2016</td>
<td>3838</td>
<td>unknown</td>
</tr>
<tr>
<td>2017</td>
<td>3938</td>
<td>unknown</td>
</tr>
<tr>
<td>2018</td>
<td>3938</td>
<td>unknown</td>
</tr>
<tr>
<td>2019</td>
<td>3938</td>
<td>unknown</td>
</tr>
</tbody>
</table>

| Ultimate Benefit: | unknown | unknown |
**Data Sources/Site-specific characteristics:**

- All data were obtained from the Prickly Pear Creek Flow Restoration Reports (2009-2013) (Holmes, 2009, 2012a, 2012b, 2013 and The Clark Fork Coalition, 2010), and raw stream gaging data for 2014.

**Assumptions:**

- None

**OTHER BENEFITS NOT QUANTIFIED**

- Promoted the recovery of neotropical migrant and resident birds and other terrestrial species
- Improved floodplain and in-channel conditions for fish and aquatic life
- Improved water quality
- Improved fish habitat, fish stocks, and fishing. Increased recreational opportunities - new lands have been conserved along the river for public recreation as a result of improved water quality and improved fishing opportunities.

**NOTES**

- This fact sheet updates the November 2013 fact sheet to describe work completed in 2014.
- Benefits beyond 2014 are dependent on funding and on flows past the Prickly Pear Point of Diversion. Local commitment to keep water in the creek is significant and BEF is working with partners to ensure the project generates a long-term continuing benefit.
- Annual 2009 through 2014 flows were as follows:
  - 2009: 2,831 acre-feet
  - 2010: 3,886 acre-feet
  - 2011: 3,112 acre-feet
  - 2012: 2,746 acre-feet
  - 2013: 1,801 acre-feet
  - 2014: 4,781 acre-feet

**REFERENCES**


The Montana Water Trust. 2009 Prickly Pear Creek Re-Watering Project. DEQ 319 Grant Application.
PROJECT NAME: Construction of Check Dams in Rajasthan, Himachal Pradesh and Uttar Pradesh, India
PROJECT ID #: 116

DESCRIPTION OF ACTIVITY: Check dam construction for recharge

LOCATION: Nagrota, Tappa and Bedu Khuaa villages in Himachal Pradesh, Ajmer region in Rajasthan and several locations in Uttar Pradesh

PRIMARY CONTACT:
Sunil Gulati
Director Technical Services
Coca-Cola India Pvt Limited
Gurgaon, India
Phone: +919899985002
sgulati@coca-cola.com

OBJECTIVES:
- Harvest catchment runoff and recharge local aquifer
- Provide source to meet irrigation water demand during non-monsoon season

BACKGROUND & ACTIVITY DESCRIPTION: The primary objective of the projects is to increase groundwater recharge to improve water supply reliability for agriculture in a region subject to severe droughts. Water is collected during the monsoon season through construction of small check dams on small ephemeral fourth order streams.

Check dams were constructed in the states of Himachal Pradesh, Rajasthan and Uttar Pradesh. In Himachal Pradesh, three check dams were constructed in Nagrota Surin, Tappa and Bedu Khuaa villages. The construction of check dams was conducted by local panchayats (village council) and with the help of local villagers. About 2,000 villagers in the area are benefiting from the projects. In Rajasthan, three check dams were constructed; two in Mandavaria and Paluna villages at Ajmer district and one in Dholpur district to recharge local groundwater in this drought prone village. In Uttar Pradesh, 21 check dams were constructed in various locations. More than 10,000 villagers are benefiting from the construction of the check dams.

No impacts on ecological flows have been observed or are anticipated. The check dams are constructed on fourth order streams to collect flash flood waters. TCCC India does not construct check dams on higher order rivers because of potential impacts on ecological flows.

The photographs below provide before and after images of the project sites.
Check dam (before and after construction) at Nagrota Surin village in Himachal Pradesh

Check dam (before and after construction) at Tappa village in Himachal Pradesh

Check dam (before and after construction) at Bedu Khuaa village in Himachal Pradesh
SUMMARY OF REPLENISH BENEFIT:

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 3,629.5 ML/YR

ACTIVITY TIMELINE:

**Himachal Pradesh**
- Project was started in 2010 and completed in 2011

**Rajasthan**
- Project was started in 2011 and completed in 2013

**Uttar Pradesh**
- Project was started in July 2011 and completed in June 2013

COCA-COLA CONTRIBUTION: 100%

- Funding for construction of check dams in Himachal Pradesh - $75,000 USD
- Funding for construction of check dams in Rajasthan - $279,240 USD
- Funding for construction of check dams in Uttar Pradesh - ~$241,642 USD
WATERSHED BENEFITS CALCULATED:
1. Increased infiltration

1. INCREASED INFILTRATION

Approach & Results:
The majority of the runoff in the watershed occurs during the monsoon season. The volume of water available for aquifer recharge is estimated by calculating the supply of available runoff from the catchment according to the following equation:

\[ \text{Supply (m}^3\text{)} = \text{Catchment Area (m}^2\text{)} \times \text{Annual Rainfall (m)} \times \text{Catchment Coefficient} \]

The “supply” from the catchment is compared to the storage potential of the check dam. Storage potential was estimated by calculating the number of times the ponded area of the check dam will fill to maximum volume. The pond volume was estimated using the dimensions provided in Table 1. The volume of water available for recharge is estimated as the minimum of supply and storage potential.

India Division suggested that for catchments in their natural state, a conservative catchment coefficient of up to 30% can be used in the calculations. However, a more conservative catchment coefficient of 7.5% (or 0.075) was utilized in the calculations to account for any evaporation or usage loss during storage of water in the check dams. Therefore, when the supply is less than the storage potential, evaporation and usage losses are considered implicitly in the supply calculations. In cases where the conservative estimation of “supply” is in excess of the storage potential, evaporation and usage losses are accounted explicitly by assuming a fraction (40-50%) of storage potential was lost, and the remaining amount was considered to be the benefit.

Table 1. Dimensions of the ponded area of the check dam

<table>
<thead>
<tr>
<th>State</th>
<th>Check Dam Location</th>
<th>Length (m)</th>
<th>Width (m)</th>
<th>Avg. Depth (m)</th>
<th>Pond Volume (m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Himachal Pradesh</td>
<td>Nagrota Surin</td>
<td>750</td>
<td>46.63</td>
<td>2</td>
<td>69,945</td>
</tr>
<tr>
<td></td>
<td>Tappa</td>
<td>700</td>
<td>36</td>
<td>2.57</td>
<td>64,764</td>
</tr>
<tr>
<td></td>
<td>Bedu Khuaa</td>
<td>600</td>
<td>37</td>
<td>1.5</td>
<td>33,300</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>Mandavaria</td>
<td>950</td>
<td>500</td>
<td>4.1</td>
<td>1,947,500</td>
</tr>
<tr>
<td></td>
<td>Paluna</td>
<td>1,800</td>
<td>1,200</td>
<td>3.8</td>
<td>8,208,000</td>
</tr>
<tr>
<td></td>
<td>Dholpur</td>
<td>7,450</td>
<td>64.8</td>
<td>3.53</td>
<td>1,704,143</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>21 different</td>
<td>150 – 720</td>
<td>6 – 45</td>
<td>0.5 – 1.8</td>
<td>1,125 – 11,880</td>
</tr>
</tbody>
</table>
Table 2. Summary of check dam characteristics and estimated recharge volume

<table>
<thead>
<tr>
<th>State</th>
<th>Location of Check Dam</th>
<th>Catchment Area (ha)</th>
<th>Annual Rainfall (mm)</th>
<th>Supply (m³/yr)</th>
<th>Storage Potential (m³)</th>
<th>Recharge Volume¹ (m³/yr)</th>
<th>Total Recharge Volume (m³/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Himachal Pradesh</td>
<td>Nagrota Surin</td>
<td>320</td>
<td>1599</td>
<td>383,760</td>
<td>139,890</td>
<td>83,934</td>
<td>201,611</td>
</tr>
<tr>
<td></td>
<td>Tappa</td>
<td>494</td>
<td>1599</td>
<td>592,430</td>
<td>129,528</td>
<td>77,717</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bedu Khuaa</td>
<td>202</td>
<td>1599</td>
<td>242,249</td>
<td>66,600</td>
<td>39,960</td>
<td></td>
</tr>
<tr>
<td>Rajasthan</td>
<td>Mandavaria</td>
<td>713</td>
<td>499</td>
<td>266,680</td>
<td>1,947,500</td>
<td>266,680</td>
<td>3,308,694</td>
</tr>
<tr>
<td></td>
<td>Paluna</td>
<td>2,704</td>
<td>660</td>
<td>1,337,872</td>
<td>8,208,000</td>
<td>1,337,872</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dholpur</td>
<td>11,352</td>
<td>670</td>
<td>5,704,380</td>
<td>3,408,286</td>
<td>1,704,143</td>
<td></td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>21 different locations</td>
<td>31 – 1,901</td>
<td>900</td>
<td>20,925 – 1,283,175</td>
<td>2,250 – 23,760</td>
<td>1,125 – 11,880</td>
<td>119,242</td>
</tr>
</tbody>
</table>

¹With the exception of the Dholpur Rajasthan site and all Uttar Pradesh sites, when supply was greater than storage potential, 40% of storage potential was assumed to be lost to evaporation and usage and the remaining 60% was considered to be the benefit. For the Dholpur Rajasthan site and Uttar Pradesh sites, when supply was greater than storage potential, 50% of storage potential was assumed to be lost to evaporation and usage and the remaining 50% was considered as the benefit.

The benefit is estimated as the sum of the total recharge volume from Himachal Pradesh, Rajasthan, and Uttar Pradesh sites.

Total benefit (increased infiltration) = 201,611 + 3,308,694 + 119,242 = 3,629,547 m³/yr = 3,629.5 ML/yr

The total (ultimate) benefit is: 3,629.5 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 3,629.5 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for the implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 3,629.5 ML/yr and TCCC’s benefit (adjusted for cost share) is 3,629.5 ML/yr.

Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 3. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>3,629.5</td>
<td>3,629.5</td>
</tr>
<tr>
<td>2016</td>
<td>3,629.5</td>
<td>3,629.5</td>
</tr>
<tr>
<td>2017</td>
<td>3,629.5</td>
<td>3,629.5</td>
</tr>
<tr>
<td>2018</td>
<td>3,629.5</td>
<td>3,629.5</td>
</tr>
<tr>
<td>2019</td>
<td>3,629.5</td>
<td>3,629.5</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>3,629.5</td>
<td>3,629.5</td>
</tr>
</tbody>
</table>

Data Sources:

- All data used in the calculations were provided by the Coca-Cola India Division.

Assumptions:

- For Himachal Pradesh sites, due to high rainfall and hard rock sub-surface geology it was conservatively assumed that storage potential is equal to twice the ponded volume (i.e., filled twice in a year).
- For the Mandavaria and Paluna sites in Rajasthan, storage potential is assumed equal to the volume of the pond. For the Dholpur site, storage potential is assumed to be equal to twice the ponded volume.
- For Uttar Pradesh sites, the storage potential is assumed to be equal to twice the ponded volume (i.e., filled twice in a year).

OTHER BENEFITS NOT QUANTIFIED

- Decrease in sediment erosion/runoff
- Employment opportunities through project construction
- Wildlife have been observed drinking water at night

NOTES

- For check dams, the recharge volume is the minimum of supply and storage potential, and if supply is greater than storage potential, then evaporative and usage losses are factored in.

REFERENCES

- India Division estimates are summarized within the master spreadsheet entitled: final_list_of_projects_types_classification_INSWA BU 2014.xlsx (spreadsheet was provided by Nilesh Jha via email on 11/21/2014). Check dam projects were separated from the master spreadsheet and summarized in an individual spreadsheet titled “India-CheckDams_2014.xlsx.”
PROJECT NAME: Forest Maintenance in Japan
PROJECT ID #: 121

DESCRIPTION OF ACTIVITY: Forest maintenance to ensure healthy forest on 52.8 hectares

LOCATION: Five locations in Japan

PRIMARY CONTACTS:
Mitsuru Shibata       Yukihiro Nakamura
4-6-3 Shibuya        Coca-Cola Japan
Shibuya Ward, Tokyo
+ 81-3-5466-8325
mitsibata@coca-cola.com  yuknakamura@coca-cola.com

OBJECTIVES:
• Reduce runoff and associated sedimentation
• Improve forest health

BACKGROUND & ACTIVITY DESCRIPTION: In the 1960s and 1970s, forests of the same species were planted at various locations in Japan. The trees are now roughly 40-50 years old. The density of the trees is very high, some are dead and the condition of the forest is generally unhealthy. Maintenance activities are being implemented at the locations indicated below to promote a healthy forest, increase the capacity of the soil to hold water, decrease runoff and increase infiltration to groundwater. These activities consist of pruning dead branches, thinning the forest and maintaining the underbrush. Pre-project and post-project photos are shown in Figure 1, and locations of the maintenance activities are shown in Table 1.

Figure 1. Example of forest before (left) and after (right) maintenance activities, showing the increased undergrowth resulting from project activities.
Table 1. Locations of Forest Maintenance Activities

<table>
<thead>
<tr>
<th>Location</th>
<th>Lat</th>
<th>Long</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurokawa Aso in Kumamoto</td>
<td>32.935321</td>
<td>131.079975</td>
<td>8</td>
</tr>
<tr>
<td>Suenaga Ebino in Miyazaki Prefecture</td>
<td>31.945612</td>
<td>130.843475</td>
<td>2</td>
</tr>
<tr>
<td>Taiho Ogimi in Okinawa</td>
<td>26.668602</td>
<td>128.120637</td>
<td>0.43</td>
</tr>
<tr>
<td>Kurishio-cyou in Kouchi</td>
<td>33.024930</td>
<td>133.010920</td>
<td>42</td>
</tr>
<tr>
<td>Shiroishi Zao, Miyagi</td>
<td>38.002478</td>
<td>140.619860</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>52.83</strong></td>
</tr>
</tbody>
</table>

SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 75.4 ML/yr

ACTIVITY TIMELINE:
- Project initiation and end dates vary by location, as shown below:
  - 2006 – 2016 Kurokawa Aso in Kumamoto
  - 2008 – 2019 Suenaga Ebino in Miyazaki Prefecture
  - 2010 – 2015 Taiho Ogimi in Okinawa
  - 2013 – 2015 Kuroshio-cyou in Kouchi
  - 2014 - 2019 Shiroishi Zao, Miyagi

COCA-COLA CONTRIBUTION: 100%
- Total project cost: $68,200 USD
  - TCCC contribution: $68,200 USD (details by site are shown below)
    - $1,200 at Kurokawa Aso in Kumamoto
    - $9,000 at Suenaga Ebino in Miyazaki Prefecture
    - $13,000 at Taiho Ogimi in Okinawa
    - $30,000 at Kuroshio-cyou in Kouchi
    - $15,000 at Shiroishi Zao, Miyagi

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff

1. **DECREASE IN RUNOFF**

Approach & Results:
Forest maintenance benefits are calculated using a site-specific method that was developed by the Japanese government and proposed for use by the Japan Business Unit. This method is similar to the “Alternative Annual Method” as described in Redder and Larson (2012), but uses a site-specific coefficient for forest maintenance based on studies by the Yamaguchi Prefecture (2009).

The water quantity benefit is calculated as the difference in the estimated “pre-project” and “post-project” runoff depths multiplied by the total surface area:

\[ \text{Water quantity benefit (m}^3/\text{yr}) = [\Delta \text{Runoff (m/yr)}] \times [\text{Surface Area (m}^2)] \]
where the change in runoff ($\Delta \text{Runoff}$) is calculated as follows:

$$\Delta \text{Runoff} (\text{m/yr}) = \{ \text{Pre-project Runoff Depth (m/yr)} – \text{Post-project Runoff Depth (m/yr)} \}$$

“Pre-project” is defined as the unhealthy condition of the land that existed prior to forest maintenance, while “post-project” is defined as the healthy forest condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

$$\Delta \text{Runoff} (\text{m/yr}) = \Delta K \times \text{[Annual Rainfall Depth (m/yr)]}$$

where $\Delta K$ is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical forest maintenance activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition ($\Delta K$) is solely due to a change in the vegetation condition. A conservative value of 0.05 was selected for $\Delta K$, consistent with the delta K (0.06 to 0.08) documented in a 2009 research report describing forest maintenance in Japan (Yamaguchi Prefecture, 2009).

The estimated average (2004-2013) rainfall depth and surface area for the project sites are provided in the table below, along with water quantify benefit. The water quantity benefit is calculated as follows:

$$\text{[Water quantity benefit (m}^3/\text{yr})] = \Delta \text{Runoff (m/yr)} \times \text{[Surface Area (m}^2\text{)]}$$

For each location, this is calculated as: $[0.05 \times \text{precipitation (m/yr)}] \times \text{[Area (m}^2\text{)]}$

<table>
<thead>
<tr>
<th>Location</th>
<th>Annual Average Precipitation (2004-2013) (m/yr)</th>
<th>Nearest Precipitation Station</th>
<th>Area (m$^2$)</th>
<th>Water Quantity Benefit (m$^3$/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurokawa Aso in Kumamoto</td>
<td>3.086</td>
<td>Kumamoto Aso Otohime-Onsen</td>
<td>80,000</td>
<td>12,344</td>
</tr>
<tr>
<td>Suenaga Ebino in Miyazaki Prefecture</td>
<td>4.505</td>
<td>Miyazaki Ebino</td>
<td>20,000</td>
<td>4,505</td>
</tr>
<tr>
<td>Taiho Ogimi in Okinawa</td>
<td>2.477</td>
<td>Okinawa Kunigami</td>
<td>4,300</td>
<td>533</td>
</tr>
<tr>
<td>Kurishio-cyou in Kouchi</td>
<td>2.750</td>
<td>Kouchi Saga</td>
<td>420,000</td>
<td>57,748</td>
</tr>
<tr>
<td>Shiroishi Zao, Miyagi</td>
<td>1.319</td>
<td>Shiroishi Miyagi</td>
<td>4,000</td>
<td>264</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>528,300</strong></td>
<td></td>
<td><strong>75,393</strong></td>
<td></td>
</tr>
</tbody>
</table>

The benefit for all locations is summed to calculate the total (maximum) benefit.

The total (maximum) benefit is: 75,393 m$^3$/yr = 75.4 ML/yr

TCCC total (maximum) benefit taken as a function of cost share is: 75,393 m$^3$/yr = 75.4 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.
2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 75.4 ML/yr and TCCC’s benefit (adjusted for cost share) is 75.4 ML/yr.

Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. Projected benefits are based on the current end dates for the maintenance agreements, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

Table 3. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>75.4</td>
<td>75.4</td>
</tr>
<tr>
<td>2016</td>
<td>17.1</td>
<td>17.1</td>
</tr>
<tr>
<td>2017</td>
<td>4.8</td>
<td>4.8</td>
</tr>
<tr>
<td>2018</td>
<td>4.8</td>
<td>4.8</td>
</tr>
<tr>
<td>2019</td>
<td>4.8</td>
<td>4.8</td>
</tr>
<tr>
<td>Maximum Benefit:</td>
<td>75.4</td>
<td>75.4</td>
</tr>
</tbody>
</table>

Project benefits vary by year and reflect the varying end dates of the maintenance activity.

Data Sources:

- Size of maintained land area: 52.8 hectares (provided by Yukihiko Nakamura, Coca-Cola Japan contact)
- Average annual precipitation (2004-2013) provided by contact, who obtained the data from the Japan Meteorological Agency (government section) survey and selected the nearest Weather Observation Station for each project location. http://www.jma.go.jp/jma/indexe.html
- Cost share provided by Yukihiko Nakamura, Coca-Cola Japan contact

Assumptions:

- $\Delta K$ (difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition) is assumed to be 0.05 as a conservative and simplifying assumption which is consistent with the Yamaguchi Prefecture, 2009.

OTHER BENEFITS NOT QUANTIFIED

- Water quality improvements, including reduced sedimentation
- Protection and improvement of habitat and biodiversity

NOTES

- This fact sheet updates the January 2014 fact sheet to include forest maintenance at one new location (Shiroishi Zao, Miyagi). Additionally, maintenance activities have ended at one location (Kaninariki Oume, Tokyo) and this location is no longer included in the benefit calculations.
• Cost share information is also updated based on information provided by the contact, and reflects the discontinuation of work at the Kaninariki Oume, Tokyo location, where costs were shared by a project partner.

REFERENCES


PROJECT NAME:  Drain Tile Removal in Midewin National Tallgrass Prairie, Illinois
PROJECT ID #: 138

DESCRIPTION OF ACTIVITY:  Tile drain removal

LOCATION:  Midewin National Tallgrass Prairie, Illinois (Latitude: 41°22'28" N; Longitude: 088°07'32" W)

PRIMARY CONTACTS:

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wes Swaffar</td>
<td>National Forest Foundation</td>
<td><a href="mailto:wswaffar@nationalforests.org">wswaffar@nationalforests.org</a></td>
<td>406-830-3356</td>
</tr>
<tr>
<td>Rena Ann Stricker</td>
<td>CCNA Group</td>
<td><a href="mailto:rstricker@coca-cola.com">rstricker@coca-cola.com</a></td>
<td>404-395-6250</td>
</tr>
<tr>
<td>Jon Radtke</td>
<td>Environment &amp; Sustainability</td>
<td><a href="mailto:jradtke@coca-cola.com">jradtke@coca-cola.com</a></td>
<td>404-676-9112</td>
</tr>
<tr>
<td>William Glass</td>
<td>Midewin National Tallgrass Prairie</td>
<td><a href="mailto:wglass@fs.fed.us">wglass@fs.fed.us</a></td>
<td>815-423-2129</td>
</tr>
</tbody>
</table>

OBJECTIVES:

- Restore natural hydrology, groundwater recharge, and flood attenuation
- Restore wetlands and sedge meadows

BACKGROUND & ACTIVITY DESCRIPTION:  The 19,000-acre U.S. Forest Service’s Midewin National Tallgrass Prairie was the nation’s first designated National Tallgrass Prairie. Historically, drain tiles were installed to drain wetlands so that the land could be farmed. Subsequently, this area served as the home to the Joliet Arsenal, a munitions and explosives manufacturing operation to support World War II. The drain tiles were maintained by the army during this period. The topography of this area is very level, and waterways are mostly channelized and downcut. Prior to this project, there existed an extensive drain tile system, pervasive invasive species and very little native vegetation.

The South Prairie Creek Outwash Plain (SPCOP) is a 2,100-acre portion of the South Prairie Creek floodplain with surrounding woodlands, grasslands, and remnant wetlands at the Midewin National Tallgrass Prairie. The outwash plain, as the focus of the National Forest Foundation’s Treasured Landscapes campaign at Midewin, is being restored to a complex mosaic of diverse floodplain, prairie, and wetland habitats. The initial stage of SPCOP restoration work involves transformation back to native habitats of a 452-acre munitions storage complex characterized by 55 massive concrete bunkers covered with sod and soil, paved and gravel-surfaced roads, railroad lines, and a system of ditches and tile drainage (The Wetlands Initiative, 2013).

Following bunker removal in 2012 (Figure 1), restoration of the area’s original hydrology was initiated through removal of ditches, roads, and drain tiles; invasive plant management; and the first stage of native plant introductions. A drain tile survey identified the locations of drain tiles within the project area. Beginning in September 2013, 5,217 feet (approximately 1 mile) of drain tile were removed (shown in purple in Figure 1). All drain lines removed were made from clay in sizes ranging from four- to
six-inch diameter tiles (Figure 2). The tile was found between three and five feet down from the surface. The tile lines removed had drained directly into Prairie Creek, or into another still-intact line that eventually drains into the creek.

In addition to the drain tile removal, 3,400 feet of ditches throughout the area being drained have also been filled. A gravel road and rail line that covered approximately 7.8 acres were removed and graded. All areas where soil was exposed as a result of drain tile removal, road and rail line removal, and ditch filling were planted by January 2014 with native grass and wildflower species, to return a healthy native plant community and to prevent invasive species from colonizing the disturbed ground. Management of invasive species, with a focus on woody species, will continue through fall of 2015.

In 2014, this project expanded and an additional 11,708 feet of agricultural tile drain were removed or disabled from the bunker field and an adjacent area south of the bunker field within the outwash plain. In total 11,085 feet of agricultural tile drain were removed and another 623 feet were assumed disabled, due to removal of tile drains up and down stream of where they pass under roads, bunkers, etc. Additionally, aggressive trees and woody vegetation were treated and removed from roughly 22 acres, and about 226 acres were treated for invasive species. Roughly 79 acres were intensively planted with native wetland and prairie plants, with additional plants installed on the remaining 147 acres (The Wetlands Initiative, 2014).

This work is expected to result in a significant expansion of wetlands throughout the affected area. The hydrologic restoration will also result in an increase in both groundwater infiltration and an improvement in the quality of water returned to the creek. Ultimately, additional restoration in this area and throughout the entire bunker field over the next few years will return a vast, high-quality native landscape of prairie and wetlands, supporting rare species that are permanently protected for future generations (The Wetlands Initiative, 2014).

Figure 1. The 452-acre South Prairie Creek bunker field with the location of drain tile lines in purple (tiles removed in 2013), in green (tiles removed in 2014) and orange (remaining tiles intact).
SUMMARY OF REPLENISH BENEFIT:

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 292.2 ML/yr

ACTIVITY TIMELINE:

- September - November 2013: Project initiation, removal of 5,217 feet of drain tile, filling of 3,400 feet of ditches, and removal and grading of a gravel road and rail line covering approximately 7.8 acres.
- January 2014: Planting of native tallgrass prairie species.
- October 2014: Removal or disabling of an additional 11,708 feet of drain tile, and treatment and removal of aggressive trees and woody vegetation from roughly 22 acres, and treatment of about 226 acres for invasive species.
- Summer - Fall 2015: Invasive species removal and replanting of native species.

COCA-COLA CONTRIBUTION: Variable

- 2013: 36.5%
  - Total cost for tile drain removal: $131,247
  - TCCC cost: $47,917
  - National Forest Foundation: $83,330
- 2014: 67.0%
  - Total cost for tile drain removal: $169,000
  - TCCC cost: $113,230
  - National Forest Foundation: $55,770

WATERSHED BENEFITS CALCULATED:

1. Reduction in volume artificially drained from the site

1. REDUCTION IN VOLUME ARTIFICIALLY DRAINED FROM THE SITE

Approach & Results:

The replenish benefit was calculated as the reduction in the annual volume of water that is artificially drained from the site as a result of the project.

The approach for estimating the replenish benefit consisted of the following steps:

1. Estimate the drainage area affected by drain tiles; and
2. Estimate the annual precipitation potentially available to the wetland in the absence of drain tiles.

**Input Data and Calculations**

The total length of all drain tiles removed by the end of 2014 equals 16,925 feet (5,159 meters). The tile lines drained an area of approximately 234 acres (946,964 m²) directly into Prairie Creek, or into another still-intact line that eventually drains into the creek.

Annual average precipitation of 921 mm (36.3 in) reported for Chicago, IL (CCNA, 2013) was selected as a representative average annual precipitation for the project location. The total annual average precipitation volume over the drainage area was calculated as follows:

\[
\text{Precipitation volume} = (946,964 \text{ m}^2) \times (0.921 \text{ m}) = 872,154 \text{ m}^3
\]

The volume of precipitation drained by agricultural landscapes with drainage systems can range up to 63% (Zucker and Brown, 1998). Conservatively, it was assumed that the tile system in the current project has the capability to drain 50% of the precipitation, and that the removal of the drain tiles makes this water available to restore the natural hydrology of the site.

\[
(872,154 \text{ m}^3) \times 0.5 = 436,077 \text{ m}^3 = 436.1 \text{ million liters/year (ML/yr)}
\]

**Total (ultimate) benefit is:** 436.1 ML/yr  
**TCCC total (ultimate) benefit taken as a function of cost share is:** 292.2 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 436.1 ML/yr, and TCCC’s benefit (adjusted for cost share) is 292.2 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>436.1</td>
<td>292.2</td>
</tr>
<tr>
<td>2016</td>
<td>436.1</td>
<td>292.2</td>
</tr>
<tr>
<td>2017</td>
<td>436.1</td>
<td>292.2</td>
</tr>
<tr>
<td>2018</td>
<td>436.1</td>
<td>292.2</td>
</tr>
<tr>
<td>2019</td>
<td>436.1</td>
<td>292.2</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>436.1</td>
<td>292.2</td>
</tr>
</tbody>
</table>
Data Sources:

- 2013 and 2014 length of tile drain removed or disabled, and area drained: Provided by The Wetlands Initiative, 2013 (2013 data) and the Midewin National Tallgrass Prairie ecologist.
- 2014 cost information: provided by the National Forest Foundation.

Assumptions:

- The tile system has the capability to drain 50% of the precipitation.
- The entire area (234 acres) is drained by the tile drains.

OTHER BENEFITS NOT QUANTIFIED

- Improved water quality
- Groundwater recharge and flood attenuation
- Restored wetlands and sedge meadows, including benefit of planting native wetland and prairie plants, treatment and removal of aggressive trees and woody vegetation, and management of invasive species
- Benefit of filling drainage ditches and removing/grading gravel road and rail line

NOTES

- This fact sheet updates the January 2014 fact sheet to reflect additional work completed in 2014. The benefit calculation also reflects tile drain removal on 85 acres in 2013 (increased from 75 acres reported previously for 2013), per the National Forest Foundation.

REFERENCES


PROJECT NAME: Invasive Species Removal in Angeles National Forest, California
PROJECT ID #: 139

DESCRIPTION OF ACTIVITY: Invasive species removal

LOCATION: Big Tujunga Canyon watershed, Angeles National Forest, California (34° 17’ 52” N, 118° 0’ 11” W)

PRIMARY CONTACTS:
Wes Swaffar
National Forest Foundation
Ecosystem Services Program
Manager
wswaffar@nationalforests.org
406-830-3356
Rena Ann Stricker
CCNA Group Environment & Sustainability
Contract Ecologist
Rstricker@coca-cola.com
404-395-6250
Jon Radtke
CCNA Group Environment & Sustainability
Manager, Water Resources
Jradtke@coca-cola.com
404-676-9112

OBJECTIVES:
- Restore natural hydrology through runoff reduction
- Reestablish native vegetation
- Stabilize soil

BACKGROUND & ACTIVITY DESCRIPTION: The Angeles National Forest provides critical resources for the approximately 13 million people who live within an hour’s drive of the forest, and rely on the forest for 33% of their drinking water and 72% of their open space. In 2009, the Station Fire damaged 252 square miles in the Angeles National Forest. This fire increased the vulnerability of the forest to invasive weed establishment, and within the first growing season following the fire, invasive species such as tamarisk, Spanish broom, and Scotch broom were observed growing in the riparian zones of the Big Tujunga Canyon watershed. In response to the fire’s devastation, the National Forest Foundation (NFF) partnered with U.S. Forest Service (USFS) staff and local communities to develop and implement a 5-year restoration plan for Big Tujunga Canyon. This restoration plan includes the inventory, treatment, and monitoring of new and expanding invasive plant populations within the Big Tujunga Canyon watershed to assist in the regrowth of native vegetation and provide for increased habitat and hydrologic functionality.

Locations of invasive weed species have been previously identified (Figure 1) and areas were selected for treatment based on size, proximity to sensitive biological areas, level of invasiveness, overall presence in the Angeles National Forest and practicality/possibility of eradication. Because invasive species can spread to other areas along waterways (i.e., through seed dispersal downstream through water), riparian zones were a key focus area for removal of invasive species. For the past three years, the USFS has deployed crews to identify and manually remove invasive species from the riparian zones; no herbicides are used. It is estimated that this effort has been 99% effective at removing tamarisk. During this work, several Forest Service sensitive species were found, highlighting the importance of removing invasive species.
This project was initiated in September 2013, and involved the removal of invasive species from 200 acres located entirely located within the Angeles National Forest. Efforts were focused on riparian zones and other sensitive areas. Figure 2 shows riparian surveys and tamarisk removal within the Angeles National Forest.
SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 4.9 ML/yr

ACTIVITY TIMELINE:
- September 2013 – Project initiation
- December 2013 – Invasive species removal on 5 acres complete
- April 2014 – Invasive species removal on a cumulative total of 200 acres of riparian habitat

COCA-COLA CONTRIBUTION: 50%
- Total cost: $66,000
- TCCC cost: $33,000

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff

1. DECREASE IN RUNOFF

The removal of invasive species allows reestablishment of native vegetation, and increased habitat hydrologic functionality. Restoration of native vegetation stabilizes the soil and reduces the volume of runoff.

**Approach & Results:**
The water quantity benefit was calculated using the “Alternative Annual Method” as described in Redder and Larson (2012). This conservative method is appropriate for land use/land cover activities that are expected to generate water quantity benefits of less than 150 ML/yr. The water quantity benefit is calculated as the difference in the estimated “pre-project” and “post-project” runoff depths multiplied by the total surface area:

\[
\text{Water quantity benefit (m}^3/\text{yr}) = [\Delta \text{ Runoff (m/yr)}] \times [\text{Surface Area (m}^2)]
\]

where the change in runoff (\(\Delta \text{ Runoff}\)) is calculated as follows:

\[
[\Delta \text{ Runoff (m/yr)}] = \{ [\text{Pre-project Runoff Depth (m/yr)}] – [\text{Post-project Runoff Depth (m/yr)}] \}
\]

“Pre-project” is defined as the degraded condition of the riparian zone dominated by invasive species, while “post-project” is defined as the condition of the riparian zone dominated by native species. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

\[
[\Delta \text{ Runoff (m/yr)}] = \Delta K \times [\text{Annual Rainfall Depth (m/yr)}]
\]

where \(\Delta K\) is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.
For a typical revegetation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition ($\Delta K$) is solely due to a change in the vegetation condition. A conservative value of 0.04 was selected for $\Delta K$ consistent with the recommendations made in the “Alternative Annual Method” memorandum (Redder and Larson, 2012). For the areas targeted for invasive species removal, the annual average precipitation of 11.98 inches (0.3 meters/yr) reported for Los Angeles, California (CCNA, 2013) was selected as a representative average precipitation for the project location. The surface area for the work is 200 acres (809,371 m$^2$) (personal communication, 2014)

Therefore, the water quantity benefit is calculated as follows:

\[
\text{[Water quantity benefit (m}^3/\text{yr}]} = [\Delta \text{Runoff (m/yr)}] \times [\text{Surface Area (m}^2\text{)}]
\]

\[
9,712 \text{ (m}^3/\text{yr)} = [0.04 \times 0.3 \text{ (m/yr)}] \times [809,371 \text{ (m}^2\text{)}] = 9.7 \text{ ML/yr}
\]

**The total (ultimate) benefit is:** 9.7 ML/yr

**TCCC total (ultimate) benefit taken as a function of cost share is:** 4.9 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 9.7 ML/yr and TCCC’s benefit (adjusted for cost share) is 4.9 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>9.7</td>
<td>4.9</td>
</tr>
<tr>
<td>2016</td>
<td>9.7</td>
<td>4.9</td>
</tr>
<tr>
<td>2017</td>
<td>9.7</td>
<td>4.9</td>
</tr>
<tr>
<td>2018</td>
<td>9.7</td>
<td>4.9</td>
</tr>
<tr>
<td>2019</td>
<td>9.7</td>
<td>4.9</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>9.7</td>
<td>4.9</td>
</tr>
</tbody>
</table>

**Data Sources:**

- Size of project area: 200 acres (Rancho Santa Ana Botanic Garden, 2014)
- Average annual precipitation from TCCC CCNA rainfall database (CCNA, 2013)
**Assumptions:**

- $\Delta K$ (difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition) is assumed to be 0.04 as a conservative and simplifying assumption.

**OTHER BENEFITS NOT QUANTIFIED**

- Water quality improvements, including reduced sedimentation.

**NOTES**

- This fact sheet updates the January 2014 fact sheet to reflect project completion and expansion of the area in which invasive species were removed (expanded from 100 to 200 hectares, for the same cost).

**REFERENCES**


**PROJECT NAME:** Floodplain Reconnection and Wetland Restoration – Mollicy Farms, Louisiana

**PROJECT ID #:** 140

**DESCRIPTION OF ACTIVITY:** Floodplain reconnection and wetland restoration (5,180 hectares)

**LOCATION:** Morehouse Parish, Louisiana

**PRIMARY CONTACTS:**
- Jon Radtke
  - CCNA Group Environment & Sustainability Manager, Water Resources
  - Jradtke@coca-cola.com
  - Tel. 404-676-9112
- Rena Ann Stricker
  - CCNA Group Environment & Sustainability Contract Ecologist
  - Rstricker@coca-cola.com
  - Tel. 404-395-6250
- Dan Weber
  - The Nature Conservancy Mollicy Farms Program Manager
  - dweber@tnc.org
  - Tel. 318-560-5725

**OBJECTIVES:**
- Restore connectivity between the Ouachita River and its historic floodplain
- Restore a historically important wetland complex
- Improve water quality in the Ouachita River
- Enhance floodplain ecosystem services
- Reduce downstream flooding

**BACKGROUND & ACTIVITY DESCRIPTION:** Mollicy Farms was cleared for row crop agriculture in 1969. In the ensuing years, 17 miles of levees, averaging 30 feet tall and 150 wide at base, were constructed surrounding the 16,000-acre site to reduce flooding. The construction of the main levee and disruption of natural flooding cycles functionally disconnected the floodplain from the Ouachita River. Subsequent modifications to interior drainages reduced natural sloughs and bayous to a series of mostly straight line ditches, and water in this interior area was removed by pumps. In particular, the inflows and outflows from a large, historically important wetland, Bear Brake, have been modified through operation of water control structures in border ditches and levees.

This type of hydrologic modification at the Mollicy Farms site is common in southern floodplains, with many having been converted to other uses and cut off from the natural pattern of seasonal flood pulses leading to species loss, impaired water quality, lost floodplain storage, and reduced productivity.

Mollicy Farms has been acquired by the U.S. Fish and Wildlife Service and included within the Upper Ouachita National Wildlife Refuge in northeastern Louisiana (Figure 1). Agricultural operations have ceased on the site, and millions of trees have been planted to jump start the transition back into bottomland forest. Recently, The Nature Conservancy, the U.S. Fish and Wildlife Service, The Coca-Cola Foundation, and others have partnered to reintroduce the Ouachita River flood pulse in this area and restore the extensive wetlands and bottomland forests once found upon the floodplain. High
functioning wetlands can greatly increase landscape resiliency by storing water during drought periods and releasing floodwaters slowly to the river after flood events. Thus, risk mitigation, improved water quality, reforestation, high quality wildlife habitat and optimal ecosystem services will all result from this effort. For example, a decline in nutrient export from the site and more mature benthic invertebrate populations have been demonstrated (see Notes section below). Mollicy Farms is the site of the largest floodplain restoration effort currently underway and as a result can serve as an “at-scale” demonstration site for future floodplain reconnection and restoration throughout the lower Mississippi Valley.

Floodplain and wetland restoration at Mollicy Farms has been conducted by breaching the levees and restoring the natural hydrology of the site to reestablish wetland ecology and function. Figure 2 shows the breach locations and the boundary of the Mollicy Farms site.

Beginning in 2010, more than 1.5 million cubic yards of soil were removed to create seven breaches in the levee. The breaches were constructed in strategically selected locations, in the vicinity of historical watershed connections to reestablish natural ingress and egress of Ouachita River flood pulses (Figure 3). Additional work has been conducted to restore the interior hydrology of the site focusing on the restoration of Bear Brake wetlands. This work involved reengineering drainage ditches to retain water within the wetland, the creation of swales and pimple mounds that will further facilitate water retention, and the recreation of 2.5 miles of stream channel during the restoration of Mollicy Bayou, a historically important drainage. Appropriate bottomland hardwood trees have also been replanted to reestablish bottomland forests, similar to those historically located in Bear Brake. A future phase, not quantified here, is planned to reconnect upland flows to the recreated Mollicy Bayou channel, further restoring the natural hydrology within the floodplain. Furthermore, in a few years when the system has been given sufficient time to equilibrate to all of the changes made, additional water quality monitoring, nutrient processing experiments, etc. will be conducted to determine if the system is functioning as envisioned or if additional ground restoration is needed.
This project restores flood pulses onto a hydrologically reconnected floodplain, and restores wetland function within Bear Brake. Based on correlations between the Ouachita River at Felsenthal stage and stage readings at the site, the project site floods to an average depth of 10 feet when the Felsenthal stage is above 65 feet (bankfull stage). Figure 4 shows Ouachita River stage at the Felsenthal gage. Although there is variability from year to year, the flood pulse typically enters the site in late fall/early winter and recedes in March.

**SUMMARY OF REPLENISH BENEFIT:**

- **2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE:** 6,157.5 ML/yr

**ACTIVITY TIMELINE:**

- 2010: Levee deconstruction began
- 2011: Levee deconstruction completed
- 2012: Work to restore wetland hydrology began
- 2013: Work to restore wetland hydrology is 50% complete
- 2014: Work to restore wetland hydrology is 100% complete
- 2015: Work to reconnect Mollicy Bayou flows to the floodplain is planned

**COCA-COLA CONTRIBUTION:** 3.9%
- Total project cost: $3,206,979
- TCCC contribution: $125,000

**WATERSHED BENEFITS CALCULATED:**

1. Increase in floodplain inundation volume

**1. INCREASE IN FLOODPLAIN INUNDATION VOLUME**

**Approach & Results:**

The approach taken for the Mollicy Farms restoration project was to estimate the annual average increase in floodplain inundation volume (i.e., the volume of water that would have otherwise flowed
downstream without serving important floodplain functions) established by the project. The water quantity benefit estimate is based on the floodplain inundation area and depth over the course of a typical 130 day flood event.

During a typical normal year flood event, 80% of the 16,000 acre-site floods. The eastern portion of the site is at a higher elevation and only floods during larger than average events. The area used for the benefit calculation is the area that floods during a normal year flood, which equals 80% * 16,000 acres = 12,800 acres.

The inundation volume is calculated for the Mollicy Farms site based on the area inundated (12,800 acres) and the inundation depth (10 feet) over the course of a typical 130-day flood event.

Inundation volume = 12,800 acres * 10 feet = 128,000 acre-feet = 157,886 ML/yr

The total water quantity benefit is calculated as **157,886 ML/yr**.

**Total (ultimate) benefit:** 157,886 ML/yr

**TCCC total (ultimate) benefit taken as a function of cost share is:** 6,157.5 ML/yr

As of October, 2014 site restoration is complete for the 12,800 acres of floodplain.

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 157,886 ML/yr and TCCC’s benefit (adjusted for cost share) is 6,157.5 ML/yr.

**Projected Replenish Benefits:**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>157,886</td>
<td>6,157.5</td>
</tr>
<tr>
<td>2016</td>
<td>157,886</td>
<td>6,157.5</td>
</tr>
<tr>
<td>2017</td>
<td>157,886</td>
<td>6,157.5</td>
</tr>
<tr>
<td>2018</td>
<td>157,886</td>
<td>6,157.5</td>
</tr>
<tr>
<td>2019</td>
<td>157,886</td>
<td>6,157.5</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>157,886</td>
<td>6,157.5</td>
</tr>
</tbody>
</table>
Assumptions:

- On average, approximately 80% of the 16,000 acres site (= 12,800 acres) will flood annually following completion of the project.
- Although there is variability from year to year, a typical flood event lasts 130 days with the flood pulse entering the site in late fall/early winter and receding in March.
- The floodplain is inundated to a depth of 10 feet over the course of a typical 130-day flood event.

Data Sources:

- All data and assumptions were obtained from Dan Weber with TNC.
- Calculations for flooding depth were provided by Dan Weber, and are based on an analysis of historic Ouachita River stages combined with on-site evaluations.

OTHER BENEFITS NOT QUANTIFIED

- Improved water quality in the Ouachita River
- Restoration of Ouachita River flows to a more natural hydrology, downstream of the restored floodplain.
- Enhanced floodplain habitat and ecosystem services
- Reduced downstream flooding
- Reforestation

NOTES

- This fact sheet updates the October 2013 fact sheet and reflects the completion of the floodplain reconnection work described in this fact sheet.
- Preliminary flood-pulse monitoring has shown a decline in nutrient export from the site in the first 3 years of flooding after the initial levee breaches.
- Based on research conducted by the Louisiana State University, benthic invertebrate populations at Mollicy have begun to resemble the populations seen on the mature natural floodplain on the western bank of the Ouachita River.

REFERENCES

PROJECT NAME: Wetland restoration in highland indigenous communities of Alto Tarapacá, I Region, Chile
PROJECT ID #: 141

DESCRIPTION OF ACTIVITY: Vegetation management to restore or improve wetland function (200 ha)

LOCATION: Altiplano of Altos de Pica, northern Chile, Tarapacá Region, Chile, above 3900 m elevation (S 19° 50’; W 68° 31’).

PRIMARY CONTACTS:
Emilio Lopez
South Latin Business Unit– Environment and Occupational Health and Safety Manager
Coca-Cola de Argentina
Paraguay 733
C1057AAI
Buenos Aires, Argentina
Phone: +54 11 4319 2033/2156
emilopez@coca-cola.com

Anibal Manzur
Avina
Responsable Técnico – Buenos Aires – Argentina.

Claudio Lopez
Corporación Norte Grande Iquique, Chile
Paraguay 733
Buenos Aires, Argentina
Phone: +56991978132
clopez@cng.cl

OBJECTIVES:
• Apply traditional techniques of the Andean native people to restore and improve wetland hydrology and function on 200 ha;
• Revive the ancient practices of lowlands management existing in indigenous Altiplano communities in the I Region of Chile aimed at improving their physical and ecological conditions;
• Exchange knowledge about the importance of the lowlands in the community, the optimization of water use and adaptive management to climate change;
• Foster community work on the territory and the transfer of knowledge across generations of participating indigenous communities.

BACKGROUND & DESCRIPTION OF ACTIVITY: Wetland systems in the Altiplano and High Andes, (herein referred to as lowlands) are a highly productive, valuable resource for the local communities; however, they are uncommon in the High Andes (<4% of the territory). In the lowlands and arid steppes that dominate the landscape, Andean people raise llamas and alpacas, one of the main pillars of the economy and permanence of these peoples.

Lowlands are composed primarily of hydrophilic herbaceous vegetation, including grasses, sedges and rushes, and are directly associated with water sources, including springs, rivers, streams, ponds, and groundwater. They are spatially arranged in islands of different sizes within a dominant desert matrix or shrub steppes and grasslands and xerophytic shrubs along with scrublands.

Climate in the lowlands is harsh, as the elevation is 4,000 to 4,300 m above sea level. Water supply is dependent on rainfall, which varies seasonally and annually, and averages about 200 mm per year and falls primarily between December and February (Atlantic summer regime). Rain and snowmelt infiltrates and runs off, appearing at the surface in available moisture gradients. From slopes and drier plains, water flows through gorges and valleys with shrubby vegetation and grasslands dependent on subsurface water, to wetlands or lowlands, with more saturated soils where water comes to the surface.
This allows for the growth of hydrophilic vegetation, either scrubland grasses or cushion plants interspersed with waterways and bodies of water and saline soil patches.

Contributors to degradation to the Altiplano wetlands include:

- Channelization and flow deviation, causing portions of the wetland to dry out.
- Trampling and overgrazing by livestock, especially introduced species such as donkeys and sheep, which cause significantly more vegetation damage and erosion than native camelids such as llamas and alpacas.
- Soil erosion and channeling of natural irregular flows, which decreases the original base water level and leaves isolated wetland patches without natural irrigation.
- Other factors, such as earthquakes, which can change the location of springs, causing similar degradation processes in the wetlands to occur.

Some Andean people manage the lowlands using an ancient traditional vegetation management technique described as “champeo” (turfing) or management of “champa,” a Quechua word that means: tangle of plants with soil. The “champas,” manageable portions of the lowlands ecosystem, are removed and transplanted in certain sectors and water intakes to generate channels, plugs or dikes to distribute and manage the water on the surface with the subsequent increase in the base level and increase in the infiltration for more subsurface moisture and water availability in the immediate surroundings (Figures 1 and 2). Thus, the water is retained in the system, its use is optimized, and the continued degradation process is avoided. While these traditional practices are known to be effective in mitigating the degradation processes, they are employed less frequently than they were historically.

![Figure 1. Examples of lowland management. Photo on the left shows channel and plug creation using native wetland plants to route water towards stressed areas or areas with a potential risk of desiccation. Photo on the right shows a dike built with wetland vegetation.](image)

This project restores and improves hydrology in the Altopico wetlands over a five-year period. It will include workshops to demonstrate traditional Andean wetland management techniques, implementation of initial restoration activities at a pilot site in year 1, followed by more extensive restoration in subsequent years. Restoration will include identification of degraded patches, identification and measurement of the channelized flows, restoration of the wetlands, and monitoring of the flows and vegetation improvement to assess the success of the champeo and water management. Before and after the management, measures will also be taken in non-degraded areas and in areas similar to the management patches to have controls for the managed areas. Figure 2 shows a degraded site, and a recovered area to illustrate the goal of this project.
2013-2014 Pilot Test
A pilot test was conducted in 2013-2014 on experimental management of high altitude wetlands in two grazing lands belonging to Aymara families in the region of the Alto Tarapacá, called Cariquima and Villablanca.

Huaytane Meadow in Cariquima Territory
The pre-project condition of the Huaytane meadow, in the Cariquima territory, was a saline grass meadow with a predominance of *Distichlis humilis* grass, and a very low presence of other species like *Zameioscirpus* sp and *Phyloscirpus* sp. The area was watered by a stream with a flow of little over 2 L/s, as measured in December 2013. Due to a lack of water distribution, the meadow was in extremely poor condition, having a salt crust, very scarce green cover and large portions of barren soil.

Between December 2013 and February 2014, flow from nearby channels running parallel to the site was diverted to the dry, extremely salty areas, by placing vegetation patches in the main drainage paths. This work was conducted when water was flowing to accurately and integrally assess where more flow was needed and where the supply was excessive, slightly improving distribution. Improvements to the Huaytane meadow focused on 1.35 ha and resulted in restoration of a total of 2.54 ha of wetlands (Figure 3).

Villablanca Meadow
The pre-project condition of the more heterogeneous Villablanca meadow included scrublands with *Deyeuxiaeminensym D. deserticola* dominating the landscape with intertwined patches of *Zameioscirpus* sp and *Oxychloe andina* coiron plants. Meadow and low grasses were scarce in the drier edges of the meadow. Water supply comes from a nearby stream and from the Villablanca River, with a flow of 4 L/s, as measured in December 2013. The condition of the Villablanca meadow was irregular, with exposed dirt in areas where inflows had been cut off. Base water levels were impacted by ongoing sedimentation, and gully erosion impeded water flow from the main river.
Improvements were focused on constructing a new waterway in the embankment area, a new stream from that point and revamping an old channel which receives mountain runoff. The channel was constructed by removing vegetation patches and placing them in lower areas to block off leakages. The excess from the areas watered by that channel was gathered by an old downstream channel. Vegetation and algae were cleared to make water flow more efficient. The improvements resulted in restoration of 4 hectares of wetlands (Figure 4).

2013-2014 Pilot Results
Vegetation and water supply monitoring of the pilot sites show improvement in the project areas between project initiation and March 2014. Figure 5 shows the increased proportion of water cover in the managed system before and after improvements. Additionally, in Huaytane meadow the salt crust decreased and vegetation increased. Figure 6 shows before (December 2013) and after (March 2014) photos of the Huaytane meadow site.
SUMMARY OF THE REPLENISH BENEFITS:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 52.3 ML/YR

ACTIVITY TIMELINE:
- March 2014: 6.5 hectares were restored
- April 2015: a cumulative total of 50 hectares will be restored. Specific activities include: community informational workshops, field surveys to identify degraded areas, management actions, monitoring and assessment of project results, and a workshop to teach communities about traditional management practices.
- April 2016: a cumulative total of 100 hectares will be restored
- April 2017: a cumulative total of 150 hectares will be restored
- April 2018: a cumulative total of 200 hectares will be restored

COCA-COLA’S CONTRIBUTION: 85%
- Total project cost: $975,332 USD
- Coca-Cola cost: $829,032 USD

WATERSHED BENEFITS CALCULATED:
1. Increase in storage volume in the wetlands

1. INCREASE IN STORAGE VOLUME

Approach and Results:
The replenish benefit was calculated as the average annual storage volume restored in the local wet meadow system due to improved land management practices implemented through the project. The regional climate is arid, with annual precipitation of only approximately 200 mm per year. However, the wet meadow systems receive the majority of their water supply from natural springs and streams that deliver water from higher elevations.

It is conservatively assumed that the fully restored wet meadow systems will capture and retain approximately 0.6 liters per hectare per second (L ha\(^{-1}\) s\(^{-1}\)) beyond the existing capture rate of water in the degraded meadow system (Salazar et al., 2005). This estimated capture/retention rate is applicable during the growing season when the presence of mature vegetation promotes water retention. Based on information provided by Emilio Lopez, “active” vegetation will be present in the wet meadow system(s) for approximately 8 months of the year.

Applying the capture rate of 0.6 L ha\(^{-1}\) s\(^{-1}\) to an 8-month period, and adjusting for success rate, generates a volume per unit area of 9,460.8 cubic meters per hectare per year (m\(^3\) ha\(^{-1}\) yr\(^{-1}\)):

\[
(0.6 \text{ L ha}^{-1} \text{ s}^{-1}) \times (60 \text{ sec/min}) \times (60 \text{ min/hr}) \times (24 \text{ hr/day}) \times (365 \text{ day/yr}) \times (1\text{ m}^{3}/1000 \text{ L}) \times (8 \text{ mo/12 mo}) = 12,614.4 \text{ m}^{3} \text{ ha}^{-1} \text{ yr}^{-1}
\]

A success rate of 75% at the end of this project was conservatively assumed, based on input from Emilio Lopez, and the volume per unit area is modified to reflect this: 0.75 * 12,614.4 m\(^3\) ha\(^{-1}\) yr\(^{-1}\) = 9,460.8 m\(^3\) ha\(^{-1}\) yr\(^{-1}\).
Applying the 9,460.8 m³ ha⁻¹ yr⁻¹ estimate to the 200 hectare wet meadow restoration area results in a total water quantity benefit of 1,892,160 m³/yr (1,892.2 ML/yr).

The total (ultimate) benefit: 1,892.2 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 1,608.3 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity at the end of the calendar year 2014. The total 2014 benefit is 61.5 ML/yr and TCCC’s benefit (adjusted for cost share) is 52.3 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. Projected benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>473.0</td>
<td>402.1</td>
</tr>
<tr>
<td>2016</td>
<td>946.1</td>
<td>804.2</td>
</tr>
<tr>
<td>2017</td>
<td>1419.1</td>
<td>1206.3</td>
</tr>
<tr>
<td>2018</td>
<td>1892.2</td>
<td>1608.3</td>
</tr>
<tr>
<td>2019</td>
<td>1892.2</td>
<td>1608.3</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>1892.2</td>
<td>1608.3</td>
</tr>
</tbody>
</table>

Data Sources:

- All data provided by Emilio Lopez.

Assumptions:

- The water retention rate (beyond the existing capture rate of water) restored in the affected wet meadow system(s) as a result of the project is estimated to be 0.6 L ha⁻¹ s⁻¹ based on Salazar et al., 2005. This estimate has been made following conservative criterion based on a lowlands requirement of 0.6 L ha⁻¹ s⁻¹, considering that scientific research shows that the necessary flows for the lowlands systems range from 0.55 L ha⁻¹ s⁻¹ in marginal areas with poor coverage to 0.96 L ha⁻¹ s⁻¹ in central areas of higher productivity.
- A success rate of 75% at the end of this project was conservatively assumed.
OTHER BENEFITS NOT QUANTIFIED

- Improvements to overall ecosystem function in the wet meadow system.
- Habitat for resident and migratory water birds such as flamingos, ducks, wading birds such as plovers, and sandpiper. Some of these species, such as the large flamingo, suri, and vicuña are vulnerable or are in international conservation categories.
- Revival of traditional “champeo” (turfing) practices compatible with the current knowledge of wetland management.
- Development and testing of strategies for adaptation to climate change in the local Altiplano communities.
- Generation and dissemination of actions for a continental strategy aimed at preserving headwater wetlands in the Andes basins.

NOTES

- Vegetation and water cover were measured at the Huaytane and Villablanca meadows when management began, and again at the end of the growing season. Six plots were placed at each site and percentage cover was visually estimated for each plot. Also, water supply was calculated based on water velocity and stream cross-sectional area.
- At Huaytane meadow, the spring supplied 1.5 L/s. The channel derived from the Chulluncane River supplied 2 L/s to the management area of the Villablanca lowland. In Huaytane meadow, the salt crust was observed to be diluted (Figure 6). The percent water cover of these wetlands increased three times as results of the meadow and water management. The mean vegetation cover increased by 42 percent in a period of three months, from December 2013 to March 2014.

REFERENCES

Alto Pica-Exhibit II. Analysis of water requirements in lowlands and wetlands in northern Chile. Dirección General de Aguas. Government of Chile.


**PROJECT NAME:** Oxapampa Asháninka Yanesha (RBOAY) Biosphere Reserve, Central Forest

**PROJECT ID #:** 143

**DESCRIPTION OF ACTIVITY:** Revegetation and native forest conservation activities

**LOCATION:** Oxapampa Asháninka Yanesha (RBOAY) Biosphere Reserve, Province of Oxapampa, Pasco Region, Peru and Argentina.

**PRIMARY CONTACTS:**
- Emilio Lopez
- Anibal Manzur
- Edgardo Castro

SLBU – Environment and Occupational Health and Safety Manager
- Coca-Cola de Argentina
- Paraguay 733 C1057A1
- Buenos Aires, Argentina
- emilopez@coca-cola.com

Fundación Avina
- Responsable Tecnico, Buenos Aires, Argentina
- anibal.manzur@gmail.com

Instituto del Bien –común (IBC)
- ecastro@ibcperu.org

**OBJECTIVES:**
- Reduce runoff and associated sedimentation
- Increase infiltration
- Improve habitat and increase biodiversity
- Recover native vegetation

**BACKGROUND & ACTIVITY DESCRIPTION:** High rates of deforestation are occurring in Amazonia, and one of the main causes is the conversion of forests into agricultural lands. Other causes include timber extraction, mining, oil exploration and extraction, and the construction of infrastructure such as roads. The main impacts of deforestation in Amazonia include a loss of biodiversity, alteration of the water cycle, and contribution to global warming (RAISG, 2012).

The Oxapampa Asháninka Yaneshas (RBOAY) Biosphere Reserve, recognized by UNESCO in 2010, coincides with the Province of Oxapampa, Pasco Department, extending over the eastern flank of the snowy Huaguruncho range from the glaciers at 5,800 meters above sea level to the Amazon plain at 350 meters above sea level. It includes the headwaters of the Pachitea River. Waters in the RBOAY are under many pressures caused by human activities. From 2000 to 2010, about 5% of the natural forests of the province of Oxapampa have been lost (Figure 1). The deforested land is typically utilized for agriculture, cattle raising, cultivation of coca, timber extraction and unplanned road construction. The aggressive deforestation has significantly impacted the landscape and the capacity of the water systems, as well as the resident flora and fauna, and the health and well-being of rural populations (McClain et al., 2001; McClain and Cossio, 2003; Castro et al., 2008; RAISG, 2012).
In the Pachitea River basin, the main causes of ecosystem deterioration are: the deforestation of the marginal areas along rivers and ravines, the pollution of water bodies by urban and agricultural runoff, implementation of damaging fishing techniques, and increased population. Clearing of riparian areas and creation of grassland for cattle grazing also contribute to the deterioration of the aquatic ecosystems in the Pachitea River basin. Water management efforts in this basin should be focused on the protection of water quality in rivers and ravines and the conservation of natural sources of water purification, such as the riparian forests and wetlands (McClain et al., 2001; Castro et al., 2008).

The objective of the project "Participatory management for the conservation, restoration and management of areas of water interest in RBOAY" is to contribute significantly to the improvement and maintenance of the water flows and quality in the natural systems of the Pichis, Huancabamba and Chorobamba sub-basins, which are located within the Pachitea River basin. This project began in 2014 and will be completed towards the end of 2017, and will establish water funds through the Reciprocal Water Arrangements or ARA (Acuerdos Recíprocos por el Agua) scheme. ARA is a scheme that connects people with biodiversity and conservation issues. It is based on the principle that the users and beneficiaries of a water resource should compensate those who safeguard the resource. In an ARA there are three parties involved: 1) the users and beneficiaries of the water resource (who make an economic contribution to conserve and recover forests); 2) the owners of the water supplying lands (who conserve, recover, and manage forests); 3) the administrator of the water service (who purifies and distributes water). This project is being conducted in cooperation with AVINA and Instituto del Bien Común (IBC).
The agreement is implemented as follows:

The Oxapampa consumers fund a grant (administered by the Oxapampa Provincial Municipality) as a means to compensate landowners for committing to forest conservation in the water supplying areas. This grant provides compensation in goods (plants, fencing, tools, etc.) needed for production. The agreements are validated by the Municipality, in a joint effort with the local hydrographic basins technical group.

The ARA scheme has established agreements between the municipality, drinking water consumers and farmers who own properties in the sub-basins that feed the drinking water systems at the populated centers of Oxapampa, Chontabamba and Chorobamba. In 2014, seventeen agreements were implemented in Chorobamba and six in Pichis. This project generates both water quality and quantity benefits by reducing erosion through forest conservation, revegetation and protection of critical areas for water production.

The main goal of this project is establish conservation agreements for: 1) conservation of 1,000 hectares of forest in the Chorobamba sub-basin and 2) initiation of revegetation of 700 hectares in the Pichis and Huancabamba sub-basins to promote water infiltration. Project locations are shown in Figure 2.

The Chorobamba ecosystem can be characterized as high forest and jungle with an annual average rainfall of 1,148.76 mm/year (Fundación Avina). In the Chorobamba sub-basin, one of the main threats to the water systems is the change in land use of the protected areas and deforestation on steep slopes (Figure 3). Due to the mountainous nature of the landscape, these land alterations lead to increased runoff, increased erosion, landslides and higher turbidity in the water. As a result, cities and populated areas...
centers are experiencing water quality issues during the rainy season and water shortage issues during the dry season.

The Huancabamba River originates in the snowy mountains of Huaguruncho, where there are 22 km² of glaciers and dozens of high Andean lagoons which are natural water reservoirs for the Pachitea basin. Huancabamba undergoes a dramatic altitude transition, ranging from 5,000 to 1,000 meters above sea level. The rural community of Huachón is one of the largest in the area occupying 41,188 hectares, and includes approximately 1,000 inhabitants of Quechua-speaking indigenous descent. The Huachón community, as well as other rural communities in the area, are key players in achieving the goal of conserving the headwaters of the Huancabamba and its water sources, since they are repositories of knowledge about the territory and its resources. Annual rainfall in the sub-basin ranges from 2,000 to 4,000 mm/year (Fundación Avina). A grassland area in the Huancabamba sub-basin is shown in Figure 4.
The Pichis sub-basin is approximately 10,000 km², with altitudes ranging from 350 to 1,800 meters above sea level. The political district of Puerto Bermúdez follows the boundaries of this sub-basin. The ecosystems in this area are high and low rainforest. The annual average rainfall ranges from 1,812 to 4,274 mm/year (Fundación Avina). In the Pichis sub-basin, many hectares of riparian forest are cleared annually by indigenous people and settlers to exploit the productive alluvial soils for seasonal crops such as corn, rice, beans, watermelon, peanuts, and papaya, among others. The riparian deforestation contributes to erosion/sedimentation processes in the rivers which, in turn, cause the expansion of riverbed and a decrease in channel depth (Figure 5). This results in the disappearance of the pools that are biologically and ecologically important habitats for many species of fish. Fish are an important protein source for the Pichis populations (Castro et. al., 2008).

Figure 5. Deforestation for commercial timber extraction (left) and erosion along the margins of the Nazarategui River (right), Pichis sub-basin.

This project involves revegetation or conservation of land within three sub-basins. The area affected by this project is shown in Table 1.

<table>
<thead>
<tr>
<th>Location</th>
<th>Area planned for revegetation (ha)</th>
<th>Area planned for conservation (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chorobamba</td>
<td>-</td>
<td>1,000</td>
</tr>
<tr>
<td>Huancabamba</td>
<td>250</td>
<td>-</td>
</tr>
<tr>
<td>Pichis</td>
<td>450</td>
<td>-</td>
</tr>
</tbody>
</table>

SUMMARY OF REPLENISH BENEFIT:

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 307.7 ML/YR

ACTIVITY TIMELINE: 2014 – 2017

- Establish cooperation agreements
- Support municipalities in the identification and outlining of areas of water interest
- Implement ARA between the municipality, water consumers and land-owning farmers
• Generate hydrological baseline and monitoring of water bodies involved in the area of implementation of the ARA
• Develop a training and social communication plan, designed and developed around the conservation of water systems and riparian forests
• Prepare an assessment of riparian deforestation at the micro-watershed level and identification of critical areas for recovery
• Develop revegetation and/or reforestation actions in the marginal strips
• Develop plans for the management of seedlings
• Conduct training workshops on nursery management and revegetation and/or reforestation actions

<table>
<thead>
<tr>
<th>Year</th>
<th>Chorobamba Protection</th>
<th>Huancabamba Revegetation</th>
<th>Pichis Revegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>15%</td>
<td>0%</td>
<td>15.5%</td>
</tr>
<tr>
<td>2015</td>
<td>45%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>2016</td>
<td>100%</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>2017</td>
<td>-</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

The corresponding total areas affected by the project at the three sites are provided in Table 1

Coca-Cola Contribution: 80%
• Overall Project Funding (2014-2017): $680,800 USD
• Coca-Cola Cost Contribution (2014-2017): $544,000 USD

Watershed Benefits Calculated:
1. Decrease in runoff

1. Decrease in Runoff

Approach & Results:
The water quantity benefit was calculated using the “Alternative Annual Method” as described in Redder and Larson (2012). This conservative method is appropriate for land use/land cover activities that are expected to generate water quantity benefits of less than 150 ML/yr. However, although the area affected by the project exceeds the threshold area described in Redder and Larson (2012), this method was chosen due to lack of data inputs to utilize the SWAT curve number approach. This estimate is conservative and appropriate for current benefit calculations. The water quantity benefit is calculated as the difference in the estimated “pre-project” and “post-project” runoff depths multiplied by the total surface area:

\[
\text{[Water quantity benefit (m}^3\text{/yr)} = [\Delta \text{Runoff (m/yr)}] \times \text{[Surface Area (m}^2\text{)]}
\]

where the change in runoff (\(\Delta \text{Runoff}\)) is calculated as follows:

\[
[\Delta \text{Runoff (m/yr)}] = [\text{Pre-project Runoff Depth (m/yr)}] – [\text{Post-project Runoff Depth (m/yr)}]
\]
“Pre-project” is defined as the unprotected condition of the land, while “post-project” is defined as the protected condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

\[
\Delta \text{Runoff (m/yr)} = \Delta K \times \text{[Annual Rainfall Depth (m/yr)]}
\]

where \( \Delta K \) is the difference between the pre- and post-project annual runoff coefficients due to changes in the vegetation condition.

For typical revegetation and land protection activities, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (\( \Delta K \)) is solely due to a change in the vegetation condition. A \( \Delta K \) value of 0.1 was provided by the contact based on existing literature (Benitez et al., 1980; Razuri Ramirez, 1984; Velazco Molina, 1991; Lemus and Navarro, 2003).

Calculated water quantity benefits are provided in Tables 3, 4 and 5 below. The total ultimate benefit (runoff reduction) for the three sub-basins is: 3,268 million liters per year (ML/yr). The ultimate benefit by sub-basin equals:

- Chorobamba: 1,148.8 ML/yr
- Huancabamba: 750 ML/yr
- Pichis: 1,369.4 ML/yr

Table 3. Summary of Water Quantity Benefits for Chorobamba Protection (1000 ha)

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Implementation Schedule *</th>
<th>Water Quantity Benefit Adjusted for Implementation Schedule (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>15% (150 ha)</td>
<td>172.3</td>
</tr>
<tr>
<td>2015</td>
<td>45% (450 ha)</td>
<td>516.9</td>
</tr>
<tr>
<td>2016</td>
<td>100% (1,000 ha)</td>
<td>1,148.8</td>
</tr>
<tr>
<td>2017</td>
<td>100% (1,000 ha)</td>
<td>1,148.8</td>
</tr>
<tr>
<td>2018</td>
<td>100% (1,000 ha)</td>
<td>1,148.8</td>
</tr>
<tr>
<td>2019</td>
<td>100% (1,000 ha)</td>
<td>1,148.8</td>
</tr>
<tr>
<td>2020</td>
<td>100% (1,000 ha)</td>
<td>1,148.8</td>
</tr>
</tbody>
</table>

*If this area weren’t protected by this project, the entire area (1000 ha) would ultimately be deforested.

Table 4. Summary of Water Quantity Benefits for Huancabamba Revegetation (250 ha)

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Implementation Schedule</th>
<th>Water Quantity Benefit Adjusted for Implementation Schedule (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>0%</td>
<td>0.0</td>
</tr>
<tr>
<td>2015</td>
<td>40% (100 ha)</td>
<td>300.0</td>
</tr>
<tr>
<td>2016</td>
<td>80% (200 ha)</td>
<td>600.0</td>
</tr>
<tr>
<td>2017</td>
<td>100% (250 ha)</td>
<td>750.0</td>
</tr>
</tbody>
</table>
Table 5. Summary of Water Quantity Benefits for Pichis Revegetation (450 ha)

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Implementation Schedule</th>
<th>Water Quantity Benefit Adjusted for Implementation Schedule (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>15.5% (70 ha)</td>
<td>212.2</td>
</tr>
<tr>
<td>2015</td>
<td>40% (180 ha)</td>
<td>547.7</td>
</tr>
<tr>
<td>2016</td>
<td>80% (360 ha)</td>
<td>1,095.5</td>
</tr>
<tr>
<td>2017</td>
<td>100% (450 ha)</td>
<td>1,369.4</td>
</tr>
</tbody>
</table>

The total (ultimate) benefit is: 3,268 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 2,614 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 384.6 ML/yr and TCCC’s benefit (adjusted for cost share) is 307.7 ML/yr.

Projected Replenish Benefits

Table 6 shows the projected benefits that this activity will provide if the project remains in productive service. All projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 6. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1,365</td>
<td>1,092</td>
</tr>
<tr>
<td>2016</td>
<td>2,844</td>
<td>2,275</td>
</tr>
<tr>
<td>2017</td>
<td>3,268</td>
<td>2,614</td>
</tr>
<tr>
<td>2018</td>
<td>3,268</td>
<td>2,614</td>
</tr>
<tr>
<td>2019</td>
<td>3,268</td>
<td>2,614</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>3,268</td>
<td>2,614</td>
</tr>
</tbody>
</table>

Data Sources:

- Size of revegetation and conservation land areas provided by Fundacion Avina.
- Schedule for revegetation and conservation provided by Fundación Avina
- Average annual precipitation provided by Fundación Avina.
  - Chorobamba – 1,148.76 mm/yr
  - Huancabamba – 3,000 mm/yr (average of range: 2,000 – 4,000 mm/yr)
  - Pichis – 3,043 mm/yr (average of range: 1,812– 4,274 mm/yr)

Assumptions:

- The Chorobamba sub-basin is being deforested at an even greater rate than the province of Oxapampa. Without protection, the current estimate is that 60% of the land area in
Chorobamba would be deforested in the next four years (information provided by Emilio Lopez). This supports the assumption that without this project the entire area (1,000 ha) would ultimately be deforested.

- A $\Delta K$ value of 0.1 was provided by the contact (E. Lopez, Pers. Comm.) based on existing literature (Razuri Ramirez, 1984; Velazco Molina, 1991; Benitez et al., 1980).

**OTHER BENEFITS NOT QUANTIFIED**
- Improved water quality, including sedimentation
- Improved habitat and increased biodiversity
- Recovery of native vegetation
- Education of local stakeholders on conservation
- Economic benefits resulting from the ARA agreement

**NOTES**
- This fact sheet updates the December 2013 fact sheet to reflect the revised implementation schedule (2014 project start date rather than 2013).
- The replenish benefits reported in this factsheet should be considered preliminary estimates based on currently available information. The estimates may be modified in the future as the project is implemented and additional information becomes available.
- The “Alternative Annual Method” was used to estimate benefits due to lack of detailed meteorological data needed to apply the “SWAT” method.

**REFERENCES**


RAISG, 2012. Amazonía bajo presión. 68 págs. (www.raisg.socioambiental.org)


PROJECT NAME: Replenishing Upper Guadiana Aquifers: “Misión Posible”
PROJECT ID #: 144

DESCRIPTION OF ACTIVITY: Irrigation water management

LOCATION: Upper Guadiana River Basin, Spain

PRIMARY CONTACTS:
Susana Pliego
Environment and Safety Manager
Coca-Cola Iberia
Ribera del Loira 20
28042 Madrid, Spain
spliego@coca-cola.com
+34-91-396-93-34

Juan José Litrán
Director Public Affairs & Communications
Coca-Cola Iberia
Ribera del Loira 20
20842 Madrid, Spain
jlitrran@coca-cola.com
+34-91 396 9369

Eva Hernández
WWF Spain
Gran Vía de San Francisco 8-D
28005 Madrid, Spain
ehernandez@wwf.es
+34 913540578

Clorinda Maldonado
WWF Spain
Gran Vía de San Francisco 8-D
28005 Madrid, Spain
cmaldonado@wwf.es
+34 91 354 0578

OBJECTIVE:
• Decrease water withdrawals from Aquifer 23 for crop irrigation
• Restore the natural water supply to Las Tablas de Daimiel National Park and other wetlands in La Mancha region

BACKGROUND & DESCRIPTION OF ACTIVITY: Water from Aquifer 23 is the main water source for Las Tablas de Daimiel National Park and other wetlands in the region. This aquifer is used for crop irrigation and is widely recognized as being overexploited.

This project aims to reduce water withdrawals for irrigation through innovative assessment, training and implementation of water saving activities for farmers to reduce pressure on Aquifer 23 and replenish the aquifer and its natural water supply to Las Tablas de Daimiel, an inland wetland with a high biodiversity and cultural value. The three project activities are targeted at reducing the volume of water used for irrigation. The first two activities are targeted at herbaceous crops and the third is targeted at vineyards.

Figure 1. Irrigation management in fields around Las Tablas de Daimiel National Park
1. Application of ACUAS II Tool for Crop Planning
Each year the Guadiana River Basin Authorities notify farmers of the legal amount of water they may extract according to their water permits. However, farmers are sometimes fined for using too much water because they do not have suitable tools or information to calculate in advance the amount of water they need for the crops they plan to plant.

The ACUAS II tool estimates the crop water consumption during each irrigation season based on the River Basin Authority’s calculation of water demands of different crops. Results are used to develop a customized crop plan for farmers consistent with the Extractions Annual Plan of overexploited aquifers. This allows the farmers to plant the most suitable types of crops and determine the area of each crop consistent with their water rights. Six participating irrigators’ communities (Daimiel, Manzanares, Herencia, San Clemente, Villarrobledo and Alcázar) have been introduced to, and trained on, a software tool (ACUAS II) for site-specific crop planning. During the period October 2013 to September 2014, 148 farms were assessed using ACUAS II. Water savings for these farms were estimated using remote sensing analyses that provide crop water consumption data from the previous and current year. These data were used to compare the amount of water withdrawn at each site before and after the ACUAS assessment.

2. Application of SITAR Tool for Irrigation Decision Taking
Official irrigation recommendations based on SIAR data (Irrigator’s Assessment System, provided by the Ministry of Agriculture) are typically available to farmers on the internet, but not all farmers can access this information. The SITAR tool (an advancement on SIAR) provides official irrigation recommendations to farmers by text messaging, adapting recommendations to the irrigation equipment of the farm, thus facilitating access to this information. This tool allows farmers to quickly learn how much water is required for each crop and when irrigation should occur. Dissemination of this information has resulted in water, energy and fertilizer savings as farmers implemented the irrigation recommendations. Water savings can be accurately estimated by Irrigator Farmer Communities through flow meter measurements of water used for irrigation.

3. OPTIWINE Pilot to Optimize Use of Water in Vineyards
Six vineyards participated in the OPTIWINE project during 2014, each growing a different variety of grapes. The vineyard managers installed a variety of sensors (soil humidity sensors, dendrometers, manometer, pluviometer, sensors of relative humidity and temperature), recorded data using a datalogger, and transmitted data to a website that is accessible to each manager. Farmers received an assessment of the optimum volume of irrigation water to apply so as to avoid excess irrigation that would go beyond the reach of the roots and be un-used by the vines.

SUMMARY OF REPLENISH BENEFIT:
• 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 626.1 ML/YR

ACTIVITY TIMELINE:
Phase 1
• 2012: Pilot project with ACUAS I tool.
• 2013: Main project initiation, developing and learning, development of ACUAS II tool.
• 2014: Continue to expand farmer participation and implementation.
• 2015: Work with already-participating farmers to maintain benefits, and encourage more to join.
Phase 2
• 2015 - 2017: Phase 2 work to maintain and expand farmer participation.
**COKE CONTRIBUTION:** 100%

**Phase 1**
- Total cost: $500,000
- TCCC cost contribution: $500,000

*The Phase 1 costs exclude a small additional amount for ACUAS I, but the exact amount is uncertain; Phase 1 cost share has been confirmed by WWF to be 100%.*

**Phase 2**

It is anticipated that the Coke contribution for Phase 2 will be 100%. Details regarding future Phase 2 funding (2015-2017) are not yet available but will be included in future fact sheet updates.

**WATERSHED BENEFITS CALCULATED:**

1. Decrease in groundwater withdrawal

---

**1. DECREASE IN GROUNDWATER WITHDRAWAL**

**Approach and Results:**

Water savings were calculated as the volume of water that is not withdrawn during an average year as a result of the application of each of the three management tools.

**ACUAS II Tool for Crop Planning**

In 2014, farmers received a personal assessment in two irrigator communities (Daimiel and Manzanares). Although contacts are maintained with four additional irrigator communities with potential (Herencia, Villarrobledo, San Clemente, Alcázar), they have not yet agreed to receive assessments.

Water savings from this activity are significant, despite the fact that relatively few farms out of the total show water savings. The rest were already respecting their water permit limits. It should be noted that the farmers that exceed their water permits are usually the most reluctant to be assessed. WWF continues working with other irrigators’ communities to get their cooperation, and expand the assessment through ACUAS mainly targeted at the farms that show bigger inconsistencies with the legal limits, thus delivering much higher water savings. The River Basin Authority is not currently enforcing compliance with water permits in the area. Therefore, the fact that this project assists farmers to achieve compliance can already be considered a success and a contribution to the recovery of the aquifer.

Crop water consumption data from the previous and current year was estimated using remote sensing analyses, and used to compare the amount of water used at each site before and after ACUAS assessment. A more detailed explanation is provided in the WWF Replenishment report (WWF, 2014). Water savings in 2014 resulting from the use of the ACUAS II tool, and resulting improvements in crop planning, are shown in Table 1.
Table 1. 2014 Water Savings Resulting from ACUAS II Tool Implementation

<table>
<thead>
<tr>
<th>Irrigation Community</th>
<th>Number of farms saving water/Number of farms assessed</th>
<th>Area with water rights (ha)</th>
<th>Total water allocation by permit (m³)</th>
<th>Systematic water consumption (m³)*</th>
<th>Actual water consumption (m³)</th>
<th>Net Savings (m³)**</th>
<th>Replenish volume (m³)***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daimiel</td>
<td>21/116</td>
<td>2,021</td>
<td>3,886,830</td>
<td>3,920,910</td>
<td>3,560,794</td>
<td>360,116</td>
<td>326,036</td>
</tr>
<tr>
<td>Manzanares</td>
<td>1/32</td>
<td>687</td>
<td>1,216,444</td>
<td>1,270,361</td>
<td>1,123,361</td>
<td>147,000</td>
<td>93,083</td>
</tr>
</tbody>
</table>

*Average water use for this crop(s) and area before ACUAS implementation

** Net savings = (Systematic water consumption) – (Actual water consumption)

*** Replenish can only count volume reductions not required by law. Therefore, where systematic consumption is greater than permit allocation, the replenish volume is the savings compared to the permit total.

The total water savings in 2014 resulting from the ACUAS II tool implementation were 507,116 m³/yr = 507.1 million liters/year (ML/yr). However, the replenishment methodology cannot count water volume savings required by law, which includes the savings to bring water use levels to within the legal permit allocation. The total volume from 2014 actions that counts toward replenish is therefore calculated as 419,119 m³/yr = 419.1 ML/yr.

The behavior of the farms assessed in 2012 (under ACUAS I) and in 2013 (ACUAS II), but not in 2014, was also evaluated (data were not available in time for previous fact sheet). As a result, it was confirmed that some of the fields that had previously been assessed, but which were not assessed in 2014, continued to adjust water use to below their legal water permit limitations and maintain additional savings, as summarized in Table 2. These continuing benefits equal 27,257 m³ = 27.3 ML/yr.

Table 2. 2014 ACUAS Water Savings of fields assessed in previous years with ongoing benefits

<table>
<thead>
<tr>
<th>Irrigation Community</th>
<th>Number of Farms saving water</th>
<th>Area with water rights (ha)</th>
<th>Total water allocation by permit (m³)</th>
<th>Systematic water consumption (m³)*</th>
<th>Actual water consumption (m³)</th>
<th>Net Savings (m³)**</th>
<th>Replenish volume (m³)***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daimiel, assessed in 2012 (ACUAS I)</td>
<td>2</td>
<td>50.1</td>
<td>97,205</td>
<td>135,274</td>
<td>94,358</td>
<td>40,916</td>
<td>2,847</td>
</tr>
<tr>
<td>Daimiel, assessed in 2013</td>
<td>3</td>
<td>69.0</td>
<td>225,030</td>
<td>290,488</td>
<td>208,380</td>
<td>82,108</td>
<td>16,650</td>
</tr>
<tr>
<td>Manzanares, assessed in 2013</td>
<td>2</td>
<td>65.6</td>
<td>131,200</td>
<td>178,786</td>
<td>123,440</td>
<td>55,346</td>
<td>7,760</td>
</tr>
<tr>
<td>TOTAL</td>
<td>7</td>
<td>184.7</td>
<td>453,435</td>
<td>604,548</td>
<td>426,178</td>
<td>178,370</td>
<td>27,257</td>
</tr>
</tbody>
</table>

*Average water use for this crop(s) and area before ACUAS implementation

** Net savings = (Systematic water consumption) – (Actual water consumption)

*** Replenish can only count volume reductions not required by law. Therefore, where systematic consumption is greater than permit allocation, the replenish volume is the savings compared to the permit total.

The total 2014 replenishment benefit from the ACUAS tool (I and II) is 419.1 + 27.3 = 446.4 ML/yr.
**SITAR Tool for Irrigation Decision Taking**

The volume of water savings was calculated as the volume of water that is not withdrawn during an average year as a result of the use of the SITAR Tool, based on measurements by the Irrigator Farmer Communities. A more detailed explanation is provided in the WWF Replenishment report (WWF, 2014). Water savings due to use of the SITAR Tool and implementation of improved practices are calculated as the difference in pre-project water withdrawal volumes and post-project water withdrawal volumes, and results for 2014 are shown in Table 3.

**Table 3. 2014 Water Savings Resulting from SITAR Tool Implementation**

<table>
<thead>
<tr>
<th>Crops</th>
<th>Surface area (ha)</th>
<th>Pre-project irrigation rate (m³/ha/yr)</th>
<th>Post-project irrigation rate (m³/ha/yr)</th>
<th>Reduction in irrigation rate (m³/ha/yr)</th>
<th>Total water savings (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watermelon</td>
<td>82.21</td>
<td>7,000</td>
<td>6,500</td>
<td>500</td>
<td>41,105</td>
</tr>
<tr>
<td>Melon</td>
<td>120.4</td>
<td>6,500</td>
<td>6,000</td>
<td>500</td>
<td>60,200</td>
</tr>
<tr>
<td>Maize</td>
<td>139.25</td>
<td>7,000</td>
<td>6,500</td>
<td>500</td>
<td>69,625</td>
</tr>
<tr>
<td>Onion</td>
<td>30.0</td>
<td>8,500</td>
<td>8,500</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Potato</td>
<td>16.2</td>
<td>8,500</td>
<td>8,000</td>
<td>500</td>
<td>8,100</td>
</tr>
<tr>
<td>Pepper</td>
<td>0</td>
<td>7,500</td>
<td>7,460</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>388.1</strong></td>
<td><strong>179,030</strong></td>
<td><strong>179,030</strong></td>
<td><strong>134</strong></td>
<td><strong>134</strong></td>
</tr>
</tbody>
</table>

The total water savings in 2014 equals 179,030 m³/yr = **179.0 ML/yr**

**OPTIWINE Pilot to Optimize Use of Water in Vineyards**

The aim of OPTIWINE is to provide water to the vine plant at the most critical (i.e., optimum) phase of its growth cycle, and thus reduce overall water consumption of each crop. The irrigation needs are set according to the input data from in situ sensors located in each plot. The sensor monitors weather conditions, soil humidity and the status of the vine. The information is used to develop a weekly water balance to confirm the most suitable irrigation conditions and minimize water use. OPTIWINE determines a water requirement based on the actual weather conditions and growth phase of the crop. The savings are based on a comparison of actual water use with the conventional United Nations Food and Agriculture Organization (FAO) method for assessing water requirements, normally applied, but which is considered to overestimate real requirements. A more detailed explanation is provided in the WWF Replenishment report (WWF, 2014). Results for 2014 are presented in Table 4.

**Table 4. 2014 Water Savings Resulting from OPTIWINE Pilot**

<table>
<thead>
<tr>
<th>No.</th>
<th>Vineyard</th>
<th>Area (ha)</th>
<th>Volume of water savings (m³/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manzanares: Macabeo, high production</td>
<td>19</td>
<td>280</td>
</tr>
<tr>
<td>2</td>
<td>Villarta: Viognier, medium production</td>
<td>24</td>
<td>126</td>
</tr>
<tr>
<td>3</td>
<td>San Clemente: Cabernet Sauvignon, low production</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Alcazar de San Juan: Chardonnay, medium production</td>
<td>30</td>
<td>177</td>
</tr>
<tr>
<td>5</td>
<td>Alameda de Cervera: Cabernet Sauvignon, low production</td>
<td>28</td>
<td>85</td>
</tr>
<tr>
<td>6</td>
<td>Manzanares: Tempranillo, low production</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>153</strong></td>
<td><strong>668</strong></td>
</tr>
</tbody>
</table>
The total water savings in 2014 from the OPTIWINE program is 668 m$^3$/yr or 0.668 ML/yr.

The average water saving per hectare in 2014 (4.4 m$^3$/ha) was considerably less than in 2013 (87 m$^3$/ha). This is explained by the fact that southeast Spain experienced significant drought conditions from October 2013 to July 2014, covering most of the 2014 reporting period. This means that the gap between over irrigation and optimal irrigation was much less than in a ‘normal’ year.

The total water savings in 2014 from all project activities is calculated as the sum of the water savings from the ACUAS Tool, SITAR Tool, and OPTIWINE pilot:

$$\text{Water savings} = 446.4 \text{ ML/yr} + 179.0 \text{ ML/yr} + 0.668 \text{ ML/yr} = 626.1 \text{ ML/yr}$$

Phase 2 of this project is due to start in 2015 with additional funding, and is projected to add 500 ML/yr over three years. The total (ultimate) water quantity benefit equals 626.1 ML/yr + 1,500 ML/yr = 2,126 ML/yr.

The total (ultimate) water quantity benefit is: 2,126 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share is: 2,126 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

### 2014 Replenish Benefit
The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 626.1 ML/yr and TCCC’s benefit (adjusted for cost share) is 626.1 ML/yr.

### Projected Replenish Benefits
Table 5 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in this table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

**Table 5. Projected Water Quantity Benefits Summary**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1,126</td>
<td>1,126</td>
</tr>
<tr>
<td>2016</td>
<td>1,626</td>
<td>1,626</td>
</tr>
<tr>
<td>2017</td>
<td>2,126</td>
<td>2,126</td>
</tr>
<tr>
<td>2018</td>
<td>2,126</td>
<td>2,126</td>
</tr>
<tr>
<td>2019</td>
<td>2,126</td>
<td>2,126</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>2,126</td>
<td>2,126</td>
</tr>
</tbody>
</table>

Data sources:
- All data and water savings information were provided by WWF Spain.
Assumptions:
- Future projections assume that farmers will continue to participate in the program, such that existing benefits continue and the Phase 2 work generates an additional benefit of 1,500 ML (spread over three years). This is a conservative estimate, modified from the WWF Spain estimate of an additional annual benefit of 1,700 ML/yr from 2015 due to an estimated increase in land area. Projected benefits will not be reported until they have been verified each year.
- The pre-project irrigation volume for the OPTIWINE pilot was estimated using the conventional United Nations Food and Agriculture Organization (FAO) method for assessing water requirements.

OTHER BENEFITS QUANTIFIED
- The ACUAS program (I and II) provided an additional volume of water savings of 239 ML/yr in 2014. As this represents water savings to bring farmers within their permit limits (a legal requirement), then this volume cannot be included in the final Replenishment volume total.

OTHER BENEFITS NOT QUANTIFIED
- Energy savings and associated cost savings
- Improved habitat in wetlands resulting from restored flow from Aquifer 23
- Helping farmers to avoid fines and keep water use within permitted volumes

NOTES
- This fact sheet updates the January 2014 version to report 2014 results and provide an estimate of future benefits resulting from Phase 2.

REFERENCES

PROJECT NAME: Tancat de la Pipa
PROJECT ID #: 147

DESCRIPTION OF ACTIVITY: Restoration of constructed wetland

LOCATION: Albufera de Valencia Natural Park, Eastern Spain
(latitude: 39° 21' 16.5924"; longitude: 0° 20' 45.2322")

PRIMARY CONTACTS:
Susana Pliego Gil
Environment & Safety Manager
c/ Ribera del Loira 20
Madrid, Spain
Tel. 34-91-396-9334
spliego@coca-cola.com

Mario Giménez
SEO/BirdLife
Madrid, Spain
Tel. 34-91-434-0910
mgimenez@seo.org

OBJECTIVES:
• Improve water quality
• Preserve and improve biodiversity
• Environmental awareness

BACKGROUND & DESCRIPTION OF ACTIVITY: Tancat de la Pipa is a large constructed wetland system located in Albufera de Valencia Natural Park in eastern Spain. The park is included in the Ramsar Convention and in the Natura 2000 Network by the European Union.

Water from the constructed wetland flows into Albufera Lake, a shallow waterbody of about 3,000 hectares. The lake has elevated levels of pollutants due to agricultural runoff and discharge from municipal wastewater plants. Water flows from the Turia and Júcar rivers through the Tancat de la Pipa wetland complex and into Albufera Lake, and then to the Mediterranean Sea (Figure 1). The constructed wetland system reduced pollutants including nitrogen and phosphorus, organics, chemical oxygen demand (COD), suspended solids and turbidity.

Figure 1. Project location (left) and detailed map of constructed wetlands (right)
Tancat de la Pipa was constructed in 2008 on the location of a former rice field. It functioned well during the early years of operation, but its effectiveness and resulting water quality declined significantly due to lack of maintenance. Several factors contributed to this decline, including: vegetation consumed by waterfowl was not replaced; non-optimum hydraulic management of the constructed wetlands after removal of overgrown vegetation; leaks and breaks in the dikes separating the constructed wetlands; and occurrence of "dead zones" with poor circulation.

To address these issues, this restoration project has involved several activities:

- Revegetation with aquatic plants such as reeds, sedges and rushes that are not consumed by waterfowl;
- Structural improvement of wetland #4 (labeled as “F4” in Figure 1), separating the wetland into three sectors through the construction of two longitudinal dikes. The three sectors are shown in Figure 2: Sector Mixto (SM) consisting of a variety of macrophytes including reeds, sedges, and bulrushes; Sector Lirios (SL) composed primarily of lilies; and Sector Carrizo (SC) composed of reeds exclusively.
- Improved water management including dike reinforcement and design and installation of floodgates for improved water flow;
- Installation of water quality monitoring equipment and biodiversity monitoring.

The purpose of this experimental phase (July 2013 to July 2014) was to gather knowledge and experience to select the best species that improve water treatment efficiency and biodiversity, and also to develop effective water management actions. The plan is to use the results to expand into the other three wetlands from late 2014 into 2015.

Macrophyte recovery in Tancat de la Pipa will support conservation of numerous species of birds, including the Red-Crested Pochard (Netta rufina) and Common Coot (Fulica atra). It will also improve the wintering status for two endangered species in Spain: the Crested Coot (Fulica cristata) and Great Bittern (Botaurus stellaris). The wetland is also the only breeding ground in Albufera for the European Pond Turtle (Emys orbicularis).
SUMMARY OF REPLENISH BENEFIT:

• 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 713.0 ML/YR

ACTIVITY TIMELINE:
This two-phase project is being implemented according to the following schedule:

• Phase 1 (July 2013 through July 2014)
  o July 2013: Project initiated.
  o July - September 2013: Revegetation and hydraulic modification in wetland #4 (3 sectors) completed.
  o October - December 2013: Flow and water quality monitoring data collected.
  o January 2014 - June 2014: Continued to work on plant selection and management, and monitored effectiveness of filters.

• Phase 2 (July 2014 through July 2015)
  o The plan is to replicate the work in the other three wetlands in Tancat de la Pipa, if funding is approved. At the time of this writing, an application for further funding has been made to the Coca-Cola Foundation, and a decision is awaited.

COCA-COLA CONTRIBUTION: 100%

• 2013 -2014: $81,400 USD provided by The Coca-Cola Foundation
• Personnel contribution from SEO/Birdlife, Agró, Universidad de Valencia, Confederación Hidrográfica del Júcar (no funding provided)

WATERSHED BENEFITS CALCULATED:

1. Volume of water treated

1. VOLUME OF WATER TREATED

Approach and Results:
The replenish benefit is estimated as the total volume of water that flows through the constructed wetland system that is treated to a relevant threshold (water quality target) for the parameter of primary concern.
**Water quality targets for the wetland system** were established as follows (based on literature review - file named “120919_Contestacion.pdf”):

- Total Nitrogen (TN) < 3 mg N/L
- Total Suspended Solids (TSS) < 10 mg/L
- Total Phosphorus (TP) < 0.1 mg P/L
- Chlorophyll-a < 5 μg/L (0.005 mg/L)

For this project, total nitrogen was selected as the parameter of primary concern for which the effectiveness of the constructed wetland system would be measured since Albufera Lake is nitrogen limited due to agricultural runoff and discharge from municipal wastewater plants. Reduction of the other parameters listed above is an additional benefit.

When the wetland system was fully functional in the past, it was demonstrated to be highly effective at reducing pollutant loads, although not all targets were fully attained (Table 1).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Water quality before treatment, mg/L</th>
<th>Water quality after treatment, mg/L</th>
<th>Reduction percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Nitrogen (TN)</td>
<td>3.9</td>
<td>1.6</td>
<td>59%</td>
</tr>
<tr>
<td>Total suspended solids (TSS)</td>
<td>40</td>
<td>13</td>
<td>68%</td>
</tr>
<tr>
<td>Total Phosphorus (TP)</td>
<td>0.30</td>
<td>0.14</td>
<td>53%</td>
</tr>
<tr>
<td>Chlorophyll-a</td>
<td>0.054</td>
<td>0.027</td>
<td>50%</td>
</tr>
</tbody>
</table>

1Based on data collected in 2010 by Confederación Hidrografica del Júcar (regional agency)

More recent water quality data collected in the F4 wetland by the Polytechnic University of Valencia in October 2013 (after new vegetation was established) indicate that the restored wetlands remove nitrogen effectively, with removal percentages ranging from 20% to 83%. As shown in Figure 4, with the exception of the October 9, 2013 data point in Sector Lirios equaling 3.06 mg/L, total nitrogen was reduced to below the water quality target of 3 mg/L TN for all measurements taken in all three sectors. Overall, the results indicate the trend is towards below 3 mg/l as the wetland becomes established. Total phosphorus removal efficiency during this period ranged from -16% (i.e., increase in TP) to 72%. The effectiveness of TN and TP removal increased over this first month of operation. Reeds (planted in Sector Carrizo (SC)) were found to be most effective at removing nutrients.
Flows through the F4 wetland were monitored from October 2013 through July 2014. Flows into the wetland sectors were monitored weekly in the early months and every two weeks in later months. From these measurements, a graph correlating water levels and flow outputs was constructed. Evaporation losses were taken into account, so the outflow was inflow less evaporation. The total recorded flow over the 10 months was 594 ML (the difference between inflow and evapotranspiration; evapotranspiration assumed during the study period was a loss of about 18.3 ML, which represents 3% of the inlet flow). This equates to an average of 22.6 liters/sec (L/s) (Instituto de Ingenieria del Agua y Medio Ambiente, 2014). This is less than the flow that was expected (50 L/s). However, some vegetation did not grow as well as expected, and some were eaten by birds.

Based on the measurement of 22.6 L/s, the annual average flow that is currently treated by the wetland is calculated as follows:

Estimate of annual average treated flow: 22.6 L/s = 1,952,640 L/day = 713 ML/yr

The volume increased in 2014 compared to 2013 due to the plants becoming established.

Flows are expected to increase further as the project extends into additional wetland areas, and establishment of plants further improves. The replenish benefit is expected to increase in 2015 to 1,245 ML/yr (39.5 L/s), but this will be confirmed in 2015.

The total (ultimate) benefit is: 1,245 ML/yr  
TCCC total (ultimate) benefit taken as a function of cost share is: 1,245 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.
**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is calculated as 713 ML/yr and TCCC’s benefit (adjusted for cost share) is 713 ML/yr.

**Projected Replenish Benefits**

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1,245</td>
<td>1,245</td>
</tr>
<tr>
<td>2016</td>
<td>1,245</td>
<td>1,245</td>
</tr>
<tr>
<td>2017</td>
<td>1,245</td>
<td>1,245</td>
</tr>
<tr>
<td>2018</td>
<td>1,245</td>
<td>1,245</td>
</tr>
<tr>
<td>2019</td>
<td>1,245</td>
<td>1,245</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>1,245</td>
<td>1,245</td>
</tr>
</tbody>
</table>

**Data Sources:**

- All data were collected by the Instituto de Ingenieria del Agua y Medio Ambiente, Universitat Politecnica de Valencia and provided to LimnoTech by TCCC.

**Assumptions:**

- The wetland complex will continue to function effectively to reduce concentrations below the established total nitrogen target.
- The measured flow over 10-month period from October 2013 to July 2014 will continue for the remainder of the 2014 calendar year at the same average rate.
- The system will be maintained properly.

**OTHER BENEFITS NOT QUANTIFIED**

- The project enhances bird habitat and aquatic life.
- An educational center and public use program provides access for birdwatching and increases awareness of the need for improved water quality and biodiversity.
- This is a demonstration project and the expectation is that lessons learned will be applied to other wetland treatment systems in the region in the future.

**NOTES**

- This fact sheet is an update of the November 2013 fact sheet and reflects current information on the status of the project.
REFERENCES


Water quality targets were provided in file prepared by TCCC on September 19, 2012 named “120919_Contestacion.pdf.” Phosphorus targets were determined in a workshop of experts and documented in “Workshop Proceedings: Study for the sustainable development of L’Albufera de Valencia wetland.”
PROJECT NAME: Chalk Creek Flow Restoration
PROJECT ID #: 149

DESCRIPTION OF ACTIVITY: In-stream flow restoration

LOCATION: South Fork Chalk Creek, Utah

PRIMARY CONTACTS:
Todd Reeve, CEO
Bonneville Environmental Foundation
240 SW 1st Avenue
Portland, OR 97204
541-760-6658
treeve@b-e-f.org

Rena Ann Striker
Contract Ecologist
CCNA Group Environment & Sustainability
404-395-6250
rstricker@coca-cola.com

Jon Radtke
Manager, Water Resources
CCNA Group Environment & Sustainability
404-676-9112
jradtke@coca-cola.com

OBJECTIVES:
• Relocate a point of diversion to re-water a portion of South Fork Chalk Creek
• Reconnect approximately 23 miles of stream habitat to the mainstem of Chalk Creek

BACKGROUND & DESCRIPTION OF ACTIVITY: The South Fork Chalk Creek is a tributary to Chalk Creek, which is located approximately 40 miles south of Ogden, Utah (Figure 1). Chalk Creek represents one of the largest networks of intact habitat for the at-risk Bonneville Cutthroat trout, but suffers from habitat fragmentation, stream dewatering, and habitat alteration associated with agricultural land use. Each of these factors threatens this migratory species of concern.

Prior to this project, a significant irrigation diversion in the South Fork of Chalk Creek dewatered the stream each summer and blocked migrations of Bonneville Cutthroat trout and other native fish, preventing them from accessing important spawning habitat and coldwater refuge areas. Figure 2 shows the pre-project irrigation diversion dam.
This project restored habitat, fish passage, and stream flow to an important section of the South Fork Chalk Creek by removing the irrigation diversion structure (Figure 2) on South Fork Chalk Creek and relocating it approximately one mile downstream. This resulted in significant stream flow being restored to the lower ¼ mile of South Fork Chalk Creek and within the mainstem between the South Fork confluence and the new point of diversion (approximately ¾ mile downstream) on Chalk Creek. This project also removed a channel-spanning fish migration barrier near the mouth of South Fork Chalk Creek and reconnected approximately 23 miles of stream habitat to the mainstem of Chalk Creek. Figure 3 shows the confluence of South Fork with the mainstem of Chalk Creek on July 22, 2013, after the diversion was relocated. During most years, the historical diversion would typically have dewatered the lower portion of South Fork Chalk Creek.

Other project activities, which are not quantified in this fact sheet are: screening of the electrical pump for new diversion to eliminate fish entrainment, and construction of an irrigation pipeline and sprinkler system.
SUMMARY OF REPLENISH BENEFIT:
• 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 4.9 ML/yr

ACTIVITY TIMELINE:
• May 10, 2013 – Project initiated
• June 9, 2013 – Project completed
• 2014 – Installation of a continuous stage recorder

COCA-COLA CONTRIBUTION: 3.8%
Total Project Cost: $262,532 USD
• Swire: $10,000 USD

WATERSHED BENEFITS CALCULATED:
1. Increase in streamflow

1. INCREASE IN STREAMFLOW

Approach & Results:

The point of diversion was relocated approximately one mile downstream of the historic location on South Fork Chalk Creek, to the much larger Chalk Creek. In May, the landowner typically begins irrigating using water from the new point of diversion.

• Pre-project: The irrigator would have typically diverted 105 acre-feet of water from South Fork Chalk Creek between May and September, dewatering this creek.

• Post-project: As a result of the new point of diversion, an average total of 105 acre-feet will remain in the lower reach of South Fork Chalk Creek in normal years.

As a result of this project, the full natural stream flow remains in South Fork Chalk Creek during the summer irrigation period, rewatering an approximately 1-mile length of stream. This volume (105 acre-feet) would normally have been diverted from South Fork Chalk Creek.

Without this project, this amount would have been diverted to the irrigator from the South Fork Chalk Creek point of diversion, dewatering this creek during the summer months. The relocation of the point of diversion to a downstream location on the larger Chalk Creek, allowed the irrigator to maintain irrigation, without dewatering the creek. The total water quantity benefit is the amount of flow restored to the previously dewatered reach.

For 2014, the water quantity benefit is calculated as 105 acre-feet (129.5 ML/yr)

In ‘normal’ water years, the irrigator will divert up to 105 acre-feet, which is his full right. Therefore, the flow restored to the dewatered reach of the creek during a normal year will equal 105 acre-feet = 129.5 ML

The total (ultimate) benefit is: 129.5 ML/yr
The total (ultimate) benefit taken as a function of cost share is: 4.9 ML/yr

The current (2014) TCCC benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.
2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 129.5 ML/yr and TCCC’s benefit (adjusted for cost share) is 4.9 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. Projected benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>129.5</td>
<td>4.9</td>
</tr>
<tr>
<td>2016</td>
<td>129.5</td>
<td>4.9</td>
</tr>
<tr>
<td>2017</td>
<td>129.5</td>
<td>4.9</td>
</tr>
<tr>
<td>2018</td>
<td>129.5</td>
<td>4.9</td>
</tr>
<tr>
<td>2019</td>
<td>129.5</td>
<td>4.9</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>129.5</td>
<td>4.9</td>
</tr>
</tbody>
</table>

Data Sources/Site-specific characteristics:

- All data provided by Todd Reeve.

Assumptions:

- Future benefits assume normal flow conditions.

OTHER BENEFITS NOT QUANTIFIED

- Improved habitat for fish and other wildlife

NOTES

- This fact sheet updates the January 2014 fact sheet to report benefits in the first full year of project implementation.
- A ‘normal’ water year for Chalk Creek is characterized by fully meeting the water right – as opposed to drought conditions curtailing the water right (resulting in less claims for water restored). In 2014, the hydrological conditions were such that the right was fully met, so it can be characterized as a "normal year."

REFERENCES

Instream Flow Monitoring Report Form (Exhibit B), September 26, 2013.

Chalk Creek 2013 Summary Memo.
PROJECT NAME: Life Plus Environment Program
PROJECT ID #: 156

DESCRIPTION OF ACTIVITY: Conservation agriculture

LOCATION: Konya Basin, Turkey

PRIMARY CONTACTS:
Erdal Kiraz Melike Kuş
Environmental Affairs Manager Project Coordinator
Coca-Cola Turkey Nature Conservation Centre
ekiraz@coca-cola.com www.dkm.org.tr

OBJECTIVES:
• Improve water holding capacity of soil
• Ensure efficient use of land and water
• Increase the capacity to use ecosystem services in agriculture

BACKGROUND & DESCRIPTION OF ACTIVITY: Two-thirds of Turkey suffers from water shortages and the country is highly sensitive to desertification and drought. The Konya Province, situated in Central Anatolia, is particularly vulnerable, and it is designated as ‘very highly sensitive and highly sensitive’ to human-induced desertification on the World Desertification Risk Map (USDA-NRCS, 1999). The project areas have the driest climate in the country and suffer from aridity and desertification. Wind erosion is a significant problem in the region due to use of small trees and bushes by the local people for fuel, and in combination with soil type and low precipitation, intensive agricultural techniques, and overgrazing, these factors contribute to loss of soil productivity and an increase in soil salinization. The project areas within Konya basin cover several districts including Karapinar, Cihanbeyli, Güneysinir, Ilgin and Sarayonu. Approximately 47% of the surface area in Konya is farmland, and about 69% of this area is used for rain-fed farming, and 29% is used for irrigated farming (Crop production statistics, undated). Wheat, barley, rye, oats and corn are the dominant crops. The area supporting industrial crops, including sugar beets, is expanding.

The amount of water consumed by cultivated crops in this region exceeds the average annual rainfall of the region. Irrigation water use has resulted in a significant decline in groundwater levels in recent years, as shown below for a well in Gül fet plateau between 1969 and 2008 (Figure 1).

![Figure 1. Water Table in Gül fet Plateau between 1969 and 2008 (Source: State Water Works as reported in Nature Conservation Centre, 2013)](image-url)
Project activities (see Figures 2 – 4) are directed at keeping the soil on the land and increasing soil moisture holding capacity, and include implementation of a variety of activities as appropriate:

- Direct seeded fields (conservation tillage)
- Wind breaks
- Improved pastures
- Crop rotation strategy report
- Ecosystem services map
- Ecosystem services vulnerabilities map
- Monitoring report
- Crop calendar adopted to climate change

![Figure 2. Wheat Fields Cultivated Using Direct Seeding](image)

![Figure 3. Wind break implementation with silverberry and acacia trees](image)
This project aims to introduce the “Ecosystem Approach” (EA) to the project area. The EA is endorsed by the Convention on Biological Diversity (CBD) and the Millennium Ecosystem Assessment (MA), as the best means to tackle the impact of climate change in agriculture and related ecosystems. The CBD defines the EA as a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. All benefits that humans receive from ecosystems are recognized as ecosystem services. These benefits can be direct (e.g., food, fresh water) or indirect (e.g., soil fertility, water cycling) emanating from the functioning of ecosystem processes (TCCC, 2013).

The project activities are also in line with the basic principles of “conservation agriculture” promoted by the Food and Agriculture Organization (FAO) of the United Nations: to minimize soil disturbance to stabilize soil structure, increase fertility and balance the ecosystem (TCCC, 2013).

TCCC’s project partners are the Ministry of Food, Agriculture and Livestock and the Nature Conservation Centre (DKM).

**SUMMARY OF REPLENISH BENEFIT:**
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 514.2 ML/YR

**ACTIVITY TIMELINE:**
- Project duration: 3 years
- 2013: Improved practices implemented on 125 ha of sprinkler-irrigated wheat (rain-fed agriculture receiving supplemental irrigation, or “dryland” farming)
- 2014: Improved practices (direct seeding and wind break) implemented on 1,129 ha (dryland and irrigated farming areas)
- 2015: Additional lands will be included in the program

**COCA-COLA CONTRIBUTION:** 100%
- Total 2013 cost: 75,000 USD
  - 75,000 USD provided by Coca-Cola Life Plus Foundation
- Total 2014 cost: 700,000 USD
  - 700,000 USD provided by Coca-Cola Life Plus Foundation
- A total of 1,500,000 USD will ultimately be invested by Coca-Cola Life Plus Foundation
WATERSHED BENEFITS CALCULATED:

1. Decrease in groundwater withdrawal

1. DECREASE IN GROUNDWATER WITHDRAWAL

Approach and Results:

The replenish benefit was calculated as the water savings in terms of the volume of water pumped from the aquifer for irrigation of crops. This water savings was calculated as the difference between the “without project” condition (traditional practices) and the “with project” condition (improved practices that increase the soil water holding capacity and soil moisture content). The current estimate is that the improved practices increase soil moisture content by approximately 10% (TCCC, 2013). A field study is planned to refine this estimate in the future, but at this time it is considered by local experts to be a conservative and reasonable estimate.

Improving the water holding capacity of soil will promote efficient utilization of both rain water and irrigation water by the crops. Therefore, it was conservatively assumed that a 10% increase in soil moisture will translate to 10% reduction in irrigation water required over the entire growing season for crops that are currently irrigated. Education and awareness activities help farmers manage irrigation scheduling on fields that are in the program. The quantity of water saved will depend on the crop type and irrigation practice. Table 1 documents the crop water requirements for crops grown in the region.

Table 1. Total Seasonal Irrigation Water Needs of Plants According to Different Irrigation Systems in the Central Anatolian Climate (mm/season)

<table>
<thead>
<tr>
<th>Plant type</th>
<th>Irrigation system</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Surface</td>
</tr>
<tr>
<td>Wheat</td>
<td>409</td>
</tr>
<tr>
<td>Barley</td>
<td>409</td>
</tr>
<tr>
<td>Corn</td>
<td>1035</td>
</tr>
<tr>
<td>Sunflower</td>
<td>906</td>
</tr>
<tr>
<td>Sugar beets (full irrigation)</td>
<td>1296</td>
</tr>
<tr>
<td>Sugar beets (no irrigation at the last month)</td>
<td>1172</td>
</tr>
<tr>
<td>Beans</td>
<td>781</td>
</tr>
</tbody>
</table>

1Ankara University, Faculty of Agriculture, Agriculture and Irrigation Dept., 2007

Table 2 illustrates cultivation areas for specific crops in the project area under dryland and irrigated farming. These cultivation areas were used to estimate the average water savings for various crops across project areas in Table 3.
Table 2. Cultivation Areas of Project-Related Agricultural Products

<table>
<thead>
<tr>
<th>Districts</th>
<th>Wheat</th>
<th>Barley</th>
<th>Corn</th>
<th>Sunflower</th>
<th>Sugar Beet</th>
<th>Proportional Average Irrigation Requirement (mm/season)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cihanbeyli</td>
<td>80%</td>
<td>20%</td>
<td>5%</td>
<td>43%</td>
<td>52%</td>
<td>838</td>
</tr>
<tr>
<td>Güneysınır</td>
<td>55%</td>
<td>45%</td>
<td>58%</td>
<td>27%</td>
<td>15%</td>
<td>761</td>
</tr>
<tr>
<td>Ilgın</td>
<td>41%</td>
<td>59%</td>
<td>15%</td>
<td>6%</td>
<td>79%</td>
<td>918</td>
</tr>
<tr>
<td>Karapınar</td>
<td>47%</td>
<td>53%</td>
<td>57%</td>
<td>27%</td>
<td>16%</td>
<td>763</td>
</tr>
<tr>
<td>Sarayönü</td>
<td>79%</td>
<td>21%</td>
<td>28%</td>
<td>45%</td>
<td>27%</td>
<td>779</td>
</tr>
<tr>
<td>Water Requirement (mm/season)</td>
<td>322</td>
<td>740</td>
<td>690</td>
<td>969</td>
<td>812</td>
<td></td>
</tr>
</tbody>
</table>

* Cultivation figures obtained from the Turkish Statistical Institute website (http://www.turkstat.gov.tr/Start.do)

To calculate irrigation water savings for different crops and irrigation systems, it is assumed that 10% of these volumes will be saved and the water savings equals the replenish benefit. An example benefit calculation for practices implemented in 2013 is shown below.

In 2013, improved practices were implemented on 125 ha of sprinkler-irrigated wheat (dryland). As shown in Table 2, the total irrigation water needs for sprinkler-irrigated wheat (dryland) over the growing season is 322 mm. The water savings are calculated as follows (1 mm = 10 m³/ha):

\[
\text{Pre-Project Irrigation Requirement} = 322 \text{ mm} \times 10 = 3,220 \text{ m}^3/\text{ha} \\
\text{Post-project Irrigation Requirement} = 3,220 \times 90\% = 2,898 \text{ m}^3/\text{ha} \\
\text{Water Savings} = 3,220 - 2,898 = 322 \text{ m}^3/\text{ha} = 0.322 \text{ ML/ha} \\
\]

\[
\text{Benefit} = \text{Water Savings} \times \text{Area of Cultivation} \\
\text{2013 Benefit} = 0.322 \text{ ML/ha} \times 125 \text{ ha} = 40.25 \text{ ML/yr} \\
\]

This calculation can be made for all major crops grown in the region (Table 3). To calculate the replenish benefit in ML/yr, the average values across project areas for various crops under rain-fed farming with supplemental irrigation (dryland) and irrigated farming in Table 3 are multiplied by the number of hectares affected by the project, as shown in Table 4. The estimated replenish benefit corresponding to various conservation activities are also shown in Table 4.
Table 3. Annual Replenish Benefit in Million Liters/hectare/year, Calculated as Reduced Irrigation Volume, by Crop and Irrigation System Type

<table>
<thead>
<tr>
<th>Crop type</th>
<th>Irrigation water savings by irrigation system (ML/ha/yr)</th>
<th>Sprinkler</th>
<th>Drip</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td></td>
<td>0.322</td>
<td>-</td>
</tr>
<tr>
<td>Barley</td>
<td></td>
<td>0.322</td>
<td>-</td>
</tr>
<tr>
<td>Corn</td>
<td></td>
<td>0.740</td>
<td>0.575</td>
</tr>
<tr>
<td>Sunflower</td>
<td></td>
<td>0.690</td>
<td>0.537</td>
</tr>
<tr>
<td>Sugar beets (full irrigation)</td>
<td></td>
<td>0.969</td>
<td>0.754</td>
</tr>
<tr>
<td>Sugar beets (no irrigation at the last month)</td>
<td></td>
<td>0.880</td>
<td>0.684</td>
</tr>
<tr>
<td>Beans</td>
<td></td>
<td>-</td>
<td>0.434</td>
</tr>
<tr>
<td>Average across project areas for various crops under rain-fed farming with supplemental irrigation (dryland)</td>
<td></td>
<td>0.322</td>
<td>-</td>
</tr>
<tr>
<td>Average across project areas for various crops under irrigated farming</td>
<td></td>
<td>0.812</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 4. Conservation activities implemented by Life Plus Environmental Project at various locations and the associated water savings

<table>
<thead>
<tr>
<th>Life Plus Environmental Project</th>
<th>Year</th>
<th>Type of activity</th>
<th>Location</th>
<th>Area Affected (ha)</th>
<th>Crop(s)</th>
<th>Irrigation Type</th>
<th>Irrigation Water savings (ML/ha)</th>
<th>Benefit (ML)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2013</td>
<td>Various conservation activities to stabilize soil structure and improve fertility and direct seeding</td>
<td>Karapınar, Konya</td>
<td>125</td>
<td>Wheat</td>
<td>Sprinkler (dryland)</td>
<td>0.322</td>
<td>40.3</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>Direct Seeding</td>
<td>Karapınar</td>
<td>142.5</td>
<td>Wheat, barley, vetch and rye</td>
<td>Sprinkler (dryland)</td>
<td>0.322</td>
<td>218.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cihanbeyli</td>
<td>206.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ilgin</td>
<td>283</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Güneysinir</td>
<td>47.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>Wind Break*</td>
<td>Karapınar</td>
<td>180</td>
<td>Wheat, barley, corn, sunflower and sugar beet</td>
<td>Sprinkler (irrigated)</td>
<td>0.812</td>
<td>146.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>45</td>
<td></td>
<td>Sprinkler (dryland)</td>
<td>0.322</td>
<td>14.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sarayönü</td>
<td>45</td>
<td>Sprinkler (irrigated)</td>
<td>0.812</td>
<td>36.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>180</td>
<td></td>
<td>Sprinkler (dryland)</td>
<td>0.322</td>
<td>58.0</td>
<td></td>
</tr>
</tbody>
</table>
The Wind Break area affected was determined based on the number of trees that were planted. Wind break trees can protect a distance of 20 times their height (Nature Conservation Centre, December 29, 2014). For example, 10,000 trees with a height of 1.5 m planted at 1.5 m intervals can protect an area of 45 ha (10,000 * 1.5 m * 1.5 m * 20 = 45,000 m² = 45 ha). In Karapınar, 40,000 trees were planted in the irrigated area (180 ha affected) and 10,000 trees were planted in the dryland area (45 ha affected). In Sarayönü, 10,000 trees were planted in the irrigated area (45 ha affected) and 40,000 trees were planted in the dryland area (180 ha affected).

Benefit = 40.3 ML/yr + 218.8 ML/yr + 146.2 ML/yr + 14.5 ML/yr + 36.5 ML/yr + 58.0 ML/yr = 514.2 ML/yr

The total (ultimate) benefit: 514.2 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 514.2 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is based on practices implemented on 1,254.4 ha of farmland by the end of 2014 and is estimated to be 514.2 ML/yr and TCCC’s benefit (adjusted for cost share) is 514.2 ML/yr.

Projected Replenish Benefits

Table 5 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>514.2</td>
<td>514.2</td>
</tr>
<tr>
<td>2016</td>
<td>514.2</td>
<td>514.2</td>
</tr>
<tr>
<td>2017</td>
<td>514.2</td>
<td>514.2</td>
</tr>
<tr>
<td>2018</td>
<td>514.2</td>
<td>514.2</td>
</tr>
<tr>
<td>2019</td>
<td>514.2</td>
<td>514.2</td>
</tr>
</tbody>
</table>

Ultimate Benefit: 514.2

Data Sources:

- Land area in program provided by TCCC and the Nature Conservation Centre.
- Irrigation water requirements for different crops were provided by Ankara University.

Assumptions:

- Conservation agriculture results in a 10% increase in soil moisture content. An 8-9% increase in soil moisture was observed in 2013, but it was an extremely dry year. The soil analysis results are expected to be higher for 2014.
Farmers will apply 10% less water after improved practices have been implemented, education and training have been provided and the resource has been managed holistically.

OTHER BENEFITS NOT QUANTIFIED
- Reduced greenhouse gas emissions
- Improved ecosystem services

NOTES
- Supplemental irrigation was applied to rain-fed agriculture, or “dryland” farming areas. Rain-fed agriculture activities do receive irrigation treatment, but to a lesser extent than the “irrigated” farming areas.
- Additional future benefits are unknown because the land areas and locations will be determined in 2015.
- The calculations can be updated if actual measurements for pre- and post-project irrigation requirements become available.
- This factsheet updates the 2013 version to reflect additional projects implemented in 2014.

REFERENCES


**PROJECT NAME:** River Nar Land Management Improvements

**PROJECT ID #:** 162

**DESCRIPTION OF ACTIVITY:** Land management best practices by farmers and silt-trap/small wetland installations

**LOCATION:** River Nar, Norfolk, UK

**PRIMARY CONTACTS:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kathy Hughes</td>
<td>Freshwater Project Manager</td>
<td>WWF – UK</td>
<td>Brewery Road 27 rue Camille Desmoulins 92784 Issy Les Moulineaux 1070 Brussels</td>
</tr>
<tr>
<td>Laure Droual</td>
<td>Sr Manager Water, Energy &amp; Climate Change</td>
<td>Coca-Cola Enterprises</td>
<td>Bergense Steenweg 1424 Ch de Mons</td>
</tr>
<tr>
<td>Jan Burger</td>
<td>NWEN Sustainability Manager</td>
<td>Coca-Cola Services</td>
<td>France</td>
</tr>
</tbody>
</table>

**OBJECTIVES:**

- Improve land management to reduce sediment runoff and increase infiltration
- Install silt traps to reduce sediment runoff and improve river water quality

**BACKGROUND & DESCRIPTION OF ACTIVITY:** The River Nar runs through the county of Norfolk, some 150 km north east of London in an agricultural region, which includes significant sugar beet production (covering approximately 25 to 30% of agricultural land in the Nar catchment). The Nar is a characteristic chalk stream and is designated a Site of Special Scientific Interest (SSSI) for its unique chalk stream and fenland habitat, but it fails to meet ‘good ecological status’ under the Water Framework Directive (includes national water quality objectives). The river faces many pressures, particularly from agriculture, and has been extensively modified over centuries by drainage works including dredging and straightening. The Nar also suffers from the impacts of diffuse agricultural pollution including eutrophication and sedimentation. The reporting period for this fact sheet is January to October 2014.

The project, in partnership with WWF-UK and the Norfolk Rivers Trust, has two components.

1. **Improve land management to reduce sediment runoff and increase infiltration.** This task involves working with farmers to improve land management to provide the joint benefit of reducing sediment, nutrient and pesticide runoff, and to create conditions for higher rates of infiltration to replenish groundwater. This is important for the River Nar for which 90% of its flow depends on groundwater seepage. Figure 1 shows typical problems of poorly controlled runoff.

2. **Install silt traps and small wetlands to reduce sediment runoff and improve river water quality.** Fourteen runoff interceptors were installed in the River Nar catchment, including designed wetlands such as swales, reed beds, ponds and silt traps (13 in 2013 and 1 in 2014). These intercept runoff before it reaches the river and create the right conditions to reduce nitrates and phosphates originating from fertilizers. An example silt trap is shown in Figure 2.

These actions are not required by law.
SUMMARY OF REPLENISH BENEFIT:

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 188.0 ML/yr.

ACTIVITY TIMELINE:

1. Land management improvements
   - Summer 2012 to Autumn 2013: Carried out catchment walkovers and map reviews to identify high priority areas for agricultural runoff, working with farmers to select focus areas and to develop a farm management plan.
   - March 2013 to Dec 2013: Following spring and autumn harvest, farmers applied the agreed-upon improvements. Out of 10 farmers approached and consulted, five farmers agreed to participate and to implement land management improvements.
   - Continuing through 2014:
     - Engagement with farmers who initiated improvements in 2013 to verify the benefits and associated practices continue.
     - Engagement to identify additional farmers to take part in the scheme. Two new farmers agreed out of seven approached. The original five farmers continued with their commitments.

2. Silt trap and small wetland construction
   - Autumn 2012 to Dec 2012: Identified suitable locations and began gaining permissions.
   - Jan 2013 to Dec 2013: Gained permissions and installed 13 silt traps.
   - During 2014: Installation of monitoring equipment and commencement of trial monitoring (at one site in Mileham).
   - 2014: Installation of water quality monitoring equipment, using phosphate as the indicator parameter. Validation is ongoing, and will not be completed in 2014.
   - 2014: Installation of 1 additional silt trap/wetland feature. Additional traps will be installed during November/December 2014, but will be reported on in 2015.
COCA-COLA CONTRIBUTION: Variable by activity (100% of activity 1, 50% of activity 2)

- Total 2013 and 2014 cost: $456,352 USD (£285,220 GBP)
  - Coca-Cola contribution: $415,778 USD (£259,861 GBP)
  - Farmers were required by WWF-UK policy to cover 50% of silt trap installations as ‘farm improvements.’ The financial cost for 14 silt traps (2013 and 2014 reporting period) was $81,149 USD (£50,718 GBP). 50% was paid by farmers and 50% by Coca-Cola. The 50% value of $40,574 USD (£25,359 GBP) represents the difference between total cost and the Coca-Cola contribution.
  - Note: An exchange rate of 1.60 USD: 1.00 GBP is applied, representing the average rate over the 2013 and 2014 period.

WATERSHED BENEFITS CALCULATED:
2. Silt trap and small wetland construction. Volume of water achieving target water quality improvement.

1. LAND MANAGEMENT IMPROVEMENTS

Approach and Results:
The task is to work with farmers to reduce the runoff of sediment, nutrients and pesticides to the River Nar and its tributaries, while at the same time facilitating increased infiltration rates of rainfall into the ground and aquifer below. There are several types of interventions:

- Plant winter cereal crops in early autumn to ensure cover before onset of winter rain
- Plant nurse crops to prevent wind erosion of soil
- Avoid cultivating on steep slopes to prevent the runoff and channeling of water onto roads and into water courses
- Remove and prevent compaction of soil by cultivating at the correct depth when the soil is suitably dry
- Cultivate across slopes to reduce water runoff along furrows and vehicle tracks (tram lines)

A farming advisor (from Norfolk Rivers Trust) visits individual farms and farmers to identify sources of runoff and areas that could be improved. This includes making the business case for improvements. For example, for sugar beet farming, reduced runoff maintains a healthier soil and reduces the cost of replacing fertilizers washed away. A second example is that buffer strips along water courses to prevent polluted runoff from cattle fields, also keep cattle out of the watercourse, reducing health problems and veterinary costs.

Calculations were made using the SCS Curve Number (CN) approach, first developed by the US Natural Resources Conservation Service, but adapted for local conditions. The method is based on an empirical relationship between runoff and a number of characteristics such as soil type, soil infiltration capacity, land use and soil condition. The model calculates a runoff volume for a given rainfall event. It is then assumed that all rainfall that does not runoff infiltrates, from which the component of groundwater recharge is further calculated.

Experts at Cranfield University adapted the model for the Nar catchment as described by Cranfield University (2012), which also gives an overview of the original SCS CN method. The model takes account of antecedent conditions (for example, wetter soil results in more runoff) to calculate potential recharge values.
on a daily time step. Of this, a proportion remains in the soil zone to be taken up by vegetation. Thus a calculation is made of the volume of water that drains from the root zone to recharge the underlying groundwater.

Curve numbers were determined based on three criteria: crop type (row, cereal or grassland), soil infiltration capacity (from <1 mm/hr to 12 mm/hr) and soil field condition (very poor, poor, fair, good or excellent).

Replenishment is achieved by applying actions to improve soil condition and thus increase infiltration. Soil condition was mapped and categorized into: very poor, poor, fair, good, excellent. Improvement measures were targeted so as to maximize the potential of improvement. By comparing infiltration volumes before and after improvements (using the modeling approach described), a replenishment volume is determined.

The intention is that the improved land management activities are followed in subsequent years to maintain the replenishment benefits.

For 2013, 788 acres (318.9 ha) of land had achieved improved practices, with a benefit of 32.2 ML/yr. For 2014, improved practices were implemented on an additional 815.9 acres (330.2 ha), providing an additional replenishment benefit of 16.9 ML/yr. The benefit is not strictly proportional to land area. It is also dependent on the actions taken (dependent on what is appropriate to each piece of land), crop type and soil type.

The local Norfolk Rivers Trust representative verified that the land improvements for 2013 are maintained by the landowners in 2014, for which the replenishment volume was 32.2 ML/yr.

Therefore, the cumulative total benefit for 2013 through October, 2014 is 32.2 + 16.9 = 49.1 ML/yr.

The ultimate target of an average 77 ML/yr for land management improvements remains. This estimate is based on the work of Cranfield University and was an estimate of the expected benefit for 1000 acres (405 ha), taking into account a typical range of conditions. In practice, the total land area has already exceeded 1000 acres, but soil conditions have been less favorable than anticipated. Given uncertainties associated with the prediction, dependent on which farmers participate and their starting land conditions, a more accurate target figure cannot be estimated. However, the target of 77 ML/yr is still considered to be realistic for the increased land area.

2. **SILT TRAP AND SMALL WETLAND CONSTRUCTION**

**Approach and Results:**

In addition to 13 installations in 2013, one new installation was constructed in the River Nar catchment in 2014. These installations included designed wetlands such as swales, reed beds, ponds and silt traps. Their purpose is to temporarily intercept runoff water before it enters the river and provide conditions to reduce sediment load and improve water quality, in particular with regards to nitrate and phosphate content. Some of the captured water infiltrates to recharge groundwater.

A swale is a shallow depression, usually vegetated, intended to intercept flood water. A silt trap is a constructed depression within the riparian zone (on the river bank) into which field runoff is directed via a defined channel, and with a defined channel for outflow to the river.
The effectiveness of such installations to trap sediment was not directly measured but is demonstrated and reported on by Ockenden et al. (2012). Their effectiveness at reducing phosphorus in agricultural runoff is reported by Braskerud (2002).

Replenishment benefits are calculated as the volume of water treated to a recognized water quality threshold. In this case, total phosphorus (P) was selected as the water quality criterion. A threshold of 60 μg/L was selected based on guidelines applied by the Environment Agency (see UK Technical Advisory Group on the Water Framework Directive (WFD), 2008, Table 11, using lower threshold for ‘Most Rivers’).

It is well established that elevated phosphate levels are a problem in the Nar catchment. The Norfolk Rivers Trust (2012, p.29) reports phosphate levels of a number of river stretches to be regularly above the target value of 0.06 mg/L (60 ug/L), with mean values of 0.07 to 0.09 mg/L. Given that agricultural runoff is a principal source of phosphates in the Nar, it can be assumed that phosphate levels in non-intercepted runoff are greater than 0.06 mg/L. The aim is to validate the results locally with new monitoring equipment, a process which is not yet complete, and will continue into 2015.

The calculation is summarized here as described by Kathy Hughes of WWF-UK, with average annual rainfall and estimated total evapotranspiration data from Cranfield University (2012), based on local records for Marham and Buxton (1981 – 2010 average).

(i) Hydrologically effective rainfall = Average annual rainfall – Estimated total evapotranspiration

\[= 665 \text{ mm} - 432 \text{ mm} = 233 \text{ mm}\]

(ii) The National River Flow Archive (NRFA, link in references) shows that only 9% of the Nar is fed by surface runoff (derived from a Base Flow Index of 0.91, or 91%). Thus 9% of hydrologically effective rainfall is calculated:

\[9\% \text{ of } 233 \text{ mm/yr} = 21 \text{ mm/yr or } 0.021 \text{ m/yr}\]

(iii) Assume that (1) non-intercepted surface runoff fails the P limit, and (2) the interventions are effective at bringing 90% of water to below the P threshold value of 60 μg/L.

\[90\% \text{ of } 0.021 \text{ m/yr} = 0.019 \text{ m/yr}\]

(iv) One wetland/silt trap intervention was implemented in 2014. The area of land drained is estimated through local knowledge of the catchment and GIS mapping. The drained area can be larger or smaller than the farm on which the intervention is sited.

Total area of land drained = 372 acres = 150 ha = 1,500,000 m²

Volume of water improved = 1,500,000 m² x 0.019 m/yr = 28,500 m³ = 28.5 ML/yr

Table 1 shows the benefit calculation for the two activities, through October 2014. (Note: In 2013, the total area of land drained for the 13 installations was 3,243 acres = 1,312 ha.) Table 2 shows the total benefit calculated as the sum of benefits from both activities, based on work planned for completion. The Table 2 calculation assumes full implementation of the land improvement activity as described previously.
Table 1. Annual and cumulative benefits to date (through October 2014)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Year</th>
<th>Annual volume (ML)</th>
<th>Cumulative volume* (ML/yr)</th>
<th>Cumulative volume, adjusted for TCCC cost share** (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Land improvements</td>
<td>2013</td>
<td>32.2</td>
<td>32.2</td>
<td>32.2</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>16.9</td>
<td>49.1</td>
<td>49.1</td>
</tr>
<tr>
<td>2. Silt traps &amp; small wetlands</td>
<td>2013</td>
<td>249.3</td>
<td>249.3</td>
<td>124.6</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>28.5</td>
<td>277.8</td>
<td>138.9</td>
</tr>
<tr>
<td><strong>2014 Cumulative Total for Both Activities</strong></td>
<td></td>
<td>326.9</td>
<td>188</td>
<td></td>
</tr>
</tbody>
</table>

* 2013 actions confirmed to be providing ongoing benefits, so 2014 actions are additional
** 100% for Land management, 50% for silt traps

Table 2. Total benefits from all activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Total Replenishment volume (ML/yr)</th>
<th>Adjusted for TCCC cost share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Land improvements</td>
<td>77</td>
<td>77</td>
</tr>
<tr>
<td>2. Silt traps &amp; small wetlands</td>
<td>440</td>
<td>220</td>
</tr>
<tr>
<td><strong>Total (rounded)</strong></td>
<td>517</td>
<td>297</td>
</tr>
</tbody>
</table>

The total (ultimate) benefit is based on the target of 77 ML/yr for land improvements plus the benefits from 22 total silt traps (8 additional silt traps expected to be completed by the end of 2014), assuming an average of approximately 20 ML/yr per silt trap. For the cost adjusted figure, only 50% of the silt trap benefit is included.

The total (ultimate) benefit is: 517 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 297 ML/yr

The current (2014) benefit is the performance-based benefit from these activities as of the end of October 2014. The total 2014 benefit is 326.9 ML/yr and TCCC’s benefit (adjusted for cost share) is 188.0 ML/yr.

Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. The benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 3. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>517</td>
<td>297</td>
</tr>
<tr>
<td>2016</td>
<td>517</td>
<td>297</td>
</tr>
<tr>
<td>2017</td>
<td>517</td>
<td>297</td>
</tr>
<tr>
<td>2018</td>
<td>517</td>
<td>297</td>
</tr>
<tr>
<td>2019</td>
<td>517</td>
<td>297</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>517</td>
<td>297</td>
</tr>
</tbody>
</table>

Assumptions:

- Land improvements
  - Farmers will continue to apply similar best practices in subsequent years, although the local facilitator will continue to work with farmers on this basis. It is also assumed that more farmers will participate, with a view to achieving the original target of 77 ML/yr.

- Silt traps and small wetlands
  - The water quality of non-point source surface runoff from fields is > 0.06 mg/L (field sampling is planned for 2015 to demonstrate this).
  - These features will reduce 90% of flow to within the P target value of 0.06 mg/L, in accordance with literature (Beskerud, 2002)
  - Similar improvements on nitrate water quality will occur.

OTHER BENEFITS NOT QUANTIFIED

- Land improvements
  - Good stakeholder engagement with local farmers should encourage a generally improved approach to environmental management.
  - Reduced runoff of pollution (e.g., fertilizers).

- Improved river habitat
  - Improved river habitat for a range of species, resulting in improved biodiversity (e.g., water voles, improved macrophyte (aquatic plant) assemblages.) This includes habitat improvement (installation of small woody debris) and full restoration (building of a new channel and connection with the floodplain). Example shown in Figure 3.
  - Improved cultural and recreational value.
  - Over 100 members of the community engaged within the Nar catchment and a small team of local volunteers trained to identify issues and ecology on the Nar.
Figure 3. River Nar at Mileham, before (left) and after (right) restoration

- Silt traps
  - Reduction of sediment load and other pollutants in runoff entering the river.
- General
  - Successful communication and public awareness results, including national media coverage (radio, TV and newspaper), government interest (visit of Secretary of State (SoS) for the Environment – see below), local community engagement (volunteer workers), and interest from other businesses (with interest of emulating support for similar activities).
  - Political interest: Visit to the Nar (with Coca-Cola Europe) by the Environment Minister and Ofwat (water industry regulator). Nar project quoted by Richard Benyon (ex-SoS for the Environment) and subsequent (also ex) SoS for the Environment Owen Patterson as best practice.
  - Hosting of sugar beet workshop with Coca-Cola and WWF colleagues from across the European network to investigate what best practice beet production should look like.
  - Nar Catchment Plan recognized by Government and communities.

NOTES

- This fact sheet updates the January 2014 fact sheet to reflect additional activities completed through October, 2014.
- Additionally, when first published for 2013 replenishment, the fact sheet title was ‘River Nar Habitat Improvements’. The title was changed because the specific ‘river habitat improvement’ work was removed from the replenishment credit due to difficulties in validation, but retained as ‘other benefits not quantified’.

REFERENCES

ADAS, 2011. An Inventory of Mitigation Methods and Guide to their Effects on Diffuse Water Pollution, Greenhouse Gas Emissions and Ammonia Emissions from Agriculture.


PROJECT NAME: Conservation of Existing Land Cover
PROJECT ID #: 165

DESCRIPTION OF ACTIVITY: Conservation of 300 ha grassland

LOCATION: Aso grassland in Kumamoto Prefecture, Japan

PRIMARY CONTACT:
Mitsuru Shibata       Yukihiko Nakamura
4-6-3 Shibuya        Coca-Cola Japan
Shibuya Ward, Tokyo   
+ 81-3-5466-8325
mitshibata@coca-cola.com  yukanakamura@coca-cola.com

OBJECTIVES:
• Source water protection
• Grassland preservation and maintenance
• Biodiversity preservation

BACKGROUND & ACTIVITY DESCRIPTION: The Aso grassland (Figure 1) is located in Kumamoto Prefecture and was formed by resource use during historic times, when volcanic activity constrained forest development. This historic grassland condition has been maintained through grass harvesting, cattle ranching, burning, and other human interventions that protect the expansive grassland landscape from invasive species and protect ecologically rich habitats for diverse plants and animals.

Over the past 40 years the size of the grassland has decreased from approximately 50,000 hectares to 22,000 hectares. Maintenance of the grassland is important to prevent further loss or degradation of the grass cover. This maintenance is increasingly difficult because of changes in farming and life styles, livestock industry depression, aging and scarce successors in the farming populations, and other social and economic changes. Efforts are underway to restore the historic grassland environment (Aso Grassland Restoration Committee website: http://www.env.go.jp/en/nature/npr/nrp_japan/pdf/16_aso.pdf).

Coca-Cola West has provided funding to the Aso Grassland Restoration Committee to support grassland management of 300 hectares. The Aso Grassland Restoration Committee is comprised of a local non-profit organization (NPO) Aso Ecofarmers Center, NPO Aso Flower Field Association, NPO Kyusyu Biomass Forum, NPO The Geoeccological Conservation Network, farmer’s associations, Kumamoto City, Kumamoto Prefecture, and the Ministry of Environment. Coca-Cola West funding supported development of a preservation plan, certification of the current grassland condition through scientific research on the flora and fauna, and execution of the conservation initiative, “Sustainable grassland utilization and maintenance: traditional cattle grazing.” This initiative helped sustain the local grassland users for continued, traditional cattle grazing, and the maintenance of the grasslands serves to reduce runoff and increase groundwater infiltration.
SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 117 ML/YR

ACTIVITY TIMELINE:
- 2011 – Project initiation
- 2012 through 2020 – Continued funding support to maintain the Aso grassland

COCA-COLA CONTRIBUTION: 100%
- Total project cost: $10,000 USD annually through 2020
- TCCC cost: $10,000 USD annually through 2020

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff that would occur by avoiding degradation of the grasslands. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (300 ha is a relatively...
small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers (CN) for the with- and without-project conditions were estimated as follows based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **“With-project”**: healthy grassland
  - Grassland in “good” condition, >75% cover and lightly grazed (CN = 61)
  - Hydrologic soil group “B”
- **“Without-project”**: unmanaged grassland dominated by invasive species
  - Grassland in “poor” condition, ~50% cover and/or heavily grazed (CN = 79)
  - Hydrologic soil group “B”

Daily meteorological data for Hitoyoshi (approximately 85 km from Kumamoto Prefecture) were obtained from the TuTiempo website. These data were compared against long-term average daily climate conditions at Aso and then adjusted to reflect mean annual climate conditions at Aso. Daily precipitation data were used to compute maximum hourly rainfall intensity. The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Curve numbers and processed meteorological data were used to compute daily runoff for the with- and without-project cases for a representative precipitation record (2010-2013). Total annual average runoff volumes and the resulting water quantity benefit for conservation of the 300 hectare native grassland area were estimated as follows:

- **“With-project” (productive grassland)**: 6,506 ML/yr (runoff depth: 2,169 mm/yr)
- **“Without-project” (degraded grassland)**: 6,623 ML/yr (runoff depth: 2,208 mm/yr)
- **Benefit (runoff reduction)**: 117 ML/yr

The total (ultimate) benefit is: 117 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 117 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 117 ML/yr, and TCCC’s benefit (adjusted for cost share) is 117 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>117</td>
<td>117</td>
</tr>
<tr>
<td>2016</td>
<td>117</td>
<td>117</td>
</tr>
<tr>
<td>2017</td>
<td>117</td>
<td>117</td>
</tr>
<tr>
<td>2018</td>
<td>117</td>
<td>117</td>
</tr>
<tr>
<td>2019</td>
<td>117</td>
<td>117</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>117</td>
<td>117</td>
</tr>
</tbody>
</table>

Data Sources:

- Size of grassland management area: 300 ha
- **Slope**: 3% (estimated based on grassland photographs provided by contact)
- **Soil type**: predominately hydrologic soil group (HSG) “B”
  - Andosols with “loam” U.S. Department of Agriculture (USDA) texture classification
  - Characterized by moderately well drained soils and high organic content
  - Based on the Harmonized World Soil Database Viewer version 1.21
- **Meteorological data**
  - Meteorological data obtained from the TuTiempo website (Hitoyoshi) and Japan Meteorological Agency (Aso)
  - Daily average precipitation and air temperature data for 2010-2013 were obtained from the TuTiempo website. Average daily precipitation and air temperature data for the years 1981 through 2010 were obtained for the Aso-Otohime weather station.

Assumptions:

- “With-project” (i.e., productive grassland) conditions were assumed to be grassland cover in “good” condition (>75% cover and lightly grazed), and “without-project” (i.e., degraded grassland) conditions were assumed to be grassland cover in “poor” condition (50% cover and/or heavily grazed).
- SWAT model parameter “CNCOEF” was set to 2.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur due to avoiding degradation of the grasslands. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated based on daily precipitation data for the 2010-2013 period.
The Cover/Management Factors ($C_{usle}$) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

- “With-project”: meadow with highly productive grass ($C_{usle} = 0.004$)
- “Without-project”: meadow with moderately productive grass ($C_{usle} = 0.01$)

Total annual sediment yields for the grassland were estimated as follows:

- **With-project**: 1,717 MT/yr (sediment unit area yield: 5.7 MT/ha/yr)
- **Without-project**: 4,369 MT/yr (sediment unit area yield: 14.6 MT/ha/yr)

**Benefit (reduced sediment yield): 2,652 MT/yr**

**The total benefit (reduced sediment yield) is:** 2,652 MT/yr and TCCC’s benefit (adjusted for cost share) is 2,652 MT/yr.
**The 2014 benefit is:** 2,652 MT/yr and TCCC’s benefit (adjusted for cost share) is 2,652 MT/yr.

Data Sources:

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.
- A soil erodibility factor of 0.37 was estimated for loamy soil with approximately 1-2% carbon content based on Haith et al. (1992).
- Cover factors for grassy meadows were obtained from Haith et al. (1992).

Assumptions:

- The Cover Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and among years).

**OTHER BENEFITS NOT QUANTIFIED**

- Increase in infiltration and baseflow
- Improvements in terrestrial habitat and biodiversity
- Maintain/protect biodiversity

**NOTES**

- This fact sheet updates the February 2014 version to present 2014 results and extend the projected benefits through 2019.

**REFERENCES**

Aso Grassland Restoration Committee


PROJECT NAME: Improving Fort Shaw Irrigation District Water Efficiency to Improve Sun River Flow

PROJECT ID #: 167

DESCRIPTION OF ACTIVITY: Instream flow restoration

LOCATION: Sun River, Montana

PRIMARY CONTACTS:

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laura Ziemer</td>
<td>Senior Counsel and Water Policy Advisor</td>
<td>Trout Unlimited</td>
</tr>
<tr>
<td>Rena Ann Striker</td>
<td>Contract Ecologist</td>
<td>CCNA Group Environment &amp; Sustainability</td>
</tr>
<tr>
<td>Jon Radtke</td>
<td>Manager, Water Resources</td>
<td>CCNA Group Environment &amp; Sustainability</td>
</tr>
<tr>
<td>406-522-7291</td>
<td></td>
<td></td>
</tr>
<tr>
<td><a href="mailto:LZiemer@tu.org">LZiemer@tu.org</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td><a href="mailto:rstricker@coca-cola.com">rstricker@coca-cola.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td><a href="mailto:jradtke@coca-cola.com">jradtke@coca-cola.com</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OBJECTIVES:

- Improve Sun River instream flows
- Improve habitat for Sun River’s wild trout fishery
- Improve water quality and lower summer Sun River water temperature
- Improve the reliability of irrigation water delivery and management in the Fort Shaw Irrigation District
- Analyze and optimize Sun River basin reservoir operations to reliably deliver conserved water for Sun River instream flows

BACKGROUND & DESCRIPTION OF ACTIVITY: The North Fork of the Sun River originates in the Bob Marshall Wilderness, meeting up with the South Fork of the Sun River approximately 20 miles downstream, where the combined flows enter Gibson Reservoir, becoming the Sun River. The Sun River is the source of water for the Fort Shaw Irrigation District (District), which distributes water to over 11,000 acres of agricultural crops on 177 small farms. The water flows from the river by gravity through a 16-mile long main canal and into the distribution system which has a total length of 85 miles. Over the past ten years, the Sun River, downstream of the District’s headworks, has gone dry on numerous occasions. The Sun River’s junior-priority instream flow reservation held by the Montana Department of Fish, Wildlife, and Parks is up to 220 cubic feet per second (cfs), with a minimum of 130 cfs. Anything less than 130 cfs on the Sun River stresses fish populations. The Bureau of Reclamation’s minimum flow operating criteria is 50 cfs, which only just about keeps the river bed from being dry.

The District is an aging Bureau of Reclamation (BoR) irrigation facility, and until recently, only small improvements had been completed since its construction in 1908. A 1983 BoR Report reviewing the District’s infrastructure status identified many areas in immediate need of repair to enhance the District’s efficiencies (Bureau of Reclamation, 1983). An important part of that report listed the main canal siphon as a limiting factor to efficient delivery of water to one-third of the District’s irrigation acres as a need to improve water management. As the water diverted from the Sun River makes its way across the project, project inefficiencies and major seeps in the canals have an estimated efficiency of only 46% (average for the District as a whole) as identified from the 1983 BoR Report. This loss is readily noticed in the loss acreage from the boggy areas and areas with high salinity. This water quantity issue impacts the small farmers, fisheries, wildlife and recreation in the area. In spite of the 1983 BoR Report findings, improvements to the District have been minimal, due to the small size of the District and low net return from crops.
This project was focused on upgrading the most antiquated and wasteful delivery systems to improve irrigation efficiency, and as a result improve instream Sun River flows. The Coca-Cola Company provided cost-share to match the public investments through state and federal programs. The Bureau of Reclamation provided the largest funding contribution, by generously supporting the FSID in tackling its backlog of long over-due upgrades to its water delivery system through two WaterSmart grants, one in 2012 and the second in 2013 (FSID, 2012; FSID, 2013a).

This project involved completion of detailed environmental and historic compliance reviews, final engineering and design, and subsequent installation of:

- A new bypass canal and pipe to deliver water directly to the “A System” area of the FSID before the water-delivery bottleneck of FSID’s irrigation infrastructure, the main canal siphon over Simms Creek,
- 2,000 feet of new lined canal to deliver “A System” water,
- 2,310 feet of PVC pipe to deliver “A System” water,
- Retirement of an old, leaky 1,500-foot section of irrigation ditch no longer needed to deliver water to the “A System,” within FSID, and
- Reduction of canal flows in 3,700-feet of FSID main canal which was losing a high volume of water, due to the new bypass lined canal and PVC pipe delivering water directly to the “A System” area of FSID.
- Conversion of 10,800 feet of open ditch to PVC pipe to deliver water within the “A-2-9 System” of FSID.

Figure 1 shows photos of some of these completed improvements. Together, these ambitious improvements result in the conservation of 9,185 acre-feet of water.

The District has agreed, through a Memorandum of Understanding with the Sun River Watershed Group, to allocate the conserved water to instream flows (FSID, 2013). The 9,185 acre-feet of conserved water is delivered to the Sun River in proportion to how the District actually diverts water through its main canal:

- April 2% = 184 acre-feet = 9.3 cfs (starting April 21st)
- May 17% = 1,561 acre-feet = 25.4 cfs
- June 19% = 1,745 acre-feet = 29.3 cfs
- July 26% = 2,388 acre-feet = 38.8 cfs
- Aug 21% = 1,929 acre-feet = 31.4 cfs
- Sept 13% = 1,194 acre-feet = 20.1 cfs
- Oct 2% = 183.7 acre-feet = 9.3 cfs (ending October 10th)

The project benefits are accurately captured by the United States Geological Survey (USGS) flow gauging station, the Simms USGS gauge, located downstream of Fort Shaw’s diversion which collects real-time flow measurements that are available on-line through the USGS flow-data archive. See, http://waterdata.usgs.gov/mt/nwis/uv/?site_no=06085800&PARAMeter_cd=00060,00065,00010. As a result of this project, the conserved water is added to the Bureau of Reclamation’s operational 50 cfs minimum flow for the Sun River, bringing the Sun River much closer to the 130 cfs instream flow reservation, and restoring habitat for the Sun’s wild trout. The low-flow conditions in the Sun River have limited the wild rainbow and brown trout fishery to between 40 and 120 fish over 8 inches per mile.
With consistently improved flows, the goal of the Sun River Watershed Group to increase fish populations to 400 fish per mile is achievable in the coming years. In good water years, the addition of the conserved water means that Sun River flows can stay above 100 cfs through the summer irrigation season. The project’s success means that the project partners are on track to meet their over-arching goal: increase the security of agricultural water supply while also restoring flows to the dewatered Sun River.

In 2014, Sun River flows stayed above 100 cfs throughout the irrigation season, except for a one-day dip to 80 cfs due to working out communications on releases from Gibson Reservoir and downstream irrigation diversions. To illustrate the achievement that this represented, and demonstrate the 9,185 acre-feet of water left instream, project partner Trout Unlimited reviewed the period of record for the USGS Simms Gauge (06085800), located on the Sun River, 4.5 miles downstream of the Fort Shaw Irrigation District’s main canal diversion from the Sun, and 51.5 miles downstream of the Diversion Dam below Gibson Reservoir at the head of the Sun River. Trout Unlimited selected water years in the period of record of the USGS Simms Gauge that were within 10% of the 2014 total inflows to the Sun River basin through August of 2014. There were 3 other years that fit this “within 10%” criteria: 2012, 2008, and 2002, and in each of these years the Sun River was frequently below 100 cfs. The flow duration curve (Figure 2) provides a comparison of the April 21 – Oct. 10 Sun River flows at the USGS gage for these similar water years, showing the increase in flows above 100 cfs during 2014.
This figure illustrates that flows during water years similar to 2014 (2002, 2008 and 2012) were less than 100 cfs approximately 70% of the time between April 21 and Oct. 10, prior to this project. After this project (2014) flows are above 100 cfs almost 100% of the time between April 21 and Oct. 10.

SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 3,512 ML/yr

ACTIVITY TIMELINE:
- Fall 2012 – Winter 2013: Project initiation, design and engineering begun; negotiation of Memorandum of Understanding (MOU) on instream dedication of conserved water underway.
- Fall 2013 – Design and engineering review completed; MOU finalized.
- Winter 2014 – Completed 2000’ of canal lining on new canal; excavation for and placement of 2,310’ of 36” PVC pipe; retirement of 1,500 feet of old canal; analyze and determine target river flows based on estimated volume of conserved water and snowpack accumulation and precipitation forecast.
- Summer 2014 – By-pass project completed; although canal liner failed in mid-irrigation season.
- Fall 2014 – Engineering firm replaced failed canal liner; construction begun on replacing ditch delivery with 10,800’ of 8” to 24” PVC pipe to deliver water to A-2-9 System. Construction expected to be complete prior to 2015 irrigation system.

COCA-COLA CONTRIBUTION: 31%
- Total Cost: $732,336
  - TCCC Cost: $229,099
  - Bureau of Reclamation WaterSmart program: $499,537
  - Watershed group partners: $3,700

The Coca-Cola Company’s contribution allocated $98,550 towards construction and material costs, and $130,549 towards the instream flow project’s monitoring, water rights change, and reservoir operations optimization.
WATERSHED BENEFITS CALCULATED:

1. Increase in streamflow

1. INCREASE IN STREAMFLOW

Approach & Results:
The benefit of the irrigation system improvements is calculated as the difference between the pre-project and post-project condition.

- **Pre-project**: Sun River flows routinely dropped well below the 130 cfs state-held instream flow reservation on the Sun River, with flows often dropping below 100 cfs in the decade before project implementation, while Sun River Watershed Group members discussed, analyzed, prioritized, and fund-raised for solutions. In the decade prior to that, the Sun River often went dry below the last irrigation diversion, and often dropped to 50 cfs or below.

- **Post-project**: As a result of the Fort Shaw Irrigation District system improvements, additional flows were restored to the Sun River during the critical summer low flow period, as follows:

<table>
<thead>
<tr>
<th>Month</th>
<th>%</th>
<th>Acre-Feet</th>
<th>CFS</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>2%</td>
<td>184</td>
<td>9.3</td>
</tr>
<tr>
<td>May</td>
<td>17%</td>
<td>1,561</td>
<td>25.4</td>
</tr>
<tr>
<td>June</td>
<td>19%</td>
<td>1,745</td>
<td>29.3</td>
</tr>
<tr>
<td>July</td>
<td>26%</td>
<td>2,388</td>
<td>38.8</td>
</tr>
<tr>
<td>Aug</td>
<td>21%</td>
<td>1,929</td>
<td>31.4</td>
</tr>
<tr>
<td>Sept</td>
<td>13%</td>
<td>1,194</td>
<td>20.1</td>
</tr>
<tr>
<td>Oct</td>
<td>2%</td>
<td>183.7</td>
<td>9.3</td>
</tr>
</tbody>
</table>

The additional post-project flows in the Sun River during the summer low flow period are 9,185 acre-feet. These are the flows used to calculate the replenish benefit. Post-project flows are calculated as follows:

A-Drop Bypass Canal.
The A-Drop lined canal and pipe eliminated ditch loss via infiltration on 5,200 feet of canal through retirement of 1,500 feet of old canal and reducing high flows in 3,700 feet of the main FSID canal that was leading to an estimated ditch loss of 1 gpm/linear foot of canal (TD&H Engineering, 2012). The new, lined canal and PVC pipe were assumed to have no ditch loss. Although the Fort Shaw Irrigation District’s legal period of use on their irrigation rights is April 1 to October 31 (214 days), the effective irrigation period is typically shorter, approximately 180 days (April 20 through October 15), depending on the year. Although for the protection of instream flows we assumed a fall irrigation schedule truncated by 6 days because river flows typically come up in October with return flows (ending October 10), the below calculation of ditch loss assumes the 180-day period.

\[
1 \text{ gpm/linear foot of canal} \times (5,200 \text{ feet of canal}) = 5,200 \text{ gpm ditch loss} \\
5,200 \text{ gpm} \times (1 \text{ cfs/448.8 gpm}) \times (1.99 \text{ a-f/day/cfs}) = 23.1 \text{ acre-feet/day} \\
23.1 \text{ acre-feet/day} \times (180\text{-day irrigation season}) = 4,158 \text{ acre-feet}
\]

A-2-9 Water Delivery Upgrade.
The A-2-9 Water Delivery Upgrade replaced ditches with 10,800 feet of 8” to 24” PVC pipe to deliver water within this part of the FSID. The Bureau of Reclamation (1983) previously estimated a 39% ditch
loss specific to the A-2-9 canals based on recorded seepage loss; it is assumed that the A-2-9 Water Delivery Upgrade has resulted in no ditch loss because it is now in a pipe. 12,820 acre-feet of water are currently being delivered annually through the A-2-9 system. 39% of 12,820 acre-feet annually is 5,000 acre-feet annually in conserved water.

Together the two projects conserve: 4,185 acre-feet/yr + 5,000 acre-feet/yr = 9,185 acre-feet/yr.

\[ \text{Total benefit} = 9,185 \text{ acre-feet/year} \times (1,233,481 \text{ liters/acre-foot}) = 11,329 \text{ ML/yr} \]

The total (ultimate) benefit is: 11,329 ML/yr

The total (ultimate) benefit taken as a function of cost share is: 3,512 ML/yr

The current (2014) TCCC benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 11,329 ML/yr and TCCC’s benefit (adjusted for cost share) is 3,512 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. Projected benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

**Table 1. Projected Water Quantity Benefits Summary**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>11,329</td>
<td>3,512</td>
</tr>
<tr>
<td>2016</td>
<td>11,329</td>
<td>3,512</td>
</tr>
<tr>
<td>2017</td>
<td>11,329</td>
<td>3,512</td>
</tr>
<tr>
<td>2018</td>
<td>11,329</td>
<td>3,512</td>
</tr>
<tr>
<td>2019</td>
<td>11,329</td>
<td>3,512</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>11,329</td>
<td>3,512</td>
</tr>
</tbody>
</table>

**Data Sources/Site-specific characteristics:**

- All data were provided Laura Ziemer, Trout Unlimited.

**Assumptions:**

- The life of the project is estimated to be 30 years, or through 2044, based on the expected life of the construction materials (PVC pipe, canal liner, and siphon over Simms Creek).
- A-Drop Bypass Canal: The old canal had an estimated ditch loss of 1 gpm/linear foot of canal. The new, lined canal and PVC pipe were assumed to have no ditch loss.
- A-2-9 Water Delivery Upgrade: The Bureau of Reclamation (1983) previously estimated a 39% ditch loss specific to the A-2-9 canals based on recorded seepage loss; it is assumed that the A-2-9 Water Delivery Upgrade has resulted in no ditch loss.
OTHER BENEFITS NOT QUANTIFIED

- Restoration of natural sediment regimes
- Improved water quality
- Regulated water temperature
- Restored habitat for aquatic species

NOTES

- None.

REFERENCES


Fort Shaw Irrigation District. 2013a. WaterSMART: Water and Energy Efficiency Grant Program, Improving Fort Shaw Irrigation District Water Efficiency to Improve Sun River Flow Phase II.


PROJECT NAME: Laguna Irrigation District Groundwater Recharge Project

PROJECT ID #: 168

DESCRIPTION OF ACTIVITY: Development of a groundwater recharge site (52 acres)

LOCATION: Laguna Irrigation District in Fresno County, California

PRIMARY CONTACTS:
Kelli McCune          Rena Ann Stricker          Jon Radtke
Senior Project Manager  Contract Ecologist  Manager, Water Resources
Sustainable Conservation  CCNA Group Environment &  CCNA Group Environment &
Conservation  Sustainability  Sustainability
415-977-0380          404-395-6250          404-676-9112
kmccune@suscon.org  rstricker@coca-cola.com  jradtke@coca-cola.com

OBJECTIVES:
- Recharge the groundwater supply
- Improve groundwater quality
- Safeguard the groundwater aquifer to secure a reliable regional supply of quality water for agriculture, communities and the environment
- Reduce downstream flood damage to communities along the Kings River corridor through floodwater diversion

BACKGROUND & DESCRIPTION OF ACTIVITY: The San Joaquin Valley is California’s top agricultural producing region. Groundwater in this area is over-drafted and groundwater levels are declining. This project makes beneficial use of floodwaters for groundwater recharge through the development of a groundwater recharge basin on a 52-acre site. The project site is located in Laguna Irrigation District in Fresno County, California, within the Tulare Lake Watershed (Figure 1). The Kings River Conservation District (KRCD) is responsible for regional groundwater management within the entire Kings River Basin. The Laguna Irrigation District is one of several water agencies that work collectively with the KRCD to manage the groundwater resources in western Fresno and Kings Counties. Laguna Irrigation District manages distribution of water to 75,000 acres including its own district and for the Murphy Slough Association.

The project site is one of eleven sites owned, developed and managed by the Laguna Irrigation District for groundwater recharge. The recharge basin is designed to capture Kings River floodwater for groundwater recharge, resulting in an increased supply of groundwater that can be pumped by public and private wells and used during droughts. This project will also improve local groundwater quality by recharging and diluting degraded groundwater with high-quality Kings River water that originates in the Sierra Nevada Mountains as snow.

The primary water source for recharge in the basin is Kings River excess floodwaters. This project also involves improvements to the conveyance capacity of Liberty Canal to increase the quantity of water that can be delivered to the site. In addition, the project includes a turnout and check structure on Liberty Canal, flowmeters, a basin with exterior levees, a settling channel, an outlet to Murphy Slough, and monitoring wells.
SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 2,605.7 ML/YR

ACTIVITY TIMELINE:
- November, 2014 – Recharge basin construction initiated
- January 2015 – Recharge basin construction completed

COCA-COLA CONTRIBUTION: 81.1%
- Total Cost of Project Construction: $308,250
- TCCC Contribution: $250,000

WATERSHED BENEFITS CALCULATED:
1. Groundwater Recharge
1. GROUNDWATER RECHARGE

Approach & Results:

The replenish benefit was calculated as the average annual recharge potential of the groundwater recharge basin. The recharge potential was estimated as a function of infiltration rate, area of the recharge basin, water availability and flood frequency.

- **Soil Infiltration Rate:** Geologic analysis of the local materials at the site suggest that below a carapace of fine grained materials, coarse grained materials dominate in the subsurface (Provost and Pritchard, 2013). This study suggests that the long-term infiltration rate for the recharge basin is 1.5 ft/day or greater. Conservatively, an infiltration rate of 1.5 ft/day was considered in the calculations.

- **Area of Recharge Basin:** The total area of the recharge basin is 52 acres (Provost and Pritchard, 2013). The wetted surface area of the basin floor is designed as 41 acres. The remaining 11 acres consists of levees, roads and a hill slope around the recharge area.

- **Water Availability and Flood Frequency:** The primary water supply for the recharge basin is Kings River floodwater. Floodwater is assumed to be available to the Laguna Irrigation District only when flood releases average at least 2,000 cfs at James Bypass near the terminus of the Kings River. This flow rate represents real surplus water that was not used by other parties who may be diverting and using floodwater upstream. Based on this assumption and the historical data from 1954 to 2011, floodwater is available in 35 percent of years (Provost and Pritchard, 2013). During wet years, floodwater is available, on average, 121 days (Provost and Pritchard, 2013). Therefore, over the long term, floodwater is available 35% x 121 days = an average of 42 days per year. The timing of the water availability ranges from early winter rainfall in December through the last of the snowmelt in September.

The average annual recharge potential of the groundwater recharge basin is calculated as follows:

\[
\text{Recharge potential} = \text{Infiltration rate} \times \text{Basin area} \times \text{Days of flood flows} \times \% \text{years with flood flow}
\]

\[
\text{Recharge potential} = 1.5 \text{ ft/day} \times 41 \text{ acres} \times 121 \text{ days} \times 35\% = 2605 \text{ acre-ft} = 3,213 \text{ ML/ year}^{1}
\]

The total water quantity benefit is calculated as **3,213 ML/yr**.

**Total (ultimate) benefit is:** 3,213 ML/yr

**TCCC total (ultimate) benefit taken as a function of cost share is:** 2,605.7 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.
2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 3,213 ML/yr and TCCC’s benefit (adjusted for cost share) is 2,605.7 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>3,213</td>
<td>2,605.7</td>
</tr>
<tr>
<td>2016</td>
<td>3,213</td>
<td>2,605.7</td>
</tr>
<tr>
<td>2017</td>
<td>3,213</td>
<td>2,605.7</td>
</tr>
<tr>
<td>2018</td>
<td>3,213</td>
<td>2,605.7</td>
</tr>
<tr>
<td>2019</td>
<td>3,213</td>
<td>2,605.7</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>3,213</td>
<td>2,605.7</td>
</tr>
</tbody>
</table>

Data Sources:
- All information and references were provided by Sustainable Conservation.

Ongoing management and monitoring:
Laguna Irrigation District will manage the recharge basin into perpetuity. They currently manage other recharge basins in their service area, and they will add this basin to their annual management activities. The District will cover the cost of ongoing management, which is approximately $5,000 per year based on other recharge basin management costs. Finally, monitoring wells surround this recharge basin and will be used to monitor the quantity of recharge during wet years when floodwater is directed into this recharge basin.

Assumptions:
- Kings River floodwater is the primary water source for the recharge basin.
- Based on historical data (1954-2011), floodwater is available in 35% of the years. The benefit calculation is adjusted to reflect 35% floodwater availability (Provost and Pritchard, 2013).
- Based on historical data (1954-2011) floodwater is available, on average, for 121 days during wet years (Provost and Pritchard, 2013).
- Evaporation is assumed to be offset by direct precipitation onto the basin, since water will be primarily recharged in the winter and spring.
- The infiltration capacity estimate is based on the assumption that the Laguna Irrigation District is diligent in maintaining the basin.
- The infiltration capacity is based on a geologic analysis of local materials.
OTHER BENEFITS NOT QUANTIFIED
- Enhanced habitat and ecosystem services
- Improved groundwater quality
- Reduced downstream flooding

NOTES
- Provost and Pritchard 2013 estimated a slightly higher recharge potential (than what is presented in this fact sheet) as a function of potential basin water depth, which could accelerate infiltration rates when the basin is full. However, we have chosen to use a more conservative rate since the basin soils will infiltrate 1.5ft/day whenever there are flood flows available, even at much shallower depths in the basin.

REFERENCES

PROJECT NAME: Protection and Restoration of Natural Paramo Areas in the Guambi Watershed – Quito Water Fund (FONAG)

PROJECT ID #: 169

DESCRIPTION OF ACTIVITY: Conservation and restoration (147 hectares); revegetation (151.26 hectares)

LOCATION: Guambi Watershed, Cerro Puntas Mountain near Cayambe Coca National Park, northeast of Quito, Ecuador. Latitude -0.241, Longitude -78.239

PRIMARY CONTACTS:
Jorge Leon Sarmiento
Latin America Water Funds Specialist
The Nature Conservancy
Cartagena de Indias, Colombia
(+57) 317-5100-880
jleon@tnc.org

Silvia Benitez P.
Water Security Team, Latin America Region
The Nature Conservancy
Quito, Ecuador
(593) 2-2257 138 ext 104
sbenitez@tnc.org

Erick Ramírez
Environmental and Safety Manager
Latin Center Business Unit
Coca-Cola
(+506) 61853276
erickramirez@coca-cola.com

OBJECTIVES:
• Facilitate conservation and regeneration of natural vegetation cover
• Protect area from further degradation

BACKGROUND & ACTIVITY DESCRIPTION: The project area is located within the Guambi subwatershed, on Cerro Puntas mountain, northeast of Quito, Ecuador (Figure 1). This area has very steep slopes, with slopes on the specific properties undergoing restoration ranging from 15.19% (Nueva Esperanza) to 60% (Hacienda Pitana). Natural ecosystems in the area include high-montane grasslands known as paramo, which is characterized by dense natural vegetation comprised of 2-3 meter shrubs and 1-1.5 meter tall tussock grasses. Paramo vegetation has a very dense root system and paramo soil has very high organic matter content that degrades very slowly, resulting in high water retention capabilities.
Over the past 20 years, the project area has been impacted by ranching and some agriculture, primarily potato cultivation. The dominant land cover in non-natural areas is pastures. Grazing and human-induced fire have caused degradation of the paramo vegetation within the project area, with 90% of the area having sparse presence of shrubs and native grasses. Figure 2 shows the current condition of the project area. Some nearby areas have suffered from extreme degradation, characterized by highly compacted soil, large patches of bare soil, and replacement of native grasses with introduced grasses (Figure 3).
This project implements restoration activities on two properties, Hacienda Pitana and Nueva Esperanza. The project includes two activities on each property:

1. **Conservation and passive restoration.** Areas have been set aside to allow for conservation and natural regeneration of high-montane paramo vegetation. This activity protects a total of 147 hectares, 85 hectares on Hacienda Pitana and 62 hectares on the Nueva Esperanza property. Conservation agreements have been signed with communities and land owners to keep cattle out and prohibit burning, and barbed wire fences have been installed to create physical barriers for cattle. As a result of this project, this area has been protected from further degradation resulting from grazing and fire, and high-montane paramo vegetation will be allowed to naturally regenerate.

2. **Revegetation of severely degraded areas.** Native trees, including *Polylepis incana*, *Polylepis reticulata*, and *Gynoxys sp* have been planted in these areas. These plants will provide a dense forest that will allow growth of other native vegetation. This activity restores 151.26 hectares on the two properties, 57.80 hectares on the Hacienda Pitana property and 93.46 hectares on the Nueva Esperanza property, by planting 816 plants per hectare 3.5 m from each other in 30 cm wide by 30 cm deep holes.
Figure 4 depicts the desired post-project condition, with dense, natural paramo cover, including trees, tussock grasses and shrubs.

Figure 4. Future desired condition resulting from protection and restoration, including dense paramo vegetation, shrubs and tall native grasses.

SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 359.1 ML/YR

ACTIVITY TIMELINE:
April 2014 - December 2014
1. Protection and restoration of 147 hectares, involving:
   - Signing of conservation agreements
   - Installation of physical barriers
2. Revegetation of 151.26 hectares, involving:
   - Planting of native tree species

COCA-COLA CONTRIBUTION:
- 100% for passive restoration activities
- 80% for revegetation

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff due to implementation of project activities involving land use changes. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (298.26 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).
Curve numbers for the pre- and post-project conditions were provided by Jorge Leon (TNC) based on information provided in the TR-55 document (USDA-NRCS, 1986):

Conservation and Passive Restoration

Pitana (85 ha):
- Project areas are predominantly hydrologic soil group (HSG) “B”
  - **Without-project:** No Paramo conservation
    - Pasture, grassland or range in “poor” condition, <50% cover (CN = 79)
  - **With-project:** Paramo conservation
    - Brush/weed/grass mixture in “good” condition, >75% cover (CN = 48)

Nueva Esperanza (62 ha):
- Project areas are predominantly hydrologic soil group (HSG) “B” (31 ha) and “C” (31 ha)
  - **Without-project:** No Paramo conservation
    - For HSG B – Pasture, grassland or range in “poor” condition, <50% cover (CN = 79)
    - For HSG C – Pasture, grassland or range in “poor” condition, <50% cover (CN = 86)
  - **With-project:** Paramo conservation
    - For HSG B – Brush/weed/grass mixture in “good” condition, >75% cover (CN = 48)
    - For HSG C – Brush/weed/grass mixture in “good” condition, >75% cover (CN = 65)

Revegetation of Severely Degraded Areas

Pitana (57.80 ha):
- Project areas are predominantly hydrologic soil groups (HSG) “B” (41.21 ha) and “C” (16.59 ha)
  - **Without-project:** Degraded pasture
    - For HSG B – Pasture, grassland or range in “poor” condition, <50% cover (CN = 79)
    - For HSG C – Pasture, grassland or range in “poor” condition, <50% cover (CN = 86)
  - **With-project:** Revegetation of degraded areas
    - For HSG B – Brush/weed/grass mixture in “good” condition, >75% cover (CN = 48)
    - For HSG C – Brush/weed/grass mixture in “good” condition, >75% cover (CN = 65)

Nueva Esperanza (93.46 ha):
- Project areas are predominantly hydrologic soil groups (HSG) “B” (48.76 ha) and “C” (44.7 ha)
  - **Without-project:** Degraded pasture
    - For HSG B – Pasture, grassland or range in “poor” condition, <50% cover (CN = 79)
    - For HSG C – Pasture, grassland or range in “poor” condition, <50% cover (CN = 86)
  - **With-project:** Revegetation of degraded areas
    - For HSG B – Brush/weed/grass mixture in “good” condition, >75% cover (CN = 48)
    - For HSG C – Brush/weed/grass mixture in “good” condition, >75% cover (CN = 65)
Daily precipitation and air temperature data were provided for the 2010-2013 period by Jorge Leon (TNC). The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Curve numbers and processed meteorological data were used to compute daily runoff for the without-and with-project cases for a 4-year period (2010-2013). Total annual average runoff volumes and the resulting water quantity benefit for protecting the 298.26 ha project area was estimated as follows:

Conservation and Passive Restoration

- **Without-project (no Paramo conservation): 611.3 ML/yr**
  - Pitana (HSG B – 85 ha): 344.8 ML/yr (runoff depth: 405.6 mm/yr)
  - Nueva Esperanza (HSG B – 31 ha): 125.7 ML/yr (runoff depth: 405.4 mm/yr)
  - Nueva Esperanza (HSG C – 31 ha): 140.8 ML/yr (runoff depth: 454.2 mm/yr)

- **With-project (Paramo conservation): 411.2 ML/yr**
  - Pitana (HSG B – 85 ha): 224.2 ML/yr (runoff depth: 263.7 mm/yr)
  - Nueva Esperanza (HSG B – 31 ha): 81.7 ML/yr (runoff depth: 263.5 mm/yr)
  - Nueva Esperanza (HSG C – 31 ha): 105.3 ML/yr (runoff depth: 339.6 mm/yr)

- **Benefit from conservation and passive restoration (runoff reduction): 200.1 ML/yr**
  - Pitana (HSG B – 85 ha): 120.6 ML/yr
  - Nueva Esperanza (HSG B – 31 ha): 44.0 ML/yr
  - Nueva Esperanza (HSG C – 31 ha): 35.5 ML/yr

Revegetation of Severely Degraded Areas

- **Without-project (degraded pasture): 640.1 ML/yr**
  - Pitana (HSG B – 41.21 ha): 167.1 ML/yr (runoff depth: 405.4 mm/yr)
  - Pitana (HSG C – 16.59 ha): 75.4 ML/yr (runoff depth: 454.3 mm/yr)
  - Nueva Esperanza (HSG B – 48.76 ha): 194.7 ML/yr (runoff depth: 399.2 mm/yr)
  - Nueva Esperanza (HSG C – 44.7 ha): 202.9 ML/yr (runoff depth: 453.9 mm/yr)

- **With-project (Paramo conservation): 441.4 ML/yr**
  - Pitana (HSG B – 41.21 ha): 108.6 ML/yr (runoff depth: 263.5 mm/yr)
  - Pitana (HSG C – 16.59 ha): 56.4 ML/yr (runoff depth: 339.7 mm/yr)
  - Nueva Esperanza (HSG B – 48.76 ha): 124.7 ML/yr (runoff depth: 255.6 mm/yr)
  - Nueva Esperanza (HSG C – 44.7 ha): 151.7 ML/yr (runoff depth: 339.3 mm/yr)

- **Benefit from revegetation of severely degraded areas (runoff reduction): 198.7 ML/yr**
  - Pitana (HSG B – 41.21 ha): 58.5 ML/yr
  - Pitana (HSG C – 16.59 ha): 19.0 ML/yr
  - Nueva Esperanza (HSG B – 48.76 ha): 70.0 ML/yr
  - Nueva Esperanza (HSG C – 44.7 ha): 51.2 ML/yr
The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

**The total (ultimate) benefit is:** $200.1+198.7\text{ ML/yr} = 398.8\text{ ML/yr}

**TCCC total (ultimate) benefit taken as a function of cost share is:** $200.1+ 198.7\times(80\%) = 359.1\text{ ML/yr}

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 398.8 ML/yr, and TCCC’s benefit (adjusted for cost share) is 359.1 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>398.8</td>
<td>359.1</td>
</tr>
<tr>
<td>2016</td>
<td>398.8</td>
<td>359.1</td>
</tr>
<tr>
<td>2017</td>
<td>398.8</td>
<td>359.1</td>
</tr>
<tr>
<td>2018</td>
<td>398.8</td>
<td>359.1</td>
</tr>
<tr>
<td>2019</td>
<td>398.8</td>
<td>359.1</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>398.8</td>
<td>359.1</td>
</tr>
</tbody>
</table>

**Data Sources:**

- **Size of project areas:** provided by Jorge Leon, TNC
  - Conservation and passive restoration
    - Pitana: HSG B – 85 ha
    - Nueva Esperanza: HSG B – 31 ha
    - Nueva Esperanza: HSG C – 31 ha
  - Revegetation of severely degraded areas
    - Pitana: HSG B – 41.21 ha
    - Pitana: HSG C – 16.59 ha
    - Nueva Esperanza: HSG B – 48.76 ha
    - Nueva Esperanza: HSG C – 44.7 ha
**Slope**: provided by Jorge Leon, TNC

**Conservation and passive restoration**
- Pitana: HSG B – 60%
- Nueva Esperanza: HSG B – 40%
- Nueva Esperanza: HSG C – 40%

**Revegetation of severely degraded areas**
- Pitana: HSG B – 40.72%
- Pitana: HSG C – 49.92%
- Nueva Esperanza: HSG B – 15.19%
- Nueva Esperanza: HSG C – 34.45%

**Soil type**: provided by Jorge Leon, TNC
- Project areas are predominantly characterized by hydrologic soil group (HSG) “B” and “C” soils.
- Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.
- Type B soils have characteristics of loam, silt loam with moderately fine to moderately coarse texture and moderate infiltration rates when thoroughly wetted.

**Meteorological data**: Daily precipitation and air temperature data were provided by Jorge Leon (TNC).

All of the above information on data sources is contained in a data package provided by Jorge Leon (TNC) on 09/29/2014 titled “1_FONAG_Ecuador.zip” and on 12/16/2014 titled “1_FONAG_Ecuador_december_2014.zip.”

**Assumptions**:
- If not conserved/revegetated, degradation would occur through grazing and human-induced fire.
- “Without-project” conditions for both conservation and passive restoration and revegetation of severely degraded areas were assumed to be pasture, grassland or range in “poor” condition (<50% cover and/or heavily grazed), and “with-project” conditions were assumed to be a brush/weed/grass mixture in “good” condition (>75% cover).
- SWAT model parameter “CNCOEF” was set to 1.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

### 2. DECREASE IN SEDIMENT EROSION/RUNOFF

**Approach & Results**:
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of implementation of project activities involving land use changes. The
meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the 2010-2013 period.

The Cover/Management Factors (C\textsubscript{usle}) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

- **Without-project**: Pasture, 60% ground cover as grass (C\textsubscript{usle} = 0.04)
- **With-project**: Pasture, 95 – 100% ground cover as grass (C\textsubscript{usle} = 0.003)

Total annual sediment yields for the project area were estimated as follows:

**Conservation and Passive Restoration**

- **Without-project (no Paramo conservation)**: 92,256 MT/yr
  - Pitana (HSG B – 85 ha): 69,972 MT/yr (sediment unit area yield: 823.2 MT/ha/yr)
  - Nueva Esperanza (HSG B – 31 ha): 12,210 MT/yr (sediment unit area yield: 393.9 MT/ha/yr)
  - Nueva Esperanza (HSG C – 31 ha): 10,074 MT/yr (sediment unit area yield: 325.0 MT/ha/yr)
- **With-project (Paramo conservation)**: 4,559 MT/yr
  - Pitana (HSG B – 85 ha): 3,401 MT/yr (sediment unit area yield: 40.0 MT/ha/yr)
  - Nueva Esperanza (HSG B – 31 ha): 593 MT/yr (sediment unit area yield: 19.1 MT/ha/yr)
  - Nueva Esperanza (HSG C – 31 ha): 565 MT/yr (sediment unit area yield: 18.2 MT/ha/yr)
- **Benefit from conservation and passive restoration (reduced sediment yield)**: 87,697 MT/yr
  - Pitana (HSG B – 85 ha): 66,571 MT/yr
  - Nueva Esperanza (HSG B – 31 ha): 11,617 MT/yr
  - Nueva Esperanza (HSG C – 31 ha): 9,509 MT/yr

**Revegetation of Severely Degraded Areas**

- **Without-project (degraded pasture)**: 40,224 MT/yr
  - Pitana (HSG B – 41.21 ha): 17,285 MT/yr (sediment unit area yield: 419.4 MT/ha/yr)
  - Pitana (HSG C – 16.59 ha): 7,077 MT/yr (sediment unit area yield: 426.6 MT/ha/yr)
  - Nueva Esperanza (HSG B – 48.76 ha): 3,971 MT/yr (sediment unit area yield: 81.4 MT/ha/yr)
  - Nueva Esperanza (HSG C – 44.7 ha): 11,891 MT/yr (sediment unit area yield: 266.0 MT/ha/yr)
- **With-project (Paramo conservation)**: 2,094 MT/yr
  - Pitana (HSG B – 41.21 ha): 840 MT/yr (sediment unit area yield: 20.4 MT/ha/yr)
  - Pitana (HSG C – 16.59 ha): 397 MT/yr (sediment unit area yield: 23.9 MT/ha/yr)
  - Nueva Esperanza (HSG B – 48.76 ha): 190 MT/yr (sediment unit area yield: 3.9 MT/ha/yr)
- Nueva Esperanza (HSG C – 44.7 ha): 667 MT/yr (sediment unit area yield: 14.9 MT/ha/yr)

- **Benefit from revegetation of severely degraded areas (reduced sediment yield): 38,130 MT/yr**
  - Pitana (HSG B – 41.21 ha): 16,445 MT/yr
  - Pitana (HSG C – 16.59 ha): 6,680 MT/yr
  - Nueva Esperanza (HSG B – 48.76 ha): 3,781 MT/yr
  - Nueva Esperanza (HSG C – 44.7 ha): 11,224 MT/yr

The total benefit (sediment yield reduction) is: 87,697 + 38,130 = 125,827 MT/yr

The total benefit (reduced sediment yield) is: 125,827 MT/yr and TCCC’s benefit (adjusted for cost share) is 118,201 MT/yr [87,697+38,130*(80%)].

The 2014 benefit is: 125,827 MT/yr and TCCC’s benefit (adjusted for cost share) is 118,201 MT/yr.

**Data Sources:**
- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

**Assumptions:**
- The Cover Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and among years).
- The soil erodibility factor ($K$) for type B soils was assumed to be 0.34 for use in the MUSLE equation. Soil erodibility factor was estimated for loam with approximately 2% organic matter content based on Haith et al. (1992).
- The soil erodibility factor ($K$) for type C soils was assumed to be 0.25 for use in the MUSLE equation. The soil erodibility factor was estimated for sandy clay loam with approximately 1-2% organic matter content based on Haith et al. (1992).

**OTHER BENEFITS NOT QUANTIFIED**
- Increase in infiltration and baseflow
- Improvements in terrestrial habitat and biodiversity
- Maintain/protect biodiversity - These areas are a buffer area for the newly created Cerro Puntas municipal protected area, which is one of the key areas identified for protecting characteristic biodiversity of Quito Metropolitan District.

**NOTES**
- This project is part of a portfolio of Water Fund projects in Latin America.

**REFERENCES**


PROJECT NAME: Forest conservation in the Daule River watershed

PROJECT ID #: 170

DESCRIPTION OF ACTIVITY: Conservation (159 hectares)


PRIMARY CONTACT:
Jorge Leon Sarmiento  
Latin America Water Funds Specialist  
The Nature Conservancy  
Cartagena de Indias, Colombia  
(+57) 317-5100-880  
jleon@tnc.org

Erick Ramírez  
Environmental and Safety Manager  
Latin Center Business Unit  
Coca-Cola  
(+506) 61853276  
erickramirez@coca-cola.com

OBJECTIVES:
• Protect the forest and associated ecosystem services, including water supply

BACKGROUND & ACTIVITY DESCRIPTION: The project area is located within the Bachillero subwatershed, near Isidro Ayora Municipality, southwest of Quito, Ecuador (Figure 1). The primary ecosystem in the area is secondary lowland dry forest. These forests are very important to ensure water availability during the dry seasons, as they store water in the wet season and also capture humidity from the mist that is over the forests during the dry season. Lowland dry forests are under great threat, with the highest deforestation rates in the country. Many forest lands are being converted for agriculture and grazing, often by burning. Local residents do not perceive the forests as a benefit, and prefer to cut down the forests and expand productive areas.

The project area is covered by secondary lowland dry forest that has a good structure, including understory and emerging trees (Figure 2). Typical dry forest trees are present, with the canopy on average 15 to 20 meters above ground. Many species of birds are present, including some threatened species.

Figure 1. Location Map
Figure 2. Current conditions in the project area; secondary growth, dense forest

Land on other properties in the area has experienced degradation due to clearing for agricultural use, grazing, etc. (Figure 3); if the project property is not protected, similar degradation will occur.

Figure 3. Degraded condition that would result if the project area were not protected

This project will protect 159 hectares of lowland dry forest. A conservation agreement with the owner of the property has been signed to ensure protection of the forest. No type of forest conversion, timber extraction, fires, or hunting will be allowed in the area. In the future this area will be included in a provincial protected area. Milestones will be placed every 100 meters to delineate the forests and avoid trespassers.

SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 140.2 ML/yr
ACTIVITY TIMELINE:
March 2014 - September 2014: Protection of 159 hectares, involving:
• Conservation agreement signed

COCA-COLA CONTRIBUTION: 100%

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff due to protection of forested land from being converted to other land uses. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (159 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

• **Without-project**: No forest protection
  o Row crops, corn with straight rows and crop residue cover in “good” condition, >20% cover (CN = 82)
  o Hydrologic soil group (HSG) “C”
• **With-project**: Forest protection
  o Woods in “good” condition, woods are protected from grazing and litter/brush adequately cover the soil (CN = 70)
  o Hydrologic soil group (HSG) “C”

Daily precipitation and air temperature data were provided for the 2009-2012 time period by Jorge Leon (TNC). The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Curve numbers and processed meteorological data were used to compute daily runoff for the without- and with-project cases for a 4-year period (2009-2012). Total annual average runoff volumes and the resulting water quantity benefit for protecting the 159 ha forest was estimated as follows:

• **Without-project (no forest protection)**: 508.4 ML/yr (runoff depth: 319.7 mm/yr)
• **With-project (forest protection)**: 368.2 ML/yr (runoff depth: 231.6 mm/yr)
• **Benefit (runoff reduction)**: 140.2 ML/yr
The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

The total (ultimate) benefit is: 140.2 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 140.2 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 140.2 ML/yr, and TCCC’s benefit (adjusted for cost share) is 140.2 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>140.2</td>
<td>140.2</td>
</tr>
<tr>
<td>2016</td>
<td>140.2</td>
<td>140.2</td>
</tr>
<tr>
<td>2017</td>
<td>140.2</td>
<td>140.2</td>
</tr>
<tr>
<td>2018</td>
<td>140.2</td>
<td>140.2</td>
</tr>
<tr>
<td>2019</td>
<td>140.2</td>
<td>140.2</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>140.2</td>
<td>140.2</td>
</tr>
</tbody>
</table>

Data Sources:

- Size of protected land area: 159 ha (provided by Jorge Leon, TNC)
- Slope: 4.4% (provided by Jorge Leon, TNC)
- Soil type: predominantly hydrologic soil group (HSG) “C” (provided by Jorge Leon, TNC). Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.
- Meteorological data: Daily precipitation and air temperature data were provided by Jorge Leon (TNC)
- All of the above information on data sources is contained in a data package provided by Jorge Leon (TNC) on 10/03/2014 titled “2_Daule_Ecuador.zip”.

Assumptions:

- If the land were not protected, deforestation would occur to establish agriculture and grazing.
- “Without-project” (i.e., no forest protection) conditions were assumed to be row crops, with straight rows and crop residue cover in “good” condition (>20% cover), and “with-project” (i.e., forest protection) conditions were assumed to be woods in “good” condition (woods are protected from grazing and litter/brush adequately cover the soil).
• SWAT model parameter “CNCOEF” was set to 1.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of protection of forested land from being converted to other land uses. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the 2009-2012 period.

The Cover/Management Factors (Cusle) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

• Without-project (no forest protection): Field crops with residue left on the field (Cusle = 0.032)
• With-project (forest protection): Managed woodland with 75-100% tree canopy (Cusle = 0.001)

Total annual sediment yields for the project area were estimated as follows:

• Without-project (no forest protection): 1,093 MT/yr (sediment unit area yield: 6.9 MT/ha/yr)
• With-project (forest protection): 25 MT/yr (sediment unit area yield: 0.2 MT/ha/yr)
• Benefit (reduced sediment yield): 1,068 MT/yr

The total benefit (sediment yield reduction) is: 1,068 MT/yr

The total benefit (reduced sediment yield) is: 1,068 MT/yr and TCCC’s benefit (adjusted for cost share) is 1,068 MT/yr.
The 2014 benefit is: 1,068 MT/yr and TCCC’s benefit (adjusted for cost share) is 1,068 MT/yr.

Data Sources:

• See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:

• The Cover Factor (Cusle) was assumed to remain constant through time (both seasonally and among years).
• The soil erodibility factor (K) was assumed to be 0.25 for use in the MUSLE equation. Soil erodibility factor was estimated for sandy clay loam with approximately 1 – 2% organic matter content based on Haith et al. (1992).
OTHER BENEFITS NOT QUANTIFIED

- Increase in infiltration and baseflow
- Improvements in terrestrial habitat and biodiversity
- Maintain/protect biodiversity

NOTES

- This project is part of a portfolio of Water Fund projects in Latin America.

REFERENCES


PROJECT NAME: Forest Protection in the Rio Siecha Watershed – Agua Somos Water Fund
PROJECT ID #: 171

DESCRIPTION OF ACTIVITY: Conservation (409.67 hectares total, among 3 properties)

LOCATION: Vereda La Trinidad, Guasca Municipality, Cundinamarca Department, Colombia. Latitude 4.778, Longitude -73.898 (Jikury property); Latitude 4.472, Longitude -73.50 (Los Salitres property); Latitude 4.473, Longitude -73.51 (Quebrada Honda property)

PRIMARY CONTACTS:
Jorge Leon Sarmiento
Latin America Water Funds Specialist
The Nature Conservancy
Cartagena de Indias, Colombia
(+57) 317-5100-880
jleon@tnc.org

Erick Ramírez
Environmental and Safety Manager
Latin Center Business Unit
Coca-Cola
(+506) 61853276
erickramirez@coca-cola.com

OBJECTIVES:
- Conserve native vegetation cover
- Improve water availability
- Improve biodiversity

BACKGROUND & ACTIVITY DESCRIPTION: The project is located in the Rio Siecha watershed, in Guasca Municipality, Cundinamarca Department, northeast of Bogota, Colombia (Figure 1). The area is located within an area of special management, “Reserva Forestal Protectora (RFP) Productora Cuenca Alta del Río Bogota”, near the Chingaza National Park and two other protected areas, RFP Paramo Grande and RFPR Santa María de las Lagunas. Within this area, there are mining activities, agriculture (primarily potato fields), and cattle raising. Many country homes are also being constructed for recreation, creating additional pressure on the natural ecosystem and local water supplies. Land prices have increased, leading to a higher opportunity cost for conservation. Guasca municipality has water availability problems, especially during the dry seasons.

The project properties were identified as areas for conservation and restoration activities in areas previously used for agriculture, grazing and mining. Native vegetation consisting of high montane Andean forests and paramo covers close to 75% of these properties (Figure 2). Each property is described briefly below.

Figure 1. Location Map
1. Jikury property (identified in Figure 1 as “Activity 1”). This property was recently declared under the category of Natural Reserve of Civil Society. A large portion (75%) of the property has natural vegetative cover of high montane Andean forest and paramo. Approximately 24% of the property consists of areas for restoration and recovery of natural vegetation with a plantation that was established in 2010, areas with invasive *Ulex europeaus*, gullies and passive restoration distributed in small patches across the property. The land owner has initiated some restoration activities, including plantings in areas previously used for agriculture and grazing. Due to the high cost of these restoration activities, however, they remain in an initial phase. Areas of the property used in the past for iron exploration are currently abandoned, with no restoration activity. It is common to observe falling materials and mass movement of soil, putting the property and restoration activities at risk. This area has the greatest problems in terms of degradation of the ecosystem and presence of the invasive plant *Ulex eropaeus*.

This project protects the native forest area via a conservation agreement signed with the landowner in August 2014 that protected 92.7 hectares. The landowner will maintain the forest in conservation, with no logging or other human intervention. Additional restoration activities are planned for the areas previously used for agriculture, grazing, and mining. If not protected, the project area will most likely be converted to agricultural production, suburban settlements, cattle pasture, or mining activities. Such activities have transformed neighboring properties, as shown in Figure 3.

![Figure 2. High montane Andean forest to be protected](image1.png)

![Figure 3. Degraded conditions in surrounding areas, due to mining, ranching, agriculture, and suburban development](image2.png)
2. Los Salitres property (identified in Figure 1 as “Activity 2”). This property has been identified as a potential area for conservation and restoration activities in areas that were previously used for agriculture and grazing. A large area of the property still has natural vegetation cover of high montane Andean forest, paramo, and secondary forest (Figure 2), which have been maintained by the landowner. Areas used in the past for potato crops and grazing are currently abandoned, with no restoration activities. It is common to observe mass movement of soil near the Los Salitres ravine, where the San Jois aqueduct supplying water for 650 people is located. If not protected, these areas will most likely be replaced by agricultural production, suburban development, or grazing areas. A parcel of 298 hectares is being protected by this project via a conservation agreement with the landowner, signed in November 2014. The landowner will maintain the forest in conservation, with no logging or degradation of the forest. Establishing conservations activities is very important in the face of heavy pressure to use the land for suburban settlement, potato crops, and cattle.

3. Quebrada Honda property (identified in Figure 1 as “Activity 3”). Most of the property is covered with native species of high montane Andean forest and paramo (Figure 2), which have been maintained by the landowner. In addition, the rural aqueduct of Paso Hondo, which supplies approximately 250 people with water, is located in 4 km of the Ravine Honda. If not protected, areas of this property most likely will be replaced by agricultural production and grazing, and potentially by mining (carbon exploitation). A parcel of 18.97 hectares is being protected by this project via a conservation agreement with the landowner, signed in November 2014. The landowner will maintain the forest in conservation, with no logging or degradation of the forest. Establishing conservations activities is very important in the face of heavy pressure to use the land for mining, potato crops, and cattle.

SUMMARY OF REPLENISH BENEFIT:

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 496.7 ML/YR

ACTIVITY TIMELINE:

April 2014 - August 2014 – Protection of 92.7 hectares on Jikury property:
- Conservation agreement signed

September 2014 – November 2014 – Protection of 298 hectares on Los Salitres property
- Conservation agreement signed

September 2014 – November 2014 – Protection of 18.97 hectares on Quebrada Honda property
- Conservation agreement signed

COCA-COLA CONTRIBUTION: 100%

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff due to protection of forested land from
being converted to other land uses. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (409.67 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers for the pre-project condition and the post-project condition were provided by Jorge Leon (TNC) based on information provided in the TR-55 document (USDA-NRCS, 1986):

**Jikury (92.7 ha):**

- **Without-project:** No forest protection
  - Hydrologic soil group (HSG) “B”
  - Fallow bare soil, suburban settlement, fallow agriculture areas (CN = 86)
- **With-project:** Forest protection
  - Hydrologic soil group (HSG) “B”
  - Woods in “good” condition, woods are protected from grazing and litter/brush adequately cover the soil (CN = 55)

**Los Salitres (298 ha):**

- **Without-project:** No forest protection
  - Hydrologic soil group
    - HSG “B” – 112 ha; HSG “C” – 186 ha
  - Pasture, grassland in “poor” condition, <50% cover (50%) and row crops, straight row in “poor” condition (50%)
    - HSG “B” – (CN = (0.5 * 79) + (0.5 * 81) = 80); HSG “C” – (CN = (0.5 * 86) + (0.5 * 88) = 87)
- **With-project:** Forest protection
  - Hydrologic soil group
    - HSG “B” – 112 ha; HSG “C” – 186 ha
  - Woods in “good” condition, woods are protected from grazing and litter/brush adequately cover the soil
    - HSG “B” – (CN = 55); HSG “C” – (CN = 70)

**Quebrada Honda (18.97 ha):**

- **Without-project:** No forest protection
  - Hydrologic soil group (HSG) “B”
  - Pasture, grassland in “poor” condition, <50% cover (40%), row crops, straight row in “poor” condition (50%) and fallow bare soil (10%) corresponding to mining and urban settlement (CN = (0.4 * 79) + (0.5 * 81) + (0.1 * 86) = 81)
- **With-project:** Forest protection
  - Hydrologic soil group (HSG) “B”
Woods in “good” condition, woods are protected from grazing and litter/brush adequately cover the soil (CN = 55)

Daily precipitation and air temperature data were provided for the 2001 – 2007 time period by Jorge Leon (TNC). The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Curve numbers and processed meteorological data were used to compute daily runoff for the without- and with-project cases for a 7-year period (2001-2007). Total annual average runoff volumes and the resulting water quantity benefit for protecting the 409.67 ha forest was estimated as follows:

- **Without-project (no forest protection):** 2,097.3 ML/yr (runoff depth: 2,015.2 mm/yr)
  - Jikury (92.7 ha): 483.1 ML/yr (runoff depth: 521.1 mm/yr)
  - Los Salitres (298 ha): 1,522.2 ML/yr
    - HSG B (112 ha): 537.3 ML/yr (runoff depth: 479.8 mm/yr)
    - HSG B (186 ha): 984.9 ML/yr (runoff depth: 529.5 mm/yr)
  - Quebrada Honda (18.97 ha): 92.0 ML/yr (runoff depth: 484.8 mm/yr)
- **With-project (forest protection):** 1,600.6 ML/yr (runoff depth: 1,500.7 mm/yr)
  - Jikury (92.7 ha): 332.9 ML/yr (runoff depth: 359.1 mm/yr)
  - Los Salitres (298 ha): 1,200.4 ML/yr
    - HSG B (112 ha): 398.6 ML/yr (runoff depth: 355.9 mm/yr)
    - HSG B (186 ha): 801.8 ML/yr (runoff depth: 431.1 mm/yr)
  - Quebrada Honda (18.97 ha): 67.3 ML/yr (runoff depth: 354.7 mm/yr)

- **Benefit (runoff reduction):** 496.7 ML/yr

The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

The total (ultimate) benefit is: 496.7 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 496.7 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 496.7 ML/yr, and TCCC’s benefit (adjusted for cost share) is 496.7 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>496.7</td>
<td>496.7</td>
</tr>
<tr>
<td>2016</td>
<td>496.7</td>
<td>496.7</td>
</tr>
<tr>
<td>2017</td>
<td>496.7</td>
<td>496.7</td>
</tr>
<tr>
<td>2018</td>
<td>496.7</td>
<td>496.7</td>
</tr>
<tr>
<td>2019</td>
<td>496.7</td>
<td>496.7</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>496.7</td>
<td>496.7</td>
</tr>
</tbody>
</table>

Data Sources:

- **Size of protected land area**: 409.67 ha (provided by Jorge Leon, TNC)
  - Jikury – 92.7 ha
  - Los Salitres – 298 ha (HSG “B” = 112 ha; HSG “C” = 186 ha)
  - Quebrada Honda – 18.97 ha
- **Slope**: provided by Jorge Leon, TNC
  - Jikury – 20%
  - Los Salitres – 16% for HSG “B” and 21% for HSG “C”
  - Quebrada Honda – 15%
- **Soil type**: provided by Jorge Leon, TNC
  - Predominantly HSG “B” soils in Jikury and Quebrada Honda. Combination of HSG “B” and HSG “C” soils in Los Salitres.
  - Type B soils have characteristics of loam, silt loam with moderately fine to moderately coarse texture and moderate infiltration rates when thoroughly wetted.
  - Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.
- **Meteorological data**: Daily precipitation and air temperature data were provided by Jorge Leon (TNC).
  - All of the above information on data sources is contained in a data packages provided by Jorge Leon (TNC) on 10/14/2014 titled “8_Bogota.zip” and on 12/16/2014 titled “8_Bogota.zip.”

Assumptions:

- If the land were not protected, deforestation would occur to establish residential development, agriculture, grazing and mining.
- “Without-project” (i.e., no forest protection) conditions for the various project sites are described above, and “with-project” (i.e., forest protection) conditions were assumed to be woods in “good” condition (woods are protected from grazing and litter/brush adequately cover the soil).
2. **DECREASE IN SEDIMENT EROSION/RUNOFF**

**Approach & Results:**

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to estimate the decrease in sediment erosion/runoff due to protection of forested land from being converted to other land uses. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the 2001-2007 period.

The Cover/Management Factors ($C_{usle}$) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

- Without-project (no forest protection): Field crops, with residue left on the field ($C_{usle} = 0.061$)
- With-project (forest protection): Managed woodland with 75-100% tree canopy ($C_{usle} = 0.001$)

Total annual sediment yields for the project area were estimated as follows:

- **Without-project (no forest protection):** 88,993 MT/ha (sediment unit area yield: 790 MT/ha/yr)
  - Jikury (92.7 ha): 24,386 MT/yr (sediment unit area yield: 263 MT/ha/yr)
  - Los Salitres (298 ha): 62,235 MT/yr
    - HSG B (112): 19,086 MT/yr (sediment unit area yield: 170 MT/ha/yr)
    - HSG C (186): 43,150 MT/yr (sediment unit area yield: 232 MT/ha/yr)
  - Quebrada Honda (18.97 ha): 2,372 MT/yr (sediment unit area yield: 125 MT/ha/yr)
- **With-project (forest protection):** 1,111 MT/yr (sediment unit area yield: 9.6 MT/ha/yr)
  - Jikury (92.7 ha): 275 MT/yr (sediment unit area yield: 3.0 MT/ha/yr)
  - Los Salitres (298 ha): 807 MT/yr
    - HSG B (112): 232 MT/yr (sediment unit area yield: 2 MT/ha/yr)
    - HSG C (186): 574 MT/yr (sediment unit area yield: 3 MT/ha/yr)
  - Quebrada Honda (18.97 ha): 28 MT/yr (sediment unit area yield: 1.5 MT/ha/yr)

**Benefit (reduced sediment yield):** 87,882 MT/yr

The total benefit (sediment yield reduction) is: 87,882 MT/yr

The total benefit (reduced sediment yield) is: 87,882 MT/yr and TCCC’s benefit (adjusted for cost share) is 87,882 MT/yr.

The 2014 benefit is: 87,882 MT/yr and TCCC’s benefit (adjusted for cost share) is 87,882 MT/yr.
Data Sources:

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:

- The Cover Factor (C_{usle}) was assumed to remain constant through time (both seasonally and among years).
- The soil erodibility factor (K) for type B soils was assumed to be 0.34 for use in the MUSLE equation. The soil erodibility factor was estimated for loam with approximately 1 – 2% organic matter content based on Haith et al. (1992).
- The soil erodibility factor (K) for type C soils was assumed to be 0.25 for use in the MUSLE equation. The soil erodibility factor was estimated for sandy clay loam with approximately 1 – 2% organic matter content based on Haith et al. (1992).

OTHER BENEFITS NOT QUANTIFIED

- Increase in infiltration and baseflow
- Improvements in terrestrial habitat and biodiversity
- Maintain/protect biodiversity
- Protect water supply and improve water availability, both within the local community and downstream, where water from this watershed provides water for Bogota

NOTES

- This project is part of a portfolio of Water Fund projects in Latin America.

REFERENCES


PROJECT NAME: Forest Conservation in the Rio Grande – Rio Chico Watershed, Corporación Cuenca Verde
PROJECT ID #: 172

DESCRIPTION OF ACTIVITY: Conservation/forest protection (89.2 hectares)

LOCATION: Belmira municipality, Antioquia Department, Colombia. Rio Grande – Rio Chico Watershed
Latitude: 6.641; Longitude: -75.706W

PRIMARY CONTACTS:
Jorge Leon Sarmiento
Latin America Water Funds Specialist
The Nature Conservancy
Cartagena de Indias, Colombia
(+57) 317-5100-880
jleon@tnc.org

Erick Ramírez
Environmental and Safety Manager
Latin Center Business Unit
Coca-Cola
+506 61853276
erickramirez@coca-cola.com

OBJECTIVES:
• Maintain forest cover to protect ecosystem services, including hydrology and water quality
• Allow regeneration of native forest

BACKGROUND & ACTIVITY DESCRIPTION:
The project area is located in the Rio Grande – Rio Chico watershed, north of Medellin, Colombia (Figure 1). Land in this area is covered by oak forests (Figure 2) and secondary shrubby vegetation. Some areas are used for raising cattle (50%), and for agricultural uses (22%) such as potato and tomato production. Slopes within the project area average 20%.

Productive activities on the hills cause soil degradation and erosion. Human-induced fires are also a problem in the area. Establishment of grasses in place of forests leads to increased sediment and nutrient loadings to local streams. Conversion of wetlands and forests to agricultural areas threatens natural vegetation (Figure 3).

The project area is the Hacienda El Yerbal, which is largely covered with native forests. The landowner rents portions of the property for dairy cattle and potato production. Cattle pastures reach the boundaries of the forested areas, allowing cattle to enter and degrade forest areas. This project

Figure 1. Location Map
maintains forest cover, allows secondary forest and shrubby vegetation to regenerate to more mature forest, and prevents degradation of the forest due to cattle grazing and conversion of forest to agricultural uses.

This project protects 89.2 hectares from degradation. A conservation agreement has been signed with the landowner, establishing that the owner will maintain the forest in conservation, and allow regeneration of the forest. Fences are being installed to prevent cattle from entering forests; installation is expected to be completed by the end of 2014.

**SUMMARY OF REPLENISH BENEFIT:**
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 87.9 ML/YR

**ACTIVITY TIMELINE:**
- April 2014 - September 2014 – Protection of 89.2 hectares, involving:
  - Conservation agreement signed

**COCA-COLA CONTRIBUTION:** 100%

**WATERSHED BENEFITS CALCULATED:**
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

---

1. **DECREASE IN RUNOFF**

**Approach & Results:**

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff due to protection of forested land from...
being converted to other land uses. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (89.2 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **Without-project:** No forest protection
  - A mixture of 25% row crops, with contoured rows and crop residue cover in “poor” condition and 75% grassland or range in “poor” condition, <50% cover  
    \[ CN = 0.25 \times 83 + 0.75 \times 86 = 85.25 \]
  - Hydrologic soil group (HSG) “C”

- **With-project:** Forest protection
  - Woods in “good” condition, woods are protected from grazing and litter/brush adequately cover the soil (CN = 70)
  - Hydrologic soil group (HSG) “C”

Daily precipitation and air temperature data were provided for the 2002-2013 time period by Jorge Leon (TNC). The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Curve numbers and processed meteorological data were used to compute daily runoff for the without- and with-project cases for a 10-year period (2002-2013). Total annual average runoff volumes and the resulting water quantity benefit for protecting the 89.2 ha forest was estimated as follows:

- **Without-project (no forest protection):** 885.5 ML/yr (runoff depth: 992.7 mm/yr)
- **With-project (forest protection):** 797.6 ML/yr (runoff depth: 894.2 mm/yr)
- **Benefit (runoff reduction):** 87.9 ML/yr

The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

**The total (ultimate) benefit is:** 87.9 ML/yr

**TCCC total (ultimate) benefit taken as a function of cost share is:** 87.9 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 87.9 ML/yr, and TCCC’s benefit (adjusted for cost share) is 87.9 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual...
benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>87.9</td>
<td>87.9</td>
</tr>
<tr>
<td>2016</td>
<td>87.9</td>
<td>87.9</td>
</tr>
<tr>
<td>2017</td>
<td>87.9</td>
<td>87.9</td>
</tr>
<tr>
<td>2018</td>
<td>87.9</td>
<td>87.9</td>
</tr>
<tr>
<td>2019</td>
<td>87.9</td>
<td>87.9</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>87.9</td>
<td>87.9</td>
</tr>
</tbody>
</table>

Data Sources:
- **Size of protected land area**: 89.2 ha (provided by Jorge Leon, TNC)
- **Slope**: 20% (provided by Jorge Leon, TNC)
- **Soil type**: predominantly hydrologic soil group (HSG) “C” (provided by Jorge Leon, TNC). Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.
- **Meteorological data**: Daily precipitation and air temperature data were provided by Jorge Leon (TNC)
- All of the above information on data sources is contained in a data package provided by Jorge Leon (TNC) on 10/03/2014 titled “3_Medellin_Colombia.zip”.
- Updated curve numbers provided by Jorge Leon (TNC) on 11/06/2014 in a spreadsheet titled “Revisited NoProject CN.xlsx”

Assumptions:
- If the land were not protected, deforestation would occur to establish agriculture and grazing.
- “Without-project” (i.e., no forest protection) conditions were assumed to be a mixture of 25% row crops, with contoured rows and crop residue cover in “poor” condition and 75% grassland or range in “poor” condition (<50% cover), and “with-project” (i.e., forest protection) conditions were assumed to be woods in “good” condition (woods are protected from grazing and litter/brush adequately cover the soil).
- SWAT model parameter “CNCOEF” was set to 2.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. **DECREASE IN SEDIMENT EROSION/RUNOFF**

**Approach & Results:**
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of protection of forested land from being converted to other land uses. The
meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the 2002-2013 period.

The Cover/Management Factors ($C_{usle}$) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

- Without-project (no forest protection): Pasture 60% ground cover as grass ($C_{usle} = 0.04$)
- With-project (forest protection): Managed woodland with 75-100% tree canopy ($C_{usle} = 0.001$)

Total annual sediment yields for the project area were estimated as follows:

- Without-project (no forest protection): 24,017 MT/yr (sediment unit area yield: 269.2 MT/ha/yr)
- With-project (forest protection): 541 MT/yr (sediment unit area yield: 6.1 MT/ha/yr)
- **Benefit (reduced sediment yield): 23,476 MT/yr**

The total benefit (sediment yield reduction) is: **23,476 MT/yr**

*The total benefit (reduced sediment yield) is: 23,476 MT/yr and TCCC’s benefit (adjusted for cost share) is 23,476 MT/yr.*

*The 2014 benefit is: 23,476 MT/yr and TCCC’s benefit (adjusted for cost share) is 23,476 MT/yr.*

**Data Sources:**

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

**Assumptions:**

- The Cover Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and among years).
- The soil erodibility factor (K) was assumed to be 0.25 for use in the MUSLE equation. Soil erodibility factor was estimated for sandy clay loam with approximately 1 – 2% organic matter content based on Haith et al. (1992).

**OTHER BENEFITS NOT QUANTIFIED**

- Increase in infiltration and baseflow
- Improvements in terrestrial habitat and biodiversity
- Maintain/protect biodiversity
- Improve water quality, including reduction in nutrient loadings to local waterways
- Project implementation will employ at least 10 people in 2014, possibly increasing to 20 people in 2015
- Protection of the water supply for 1.2 million people served by the Rio Grande II dam

**NOTES**

- This project is part of a portfolio of Water Fund projects in Latin America.
REFERENCES


PROJECT NAME: Tropical Rainforest Conservation in the Panama Canal Watershed
PROJECT ID #: 173

DESCRIPTION OF ACTIVITY: Forest conservation/protection (135 hectares)

LOCATION: Corozal stream within the Gatuncillo subwatershed of the Panama Canal watershed, near Communidad de Nuevo Ocu, in Colon Province, Panama. Latitude 9.335, Longitude -79.629

PRIMARY CONTACTS:
Jorge Leon Sarmiento
Latin America Water Funds Specialist
The Nature Conservancy
Cartagena de Indias, Colombia
(+57) 317-5100-880
jleon@tnc.org

Erick Ramírez
Environmental and Safety Manager
Latin Center Business Unit
Coca-Cola
(+506) 61853276
erickramirez@coca-cola.com

OBJECTIVES:
• Protect forested areas and associated ecosystem services

BACKGROUND & ACTIVITY DESCRIPTION: The project area is located in the Panama Canal watershed, within the Gatuncillo subwatershed near Communidad de Nuevo Ocu, Corregimiento de Salamanca, in the Colon district of Colon Province, Panama (Figure 1). The ecosystem in the area is tropical rainforest. Selective cutting of arboreal species 30 years ago diminished native species in the region. Traditional agricultural practices, including slash and burn methods, threaten native forests.

The project area consists of three properties with a total of 135 hectares (Endara 55, Carrasco 40, and Ovalle 40), located in the buffer zone of Chagres National Park. These properties have more than 50% dense secondary forest, along with 25% stubble with agroforestry, and some agriculture (Figure 2). Neighboring properties have been transformed to pastures for cattle, non-shaded coffee cultivation, or selective timber extraction (Figure 3). Poor agricultural practices on these properties lead to reduced vegetative cover, soil loss, and erosion. The majority of the forest within the project area has no physical restrictions, allowing access by both local residents and cattle. It is common for members of the community to extract wood from the forests for domestic use. Intensive extraction of wood for fuel and associated ecosystem degradation is likely if the forests are not protected. Without protection, the forests in the project area are also likely to be cleared and replaced by agriculture.
The project protects the existing secondary forest by implementing conservation agreements with the landowners and installing physical barriers to avoid illegal wood extraction. Approximately 135 hectares are protected, based on estimates provided by the landowners. Barbed wire fences have been installed, and conservation agreements with the landowners have been signed.

**Figure 2. Current conditions to be conserved and improved**

**Figure 3. Conditions on neighboring properties: degraded conditions due to logging and conversion to pasture**

**SUMMARY OF REPLENISH BENEFIT:**
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 178.8 ML/yr
ACTIVITY TIMELINE:
April 2014 - September 2014 – Protection of 135 hectares, involving:
- Conservation agreements signed
- Fences installed

COCA-COLA CONTRIBUTION: 100%

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al., 2005) was used to estimate the decrease in runoff due to protection of forested land from being converted to other land uses. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (135 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers for the pre-project condition and the post-project condition were provided by Jorge Leon (TNC) based on information provided in the TR-55 document (USDA-NRCS, 1986):
- **Without-project**: No forest protection
  - Pasture in poor condition, <50% cover (CN = 86)
  - Hydrologic soil group (HSG) “C”
- **With-project**: Forest protection
  - Woods in “good” condition, woods are protected from grazing and litter/brush adequately cover the soil (CN = 70)
  - Hydrologic soil group (HSG) “C”

Daily precipitation and air temperature data were provided for the 2010-2013 time period by Jorge Leon (TNC). The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Curve numbers and processed meteorological data were used to compute daily runoff for the without- and with-project cases for a 4-year period (2010-2013). Total annual average runoff volumes and the resulting water quantity benefit for protecting the 135 ha forest was estimated as follows:
- **Without-project (no forest protection)**: 2,931.3 ML/yr (runoff depth: 2,171.3 mm/yr)
- **With-project (forest protection)**: 2,752.5 ML/yr (runoff depth: 2,038.9 mm/yr)
- **Benefit (runoff reduction)**: 178.8 ML/yr
The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

**The total (ultimate) benefit is:** 178.8 ML/yr

**TCCC total (ultimate) benefit taken as a function of cost share is:** 178.8 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 178.8 ML/yr, and TCCC’s benefit (adjusted for cost share) is 178.8 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>178.8</td>
<td>178.8</td>
</tr>
<tr>
<td>2016</td>
<td>178.8</td>
<td>178.8</td>
</tr>
<tr>
<td>2017</td>
<td>178.8</td>
<td>178.8</td>
</tr>
<tr>
<td>2018</td>
<td>178.8</td>
<td>178.8</td>
</tr>
<tr>
<td>2019</td>
<td>178.8</td>
<td>178.8</td>
</tr>
<tr>
<td><strong>Ultimate Benefit:</strong></td>
<td><strong>178.8</strong></td>
<td><strong>178.8</strong></td>
</tr>
</tbody>
</table>

**Data Sources:**

- **Size of protected land area:** 135 ha (provided by Jorge Leon, TNC)
- **Slope:** 19.99% (provided by Jorge Leon, TNC)
- **Soil type:** predominantly hydrologic soil group (HSG) “C” (provided by Jorge Leon, TNC). Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.
- **Meteorological data:** Daily precipitation and air temperature data were provided by Jorge Leon (TNC).
- All of the above information on data sources is contained in a data package provided by Jorge Leon (TNC) on 12/16/2014 titled “S_Panama_December_2014.zip.”
- Updated curve numbers provided by Jorge Leon (TNC) on 11/06/2014 in a spreadsheet titled “Revisited NoProject CN.xlsx.”

**Assumptions:**

- If the land were not protected, deforestation would occur due to logging, conversion to pasture rangelands, and agriculture activities.
• “Without-project” (i.e., no forest protection) conditions were assumed to be pasture in “poor” condition (<50% cover), and “with-project” (i.e., forest protection) conditions were assumed to be woods in “good” condition (woods are protected from grazing and litter/brush adequately cover the soil).

• SWAT model parameter “CNCOEF” was set to 2.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of protection of forested land from being converted to other land uses. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the 2010-2013 period.

The Cover/Management Factors (Cusle) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

• Without-project (no forest protection): Pasture, 60% ground cover as grass (Cusle = 0.04)
• With-project (forest protection): Managed woodland with 75-100% tree canopy (Cusle = 0.001)

Total annual sediment yields for the project area were estimated as follows:

• Without-project (no forest protection): 86,725 MT/yr (sediment unit area yield: 642.4 MT/ha/yr)
• With-project (forest protection): 2,034 MT/yr (sediment unit area yield: 15.1 MT/ha/yr)

**Benefit (reduced sediment yield): 84,691 MT/yr**

The total benefit (sediment yield reduction) is: 84,691 MT/yr

**The total benefit (reduced sediment yield) is: 84,691 MT/yr and TCCC’s benefit (adjusted for cost share) is 84,691 MT/yr.**

**The 2014 benefit is: 84,691 MT/yr and TCCC’s benefit (adjusted for cost share) is 84,691 MT/yr.**

Data Sources:

• See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:

• The Cover Factor (Cusle) was assumed to remain constant through time (both seasonally and among years).
• The soil erodibility factor (K) was assumed to be 0.25 for use in MUSLE equation. Soil erodibility factor was estimated for sandy clay loam with approximately 1 – 2% organic matter content based on Haith et al. (1992).
OTHER BENEFITS NOT QUANTIFIED

- Increase in infiltration and baseflow
- Improvements in terrestrial habitat and biodiversity
- Maintain/protect biodiversity
- Protect the water supply of the Nuevo Ocu community
- Maintain streams that drain to Gatun Lake, which is important for the operation of the Panama Canal
- The project will also activate a local tree nursery managed by women from the local community and employ local labor

NOTES

- This project is part of a portfolio of Water Fund projects in Latin America.

REFERENCES


Spreadsheet titled “Revised NoProject CN.xlsx” dated 11/06/2014


PROJECT NAME: Forest Conservation in the Greater Tarcoles River Watershed – Agua Tica Water Fund
PROJECT ID #: 174

DESCRIPTION OF ACTIVITY: Conservation (151.3 hectares)

LOCATION: Rio Macho micro-basin, Virilla subwatershed, Greater Tarcoles River watershed, east of San Jose, Costa Rica. Latitude 9.989, Longitude -83.952

PRIMARY CONTACTS:
Jorge Leon Sarmiento
Latin America Water Funds Specialist
The Nature Conservancy
Cartagena de Indias, Colombia
(+57) 317-5100-880
jleon@tnc.org

Erick Ramírez
Environmental and Safety Manager
Latin Center Business Unit
Coca-Cola
(+506) 61853276
erickramirez@coca-cola.com

OBJECTIVES:
• Protect native forest remnants and associated ecosystem services, particularly water supply
• Protect and improve biodiversity

BACKGROUND & ACTIVITY DESCRIPTION:
The project area is located in the Greater Tarcoles River watershed, in the greater San Jose metropolitan area (Figure 1). 60% of the population of Costa Rica resides within this watershed. Ecosystems in the area include premontane tropical wet forest, low montane tropical wet forest, and low montane tropical rain forest. In the mountain areas surrounding San Jose, land uses are predominantly agricultural at lower elevations, and cattle ranching at higher elevations. In non-natural areas, pastures are the dominant cover, followed by permanent and non-permanent crops, and planted forests of mostly non-native species. Due to the high slopes in the area, soil erosion is common. Areas that supply water for the San Jose metropolitan area have primarily agricultural landscapes and are threatened by suburban expansion.

Current conditions within the areas to be protected by this project are shown in Figure 2 and include inland and riverine riparian forest areas, with native cloud mountain forest species. Foliage and plant debris provide abundant organic matter in the soil. If these areas are not protected, it is likely they will be converted to agricultural productive uses to increase the income of the landowners. Extensive cattle pastures, which predominate in the surrounding landscape (Figure 3), are likely to replace these forests. Cattle trampling and overgrazing, combined with the high slopes in the area will lead to increased erosion and worsening hydrologic conditions.

Figure 1. Location Map
This project protects 151.3 hectares of native forest remnants, spread among several project sites. All of the properties are located in the upper areas of watersheds that directly contribute flow to rural and suburban aqueducts. Conservation agreements have been signed with the landowners, and physical barriers have been installed to exclude cattle from the forest areas.

**SUMMARY OF REPLENISH BENEFIT:**
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 166.6 ML/yr

**ACTIVITY TIMELINE:**
- December 2014 – Conservation of 151.3 hectares:
  - Conservation agreements signed
  - Physical barriers installed to keep cattle out of forest areas

**COCA-COLA CONTRIBUTION:** 100%
WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al., 2005) was used to estimate the decrease in runoff due to protection of forested land from being converted to other land uses. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (151.3 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):
- **Without-project**: No forest protection
  - Pasture in “poor” condition, <50% cover (CN = 86)
  - Hydrologic soil group (HSG) “C”
- **With-project**: Forest protection
  - Woods in “good” condition, woods are protected from grazing and litter/brush adequately cover the soil (CN = 70)
  - Hydrologic soil group (HSG) “C”

Daily precipitation and air temperature data were provided for the 2010-2013 time period by Jorge Leon (TNC). The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Curve numbers and processed meteorological data were used to compute daily runoff for the without- and with-project cases for a 4-year period (2010-2013). Total annual average runoff volumes and the resulting water quantity benefit for protecting the 151.3 ha forest was estimated as follows:
- **Without-project (no forest protection)**: 2,361.4 ML/yr (runoff depth: 1,560.7 mm/yr)
- **With-project (forest protection)**: 2,194.8 ML/yr (runoff depth: 1,450.6 mm/yr)
- **Benefit (runoff reduction)**: 166.6 ML/yr

The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

**The total (ultimate) benefit is**: 166.6 ML/yr

**TCCC total (ultimate) benefit taken as a function of cost share is**: 166.6 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.
2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 166.6 ML/yr, and TCCC’s benefit (adjusted for cost share) is 166.6 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>166.6</td>
<td>166.6</td>
</tr>
<tr>
<td>2016</td>
<td>166.6</td>
<td>166.6</td>
</tr>
<tr>
<td>2017</td>
<td>166.6</td>
<td>166.6</td>
</tr>
<tr>
<td>2018</td>
<td>166.6</td>
<td>166.6</td>
</tr>
<tr>
<td>2019</td>
<td>166.6</td>
<td>166.6</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>166.6</td>
<td>166.6</td>
</tr>
</tbody>
</table>

Data Sources:
- **Size of protected land area**: 151.3 ha (provided by Jorge Leon, TNC)
- **Slope**: 27.18% (provided by Jorge Leon, TNC)
- **Soil type**: predominately hydrologic soil group (HSG) “C” (provided by Jorge Leon, TNC). Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.
- **Meteorological data**: Daily precipitation and air temperature data were provided by Jorge Leon (TNC).
- All of the above information on data sources is contained in a data package provided by Jorge Leon (TNC) on 12/17/2014 titled “4_San_Jose_december_2014.zip.”

Assumptions:
- If the land were not protected, deforestation would occur to establish agriculture and grazing.
- “Without-project” (i.e., no forest protection) conditions were assumed to be pasture in “poor” condition (<50% cover), and “with-project” (i.e., forest protection) conditions were assumed to be woods in “good” condition (woods are protected from grazing and litter/brush adequately cover the soil).
- SWAT model parameter “CNCOEF” was set to 1.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).
2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of protection of forested land from being converted to other land uses. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the 2010-2013 period.

The Cover/Management Factors (C_{usle}) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

- Without-project (no forest protection): Pasture, 60% ground cover as grass (C_{usle} = 0.04)
- With-project (forest protection): Managed woodland with 40-75% tree canopy (C_{usle} = 0.002)

Total annual sediment yields for the project area were estimated as follows:

- Without-project (no forest protection): 113,983 MT/yr (sediment unit area yield: 753.4 MT/ha/yr)
- With-project (forest protection): 5,287 MT/yr (sediment unit area yield: 34.9 MT/ha/yr)
- **Benefit (reduced sediment yield): 108,696 MT/yr**

The total benefit (sediment yield reduction) is: 108,696 MT/yr and TCCC’s benefit (adjusted for cost share) is 108,696 MT/yr.

The 2014 benefit is: 108,696 MT/yr and TCCC's benefit (adjusted for cost share) is 108,696 MT/yr.

Data Sources:

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:

- The Cover Factor (C_{usle}) was assumed to remain constant through time (both seasonally and among years).
- The soil erodibility factor (K) was assumed to be 0.25 for use in MUSLE equation. Soil erodibility factor was estimated for sandy clay loam with approximately 1 – 2% organic matter content based on Haith et al. (1992).

**OTHER BENEFITS NOT QUANTIFIED**

- Increase in infiltration and baseflow
- Direct water supply benefits to nine landowners and several rural communities that withdraw water from streams draining the protected areas
- Protect water supplies for thousands of people in the San Jose metropolitan area
- Improvements in terrestrial habitat and biodiversity
- Maintain/protect biodiversity
NOTES

• This project is part of a portfolio of Water Fund projects in Latin America.

REFERENCES


PROJECT NAME: Forest Protection, Agroforestry Promotion, and Reforestation in the Xaya-Pixcaya Watershed

PROJECT ID #: 175

DESCRIPTION OF ACTIVITY: Conservation and restoration (64 hectares)

LOCATION: Xaya-Pixcaya watershed in the Department of Chimaltenango, Guatemala. Latitude 14.708, Longitude -90.918

PRIMARY CONTACTS:
Jorge Leon Sarmiento
Latin America Water Funds Specialist
The Nature Conservancy
Cartagena de Indias, Colombia
(+57) 317-5100-880
jleon@tnc.org

Erick Ramírez
Environmental and Safety Manager
Latin Center Business Unit
Coca-Cola
(+506) 61853276
erickramirez@coca-cola.com

OBJECTIVES:
• Protect existing forest areas and associated ecosystem services
• Improve forest cover in agricultural areas
• Reduce pressure on natural forests
• Improve forest structure and hydrological function in deforested areas
• Protect the source of 30% of the water supply for the Guatemala City metropolitan area

BACKGROUND & ACTIVITY DESCRIPTION: The project area is located in the Xaya-Pixcaya watershed in the Department of Chimaltenango, west of Guatemala City (Figure 1). Flows from the Xaya and Pixcaya rivers provide approximately 30% of the water supply for the Guatemala City metropolitan region. The primary ecosystems within these watersheds are subtropical low montane very humid forest and subtropical low montane humid forest. Primary land cover (58.63%) within the region is classified as bare soil, including both agricultural activities and idle lands. Lands in these areas are devoid of permanent vegetation and are subject to soil degradation and erosion (Figure 2).

Forests comprise 37.7% of the watershed area. Existing forested areas are under significant pressure. Landowners who have voluntarily protected forests need to increase their income, and are likely to transform forested areas to agriculture if the lands are not protected. These lands might also be degraded due to intensive extraction of wood for fuel, since demand for wood outstrips supply by nearly 200% in this region. If current trends continue, forest cover is predicted to decrease by more than 13% over the next ten years.

Figure 1. Location Map
This project includes three activities:

1. **Forest protection** in areas currently maintaining at least 70% forest cover, with the presence of primary vegetation and healthy understory, and no apparent symptoms of soil erosion. Figure 3 shows the conditions to be maintained in these areas. The project has protected 22 hectares distributed on 19 plots of land. Activities include installation of physical barriers to avoid illegal wood extraction and development of conservation agreements through the national incentives program (PINPEP). Management plans are under development for each site and will be completed by the end of 2014; these will include forest fire prevention, signposting, boundary demarcation and maintenance, and monitoring of forest pests and diseases.

2. **Promotion of agroforestry** systems on lands currently used for traditional agriculture (primarily maize and beans). Agroforestry systems will replace the dominant agricultural ensemble of the region, temporary crops in straight rows, without terracing, contouring or any kind of soil conservation practices, as shown in Figure 4. Most likely crops include corn, green beans, pumpkins and broccoli. Figure 5 shows the desired condition of these lands, including avocado as an agricultural crop, with trees used as hedgerows. The project has implemented agroforestry on 20 hectares distributed on 79 plots, through planting of hedgerows and trees, seeking to reach at least 30% forest cover on these lands. Avocado trees have been planted to provide income for landowners. Management plans are under development for each site and will be completed by the end of 2014; these will include maintenance of fencing and signposting, and fire management training.

3. **Reforestation** of areas having forest cover of less than 30%, which are or recently have been used for agricultural production, through planting trees or managing natural regeneration. Reforestation plots will replace the dominant agricultural ensemble of the region, temporary crops, in straight rows, without terracing, contouring or any kind of soil conservation practices. Figure 6 shows degraded conditions to be improved by reforestation. The project has reforested 22 hectares across 53 plots. For lands showing early signs of secondary succession, desirable forest species have been planted to provide an incentive for land owners to avoid clearing the land for agricultural use. Management plans are under development for each site and will be completed by the end of 2014; these will include tracking seedling performance, control and monitoring of pests and diseases, signposting, boundary demarcation and maintenance.
Figure 3. Forest area to be conserved

Figure 4. Agricultural conditions to be replaced

Figure 5. Agroforestry condition to be promoted: agroforestry system which incorporates avocado as the main agricultural crop, with trees used as hedgerows.
SUMMARY OF REPLENISH BENEFIT:

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 51.1 ML/YR

ACTIVITY TIMELINE:

July 2014 - September 2014 – Conservation of 64 hectares, including:
- 22.07 hectares forest protected
- 20.07 hectares agroforestry planted
- 22.01 hectares reforested

COCA-COLA CONTRIBUTION: 100%
WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff due to implementation of project activities involving land use changes related to forest protection, agroforestry and reforestation. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (64 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

Forest protection (22.07 ha):
- Without-project: No forest protection
  - A mixture of Row Crops, Straight Row, both in “poor” and “good” condition; Small grain, Straight Row, both in “poor” and “good” condition; Close seeded or broadcast legumes, Straight Row, both in “poor” and “good” hydrologic condition \[ CN = (88+85+84+83+85+81)/6 = 84.3 \]
  - Hydrologic soil group (HSG) “C”
- With-project: Forest protection
  - Woods in “good” condition, woods are protected from grazing and litter/brush adequately cover the soil \[ CN = 70 \]
  - Hydrologic soil group (HSG) “C”

Agroforestry (20.07 ha):
- Without-project: Cropland
  - A mixture of Row Crops, Straight Row, both in “poor” and “good” condition; Small grain, Straight Row, both in “poor” and “good” condition; Close seeded or broadcast legumes, Straight Row, both in “poor” and “good” hydrologic condition \[ CN = (88+85+84+83+85+81)/6 = 84.3 \]
  - Hydrologic soil group (HSG) “C”
- With-project: Agroforestry
  - Wood-grass combination in “good” condition \[ CN = 72 \]
  - Hydrologic soil group (HSG) “C”
Reforestation (22.01 ha):

- **Without-project**: Cropland
  - A mixture of Row Crops, Straight Row, both in “poor” and “good” condition; Small grain, Straight Row, both in “poor” and “good” condition; Close seeded or broadcast legumes, Straight Row, both in “poor” and “good” hydrologic condition; bare soil with crop residue in “good” hydrologic condition \[CN = (88+85+84+83+85+81+88)/7 = 84.85\]
  - Hydrologic soil group (HSG) “C”

- **With-project**: Reforestation
  - Woods in “good” condition, woods are protected from grazing and litter/brush adequately cover the soil \(CN = 70\)
  - Hydrologic soil group (HSG) “C”

Daily precipitation and air temperature data were provided during the 2007-2013 time period by Jorge Leon (TNC). The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Curve numbers and processed meteorological data were used to compute daily runoff for the without- and with-project cases for the 2007-2013 period. Total annual average runoff volumes and the resulting water quantity benefit from the project were estimated as follows:

- **Without-project**: 412.6 ML/yr
  - No forest protection (22.07 ha): 141.6 ML/yr (runoff depth: 641.6 mm/yr)
  - No agroforestry (20.07 ha): 128.8 ML/yr (runoff depth: 641.9 mm/yr)
  - No reforestation (22.01 ha): 142.1 ML/yr (runoff depth: 645.6 mm/yr)

- **With-project**: 361.5 ML/yr
  - Forest protection (22.07 ha): 123.6 ML/yr (runoff depth: 560.2 mm/yr)
  - Agroforestry (20.07 ha): 114.5 ML/yr (runoff depth: 570.7 mm/yr)
  - Reforestation (22.01 ha): 123.3 ML/yr (runoff depth: 560.2 mm/yr)

- **Benefit (runoff reduction)**: 51.1 ML/yr
  - Forest protection (22.07 ha): 18.0 ML/yr
  - Agroforestry (20.07 ha): 14.3 ML/yr
  - Reforestation (22.01 ha): 18.8 ML/yr

The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

*The total (ultimate) benefit is: 51.1 ML/yr*

*TCCC total (ultimate) benefit taken as a function of cost share is: 51.1 ML/yr*

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 51.1 ML/yr and TCCC’s benefit (adjusted for cost share) is 51.1 ML/yr.
Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>51.1</td>
<td>51.1</td>
</tr>
<tr>
<td>2016</td>
<td>51.1</td>
<td>51.1</td>
</tr>
<tr>
<td>2017</td>
<td>51.1</td>
<td>51.1</td>
</tr>
<tr>
<td>2018</td>
<td>51.1</td>
<td>51.1</td>
</tr>
<tr>
<td>2019</td>
<td>51.1</td>
<td>51.1</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>51.1</td>
<td>51.1</td>
</tr>
</tbody>
</table>

Data Sources:

- **Size of protected land area:**
  - Forest protection – 22.07 ha (provided by Jorge Leon, TNC)
  - Agroforestry – 20.07 ha (provided by Jorge Leon, TNC)
  - Reforestation – 22.01 ha (provided by Jorge Leon, TNC)
- **Slope**: 5% (provided by Jorge Leon, TNC)
- **Soil type**: predominantly hydrologic soil group (HSG) “C” (provided by Jorge Leon, TNC). Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.
- **Meteorological data**: Daily precipitation and air temperature data were provided by Jorge Leon (TNC)
- All of the above information on data sources is contained in a data package provided by Jorge Leon (TNC) on 10/14/2014 titled “6_Guatemala.zip”.
- Updated curve numbers provided by Jorge Leon (TNC) via email on 11/18/2014

Assumptions:

- If the land were not protected, deforestation would occur to establish agriculture and extract wood for fuel.
- Forest protection “without-project” (i.e., no forest protection) conditions were assumed to be a mixture of row crops, small grain, and close seeded or broadcast legumes, all straight row both in “poor” and “good” hydrologic condition, and “with-project” (i.e., forest protection) conditions were assumed to be woods in “good” condition (woods are protected from grazing and litter/brush adequately cover the soil).
- Agroforestry “without-project” (i.e., cropland) conditions were assumed to be a mixture of row crops, small grain, and close seeded or broadcast legumes, all straight row both in “poor” and
“good” hydrologic condition, and “with-project” (i.e., agroforestry) conditions were assumed to be a wood-grass combination in “good” condition.

- Reforestation “without-project” (i.e., cropland) conditions were assumed to be a mixture of row crops, small grain, and close seeded or broadcast legumes, all straight row both in “poor” and “good” hydrologic condition plus bare soil with crop residue in “good” hydrologic condition, and “with-project” (i.e., reforestation) conditions were assumed to be woods in “good” condition (woods are protected from grazing and litter/brush adequately cover the soil).

- SWAT model parameter “CNCOEF” was set to 1.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of implementing project activities related to forest protection, agroforestry and reforestation. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the 2007-2013 period.

The Cover/Management Factors ($C_{usle}$) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

Forest protection (22.07 ha):
- Without-project (no forest protection): Field crops, with residue left on the field ($C = 0.032$)
- With-project (forest protection): Managed woodland with 75-100% tree canopy ($C_{usle} = 0.001$)

Agroforestry (20.07 ha):
- Without-project (cropland): Field crops, with residue left on the field ($C = 0.032$)
- With-project (agroforestry): Managed woodland with 40-75% tree canopy ($C_{usle} = 0.002$)

Reforestation (22.01 ha):
- Without-project (cropland): Field crops, with residue left on the field ($C = 0.032$)
- With-project (reforestation): Managed woodland with 75-100% tree canopy ($C_{usle} = 0.001$)

Total annual sediment yields for the project area were estimated as follows:
- Without-project: 813 MT/yr
  - No forest protection: 280 MT/yr (sediment unit area yield: 12.7 MT/ha/yr)
  - No agroforestry: 252 MT/yr (sediment unit area yield: 12.5 MT/ha/yr)
  - No reforestation: 281 MT/yr (sediment unit area yield: 12.8 MT/ha/yr)
- With-project: 30 MT/yr
  - Forest protection: 8 MT/yr (sediment unit area yield: 0.3 MT/ha/yr)
Agroforestry: 14 MT/yr (sediment unit area yield: 0.7 MT/ha/yr)
Reforestation: 8 MT/yr (sediment unit area yield: 0.3 MT/ha/yr)

- **Benefit (reduced sediment yield): 783 MT/yr**
  - Forest protection: 272 MT/yr
  - Agroforestry: 238 MT/yr
  - Reforestation: 273 MT/yr

**The total benefit (sediment yield reduction) is: 783 MT/yr**

**The total benefit (reduced sediment yield) is: 783 MT/yr and TCCC’s benefit (adjusted for cost share) is 783 MT/yr.**

**The 2014 benefit is: 783 MT/yr and TCCC’s benefit (adjusted for cost share) is 783 MT/yr.**

**Data Sources:**
- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

**Assumptions:**
- The Cover Factor (Cusle) was assumed to remain constant through time (both seasonally and among years).
- The soil erodibility factor (K) was assumed to be 0.25 for use in MUSLE equation. Soil erodibility factor was estimated for sandy clay loam with approximately 1 – 2% organic matter content based on Haith et al. (1992).

**OTHER BENEFITS NOT QUANTIFIED**
- Increase in infiltration and baseflow
- Protection of an important drinking water source for the Guatemala City metropolitan area
- Improvements in terrestrial habitat and biodiversity
- Maintain/protect biodiversity
- Economic benefits of agroforestry systems

**NOTES**
- This project is part of a portfolio of Water Fund projects in Latin America.

**REFERENCES**


PROJECT NAME: Forest Conservation in the Higua River Watershed - Yaque del Norte Water Fund
PROJECT ID #: 176

DESCRIPTION OF ACTIVITY: Conservation (86 hectares) and Restoration (4.56 hectares)

LOCATION: Higua River subwatershed within the Yaque del Norte basin, southwest of Santiago, Dominican Republic. Latitude: 19.281, Longitude: -71.019

PRIMARY CONTACTS:
Jorge Leon Sarmiento
Latin America Water Funds Specialist
The Nature Conservancy
Cartagena de Indias, Colombia
(+57) 317-5100-880
jleon@tnc.org

Erick Ramírez
Environmental and Safety Manager
Latin Center Business Unit
Coca-Cola
(+506) 61853276
erickramirez@coca-cola.com

OBJECTIVES:
- Protect forested areas and associated ecosystem services, including water supply

BACKGROUND & ACTIVITY DESCRIPTION:
The project is located in the Higua River subwatershed of the Yaque del Norte basin, southwest of the city of Santiago in the Dominican Republic (Figure 1). This watershed is an important source of drinking water for the city of Santiago. Within the region, native forests have largely been converted for agricultural uses, with land use in the watershed 45% degraded pastures and agriculture, 20% shade grown coffee, 24% humid and dry shrubs, and 8% pine and hardwood forest. Land use changes due to extensive cattle ranching have decreased forest cover, altering the hydrology of the watershed.
This project includes both protection and restoration activities, as follows:
1. Protection of existing forests to avoid deforestation. This project protects 86 hectares of primary tropical forest remnants, avoiding conversion to agriculture or ranching. A conservation agreement has been reached with the landowner that will maintain the forest in conservation and prohibit forest conversion and timber extraction. The project area currently maintains at least 70% forest cover, with the presence of primary vegetation and healthy understory, and no apparent symptoms of soil erosion. Figure 2 shows the current conditions. Note the clear difference between forested and cleared land in the photo on the right. If not protected, the project area will most likely be cleared and replaced by cattle ranching. Figure 3 highlights the degraded conditions that have occurred on neighboring properties.

Figure 1. Location Map
2. Restoration to improve cover. This activity restores 4.56 hectares. These lands have traditionally been used for coffee production, but production has significantly decreased due to local plague. Hydrologic conditions are poor, and there is low shade cover and visible exposed soil. The restoration will plant coffee trees, along with species such as Honduran Mahogany to provide shade (Figure 4). If not restored, these areas most likely will be converted for cattle production or intensive agriculture (Figure 5).
SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 106.6 ML/YR

ACTIVITY TIMELINE:
- May 2014 - September 2014 – Protection of 86 hectares via a conservation agreement
- September 2014 - November 2014 – Restoration of 4.56 hectares via planting of coffee and shade trees

COCA-COLA CONTRIBUTION: 100%

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff
1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff due to implementation of project activities involving land use changes. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (90.6 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers for the pre-project condition and the post-project condition were provided by Jorge Leon (TNC) based on information provided in the TR-55 document (USDA-NRCS, 1986):

Forest Protection (86 ha):
- **Without-project**: No forest protection
  - A mixture of 25% row crops, with contoured rows and crop residue cover in “poor” condition and 75% pasture, grassland, or range in “poor” condition, <50% cover \[CN = 0.25 \times 83 + 0.75 \times 86 = 85.25\]
  - Hydrologic soil group (HSG) “C”
- **With-project**: Forest protection
  - Woods in “good” condition, woods are protected from grazing and litter/brush adequately cover the soil \( CN = 70 \)
  - Hydrologic soil group (HSG) “C”

Restoration with Shade Coffee (4.56 ha):
- **Without-project**: Cropland
  - A mixture of 50% row crops, straight row and crop residue cover in “poor” hydrologic condition and 50% pasture, grassland, or range in “poor” condition, <50% cover \[CN = 0.50 \times 87 + 0.50 \times 86 = 87\]
  - Hydrologic soil group (HSG) “C”
- **With-project**: Restoration with shade coffee
  - Shade coffee in “good” hydrologic condition with ground cover \( CN = 68 \)
  - Hydrologic soil group (HSG) “C”

Daily precipitation and air temperature data were provided by Jorge Leon (TNC). The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Curve numbers and processed meteorological data were used to compute daily runoff for the without-and with-project cases for an 11-year period (2003-2013) for the forest protection project. Daily runoff for the shade coffee restoration project was computed for a 10-year meteorological period (1990-1999).

Total annual average runoff volumes and the resulting water quantity benefit for protecting the 90.6 ha forest was estimated as follows:
• **Without-project**: 407.1 ML/yr
  - No forest protection (86 ha): 382.8 ML/yr (runoff depth: 445.1 mm/yr)
  - Cropland (4.56 ha): 24.3 ML/yr (runoff depth: 532.4 mm/yr)

• **With-project**: 300.5 ML/yr
  - Forest Protection (86 ha): 281.6 ML/yr (runoff depth: 327.5 mm/yr)
  - Restoration with Shade Coffee (4.56 ha): 18.9 ML/yr (runoff depth: 415.5 mm/yr)

• **Benefit (runoff reduction)**: **106.6 ML/yr**

The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

The total (ultimate) benefit is: **106.6 ML/yr**

TCCC total (ultimate) benefit taken as a function of cost share is: **106.6 ML/yr**

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 106.6 ML/yr, and TCCC’s benefit (adjusted for cost share) is 106.6 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>106.6</td>
<td>106.6</td>
</tr>
<tr>
<td>2016</td>
<td>106.6</td>
<td>106.6</td>
</tr>
<tr>
<td>2017</td>
<td>106.6</td>
<td>106.6</td>
</tr>
<tr>
<td>2018</td>
<td>106.6</td>
<td>106.6</td>
</tr>
<tr>
<td>2019</td>
<td>106.6</td>
<td>106.6</td>
</tr>
<tr>
<td><strong>Ultimate Benefit:</strong></td>
<td><strong>106.6</strong></td>
<td><strong>106.6</strong></td>
</tr>
</tbody>
</table>

**Data Sources:**

• **Size of protected land area**: 90.6 ha (provided by Jorge Leon, TNC)
  - Forest Protection – 86 ha
  - Restoration with Shade Coffee – 4.56 ha

• **Slope**: provided by Jorge Leon, TNC
  - Forest Protection – 5%
  - Restoration with Shade Coffee – 25%
• **Soil type**: predominantly hydrologic soil group (HSG) “C” (provided by Jorge Leon, TNC). Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.

• **Meteorological data**: Daily precipitation and air temperature data were provided by Jorge Leon (TNC) for an 11-year period (2003-2013) for the forest protection project and for a 10-year period (1990-1999) for the shade coffee restoration project.

• All of the above information on data sources is contained in a data package provided by Jorge Leon (TNC) on 10/14/2014 titled “7_DominicanRepublic.zip” and then on 12/17/2014 titled “7_DominicanRepublic_december_2014.zip.”

• Updated curve numbers for the forest protection activity provided by Jorge Leon (TNC) on 11/06/2014 in a spreadsheet titled “Revisited NoProject CN.xlsx.”

**Assumptions:**

• If the land were not protected, deforestation would occur to establish agriculture and grazing.

• “Without-project” conditions for both the forest protection and shade coffee restoration projects were assumed to be a mixture of row crops, with contoured rows and crop residue cover in “poor” condition and pasture, grassland, or range in “poor” condition (<50% cover), and “with-project” conditions were assumed to be woods in “good” condition for the forest protection project and shade coffee in “good” condition for the shade coffee restoration project.

• SWAT model parameter “CNCOEF” was set to 2.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

### 2. DECREASE IN SEDIMENT EROSION/RUNOFF

**Approach & Results:**

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of implementation of project activities involving land use changes. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the relevant meteorological period.

The Cover/Management Factors ($C_{usle}$) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

**Forest Protection (86 ha):**

• **Without-project (no forest protection)**: Pasture, 60% ground cover as grass ($C_{usle} = 0.04$)

• **With-project (forest protection)**: Managed woodland with 75-100% tree canopy ($C_{usle} = 0.001$)
Restoration with Shade Coffee (4.56 ha):

- **Without-project (cropland):** Mixture of 50% field crops with residue left on the field and 50% pasture with 60% ground cover as grass ($C_{usle} = 0.5 (0.032) + 0.5 (0.04) = 0.036$)
- **With-project (restoration with shade coffee):** Shade coffee, 20-40% tree canopy ($C_{usle} = 0.003$)

Total annual sediment yields for the project area were estimated as follows:

- **Without-project:** 1,685.3 MT/yr
  - No Forest Protection (86 ha): 1,110.7 MT/yr (sediment unit area yield: 12.9 MT/ha/yr)
    - Cropland (4.56 ha): 574.6 MT/yr (sediment unit area yield: 126 MT/ha/yr)
  
- **With-project:** 57.8 MT/yr
  - Forest Protection (86 ha): 20.4 MT/yr (sediment unit area yield: 0.2 MT/ha/yr)
  - Restoration with Shade Coffee (4.56 ha): 37.4 MT/yr (sediment unit area yield: 8.2 MT/ha/yr)

**Benefit (reduced sediment yield):** 1,627.5 MT/yr

The total benefit (sediment yield reduction) is **1,627.5 MT/yr**

The total benefit (reduced sediment yield) is: 1,627.5 MT/yr and TCCC’s benefit (adjusted for cost share) is 1,627.5 MT/yr.

The 2014 benefit is: 1,627.5 MT/yr and TCCC’s benefit (adjusted for cost share) is 1,627.5 MT/yr.

**Data Sources:**

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

**Assumptions:**

- The Cover Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and among years).
- The soil erodibility factor ($K$) was assumed to be 0.25 for use in MUSLE equation. The soil erodibility factor was estimated for sandy clay loam with approximately 1-2% organic matter content based on Haith et al. (1992).

**Other Benefits Not Quantified**

- Protection of an important drinking water source
- Increase in infiltration and baseflow
- Improvements in terrestrial habitat and biodiversity
- Maintain/protect biodiversity

**Notes:**

- This project is part of a portfolio of Water Fund projects in Latin America.
REFERENCES


PROJECT NAME: Wetland Restoration in Jialing River Basin
PROJECT ID #: 177

DESCRIPTION OF ACTIVITY: Green Certification for Pear Production (333.3 hectares)

LOCATION: Longtan Town, Lizhou District, Guangyuan City, Sichuan Province in the Upper Yangtze River Basin, Upstream of Guangyuan Nanhe National Wetland Park (N 32°22′, E 105°51′)

PRIMARY CONTACTS:
Kevin Jiang
Greater China & Korea Business Unit
No. 1188 Ziyue Road
Zizhu Science Based Industrial Park
Minhang District, Shanghai, 200241, China
Tel: 86-21-61928318
E-mail: kejiang@coca-cola.com

Baoyu Wei
WWF China
Director of Chengdu Programme Office
bywei@wwfchina.org

Judy Takats
WWF US
1250 24th St., NW
Washington, DC 20037-1193
Tel (U.S.) 615-476-6176
judy.takats@wwfus.org

OBJECTIVES:
• Demonstrate that sustainable agriculture practices reduce runoff and pollutant loading (i.e., sediment, fertilizers, herbicides, pesticides) from agricultural lands
• Protect downstream wetlands from further degradation and improve hydrology and water quality

BACKGROUND & ACTIVITY DESCRIPTION: The Yangtze River Basin contains nearly 40% of China’s freshwater and is a region of global significance for freshwater conservation. The Jialing River Basin, with a total area of 160,000 km² and a length of 1,200 km, is the largest tributary to the Yangtze River. The Jialing River Basin is of great importance to the Yangtze River in terms of water source protection, biodiversity conservation, and ecosystem security. The Jialing River Basin contains varying landscapes from the headwaters to an estuary and is characterized by unique biodiversity. The headwaters of the Jialing River Basin provide habitat for the Giant Panda, and the main stem is an area with high fish biodiversity. In addition, large populations of water birds utilize the wetlands for habitat on a seasonal or annual basis. The Jialing River Basin is also home to about 30 million residents.

The Guangyuan Nanhe National Wetland Park is located at the upper reach of the Jialiang River. The wetland has a significant role in protecting water resources, ecosystems, and the sustainability of local socio-economic development. The wetland park has been degraded due to improper and excessive development for recreational purposes as well as unsustainable farming activities that occur upstream. These activities have resulted in hydrologic alteration, loss of riparian vegetation, increased pollutant loading, habitat loss, and a decrease in biodiversity.

Longtan Town is located upstream of Guangyuan Nanhe National Wetland Park. Fruit, including pears, and vegetable production is important in the local region. The standard agricultural practices for pear production result in an increase in surface water runoff and pollutant loading to the Jialing River. The pollutant loading is attributed to the application of fertilizers, pesticides and herbicides. These agricultural practices also contribute to the accumulation of pesticides, low prices for pears, and potential health risks to customers.
In order to mitigate the impact of the existing agricultural (farming) practices on the Jialing River and the neighboring Guangyuan Nanhe National Wetland Park, TCCC and WWF implemented a sustainable agriculture demonstration project beginning in 2013 and in parallel with the wetland restoration project in the Guangyuan Nanhe National Wetland Park. The project is in cooperation with the Guangyuan City Agriculture Bureau and the Lizhou District Agriculture Bureau.

The work of WWF has focused on Green Certification for Pears grown on 333.3 ha (Figure 1). Specific project activities include: leveling land; developing a pear-vegetable inter-planting regime (Figure 2); and reducing the application of fertilizers, herbicides, and pesticides. The sustainable agriculture demonstration project has been successful. The terracing to level the land has helped to reduce surface runoff and pollutant loading. The inter-planting of vegetables under the pear trees has helped to increase the vegetation cover and also reduce surface runoff and pollutant loading. The use of chemicals in production is strictly controlled through the green farm regulatory program. These actions serve to protect the waters on the farm and downstream. In addition, the certified agriculture products, including pear and vegetables, will start to generate greater economic returns to the local growers.

Figure 1: WWF and TCCC sustainable agriculture project location in the Jialing River Basin.

Figure 2: Vegetation cover before vegetable planting (A), at planting (B), and after planting (C).
SUMMARY OF REPLENISH BENEFIT:
• 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 156.0 ML/yr

ACTIVITY TIMELINE:
• 2013: Stakeholder alignment and project initiated
• 2014 and beyond: Project complete and the benefits continue

COCA-COLA CONTRIBUTION: 100%
• Overall Project Funding: $64,516 USD
  o Coca-Cola Cost Contribution: $64,516 USD

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al., 2005) was used to estimate the decrease in runoff due to the inter-planting of pears and vegetables. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (333.3 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

The pear-vegetable production site is dominated by soils that belong to the “type B” hydrologic soil group. Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

Pear-Vegetable Production Site (333.3 ha):
• **Without-project**: Pear production only
  o Row crops, straight row, “poor” condition (CN = 81).
    
    Note: Pear production would typically fall under the “woods-grass combination” (orchard or tree farm) cover type classification for curve numbers. This classification is based on the assumption that there is 50% cover by woods and 50% cover by grass or pasture. Therefore, the woods-grass combination (orchard or tree farm) cover type classification is not appropriate for this site as the pre-project condition contains exposed and bare soils, similar to a row crop situation. The “row crop” cover type classification provides the best surrogate representation of the actual site conditions.
  o Hydrologic soil group (HSG) “B”

• **With-project**: Pear-vegetable inter-planting
  o Close seeded or broadcast legumes or rotation meadow, contoured and terraced, (CN = 71). The curve number value represents an overall annual average condition to account
for changes in the vegetable crop cover between plantings and harvests. The close seeded or broadcast legumes or rotation meadow, contoured and terraced, conditions of “poor” (CN = 73) and “good” (CN = 67) were used to obtain the overall annual average condition.

Note: The “close seeded or broadcast legumes or rotation meadow”, contoured and terraced cover type classification curve numbers provide the best available representation of the pear-vegetable site condition. Because the vegetable crop cover will vary between planting and harvest times, the curve number is based on an overall annual average condition.

- Hydrologic soil group (HSG) “B”

Daily precipitation and air temperature data were acquired for the Tutiempo, Mianyang climate station (http://www.tutiempo.net/en/Climate/MIANYANG/561960.htm), which was the closest station to the site location with data available for the 2006-2013 time period. The Hamon method was initially used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963). The initial PET values calculated were scaled based on the annual average PET value reported for the site location in the Global GIS Dataset (Hearn et al., 2003).

Curve numbers and processed climate data were used to compute daily runoff for the without- and with-project cases for an 8-year period (2006-2013). Total annual average runoff volumes and the resulting water quantity benefit for protecting the 333.3 ha pear production site were estimated as follows:

- **Without-project (pear production only):** 1,227.9 ML/yr (runoff depth: 368.40 mm/yr)
- **With-project (pear-vegetable inter-planting):** 1,071.9 ML/yr (runoff depth: 321.60 mm/yr)
- **Benefit (runoff reduction):** 156 ML/yr

The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

- **The total (ultimate) benefit is:** 156 ML/yr
- **TCCC total (ultimate) benefit taken as a function of cost share is:** 156 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 156 ML/yr, and TCCC’s benefit (adjusted for cost share) is 156 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>156</td>
<td>156</td>
</tr>
<tr>
<td>2016</td>
<td>156</td>
<td>156</td>
</tr>
<tr>
<td>2017</td>
<td>156</td>
<td>156</td>
</tr>
<tr>
<td>2018</td>
<td>156</td>
<td>156</td>
</tr>
<tr>
<td>2019</td>
<td>156</td>
<td>156</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>156</td>
<td>156</td>
</tr>
</tbody>
</table>

Data Sources:

- **Size of protected land area**: 333.3 ha (provided by Kevin Jiang, TCCC)
- **Slope**:
  - Pre-project – 6% (based on Global GIS dataset, Hearn et al., 2003)
  - Post-project – 5% (provided by Kevin Jiang, TCCC)
- **Soil type**: Hydrologic soil group (HSG) “B” (provided by Kevin Jiang, TCCC). Type B soils are characterized as having moderately low runoff potential when thoroughly wet (i.e., moderately well drained). Type B soils typically have moderately fine to moderately coarse loamy sand or sandy loam textures. Some soils having loam, silt loam, silt, or sandy clay loam textures may be placed in the Type B soil group if the soils are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
- **Climate data**: Tutiempo, Mianyang ([http://www.tutiempo.net/en/Climate/MIANYANG/561960.htm](http://www.tutiempo.net/en/Climate/MIANYANG/561960.htm)) for 2006-2013
- Data provided by Kevin Jiang, TCCC, as referenced above, is in a document titled “Fact Sheet - Wetland Restoration in Jialingjiang 16Oct2014(R1).docx”.

Assumptions:

- “Without-project” (i.e., pear production only) conditions were assumed to be row crops, with straight rows in “poor” condition, and “with-project” (i.e., pear-vegetable inter-planting) conditions were assumed to be close seeded or broadcast legumes or rotation meadow, contoured and terraced, with an overall annual average hydrologic condition to account for changes in the vegetable crop cover between plantings and harvests.
- SWAT model parameter “CNCOEF” was set to 2.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. **DECREASE IN SEDIMENT EROSION/RUNOFF**

**Approach & Results:**

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result pear and vegetable inter-planting. The climate and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation.
Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the 2006-2013 period.

The Cover/Management Factors ($C_{usle}$) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

- Without-project (pear production only): Managed woodland, 20-40% canopy cover ($C_{usle} = 0.01$)
- With-project (pear-vegetable inter-planting): Managed woodland, 75-100% canopy cover ($C_{usle} = 0.001$)

Note: The “managed woodland” classification for the Cover/Management Factors ($C_{usle}$) provides the best available representation of the pear-vegetable site condition given that a combined woodland-crop classification is not available.

Total annual sediment yields were estimated as follows:

- Without-project (pear production only): 574.3 MT/yr (sediment unit area yield: 1.72 MT/ha/yr)
- With-project (pear-vegetable inter-planting): 18.8 MT/yr (sediment unit area yield: 0.06 MT/ha/yr)
- **Benefit (reduced sediment yield): 555.5 MT/yr**

The total benefit (sediment yield reduction) is: 555.5 MT/yr

The total benefit (reduced sediment yield) is: 555.5 MT/yr and TCCC’s benefit (adjusted for cost share) is 555.5 MT/yr.

The 2014 benefit is: 555.5 MT/yr and TCCC’s benefit (adjusted for cost share) is 555.5 MT/yr.

**Data Sources:**

- See previous runoff section for a description of supporting climate and physical datasets and sources.

**Assumptions:**

- The Cover Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and among years).
- The soil erodibility factor ($K$) for type B soils was assumed to be 0.10 for use in MUSLE equation. Soil erodibility factor was estimated for loamy sand with approximately 2% organic matter content based on Haith et al. (1992).

**OTHER WATERSHED BENEFITS NOT QUANTIFIED**

- Increased infiltration and baseflow
- Improved habitat and increased biodiversity
- Reduced health impacts resulting from decreased pollutant loads
- Increased economic returns resulting from certification

**NOTES**

- None.
REFERENCES


PROJECT NAME: Wetland Restoration in Jialing River Basin  
PROJECT ID #: 177

DESCRIPTION OF ACTIVITY: Wetland and lake creation and restoration

LOCATION: Guangyuan Nanhe National Wetland Park, Guangyuan City, Sichuan Province, China (Latitude/Longitude: 32.421320 N, 105.852047 E)

PRIMARY CONTACTS:
Kevin Jiang  
Greater China & Korea Business Unit  
No. 1188 Ziyue Road, Zizhu Science Based Industrial Park, Minhang District, Shanghai, 200241, China  
Tel: 86-21-61928318  
E-mail: kejiang@coca-cola.com

Baoyu Wei  
Director of Chengdu Programme Office  
No. 1250 24th St., NW  
Tel (U.S.) 615-476-6176  
E-mail: bywei@wwfchina.org

Judy Takats  
WWF US  
1250 24th St., NW  
Washington, DC 20037-1193  
Tel (U.S.) 615-476-6176  
E-mail: judy.takats@wwfus.org

OBJECTIVES:
• Protect drinking water supply
• Increase aquatic habitat and biodiversity
• Increase groundwater levels in the region

BACKGROUND & DESCRIPTION OF ACTIVITY: Holding nearly 40% of China’s freshwater, the Yangtze River basin is home to 460 million people, one-third of China’s population, and 40% of the country’s GDP. It is also a region of global significance to freshwater conservation. The Jialing River is the largest tributary to the Yangtze River, with a length of 1200 km and a basin area of 160,000 km². With an average annual runoff of 683 X 10^8 m³, the Jialing River is an important water source for the upper and middle reaches of the Yangtze River. The basin has varying landscapes from headwater to mouth, and is characterized by unique biodiversity. The headwaters flow through the habitat for the Giant Panda and its mainstream has a high diversity of fish species. Large populations of water birds rely on wetlands along the Jialing River as their home. The basin is also home to about 30 million residents. For these reasons, the Jialing River Basin is of great importance to the Yangtze River in terms of water source protection, biodiversity conservation and ecosystem security (WWF China, 2014).

Guangyuan Nanhe National Wetland Park (68 ha) is located in the upper reach of the Jialiang River at the confluence of the Nanhe and Wanyuan Rivers (Figures 1 and 2). The water that flows through the wetland park provides drinking water to downstream residents, and the wetlands play a significant role in protecting the sustainability of Jialing River water resources. However, due to land development and unsustainable farming activities upland of the wetland park, the park is experiencing loss of riparian wetlands, declining groundwater levels and declining biodiversity (WWF China, 2014).

Figure 1. Location of Guangyuan Nanhe National Wetland Park
Activity 1: Two terrace wetlands were created from abandoned rice paddies. Pipes and a new channel have been installed to bring water from a reservoir to the wetlands. The restoration included planting terrace wetland No. 1 (0.77 ha) with wetland farm crops, referred to as “participatory farming.” Terrace wetland No. 2 (1.15 ha) was planted with native wetland plants in small ponds with varying water depths to create a wetland plant nursery.

Activity 2: Three artificial lakes (1.74 ha in total surface area) were dredged and vegetated to increase groundwater recharge through natural infiltration. A pump station was installed to provide supplementary water to the lakes. An existing cement channel was converted to a natural water course to allow groundwater recharge to occur through the channel bottom.

Activity 3: Riparian habitat (2.45 ha) was improved by creating a depression in a riparian area so water could flow in from the river to improve habitat. The area previously had low water holding capacity. The river bank was cut back, a natural depression was created and native aquatic plants were planted.

Activities to improve wetland management and capacity building for the park management staff were also implemented.
SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 555.8 ML/yr

ACTIVITY TIMELINE:
- 2011 WWF and TCCC, together with the Sichuan Forestry Department and local government began working together to demonstrate methods for comprehensive restoration activities at Guangyuan Nanhe National Wetland Park.
- 2012 Nov: Stakeholder aligned and project design started
- 2013 July: Construction of the 3 activities started
- 2014 June: All construction and planting completed
- 2014 and beyond: Project maintenance

COCA-COLA CONTRIBUTION: Variable by activity
TCCC cost contribution by activity:
- Activity 1: 62.8% provided by TCCC (Subtotal: $295,161.30; TCCC cost: $185,483.90)
- Activity 2: 93.3% provided by TCCC (Subtotal: $216,129.00; TCCC cost: $201,612.90)
- Activity 3: 25.0% provided by TCCC (Subtotal: $129,032.30; TCCC cost: $32,258.10)
Total Cost: $640,322.60; TCCC Cost: $419,354.90.

WATERSHED BENEFITS CALCULATED:
- Activity 1: Volume provided to terrace wetlands
- Activity 2: Volume recharged through artificial lakes
- Activity 3: Volume provided to riparian wetland
ACTIVITY 1: VOLUME PROVIDED TO TERRACE WETLANDS

Approach & Results:
The annual water volume provided from the reservoir to the terrace wetlands is calculated as:

\[
\text{Total volume} = \text{Volume provided to terrace wetland 1} + \text{Volume provided to terrace wetland 2}
\]

Inputs:
- Volume of water supplied to terrace wetland No. 1 = \(2.4243 \times 10^{-3} \text{ m}^3/\text{s}\) (based on monitoring data)
- Volume of water supplied to terrace wetland No. 2 = \(6.75 \times 10^{-3} \text{ m}^3/\text{s}\) (based on monitoring data)

The total volume supplied to the two terrace wetlands = \((2.4243 \times 10^{-3} \text{ m}^3/\text{s}) + (6.75 \times 10^{-3} \text{ m}^3/\text{s}) = 9.1743 \times 10^{-3} \text{ m}^3/\text{s} = 289,320.7 \text{ m}^3/\text{yr} = 289.3 \text{ ML/yr}\)

-----------------------------------------------------------------------------------------------------------

ACTIVITY 2: VOLUME RECHARGED THROUGH ARTIFICIAL LAKES

Approach & Results:
The annual water volume recharged is calculated as follows:

\[
\text{Volume recharged} = \text{Volume pumped into lakes} – \text{Volume evaporated}
\]

Inputs:
- Pre-project condition: no groundwater recharge
- Post-project condition: water pumped to lakes for groundwater recharge
- Pumping rate: 50 m³/hour/water pump, 350 hours/month, 2 water pumps
- Average evaporation rate = 1469 mm/yr
- Total evaporation area of artificial lake = 1.74 ha

\[
\text{Volume recharged} = (2 \times 50 \text{ m}^3/\text{hour} \times 350 \text{ hours/month} \times 12 \text{ months}) – (1.74 \text{ ha} \times 1469 \text{ mm/yr}) = 420 \text{ ML/year} - 25.6 \text{ ML/year} = 394.4 \text{ ML/year}
\]

-------------------------------------------------------------------------------------------------------------

ACTIVITY 3: VOLUME PROVIDED TO RIPARIAN WETLAND

Approach & Results:
The volume annually provided to the riparian wetland is calculated as follows:

\[
\text{Water volume provided} = \text{Area of riparian wetland} \times \text{Increase in water depth}
\]

Inputs:
- Area of restored riparian wetland: 2.45 ha
- Depth of water pre-project: 0.5 meter
- Depth of water post-project: 1.5 meter

\[
\text{Volume provided} = 2.45 \text{ ha} \times (1.5 \text{ m} - 0.5 \text{ m}) = 24,500 \text{ m}^3/\text{yr} = 24.5 \text{ ML/yr}
\]

The total (ultimate) benefit is the sum of benefits from the three activities, and the TCCC benefit accounts for cost share.

The total (ultimate) benefit = 289.3 + 394.4 + 24.5 = 708.2 ML/yr
The TCCC benefit = (289.3 ML/yr * 0.628) + (394.4 ML/yr * 0.933) + (24.5 ML/yr * 0.25)
= 181.7 + 368 + 6.1 = 555.8 ML/yr
Total (ultimate) benefit is: 708.2 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 555.8 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 708.2 ML/yr, and TCCC’s benefit (adjusted for cost share) is 555.8 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>708.2</td>
<td>555.8</td>
</tr>
<tr>
<td>2016</td>
<td>708.2</td>
<td>555.8</td>
</tr>
<tr>
<td>2017</td>
<td>708.2</td>
<td>555.8</td>
</tr>
<tr>
<td>2018</td>
<td>708.2</td>
<td>555.8</td>
</tr>
<tr>
<td>2019</td>
<td>708.2</td>
<td>555.8</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>708.2</td>
<td>555.8</td>
</tr>
</tbody>
</table>

Data sources:
- All data and calculations were provided by WWF in file named “Fact Sheet - Wetland Restoration in Jialingjiang 16Oct2014(R1).docx”
- Average evaporation rates are shown in Table 2 (Guangyuan City Government, 2012).

Table 2. Average Evaporation Rate (mm) in Guangyuan City

<table>
<thead>
<tr>
<th>Month</th>
<th>Average Evaporation Rate (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>67.4</td>
</tr>
<tr>
<td>February</td>
<td>71.9</td>
</tr>
<tr>
<td>March</td>
<td>110.1</td>
</tr>
<tr>
<td>April</td>
<td>152.3</td>
</tr>
<tr>
<td>May</td>
<td>200.1</td>
</tr>
<tr>
<td>June</td>
<td>175.4</td>
</tr>
<tr>
<td>July</td>
<td>163.5</td>
</tr>
<tr>
<td>August</td>
<td>171.3</td>
</tr>
<tr>
<td>September</td>
<td>111.4</td>
</tr>
<tr>
<td>October</td>
<td>98.0</td>
</tr>
<tr>
<td>November</td>
<td>82.9</td>
</tr>
<tr>
<td>December</td>
<td>64.9</td>
</tr>
<tr>
<td>Annual Subtotal</td>
<td>1469</td>
</tr>
</tbody>
</table>
Assumptions:
- The calculations are based on monitored data, and are assumed to represent long-term average conditions.
- The artificial lakes were dredged as part of this project, and WWF has confirmed that the lakes have sufficient storage capacity to receive and store the new supply of water.

OTHER BENEFITS NOT QUANTIFIED
- More water is now intercepted by the wetlands and the landscape of the wetland park is turning from dry to wet.
- Continuous monitoring of bird populations shows a significant increase of bird species.
- The project has helped to provide improved ecotourism and a recreation environment for visitors.
- Water quality has improved.

NOTES
- None

REFERENCES

PROJECT NAME: Upper Methow River Restoration
PROJECT ID #: 178

DESCRIPTION OF ACTIVITY: Restoring groundwater storage through beaver reintroduction

LOCATION: Upper Methow River Watershed, Okanagan-Wenatchee National Forest, Washington

PRIMARY CONTACTS:
Kent Woodruff
USDA Forest Service
Ecosystem Services
Okanagan-Wenatchee National Forest
Program Manager – National Forest Foundation
406-830-3356
kwoodruff@fs.fed.us

Wes Swaffar
CCNA Group
Environment & Sustainability
404-395-6250
wswaffar@nationalforestswaffar.com

Rena Stricker
CCNA Group Environment
Contract Ecologist
404-676-9112
Rstricker@coca-cola.com

Jon Radtke
CCNA Group Environment & Sustainability
Manager, Water Resources
404-676-9112
Jradtke@coca-cola.com

OBJECTIVES:
• Increase groundwater storage, attenuating runoff for later season delivery
• Reduce stream temperatures
• Restore stream complexity
• Increase riparian vegetation
• Increase wood in streams
• Decrease sediment delivery
• Improve habitat for salmonids and other native fish

BACKGROUND & ACTIVITY DESCRIPTION: In most of the temperate Northern Hemisphere, beavers historically altered low-gradient, small-stream ecosystems by constructing dams made primarily of wood. Beaver dams created stream systems with slow, deep water and floodplain wetlands dominated by emergent vegetation and shrubs. The geomorphology and plant communities of small low-gradient streams changed significantly throughout much of the Northern Hemisphere after reduction of beaver populations. Beaver dams measurably affect the rates of groundwater recharge and stream discharge, retain enough sediment to cause measurable changes in valley floor morphology, and generally enhance stream habitat quality for many fishes (Pollock et al., 2003).

The Methow basin provides significant spawning areas for Spring Chinook salmon and also supports spawning steelhead, cutthroat trout, Pacific lamprey, bull trout, and a wide variety of other aquatic species. Wetlands on National Forest land in the Methow River watershed, Washington have experienced lowered water tables, reduced stream complexity, and a loss of riparian vegetation in areas historically inhabited by beavers. This project restores active beaver colonies to streams in the Methow River watershed to increase groundwater storage for later season delivery and to reduce stream temperatures.

The project also is conducting a peer reviewed study to quantify the stream temperature and stream flow benefit of beaver establishment. Thirty two temperature monitoring stations and six flow stations were established and have been monitored for four years.

The following tasks are implemented to ensure success:
1. GIS analysis and scorecard assessment to identify priority locations for beaver reintroduction, based on areas where suitable stream gradient, stream flow, food resources, and other important habitat attributes occur together.

2. Employing a reliable beaver sexing method to rapidly tell male and female beavers apart. This was historically difficult because beavers have internal reproductive organs.

3. Provision of a period of group acclimation to ensure that compatible males and females are included in the release groups.

4. Construction of a lodge for the beavers to use when first reintroduced, to provide a safe refuge from predators until the beavers can establish their own infrastructure.

5. Temperature and flow data collection.

For seven years (2008-2014), the project has successfully reintroduced beavers to streams in the Methow watershed, resulting in establishment of 31 successful beaver colony sites. The number of dams per site ranges from 1 to 12 within the project area. A site is determined to be successful if beavers have constructed or maintained at least one dam sufficient to at least double the cross-sectional measure of the stream (width x depth).

Seventeen sites are currently active (October 31, 2014) and 15 sites have produced young. The 31 successful sites created an average water surface area of 0.46 acres per site. The 15 ‘mature’ sites that have become well established support an average water surface area of 0.89 acres per site. Time to colony maturity is 2 to 4 years. Figure 1 shows two successfully restored beaver colonies.

![Figure 1. Successfully restored sites on South Fork Beaver Creek (left) and Libby Creek (right)](image)

At some sites where beavers have been successfully reintroduced, previously intermittent streams are observed to now flow continuously during the dry season (mid-July through mid-October). Streamflow in some perennial streams has also increased. These observed hydrological changes to date together with the work of beaver researchers in other states, continue to support the concept that beaver dams substantially increase groundwater recharge. This increased groundwater storage serves as the source of added streamflow during the dry season.

2014 was an exceptionally challenging year for beaver reintroduction in north central Washington due to significant wildfires that were followed by destructive floods. Several release sites, including one established colony, were heavily impacted and some monitoring stations were lost or altered. In cooperation with the Washington Department of Ecology, Ecotrust, the Colville Confederated Tribes, Seattle City Light, the Washington Department of Natural Resources, and the National Forest Foundation, project partners: the Methow Salmon Recovery Foundation, the Washington Department of Fish and Wildlife, the USFWS National Fish Hatchery, Woodsmith Watershed Consulting, and the US
Forest Service released 38 beavers to 13 sites. Eight of those were successful and are beginning to store water in 39 ponds with an initial pond surface area total of 0.6 acres as of November 14, 2014 (Methow Beaver Project, 2014). Some of these sites are less than one month old and a few are on small drainages, potentially limiting their size. Some might not survive the winter. Since the beginning of the project, about four new sites have become successfully established each year through beaver reintroduction. Figure 2 shows a new dam and pond established in 2014.

SUMMARY OF REPLENISH BENEFIT:

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 12.8 ML/yr

ACTIVITY TIMELINE:

- 2008-2013: Establishment of 23 successful sites
- 2014: Establishment of 8 additional successful sites for a cumulative total of 31 successful sites
- 2015 and beyond: Establish a cumulative total of 50 successful sites.

COCA-COLA CONTRIBUTION: 13.6%

- Total project cost (2014): $271,000
  - Coca-Cola cost (2014): $36,799.75
  - NFF cost (2014): $18,125.25
  - Contribution from other project partners (2014): $216,075

WATERSHED BENEFITS CALCULATED:

1. Increase in groundwater storage

1. INCREASE IN GROUNDWATER STORAGE

Approach & Results:

The benefit is calculated as the increase in annual groundwater recharge resulting from beaver colony reestablishment. The eight successful 2014 sites are reported to be storing water in 39 ponds. However, based on the survival rate of sites in previous years, only half of these sites are expected to persist through the winter due to normal attrition. Therefore, the benefit calculation was based on establishment of four sites (half of the 8 newly-established sites in 2014). The benefit was calculated by multiplying the number of sites likely to persist (4) by the measured average ponded surface area per successful site (average for 31 sites established between 2008 and 2014). This is a conservative estimate of per-site ponded surface area because it includes the 8 newly-established sites, some of which are less than a month old.

A conservative estimate of the groundwater storage volume was made using simple calculations described in Pollock et al., (2003) as follows:
Number of successful sites * Average pond surface area per site (m²/site) * Infiltration rate (m/s) * Number of days of infiltration * Conversion factor = Volume of groundwater storage (m³/yr)

\[ 4 \times 1,861.6 \times 0.0000004 \times 365 \times 86,400 = 93,930 \text{ m}^3/\text{yr} = 94 \text{ million liters/yr} \]

Where:
- Number of successful sites in 2014 = 4 sites
- Average pond surface area/successful site = 0.46 acres/site = 1,861.6 m²/site
- Infiltration rate = 0.0000004 m/sec (Pollock et al., 2003)
- Number of days of infiltration = 365 days (ponds are observed to have water year-round)
- Conversion factor = 86,400 (converting from ‘per second’ to ‘per day’)

The estimated replenish benefit for the four sites that are not yet mature equals 94 ML/yr.

The total (ultimate) benefit for the 4 successful sites was calculated following the same methodology, but uses an average reported pond surface area/successful site of 0.89 acres/site. This is the average measured area for 15 mature sites (2-4 years old). The total (ultimate) benefit for 4 successful sites established in 2014 equals 182 ML/yr.

The total (ultimate) benefit is: 182 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 24.7 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 94 ML/yr, and TCCC’s benefit (adjusted for cost share) is 12.8 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>94</td>
<td>12.8</td>
</tr>
<tr>
<td>2016</td>
<td>94</td>
<td>12.8</td>
</tr>
<tr>
<td>2017</td>
<td>182</td>
<td>24.7</td>
</tr>
<tr>
<td>2018</td>
<td>182</td>
<td>24.7</td>
</tr>
<tr>
<td>2019</td>
<td>182</td>
<td>24.7</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>182</td>
<td>24.7</td>
</tr>
</tbody>
</table>

*Projections assume 3 years to site maturity (average of reported maturity of 2-4 years).*
Data Sources:

- In 2014, 38 beavers were released to 13 sites, and eight of those were successful and are beginning to store water in 39 ponds with an initial pond surface area total of 0.6 acres as of November 14, 2014: Methow Beaver Project Successes and Challenges 2014 (Methow Beaver Project 18 November 2014 update.docx)
- Information regarding project background and beaver reintroduction activities: Methow Beaver Project Accomplishments and Outcomes, April 2013, and communication with Kent Woodruff (USDA Forest Service)

Assumptions:

- Based on past experience (2008-2013), it is assumed that 4 of the 8 newly established sites will persist in future years.
- The infiltration rate is assumed to equal 0.0000004 m/second, typical of fine-grained alluvial deposits (Pollock et al., 2003).
- The average pond area/site for 2014 is conservatively assumed to equal the average pond area/site for the 31 successful sites established between 2008 and 2014.
- The average pond area/site for mature sites is assumed to represent the average pond area/site for 2014 sites after 3 years (used for projected water quantity benefits).
- Projected benefits conservatively assume no additional benefits resulting from beaver reproduction and establishment of future colonies.

OTHER BENEFITS NOT QUANTIFIED

- Decreased stream temperatures
- Increased floodplain reconnection
- Decreased sediment delivery
- Improved habitat for salmonids and other native fish

NOTES

- Coca-Cola only contributed to the project in 2014, not in prior years. As such, benefits are not calculated for the 23 successful sites established in 2008-2013.
- There are currently 31 sites that are a mix of active and inactive. Eight are new in 2014, 15 are mature and the rest are somewhere in-between in terms of maturity. Beaver sites are dynamic, and change with each water season. Changes include beaver loss through predation, disease, and legal recreational trapping, as well as population increases through reproduction.
- Active sites are assessed based on observations of scat, fresh cuttings, fresh work on dams, fresh scent mounts or observation of beavers or their tracks.
- Water-holding benefits of a dam can persist for decades after beavers are no longer present, but this length of time may vary by location.
- It is possible that additional sites were created through this project, which haven’t yet been located. Benefits are based only on the number of sites observed.
- The projected benefits from the beaver colonies re-established in 2014 are shown in Table 1. Even with no further project activity, these water quantity benefits would be expected to accrue. The project is, however, expected to continue. Additional years of beaver restoration are planned and currently funded, and the goal of 50 colonies re-established in the Methow
watershed remains a realistic project goal. Annual monitoring will continue to refine and improve the information reported.

REFERENCES


PROJECT NAME: Night Irrigation Project for Harran Plain
PROJECT ID #: 179

DESCRIPTION OF ACTIVITY: Night irrigation
LOCATION: Harran Plain, Turkey

PRIMARY CONTACTS:
Erdal Kiraz  Melike Kuş
Environmental Affairs Manager  Project Coordinator
Coca-Cola Turkey  Nature Conservation Centre
ekiraz@coca-cola.com  melike.kus@dkm.org.tr

OBJECTIVES:
• Ensure efficient use of land and water
• Demonstrate improved practices and encourage similar improvements across the region

BACKGROUND & DESCRIPTION OF ACTIVITY: Turkey has a thriving agricultural economy, and the country is a leader in food production. However, significant irrigation is required due to the hot, dry and windy climate in many growing regions. For this reason, irrigation improvements can result in significant water savings. In Southeastern Anatolia, there are two cropping seasons and intensive irrigation is required. In Sanliurfa, irrigation water is applied 8 to 10 times per year for corn production and 6 times per year for cotton production. Furrow irrigation (i.e., flood or surface irrigation) is the most common type of irrigation, but it has been increasingly replaced with sprinkler and drip irrigation in recent years.

Daytime evaporation contributes to significant consumptive losses through evaporation. Surface irrigation has an irrigation efficiency between 35% and 40%, and sprinkler and drip irrigation have irrigation efficiencies estimated at 25% and 10%, respectively (FAO Annex I). To reduce the amount of water lost by evaporation, it is important to carry out irrigation in the early hours of the day, in the evening or at night instead of irrigation in the daytime. These measures can also reduce problems related to over-irrigation such as salination, fungal diseases and pollution.

This project involves a pilot project that demonstrates and promotes night irrigation in the Cullap Irrigation Union, Harran Plain, Sanliurfa (Figure 1). The project was carried out in the villages of Çamlidere (39°03’50’’ ) and Kaynaklı (39°05’25’’) in the area of Cullap Irrigation Union. Results from the pilot projects will be disseminated to other areas in the Harran Plain.

Figure 1. Project locations in Harran Plain
The pilot project includes the following activities:

- Educating farmers about water savings
  - Informing 200 farmers who are members of Cullap Irrigation Union about the project
  - Educating farmers about the importance of water savings
  - Educating farmers about water savings associated with night irrigation
  - Visiting a project area with the attendance of Irrigation Union Directors

- Implementing night irrigation in a pilot area
  - Field visits for detecting areas for night irrigation
  - Hiring and educating workers to carry out the night irrigation
  - Installing tensiometers in the fields
  - Implementing night irrigation
  - Monitoring and reporting the volume of water savings at the end of the irrigation season (late August for cotton; mid-September for corn)

- Extending the results in the Harran Plain
  - A brochure explaining project results will be prepared
  - Meetings will be conducted with the other irrigation unions present in Harran Plain and project results will be shared
  - Meetings with farmers of other irrigation unions will be conducted and project outputs (monitoring data) will be compared

**SUMMARY OF REPLENISH BENEFIT:**
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 540.6 ML/yr

**ACTIVITY TIMELINE:**
- January through November 2014:
  - Farmer education was conducted in 2014
  - Night irrigation was implemented on 500 hectares in 2014 (pilot project)
  - Monitoring data was collected for the night irrigation pilot projects

- Planned activities in 2015:
  - Monitoring data will be evaluated to determine the actual water savings
  - Night irrigation will be expanded to larger area

**COCA-COLA CONTRIBUTION:** 100%
- Total project cost (2014): $51,000 USD
- TCCC cost (2014): $51,000 USD

**WATERSHED BENEFITS CALCULATED:**
1. Decrease in groundwater withdrawal

### 1. DECREASE IN GROUNDWATER WITHDRAWAL

**Approach and Results:**

In 2014, night irrigation was implemented on 406.0 hectares of cotton and 94.0 hectares of corn cultivation areas. Approximately 75% of the total area is irrigated with furrow irrigation and 25% is irrigated by sprinkler irrigation. Evaporative losses will be reduced significantly with night irrigation through both irrigation methods. Monitoring was conducted as part of the pilot projects, but results will
not be available until 2015. For this reason, a conservative estimate of 10% water savings was assumed for the replenish benefit calculations. The benefit estimates will be refined after monitoring data become available and night irrigation is implemented on additional acres.

The areas affected by the pilot projects, the irrigation requirements for cotton and corn and the resulting water savings are shown in Table 1. The irrigation requirement, provided by TCCC Turkey based on consultation with local experts, is the crop-specific volume of water necessary to grow the crops in the project area, considering the irrigation technology that is used (i.e., sprinkler, furrow).

Table 1. Irrigation Requirements and Water Savings from Night Irrigation

<table>
<thead>
<tr>
<th>Crop</th>
<th>Area (ha) and Irrigation Type</th>
<th>Irrigation Requirement (m³/ha)</th>
<th>Water Savings (10%) (m³/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton</td>
<td>406</td>
<td>11,000</td>
<td>1,100</td>
</tr>
<tr>
<td></td>
<td>Sprinkler: 125.6 ha</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Furrow: 280.4 ha</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>94</td>
<td>10,000</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>All Furrow Irrigated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Benefit = Water Savings x Area = (1,100 m³/ha x 406 ha) + (1,000 m³/ha x 94 ha) = 540,600 m³

The total benefit equals 540.6 ML/yr

The total (ultimate) benefit is: 540.6 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 540.6 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is based on practices implemented on 500 ha of farmland in 2014 and is estimated to be 540.6 ML/yr and TCCC’s benefit (adjusted for cost share) is 540.6 ML/yr.

Projected Replenish Benefits

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>540.6</td>
<td>540.6</td>
</tr>
<tr>
<td>2016</td>
<td>540.6</td>
<td>540.6</td>
</tr>
<tr>
<td>2017</td>
<td>540.6</td>
<td>540.6</td>
</tr>
<tr>
<td>2018</td>
<td>540.6</td>
<td>540.6</td>
</tr>
<tr>
<td>2019</td>
<td>540.6</td>
<td>540.6</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>540.6</td>
<td>540.6</td>
</tr>
</tbody>
</table>

Data Sources:
- Land area in program in 2014 provided by TCCC Turkey
- Irrigation water requirements and assumptions regarding water savings estimate provided by TCCC Turkey based on consultation with local experts

Assumptions:
- Based on preliminary evaluation of the project outcome and consultation with the local experts, TCCC Turkey estimates that night irrigation practices result in a 10% decrease in irrigation application by the farmers. The evaporation loss of 10% is a very conservative assumption and actual losses are likely much higher.
- Education and training have been provided, and farmers will continue to apply night irrigation.

OTHER BENEFITS NOT QUANTIFIED
- Reduced water and energy costs
- Reduced potential for salination, fungal diseases and pollution

NOTES
- The calculations will be updated when actual pre- and post-project irrigation requirements become available and the project is expanded.

REFERENCES

PROJECT NAME: Wetland treatment to improve quality of Lake Wuliangsu
PROJECT ID #: 180

DESCRIPTION OF ACTIVITY: Construction of a pilot pond for wetland treatment and aquaculture development

LOCATION: Lake Wuliangsu, Urad Qianqi district, Bayan Nur City, Inner Mongolia, China

PRIMARY CONTACTS:
Jasmine Tian     Weidong Zhang
KO/PAC China     UNDP China
jatian@apac.ko.com  weidong.zhang@undp.org

OBJECTIVES:
• Improve water quality in Lake Wuliangsu
• To facilitate ecosystem protection and aquaculture development

BACKGROUND & DESCRIPTION OF ACTIVITY: Lake Wuliangsu is the largest freshwater lake in the Inner Mongolia Section of the Yellow River Basin. All of the wastewater from the City of Bayan Nur, including industrial and agriculture wastewater as well as domestic sewage, is discharged into this lake, which leads to severe impacts on the water body. As a result of climate change and inappropriate economic activities in the past decades, Lake Wuliangsu is facing serious challenges such as decreases of water quantity, deterioration of water quality and desertification. Moreover, it is located in the remote rural areas of Western China, where the living standards and economic conditions are relatively low and local residents generally lack advanced agricultural/fishery skills. This project is a pilot project with the United Nations Development Program (UNDP) to address the need for pollution mitigation as well as aquaculture development.

A pilot aquaculture pond with an area of 200 Mu (i.e., 13 ha) was constructed as a wetland treatment system (Figure 1). Experts in aquaculture and ecology were invited to introduce advanced aquaculture technologies. Fish farming and artificial floating islands were introduced to the pilot pond (Figure 2). The wetland treatment system is operated using water sluices. Water flows through the inlet sluice, and flows into the wetland pond where it is treated. After 7-8 days, the outlet sluice is opened to allow water to flow into Lake Wuliangsu. The operation of water sluices allows enough water retention for the water to be treated in the wetland system. Water channels equipped with influent and effluent monitoring systems were also built to collect flow and water quality data (Figure 3). Construction and implementation of the wetland treatment system substantially improves the water quality of the receiving water by reducing nutrient pollution, including nitrogen and phosphorus load reductions.
Figure 1. Layout of the pilot pond

Figure 2. The artificial floating island
SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 138 ML/yr

ACTIVITY TIMELINE:
- Project initiation: March 2014
- Project completed: October 2014

COCA-COLA CONTRIBUTION: 41.7%
- Total cost: $48,000 USD
- TCCC cost contribution: $20,000 USD

WATERSHED BENEFITS CALCULATED:

1. Volume of water treated

1. VOLUME OF WATER TREATED

Approach and Results:
The replenish benefit was calculated as the total volume of water treated to a relevant water quality target by the pilot pond. The wetland treatment system operated four times from May to October, 2014. Table 1 presents the volume of water treated during each operation, as measured at the discharge.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Operation Period</th>
<th>Retention Time (day)</th>
<th>Discharge (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>May 16 – May 22</td>
<td>7</td>
<td>76,000</td>
</tr>
<tr>
<td>2</td>
<td>June 26 – July 3</td>
<td>8</td>
<td>86,000</td>
</tr>
<tr>
<td>3</td>
<td>August 5 – August 12</td>
<td>8</td>
<td>89,000</td>
</tr>
<tr>
<td>4</td>
<td>September 25 – October 2</td>
<td>8</td>
<td>81,000</td>
</tr>
</tbody>
</table>
Data collected at the outlet demonstrate that the water quality is being substantially improved (Table 2). The relevant water quality target is Grade V according to China’s environmental quality standards for surface water (GB3838-2002), as listed in Table 2. These water quality standards are being met at the discharge.

Table 2. Water quality standards and water quality monitoring data

<table>
<thead>
<tr>
<th>Target parameter</th>
<th>Grade V Environmental Standard for Surface Water (mg/L)</th>
<th>Average concentration before treatment (mg/L)</th>
<th>Average concentration after treatment (mg/L)</th>
<th>Reduction percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total phosphorus</td>
<td>0.4</td>
<td>1.80</td>
<td>0.23</td>
<td>87.2</td>
</tr>
<tr>
<td>Ammonia</td>
<td>2.0</td>
<td>3.67</td>
<td>1.56</td>
<td>57.5</td>
</tr>
<tr>
<td>Total nitrogen</td>
<td>2.0</td>
<td>3.81</td>
<td>1.74</td>
<td>54.3</td>
</tr>
</tbody>
</table>

Note: Pollutant concentrations before and after treatment were calculated as the average influent and effluent concentrations of the four operations, respectively.

The metered and estimated flow was used in the benefit calculation as follows:

Total benefits = Total volume of treated water in 2014

\[
= 76,000 \text{ m}^3 + 86,000 \text{ m}^3 + 89,000 \text{ m}^3 + 81,000 \text{ m}^3 = 332,000 \text{ m}^3 = 332 \text{ ML/yr}
\]

The total (ultimate) benefit is: 332 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 138 ML/yr.

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 332 ML/yr and TCCC’s benefit (adjusted for cost share) is 138 ML/yr.

Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service with an operation frequency of four times per year. While not shown in the table, the benefits are anticipated to continue to be generated till the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 3. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>332</td>
<td>138</td>
</tr>
<tr>
<td>2016</td>
<td>332</td>
<td>138</td>
</tr>
<tr>
<td>2017</td>
<td>332</td>
<td>138</td>
</tr>
<tr>
<td>2018</td>
<td>332</td>
<td>138</td>
</tr>
<tr>
<td>2019</td>
<td>332</td>
<td>138</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>332</td>
<td>138</td>
</tr>
</tbody>
</table>
Data Sources:

- All data used in the calculations were provided by UNDP China and TCCC.

Assumptions:

- It is assumed that the pond is maintained so that it can continue to function and improve water quality.
- Since the volume of water treated during each operation was measured at the discharge, the entire volume of water treated by the wetland can be counted as replenish benefit.

OTHER BENEFITS NOT QUANTIFIED

- Decreased pollutant load
- Improved technologies and skills for aquaculture
- Economic and social benefits to local farmers
- Improvements to quality of downstream waters
- Improved wetland habitat

NOTES

- The system is designed according to industry standards and meets all regulatory requirements.
- Impact assessments are conducted for all UNDP projects in China, and no adverse environmental or social impacts were identified for this project.

REFERENCES

PROJECT NAME: Project Khula: Protecting Freshwater Resources while Improving the Livelihoods of Disadvantaged and Previously Disadvantaged Sugarcane Growers in South Africa

PROJECT ID #: 182

DESCRIPTION OF ACTIVITY: Invasive species removal

LOCATION: Wartburg, South Africa in the State of Kwa-Zulu Natal

PRIMARY CONTACTS:
Vaughan Koopman
WWF – South Africa
Mondi Wetlands Programme: KwaZulu-Natal
Resilient Landscapes Project Coordinator;
Sustainable Agriculture Programme: Sugarcan Project Manager
Suite 1, Quarry Centre, 57 Hilton Ave, Hilton,
KwaZulu-Natal
PO Box 559, Howick, 3290, South Africa
+27 (0)33 343 1464
vkooman@wwf.org.za

Tom Webster
SASRI Pest and Disease officer, Wartburg
Mondi Wetlands Programme: KwaZulu-Natal
Resilient Landscapes Project Coordinator;
Sustainable Agriculture Programme: Sugarcan Project Manager
Suite 1, Quarry Centre, 57 Hilton Ave, Hilton,
KwaZulu-Natal
PO Box 559, Howick, 3290, South Africa
+27(0)33 503 1818
mnpd@sai.co.za

OBJECTIVES:
• Increase water availability through invasive species removal
• Reduce the impact of floods and wildfires and their associated risks
• Improve water quality
• Reduce further loss of productive land, thereby contributing to food security
• Restore biodiversity, create jobs and improve resilience to climate change

BACKGROUND & DESCRIPTION OF ACTIVITY: The Republic of South Africa is significantly impacted by invasive species. Invasive and introduced species use a significant amount of available water, in a country where water resources are highly stressed. According to Nel et al., 2008, the 2004 National Water Resource Strategy identified alien invasive clearing as one of the most important water side interventions South Africa can make at a national scale. In the state of KwaZulu-Natal, it is estimated that 17% of the total volume of water is used by invasive species.

Project Khula engaged with a government program, Working for Water, to help create employment opportunities for the underemployed who are paid to remove invasive species. By 2013, project members cleared more than 100 hectares of invasive trees and shrubs, helping to conserve local freshwater sources. The target species included gum trees, melaluca, lantana, water lilies and pines. Approximately 45 hectares of the cleared land was predominantly gum tree biomass, and the remainder was smaller trees and shrubs. Table 1 summarizes the cleared areas by farmer, in addition to identifying those areas that were confirmed in 2014 to be followed-up on to prevent regrowth. Figure 1 shows the location of the farmers that received support from Project Khula to remove invasive species.
Table 1. Summary of areas cleared and maintained

<table>
<thead>
<tr>
<th>Farmer</th>
<th>Original area cleared (ha)</th>
<th>Area maintained</th>
<th>Included in benefit calculation?</th>
<th>Area used in benefit calculation (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truter</td>
<td>45.1657</td>
<td>Unknown</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Gevers</td>
<td>26.4943</td>
<td>Yes</td>
<td>Yes</td>
<td>26.4943</td>
</tr>
<tr>
<td>Schulz</td>
<td>11.4366</td>
<td>Yes</td>
<td>Yes</td>
<td>11.4366</td>
</tr>
<tr>
<td>Schroeders</td>
<td>11.4366</td>
<td>Yes</td>
<td>Yes</td>
<td>11.4366</td>
</tr>
<tr>
<td>Eggers</td>
<td>25.2071</td>
<td>Yes</td>
<td>1/3 of area included - actual land distribution unknown</td>
<td>8.4024</td>
</tr>
<tr>
<td>Meyer</td>
<td>11.4366</td>
<td>No</td>
<td>Unknown</td>
<td>8.4024</td>
</tr>
<tr>
<td>Total</td>
<td>108.3</td>
<td></td>
<td></td>
<td>46.3</td>
</tr>
</tbody>
</table>

Figure 1. Catchments cleared of invasive species

SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 61.5 ML/YR

ACTIVITY TIMELINE:
- January 1, 2010: Project initiation
- February 28, 2013: Project completion
- 2014 and beyond: Maintenance to ensure areas remain clear of invasive species until the invasive seed bank is eliminated and native vegetation takes root.

COKE CONTRIBUTION: 74.8%
- Total project cost: $200,454
- TCCC cost: $150,000

WATERSHED BENEFITS CALCULATED:
1. Increased water availability
1. INCREASED WATER AVAILABILITY

The removal of invasive species and ongoing maintenance to ensure the invasives do not return allows reestablishment of native vegetation, and increased habitat and hydrologic functionality. Areas with invasive species have less water available for beneficial uses compared to areas with native vegetation.

Approach & Results:

The water quantity benefit was calculated as the change in available water between the pre-project and post-project conditions. The pre-project condition is a landscape populated by invasive species, and the post-project condition is a landscape populated by native species.

The increase in available water was estimated using predictions from a biomass-based regression model that had been applied to four South African catchments (Le Maitre et al., 2002). The model predicted water savings based on the total above-ground biomass of invasive plants compared to natural vegetation.

Although a surface area of 108.3 hectares was initially cleared of invasive species, it could only be confirmed that the surface area remaining cleared in 2014 equals 46.3 hectares (463,000 m²). The total (ultimate) and current benefit calculations are based on the 46.3 hectare area.

The water quantity benefit of invasive species removal was calculated as:

\[
\text{Area treated (ha)} \times \text{annual water savings from invasive species removal (m}^3/\text{ha/yr)}
\]

\[
46.3 \text{ ha} \times 1,776 \text{ m}^3/\text{ha/yr} = 82,228.8 \text{ m}^3/\text{yr} = 82.2 \text{ ML/yr}
\]

Where:

- Area treated = 46.3 hectares
- Annual water savings = 1,776 m³/ha/yr

The annual water savings was conservatively estimated based on lowest rate reported in Le Maitre et al., 2002.

The total (ultimate) benefit is: 82.2 ML/yr
TCCC total (ultimate) benefit is: 61.5 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit
The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 82.2 ML/yr and TCCC’s benefit (adjusted for cost share) is 61.5 ML/yr.

Projected Replenish Benefits
Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 2. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>82.2</td>
<td>61.5</td>
</tr>
<tr>
<td>2016</td>
<td>82.2</td>
<td>61.5</td>
</tr>
<tr>
<td>2017</td>
<td>82.2</td>
<td>61.5</td>
</tr>
<tr>
<td>2018</td>
<td>82.2</td>
<td>61.5</td>
</tr>
<tr>
<td>2019</td>
<td>82.2</td>
<td>61.5</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>82.2</td>
<td>61.5</td>
</tr>
</tbody>
</table>

Data sources:
- Size of project area provided by WWF-South Africa.
- Confirmation of the areas that remain clear of invasives provided by WWF-South Africa.
- Cost information: Project Khula CWP 2012.doc

Assumptions:
- Projected future benefits assume continued removal of invasive species to ensure the invasive species do not return.
- The increased water availability was conservatively calculated based on the lowest incremental rate provided in Le Maitre et al. (2002) for invasives removal in this region of South Africa.
- 108.3 hectares were initially cleared, but only those areas confirmed to have continued invasive species maintenance were included in the benefit calculation.
- One of three farmers that cleared a total of 25.2071 hectares was confirmed to have continued maintenance to ensure the invasive species do not return. The exact area owned by the three farmers is unknown; therefore it was assumed that 1/3 of area (8.4 hectares) was maintained.

OTHER BENEFITS NOT QUANTIFIED
- Removal of invasive plants and revegetation with native species will expand habitat availability and quality, and lead to increased abundance of native birds, mammals, reptiles, and fish.

NOTES
- None.

REFERENCES


PROJECT NAME: Western Nebraska Irrigation Project
PROJECT ID #: 183

DESCRIPTION OF ACTIVITY: Variable Rate Irrigation and Advanced Irrigation Scheduling

LOCATION: South Platte River Valley, Western Nebraska

PRIMARY CONTACTS:
John T. Heaston, Director  Rena Stricker  Jon Radtke
Platte River Program Office  Contract Ecologist  Water Resources Manager
The Nature Conservancy  CCNA Group Environment & Sustainability
Conservation Strategist  Sustainability  CCNA Group Environment & Sustainability
308-784-5336  404-395-6250  404-676-9112
jheaston@tnc.org  rstricker@coca-cola.com  jradtke@coca-cola.com

OBJECTIVE:
• Decrease pumping of groundwater for irrigation

BACKGROUND & DESCRIPTION OF ACTIVITY: The Western Nebraska Irrigation Project (WNIP) was developed to provide tools to help farmers maximize yields while minimizing water use and associated input costs. The farmers enrolled in the program use center pivot irrigation systems (Figure 1). WNIP promotes the use of Advanced Irrigation Scheduling (AIS) (through use of electro-conductivity mapping, remote pivot control, and soil moisture probes) and Variable Rate Irrigation (VRI). For this project, VRI is implemented by slowing down and speeding up the pivots to control the flow of water as needed across the field. The purpose is to address topographic and soil variability. Although not implemented on this project, examples of alternative VRI applications include using upgraded GPS technology to remove non-crop areas (e.g., ditches, rocks, wetlands) from irrigation or eliminating double application due to pivot overlap.

The farms participating in the program are located in an isolated valley, and The Nature Conservancy (TNC) is hoping to gain an understanding of how these technologies can positively impact the South Platte River watershed when implemented on a large area of farms. Research shows that VRI and AIS reduce water pumping by an average of approximately 15% (Perry and Yager, 2011). Tillage and other best management practices can provide additional water savings.
SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 695.0 ML/yr

ACTIVITY TIMELINE:
- Year 1: July 2013 – June 2014
- Year 2: July 2014 – June 2015

COCA-COLA CONTRIBUTION: 80.6%
- Total cost: $930,000
- TCCC cost contribution: $750,000

WATERSHED BENEFITS CALCULATED:
1. Decrease in groundwater withdrawal

1. **DECREASE IN GROUNDWATER WITHDRAWAL**

Approach and Results:
Water savings were calculated by applying evaluation techniques from the best available irrigation management studies to the data available for this project. The results of a number of TNC and university studies (referenced below) were considered. Research conducted at The Stripling Irrigation Research Park by the University of Georgia (2011) supports a 15% reduction in pumping by advanced irrigation scheduling and an additional 15% reduction through the use of Variable Rate Irrigation (VRI) technology. These estimates were corroborated by information gathered by the 2009 Nebraska Agricultural Water Management Network (NAWMAN) survey at the University of Nebraska and the 2013 USDA Irrigation Census (USDA, 2013).

AIS and VRI techniques are complementary, but water savings can be calculated for each since VRI reduces the volume of water applied by controlling “where/how” the center pivot will irrigate while AIS reduces the total number of irrigations by addressing “when” to apply irrigation. Due to continuing analysis and the further need for collection of specific data gained about the project area and how these techniques were actually implemented at the producer level (e.g., reduced number of irrigations or
water volume per irrigation for AIS), TNC suggests that a 10% reduction in total irrigation water application is a conservative estimate of water savings from AIS and from VRI (separately). The pivot irrigation systems used are already the most efficient available for the particular crops and land conditions (Evans, 1998), so losses through runoff and leaching are minimal and were not explicitly accounted for in the calculations. Additional water savings result from other best management practices, but data were not available, so those benefits are not included in the benefit calculations below.

The 2014 water savings can be calculated based on the measured 2014 values as follows:

In Year 1 (2014), a total of 4,100 acres of irrigated crop fields were enrolled in the TNC/WNIP program using AIS. Of those acres, 2,055 acres also used variable rate irrigation, providing an additional water savings.

The volume of irrigation water applied to the fields enrolled in the program was monitored in 2014 (with AIS and VRI practices implemented). 2014 was considered a typical year in terms of climate, so these measured values are considered representative of long-term average conditions.

AIS Water Savings in 2014:
Average volume applied (measured) with AIS = 12.26 in/ac
Acres utilizing AIS = 4,100 acres
Total volume applied per year = 12.26 in/ac/yr x 4100 ac = 4,189 ac-ft/yr = 5,166,849,889 L/yr
AIS water savings assuming 10% decrease in pumping = (volume applied/0.9) - volume applied = 574,094,432 L/yr = 574.1 ML/yr

VRI Water Savings in 2014:
Average volume applied (measured) with VRI = 12.26 in/ac
Acres utilizing VRI = 2,055 acres
Total volume applied per year = 12.26 in/ac/yr x 2,055 ac = 2,100 ac-ft/yr = 2,589,725,981 L/yr
VRI water savings assuming 10% decrease in pumping = (volume applied/0.9) - volume applied = 287,747,331 L/yr = 287.8 ML/yr

The total water savings in 2014 from both projects is calculated as the sum of the water savings from AIS and VRI:

Total 2014 water savings = 574,094,432 L/yr + 287,747,331 L/yr = 861,841,763 L/yr = 861.8 ML/yr

In 2015 and beyond, an estimated 12,500 acres are anticipated to be using AIS and 2,055 acres are anticipated to be using both AIS and VRI. The water savings is calculated as follows:

AIS Water Savings in 2015 and beyond:
Average volume applied (measured) with AIS = 12.26 in/ac
Acres utilizing AIS = 12,500 acres
Total volume applied per year = 12.26 in/ac/yr x 12,500 ac = 12,771 ac-ft/yr = 15,752,591,126 L/yr
AIS water savings assuming 10% decrease in pumping = (volume applied/0.9) - volume applied = 1,750,287,903 L/yr = 1,750.3 ML/yr
VRI Water Savings in 2015 and beyond:
Average volume applied (measured) with VRI = 12.26 in/ac
Acres utilizing VRI = 2,055 acres
Total volume applied per year = 12.26 in/ac/yr x 2,055 ac = 2,100 ac-ft/yr = 2,589,725,981 L/yr
VRI water savings assuming 10% decrease in pumping = (volume applied/0.9) - volume applied = 287,747,331 L/yr = 287.8 ML/yr

The total water savings in 2015 and beyond from both projects is calculated as the sum of the water savings from AIS and VRI:

**Total 2015 water savings** = 1,750,287,903 liters + 287,747,331 liters = 2,038,035,234 liters = 2,038.0 ML/yr

The total (ultimate) water quantity benefit is: 2,038 ML/yr.
TCCC total (ultimate) benefit taken as a function of cost share is: 1,643 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**
The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 861.8 ML/yr and TCCC’s benefit (adjusted for cost share) is 695 ML/yr.

**Projected Replenish Benefits**
Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in this table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>2,038</td>
<td>1,643</td>
</tr>
<tr>
<td>2016</td>
<td>2,038</td>
<td>1,643</td>
</tr>
<tr>
<td>2017</td>
<td>2,038</td>
<td>1,643</td>
</tr>
<tr>
<td>2018</td>
<td>2,038</td>
<td>1,643</td>
</tr>
<tr>
<td>2019</td>
<td>2,038</td>
<td>1,643</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>2,038</td>
<td>1,643</td>
</tr>
</tbody>
</table>

Data sources:
- Measurements of water applied were collected by TNC.
- An estimated 10% water savings provided by TNC as conservative estimate based on literature values.
Assumptions:

• Average conditions were assumed. Some years will have smaller or larger savings depending on the amount of rainfall during the growing season.

OTHER BENEFITS NOT QUANTIFIED

• Energy savings and associated cost savings
• Additional benefits of other BMPs implemented on the fields were not calculated

NOTES

• For this project, VRI did not include using upgraded GPS technology to remove non-crop areas (e.g., ditches, rocks, wetlands) from irrigation or eliminating double application due to pivot overlap. As such, water savings cannot be estimated based on the volume of water that is not withdrawn due to the number of acres removed from irrigation.
• TNC notes: “Estimating water savings from improved irrigation practices is an emergent and dynamic field of study. As part of this project, we are discovering new and improved methods for calculating water savings and trying to incorporate them into the project to improve accuracy in demonstrating water conservation. Additional post-harvest analysis will be critical to greater accuracy. We are working with partners to improve our analytics for water management, and the numbers reflected in this report are a conservative estimate based upon our current understanding. As we develop and refine our methodology, these numbers are subject to change.”

REFERENCES


University of Nebraska Lincoln Extension. 2009 NAWMDN Survey. URL: http://water.unl.edu/c/document_library/get_file?uuid=7c342db7-0a59-488f-bccf-62120e4c8088&groupd=1882&.pdf

USDA Census of Agriculture. 2013 Farm and Ranch Irrigation Survey. URL: http://www.agcensus.usda.gov/Publications/2012/Online_Resources/Farm_and_Ranch_Irrigation_Survey/
PROJECT NAME: Restoration of Lake Sazanie in the Volga-Akhtuba Floodplain
PROJECT ID #: 185

DESCRIPTION OF ACTIVITY: Restoration of the natural flooding regime of Lake Sazanie and nearby wetlands

LOCATION: Lower Volga Watershed, Russia

PRIMARY CONTACTS:
Julia Avetova  
Environment, Sustainability and NGOs  
Relations Manager  
The Coca-Cola Export Corporation  
8 Ivana Franko str., 121008, Moscow, Russia  
Tel: +7 495 651 6900, ext. 1317  
javetova@coca-cola.com

Denis Arakcheev  
Environmental and Occupational Safety and Health Manager  
The Coca-Cola Export Corporation  
8 Ivana Franko str., 121008, Moscow, Russia  
Tel: +7 495 651 6900, ext. 1667  
darakcheev@coca-cola.com

OBJECTIVES:
• Restore hydrologic regime of Lake Sazanie and nearby wetlands
• Improve biodiversity
• Restore fish spawning grounds

BACKGROUND & DESCRIPTION OF ACTIVITY: The Volga-Akhtuba floodplain is one of the largest floodplains in Europe. Lake Sazanie is located in the Volga-Akhtuba floodplain and is representative of the shallow lakes that are found throughout the floodplain. The lake and nearby wetland meadow is characterized by terrestrial and aquatic ecosystem features that are important for maintaining biodiversity. Lake Sazanie plays an important role in the life cycles of terrestrial and aquatic flora and fauna. The natural hydrologic and ecosystem function of the lake has been altered due to anthropogenic influences, including unauthorized construction of a dam on the Ogibnoy Erik River, which serves as the source of water to Lake Sazanie.

The main objective of this project was to supply water to Lake Sazanie to restore the natural hydrologic regime. This was accomplished by eliminating the unauthorized dam on the Ogibnoy Erik River. In addition, accumulated sediment was removed from the natural branch connecting the lake and the Ogibnoy Erik River and within the bed of the lake. As a result of these activities, the inflow of flood waters and water supply to the lake increased. The area of the wetland meadows flooded also increased. The location of the natural branch and unauthorized dam that connects the Ogibnoy Erik River to Lake Sazanie is shown in Figure 1. The flooded area of Lake Sazanie before the project and after the project is shown in Figure 2. The wetland meadow flooding, after the project was completed, is shown in Figure 3.
Figure 1. Location of the natural branch and non-authorized dam (in red) that connects Ogibnoy Erik River to Lake Sazanie.

Figure 2. The flooded area of Lake Sazanie before the project (left) and after the project (right).

Figure 3. Wetland meadow flooding after the project was completed.
To restore natural vegetation, the invasive trees, *Fraxinus pennsylvanica*, were partially cut down and their natural seeding was eliminated by the locals, volunteers and entrepreneurs. 3,200 plants representing seven different local or native species were planted. A fish wintering hole was constructed in the Lake Sazanie and the lake was stocked with 10,452 fish. The biodiversity of ichthyoid (fish) fauna increased by two species. Local or native aquatic plants were also introduced, which included 12 species and a total of 1,000 plants. The biodiversity of aquatic and semi-aquatic plants increased by seven species. The restoration of the shore vegetation helped increase the number of bird nests. In addition, the expanded flooding area of wetland meadows improved the conditions for fish spawning.

**SUMMARY OF REPLENISH BENEFIT:**
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 422 ML/YR

**ACTIVITY TIMELINE:**
- May 16, 2013: Project initiated
- December, 2013: Work was 32% complete
- May 1, 2014: Project complete

**COCA-COLA CONTRIBUTION:** 49.4%
- Total Project Cost: $101,226.93 USD
- Coca-Cola Cost: $50,000 USD

**WATERSHED BENEFITS CALCULATED:**
1. Increase in volume of Lake Sazanie

### 1. INCREASE IN VOLUME OF LAKE SAZANIE

**Approach and Results:**

The water quantity benefit is calculated as the average increase in volume of Lake Sazanie due to the inflow of flood waters and the increase in capacity due to sediment removal. This method was selected for simplification purposes and is considered to be a conservative approach. More complex methods to estimate storage volume exist (accounting for retention time and volumes of inflow and outflow), but the required data inputs are not available.

The TCCC contact has provided the average surface area and depth of Lake Sazanie before the project was completed and after the project was completed. The TCCC contact has confirmed that the completed project has improved the natural flooding regime of the lake.

**Lake Sazanie**

- Without-project: The surface area of the lake before the project was 111,987 m$^2$ and the depth ranged from 0.69 m to 0.93 m. A conservative estimate of an annual average lake depth of 0.93 m over the entire area of the lake is used in the calculation. The lake volume before the project can be calculated as:

  \[ \text{[Lake Volume]} = (0.93 \text{ m}) \times (111,987 \text{ m}^2) = 104,147 \text{ m}^3 = 104.1 \text{ ML} \]
• With-project: The surface area of the lake after the project during flooding is at least 410,000 m\(^2\) and the average depth is at least 2.34 m. The lake volume after the project can be calculated as:

\[ \text{Lake Volume} = (2.34 \text{ m}) \times (410,000 \text{ m}^2) = 959,400 \text{ m}^3 = 959.4 \text{ ML} \]

• Without-project: 104.1 ML/yr

• With-project: 959.4 ML/yr

• Benefit (increase in volume of Lake Sazanie): 855.3 ML/yr

The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

The total (ultimate) benefit: 855 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 422 ML/yr

The 2014 benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 855 ML/yr and TCCC’s benefit (adjusted for cost share) is 422 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

**Table 1. Projected Water Quantity Benefits Summary**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>855</td>
<td>422</td>
</tr>
<tr>
<td>2016</td>
<td>855</td>
<td>422</td>
</tr>
<tr>
<td>2017</td>
<td>855</td>
<td>422</td>
</tr>
<tr>
<td>2018</td>
<td>855</td>
<td>422</td>
</tr>
<tr>
<td>2019</td>
<td>855</td>
<td>422</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>855</td>
<td>422</td>
</tr>
</tbody>
</table>

Data Sources:

• All data used in the calculations were provided by Julia Avetova, TCCC.

Assumptions:

• The connection between the Ogibnoy Erik River and Lake Sazanie remains open and unimpeded.

• The surface area of the lake after the project during flooding is at least 410,000 m\(^2\) and the average water depth in the lake is at least 2.34 meters (measurements were taken during the low period).
OTHER BENEFITS NOT QUANTIFIED

- Improved biodiversity
- Development of bird, fish and other wildlife habitat

NOTES

- None

REFERENCES

PROJECT NAME: Tommy Thompson Park Wetland Regeneration
PROJECT ID #: 186

DESCRIPTION OF ACTIVITY: Capping of contaminated sediments

LOCATION: Toronto, Ontario, Canada

PRIMARY CONTACTS:
Project Manager  Manager  Manager, Water Resources
Toronto and Region  Environment & Sustainability  CCNA Group Environment &
Conservation Authority (TRCA)  (Canada)  Sustainability
416.661.6600 x 5248  416-206-2732  404-676-9112
kmcdonald@trca.on.ca  samirpathak@coca-cola.com  jradtke@coca-cola.com

OBJECTIVE:
• Eliminate transport of contaminants from sediments to water column

BACKGROUND & DESCRIPTION OF ACTIVITY: Tommy Thompson Park (TTP) is located on the Leslie Street Spit, a 5 km (3.1 mi) long man-made peninsula that extends into Lake Ontario just east of downtown Toronto. Historically, the spit was used for industrial and shipping activities and disposal of rubble and fill from the construction industry and sediments dredged from the Keating Channel (TRCA, 2012). There are three confined disposal facilities (CDFs), or cells, at TTP that were created to contain contaminated dredging material (Figure 1). This project focuses on Cell 2, a 9.5 hectare (ha) CDF that was filled to capacity by 1997. The existing ecological conditions within the cell are impaired due to the contaminated sediments and poor habitat quality.

The sediments that constituted the aquatic substrate within Cell 2 exceed Canadian Environmental Quality Guidelines for contaminated sediments. The Toronto and Region Conservation Authority (TRCA) is capping the sediments to eliminate contaminant exposure to aquatic species, stop the transport of contaminants into the water column, and eliminate export of contaminants to Lake Ontario. Sediment capping will enable subsequent habitat restoration by TRCA, similar to previous restoration work in Cell 1.

Figure 1. Tommy Thompson Park showing three CDFs (left) and close up of pre-project cell 2 (right)
A total of 9.5 ha of Cell 2 will ultimately be capped, and work is projected to be completed by the end of 2015. TCCC is funding the capping of 4.5 ha (at 50% of total cost). By the end of December 2014, a total of 1.1 ha was capped, equivalent to 11.6% of the total area to be capped. Figure 2 shows perimeter capping in progress.

**SUMMARY OF REPLENISH BENEFIT:**

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 60.3 ML/yr

**ACTIVITY TIMELINE:**

- Nov-Dec 2014: Built a portion of the main berm separating Phase 1 and 3 and built a portion of road 1, separating phase 1A from phase 1B. Built a portion of avenue 1 dividing Phase 1A into two areas.
- December 2014: Began perimeter capping.
- End of December 2014: 1.1 ha of 9.5 ha was capped
- 2015: Phases 2 and 3 work will be conducted. 9.5 ha will be capped by the end of 2015.

**COCA-COLA CONTRIBUTION: 50%**

- Total Cost: $1,000,000 (CDF capping of 9.5 ha)
- TCCC Cost: $500,000 (CDF capping of 4.5 ha)

**WATERSHED BENEFITS CALCULATED:**

1. Water volume with improved quality

**1. WATER VOLUME WITH IMPROVED QUALITY**

**Approach & Results:**
The total benefit is calculated as the annual volume of water flushed through Cell 2 that is no longer exposed to contaminated sediments due to the project activity (sediment capping). The volume flushed
through Cell 2 was estimated by TRCA based on the volume of water in the cell and the hydrologic flushing rate for Cell 2, as described below.

The flushing rate for the restored Cell 2 is estimated based on the Toronto Harbor flushing rate, adjusted for the difference in outflow configurations, as shown in Table 1. Toronto Harbor and restored Cell 2 volumes are illustrated in Table 2.

### Table 1. Toronto Harbor and Restored Cell 2 Outflow Configurations

<table>
<thead>
<tr>
<th></th>
<th>Average Depth (m)</th>
<th>Average Width (m)</th>
<th>Outflow Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Gap of Toronto Harbor Outflow</td>
<td>8.8</td>
<td>207</td>
<td>1821.6</td>
</tr>
<tr>
<td>Western Gap of Toronto Harbor Outflow</td>
<td>8.2</td>
<td>120</td>
<td>984.0</td>
</tr>
<tr>
<td>Total Area of Eastern and Western Gaps</td>
<td>-</td>
<td>-</td>
<td>2805.6</td>
</tr>
<tr>
<td>Restored Cell 2 Gap (estimate)</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

*Source: TRCA (2015)*

### Table 2. Toronto Harbor and Restored Cell 2 Volume

<table>
<thead>
<tr>
<th></th>
<th>Average Depth (m)</th>
<th>Surface Area (m²)</th>
<th>Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toronto Harbor</td>
<td>8</td>
<td>5,000,000</td>
<td>40,000,000</td>
</tr>
<tr>
<td>Restored Cell 2 (estimate)</td>
<td>1</td>
<td>80,000</td>
<td>80,000</td>
</tr>
</tbody>
</table>

*Source: TRCA (2015)*

The Toronto Harbor flushing rate = 10 days (approximate) as estimated by Haffner, et al. (1982)

Therefore, the Toronto Harbor Flow Rate = 40,000,000 m³ volume / 10 day flushing rate = 4,000,000 m³/day

Applying the Toronto Harbor flow rate to the restored Cell 2 and adjusting for the difference in outflow configurations:

The Restored Cell 2 Flow Rate (or the volume flushed per year) = (2 m² restored Cell 2 gap area / 2,805.6 m² total Eastern and Western gap area) * 4,000,000 m³/day Toronto Harbor flow rate = 2,851 m³/day * 365 day/yr = 1,040,776 m³/yr = **1,040.8 ML/yr** (with an estimated flushing rate = 80,000 m³ / 2,851 m³/day = 28 days)

**The total (ultimate) benefit is:** 1,040.8 ML/yr

**The total (ultimate) benefit taken as a function of cost share is:** 520.4 ML/yr
The current (2014) TCCC benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit based on 11.6% completion by the end of December 2014 is 120.5 ML/yr and TCCC’s benefit (adjusted for cost share) is 60.3 ML/yr.

**Projected Replenish Benefits**

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. Projected benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

**Table 3. Projected Water Quantity Benefits Summary**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1,040.8</td>
<td>520.4</td>
</tr>
<tr>
<td>2016</td>
<td>1,040.8</td>
<td>520.4</td>
</tr>
<tr>
<td>2017</td>
<td>1,040.8</td>
<td>520.4</td>
</tr>
<tr>
<td>2018</td>
<td>1,040.8</td>
<td>520.4</td>
</tr>
<tr>
<td>2019</td>
<td>1,040.8</td>
<td>520.4</td>
</tr>
<tr>
<td><strong>Ultimate Benefit:</strong></td>
<td><strong>1,040.8</strong></td>
<td><strong>520.4</strong></td>
</tr>
</tbody>
</table>

**Data Sources:**

- Estimate of Toronto Harbor flushing rate from Haffner, et al. (1982)
- All other data and estimates provided by TRCA

**Assumptions:**

- The approach assumes that the flushing rate of Cell 2 is proportional to the flushing rate of Toronto Harbor, and a function of the outlet configuration.

**OTHER BENEFITS NOT QUANTIFIED**

- Improved habitat
- Recreational benefits

**NOTES**

- The average depth and width of the Eastern and Western gaps of the Toronto Harbor, as well as the depth and surface area of the Toronto Harbor itself, utilized in the Cell 2 flushing rate calculations are present day measurements. Since the Haffner, et al. (1982) paper was published, a new ferry dock was constructed at the Eastern Gap, narrowing the channel. Additionally, the harbor is now shallower due to sedimentation. The average depth is based on current harbor soundings (TRCA communication, 2015).
REFERENCES


PROJECT NAME: South Platte River Sustainable Irrigation
PROJECT ID #: 187

DESCRIPTION OF ACTIVITY: Sustainable Irrigation in the Lower South Platte River Basin

LOCATION: Lower South Platte River Basin, Colorado

PRIMARY CONTACTS:
James Pritchett  Rena Stricker  Jon Radtke
Associate Head and Professor  Contract Ecologist  Water Resources Manager
Agriculture and Resource Economics  CCNA Group Environment & Sustainability  CCNA Group Environment & Sustainability
Colorado State University  Sustainability  Colorado State University  Sustainability
Fort Collins, CO 80523
970-491-5496  404-395-6250  404-676-9112
James.Pritchett@ColoState.edu  rstricker@coca-cola.com  jradtke@coca-cola.com

OBJECTIVE:
• Updating irrigation infrastructure and reducing irrigation on farmlands by applying water only where and when it is needed will maintain water for nature, City of Denver residents, and corn farm productivity in the Lower South Platte River Basin.

BACKGROUND & DESCRIPTION OF ACTIVITY: This project is focused on implementing various improved irrigation practices to reduce irrigation application in the Lower South Platte River Basin. Reducing crop irrigation in the Lower South Platte River Basin is accomplished through a collaborative effort between Colorado State University (CSU) and the Parker Water Sanitation District to help farmers incorporate water saving strategies into their farm systems using methods such as soil moisture monitoring, remote sensing and crop testing in corn fields.

Reducing agriculture water use involves tradeoffs, namely that local farmers and local economies may be impacted by a smaller irrigated cropping base and return flows to the watershed might be reduced. This project saves water and documents the savings while minimizing local impacts to the economy and watershed. Water stewardship strategies are demonstrated to local stakeholders.

The project leverages an existing CSU water stewardship and outreach project in the Lower South Platte River Basin. The CSU water stewardship project is a collaborative effort between Colorado State University and the Parker Water and Sanitation District. The ongoing research focuses on (a) evaluating different irrigation methods and amounts to quantify water savings, (b) assessing the applicability of reduced irrigation practices to various crops, (c) evaluating means to quantify the consumptive use savings under varying irrigation techniques and crops, (d) demonstrating techniques to local stakeholders, (e) analyzing regional economic impacts of innovative water saving activities. The research has been guided by contributions of an advisory committee that includes representatives from water users, farmers, regulators, scientists and local community leaders. Results from the research have been widely disseminated; including on-site field days, written communications to the Colorado Water Conservation Board and publications by the Colorado Water Institute, and numerous presentations including the Colorado Water Congress, Four States Irrigation Council, Agricultural Water Alliance, and the Governor’s Outlook Forum, as well as scientific meetings.
This factsheet documents several irrigation management practices implemented in the Lower South Platte River Basin. These include: 1) water savings through limited irrigation practice at an ARDEC (Agricultural Research, Development and Education Center) site in Larimer County, Colorado and at a site in Iliff, CO that are measured against an irrigated corn benchmark; 2) cultivation of alternative forage crop (sorghum) under limited irrigation instead of corn under full irrigation on 20 acres at Iliff; 3) implementation of Water Irrigation Scheduler for Efficiency (WISE) online tool on about 280 acres of sugar beet fields irrigated by center pivots in western Weld County; 4) implementation of WISE online tool for corn cultivation on about 16 acres at a site near Greeley, CO in Western Weld county; 5) utilization of advanced irrigation scheduling to reduce applied irrigation near LaSalle, CO on 247.1 acres of irrigated corn; and 6) implementation of precision irrigation (variable rate and spacing of irrigation) at several sites for irrigated cultivation on a total of 75 acres.

Figure 1. Alternative cropping systems and irrigation amounts in fields near Iliff, Colorado. These fields are also used for community outreach and demonstration.

SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 152.79 ML/YR
ACTIVITY TIMELINE:
- Project initiation: July 2013
- Project completion: December 2014

COKE CONTRIBUTION: 100%
- Total cost: $120,971.22
- TCCC cost contribution: $120,971.22

WATERSHED BENEFITS CALCULATED:
1. Decrease in alluvial groundwater and surface water withdrawal

1. DECREASE IN ALLUVIAL GROUNDWATER AND SURFACE WATER WITHDRAWAL

Approach and Results:
Water savings resulting from sustainable irrigation practices were estimated using different methods (through field measurements or using conservative estimates). Water savings estimations were provided by Professor James Pritchett at Colorado State University. The water savings estimates are provided below.

- Limited irrigation for corn cultivation at an ARDEC site in Larimer County, Colorado and at a site in Iliff, Colorado

Full irrigation at ARDEC: Irrigation requirement (irrigated corn benchmark) – 809.37 m³/acre
Limited irrigation on parcel 1 at 0.93 acres: Irrigation requirement (no irrigation during V5 to V10 growth stages, when five to ten leaf collars are visible, from approximately late June to late July) – 607.03 m³/acre
  - Water savings = (809.37 - 607.03) m³/acre x 0.93 acre = 188.34 m³
50% of full irrigation on parcel 2 at 0.93 acres: Irrigation requirement (drought) – 404.69 m³/acre
  - Water savings = (809.37 – 404.69) m³/acre x 0.93 acre = 376.67 m³

Total water savings at ARDEC (1.86 acres) = (188.34 + 376.67) m³ = 565.01 m³ = 0.57 ML

Full irrigation at Iliff: Irrigation requirement (irrigated corn benchmark) – 607.03 m³/acre
Limited irrigation on parcel 1 at 2.55 acres: Irrigation requirement (no irrigation during V5 to V10 growth stages, when five to ten leaf collars are visible, from approximately late June to late July) – 101.17 m³/acre
  - Water savings = (607.03 – 101.17) m³/acre x 2.55 acre = 1,287.50 m³
50% of full irrigation on parcel 2 at 2.55 acres: Irrigation requirement (drought) – 238.28 m³/acre
  - Water savings = (607.03 – 238.28) m³/acre x 2.55 acre = 824.00 m³

Total water savings at Iliff (5.1 acres) = (1,287.50 + 824.00) m³ = 2,111.50 m³ = 2.11 ML
• **Cultivation of alternative forage crop (sorghum) under limited irrigation instead of corn under full irrigation on 20 acres at Iliff**

  Full irrigation requirement for forage corn – 607.03 m³/acre  
  Limited irrigation requirement for forage sorghum – 242.81 m³/acre  

  Total Water savings of alternative forage crop (sorghum) under limited irrigation = (607.03 – 242.81) m³/acre x 19.77 acre = 7,200 m³ = 7.2 ML

• **Implementation of Water Irrigation Scheduler for Efficiency (WISE) online tool on about 280 acres of sugar beet fields irrigated by center pivots in Western Weld County**

  Previous tests conducted by CSU on a center pivot-irrigated corn field near Greeley (separate location from the 16 acre site near Greeley described below) showed that using WISE for scheduling can reduce gross irrigation amounts by as much as 27% in comparison to a fixed irrigation schedule of every 3 days that the farmer was using for his pivot.

  Using a conservative water savings of 10% for sugar beets and an average seasonal gross irrigation of 16 inches (based on data from 4 sugar beet fields in 2013) on 280 acres, the potential water savings are estimated as 12,165,120 gallons or 46.05 ML.

  Total water savings due to WISE irrigation scheduling = 46.05 ML.

• **Implementation of WISE online tool for corn cultivation on about 16 acres at a site near Greeley in Western Weld county**

  WISE irrigation scheduling is utilized for corn cultivation resulting in reducing irrigation application by approximately 27% (or 50,000 gallons/acre) in comparison to a fixed irrigation schedule of every 3 days:

  Full irrigation requirement = 6.9 inches  
  o  Water savings = 27% of full irrigation = 1.863 inches = 50,000 gallons/acre  

  Total water savings for 16 acres = 50,000 gallons/acre x 16 acres = 800,000 gallons = 3.03 ML

  Total water savings due to WISE irrigation scheduling = 3.03 ML.

• **Utilization of advanced irrigation scheduling to reduce applied irrigation near LaSalle, CO on 247.1 acres of irrigated corn**

  CSU has estimated that the water savings resulting from implementing advanced irrigation scheduling activities, such as soil moisture monitoring and remote sensing, on 247.1 acres is 16,774,384 gallons or 63.50 ML:

  Water savings from two full irrigations = 2.5 inches = 67,885 gallons/acre x 247.1 acres = 16.77 million gallons

  Total water savings due to advanced irrigation scheduling = 63.50 ML
Implementation of precision irrigation (variable rate and spacing of irrigation) at several sites for irrigation cultivation on a total of 75 acres

CSU has estimated that the aggregate water savings resulting from implementing three separate precision irrigation activities on three 25-acre parcels (75 acres in total) is 8,012,325 gallons or 30.33 ML:

**Full irrigation requirement:** approximately 267,078 gallons/acre

**Treatment 1 on parcel 1:** Limited irrigation – 80% of full irrigation (approximately 213,662 gallons/acre)

- Water savings = 53,415 gallons/acre x 25 acres = 1,335,375 gallons

**Treatment 2 on parcel 2:** Limited irrigation – 60% of full irrigation (approximately 160,247 gallons/acre)

- Water savings = 106,831 gallons/acre x 25 acres = 2,670,775 gallons

**Treatment 3 on parcel 3:** Limited irrigation – 40% of full irrigation (approximately 106,831 gallons/acre)

- Water savings = 160,247 gallons/acre x 25 acres = 4,006,175 gallons

**Total water savings due to precision irrigation = 30.33 ML**

The **total water savings** is calculated as the sum of the water savings from various irrigation projects:

\[
\text{Water savings} = 0.57 + 2.11 + 7.20 + 46.05 + 3.03 + 63.50 + 30.33 = 152.79 \text{ ML/yr}
\]

The total (ultimate) water quantity benefit is: 152.79 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share is: 152.79 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 152.79 ML/yr and TCCC’s benefit (adjusted for cost share) is 152.79 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in this table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>152.79</td>
<td>152.79</td>
</tr>
<tr>
<td>2016</td>
<td>152.79</td>
<td>152.79</td>
</tr>
<tr>
<td>2017</td>
<td>152.79</td>
<td>152.79</td>
</tr>
<tr>
<td>2018</td>
<td>152.79</td>
<td>152.79</td>
</tr>
<tr>
<td>2019</td>
<td>152.79</td>
<td>152.79</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>152.79</td>
<td>152.79</td>
</tr>
</tbody>
</table>

Data sources:
- All project information and benefit calculations were provided by Prof. James Pritchett at Colorado State University.

Assumptions:
- Crop evapotranspiration (ET) is determined using local weather stations and standard techniques.
- Savings are calculated as the difference between the amount of water needed to meet Crop ET and the reduced amount of applied water.

OTHER BENEFITS NOT QUANTIFIED
- Energy savings and associated cost savings

NOTES
- Demonstration projects are expected to continue during future years. Any change in future demonstration activities will be updated accordingly.

REFERENCES
PowerPoint file titled “CSU-CCR South Platte Project update.pptx” provide by Prof. James Pritchett at Colorado State University on November 3, 2014.
Excel file titled “ARDEC 1070 and Iliff water savings calc for Coke.xlsx” provided by Prof. James Pritchett at Colorado State University on November 3, 2014.
PROJECT NAME: Forest Conservation in the Greater Tarcoles River Watershed – Agua Tica Water Fund
PROJECT ID #: 189

DESCRIPTION OF ACTIVITY: Conservation (9.9 hectares) and restoration (14.2 hectares)

LOCATION: Virilla subwatershed, Greater Tarcoles River watershed, southeast of San Jose, Costa Rica. Latitude 9.85720, Longitude -84.13248

PRIMARY CONTACTS:
Jorge Leon Sarmiento  Erick Ramírez
Latin America Water Funds Specialist  Environmental and Safety Manager
The Nature Conservancy  Latin Center Business Unit
Cartagena de Indias, Colombia  Coca-Cola
(+57) 317-5100-880  +506 61853276
jleon@tnc.org  erickramirez@coca-cola.com

OBJECTIVES:
• Improve hydrologic conditions and reduce runoff
• Protect native forest remnants and associated ecosystem services, particularly water supply

BACKGROUND & ACTIVITY DESCRIPTION:
The project area is located in the Greater Tarcoles River watershed, in the greater San Jose metropolitan area (Figure 1). 60% of the population of Costa Rica resides within this watershed. Ecosystems in the area include premontane tropical wet forest, low montane tropical wet forest, and low montane tropical rain forest. In the mountain areas surrounding San Jose, land uses are predominantly agricultural at lower elevations, and cattle ranching at higher elevations. In non-natural areas, pastures are the dominant cover, followed by permanent and non-permanent crops. Urban sprawl is also increasing. Areas that supply water for the San Jose metropolitan area have primarily agricultural landscapes and are threatened by suburban expansion.

This project benefits a total of 24.1 hectares on two properties, Finca Lajas and Finca El Higueron, and consists of two activities:

1. Forest protection. Landowners of the two properties have been voluntarily protecting native forest remnants and riparian buffer areas. However, economic pressures threaten the continued protection of these areas. Without technical support and financial incentives, these lands are
likely to be converted to pasture and residential uses. Current conditions within the areas to be protected by this project are shown in Figure 2.

![Figure 2. Forest remnants to be protected in the project area](image1)

This project protects 9.9 hectares of native forest remnants, spread among the two sites. Conservation agreements have been signed with the landowners, and physical barriers will be installed to protect these forest remnants.

2. Natural regeneration of pasture areas. Some areas of the properties are used for cattle ranching. Figure 3 shows the current conditions in these areas, which can be described as pastures and grasslands in fair condition. The property owner has set aside 14.2 hectares for natural regeneration. The project will isolate the regeneration area with live fences to promote natural regeneration and ensure future protection. Figure 4 shows the desired condition, forested area in good condition. This activity will reduce erosion and runoff and conserve biodiversity.

![Figure 3. Current pasture/grassland conditions](image2)
SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 22.2 ML/YR

ACTIVITY TIMELINE:
- December 2014 – Conservation of 9.9 hectares:
  - Conservation agreements signed
  - Physical barriers installed
- December 2014 – Implementation of natural regeneration on 14.2 hectares:
  - Isolation of regeneration areas with live fences

COCA-COLA CONTRIBUTION: 100%

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al., 2005) was used to estimate the decrease in runoff due to implementation of project activities involving land use changes. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (24.1 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers for the pre-project condition and the post-project conditions were provided by Jorge Leon (TNC) based on information provided in the TR-55 document (USDA-NRCS, 1986):

Forest Protection (9.9 ha):
- Without-project: No forest protection
Pastures in “poor” (<50% cover) and “fair” (50-75% cover) hydrologic condition and townhouses on <1/8 acre lots (65% average impervious area) (CN = 86*0.25 + 79*0.25 + 90*0.5 = 86.25)

- Hydrologic soil group (HSG) “C”

**With-project:** Forest protection

- Tropical woods, tropical cloud forests in “good” hydrologic condition protected from grazing (CN = 70)
- Hydrologic soil group (HSG) “C”

**Natural Regeneration (14.2 ha):**

- **Without-project:** No forest protection
  - Pastures in “poor” (<50% cover) and “fair” (50-75% cover) hydrologic condition due to overgrazing on steep slopes producing soil erosion, cattle entrance present (CN = 86*0.5 + 79*0.5 = 82.5)
  - Hydrologic soil group (HSG) “C”

- **With-project:** Natural regeneration
  - Tropical woods, tropical cloud forests in “good” hydrologic condition protected from grazing (CN = 70)
  - Hydrologic soil group (HSG) “C”

Daily precipitation and air temperature data were provided for the 2010-2013 time period by Jorge Leon (TNC). The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Curve numbers and processed meteorological data were used to compute daily runoff for the without- and with-project cases for a 4-year period (2010-2013). Total annual average runoff volumes and the resulting water quantity benefit for protecting the 24.1 ha project area was estimated as follows:

- **Without-project:** 372 ML/yr
  - Forest Protection (9.9 ha): 154.8 ML/yr (runoff depth: 1,563.8 mm/yr)
  - Natural Regeneration (14.2 ha): 217.2 ML/yr (runoff depth: 1,529.7 mm/yr)

- **With-project:** 349.8 ML/yr
  - Forest Protection (9.9 ha): 143.7 ML/yr (runoff depth: 1,451.1 mm/yr)
  - Natural Regeneration (14.2 ha): 206.1 ML/yr (runoff depth: 1,451.4 mm/yr)

- **Benefit (runoff reduction):** 22.2 ML/yr

The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

**The total (ultimate) benefit is:** 22.2 ML/yr

**TCCC total (ultimate) benefit taken as a function of cost share is:** 22.2 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.
2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 22.2 ML/yr, and TCCC’s benefit (adjusted for cost share) is 22.2 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>22.2</td>
<td>22.2</td>
</tr>
<tr>
<td>2016</td>
<td>22.2</td>
<td>22.2</td>
</tr>
<tr>
<td>2017</td>
<td>22.2</td>
<td>22.2</td>
</tr>
<tr>
<td>2018</td>
<td>22.2</td>
<td>22.2</td>
</tr>
<tr>
<td>2019</td>
<td>22.2</td>
<td>22.2</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>22.2</td>
<td>22.2</td>
</tr>
</tbody>
</table>

Data Sources:

- **Size of protected land area**: 24.1 ha (provided by Jorge Leon, TNC)
  - Forest Protection – 9.9 ha
  - Natural Regeneration – 14.2 ha
- **Slope**: provided by Jorge Leon, TNC
  - Forest Protection – 28.9%
  - Natural Regeneration – 31.58%
- **Soil type**: predominantly hydrologic soil group (HSG) “C” (provided by Jorge Leon, TNC). Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.
- **Meteorological data**: Daily precipitation and air temperature data were provided by Jorge Leon, TNC.
- All of the above information on data sources is contained in a data package provided by Jorge Leon (TNC) on 12/17/2014 titled “4_San_Jose_december_2014.zip.”

Assumptions:

- If the land were not protected, deforestation would occur to establish agriculture and grazing.
- “Without-project” (i.e., no forest protection) conditions were assumed to be pasture in “poor” condition (<50% cover) and townhouses on <1/8 acre lots for forest protection activities and pastures in “poor” (<50% cover) and “fair” (50-75% cover) condition for natural regeneration.
activities. “With-project” (i.e., forest protection, natural regeneration) conditions were assumed to be a tropical woods in “good” condition.

- SWAT model parameter “CNCOEF” was set to 2.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of implementation of project activities involving land use changes. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the 2010-2013 period.

The Cover/Management Factors (C_{usle}) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

- **Forest Protection (9.9 ha):**
  - Without-project (no forest protection): Pasture, 60% cover as grass (C_{usle} = 0.040)
  - With-project (forest protection): Managed woodland, 75-100% tree canopy (C_{usle} = 0.001)

- **Natural Regeneration (14.2 ha):**
  - Without-project (no forest protection): Pasture, 60% cover as grass (C_{usle} = 0.040)
  - With-project (natural regeneration): Managed woodland, 75-100% tree canopy (C_{usle} = 0.001)

Total annual sediment yields for the project area were estimated as follows:

- **Without-project:** 16,119 MT/yr
  - Forest Protection (9.9 ha): 5,972 MT/yr (sediment unit area yield: 603.3 MT/ha/yr)
  - Natural Regeneration (14.2 ha): 10,147 MT/yr (sediment unit area yield: 714.6 MT/ha/yr)

- **With-project:** 378 MT/yr
  - Forest Protection (9.9 ha): 138 MT/yr (sediment unit area yield: 14.0 MT/ha/yr)
  - Natural Regeneration (14.2 ha): 240 MT/yr (sediment unit area yield: 16.9 MT/ha/yr)

- **Benefit (reduced sediment yield):** 15,741 MT/yr

The total benefit (sediment yield reduction) is: 15,741 MT/yr

The total benefit (reduced sediment yield) is: 15,741 MT/yr and TCCC’s benefit (adjusted for cost share) is 15,741 MT/yr.

The 2014 benefit is: 15,741 MT/yr and TCCC’s benefit (adjusted for cost share) is 15,741 MT/yr.
Data Sources:
- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:
- The Cover Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and among years).
- The soil erodibility factor ($K$) was assumed to be 0.25 for use in MUSLE equation. The soil erodibility factor was estimated for sandy clay loam with approximately 1-2% organic matter content based on Haith et al. (1992).

OTHER BENEFITS NOT QUANTIFIED
- Increase in infiltration and baseflow
- Direct water supply benefits to local communities
- Protect water supplies for thousands of people in the San Jose metropolitan area
- Improvements in terrestrial habitat and biodiversity
- Maintain/protect biodiversity

NOTES
- This project is part of a portfolio of Water Fund projects in Latin America.

REFERENCES


PROJECT NAME: Forest Protection and Restoration in the El Zapote Watershed, Cordillera Alux Forest Reserve

PROJECT ID #: 190

DESCRIPTION OF ACTIVITY: Conservation (22.66 hectares) and restoration (0.29 hectares)

LOCATION: El Zapote watershed within the Cordillera Alux Forest Reserve, near the Guatemala City metropolitan area. Latitude (for protected area): 14.700 to 14.599, Longitude: -90.604 to -90.665

PRIMARY CONTACTS:
Jorge Leon Sarmiento
Latin America Water Funds Specialist
The Nature Conservancy
Cartagena de Indias, Colombia
(+57) 317-5100-880
jleon@tnc.org

Erick Ramírez
Environmental and Safety Manager
Latin Center Business Unit
Cartagena de Indias, Colombia
(+506) 61853276
erickramirez@coca-cola.com

OBJECTIVES:
• Protect forested areas and associated ecosystem services, including water supply
• Restore forest to lands previously used for row agriculture
• Improve soil cover and hydrologic condition

BACKGROUND & ACTIVITY DESCRIPTION: The project area is located in the El Zapote watershed, part of a group of 15 watersheds that provide water for the Metropolitan Guatemala City region (Figure 1). The properties are located in the Cordillera Alux Forest Reserve, which borders the metropolitan area and provides ecological services and hydrological functions; the Cordillera Alux is one of the main areas of water recharge for Guatemala City. It was declared a protected area in 1989. However, population growth, increasing demand for wood products, and a lack of enforcement of existing legislation threaten the future status of these lands. Illegal logging and land invasion are threats to the protected status of the area. In addition, future economic objectives could promote land use changes.

This project consists of two activities:
1. Forest protection. This activity protects 22.66 hectares of forested areas from transformation to urban land uses. Some of these areas have been voluntarily protected by the land owners and have predominantly native species; others have experienced degradation of the original forests, leaving a mixture of brush, weeds, and some grasses. Figure 2 shows current conditions on the project properties.
These properties border current urban areas; without protection, they will likely be replaced by urban settlements or illegal dumpsites. Figure 3 shows the conditions to be avoided by implementation of the project, while Figure 4 depicts the expected conditions as a result of project implementation, with forest cover maintained, hydrologic conditions improved, and no logging or other forest degradation.

Figure 2. Current conditions, showing remnants of original forest ecosystem

Figure 3. Degraded conditions to be avoided by implementation of the project

Figure 4. Conditions expected due to project implementation; forest cover is maintained and conditions are improved
2. Reforestation of areas used for row crops. The project properties include cleared areas that are or recently were used for agricultural production, primarily basic grains such as maize and beans. These areas provide a source of food and income for the landowners, but are devoid of forest cover and often in poor condition (Figure 5). Restoration of these lands with predominant native species will improve hydrological functioning of the watershed. Incorporating commercial species and allowing low impact wood extraction will provide benefits to the landowners and alleviate pressures on natural forest areas. This project will restore 0.29 hectares. Figure 6 shows anticipated conditions as a result of project implementation.

![Aerial photograph: TNC, Lighthawk, 2014](image1)

![Aerial photograph: TNC, Lighthawk, 2014](image2)

Figure 5. Current conditions to be restored

![Aerial photograph: TNC, Lighthawk, 2014](image3)

Figure 6. Restored conditions expected as a result of project implementation

**SUMMARY OF REPLENISH BENEFIT:**
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 15.5 ML/YR

**ACTIVITY TIMELINE:**
December 2014 – Forest protection of 22.66 hectares via signed conservation agreements
December 2014 - Restoration of 0.29 hectares of former agricultural lands via planting of native species

**COCA-COLA CONTRIBUTION:** 100%

**WATERSHED BENEFITS CALCULATED:**
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

---

1. **DECREASE IN RUNOFF**

**Approach & Results:**

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al., 2005) was used to estimate the decrease in runoff due to implementation of project activities involving land use changes. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (22.95 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers for the pre-project condition and the post-project conditions were provided by Jorge Leon (TNC) based on information provided in the TR-55 document (USDA-NRCS, 1986):

**Protection of forest (22.66 ha):**

- **Without-project:** No forest protection
  - 30% residential districts with lots 1/8 acre or less (65% average impervious area), 70% open space (illegal dump sites) in “poor” condition (grass cover < 50%) \( (CN = 0.3 \times 90 + 0.7 \times 86 = 87.2) \)
  - Hydrologic soil group (HSG) “C”
- **With-project:** Forest protection
  - Woods in “good” hydrologic condition, woods are protected from grazing, and litter and brush adequately cover the soil \( (CN = 70) \)
  - Hydrologic soil group (HSG) “C”

**Reforestation (0.29 ha):**

- **Without-project:** Cropland
  - Row crops, straight row, in “poor” to “good” hydrologic condition \( (CN = 0.5 \times 88 + 0.5 \times 85 = 86.5) \)
  - Hydrologic soil group (HSG) “C”
- **With-project:** Reforestation
  - Woods and grass combined (50% woods and 50% grass cover) in “good” hydrologic condition \( (CN = 72) \)
  - Hydrologic soil group (HSG) “C”
Daily precipitation and air temperature data were provided during the 1995-2012 time period by Jorge Leon (TNC). The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Curve numbers and processed meteorological data were used to compute daily runoff for the without-and with-project cases for a 13-year period. Total annual average runoff volumes and the resulting water quantity benefit from the project were estimated as follows:

- **Without-project**: 175.4 ML/yr
  - Protection of forest (22.66 ha): 173.2 ML/yr (runoff depth: 764.3 mm/yr)
  - Reforestation (0.29 ha): 2.2 ML/yr (runoff depth: 758.4 mm/yr)

- **With-project**: 159.9 ML/yr
  - Protection of forest (22.66 ha): 157.8 ML/yr (runoff depth: 696.4 mm/yr)
  - Reforestation (0.29 ha): 2.1 ML/yr (runoff depth: 724.1 mm/yr)

- **Benefit (runoff reduction)**: 15.5 ML/yr

The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

- **The total (ultimate) benefit is**: 15.5 ML/yr
- **TCCC total (ultimate) benefit taken as a function of cost share is**: 15.5 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 15.5 ML/yr, and TCCC’s benefit (adjusted for cost share) is 15.5 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>15.5</td>
<td>15.5</td>
</tr>
<tr>
<td>2016</td>
<td>15.5</td>
<td>15.5</td>
</tr>
<tr>
<td>2017</td>
<td>15.5</td>
<td>15.5</td>
</tr>
<tr>
<td>2018</td>
<td>15.5</td>
<td>15.5</td>
</tr>
<tr>
<td>2019</td>
<td>15.5</td>
<td>15.5</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>15.5</td>
<td>15.5</td>
</tr>
</tbody>
</table>

**Data Sources:**

- **Size of protected land area**: 22.95 ha (provided by Jorge Leon, TNC)
  - Protection of forest - 22.66 ha

309
Reforestation - 0.29 ha

**Slope:**
- Protection of forest – 21.85% (provided by Jorge Leon, TNC)
- Reforestation – 18.68% (provided by Jorge Leon, TNC)

**Soil type:** predominantly hydrologic soil group (HSG) “C” (provided by Jorge Leon, TNC). Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.

**Meteorological data:** Daily precipitation and air temperature data were provided by Jorge Leon (TNC) for the 1995 – 2014 period. A total of 13 years of meteorology data was used in the calculation. The following years had large data gaps in either precipitation or temperature or both: 2003; 2008; 2009; 2013 and 2014. In addition precipitation and temperature data are not available for the following years: 1997 and 2004.

All of the above information on data sources is contained in a data package provided by Jorge Leon (TNC) on 12/16/2014 titled “6_GUATEMALA_december_2014.zip.”

**Assumptions:**
- If the land were not protected, deforestation would occur to establish agriculture or high density residential lots.
- Protection of forest: “Without-project” (i.e., no forest protection) conditions were assumed to be 30% residential districts with lots 1/8 acre or less (65% average impervious area) and 70% open space (illegal dump sites) in “poor” condition (grass cover < 50%), and “with-project” (i.e., forest protection) conditions were assumed to be woods in “good” condition (woods are protected from grazing and litter/brush adequately cover the soil).
- Reforestation: “Without-project” (i.e., cropland) conditions were assumed to be row crops, straight row, in “poor” to “good” hydrologic condition, and “with-project” (i.e., reforestation) conditions were assumed to be woods and grass combined (50% woods and 50% grass cover) in “good” hydrologic condition.
- SWAT model parameter “CNCOEF” was set to 1.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. **DECREASE IN SEDIMENT EROSION/RUNOFF**

**Approach & Results:**
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of implementation of project activities involving land use changes. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the 1995-2012 period.
The Cover/Management Factors ($C_{usle}$) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

**Protection of forest (22.66 ha):**
- **Without-project (no forest protection):** Pasture, 60% ground cover as weeds ($C_{usle} = 0.090$)
- **With-project (forest protection):** Managed woodland, 75-100% tree canopy ($C_{usle} = 0.001$)

**Reforestation (0.29 ha):**
- **Without-project (cropland):** Field crops with residue left on field ($C_{usle} = 0.032$)
- **With-project (reforestation):** Managed woodland, 40-75% tree canopy ($C_{usle} = 0.004$)

Total annual sediment yields for the project area were estimated as follows:
- **Without-project:**
  - Protection of forest (22.66 ha): 10,327 MT/yr (sediment unit area yield: 455.7 MT/ha/yr)
  - Reforestation (0.29 ha): 21.2 MT/yr (sediment unit area yield: 73.1 MT/ha/yr)
- **With-project:**
  - Protection of forest (22.66 ha): 104.5 MT/yr (sediment unit area yield: 4.6 MT/ha/yr)
  - Reforestation (0.29 ha): 2.5 MT/yr (sediment unit area yield: 8.6 MT/ha/yr)

**Benefit (reduced sediment yield):** 10,241.2 MT/yr

The total benefit (sediment yield reduction) is: 10,241.2 MT/yr and TCCC’s benefit (adjusted for cost share) is 10,241.2 MT/yr.

The 2014 benefit is: 10,241.2 MT/yr and TCCC’s benefit (adjusted for cost share) is 10,241.2 MT/yr.

**Data Sources:**
- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

**Assumptions:**
- The Cover Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and among years).
- The soil erodibility factor ($K$) was assumed to be 0.25 for use in MUSLE equation. Soil erodibility factor was estimated for sandy clay loam with approximately 1 – 2% organic matter content based on Haith et al. (1992).

---

**OTHER BENEFITS NOT QUANTIFIED**
- Increase in infiltration and baseflow
- Protection of an important drinking water source
- Increased income for producers and economic benefits for local community
• Improvements in terrestrial habitat and biodiversity
• Maintain/protect biodiversity

NOTES
• This project is part of a portfolio of Water Fund projects in Latin America.

REFERENCES
deg by 1/2 deg grid (Version 1.0). Working paper and Preprint 96/05. International Soil Reference
and Information Centre (ISRIC), Wageningen, The Netherlands.


Res. Serv., USDA. Washington DC. pp. 244-252.
PROJECT NAME: Forest Protection and Restoration in the Haina-Duey Subwatershed – Santo Domingo Water Fund

PROJECT ID #: 191

DESCRIPTION OF ACTIVITY: Conservation (37 hectares) and restoration (8.87 hectares)

LOCATION: Haina-Duey microwatershed within the mid Haina del Norte basin, northwest of Santo Domingo, Dominican Republic. Latitude: N 18°37’49.9” to N 18°41’31.84”, Longitude: W 70°17’21.36” to W 70°16’12.61”

PRIMARY CONTACTS:
Jorge Leon Sarmiento
Latin America Water Funds Specialist
The Nature Conservancy
Cartagena de Indias, Colombia
(+57) 317-5100-880
jleon@tnc.org

Erick Ramírez
Environmental and Safety Manager
Latin Center Business Unit
Coca-Cola
(+506) 61853276
erickramirez@coca-cola.com

OBJECTIVES:
• Protect forested areas and associated ecosystem services, including water supply
• Improve soil cover and hydrologic conditions

BACKGROUND & ACTIVITY DESCRIPTION: The project is located in the Haina-Duey subwatershed within the mid Haina del Norte basin, San Cristobal province (Figure 1). This area represents a significant source of drinking water for the Santo Domingo municipal water system. The intervention areas are mainly within a Sub-tropical Humid Forest ecosystem that has been increasingly converted to agricultural uses, including cocoa and various short cycle crops and cattle ranching activities. Private landowners have implemented traditional agricultural practices, with tendencies to burn the vegetative cover and implement subsistence agriculture. Forested areas have started to become impacted by such agricultural practices.

This project consists of two activities:
1. Restoration to improve cover. The areas to be restored have been used for years for subsistence farming; forest cover has been shifted almost entirely to the cultivation of traditional agriculture. Cutting and burning the land have been traditional practices in the area. These lands are often not highly productive and provide little economic benefit to farmers; in many cases these properties are semi-abandoned. Hydrologic conditions are poor. Figure 2 shows current conditions on these properties.

Figure 1. Location Map
This activity assists in the recovery of forest structure and hydrological functions in degraded areas owned by two landowners, totaling 8.87 hectares. Trees are planted simulating the original vegetation of the area in terms of its structure and function. Local farmers use production practices that incorporate analog forestry, which is based on the use of evergreen tree species that emulate the ecological function of an undisturbed forest, and produce an economic benefit. The implemented methodology is planting perennials, in this case the primary crop is cocoa, along with other fruits such as sapodilla, and species that produce shade such as Honduran mahogany. Figure 3 shows the conditions expected after restoration, with adequate forest cover and productive perennial crops that can generate income to producers.

Figure 2. Current conditions, showing removal of forest cover

Figure 3. Conditions expected after restoration

2. Protection to avoid deforestation. This activity is focused on areas currently maintaining at least 70% forest cover, with the presence of primary vegetation (some areas with longstanding native forest plantations have been considered), and no apparent symptoms of soil erosion. Areas with remnants of riverine riparian forests are high priority. Figure 4 shows the current conditions to be maintained. Some of these areas are bordered by crops, which increases the risk for them to be transformed for agricultural activities. Some areas have been voluntarily protected from
other land uses by the owners, but the owners’ economic needs represent a future threat to the forests. Neighboring properties have been converted for non-shaded coffee cultivation, row crops, or timber extraction. If not protected, the forests will likely be burned, leading to soil exposure and erosion (Figure 5). This activity protects 37 hectares of land owned by two land owners, via conservation agreements that prohibit forest conversion and timber extraction.

SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 54.8 ML/yr

ACTIVITY TIMELINE:
- September 2014 – November 2014 – Restoration of 8.87 hectares by planting perennial species, including cocoa, sapodilla, and Honduran mahogany
- December 2014 – Conservation agreements with property owners signed to protect 37 hectares of forest
**COCA-COLA CONTRIBUTION:** 100%

**WATERSHED BENEFITS CALCULATED:**
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

---

### 1. DECREASE IN RUNOFF

**Approach & Results:**

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al., 2005) was used to estimate the decrease in runoff due to implementation of project activities related to land use changes. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (45.87 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers for the pre-project condition and the post-project conditions were provided by Jorge Leon (TNC) based on information provided in the TR-55 document (USDA-NRCS, 1986):

**Restoration (8.87 ha):**

- **Without-project:** Row crops
  - Row crops, mixture of straight row and straight row with crop residue cover in “poor” hydrologic condition with burning evidence present (CN = 87)
  - Hydrologic soil group (HSG) “C”
- **With-project:** Restoration
  - Tropical woods in “fair” hydrologic condition mixed with brush in “good” hydrologic condition (>75% cover). Includes shade cocoa and the woods are grazed but not burned (CN = 0.5*73 + 0.5*65 = 69)
  - Hydrologic soil group (HSG) “C”

**Forest Protection (37 ha):**

- **Without-project:** No forest protection
  - Row crops, mixture of straight row and straight row with crop residue cover in “poor” hydrologic condition (CN = 88)
  - Hydrologic soil group (HSG) “C”
- **With-project:** Forest protection
  - Tropical woods in “good” hydrologic condition, protected from grazing (CN = 70)
  - Hydrologic soil group (HSG) “C”

Daily precipitation and air temperature data were provided during the 1990-1999 time period by Jorge Leon (TNC). The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).
Curve numbers and processed meteorological data were used to compute daily runoff for the without-and with-project cases for a 10-year period (1990-1999). Total annual average runoff volumes and the resulting water quantity benefit for protecting the 45.87 ha project area was estimated as follows:

- **Without-project**: 629.5 ML/yr
  - Restoration (8.87 ha): 121.4 ML/yr (runoff depth: 1368.2 mm/yr)
  - Forest Protection (37 ha): 508.1 ML/yr (runoff depth: 1373.1 mm/yr)

- **With-project**: 574.7 ML/yr
  - Restoration (8.87 ha): 111.5 ML/yr (runoff depth: 1257.0 mm/yr)
  - Forest Protection (37 ha): 463.2 ML/yr (1251.9 mm/yr)

- **Benefit (runoff reduction)**: 54.8 ML/yr

The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

- The total (ultimate) benefit is: 54.8 ML/yr
- TCCC total (ultimate) benefit taken as a function of cost share is: 54.8 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 54.8 ML/yr, and TCCC’s benefit (adjusted for cost share) is 54.8 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>54.8</td>
<td>54.8</td>
</tr>
<tr>
<td>2016</td>
<td>54.8</td>
<td>54.8</td>
</tr>
<tr>
<td>2017</td>
<td>54.8</td>
<td>54.8</td>
</tr>
<tr>
<td>2018</td>
<td>54.8</td>
<td>54.8</td>
</tr>
<tr>
<td>2019</td>
<td>54.8</td>
<td>54.8</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>54.8</td>
<td>54.8</td>
</tr>
</tbody>
</table>

**Data Sources:**

- **Size of protected land area**: 45.87 ha (provided by Jorge Leon, TNC)
  - Restoration – 8.87 ha
  - Forest Protection – 37 ha
- **Slope**: provided by Jorge Leon, TNC
- Restoration – 25%
- Forest Protection – 15%

- **Soil type:** predominantly hydrologic soil group (HSG) “C” (provided by Jorge Leon, TNC). Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.

- **Meteorological data:** Daily precipitation and air temperature data were provided by Jorge Leon, TNC.

- All of the above information on data sources is contained in a data package provided by Jorge Leon (TNC) on 12/17/2014 titled “7_DominicanRepublic_december_2014.zip.”

**Assumptions:**

- If the land were not protected, deforestation would occur to establish agriculture and grazing.

- Restoration: “Without-project” (i.e., row crops) conditions were assumed to be row crops, straight row and crop residue cover in “poor” hydrologic condition, and “with-project” (i.e., restoration) conditions were assumed to be tropical woods in “fair” hydrologic condition mixed with brush in “good” hydrologic condition (>75% cover).

- Forest Protection: “Without-project” (i.e., no forest protection) conditions were assumed to be row crops, straight row in “poor” hydrologic condition, and “with-project” (i.e., forest protection) conditions were assumed to be tropical woods in “good” hydrologic condition, protected from grazing.

- SWAT model parameter “CNCOEF” was set to 2.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. **DECREASE IN SEDIMENT EROSION/RUNOFF**

**Approach & Results:**

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of implementation of project activities related to land use changes. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the 1990-1999 period.

The Cover/Management Factors ($C_{usle}$) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

**Restoration (8.87 ha):**

- **Without-project (row crops):** Straight row cropping with 30 to 40% residue remaining to reflect burning ($C_{usle} = 0.190$)
- **With-project (restoration):** Managed woodland, 20-40% tree canopy ($C_{usle} = 0.010$)

**Forest Protection (37 ha):**
• **Without-project (no forest protection):** Field crops with residue left on field ($C_{usle} = 0.032$)
• **With-project (forest protection):** Managed woodland, 40-75% tree canopy ($C_{usle} = 0.002$)

Total annual sediment yields for the project area were estimated as follows:

- **Without-project:** 23,323.9 MT/yr
  - **Restoration (8.87 ha):** 17,208 MT/yr (sediment unit area yield: 1,940.0 MT/ha/yr)
  - **Forest Protection (37 ha):** 6,115.9 MT/yr (sediment unit area yield: 165.3 MT/ha/yr)

- **With-project:** 1,185.6 MT/yr
  - **Restoration (8.87 ha):** 835.6 MT/yr (sediment unit area yield: 94.2 MT/ha/yr)
  - **Forest Protection (37 ha):** 350 MT/yr (sediment unit area yield: 9.5 MT/ha/yr)

- **Benefit (reduced sediment yield):** 22,138.3 MT/yr

The total benefit (sediment yield reduction) is: 22,138.3 MT/yr and TCCC’s benefit (adjusted for cost share) is 22,138.3 MT/yr.

**Data Sources:**

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

**Assumptions:**

- The Cover Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and among years).

- The soil erodibility factor (K) was assumed to be 0.25 for use in MUSLE equation. The soil erodibility factor was estimated for sandy clay loam with approximately 1-2% organic matter content based on Haith et al. (1992).

**OTHER BENEFITS NOT QUANTIFIED**

- Increase in infiltration and baseflow
- Protection of an important drinking water source
- Increased income for producers and economic benefits for local community
- Improvements in terrestrial habitat and biodiversity
- Maintain/protect biodiversity

**NOTES**

- This project is part of a portfolio of Water Fund projects in Latin America.
REFERENCES


PROJECT NAME: Forest Protection and Restoration in the Mahomita Microwatershed – Santo Domingo Water Fund

PROJECT ID #: 192

DESCRIPTION OF ACTIVITY: Conservation (11 hectares) and restoration (8.33 hectares)

LOCATION: Mahomita microwatershed within the mid Nizao basin, northwest of Santo Domingo, Dominican Republic. Latitude: from N 18°35´32.05” to N 18°36´40.75”, Longitude: from W 70°20´12.35” to W 70°18´56.52”

PRIMARY CONTACTS:
Jorge Leon Sarmiento
Latin America Water Funds Specialist
The Nature Conservancy
Cartagena de Indias, Colombia
(+57) 317-5100-880
jleon@tnc.org

Erick Ramírez
Environmental and Safety Manager
Latin Center Business Unit
Coca-Cola
(+506) 61853276
erickramirez@coca-cola.com

OBJECTIVES:
• Protect forested areas and associated ecosystem services, including water supply
• Facilitate conservation and regeneration of natural vegetation cover
• Protect area from further degradation

BACKGROUND & ACTIVITY DESCRIPTION: The project is located in the Mahomita microwatershed within the mid Nizao basin, northwest of Santo Domingo (Figure 1). The intervention areas are mainly within Lower Montane Rain Forest and Lower Montane Wet Forest ecosystems that have been increasingly converted to agricultural uses, particularly coffee. Lands are subject to high erosivity due to high slopes, deforestation, road construction, and poor agricultural practices.

This watershed is an important source of water to Aguacate dam, which provides water and electricity for the city of Santo Domingo. Erosion has caused sedimentation in the Aguacate reservoir. Targeted actions are necessary to restore the ecosystems and reduce erosion and sedimentation.

The intervention area has been divided into two blocks, one within the community of Arroyo Grande and the other, the Santana community. There are multiple landowners, all of whom are small producers. This project consists of three activities:

Figure 1. Location Map
1. Protection to avoid deforestation. This activity is focused in areas currently maintaining at least 70% forest cover, with the presence of primary vegetation (some areas with longstanding native forest plantations have been considered), healthy understory, and no apparent symptoms of soil erosion. Areas with remnants of riverine riparian forests are high priority. Figure 2 shows the current conditions to be maintained. Some of these areas are bordered by crops, which increases the risk for them to be transformed for agricultural activities. Some areas have been voluntarily protected from other land uses by the owners, but the owners’ economic needs represent a future threat to the forests. Neighboring properties have been transformed for non-shaded coffee, row crops, or elective timber extraction. If not protected, these lands will likely be similarly converted for intensive agriculture, with loss of cover, soil exposure, and erosion, as shown in Figure 3. This project protects 11 hectares via establishment of conservation agreements with the owners, who agree to maintain the forest in conservation, allow regeneration of the forest, and prohibit timber extraction.

2. Restoration to improve cover. This activity restores 3.23 hectares. These lands have traditionally been used for coffee production, but production has significantly decreased due to local plague. Hydrologic conditions are poor, and there is low shade cover and visible exposed soil (Figure 4). The
restoration will plant coffee trees, along with species such as Honduran Mahogany to provide shade. If not restored, these areas most likely will be burned and converted to intensive agriculture. Figure 5 shows the conditions expected after restoration, with improved forest cover, and productive coffee crops that can generate income to producers.

Figure 4. Current conditions, intensive agriculture

Figure 5. Conditions expected after restoration, shade coffee with improved soil cover

3. Assisted restoration of agricultural lands. This activity assists in the recovery of forest structure and cover in areas previously used for agriculture, via planting of native and endemic conifer and broadleaf species. The lands to be restored have been used for years for subsistence farming. Forest cover has shifted almost entirely to traditional agriculture and row crops, which are not highly productive and provide few economic benefits to the farmers. In many cases, the properties are semi-abandoned and maintained in a fallow or grassland state. Hydrologic conditions are poor. Figure 6 depicts these conditions. This activity restores 5.10 hectares. The restoration will increase forest cover, promote soil stabilization, and provide highly productive perennial crops that can generate income to producers. 75% of the area will be forest, and 25% will be row crop. Figure 7
shows the anticipated conditions as a result of the project, with forest cover at different heights resembling un-impacted areas.

![Figure 6. Current conditions to be restored](image)

![Figure 7. Conditions expected after restoration, forested area with improved ecosystem functions](image)

**SUMMARY OF REPLENISH BENEFIT:**
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 17.1 ML/yr

**ACTIVITY TIMELINE:**
- November 2014 – Conservation agreements protecting 11 hectares signed with La Esperanza Coffee Producers Association (ASOCAE), property owners, and CEDAF, the local project implementer
- November 2014 – Restoration of 3.23 hectares via planting of coffee and shade trees
- November 2014 – Restoration of 5.10 hectares via planting of conifer and broadleaf species

**COCA-COLA CONTRIBUTION:** 100%
WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al., 2005) was used to estimate the decrease in runoff due to implementation of project activities involving land use changes. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas (19.33 ha is a relatively small land area relative to watershed scales for which hydrologic conditions are typically simulated/estimated).

Curve numbers for the pre-project condition and the post-project condition were provided by Jorge Leon (TNC) based on information provided in the TR-55 document (USDA-NRCS, 1986):

Forest Protection (11 ha):
- **Without-project**: No forest protection
  - Row crops, mixture of straight row and straight row with crop residue cover in “poor” hydrologic condition (CN = 88)
  - Hydrologic soil group (HSG) “C”
- **With-project**: Forest protection
  - Tropical woods in “good” hydrologic condition, protected from grazing (CN = 70)
  - Hydrologic soil group (HSG) “C”

Restoration with Shade Coffee (3.23 ha):
- **Without-project**: Row crops
  - Low production coffee with exposed soils in “poor” hydrologic condition with evidence of burning (CN = 79)
  - Hydrologic soil group (HSG) “C”
- **With-project**: Restoration
  - Coffee with ground cover and terraces in “fair” hydrologic condition, grazed but not burned (CN = 68)
  - Hydrologic soil group (HSG) “C”

Assisted Restoration (5.1 ha):
- **Without-project**: Row crops
  - Row crops, mixture of straight row and straight row with crop residue cover in “poor” hydrologic condition with evidence of burning (CN = 88)
  - Hydrologic soil group (HSG) “C”
- **With-project**: Restoration
Tropical woods in “fair” hydrologic condition, grazed but not burned (CN = 73)
Hydrologic soil group (HSG) “C”

Daily precipitation and air temperature data were provided during the 1990-1999 time period by Jorge Leon (TNC). The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Curve numbers and processed meteorological data were used to compute daily runoff for the without- and with-project cases for a 10-year period (1990-1999). Total annual average runoff volumes and the resulting water quantity benefit for protecting the 19.33 ha project area was estimated as follows:

- **Without-project:** 229.1 ML/yr
  - Forest Protection (11 ha): 131.6 ML/yr (runoff depth: 1196.6 mm/yr)
  - Restoration with Shade Coffee (3.23 ha): 36.5 ML/yr (runoff depth: 1129 mm/yr)
  - Assisted Restoration (5.1 ha): 61 ML/yr (runoff depth: 1197 mm/yr)

- **With-project:** 212 ML/yr
  - Forest Protection (11 ha): 120.5 ML/yr (runoff depth: 1095.8 mm/yr)
  - Restoration with Shade Coffee (3.23 ha): 35 ML/yr (runoff depth: 1084.3 mm/yr)
  - Assisted Restoration (5.1 ha): 56.5 ML/yr (runoff depth: 1107.5 mm/yr)

- **Benefit (runoff reduction):** 17.1 ML/yr

The total (ultimate) benefit is calculated as the sum of benefits for all areas protected.

The total (ultimate) benefit is: 17.1 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 17.1 ML/yr, and TCCC’s benefit (adjusted for cost share) is 17.1 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>17.1</td>
<td>17.1</td>
</tr>
<tr>
<td>2016</td>
<td>17.1</td>
<td>17.1</td>
</tr>
<tr>
<td>2017</td>
<td>17.1</td>
<td>17.1</td>
</tr>
<tr>
<td>2018</td>
<td>17.1</td>
<td>17.1</td>
</tr>
<tr>
<td>2019</td>
<td>17.1</td>
<td>17.1</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>17.1</td>
<td>17.1</td>
</tr>
</tbody>
</table>

Data Sources:
- **Size of protected land area:** 19.33 ha (provided by Jorge Leon, TNC)
  - Forest Protection – 11 ha
  - Restoration with Shade Coffee - 3.23 ha
  - Assisted Restoration – 5.1 ha
- **Slope:** provided by Jorge Leon, TNC
  - Forest Protection – 30%
  - Restoration with Shade Coffee – 15%
  - Assisted Restoration – 35%
- **Soil type:** predominantly hydrologic soil group (HSG) “C” (provided by Jorge Leon, TNC). Type C soils have characteristics of sandy clay loam, with moderately fine to fine texture and low infiltration rates when thoroughly wetted.
- **Meteorological data:** Daily precipitation and air temperature data were provided by Jorge Leon, TNC.
- All of the above information on data sources is contained in a data package provided by Jorge Leon (TNC) on 12/17/2014 titled “7_DominicanRepublic_december_2014.zip.”

Assumptions:
- If the land were not protected, deforestation would occur to establish agriculture and grazing.
- Forest Protection: “Without-project” (i.e., no forest protection) conditions were assumed to be row crops, mixture of straight row and straight row with crop residue cover in “poor” hydrologic condition, and “with-project” (i.e., forest protection) conditions were assumed to be tropical woods in “good” hydrologic condition, protected from grazing.
- Restoration with Shade Coffee: “Without-project” (i.e., row crops) conditions were assumed to be low production coffee with exposed soils in “poor” hydrologic condition with evidence of burning, and “with-project” (i.e., restoration) conditions were assumed to be coffee with ground cover and terraces in “fair” hydrologic condition, grazed but not burned.
- Assisted Restoration: “Without-project” (i.e., row crops) conditions were assumed to be row crops, mixture of straight row and straight row with crop residue cover in “poor” hydrologic...
condition with evidence of burning, and “with-project” (i.e., restoration) conditions were assumed to be tropical woods cover in “fair” hydrologic condition, grazed but not burned.

- SWAT model parameter “CNCOEF” was set to 2.0 (plant evapotranspiration curve number coefficient used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of implementation of project activities involving land use changes. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated for the 1990-1999 period.

The Cover/Management Factors ($C_{usle}$) for the MUSLE were estimated as follows based on information available in Haith et al. (1992):

- **Forest Protection (11 ha):**
  - Without-project (no forest protection): Field crops with residue left on field ($C_{usle} = 0.032$)
  - With-project (forest protection): Managed woodland, 40-75% tree canopy, protected from grazing ($C_{usle} = 0.002$)

- **Restoration with Shade Coffee (3.23 ha):**
  - Without-project (cropland): Coffee cropping with only 30 to 40% residue remaining to reflect burning ($C_{usle} = 0.190$)
  - With-project (forest protection): Shade coffee and woods, 20-40% tree canopy, grazed but not burned ($C_{usle} = 0.010$)

- **Assisted Restoration (5.1 ha):**
  - Without-project (cropland): Straight row cropping with 30 to 40% residue remaining to reflect burning ($C_{usle} = 0.190$)
  - With-project (forest protection): Managed woodland, 20-40% tree canopy, grazed but not burned ($C_{usle} = 0.010$)

Total annual sediment yields for the project area were estimated as follows:

- Without-project (no forest protection): 20,360.9 MT/yr
  - Forest Protection (11 ha): 4,342.6 MT/yr (sediment unit area yield: 394.8 MT/ha/yr)
  - Restoration with Shade Coffee (3.23 ha): 1,932.6 MT/yr (sediment unit area yield: 598.3 MT/ha/yr)
  - Assisted Restoration (5.1 ha): 14,085.7 MT/yr (sediment unit area yield: 2,761.9 MT/ha/yr)
• **With-project (forest protection):** 1,035.6 MT/yr
  - **Forest Protection (11 ha):** 249.5 MT/yr (sediment unit area yield: 22.7 MT/ha/yr)
  - **Restoration with Shade Coffee (3.23 ha):** 97.9 MT/yr (sediment unit area yield: 30.3 MT/ha/yr)
  - **Assisted Restoration (5.1 ha):** 688.2 MT/yr (sediment unit area yield: 134.9 MT/ha/yr)

• **Benefit (reduced sediment yield):** 19,325.3 MT/yr

**The total benefit (sediment yield reduction) is:** 19,325.3 MT/yr

The total benefit (reduced sediment yield) is: 19,325.3 MT/yr and TCCC’s benefit (adjusted for cost share) is 19,325.3 MT/yr.

**The 2014 benefit is:** 19,325.3 MT/yr and TCCC’s benefit (adjusted for cost share) is 19,325.3 MT/yr.

**Data Sources:**
- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

**Assumptions:**
- The Cover Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and among years).
- The soil erodibility factor ($K$) was assumed to be 0.25 for use in MUSLE equation. The soil erodibility factor was estimated for sandy clay loam with approximately 1-2% organic matter content based on Haith et al. (1992).

**OTHER BENEFITS NOT QUANTIFIED**
- Increase in infiltration and baseflow
- Protection of an important drinking water source
- Reduced sedimentation and improved performance of hydroelectric system
- Increased income for producers and economic benefits for local community
- Improvements in terrestrial habitat and biodiversity
- Maintain/protect biodiversity

**NOTES**
- This project is part of a portfolio of Water Fund projects in Latin America.

**REFERENCES**


Appendix E

Fact Sheets for Water for Productive Use Projects

Fact sheets for updated and new activities quantified:
### Appendix E Table of Contents

<table>
<thead>
<tr>
<th>LTI ID</th>
<th>TCCC ID</th>
<th>Country</th>
<th>Partner / Lead</th>
<th>Project Name</th>
<th>Description of Activity</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>10</td>
<td>South Africa</td>
<td>GETF</td>
<td>Supply with Watergy™ Intervention and Education (2 projects: 1.) Watergy™ Program - Fixing the Leaks, 2.) School Plumbing Repair and Energy Savings)</td>
<td>Leak repair</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>71</td>
<td>U.S. PA</td>
<td>Borough of Bellefonte</td>
<td>Big Spring Watershed Protection</td>
<td>Leak repair</td>
<td>5</td>
</tr>
<tr>
<td>94</td>
<td>427</td>
<td>China</td>
<td>UNDP</td>
<td>Guangxi Sustainable Sugarcane Initiative: Phases I and II</td>
<td>Conversion of flood irrigation to drip irrigation</td>
<td>9</td>
</tr>
<tr>
<td>104</td>
<td>456</td>
<td>India</td>
<td>TCCC</td>
<td>Conserving Water Usage through Improved Irrigation Techniques</td>
<td>Laser leveling activities and conversion to drip irrigation</td>
<td>15</td>
</tr>
<tr>
<td>117</td>
<td></td>
<td>India</td>
<td>TCCC</td>
<td>Rehabilitation of Farm Ponds Across India</td>
<td>Desilting and rejuvenation of farm ponds</td>
<td>22</td>
</tr>
<tr>
<td>154</td>
<td></td>
<td>Swaziland</td>
<td>GETF</td>
<td>Swaziland: Water for a Generation</td>
<td>Irrigation water supply</td>
<td>26</td>
</tr>
<tr>
<td>166</td>
<td></td>
<td>Morocco</td>
<td>L'ALCESDAM</td>
<td>RAIN Project for the Rehabilitation of Palm Plantations in Southern Morocco</td>
<td>Irrigation improvements</td>
<td>29</td>
</tr>
<tr>
<td>181</td>
<td></td>
<td>China</td>
<td>UNDP</td>
<td>Flood Utilization and Ecosystem Management in the Haihe Basin</td>
<td>Flood utilization and ecosystem management</td>
<td>35</td>
</tr>
<tr>
<td>194</td>
<td></td>
<td>Kyrgyzstan</td>
<td>Aga Khan Foundation and MSDSP-KG</td>
<td>Enhancing Opportunities for Youth in Income-Generation, Entrepreneurship, and Education in Kyrgyzstan and Afghanistan</td>
<td>Rehabilitation of man-made canals</td>
<td>41</td>
</tr>
</tbody>
</table>

**Notes:**
GETF = Global Environment & Technology Foundation  
MSDSP-KG = Kyrgyzstan Mountain Societies Development Support Program  
L'ALCESDAM = Association for Combating Erosion, Drought and Desertification in Morocco  
TCC = The Coca-Cola Company  
UNDP = United Nations Development Program
PROJECT NAME: Supply with Watergy™ Intervention and Education (2 projects: 1.) Watergy™ Program - Fixing the Leaks, 2.) School Plumbing Repair and Energy Savings

PROJECT ID #: 08

DESCRIPTION OF ACTIVITY: Leak repair in drinking water and sanitary plumbing systems

LOCATION: South Africa

PRIMARY CONTACTS:
Tara Varghese
Global Environment & Technology Foundation (GETF)
Tara.Varghese@getf.org

Naabia Ofosu-Amaah
Global Environment & Technology Foundation (GETF)
naabia.ofosu-amaah@getf.org

OBJECTIVE:
• Increase water use efficiency

BACKGROUND & DESCRIPTION OF ACTIVITY: Recognizing the water-energy nexus and opportunities to create energy efficiencies through water savings, the Alliance to Save Energy established the Watergy™ Program, which has been active in South Africa since 2003. Because of widespread wastage and high levels of non-revenue water in South Africa, Watergy™ implements a basket of proven interventions at the supply and end-use levels, leading to significant water and energy savings. Through Watergy™, the Alliance has attained extensive experience helping developing countries reap the benefits of efficiencies. Watergy™ projects improve water conservation in South African communities by repairing leaks and promoting water savings in schools and private households. Between 1997 and 2009, leak repair has been conducted at more than ten schools and nearly 5,000 households in various locations throughout South Africa.

SUMMARY OF REPLENISH BENEFIT:
• 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 126.3 ML/yr

ACTIVITY TIMELINE: (from CWP, 2009) and Alliance to Save Energy project Close-Out reports – see References
• May through October 2009: Leak repairs at schools in Ekhuruleni, Gauteng, South Africa; Cape Town, Western Cape, South Africa; Mandela Bay, Eastern Cape, South Africa
• August 2006 to April 2007: Leak repairs at 3,650 households in Sharpeville, Gauteng, South Africa
• May through November 2006: Leak repairs at seven primary schools (Fred Habedi, Masimini, Theo Twala, Duduza, James Nkosi, Emzimkulu, Elusindisweni) in municipalities of Groblersdal, Middelburg, Witbank, Duduza, Standerton, and Katorus in provinces of Gauteng and Mpumalanga, South Africa
• December 2005 through July 2006: Leak repairs at 1,371 households in Munsieville, Gauteng, South Africa
• Approximately 1997 to 2004: Leak repairs at three primary schools (Ntuthuko, Vumbeni, Abram Hlope) in Ekhuruleni, Gauteng, South Africa

COCA-COLA CONTRIBUTION: 31%
Total project cost: $1,128,417 USD
TCCC contribution: $354,840 USD

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:
1. Decrease in surface/ground water usage

1. DECREASE IN SURFACE/GROUND WATER USAGE

Approach & Results:
Water savings were reported for five projects (see below) in either the project survey returned by GETF (CWP, 2009) or in the project-associated Close-Out reports. Water savings were estimated for three schools, based on the average of water savings for all other reporting schools. See Notes section for further details.

- **Leak repairs at schools in three municipalities (Ekhuruleni, Cape Town, Mandela Bay)**
  
  Water Savings: Estimate 660 L/hour savings per municipality = 5,781,600 L/year savings per municipality = 17,344,800 L/year total savings

- **Leak repairs at 3,650 households in Sharpeville**
  
  Water Savings: 513 KL per day from municipal meter readings = 187,245,000 L/year

- **Leak repairs at seven primary schools in provinces of Gauteng and Mpumalanga**
  
  Water Savings: 20,809,243 L/year from meter readings (16,311,000 L/yr for 6 primary schools from meter readings + 4,498,243 L/yr estimated savings for Emzimkulu Primary School)

- **Leak repairs at 1,371 households in Munsieville**
  
  Water Savings: 432.733 KL per day from municipal meter readings = 157,947,545 L/year

- **Leak repairs at three primary schools in Ekhuruleni**
  
  Water Savings: 24,173,186 L/year (15,176,700 L/year from meter readings for Vumbeni Primary School + 8,996,486 L/year estimated savings for Ntuthuko and Abram Hlope Primary Schools)

- **Total Water Savings at Schools and Households from the 5 projects listed above = 407,519,774 liters/year = 407.52 ML/yr**

The total (ultimate) benefit is: 407.52 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share is: 126.3 ML/yr.

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.
2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 407.52 ML/yr and TCCC’s benefit (adjusted for cost share) is 126.3 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first second and are adjusted for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>407.52</td>
<td>126.3</td>
</tr>
<tr>
<td>2016</td>
<td>407.52</td>
<td>126.3</td>
</tr>
<tr>
<td>2017</td>
<td>407.52</td>
<td>126.3</td>
</tr>
<tr>
<td>2018</td>
<td>407.52</td>
<td>126.3</td>
</tr>
<tr>
<td>2019</td>
<td>407.52</td>
<td>126.3</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>407.52</td>
<td>126.3</td>
</tr>
</tbody>
</table>

Data sources:
- For schools in three municipalities (Ekuruleni, Cape Town, Mandela Bay), water savings were reported in CWP, 2009.
- For the 3,650 households in Sharpeville, water savings were reported in the Munsieville & Sharpeville Power Point presentation and Sharpeville Close-Out Report (Alliance to Save Energy, 2006b and 2007).
- For six of the seven primary schools in provinces of Gauteng and Mpumalanga, water savings were reported in the Close-Out Report (Alliance to Save Energy, 2008a); water savings for Emzimkulu Primary School were estimated (see below).
- For the 1,371 households in Munsieville, water savings were reported in the Munsieville Close-Out Report and Munsieville & Sharpeville Power Point presentation (Alliance to Save Energy, 2006a and 2006b).
- For the three primary schools in Ekuruleni, water savings for Vumbeni Primary School were reported in the Close-Out Report (Alliance to Save Energy, 2008b); water savings for Ntuthuko Primary School and Abram Hlope Primary School were estimated (see below).
- “Continuous” water wastage is 24 hours/day; leaking urinals, cisterns and taps are running constantly (email from GETF to LimnoTech, 3/24/2009)

Assumptions:
- For all locations, assumed no depreciation in savings (systems continue to function as when repairs were completed).
- For the seven primary schools in provinces of Gauteng and Mpumalanga, water savings were not reported for one school (Emzimkulu Primary School) because of frequent interruptions of water supply during the logging exercise, so savings for this school were estimated as the average of water savings for all other reporting schools for all projects.
• For the three primary schools in Ekhuruleni, water savings were not reported for two schools (Ntuthuko Primary School, Abram Hlope Primary School), so savings for these schools were estimated as the average of water savings for all other reporting schools for all projects.

OTHER BENEFITS NOT QUANTIFIED
• Environmental benefits from water conservation behaviors as a result of community education

NOTES
• This fact sheet updates the August 2009 fact sheet to include updated cost share information.
• This project included job training for more than 80 beginner plumbers, improved the plumbing infrastructure for more than 37,800 people, and promoted water conservation education for community members.

REFERENCES
Alliance to Save Energy. 2008a. The Implementation of a Watergy Intervention and Education Project at Selected Schools within the Coca-Cola/Shanduka Beverages Area of Supply, Closure Report, December.

Alliance to Save Energy. 2008b. The Implementation of a Watergy Intervention and Education Project at Selected Schools within the Ekurhuleni Metropolitan Area, Closure Report, April.


Community Water Partnership (CWP), 2009. CWP survey responses provided by GETF in the file 08_Supply_with_Watergy_Intervention__and_Education_in_Schools.xls March 23, 2009.
PROJECT NAME: Big Spring Watershed Protection
PROJECT ID #: 14

DESCRIPTION OF ACTIVITY: Leak detection and repair of municipal water distribution and piping system

LOCATION: Borough of Bellefonte, Pennsylvania

PRIMARY CONTACT:
Rena Stricker  Jon Radtke  James Gazza, CSP
Contract Ecologist  Water Resources Manager  Safety, Environmental and Security
CCNA Group Environment & Sustainability  CCNA Group Environment & Sustainability  The Coca-Cola Company
Sustainability  Sustainability  Safety, Environmental and Security
Manager  Manager  Manager
Howard, PA
404-395-6250  404-676-9112  814-357-8631
rstricker@coca-cola.com  jradtke@coca-cola.com  jgazza@coca-cola.com

OBJECTIVE:
• Increase water use efficiency

BACKGROUND & DESCRIPTION OF ACTIVITY: Big Spring is an artesian ground water source serving the Borough of Bellefonte, a number of neighboring communities (including the Borough of Milesburg) and commercial customers. Approximately 16 million gallons per day are pumped from the spring. The Borough of Bellefonte is allocated five million gallons of water per day and uses, on average, three million gallons to service its community. The city has had problems with aging piping and distribution infrastructure that were causing leaks and water loss. The leaking water is not infiltrating back into the aquifer because it is deep and confined. The Borough Council considered increasing water fees to fund infrastructure improvements, but Coca-Cola (the Milesburg plant) offered to partner with the Borough Council to fund improvements in its infrastructure in lieu of increasing water fees. The Coca-Cola plant partnered with the Borough to support the construction of a catchment around and a cover over the Big Spring from 1998 to 1999, to support improvements in the Big Spring pump house from 2006 to 2007, and to provide sonic testing of the piping system to detect leaks from 2006 to the present.

SUMMARY OF REPLENISH BENEFIT:
• 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 637 ML/YR

ACTIVITY TIMELINE:
• Construction of a catchment around and a cover over the Big Spring from 1998 to 1999
• Improvements in the Big Spring pump house from 2006 to 2007
• Sonic testing of the piping system to detect leaks and repair of detected leaks from 2006 (ongoing)
**Coca-Cola Contribution:** Variable over time (see Table 1).

### Table 1. Cost Share

<table>
<thead>
<tr>
<th>Time period</th>
<th>Total Cost ($)</th>
<th>Borough of Bellefonte contribution ($)</th>
<th>TCCC contribution ($)</th>
<th>TCCC contribution (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006-2010</td>
<td>$318,000</td>
<td>$276,000</td>
<td>$42,000</td>
<td>13%</td>
</tr>
<tr>
<td>2011</td>
<td>$38,671</td>
<td>$31,171</td>
<td>$7,500</td>
<td>19%</td>
</tr>
<tr>
<td>2012</td>
<td>$42,500</td>
<td>$35,000</td>
<td>$7,500</td>
<td>18%</td>
</tr>
<tr>
<td>2013</td>
<td>$112,500</td>
<td>$105,000</td>
<td>$7,500</td>
<td>7%</td>
</tr>
</tbody>
</table>

Note: The 2013 contribution from the Borough of Bellefonte is between $95,000 and $105,000. To be conservative, the upper value is used in the cost share calculation.

**Water for Productive Use Benefits Calculated:**

1. Decrease in ground water pumping

### 1. Decrease in Ground Water Pumping

**Approach and Results:**

Water savings from the detection and repair of leaks in the water supply distribution system were initially obtained in a project survey in 2009. Subsequently, updated leak detection and repair information was provided through 2010, through 2011 and then again through 2013 via e-mails from The Coca-Cola Company Milesburg plant. A summary of water savings based on this information is provided in Table 2.

### Table 2. Water Savings by Year

<table>
<thead>
<tr>
<th>Time period</th>
<th>Number of leaks identified and repaired</th>
<th>Water savings from leak repair (gallons/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>47</td>
<td>1,153,520</td>
</tr>
<tr>
<td>2007</td>
<td>27</td>
<td>596,000</td>
</tr>
<tr>
<td>2008</td>
<td>16</td>
<td>241,000</td>
</tr>
<tr>
<td>2009</td>
<td>26</td>
<td>268,750</td>
</tr>
<tr>
<td>2010</td>
<td>22</td>
<td>247,250</td>
</tr>
<tr>
<td>2011</td>
<td>25</td>
<td>228,000</td>
</tr>
<tr>
<td>2012</td>
<td>35</td>
<td>421,000</td>
</tr>
<tr>
<td>2013</td>
<td>32</td>
<td>231,750</td>
</tr>
<tr>
<td>Cumulative total (2006-2013)</td>
<td>230</td>
<td>3,387,270</td>
</tr>
</tbody>
</table>

The cumulative water savings for 2013 is calculated as the sum of the estimated savings to date and equals 3,387,270 gals/day.

The total water quantity benefit is therefore the savings from all leak repair conducted to date.

- **The total (ultimate) benefit is:** 3,387,270 gal/day or 4,680 ML/yr.
- **TCCC total (ultimate) benefit taken as a function of cost share:** 637 ML/yr.

Table 3 shows how the variable cost share is considered in the calculation of the TCCC benefit.
Table 3. Benefit calculation considering cost share

<table>
<thead>
<tr>
<th>Time period</th>
<th>Annual water savings (ML/yr)</th>
<th>TCCC Cost Share (ML/yr)</th>
<th>TCCC benefit taken as a function of cost share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>1,593.6</td>
<td>13%</td>
<td>207.2</td>
</tr>
<tr>
<td>2007</td>
<td>823.4</td>
<td>13%</td>
<td>107.0</td>
</tr>
<tr>
<td>2008</td>
<td>332.9</td>
<td>13%</td>
<td>43.3</td>
</tr>
<tr>
<td>2009</td>
<td>371.3</td>
<td>13%</td>
<td>48.3</td>
</tr>
<tr>
<td>2010</td>
<td>341.6</td>
<td>13%</td>
<td>44.4</td>
</tr>
<tr>
<td>2011</td>
<td>315.0</td>
<td>19%</td>
<td>59.8</td>
</tr>
<tr>
<td>2012</td>
<td>581.6</td>
<td>18%</td>
<td>104.7</td>
</tr>
<tr>
<td>2013</td>
<td>320.2</td>
<td>7%</td>
<td>22.4</td>
</tr>
<tr>
<td>Total</td>
<td>4,680</td>
<td></td>
<td>637</td>
</tr>
</tbody>
</table>

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of calendar year 2014. The total 2014 benefit is 4,680 ML/yr and TCCC’s benefit (adjusted for cost share) is 637 ML/yr.

Projected Replenish Benefits

Table 4 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 4. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>4,680</td>
<td>637</td>
</tr>
<tr>
<td>2016</td>
<td>4,680</td>
<td>637</td>
</tr>
<tr>
<td>2017</td>
<td>4,680</td>
<td>637</td>
</tr>
<tr>
<td>2018</td>
<td>4,680</td>
<td>637</td>
</tr>
<tr>
<td>2019</td>
<td>4,680</td>
<td>637</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>4,680</td>
<td>637</td>
</tr>
</tbody>
</table>

Data sources:

- Water savings from leak repair are estimated based on the hole size and psi variations. 2006-2008 water savings were reported in a survey response. Water savings through 2010, and again updated through 2011, 2012 and through 2013 were reported in e-mails from James Gazza (The Coca-Cola Company).
- 2014 water savings and costs were not available. Because the 2013 results are expected to continue in 2014, the cumulative water savings through 2013 are considered to be a conservative estimate of 2014 benefits.
Assumptions:

- Projected benefits assume no additional leak repairs are conducted in the future, but it is expected that leak repairs will continue and additional benefits will be reflected in future fact sheets.
- 2013 costs were provided as a range. The higher contribution from the Borough of Bellefonte was assumed in the TCCC cost share calculations, making this a conservative estimate.
- Assumed no depreciation in savings over 5 years.

OTHER BENEFITS NOT QUANTIFIED

- Source water protection benefits resulting from the construction of a catchment around and a cover over the Big Spring from 1998-1999 were not quantified.

NOTES

- Industries and homeowners benefited because water fees were not increased.
- This fact sheet updates the October 2012 fact sheet by including 2013 benefits.
- In late 2014, the Milesburg plant purchased leak detection devices for the Borough of Bellefonte. Therefore, leaks identified or repaired are not available for 2014. Going forward, Bellefonte will maintain an inventory of the number of leaks they identify and repair as well as the volume of water associated with the leaks.
- The Big Spring pipeline also supplies water to the Borough of Milesburg. In 2014, the Milesburg plant bought leak detection devices for the Borough of Milesburg. Information on leaks detected and water volumes saved may be available from the Borough of Milesburg in the future.

REFERENCES

- Bellefonte annual reports on leak repairs provided by James Gazza.
PROJECT NAME: Guangxi Sustainable Sugarcane Initiative: Phases I and II
PROJECT ID #: 94

DESCRIPTION OF ACTIVITY: Conversion of flood irrigation to drip irrigation

LOCATION: Chongzuo City, Guangxi Province, China

PRIMARY CONTACTS:
Kevin Jiang  Weidong Zhang
Greater China & Korea Business Unit  UNDP China
No. 1188 Ziyue Road
Zizhu Science Based Industrial Park
Minhang District, Shanghai
200241, China
Tel: 86-21-61928318
E-mail: kejiang@coca-cola.com  E-mail: weidong.zhang@undp.org

OBJECTIVES:
• Improve sugarcane irrigation efficiency
• Provide support for local water resources management

BACKGROUND & DESCRIPTION OF ACTIVITY: Sugar production is the major industry of Ningming County and Jiangzhou District in Chongzuo City, Guangxi Province. Sugar production accounts for over two thirds of the total county revenues in Ningming, while the sugarcane area in Jiangzhou is over 66,000 ha, accounting for 83% of the total arable land. In recent years, water scarcity has caused pressing challenges for the over 100,000 ha of sugarcane fields in this area that historically have relied primarily on rainwater for water supply. The drought conditions have caused severe impacts on sugarcane yields, as well as the local sugar industry. This project is a demonstration project with the United Nations Development Program (UNDP) to address the need for reliable and efficient irrigation of sugarcane.

This irrigation demonstration project involves the construction of drip irrigation systems for sugarcane production in Tianxi Village, Ningming County and Tuozhu Village, Jiangzhou District. The construction of the system in Tianxi Village mainly includes: an irrigation reservoir, a pumping station, a filter system, water diversion channels, water delivery pipelines, field drip-irrigation systems, and subsidiary facilities. The system for Tuozhu Village mainly includes: four irrigation reservoirs, three pumping stations, water delivery pipelines, and field droppers (Figure 1). Implementation of the drip irrigation systems substantially reduces the abstraction of river water for irrigation requirement compared to conventional irrigation.
SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 662.6 ML/YR

ACTIVITY TIMELINE:
- Project initiation: January 2014
- Ningming County: Project completed in March 2014
• Jiangzhou District: Project completed in April 2014

**COCA-COLA CONTRIBUTION:** Variable (details below)

- Ningming County: 46.5%
  - 370,400 USD (RMB 2,296,600) provided by local finance
  - 322,580 USD (RMB 2,000,000) provided by TCCC

- Jiangzhou District: 22.2%
  - 322,580 USD (RMB 2,000,000) provided by local finance
  - 161,290 USD (RMB 1,000,000) provided by TCCC
  - 161,290 USD (RMB 1,000,000) provided by Zhongliang Tunhe Sugar Industry Co., Ltd
  - 80,645 USD (RMB 500,000) provided by Guangxi Zhuangtang Agricultural Science and Technology Co., Ltd

**WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:**

1. Improved irrigation efficiency

**Approach and Results:**

The replenish benefit was estimated based on the reduction in the consumed fraction of water applied due to conversion to drip irrigation.

The irrigation water requirements for the pre-and post-project conditions were based on the crop water requirement and irrigation efficiencies of flood irrigation (prior to the project) and drip irrigation (after the project).

- Crop water requirement of sugarcane in the project area: 3,578 m³/ha.

The irrigation water requirements for each project in Ningming County and Jiangzhou District were calculated as follows:

- Ningming County
  - Irrigation efficiency of flood irrigation: 32%
  - Irrigation efficiency of drip irrigation: 85%
  - Irrigation requirement with flood irrigation = 3,578/0.32 = 11,181.25 m³/ha
  - Irrigation requirement with drip irrigation = 3,578/0.85 = 4,209.41 m³/ha

- Jiangzhou District
  - Irrigation efficiency of flood irrigation: 25%
  - Irrigation efficiency of drip irrigation: 68%
  - Irrigation requirement with flood irrigation = 3,578/0.25 = 14,312.00 m³/ha
  - Irrigation requirement with drip irrigation = 3,578/0.68 = 5,261.76 m³/ha
The total volume of water applied for irrigation can be divided into two main fractions (Foster and Perry, 2010); consumed and non-consumed fraction. Consumed fraction refers to the beneficial transpiration being consumed by the crop and the non-beneficial evaporation from wet soil. Non-consumed fraction refers to the recoverable seepage infiltrating as a ‘return flow’ to a fresh water aquifer. To estimate water savings in terms of water consumption, the benefit quantification approach described below accounts for the volume of water that infiltrates as ‘return flow’ to the freshwater aquifer when water is applied for irrigation. A reasonable assumption of return flow for flood irrigation and micro-irrigation are 25% and 5%, respectively, of the applied water (Foster and Perry, 2010). The calculations for Ningming County and Jiangzhou District are as follows:

- Ningming County
  - Pre-project: (flood irrigation)
    - Water applied for irrigation = farmland area irrigated x annual irrigation water requirement per unit of farmland
    - Water applied for irrigation = 11,181.25 m³/ha
    - Consumed fraction = (1-fraction of return flow) x water applied
      = (1-0.25) X 11,181.25 m³/ha = 8,385.94 m³/ha
  - Post-project: (drip irrigation)
    - Water applied for irrigation = farmland area irrigated x annual irrigation water requirement per unit of farmland
    - Water applied for irrigation = 4,209.41 m³/ha
    - Consumed fraction = (1-fraction of return flow) x water applied
      = (1-0.05) X 4,209.41 m³/ha = 3,998.94 m³/ha
  - Water savings = (8,385.94 – 3,998.94) m³/ha = 4,387 m³/ha
  - Area of cultivation = 200 ha
  - Total benefits in Ningming County = Water savings x Area of cultivation
    = 4,387 m³/ha x 200 ha = 877,400 m³ = 877.4 ML

- Jiangzhou District
  - Pre-project: (flood irrigation)
    - Water applied for irrigation = farmland area irrigated x annual irrigation water requirement per unit of farmland
    - Water applied for irrigation = 14,312.00 m³/ha
    - Consumed fraction = (1-fraction of return flow) x water applied
      = (1-0.25) X 14,312.00 m³/ha = 10,734.00 m³/ha
  - Post-project: (drip irrigation)
    - Water applied for irrigation = farmland area irrigated x annual irrigation water requirement per unit of farmland
- Water applied for irrigation = 5,261.76 m³/ha
- Consumed fraction = (1-fraction of return flow) x water applied
  = (1-0.05) X 5,261.76 m³/ha = 4,998.67 m³/ha
  - Water savings = (10,734.00 – 4,998.67) m³/ha = 5,735.33 m³/ha
  - Area of cultivation = 200 ha
  - Total benefits in Jiangzhou District = Water savings x Area of cultivation
    = 5,735.33 m³/ha x 200 ha = 1,147,066 m³ = 1,147.07 ML

Sum of benefits due to irrigation efficiency projects:
The total benefits = Total benefits in Ningming County + Total benefits in Jiangzhou District

\[ \text{Total benefit} = 877.4 \text{ ML/yr} + 1,147.07 \text{ ML/yr} = 2,024.5 \text{ ML/yr} \]

The total (ultimate) benefit: 2,024.5 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 662.6 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 2,024.5 ML/yr and TCCC’s benefit (adjusted for cost share) is 662.6 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated until the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>2,024.5</td>
<td>662.6</td>
</tr>
<tr>
<td>2016</td>
<td>2,024.5</td>
<td>662.6</td>
</tr>
<tr>
<td>2017</td>
<td>2,024.5</td>
<td>662.6</td>
</tr>
<tr>
<td>2018</td>
<td>2,024.5</td>
<td>662.6</td>
</tr>
<tr>
<td>2019</td>
<td>2,024.5</td>
<td>662.6</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>2,024.5</td>
<td>662.6</td>
</tr>
</tbody>
</table>

Data Sources:
- All data used in the calculations were provided by Chongzuo Bureau of Commerce and UNDP China. These data include the following items:
Area affected by the project
Crop water requirement of sugarcane for the project area
Site-specific irrigation efficiencies for flood and drip irrigation in Ningming County and the Jiangzhou District - efficiencies are dependent on many factors including climate, soil, topography and irrigation technology

Assumptions:
• Return flow is assumed to be 25% for flood irrigation and 5% for drip irrigation (Foster and Perry, 2010).

OTHER BENEFITS NOT QUANTIFIED
• Improved technological standards for sugarcane irrigation and sugar production
• Improved water use efficiency and mitigated water shortage
• Economic and social benefits to sugarcane farmers
• Improved local drainage and reduced flooding risks
• Reduced vulnerability to droughts and climate change
• Facilitated local sugar industry development
• Support and examples for replications throughout China

NOTES
• Impact assessments are conducted for all UNDP projects in China, and no adverse environmental or social impacts were identified.

REFERENCES


UNDP. 2012 Coca-Cola programs in Guangxi Autonomous Region.
PROJECT NAME: Conserving water usage through improved irrigation techniques
PROJECT ID #: 104

DESCRIPTION OF ACTIVITY: Laser leveling activities and conversion to drip irrigation

LOCATION: Locations throughout India

PRIMARY CONTACT:
Sunil Gulati
Director Technical Services
Coca-Cola India Pvt Limited
Gurgaon, India
sgulati@coca-cola.com

OBJECTIVE:
- Improve ground water availability

BACKGROUND & ACTIVITY DESCRIPTION:

Laser Leveling
Laser leveling is a new, but very cost effective technology being deployed to ensure appropriate and scientific leveling of the land to be irrigated. Once leveled precisely with the help of laser guided equipment, the field is rendered flat thereby ensuring that the water is uniformly applied. The bottlers have collaborated with technology providers and local farmers in the northern state of Punjab and Uttar Pradesh and provided use of this technology on many farms, totaling more than 3,149 acres. Figure 1 shows a typical laser leveling operation at a farm. The crops cultivated in the laser-leveled fields include wheat and paddy.

Figure 1. Laser guided precision leveling activity of field in India
Drip Irrigation
Promoting water efficient agriculture in the village of Kaladera, located in the district of Jaipur, Rajasthan is the main focus of the drip irrigation initiatives. Drip irrigation, also known as micro-irrigation, is a method that minimizes the use of water and fertilizer by allowing water to drip slowly to the roots of plants through a network of valves, pipes, tubing, and emitters. Drip irrigation projects are executed in partnership with the Government of Rajasthan by way of financial subsidy, *Krishi Vigyan Kendra* which provides training and insights to the farmers to carry out drip irrigation-based farming. Starting with one pilot project in 2005 and followed by 27 drip-irrigation projects installed in 2008 in an area of 34.6 acres (14 hectares), this initiative has been widely adopted in the community, and drip irrigation is currently employed by approximately 598 farmers on more than 739 acres of agricultural land. Crops cultivated under drip irrigation include onions and a variety of other vegetables.

**Figure 2. Drip irrigation system on an onion field in India**

**SUMMARY OF REPLENISH BENEFIT:**
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 4,685.7 ML/yr

**ACTIVITY TIMELINE:**
- As of the end of 2014, laser leveling and drip irrigation activities have been implemented on 3,149 and 739 acres, respectively.

**COCA-COLA CONTRIBUTION:** 100%
- Projects are fully funded by Coca-Cola

**WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:**
1. Decrease in quantity of ground water consumption

1. **DECREASE IN QUANTITY OF GROUND WATER CONSUMPTION**
Approach and Results:

Water savings for both drip irrigation and laser leveling were computed as the difference in the consumed fraction of water applied for irrigation between pre- and post-project conditions. The total volume of water applied for irrigation can be divided into two main fractions (Foster and Perry, 2010); consumed and non-consumed fraction. Consumed fraction refers to the beneficial transpiration being consumed by the crop and the non-beneficial evaporation from wet soil. Non-consumed fraction refers to the recoverable seepage infiltrating as a ‘return flow’ to a fresh water aquifer. To estimate water savings in terms of water consumption, the benefit quantification approach described below accounts for the volume of water that infiltrates as ‘return flow’ to the freshwater aquifer when water is applied for irrigation.

Laser Leveling:
The crops that are cultivated in the laser-leveled fields include wheat and paddy. The India Division has determined that research studies conducted by Punjab Agricultural University, Ludhiana indicate an approximate 25–30% reduction in water application (Agarwal et al., 2009; Sidhu et al., 2009). For benefit calculations, it was assumed that laser leveling would result in 25% less water applied compared to non-laser leveled field conditions. The India Division suggested that for paddy crops, a reasonable estimate of the return flow is 30% of the water applied for irrigation. During pre- and post-laser leveling activities, the method of irrigation is traditional flood irrigation. The volumes of irrigation water applied pre- and post-project (8,000 m$^3$/ac and 6,000 m$^3$/ac) were determined through a survey of the farmers participating in the program (see “Data Sources”). The calculations are as follows.

Pre-project:
- Water applied for irrigation = 8,000 cubic meters/acre
- Consumed fraction = (1 - fraction of return flow) \times water applied
  = (1 - 0.3) \times 8,000 \text{ cubic meters/acre} = 5,600 \text{ cubic meters/acre}

Post-project:
- Water applied for irrigation = 6,000 cubic meters/acre
- Consumed fraction = (1 - fraction of return flow) \times water applied
  = (1 - 0.3) \times 6,000 \text{ cubic meters/acre} = 4,200 \text{ cubic meters/acre}

Water savings = (5,600 - 4,200) cubic meters/acre = 1,400 cubic meters/acre
Area of cultivation = 3,149 acres

Total benefits = Water savings \times Area of cultivation
  = 1,400 \text{ cubic meters/acre} \times 3,149 \text{ acres} = 4,408,600 \text{ cubic meters} = 4,408.6 \text{ ML/yr}

Drip Irrigation:
Crops cultivated under drip irrigation include predominantly onions (> 85%) and some vegetables. For the purpose of calculations, it was assumed that onions are grown in the entire project area. Food and Agricultural Organization of the United Nations (FAO) reports that the average yield for onions grown in India (based on 2001 - 2010 data) is 13,548 kg/ha (FAOSTAT). Using available data sources, the crop water requirement for onions in the Rajasthan region was estimated to be 989 m$^3$/ha (Mekonnen and Hoekstra, Appendix II, 2010).
Assuming an irrigation efficiency of 40% (FAO, 1989 estimate of irrigation efficiency of “reasonable” irrigation schemes), the irrigation water requirement using traditional flood irrigation was estimated to be 2,473 m³/ha. According to the India Division, installing drip irrigation results in a 50% reduction in irrigation water application. This estimate was determined through a survey of the farmers participating in the program.

The India Division also estimates that for vegetables including onions, a reasonable estimate of ‘return flow’ is 15% of the water applied for flood irrigation. Under drip irrigation, the ‘return flow’ component is usually a small to negligible fraction of the total irrigation water applied. A ‘return flow’ fraction of 5% based on literature (Foster and Perry, 2010) was assumed in the calculations. The calculations are as follows:

Pre-project:
- Method of irrigation: flood
- Water applied for irrigation = 2,473 cubic meters/hectare = 1,001 cubic meters/acre
- Consumed fraction = (1 - fraction of return flow) X water applied
  = (1 - 0.15) X 1,001 cubic meters/acre = 851 cubic meters/acre

Post-project:
- Method of irrigation: drip
- Water applied for irrigation = 1,236 cubic meters/hectare = 501 cubic meters/acre
- Consumed fraction = (1 - fraction of return flow) X water applied
  = (1 - 0.05) X 501 cubic meter/acre = 476 cubic meters/acre

Water savings = (851 – 476) cubic meters/acre = 375 cubic meters/acre
Area of cultivation = 739 acres
Total benefits = Water savings x Area of cultivation
  = 375 cubic meters/acre x 739 acres = 277,125 cubic meters = 277.1 ML/yr.

The total benefit of all irrigation projects is calculated by summing the benefits of the laser leveling and drip irrigation projects. Until data become available for future years it is assumed that the total (ultimate) benefit will remain the same as the 2014 benefit.

The total (ultimate) benefit = 4,408.6 + 277.1 = 4,685.7 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 4,685.7 ML/yr.

The current (2014) benefit and projected benefits are presented below. It is assumed that the projected benefits will remain the same as 2014 in each future year.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 4,685.7 ML/yr and TCCC’s benefit (adjusted for cost share) is 4,685.7 ML/yr.
Projected Replenish Benefits
Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

### Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>4,685.7</td>
<td>4,685.7</td>
</tr>
<tr>
<td>2016</td>
<td>4,685.7</td>
<td>4,685.7</td>
</tr>
<tr>
<td>2017</td>
<td>4,685.7</td>
<td>4,685.7</td>
</tr>
<tr>
<td>2018</td>
<td>4,685.7</td>
<td>4,685.7</td>
</tr>
<tr>
<td>2019</td>
<td>4,685.7</td>
<td>4,685.7</td>
</tr>
<tr>
<td></td>
<td>Ultimate Benefit:</td>
<td>4,685.7</td>
</tr>
</tbody>
</table>

Data Sources:
- Land areas were provided by the India Division.
- Water use values are based on documents cited.
- Laser leveling: The volumes of irrigation water applied pre- and post-project were provided by the India Division in a spreadsheet titled “Approach to laser_leveling_fmt_amritsar_example.xlsx.”
- Drip irrigation: The percent reduction in irrigating application due to drip irrigation was provided by the India Division in a spreadsheet titled “Approach to drip_kaladera_revised_post_inputs-from_limnotech_PS.xlsx.”

Coca-Cola India has provided the following text related to data validation: “Coca-Cola India has developed comprehensive requirements and guidelines for approaching the water replenishment (WR) initiatives, technically pre-validating the proposed intervention, maintaining the developed structures/projects and establishing efficiency of the developed WR initiatives. These guidelines are applicable to all operations present in the India South West Asia Business Unit (INSWA BU) including manufacturing/bottling entities. A brief summary of guidelines and requirements setup by Coca-Cola, India to approach water replenishment initiatives is provided in Water Replenish Requirements (WRR) document (2011). The document contains appendices that provide a sample template of data needed to develop various WR initiatives. The existing WR initiatives are required to undergo field validation. The elements of field validation include documentation status review; design record sufficiency review; ownership record status review; maintenance record status review; and field level physical verification. The field validation involves a score based Data Quality Assessment (DQA) process. If the overall DQA score resulted in less than 60% for any particular project location, then the replenish benefits are not accounted. An example DQA calculation is provided by Coca-Cola, India as an appendix to the WRR document.”

Assumptions:
- All projects have been field validated.
• Water applied does not exceed the estimated irrigation water requirement for flood and drip irrigations.
• The effect of laser leveling is expected to last for five to eight years (Rickman, 2002). Laser leveling initiatives began in 2008; it is assumed that all estimated benefits continue to be generated.
• The average life expectancy of drip irrigation systems is 10 years (FAO, 2000). Drip irrigation initiatives began in 2005; it is assumed that all estimated benefits continue to be generated.
• The fields affected by improved irrigation techniques (drip irrigation and laser leveling) are managed properly.

**OTHER BENEFITS NOT QUANTIFIED**

• Reduced energy usage
• Increased crop yields and incomes
• Reduced fertilizer application and reduced pollution of surface runoff and ground water
• Reduced weed, pest, and disease problems

**NOTES**

• This factsheet updates the 2013 factsheet, as additional farms were added to the program in 2014.
• Additional laser leveling activities of 434 acres were reported in 2014. The total leveling activities covered in 2014 is 3,149 acres relative to 2,715 acres in 2013.
• No additional drip irrigation activities were reported in 2014.
• In the 2012 factsheet, the irrigation water requirement for flood irrigation was revised from 900 m3/ha to 989 m3/ha based on updated information.
• The project benefit total presented in this fact sheet was decreased slightly based on field confirmation of a benefit change. 2014 benefits reported by TCCC reflect this adjustment.

**REFERENCES**


India Division estimates are summarized within the master spreadsheet entitled: final_list_of_projects_types_classification_INSWA_BU_2014.xlsx (spreadsheet was provided by Nilesh Jha via email on 11/21/2014). Irrigation projects were separated from the master spreadsheet and summarized in an individual spreadsheet titled “India-Irrigation_2014.xlsx.”

Water Replenish Requirements (2011). Document provided by Dr. Murthy on November 02 2011, describing the requirements of approaching developing, maintaining and understanding efficiency of the WR interventions initiated by INSWA BU. This includes a DQA example in the following appendix: annexure_7_DQA_worked_out_example.xlsx.

Supporting information regarding laser leveling projects is provided by the India Division in the spreadsheet entitled: Approach to laser_leveling_fmt_amritsar_example.xlsx.

Supporting information regarding drip irrigation projects is provided by the India Division in the spreadsheet entitled Approach to drip_kaladera_revised_post_inputs-from_Limnotech_PS.xlsx.
PROJECT NAME: Rehabilitation of Farm Ponds across India

PROJECT ID #: 117

DESCRIPTION OF ACTIVITY: Desilting and rejuvenation of farm ponds

LOCATION: Various locations in the states of Andhra Pradesh, Chhattisgarh, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Uttar Pradesh, West Bengal, Rajasthan and Tamil Nadu.

PRIMARY CONTACT:
Sunil Gulati
Director Technical Services
Coca-Cola India Pvt Limited
Gurgaon, India
Phone:+919899985002
sgulati@coca-cola.com

OBJECTIVES:
- Recharge local aquifers
- Provide source water for irrigation

BACKGROUND & ACTIVITY DESCRIPTION: Some Indian farmers have developed ponds in localized depressions that collect water that is used for irrigation. However, over the years the ponds often get silted up due to lack of required maintenance. With the help of the bottlers, various farm ponds have been identified and rejuvenated using appropriate technology options suitable to local topographical, geological, hydrological and usage conditions. Such rejuvenated ponds recharge the aquifer during the monsoon period and provide water for farmers during the irrigation period.

The project activity involves three steps in the design of an engineered system: 1) identification of localized depressions and silted ponds; 2) desilting of the ponds and removal of bottom clay material; and 3) installation of a shaft system to facilitate recharge of groundwater (Figure 1). Desilting typically increases the pond depth from 2-3 meters to 3-5 meters, depending on the location. To date, function has been restored in a total of 82 farm ponds in ten states: Andhra Pradesh, Chhattisgarh, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Uttar Pradesh, West Bengal, Rajasthan and Tamil Nadu. Approximately 80,000 villagers are benefiting as a result of these activities. The projects are maintained annually.

Figure 1. Farm pond showing recharge shafts on the bottom surface
SUMMARY OF REPLENISH BENEFIT:
• 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 3,064.6 ML/yr

ACTIVITY TIMELINE:
• The projects were initiated in 2010 through 2014
• All projects were completed and were fully operational in 2014

COCA-COLA CONTRIBUTION: 100% for all but one pond in Maharashtra which is 50% funded
• All projects are funded and implemented by the Coca-Cola bottlers in the local community

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:
1. Increased infiltration

1. INCREASED INFILTRATION

Approach & Results:
The benefit is calculated as the volume of water recharged to the aquifer. The volume of water available for aquifer recharge is estimated separately for each farm pond by calculating the supply of available runoff from the catchment according to the equation below:

Supply (m3) = Catchment Area (m2) x Annual Rainfall (m) x Catchment Coefficient

The supply from the catchment is compared to the available storage of the farms ponds. Storage potential was estimated by considering the number of times the farm ponds will fill to maximum volume. It was conservatively assumed that each pond can potentially be filled two times (in cases of hard rock sub-surface geology) or three times (in cases of soft rock sub-surface geology) its volume annually. The volume of water captured by the farm ponds is estimated as the minimum of supply and available storage (after accounting for usage and evaporation losses of storage potential).

The total volume of each pond, catchment area, and annual rainfall were provided by the India Division. India Division suggested that for catchments in their natural state, a conservative catchment coefficient of up to 30% can be used in the calculations. However, a more conservative catchment coefficient of 7.5% (or 0.075) was utilized in the calculations for most farm ponds (see Notes section below) to account for uncertainties in the catchment area estimation and any evaporation or usage loss during storage of water in the farm ponds. Therefore, when the supply is less than the available storage, evaporation and usage losses are considered implicitly in the supply calculations. In cases where the conservative estimation of “supply” is in excess of the available storage, evaporation and usage losses are accounted explicitly by assuming a fraction of stored water was lost. When supply is greater than available storage, it is assumed that 40 - 65% of the water captured in the ponds is lost to evaporation and withdrawal for irrigation. This is a conservative assumption because the shaft design in the pond will facilitate quick recharge of the stored water. The recharge volume is then estimated as the volume of captured water remaining after accounting for evaporative losses and withdrawals.

The total estimated replenish benefit from the farm ponds is provided below.

• Benefit (increase in recharge): 3,144.6 ML/yr

The total (ultimate) benefit = 3,144.6 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share = 3,064.6 ML/yr
The current (2014) benefit and projected benefits are presented below. It is assumed that the projected benefits will remain the same as 2014 in each future year.

**2014 Replenish Benefit**

The 2014 benefit is the performance based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 3,144.6 ML/yr and TCCC’s benefit (adjusted for cost share) is 3,064.6 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

**Table 1. Projected Water Quantity Benefits Summary**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>3,144.6</td>
<td>3,064.6</td>
</tr>
<tr>
<td>2016</td>
<td>3,144.6</td>
<td>3,064.6</td>
</tr>
<tr>
<td>2017</td>
<td>3,144.6</td>
<td>3,064.6</td>
</tr>
<tr>
<td>2018</td>
<td>3,144.6</td>
<td>3,064.6</td>
</tr>
<tr>
<td>2019</td>
<td>3,144.6</td>
<td>3,064.6</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>3,144.6</td>
<td>3,064.6</td>
</tr>
</tbody>
</table>

**Data Sources:**

- Data on pond volumes, catchment areas and rainfall were provided by the Coca-Cola India Division.

**Assumptions:**

- The farms ponds are maintained properly to prevent further silting. This includes annually clearing the openings of the recharge shafts of debris prior to the arrival of monsoon rain.

**OTHER BENEFITS NOT QUANTIFIED**

- Local employment opportunities during construction and maintenance
- Increased incomes due to improved water supply and higher yields

**NOTES**

- This factsheet updates the 2013 factsheet, and reflects the new projects that were added in 2014.
- In 2012, factsheet evaporation and usage losses were assumed to be 50%. In the current factsheet, an evaporation and usage loss of 40% is assumed for most projects. The 40% value for these projects was suggested by the India Division based on recent discussions and inputs from local experts for select projects. For a farm pond location in Rajasthan, usage and evaporation losses of 65% was assumed.
- For ten new projects in West Bengal added in 2013 and one new project in West Bengal added in 2014, a catchment coefficient of 30% was used by the India division to reflect the higher runoff yield from these catchments. For TamilNadu, a catchment coefficient of 4% was used.
- For farm ponds, the recharge volume is the minimum of supply and available storage (after accounting for evaporative and usage losses). Comparison of supply to available storage in this fact sheet is considered appropriate and conservative for farm ponds based on discussions with the India Division.

REFERENCES

India Division estimates are summarized within the master spreadsheet entitled: final_list_of_projects_types_classification_INSWA_BU_2014.xlsx (spreadsheet was provided by Nilesh Jha via email on 11/21/2014). Farm pond projects were separated from the master spreadsheet and summarized in an individual spreadsheet titled “India_farmponds_2014.xlsx”
PROJECT NAME: Swaziland: Water for a Generation
PROJECT ID #: 154

DESCRIPTION OF ACTIVITY: Irrigation water supply for vegetable cultivation on 19.5 ha

LOCATION: Countrywide - Swaziland

PRIMARY CONTACTS:
Tara Varghese
Global Environment & Technology Foundation (GETF)
Tara.Varghese@getf.org

Naabia Ofosu-Amaah
Global Environment & Technology Foundation (GETF)
naabia.ofosu-amaah@getf.org

OBJECTIVES:
• Supply irrigation water
• Increase food security

BACKGROUND & ACTIVITY DESCRIPTION: In Swaziland, The Coca-Cola Africa Foundation is working with Nazarene Compassionate Ministries, Inc. (NCMI) through the Replenish Africa Initiative (RAIN) to improve the health and self-sufficiency of 41 communities through 50 water systems throughout the country. The water for productive use activity described in this fact sheet relates to the establishment of vegetable gardens and provision of irrigation water through the Water for a Generation (WAG) project. In total, 16 community gardens, clinic gardens, school gardens and agriculture projects were established to support nutrition and income generation, on a total of 19.5 hectares. GETF site visits and monthly phone calls with the implementing partner have confirmed that the gardens are successful.

SUMMARY OF REPLENISH BENEFIT:
• 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 16.6 ML/YR

ACTIVITY TIMELINE:
• July 2009: Project initiation
• June 2013: Project completed

COCA-COLA CONTRIBUTION: 77%
• Total project cost: $4,071,767 USD
• TCCC cost share: $3,136,000 USD

Note: The irrigation improvement activity is part of a larger project. Costs for the irrigation activity alone were not available; the costs above represent the cost for all project activities.

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:
1. Irrigation water supply

1. IRRIGATION WATER SUPPLY

Approach & Results:
The crops affected by this project include tomatoes, beetroots and cabbage. Publicly available information (FAOSTAT, 2013; FAO, 1989; Mekonnen and Hoekstra, 2010) was used to estimate the
average irrigation requirements for growing these crops in Swaziland. Data is only available for the tomato, which is used as the representative crop for this project. The irrigation requirements were calculated in the following steps.

- According to the Food and Agriculture Organization (FAO) FAOSTAT database, the average crop yield for growing tomatoes in Swaziland (based on 2010 data) is 12,509 kg/ha.

- The water footprint associated with irrigation (i.e., blue water footprint) for growing tomatoes in Swaziland (country-wide) is 71 m³/metric tonne crop based on data from Mekonnen and Hoekstra, 2010.

- An irrigation efficiency of 60% was assumed based on the FAO, 1989 estimate of irrigation efficiency corresponding to surface irrigation.

- The yield information, water footprint, and irrigation efficiency factor were used to estimate irrigation water requirements with traditional irrigation.

The estimated average irrigation water requirements for growing the crops was 1,480 m³/ha.

The total volume of water applied for irrigation can be divided into two main fractions (Foster and Perry, 2010); consumed and non-consumed fraction. The consumed fraction refers to the beneficial transpiration being consumed by the crop and the non-beneficial evaporation from wet soil. The non-consumed fraction refers to the recoverable seepage infiltrating as a ‘return flow’ to a fresh water aquifer. To describe irrigation water use in terms of water consumption, the benefit quantification approach described below accounts for the volume of water that infiltrates as ‘return flow’ to the freshwater aquifer when water is applied for irrigation. A reasonable assumption of return flow for traditional-irrigation is 25% of the applied water (Foster and Perry, 2010).

- Water applied for irrigation = 1,480 m³/ha
- Consumed fraction = (1-fraction of return flow) x water applied
  = (1-0.25) X 1,480 m³/ha = 1,110 m³/ha
- Area of cultivation = 19.5 ha

Total benefit (Irrigation Supply) = Consumed fraction x Area of cultivation

= 1,110 m³/ha x 19.5 ha =21,645 m³ = 21.6 ML

The total (ultimate) benefit is: 21.6 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share is: 16.6 ML/yr.

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2014 Replenish Benefit**

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 21.6 ML/yr and TCCC’s benefit (adjusted for cost share) is 16.6 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual
benefits. The total benefits are in the second column and are adjusted for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>21.6</td>
<td>16.6</td>
</tr>
<tr>
<td>2016</td>
<td>21.6</td>
<td>16.6</td>
</tr>
<tr>
<td>2017</td>
<td>21.6</td>
<td>16.6</td>
</tr>
<tr>
<td>2018</td>
<td>21.6</td>
<td>16.6</td>
</tr>
<tr>
<td>2019</td>
<td>21.6</td>
<td>16.6</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>21.6</td>
<td>16.6</td>
</tr>
</tbody>
</table>

Data Sources:
- Area of cultivation: provided by GETF (16 community gardens on a total of 19.5 hectares)
- Blue water footprint for tomatoes obtained from Mekonnen and Hoekstra (2010).
- Crop yield obtained from FAOSTAT database.
- Surface irrigation efficiency factor obtained from FAO (FAO, 1989).

Assumptions:
- Projected benefits assume the project will continue as currently designed.

OTHER BENEFITS NOT QUANTIFIED
- Increased crop yield
- Economic benefits and food security

NOTES
- This fact sheet updates the January 2014 fact sheet to reflect updated cost share.

REFERENCES
PROJECT NAME: RAIN Project for the Rehabilitation of Palm Plantations in Southern Morocco
PROJECT ID #: 166

DESCRIPTION OF ACTIVITY: Irrigation improvements (122 ha)

LOCATION: Tata Province, Lower Draa River Basin, Morocco

PRIMARY CONTACTS:
Tara Varghese Naabia Ofosu-Amaah
Global Environment & Technology Foundation Global Environment & Technology Foundation
(GETF) (GETF)
Tara.Varghese@getf.org naabia.ofosu-amaah@getf.org

OBJECTIVES:
• Provide irrigation water
• Improve irrigation efficiency
• Increase food security
• Reduce water withdrawals and improve reliability of water supply

BACKGROUND & ACTIVITY DESCRIPTION: For centuries, the date palm has been the heart of the oasis ecosystem, creating a micro-climate that is favorable to cultivation of cereals, alfalfa and gardens. In combination with the date palm, the consumption needs and income for the rural population are met through cultivation of these other crops. The date palm also provides straw and twine for the handcraft industry, firewood for energy production and associated jobs.

The most practiced form of irrigation in the region is flood irrigation. Water is supplied for irrigation through khettaras systems and collective groundwater wells. Khettaras are traditional irrigation systems that involve the use of underground channels that capture seepage from groundwater. Many khettaras are still operational, but farmers are preferentially using wells in place of khettaras.

The hydrology of this region is characterized by different key water points, called foums, where the water table is at its highest (Carollo, 2009). The project area is located near the Foum Akka. Groundwater near the Foum Akka remains the main source of irrigation for the project plantations. Foum Akka has a higher recharge rate than its current extraction rate. Groundwater recharge is estimated at 600 liters/second, and the rate of extraction is 200 liters/second (Warner et al., 2013).

With financing from Coca-Cola, the Association for Combating Erosion, Drought and Desertification in Morocco (L’ALCESDAM) is rehabilitating and creating palm plantations in Southern Morocco, improving existing irrigation methods, and training community members in water efficiency and new irrigation methods.

This project involved the provision of drip irrigation for young date palms, and the improved efficiency of water delivery to reduce transmission losses for flood irrigation of existing palm plantations in southern Morocco. Figure 1 shows the area that was cultivated using drip irrigation. Table 1 provides a summary of the activities quantified in this fact sheet.
Table 1. Overview of Activities Evaluated

<table>
<thead>
<tr>
<th>Location(s)</th>
<th>Site description</th>
<th>Activity description</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Touzounine</td>
<td>New palm plantation (2 locations)</td>
<td>Provided drip irrigation to a new palm plantation</td>
<td>40</td>
</tr>
<tr>
<td>Agadir Lehna</td>
<td>Existing date palm plantation</td>
<td>Lined 1.5 kilometers of earthen seguias (canals dug into the ground to irrigate crops) with concrete to reduce transmission losses</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>(separate from Agadir Lehna)</td>
<td>Replaced open-air earthen channels that deliver water from the wells to basins at the plantations with PVC pipes to reduce transmission losses</td>
<td>42</td>
</tr>
</tbody>
</table>

SUMMARY OF REPLENISH BENEFIT:
- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 803 ML/yr

ACTIVITY TIMELINE:
- Provided drip irrigation to two new palm plantations
  - May 2012: Project initiation
  - September 2013: Installation of drip irrigation completed
- Concrete lining of entire system of seguias at Agadir Lehna
  - September 2014: Project initiation
  - December 2014: Expected completion of concrete lining of the entire system of seguias at Agadir Lehna
- Replaced open-air earthen channels with PVC pipes
  - March 2012: Project initiation
  - May 2014: Installation of PVC pipes completed

COCA-COLA CONTRIBUTION: 86%
- Total project cost: $1,634,694.30 USD
- TCCC contribution: $1,403,340 USD (The Coca-Cola Africa Foundation and Bottler)
WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Irrigation water supply
2. Improved irrigation efficiency

1. IRRIGATION WATER SUPPLY

Approach & Results:
This project implemented drip irrigation at two new date palm plantations in Touzounine (20 hectares each). The benefit is calculated as the volume of water provided for irrigation.

*Drip Irrigation Volume Provided to New Date Palm Plantations*

A total of 40 hectares of new date palm plantations are being irrigated by drip irrigation, using both standard drip irrigation and Bas Rhone. The flow rates for these two methods of drip irrigation are comparable, with the primary difference being that the Bas Rhone system has larger emitters that allow the farmers to see the water. The irrigation needs of date palms vary depending on the phenological stage of the tree. Table 2 presents the volume of water provided per hectare of young date palm, based on information provided by GETF in the file RAIN Morocco - Replenish Summary Table_v3.xlsx, based on document review and experiences of ALCESDAM via expert R. Loussert. The values provided by GETF (for 360 days/yr) were slightly adjusted to account for 365 days/yr. This is used as a conservative estimate of the volume of water provided for irrigation, understanding that the irrigation requirement (and therefore the volume provided and associated benefit) will increase as the trees mature.

Table 2. Annual volume of water provided to young date palms via drip irrigation (liters/hectare/year)

<table>
<thead>
<tr>
<th>Period</th>
<th>Phenological Stage</th>
<th>Number of days</th>
<th>Volume water irrigated (Liters/tree/day)</th>
<th>Number of trees/ha</th>
<th>Irrigation (Liters/ha/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>December - January</td>
<td>Dormant</td>
<td>62</td>
<td>80</td>
<td>150</td>
<td>744,000</td>
</tr>
<tr>
<td>February - March</td>
<td>Flowering, fertilization</td>
<td>59</td>
<td>100</td>
<td>150</td>
<td>885,000</td>
</tr>
<tr>
<td>April - May</td>
<td>Fruit set and development</td>
<td>61</td>
<td>100</td>
<td>150</td>
<td>915,000</td>
</tr>
<tr>
<td>June - July</td>
<td>Fruit growth</td>
<td>61</td>
<td>150</td>
<td>150</td>
<td>1,372,500</td>
</tr>
<tr>
<td>August - November</td>
<td>Maturation of dates</td>
<td>122</td>
<td>170</td>
<td>150</td>
<td>3,111,000</td>
</tr>
</tbody>
</table>

**Liters per hectare per year provided by drip irrigation to young date palms>> 7,027,500**

The total annual per-hectare drip irrigation volume (liters/ha/yr) was multiplied by the palm plantation area (ha) to calculate the total annual volume of drip irrigation water provided.

Total annual drip irrigation volume provided = 7,027,500 liters/ha/yr * 40 ha = 281,100,000 liters/yr = 281 ML/yr
2. IMPROVED IRRIGATION EFFICIENCY

Approach & Results:

As a result of this project, the following irrigation infrastructure improvements are being implemented on existing date palm plantations:

- Line 1,500 meters of earthen seguias with concrete to reduce water loss through infiltration and percolation, and also reduce evaporation, due to the increased speed of circulation. The location for this work is Agadir Lehna.

- Replace the open-air earthen channels that deliver water from the wells to basins at the plantations with PVC pipes to reduce transmission losses due to infiltration, percolation and evaporation. This activity is planned to occur at multiple locations, at sites that are different from the site described above.

Lining earthen seguias (channels) with concrete

The replenish benefit is calculated as the reduction in transmission losses resulting from lining the earthen seguias with concrete. The amount of water put into the channel (initial water) was conservatively calculated as the average of volumes provided by GETF for earthen and concrete seguias based on a palm density of 156 palms/hectare (Information provided by GETF in the file RAIN Morocco - Replenish Summary Table_v3.xlsx). Transmission losses for the earthen and concrete seguias were also provided by GETF in the file “RAIN Morocco - Replenish Summary Table_v3.xlsx.” Specific references are detailed in the Excel file.

For the 40 hectare Agadir Lehna location, it is estimated that approximately 22,688 m³/ha/yr water would be withdrawn for irrigation for a palm density of 156 palms/hectare. The transmission losses for pre-project and post-project conditions are calculated as:

\[
\text{Pre-project transmission loss (m}^3/\text{yr)} = \text{Area irrigated (ha)} \times \text{volume withdrawn for irrigation (m}^3/\text{ha/yr)} \times 0.5 \text{ (to account for 50% transmission loss in earthen seguias)}
\]

\[
= 40 \text{ hectares} \times 22,688 \text{ m}^3/\text{ha/yr} \times 0.5 = 454 \text{ ML/yr}
\]

\[
\text{Post-project transmission loss (m}^3/\text{yr)} = \text{Area irrigated (ha)} \times \text{volume withdrawn for irrigation (m}^3/\text{ha/yr)} \times 0.25 \text{ (to account for 25% transmission loss in concrete seguias)}
\]

\[
= 40 \text{ hectares} \times 22,688 \text{ m}^3/\text{ha/yr} \times 0.25 = 227 \text{ ML/yr}
\]

The benefit of lining the earthen seguias with concrete is calculated as: 454 ML/yr – 227 ML/yr = 227 ML/yr

Replacing open-air earthen channels with PVC connections

In locations separate from the project activities previously described, open-air earthen channels were replaced with PVC pipes. The replenish benefit is calculated as the reduction in transmission losses resulting from replacing the earthen channels with PVC pipes. The amount of water put into the channel (initial water) was conservatively calculated as the average of volumes provided for earthen channels and PVC pipes based on a palm density of 156 palms/hectare (Information provided by GETF in the file RAIN Morocco - Replenish Summary Table_v3.xlsx). Transmission losses for the open air earthen channels and PVC pipes were also provided by GETF in the file “RAIN Morocco - Replenish Summary Table_v3.xlsx.” Specific references are detailed in the Excel file.
For 42 hectares of irrigated palm plantations, it is estimated that approximately 20,708 m³/ha/yr water would be withdrawn for irrigation given a palm density of 156 palms/hectare. The transmission losses for pre-project and post-project conditions are calculated as:

Pre-project transmission loss (m³/yr) = Area irrigated (ha) * volume withdrawn for irrigation (m³/ha/yr)* 0.5 (to account for 50% transmission loss in open air earthen channels)

= 42 hectares * 20,708 m³/ha/yr * 0.5 = 435 ML/yr

Post-project transmission loss (m³/yr) = Area irrigated (ha) * volume withdrawn for irrigation (m³/ha/yr)* 0.01 (to account for 1% transmission loss in PVC pipes)

= 42 hectares * 20,708 m³/ha/yr * 0.01 = 9 ML/yr

The benefit of replacing open air earthen channels with PVC pipe is calculated as: 435 ML/yr – 9 ML/yr = 426 ML/yr

The total (ultimate) benefit is calculated as the sum of benefits from all project activities, as follows:

Volume supplied to new palm plantations and other crops + reduced volume pumped to existing plantations = 281 ML/yr + 227 ML/yr + 426 ML/yr = 934 ML/yr

The total (ultimate) benefit is: 934 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share is: 803 ML/yr.

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 934 ML/yr and TCCC’s benefit (adjusted for cost share) is 803 ML/yr.

Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are scaled for implementation schedule in the second column and are adjusted for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>934</td>
<td>803</td>
</tr>
<tr>
<td>2016</td>
<td>934</td>
<td>803</td>
</tr>
<tr>
<td>2017</td>
<td>934</td>
<td>803</td>
</tr>
<tr>
<td>2018</td>
<td>934</td>
<td>803</td>
</tr>
<tr>
<td>2019</td>
<td>934</td>
<td>803</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>934</td>
<td>803</td>
</tr>
</tbody>
</table>
Data Sources:

- All information provided by GETF based on their conversations with ALCESDAM and additional research.
- Data for benefit calculations was provided by GETF in the file “RAIN Morocco - Replenish Summary Table_v3.xlsx,” and additional project information was summarized in the file “RAIN_Morocco_WaterResourcesBackgroundInformation.docx.” References are cited within these two files.

Assumptions:

- Projected benefits assume project will continue as currently designed.
- It was conservatively assumed that the current volume provided by drip irrigation to young date palms remains the same in the future. However, as the trees grow, the water provided to the palms (and the replenish benefit) is expected to increase.

OTHER BENEFITS NOT QUANTIFIED

- Increased crop yield
- Economic benefits and food security

NOTES

- For the improved irrigation efficiency replenish benefit calculations, the amount of water put into the channel (initial water) for the two activities was based on the average for earthen and concrete seguias and the average for earthen channels and PVC pipes as provided by GETF based on a palm density of 156 palms/hectare. Averaged volumes were conservatively utilized to make an ‘apples to apples’ comparison for the before and after conditions to avoid calculating transmission losses based on one volume for the pre-project condition, and a different volume for the post-project condition.

- There are no irrigation water quality standards that apply to this site; however, the water was tested to ensure that it does not have high salinity levels (Personal communication with GETF).

REFERENCES


GETF, personal correspondence.


PROJECT NAME: Flood Utilization and Ecosystem Management in the Haihe Basin
PROJECT ID #: 181
DESCRIPTION OF ACTIVITY: Flood utilization and ecosystem management
LOCATIONS: Haihe Basin (Dahuangbaowa flood detention basins), China

PRIMARY CONTACTS:

Kevin Jiang
Greater China & Korea Business Unit
No. 1188 Ziyue Road
Zizhu Science Based Industrial Park
Minhang District, Shanghai
200241, China
Tel: 86-21-61928318
E-mail: kejiang@coca-cola.com

Zhang Weidong
Programme Manager, UNDP China
weidong.zhang@undp.org

OBJECTIVES:
• Repair and construct flood utilization facilities
• Optimize floodwater resources allocation among various sectors (i.e., agriculture, fishery, wetland and groundwater)
• Improve water resources and wetlands conservation, and help alleviate water stress for local residents

BACKGROUND & ACTIVITY DESCRIPTION: The Hai River Basin (“Haihe Basin”) is severely threatened by water shortages. Water availability per capita is 270 m$^3$/yr, which is only one-eighth of the national average in China. Many regions of the Haihe Basin, such as Dahuangbaowa basin, are designed as flood detention basins and experience frequent water scarcity events. Rain-flood utilization could be an effective water-shortage mitigation option, but it has not yet been adopted anywhere within the river basin. The primary goals of this project are to: 1) demonstrate a multi-win solution from peak flow utilization in the flood retention area; and 2) change the associated polices nationwide.

In the community of Dahuangbao, there was one flood control structure built many years ago. However, it was in disrepair and the channels were clogged and lack of related facilities, policies and trained personnel have made it very difficult to utilize the flood resources during flooding seasons. This project was proposed to address the urgent need for rain-flood utilization and water resources management. The new source of water will reduce pressure on the aquifer and wetlands, and be used to expand agricultural and fish production in the basin.

The first phase of this project, completed in August 2013, involved a feasibility study of rain-flood utilization in the community of Dahuangbao and development of policy recommendations on utilization of flood resources in the Basin. The second phase of the project started in March 2014, and it focused on facility construction, reoperation of the floodgate, floodwater optimization and allocation, personnel training, and public participation enhancement. The flood control infrastructure and fish ponds were repaired, and local channel dredging was conducted; monitoring systems were built; local farmers were employed and trained to ensure maintenance and operation of the gates; and optimized water allocation regimes among different water users were obtained and implemented.

Through facility construction/repairs, flood resources optimization and public participation enhancement, the project realized the quantitative benefits of floodwater utilization for productive use in agriculture, fish production, wetland and groundwater recharges. This is the first rain-flood utilization project in the Haihe Basin. It demonstrates a new approach for water-shortage and flood risk mitigation, flood resources optimization, as well as efficient ecosystem management in the flood detention areas of the Basin.
Figure 1 shows the location of the community of Dahuangbao within the Haihe Basin. Figure 2 shows the range of water flow after release at the gate, and associated uses.

Figure 1. Location of the Dahuangbao area

Figure 2. Range of water flow after release through the gate
Flooding utilization facilities are shown in Figure 3, and a photograph of participants who participated in the training is shown in Figure 4.

**Figure 3. Flood utilization facilities**

**Figure 4. Maintenance and operation training to local residents**

**SUMMARY OF REPLENISH BENEFIT:**

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 10,000 ML/YR

**ACTIVITY TIMELINE:**

- Phase I: Feasibility study and field testing (January, 2012 through August, 2013)
- Phase II: Construction, training, optimization and allocation (March, 2014 through December, 2014)

**COCA-COLA CONTRIBUTION: 100%**

- Total project cost: US$182,596
- TCCC Contribution: US$182,596 for Phases 1 and 2
- Phase I
  - Baseline Study (US$15,000): Fee for researchers and consultants, data collection and purchase, accommodations for field trips
  - Stakeholder Engagement (US$2,500): Workshops with local governments and communities on the flood utilization necessity, feasibility and mechanism
  - Management Fee (US$2,000)
  - Monitoring and Evaluation (M&E) (US$500)
- Phase II
  - Infrastructure Improvement (US$89,428): Sluice gates operation and maintenance, water courses cleaning and dredging, dikes and fishing ponds enhancement, drinking water facilities in villages; this cost covered the full cost to release 13 BL in 2014.
Flood Allocation Mechanism (US$32,519): Meetings with key stakeholders to discuss and develop the flood resources allocation mechanism, and trainings to local communities to build their capacity on water retention and risk prevention

Management Fee (US$16,260)

M&E (US$24,389): Data collection on sites, project monitoring and evaluation

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Flood resource utilization

Approach and Results:
The estimated volume of water provided for productive use on an average annual basis is based on flood frequency analysis, hydrological modeling, hydraulic calculation, morphological analysis and the regulations for flood use in detention areas.

Modeling studies combined with collection of site-specific observations and data were conducted to determine the volume of water that could be released safely without risk to the local population (Peking University, 2013). Given flood frequencies \( P_1, P_2, P_3, \ldots, P_n \) corresponding to inflow volumes \( V_1, V_2, V_3, \ldots, V_n \), the volume of expected annual flood water resource \( E(V) \) can be expressed as:

\[
E(V) = \frac{1}{2} \sum_{i=1}^{n} (V_i + V_{i+1})(P_{i+1} - P_i)
\]

Based on model results and site-specific data, the flood resource volume under each year type (with different water levels) was calculated. A multi-year average annual flood-resource volume was then generated. The storage capacity of the flood resource in Dahuangbaowa was obtained through investigation and survey, and this was determined to be 10,000 ML/year.

The optimized water allocation among agriculture, fish ponds, wetland and groundwater recharges was determined to be 3.3%, 81.6%, 8%, and 7.1%, respectively. This water allocation scheme was followed for the flood water allocation in 2014, and is planned to be followed for the next five years. The distribution of water between these four uses is:

- Agricultural use = 330 ML/yr
- Fishery = 8,160 ML/yr
- Wetland = 800 ML/yr
- Groundwater recharges = 710 ML/yr

This estimate of 10,000 ML was confirmed in two separate ways: 1) measurements of storage pond capacity; and 2) official notification of the 2014 flow transfer volume. Each confirmation is described below.

Measurements of storage pond capacity
In 2013, computer simulations for different flood events, combined with on-the-ground measurements were used to determine the capacity of the storage ponds. The values in Table 1 were derived based on three actual releases, as follows. After the first release of floodwater, the local water authority closed the sluice gate after the water in the target areas reached target levels, to prevent risks to property. A few days later after the water had infiltrated and all water had been used, the gates were opened again. This was repeated one more time for a total of three releases. The ponds were emptied after each release and then filled to capacity with each new release. These measurements are approximate, and do not account for the volume of water that is recharged to groundwater. Therefore, they confirm that the estimated volume of floodwater provided for productive use is at least 10,000 ML per year.
Table 1. Storage capacity of pond receiving flood waters and estimated volumes

<table>
<thead>
<tr>
<th>Pond Type</th>
<th>Length(m)</th>
<th>Width(m)</th>
<th>Depth(m)</th>
<th>Average Volume (m) for each release</th>
<th>Total Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish Ponds</td>
<td>21,000</td>
<td>2,000</td>
<td>0.06</td>
<td>2,520,000</td>
<td>7,560,000</td>
</tr>
<tr>
<td>Wetlands</td>
<td>3,300</td>
<td>2,000</td>
<td>0.04</td>
<td>264,000</td>
<td>792,000</td>
</tr>
<tr>
<td>Agricultural Irrigation</td>
<td>2,000</td>
<td>1,850</td>
<td>0.03</td>
<td>111,000</td>
<td>333,000</td>
</tr>
<tr>
<td>Groundwater recharges</td>
<td>22,000</td>
<td>2,200</td>
<td>0.005</td>
<td>242,000</td>
<td>726,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>9,411,000</strong></td>
</tr>
</tbody>
</table>

Official notification of the 2014 flow transfer volume

The Wuqing District Water Resource Bureau confirmed that the 2014 peak flow transfer volume was 13 billion liters (BL) (Wuqing District Water Resource Bureau, 2014). The water was transferred from both the Qinglongwan River (8 BL) and the North Canal (5 BL). TCCC paid for both water transfers.

Total benefit = long-term average annual volume provided for productive use = 10,000 ML/yr

The total (ultimate) benefit: 10,000 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 10,000 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 10,000 ML/yr and TCCC’s benefit (adjusted for cost share) is 10,000 ML/yr.

Projected Replenish Benefits

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 2. Projected Water Quantity Benefits

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>2016</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>2017</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>2018</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>2019</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td><strong>Ultimate Benefit:</strong></td>
<td>10,000</td>
<td>10,000</td>
</tr>
</tbody>
</table>

Data Sources:

- All data used in the calculations were provided by TCCC, Peking University and UNDP China (see references).

Assumptions:

- It is assumed that all floodwaters stored in the ponds are used for productive use or recharge in any given year.
OTHER BENEFITS NOT QUANTIFIED

- Optimized water allocation scheme
- Reduced flood risk due to improved drainage
- Increased government investment in floodwater utilization
- Enhanced public participation of floodwater utilization
- Economic and social benefits to local residents (45,200 residents in this area have benefited from the project in terms of water access and water for productive use)
- Improved ecosystem and biodiversity

NOTES

- Impact assessments have been conducted for all UNDP projects in China, and no adverse environmental or social impacts were identified.

REFERENCES


Prof. Yang Xiaoliu, Beijing University. 2014. Flood Utilization and Management Regulation in the Dahuangbaowa Area (Draft, under local government’s approval). Prepared May, 2014


PROJECT NAME: Enhancing Opportunities for Youth in Income-generation, Entrepreneurship, and Education in Kyrgyzstan and Afghanistan

PROJECT ID: 194

DESCRIPTION OF ACTIVITY: Rehabilitation of two man-made canals to enhance water supply for regional irrigation

LOCATION: Naryn District, Kyrgyzstan

PRIMARY CONTACT:
Dr. Oleg Piletsky
Public Affairs and Communication Manager, Caucasus and Central Asia Republics Region
Istanbul, Turkey
opiletsky@coca-cola.com

OBJECTIVE:
• Improve access to irrigation water in rural Kyrgyzstan

BACKGROUND & ACTIVITY DESCRIPTION: The Sary-Koo and Kara-Seki irrigation canals, which are located in the Naryn District of Kyrgyzstan, were constructed by the Soviet Union in the 1970s. Prior to this project, no major repairs or cleaning had been conducted in the canals since the 1990s. As a result, the canals were silted in and some portions were damaged, inhibiting the water delivery capacity of the canals and negatively affecting farmers’ harvest yields in the region. This project, which was funded and implemented in collaboration with the Aga Khan Foundation and the Kyrgyzstan Mountain Societies Development Support Program (MSDSP KG), improved the flow capacity of the canals via rehabilitation and new construction activities (Aga Khan Foundation 2014).

Sary-Koo Canal

The Sary-Koo irrigation canal, which is 18 km in length, provides irrigation water for 525 people in the At-Bashy village of At-Bashy Ayil Aimak who farm a total of 382 hectares. Due to the lack of maintenance, the canal was only operating at 60-70% of its flow capacity. This project rehabilitated a 3-km reach of the canal to increase the canal’s capacity from ~400 L/s to ~600 L/s.

Rehabilitation activities on Sary-Koo canal were conducted September through November 2013. The specific activities conducted for the rehabilitation of the canal included (Figure1):
• Excavation of 10,858 m³ of earth;
• Finalization of digging manually – 706 m³ of earth;
• Construction of 5 water distribution systems;
• Installation of 5 metallic water gates;
• Installation of a water pump; and
• Installation of 5 metal bridges to allow communities to cross the canal.

The rehabilitation of the irrigation canal was completed on November 10, 2013 and officially approved by the MSDSP KG and the At-Bashy Sub-District authorities on November 14, 2013. On November 18, 2013, under the At-Bashy District Water Management Department (DWMD) Act of #16, the future maintenance and operation of the Sary-Koo irrigation canal was transferred to the At-Bashy DWMD.
Kara-Seki Canal

The Kara-Seki irrigation canal, which is 12.5 km in length, is supplied by the glacier-fed Baydulu River and provides irrigation water for more than 230 hectares of land. Due to the lack of maintenance, the canal has only been operating at 60-70% of its flow capacity, resulting in irrigation water shortages during the summer months. Rehabilitation and construction activities on Kara-Seki canal were conducted during September through December 2013 and included:

- Construction of a pumping station on the On-Archa River with a capacity of 80-90 L/s; and
- Cleaning of a 3-km reach of the canal to restore flow capacity.

Construction activities on the canal were completed on December 15, 2013. The pump station was successfully tested and approved in May 2014 by the head of the On-Archa Aiyil Okmotu, the director of construction contractor, and the MSDSP Infrastructure Coordinator. Rehabilitation activities resulted in the canal’s flow capacity increasing from 150-175 L/s to 250-300 L/s, and the new pumping station further increased the flow capacity by approximately 83 L/s.

SUMMARY OF REPLENISH BENEFIT:

- 2014 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 397.0 ML/YR

ACTIVITY TIMELINE:

- Project initiation: September 2013
- Project completion: December 2013

COCA-COLA CONTRIBUTION: Variable (59.9 – 69.2%)

- **Sary-Koo canal**: 69.2%
  - Total cost: $28,305 USD
  - The Coca-Cola Foundation: $19,576 USD
  - Local contributions (from DWMD and sub-district): $8,729 USD

- **Kara-Seki canal**: 59.9%
  - Total cost: $41,773 USD
  - The Coca-Cola Foundation: $25,002 USD
  - Local contributions (from community and sub-district): $16,771 USD
1. **Improved irrigation efficiency**

**Approach and Results:**

The water quantity benefit for this project is calculated as the increase in water delivery by the canals to irrigation points as a result of the rehabilitation activities completed during the fall of 2013. The final project report (Aga Khan Foundation, 2014) provides estimates of irrigation water delivery/usage prior to rehabilitation of the canals, as well as projections of increased irrigation water usage following rehabilitation:

- **Sary-Koo Canal:**
  - Supply before rehabilitation: 988,600 m³/yr
  - Supply after rehabilitation: 1,477,143 m³/yr

- **Kara-Seki Canal:**
  - Supply before rehabilitation: (2,514 m³/ha/yr) * (236 ha) = 593,304 m³/yr
  - Supply after rehabilitation: (5,024 m³/ha/yr) * (272 ha) = 1,366,528 m³/yr

In addition, irrigation volumes were measured on a monthly basis for both canals during the 2014 irrigation season, after rehabilitation activities had been completed. Monthly volumes are tabulated in Table 1 for the Sary-Koo canal and in Table 2 for the Kara-Seki canal.

**Table 1. Sary-Koo Canal Irrigation Supply Volumes Before and After Rehabilitation**

<table>
<thead>
<tr>
<th>Month</th>
<th>Irrigation Volume Before Rehabilitation (m³)</th>
<th>2014 Irrigation Volume After Rehabilitation (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>n/a</td>
<td>206,200</td>
</tr>
<tr>
<td>June</td>
<td>n/a</td>
<td>393,800</td>
</tr>
<tr>
<td>July</td>
<td>n/a</td>
<td>458,600</td>
</tr>
<tr>
<td>August</td>
<td>n/a</td>
<td>278,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>988,600</strong></td>
<td><strong>1,336,600</strong></td>
</tr>
</tbody>
</table>

1 Monthly irrigation volumes are not available for the “before rehabilitation” case, only the annual irrigation volume.
Table 2. Kara-Seki Canal Monthly Irrigation Supply Volumes Before and After Rehabilitation

<table>
<thead>
<tr>
<th>Month</th>
<th>Irrigation Volume Before Rehabilitation (m$^3$)</th>
<th>2014 Irrigation Volume After Rehabilitation (m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>n/a</td>
<td>131,500</td>
</tr>
<tr>
<td>June</td>
<td>n/a</td>
<td>251,000</td>
</tr>
<tr>
<td>July</td>
<td>n/a</td>
<td>298,900</td>
</tr>
<tr>
<td>August</td>
<td>n/a</td>
<td>172,600</td>
</tr>
<tr>
<td>Total</td>
<td>593,304</td>
<td>854,000</td>
</tr>
</tbody>
</table>

1 Monthly irrigation volumes are not available for the “before rehabilitation” case, only the annual irrigation volume.

The measured volumes listed in Tables 1 and 2 correspond to an annual irrigation volume that is lower than the “post-rehabilitation” projections inferred in the project final report. To be conservative, the total annual volumes reported for 2014 are used as the basis for the water quantity benefit estimates.

The water quantity benefit for each canal can be estimated by calculating the difference in total annual irrigation volume between the “before rehabilitation” and “after rehabilitation” conditions:

For Sary-Koo Canal: \[ \text{Benefit} = (1,336,600 \text{ m}^3/\text{yr}) - (988,600 \text{ m}^3/\text{yr}) = 348,000 \text{ m}^3/\text{yr} = 348.0 \text{ ML/yr} \]

For Kara-Seki Canal: \[ \text{Benefit} = (854,000 \text{ m}^3) - (593,304 \text{ m}^3) = 260,696 \text{ m}^3 = 260.7 \text{ ML/yr} \]

Therefore, the total water quantity benefit is: \( (348.0 \text{ ML/yr}) + (260.7 \text{ ML/yr}) = 608.7 \text{ ML/yr} \).

The total (ultimate) benefit is: 608.7 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 397.0 ML/yr

The current (2014) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2014 Replenish Benefit

The 2014 benefit is the performance-based benefit from this activity as of the end of the calendar year 2014. The total 2014 benefit is 608.7 ML/yr, and TCCC’s benefit (adjusted for cost share) is 397.0 ML/yr.

Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 3. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>608.7</td>
<td>397.0</td>
</tr>
<tr>
<td>2016</td>
<td>608.7</td>
<td>397.0</td>
</tr>
<tr>
<td>2017</td>
<td>608.7</td>
<td>397.0</td>
</tr>
<tr>
<td>2018</td>
<td>608.7</td>
<td>397.0</td>
</tr>
<tr>
<td>2019</td>
<td>608.7</td>
<td>397.0</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>608.7</td>
<td>397.0</td>
</tr>
</tbody>
</table>

Data Sources:
- All flow estimates and data used in the above benefit calculations were provided in the project final report developed by Aga Khan Foundation (2014) and provided to LimnoTech by Dr. Oleg Piletsky.

Assumptions:
- Annual estimates of irrigation water supply/usage cited in the final project report for pre-2014 conditions (Aga Khan Foundation, 2014) are representative of average annual irrigation supply/usage prior to canal rehabilitation.
- Monthly flow data collected for and reported for May-August, 2014 are representative of post-rehabilitation irrigation usage and flow conditions in the canals.
- Projected benefits assume that the canals will be adequately maintained in coming years by the project partners to ensure that the benefits (irrigation water delivery) obtained by the canal rehabilitation project are not reduced.

OTHER BENEFITS NOT QUANTIFIED
- Economic and social benefits to farmers in the region (e.g., increased harvest yields):
  - For Sary-Koo canal, it is estimated that increased crop yields will increase overall income for farmers by $80,000 USD.
  - For Kara-Seki canal, it is estimated that increased crop yields will increase overall income for farmers by $90,000 USD.
- Reduced vulnerability of crops to droughts and climate change.

NOTES
- Project partners included the Mountain Societies Development Support Program (MSDSP KG), the Aga Khan Foundation, and Naryn DWMD.

REFERENCE
Aga Khan Foundation. 2014. “Enhancing Opportunities for Youth in Income Generation, Entrepreneurship, and Education in Kyrgyzstan and Afghanistan.” Project final report provided to LimnoTech by Dr. Oleg Piletsky on December 10, 2014.
Appendix F
Fact Sheets for Water Access and Sanitation Projects
## Appendix F Table of Contents

<table>
<thead>
<tr>
<th>LTI ID</th>
<th>TCCC ID</th>
<th>Country</th>
<th>Partner / Lead</th>
<th>Project Name</th>
<th>Description of Activity</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>n/a</td>
<td>653</td>
<td>Burundi</td>
<td>GETF/ Betraco-Mesodi</td>
<td>Water Supply, Sanitation, and Hygiene Education in Peri-Urban Bujumbura (WADA)</td>
<td>The main goal of this project is to improve the health and well-being of community members by providing sustained and improved access to safe water supply in the three targeted villages of rural Bujumbura Province.</td>
<td>1</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>Burkina Faso</td>
<td>GETF/ WaterAid</td>
<td>Improving Access to Water in Peri-Urban Ouagadougou</td>
<td>This project provided water supply services and hygiene education to residents of Balkuy, an informal settlement in peri-urban Ouagadougou, Burkina Faso.</td>
<td>2</td>
</tr>
<tr>
<td>n/a</td>
<td>406</td>
<td>Cameroon</td>
<td>GETF/ Plan Cameroon</td>
<td>Water and Sanitation for Schools and Communities in Akonolinga and Gaschiga Councils</td>
<td>This project provided full access to water through the construction of hand dug wells equipped with pumps.</td>
<td>3</td>
</tr>
<tr>
<td>n/a</td>
<td>555</td>
<td>Philippines</td>
<td>Alternative Indigenous Development Foundation, Inc. (AIDFI), Earth Day Network Philippines</td>
<td>AGOS Hydraulic Ram Pump Project</td>
<td>The project provides poor upland communities with accessible and reliable community water systems using hydraulic ram pumps and ferrocement storage tanks. These benefits are metered.</td>
<td>4</td>
</tr>
<tr>
<td>n/a</td>
<td>403</td>
<td>Egypt</td>
<td>GETF/ CARE Egypt</td>
<td>Community Water Connections and Health Improvement</td>
<td>This project will give full access to water to people through household connections</td>
<td>6</td>
</tr>
<tr>
<td>n/a</td>
<td>656</td>
<td>Egypt</td>
<td>GETF/ UNICEF</td>
<td>Raising Healthy Children with Safe Household Water Supply and Sanitation</td>
<td>This project provided access to household water (and potentially waste water) connections in Assiut governorate, one of the most deprived areas in Egypt.</td>
<td>7</td>
</tr>
<tr>
<td>LTI ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Page #</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>n/a</td>
<td>41</td>
<td>Ethiopia</td>
<td>GETF/ Millennium Water Alliance</td>
<td>Amhara Community Water Supply, Sanitation, and Hygiene Project</td>
<td>Community members benefitted from full access to water.</td>
<td>8</td>
</tr>
<tr>
<td>n/a</td>
<td>559</td>
<td>Ghana</td>
<td>GETF/ Relief International, WaterHealth International, Beta Construction Engineers</td>
<td>Water Supply and Sanitation Project in Teshie, Greater Accra</td>
<td>This project will give full access to water to people by constructing WaterHealth Centers in peri-urban communities.</td>
<td>9</td>
</tr>
<tr>
<td>n/a</td>
<td>109</td>
<td>Ghana &amp; Ivory Coast</td>
<td>GETF/ CARE Gulf of Guinea</td>
<td>Trans boundary Community Water Management</td>
<td>This project gave full access to water to people through the construction of boreholes, wells, and pumps.</td>
<td>10</td>
</tr>
<tr>
<td>n/a</td>
<td>560</td>
<td>Ghana</td>
<td>GETF/ WaterHealth International</td>
<td>Safe Water for Africa</td>
<td>To date, this project has constructed 5 WaterHealth Centers in Ghana and provided WASH education to the community.</td>
<td>11</td>
</tr>
<tr>
<td>n/a</td>
<td>243</td>
<td>Kenya</td>
<td>WorldVision</td>
<td>Safe Water in Kenya</td>
<td>This project provided people with full access to water through the building and renovation of wells, extension of water pipelines, and provision of water storage tanks.</td>
<td>12</td>
</tr>
<tr>
<td>n/a</td>
<td>244</td>
<td>Kenya</td>
<td>GETF/ Aga Khan Foundation</td>
<td>Water and Sanitation Improvement Program</td>
<td>This project gave people full access to water through construction of water storage facilities, and water points.</td>
<td>13</td>
</tr>
<tr>
<td>n/a</td>
<td>242</td>
<td>Kenya</td>
<td>GETF/ Florida International University, World Vision</td>
<td>Mara River Basin Water &amp; Development Alliance</td>
<td>This project gave people full access to water through the construction of protected and shallow springs and boreholes.</td>
<td>14</td>
</tr>
<tr>
<td>LTI ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Page #</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>------------</td>
<td>-------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>Kenya</td>
<td>GETF/ Water and Sanitation for the Urban Poor</td>
<td>Water &amp; Sanitation for Naivasha's Peri-Urban Poor Project, Kenya</td>
<td>This project established water treatment, storage, and distribution networks in Naivasha’s peri-urban settlements.</td>
<td>15</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>Liberia</td>
<td>GETF/ WaterHealth International</td>
<td>Safe Water for Africa</td>
<td>This project has constructed WaterHealth Centers in Liberia and provided WASH education to the community.</td>
<td>16</td>
</tr>
<tr>
<td>n/a</td>
<td>666</td>
<td>Morocco</td>
<td>GETF/ CARE</td>
<td>Potable Water Supply and Small-Scale Irrigation (WADA)</td>
<td>Provided access to water supply sources and improved water use practices by at least seven groups of small farmers in intensive agricultural production areas.</td>
<td>17</td>
</tr>
<tr>
<td>n/a</td>
<td>416</td>
<td>Mozambique</td>
<td>GETF/ CARE Mozambique</td>
<td>Strengthening Communities through Integrated WASH Activities</td>
<td>This project gave full access to water through construction of well points and household connections.</td>
<td>18</td>
</tr>
<tr>
<td>n/a</td>
<td>517</td>
<td>Philippines</td>
<td>Winrock AMORE</td>
<td>Sarangani and Sultan Kudarat Community Water Access Project</td>
<td>This project provided people with improved access to potable water &amp; sanitation through the construction of spring boxes and rainwater harvesting</td>
<td>19</td>
</tr>
<tr>
<td>n/a</td>
<td>44</td>
<td>Mozambique</td>
<td>GETF/ VITENS</td>
<td>Rehabilitating the TextAfrica Water Treatment System and expanding water supply to Bairro 4</td>
<td>This project gave people full access to water through the renovation of a dilapidated water treatment system and by expanding piped water supply.</td>
<td>20</td>
</tr>
<tr>
<td>n/a</td>
<td>287</td>
<td>Niger</td>
<td>GETF/ Winrock International</td>
<td>Multiple Use Services and Point of Use Treatment</td>
<td>This project gave full access to water through the construction of boreholes</td>
<td>21</td>
</tr>
<tr>
<td>LTI ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Page #</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>---------------</td>
<td>---------------------------</td>
<td>--------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>n/a</td>
<td>45</td>
<td>Nigeria</td>
<td>GETF/ WOFAN</td>
<td>Improved Health and Livelihoods in Rural Communities</td>
<td>This project gave full access to water and sanitation by constructing boreholes, tap stands, a well, and latrines.</td>
<td>22</td>
</tr>
<tr>
<td>n/a</td>
<td>289</td>
<td>Nigeria</td>
<td>GETF/ Society for Family Health</td>
<td>Water and Sanitation in Nkanu East</td>
<td>Increased access to improved community water supplies and increased schoolchildren’s access to improved sanitation facilities.</td>
<td>23</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>Nigeria</td>
<td>GETF/ WaterHealth International</td>
<td>Safe Water for Africa</td>
<td>This project is constructing three WaterHealth Centers in Nigeria and providing WASH education to the community.</td>
<td>24</td>
</tr>
<tr>
<td>n/a</td>
<td>561</td>
<td>Rwanda</td>
<td>GETF/ Water For People</td>
<td>Water and Sanitation in Gahanga and Masaka</td>
<td>This project provided people with access to clean water.</td>
<td>25</td>
</tr>
<tr>
<td>n/a</td>
<td>552</td>
<td>Philippines</td>
<td>Nortehanon Access Center , Inc.</td>
<td>Community-based Potable Water System Management Project</td>
<td>A level -2 water system was installed in Barangays Caburihan and Sabang Tabok, Lavezares, Northern Samar.</td>
<td>26</td>
</tr>
<tr>
<td>n/a</td>
<td>47</td>
<td>Rwanda</td>
<td>Blood:Water Mission</td>
<td>Community Development through Sustainable Water Supply</td>
<td>This project gave people full access to water.</td>
<td>27</td>
</tr>
<tr>
<td>n/a</td>
<td>473</td>
<td>Vietnam</td>
<td>CEFACOM</td>
<td>Clean Water for Communities in Thuong Tin and Thu Duc districts</td>
<td>This project provided people by extending water provision facilities to rural areas</td>
<td>28</td>
</tr>
<tr>
<td>n/a</td>
<td>562</td>
<td>Senegal</td>
<td>Research Triangle Institute</td>
<td>Community Water, Sanitation, and Hygiene</td>
<td>This project gave full access to water though installation and rehabilitation of water access infrastructure in villages.</td>
<td>29</td>
</tr>
<tr>
<td>LTI ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Page #</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>---------------</td>
<td>----------------------</td>
<td>-------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>n/a</td>
<td>134</td>
<td>Thailand</td>
<td>HAIi</td>
<td>Village that Learns and Earns</td>
<td>This project has been implemented in 3 villages - Limthong, Mae Tarn Noi, and Nonrang</td>
<td>30</td>
</tr>
<tr>
<td>n/a</td>
<td>285</td>
<td>South Africa</td>
<td>The Mvula Trust</td>
<td>Water Supply, Watergy Intervention and Education</td>
<td>This project provided full access to water through the refurbishment of a water treatment facility and the construction of pipeline and tap stands.</td>
<td>31</td>
</tr>
<tr>
<td>n/a</td>
<td>393</td>
<td>Swaziland</td>
<td>GETF/ NCMI</td>
<td>Water for a Generation</td>
<td>This project provided full access to water through the construction and rehabilitation of 50 wells and boreholes.</td>
<td>32</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>Tanzania</td>
<td>GETF/ Women for Water Partnership (WfWP)</td>
<td>Improving Access to Water in Mweteni Village</td>
<td>This project provided access to safe sustainable drinking water through a gravity-fed water supply scheme in Mweteni village and a rainwater harvesting unit at Mturo Primary School.</td>
<td>33</td>
</tr>
<tr>
<td>n/a</td>
<td>553</td>
<td>Philippines</td>
<td>SUNGCOD, Inc.</td>
<td>Community Managed Potable Water Supply through Creek Development and Rain Harvesting in Barangays San Fernando and Dumuyog, Del Carmen, Surigao del Norte</td>
<td>The primary focus of the project is the installation of a Rainwater Harvesting Facility and the rehabilitation / improvement of a creek-based water source towards operationalization of a Level II Potable Water System in each of the two barangays.</td>
<td>34</td>
</tr>
<tr>
<td>n/a</td>
<td>49</td>
<td>Uganda</td>
<td>GETF/ Christian Children's Fund</td>
<td>Northern Uganda Watersprings Initiative</td>
<td>This project gave full access to water through borehole construction and latrines.</td>
<td>35</td>
</tr>
<tr>
<td>LTI ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Page #</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>---------------</td>
<td>-------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>n/a</td>
<td>389</td>
<td>Uganda</td>
<td>GETF/ Water and Sanitation for the Urban Poor</td>
<td>Bwaise Urban Water Access Program</td>
<td>This project gave people full access to safe, affordable water through the rehabilitation of the water distribution network.</td>
<td>36</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>Ukraine</td>
<td>UNDP</td>
<td>Every Drop Matters - 3rd Generation</td>
<td>The project aimed to improve waste water treatment in the local communities (residential municipal housing) through implementation of partnership community projects on water replenishment to ameliorate environmental, hygiene and sanitation situation.</td>
<td>37</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>Thailand</td>
<td>The Forest and Sea for Life Foundation</td>
<td>Enhancing the Capability of Community Organization and Klong Yan Watershed Resource Conservation and Rehabilitation Network</td>
<td>This project provided water supply systems for households.</td>
<td>38</td>
</tr>
<tr>
<td>33</td>
<td>n/a</td>
<td>Pakistan</td>
<td>WWF-Pakistan</td>
<td>Environment Conservation &amp; Watershed Management</td>
<td>Roof water harvesting schemes were established in three sites where there was shortage of spring and stream water.</td>
<td>39</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>Egypt</td>
<td>Egyptian Food Bank</td>
<td>Egypt Livelihood Program</td>
<td>Connecting clean water connections to houses in 8 villages as a part of the 100 Villages project that aims to develop 100 villages in Egypt by the year 2020.</td>
<td>40</td>
</tr>
<tr>
<td>LTI ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Page #</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>---------------</td>
<td>---------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>n/a</td>
<td>40</td>
<td>Egypt</td>
<td>GETF/IRG</td>
<td>Environmental Services for Improving Water Quality Management</td>
<td>WADA partners worked to improve water quality management in Gharbiya Governorate, Lower Egypt and Qena Governorate, Upper Egypt.</td>
<td>41</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>Philippines</td>
<td>Habitat for Humanity</td>
<td>Agos - Habitat Rebuild Water Project</td>
<td>Partnership project of Coca-Cola Foundation and Habitat for Humanity (H4H) in the rebuilding of water systems of seven (7) project sites (covering several barangays from adjacent provinces) destroyed by Bohol Earthquake in 2013.</td>
<td>42</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>Philippines</td>
<td>Philippine Rural Reconstruction Movement</td>
<td>AGOS Gravity-Fed Water Access</td>
<td>PRRM and CCFPI jointly facilitate the project for the construction of spring development gravity-fed water systems in selected five (5) rural communities in the provinces of Aklan, Camarines Norte, Camarines Sur, Eastern Samar, and Nueva Ecija.</td>
<td>43</td>
</tr>
<tr>
<td>n/a</td>
<td>n/a</td>
<td>Cambodia</td>
<td>Cambodian Women for Peace and Development</td>
<td>Communities Clean Water Supply and Sanitation 2014</td>
<td>This project intends to improve access to safe drinking water and increase the sanitation behavior through through a water pipe connection to a clean water supply and sanitation/ personal hygiene education.</td>
<td>44</td>
</tr>
</tbody>
</table>
### Project Description

This project rehabilitated and constructed water conveyance infrastructures (tanks, water standposts) in the three villages of Gatamba, Kinyinya and Rubabamuramvwa in the Mubimbi Commune of Bujumbura, Burundi, benefiting directly nearly 12,000 people. The project also provided sanitation and hygiene education to community members and built community capacity to efficiently use, maintain and manage the water infrastructure.

### For Water Access Projects:

1. Yellow shaded cells require data from you.
2. Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pump systems.
3. “Full Access” for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from the place of use and that it is possible to rely on it at least 20 times per member of a household per day. Examples include new boreholes installed in a village.
4. “Limited Access” means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).
5. Please make sure it is perfectly clear whether the project has been implemented or is planned. If the project is being implemented in phases, please indicate which phases have already been implemented and which are planned. Maintain this distinction regarding the statement of Replenish benefits.
6. Certain projects, such as Community Education & Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.

### Quantification Method Choices:

- Preferred: Annual meter reading indicating total flow through the system for a given year, or
- Alternative: Total number of beneficiaries served, or
- Engineering Design Capacity

### Project Completion (If applicable):

- “Full Access” for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from the place of use and that it is possible to rely on it at least 20 times per member of a household per day.
- “Limited Access” means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).

### For Sanitation Projects:

1. “Full Access” for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from the place of use and that it is possible to rely on it at least 20 times per member of a household per day. Examples include new boreholes installed in a village.
2. “Limited Access” means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).
3. Certain projects, such as Community Education & Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.

### Post Implementation System Operation and Monitoring Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)

- Equipment and Technology
- Water Quality
- Water Management Committees and Regideso
- Community Education and Awareness

### Additional Partner and Related Projects:

- Regideso, water utility
- USAID-Burundi Mission
- Coca-Cola / Brarudi

### Additional Project Information:

- This project is officially closed.

---

**Table: Project Fact Sheet for Water Access and Sanitation Projects**

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Date</th>
<th>Project Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>----</td>
<td>--------------</td>
<td>------</td>
<td>--------------</td>
</tr>
</tbody>
</table>

**Water Management Committees and Regideso**

*This project is officially closed.*
### Template 3: Project Fact Sheet for Water Access and Sanitation Projects

**Project Name:** Improving Access to Water in Peri-Urban Ouagadougou

- **Type of Project:** Water Access
- **Benefit:** Community Education, Testing & Awareness

**TCC Group:** Central, Eastern and Western Africa

**TCC BU:** Burkina Faso

**Country:** Burkina Faso

**Name of Project Contact:** Tara Varghese (GETF)

**Total Cost of Project (Including taxes):** $150,825

**Coca-Cola/Bottle Cost Contribution:** $125,000

**Coca-Cola Cost Share Percentage:** 83%

**Name**  

**Organization**  

**Role**  

**Phone**  

**Email**  

**Coca-Cola System Contact Person:**

- **Name:** Don Dussey  
- **Organization:** Technology Foundation (GETF)  
- **Phone:** +225 25-20-85-85  
- **Email:** ddussey@cocacola.com

**Guidance:**

1. Yellow shaded cells require data input from you.
2. Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pumps systems.
3. Full/Access for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from its place of use and that it is possible to reliably obtain at least 20 liters per member of a household per day. Examples include new boreholes installed in a village.
4. Limited Access means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).
5. Please make sure it is perfectly clear whether the project has been implemented or is planned. If the project is being implemented in phases, please indicate which phases have already been implemented and which are planned. Maintain this distinction regarding the statement of Replenish benefits.
6. Certain projects, such as Community Education & Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.

---

**Quantification Method Choices:**

- For Water Access Projects, there are two choices for quantifying benefits:
  - a. Preferred: Annual Water Reading indicating total flow through system for given year, or
  - b. Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

- For Sanitation Projects: For benefits to be quantified, the project must be measured and the annual flow through volume recorded each year.

---

**Benefits are based on:**

- the volume of wastewater that is treated. Can be determined based on either of the following:
  a. Preferred: Annual meter reading indicating the total flow through the system for a given year, or
  b. The engineering design capacity of the system.
  c. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

---

**Past Implementation System Operation and Monitoring Plan:**

- **Type of Water Access Infrastructure**
  - **Type of Sanitation Infrastructure**
  - **Method of Estimating Benefits**
  - **Latitude (Decimal Degrees)**
  - **Longitude (Decimal Degrees)**

---

**Comments:** (Please include anything else that should be known about this project)

Please contact GETF with any further questions on project documentation.

---

**Tara Varghese**  
Director, Water & Development Programs  
Global Environment & Technology Foundation (GETF)  
703-379-2713  
Tara.Varghese@getf.org

---

**TCC BU:** Central, Eastern and Western Africa

**Number of Direct Beneficiaries:** 83%

---

**Lesson Learned:**

- Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pumps systems.

---

**Contact Person:**

- **Name:** Romain Broseus  
- **Title:** Urban Program Manager  
- **Organization:** WaterAid America  
- **Phone:** +225 25-20-85-85  
- **Email:** rbroseus@wateraidamerica.org

---

**Comments:**

Post Implementation System Operation and Monitoring Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)

Who is Responsible for Operation and Maintenance of Water Access Point:

- **GETF:** Operations and Maintenance Plan (O&M)  

All stakeholders, headed over to the community, are owned and operated by ONEA, the national water utility. ONEA retains responsibility for ongoing water quality testing (monthly at the storage tank and at random points in the distribution system). The water stand post committees have received training on O&M of the infrastructure and contact ONEA with any issues needing attention beyond their capabilities. Further details can be found in the project close-out report.

---

**Please Complete A Row in the Below Table For Each Sanitation System Installed:**

<table>
<thead>
<tr>
<th>Type of Sanitation Infrastructure</th>
<th>Access Level</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year - with cost share)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Please Complete A Row in the Below Table For Each Water Access Point Installed and In Operation:**

<table>
<thead>
<tr>
<th>Type of Water Access Infrastructure</th>
<th>Access Level</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year - with cost share)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community stand post</td>
<td>Full Access</td>
<td>May 14</td>
<td>7380</td>
<td>4740006828.73</td>
<td>WHO-20 Standard</td>
<td>+225 20 65 66</td>
<td>-1.464729</td>
</tr>
</tbody>
</table>

---

**Additional Information:**

- **Project Name:** Improving Access to Water in Peri-Urban Ouagadougou
- **Date:** 14-Oct-14
- **Project Code:**

---

**Please contact GETF with any further questions on project documentation.”
**Template 3: Project Fact Sheet for Water Access and Sanitation Projects**

**Project Name:** Water and Sanitation for Schools and Communities in Alotinga and Gaschiga Councils

**Type of Project:** Water Access, Sanitation, Community Education, Training & Awareness

**TCC Group:** Central, Eastern and Western Africa

**Country:** Cameroon

**Name of Project Contact:** Lucas Ganye

**Email:** lucas.ganye@plan-international.org

**Number of Direct Beneficiaries**

- **Disrtibution Network Construction/Rehabilitation:**
  - **Name:** Tara Varghese
  - **Email:** tara.varghese@getf.org

**Community Education, Training & Awareness**

**Access Level:** Full Access

**Date Installed and Operational:** 6-Jun-11

**WHO 20 liters/day/capita**

- **Population:** 5,400
- **Flow Rate:** 37167601.91
- **WHO 20 liters/day/capita**

**Coca-Cola/Bottle Cost Contribution:**

- **Name:** Tara Varghese
- **Email:** yevangal@coca-cola.com

**Coca-Cola System Contact Person:** Lucas Ganye

**Country:** Central, Eastern and Western Africa

**Organization:** The Coca-Cola Company

**Phone:** 703-379-2713

**Email:** Lucas.Ganye@coca-cola.com

**Number of Direct Beneficiaries**

- **Date Installed and Operational:** 5-Nov-14
- **Access Level:** Full Access

**Please Complete A Row in the Below Table For Each Individual Water Access Point (only include access points installed and in operation)**

<table>
<thead>
<tr>
<th>Type of Water Access Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year) - with cost share</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand dug wells</td>
<td>Full Access</td>
<td>6-Jun-11</td>
<td>5,400</td>
<td>37167601.91</td>
<td>WHO 20 litres/day/capita</td>
<td>38.017601.91</td>
<td>10.60017601.91</td>
</tr>
</tbody>
</table>

**Please Complete A Row in the Below Table For Each Sanitation System Installed and Operational**

**Total Number of Sanitation Systems Installed and Operational:**

<table>
<thead>
<tr>
<th>Type of Sanitation Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year) - with cost share</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Post Implementation System Operation and Monitoring Plan**

The management committee was elected in presence of the local government administrative officers and trained on user fee collection, elementary project related book keeping, settlement of disputes etc in order to continue the management and maintenance of the project. The caretaker for the hand-dug wells was elected by the community and was trained in minor repairs and maintenance and in hiring with a professional repair person when there is a need. PLAN will continue to follow-up on work done through this project as it falls within Plan communities alongside similar projects.

**Comments (Please include anything else that should be known about this project)**

- **Name:** Tara Varghese
- **Title:** Director, Water and Development programs
- **Organization:** Global Environment and Technology Foundation
- **Phone:** 703-379-2713
- **Email:** tara.varghese@gatf.org

**Submitted by:** Tara Varghese

**Date:** 5-Nov-14
### Template 3: Project Fact Sheet for Water Access and Sanitation Projects

<table>
<thead>
<tr>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual/Replenish Volume (L/s)</th>
<th>Method of Estimating Benefits (Water or Estimate)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Water Access Infrastructure</strong></td>
<td><strong>Access Level</strong></td>
<td><strong>Date Installed and Operational</strong></td>
<td><strong>Number of Direct Beneficiaries</strong></td>
<td><strong>Annual/Replenish Volume (L/s) Per Year</strong></td>
<td><strong>Method of Estimating Benefits</strong></td>
</tr>
<tr>
<td><strong>Protected Spring Box</strong></td>
<td><strong>Phase 1A</strong></td>
<td><strong>3rd</strong> March</td>
<td><strong>600</strong></td>
<td><strong>18,419,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Rainwater Harvesting</strong></td>
<td><strong>Phase 3B</strong></td>
<td><strong>9th</strong> November</td>
<td><strong>900</strong></td>
<td><strong>17,520,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Protected Spring Box</strong></td>
<td><strong>Phase 1A</strong></td>
<td><strong>3rd</strong> March</td>
<td><strong>600</strong></td>
<td><strong>18,419,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Rainwater Harvesting</strong></td>
<td><strong>Phase 3B</strong></td>
<td><strong>9th</strong> November</td>
<td><strong>900</strong></td>
<td><strong>17,520,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Protected Spring Box</strong></td>
<td><strong>Phase 1A</strong></td>
<td><strong>3rd</strong> March</td>
<td><strong>600</strong></td>
<td><strong>18,419,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Rainwater Harvesting</strong></td>
<td><strong>Phase 3B</strong></td>
<td><strong>9th</strong> November</td>
<td><strong>900</strong></td>
<td><strong>17,520,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Protected Spring Box</strong></td>
<td><strong>Phase 1A</strong></td>
<td><strong>3rd</strong> March</td>
<td><strong>600</strong></td>
<td><strong>18,419,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Rainwater Harvesting</strong></td>
<td><strong>Phase 3B</strong></td>
<td><strong>9th</strong> November</td>
<td><strong>900</strong></td>
<td><strong>17,520,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Protected Spring Box</strong></td>
<td><strong>Phase 1A</strong></td>
<td><strong>3rd</strong> March</td>
<td><strong>600</strong></td>
<td><strong>18,419,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Rainwater Harvesting</strong></td>
<td><strong>Phase 3B</strong></td>
<td><strong>9th</strong> November</td>
<td><strong>900</strong></td>
<td><strong>17,520,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Protected Spring Box</strong></td>
<td><strong>Phase 1A</strong></td>
<td><strong>3rd</strong> March</td>
<td><strong>600</strong></td>
<td><strong>18,419,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Rainwater Harvesting</strong></td>
<td><strong>Phase 3B</strong></td>
<td><strong>9th</strong> November</td>
<td><strong>900</strong></td>
<td><strong>17,520,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Protected Spring Box</strong></td>
<td><strong>Phase 1A</strong></td>
<td><strong>3rd</strong> March</td>
<td><strong>600</strong></td>
<td><strong>18,419,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Rainwater Harvesting</strong></td>
<td><strong>Phase 3B</strong></td>
<td><strong>9th</strong> November</td>
<td><strong>900</strong></td>
<td><strong>17,520,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Protected Spring Box</strong></td>
<td><strong>Phase 1A</strong></td>
<td><strong>3rd</strong> March</td>
<td><strong>600</strong></td>
<td><strong>18,419,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Rainwater Harvesting</strong></td>
<td><strong>Phase 3B</strong></td>
<td><strong>9th</strong> November</td>
<td><strong>900</strong></td>
<td><strong>17,520,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Protected Spring Box</strong></td>
<td><strong>Phase 1A</strong></td>
<td><strong>3rd</strong> March</td>
<td><strong>600</strong></td>
<td><strong>18,419,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
<tr>
<td><strong>Rainwater Harvesting</strong></td>
<td><strong>Phase 3B</strong></td>
<td><strong>9th</strong> November</td>
<td><strong>900</strong></td>
<td><strong>17,520,000.00</strong></td>
<td><strong>Beneficiary</strong></td>
</tr>
</tbody>
</table>
### Post Implementation System Operation and Monitoring Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)

<table>
<thead>
<tr>
<th>Type of Sanitation Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brgy. Buan, Panglima, Sugala, Tawi-tawi (CREST)</td>
<td>Full</td>
<td>5-Jul-13</td>
<td>2,035</td>
<td>10,600.00</td>
<td>Meter</td>
<td>5° 10' 59.9988&quot;</td>
<td>120° 1' 0.0006&quot;</td>
</tr>
<tr>
<td>Brgy. Bandang and Kiutan, Talipao, Sulu (CREST)</td>
<td>Full</td>
<td>3-Jul-14</td>
<td>750</td>
<td>59,904.00</td>
<td>Meter</td>
<td>5° 55' 59.9988&quot;</td>
<td>121° 5' 59.9994&quot;</td>
</tr>
<tr>
<td>Inukadan Spring, Brgy. Paningayan, Culasi, Antique</td>
<td>Full</td>
<td>10-Oct-14</td>
<td>750</td>
<td>93,805.00</td>
<td>Meter</td>
<td>11° 25' 0.0012&quot;</td>
<td>122° 4' 0.0006&quot;</td>
</tr>
<tr>
<td>Purok Star Aple, Brgy. Kamingawan, Kabankalan City, Negros Occidental</td>
<td>Full</td>
<td>4-Sep-14</td>
<td>750</td>
<td>40,000.00</td>
<td>Meter</td>
<td>9° 52' 37.3434&quot;</td>
<td>122° 52' 6.0126&quot;</td>
</tr>
<tr>
<td>Sitio Balukanag, Brgy. Cabacungan, La Castellana, Negros Occidental</td>
<td>Full</td>
<td>3-Sep-14</td>
<td>750</td>
<td>40,000.00</td>
<td>Meter</td>
<td>10° 17' 33.219&quot;</td>
<td>123° 1' 28.7472&quot;</td>
</tr>
<tr>
<td>Sta. Elena and Hda. Esmeralda, Brgy. Katilingban, Talisay City, Negros Occidental</td>
<td>Full</td>
<td>12-Oct-14</td>
<td>545</td>
<td>94,000.00</td>
<td>Meter</td>
<td>10° 42' 2.1312&quot;</td>
<td>122° 58' 22.2852&quot;</td>
</tr>
<tr>
<td>Hda. Mandayao, Brgy. Mansalanao, La Castellana, Negros Occidental</td>
<td>Full</td>
<td>31-Oct-14</td>
<td>350</td>
<td>18,815.00</td>
<td>Meter</td>
<td>10° 21' 8.4774&quot;</td>
<td>123° 4' 23.718&quot;</td>
</tr>
<tr>
<td>Sitio Banate, Brgy. Macagahay, Moises Padilla, Negros Occidental</td>
<td>Full</td>
<td>31-Oct-14</td>
<td>325</td>
<td>16,834.00</td>
<td>Meter</td>
<td>10° 16' 0.0006&quot;</td>
<td>123° 4' 59.9982&quot;</td>
</tr>
<tr>
<td>Brgy. Butason II, Tabango, Leyte (CREST)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11° 19' 0.0012&quot;</td>
<td>124° 22' 0.0012&quot;</td>
</tr>
<tr>
<td>Brgy. Mahayahay, San Luis, Agusan del Sur (CREST)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8° 36' 18.6006&quot;</td>
<td>125° 55' 0.2604&quot;</td>
</tr>
<tr>
<td>Brgys. Tombo, Capiz, San Isidro of Alang-Alang, Leyte (CREST)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Candoni, Negros Occidental</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Describe Operations and Maintenance Plan (Briefly)**

Prior to the start of the project, our partner (either Earth Day Network Philippines, AIDFI), prepares the community by engaging a community development worker (CDW) for two months to help the community in setting up a community water management system such as a community water association. The CDW also assists the community in setting up an ecological management system.

During the installation of the system, two technicians from the community will be trained to ensure that there is someone to fix the system should there be any concern.

After the installation, a formal turnover will be held from EEDNP, AIDFI, and CCFPI to the community through a partnership agreement that includes mechanisms for sustainability and the commitment to sustain an ecological waste management system.

**Post-Completion System Operation and Monitoring Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Organization</th>
<th>Telephone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mona P. Pacheco</td>
<td>Program Officer - Environment</td>
<td>Coca-Cola Foundation Phils., Inc</td>
<td>(632) 8662120</td>
<td><a href="mailto:monina.pacheco@coca-cola.com.ph">monina.pacheco@coca-cola.com.ph</a></td>
</tr>
</tbody>
</table>

**Submission Details:**

Submitted by: Mona P. Pacheco
Date: 10/28/2014

**Comments (Please include anything else that should be known about this project)**

1) Plan is to install ram pump systems in 50 communities, on the average per year from 2014-2020, with an average yield of 15.5 ML/acre. 2) Exploring simple and affordable point-of-use water treatment technologies for ram pump communities with water quality issues. All sites completed in 2014 and 2013 were visited at least once this year. Only few sites completed prior to 2013 were visited. Of the sites that have been visited, 3 sites had decreased outflow from source.
### Template 3: Project Fact Sheet for Water Access and Sanitation Projects

**Date:**

**Project Code:**

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Community Water Connections and Health Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCC BU:</td>
<td>Central, Eastern and Western Africa</td>
</tr>
<tr>
<td>Name of Project Contact:</td>
<td>Sandra Azmy</td>
</tr>
<tr>
<td>Country:</td>
<td>Egypt</td>
</tr>
<tr>
<td>Total Cost of Project (including co-finance):</td>
<td>$803,588</td>
</tr>
<tr>
<td>Coca-Cola/Bill Cost Contribution:</td>
<td>$828,947</td>
</tr>
<tr>
<td>Coca-Cola Cost Share Percentage:</td>
<td>80%</td>
</tr>
</tbody>
</table>

#### Description:

The project extended the coverage of potable water and sanitation to households in rural upper Egypt and enhanced awareness about hygiene and the proper usage of sanitation facilities. A total of 1501 water connections were installed in 4 villages in the governorate of Beni Suef, and environmental awareness sessions were conducted for 4500 members of households and 6000 students. Capacity building was conducted with three Community Development Associations and 103 teachers. Training of trainers for 150 teachers from 100 schools was conducted on an environmental manual. Follow up water quality testing was done for three villages. To close out the environmental training done in schools, environmental activities and closing events were held in ten schools with a total of 3000 students.

**Major Activities**

- Protected Spring Box
- Rainwater Harvesting
- Community Water Treatment System
- Household Pump Systems

**Type of Water Access Infrastructure**

<table>
<thead>
<tr>
<th>Type of Water Access Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe connection to main water system</td>
<td>Full Access</td>
<td>13-May-12</td>
<td>7505</td>
<td>43561563.92</td>
</tr>
</tbody>
</table>

**Type of Sanitation Infrastructure**

<table>
<thead>
<tr>
<th>Type of Sanitation Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Implementation System Operation and Maintenance Plan**

Describe Operations and Maintenance Plan (Briefly)

**Comments**

Please provide any other comments that should be known about this project.

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Organization</th>
<th>Telephone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tara Verphee</td>
<td>Director, Water Development programs</td>
<td>GETF</td>
<td>703-379-2713</td>
<td><a href="mailto:tverphee@getf.org">tverphee@getf.org</a></td>
</tr>
</tbody>
</table>

**Submissions**

1. Yellow shaded cells require data input from you.
2. Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring catchment structures, rainwater harvesting, community water treatment systems and household pump systems.
3. “Full Access” means that the water source is available to beneficiaries less than 1 kilometer away from its place of use and that it is possible to reliably obtain at least 20 liters per member of a household per day. Examples include new boreholes installed in a village.

4. Limited Access” means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).

5. Please make sure it is perfectly clear whether the project has been implemented or is planned. If the project is being implemented in phases, please indicate which phases have already been implemented and which are planned. Maintain this distinction according to the statement of Replenish.

6. Certain projects, such as Community Education & Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.

**Quantification Method Choices:**

- For Water Access Projects, there are two choices for quantifying benefits:
  - Preferred: Annual Meter Reading indicating total flow through system for given year, or
  - b. Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1 km of the source, while not exceeding the population or the maximum flow rate of the system.

- For Sanitation Projects:
  - Absolute Description (Briefly): Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

- Post Implementation System Operation and Maintenance Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)

**Post Implementation System Operation and Maintenance Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations):**

CARE invested in building the capacities of local CDA and equipping the people, particularly children, with valuable and transferable knowledge on hygiene, the environment and health to ensure the sustainability of the project.
**Template 3: Project Fact Sheet for Water Access and Sanitation Projects**

<table>
<thead>
<tr>
<th>Date</th>
<th>Project Code:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Project Name:** Raising Healthy Children with Safe Household Water Supply and Sanitation

**TCC Group:** Eurasia-Africa

**TCC BU:** Central, Eastern and Western Africa

**Country:** Egypt

**Email:** dabousenna@unicef.org

**Total Cost of Project:** $723,816

**Sanitation**

**52%**

**Coca-Cola/Bottle Cost Contribution:** $373,816

**Coca-Cola System Contact Person:** Tara Varghese

**Phone:** 703-379-2713

**Coca-Cola Cost Share Percentage:**

**Project Description (Brief):** Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

**Sanitation Projects:**

For Limited Access Projects: Projects for benefit to be quantified, the project must be metered and the annual flow through volume recorded each year.

**Benefits are based on the volume of wastewater that is treated. Can be determined based on either the following:**

- Preferred: Annual meter reading indicating the total flow through system for given year, or
- Engineering design capacity of the system
- There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

**Annual Replenish Volume (Litters Per Year - with cost share):**

**Method of Estimating Benefits (Water or Engineering Design):**

**Latitude (Decimal Degrees):**

**Longitude (Decimal Degrees):**

**Phase Number**

**Description**

**Completed or In Development**

**Project is Being Completed in Phases, Please include Implementation Schedule.**

**Phase Completed A row in the below Table For Each Individual Water Access Point (only include access points installed and in operation):**

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sanitation System Installation:**

<table>
<thead>
<tr>
<th>Type of Sanitation Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Litters Per Year - with cost share)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full Access</td>
<td>Date: 31-Aug-13, Operational: 5825</td>
<td>Annual Replenish Volume (Litters Per Year)</td>
<td>Method of Estimating Benefits (Water or Engineering Design)</td>
<td>Latitude (Decimal Degrees)</td>
<td>Longitude (Decimal Degrees)</td>
<td></td>
</tr>
</tbody>
</table>

**Sanitation System Operation and Monitoring Plan (ensures the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations):**

**UNICEF ensured both institutional and financial sustainability of this project through increased institutional capacity for the management of the Revolving Fund (RF), establishment of the RF unit within the water companies to ensure alignment and ownership at governorate and national level, selecting members of the RF unit within Asuol water company in a way that made their roles and responsibilities in the RF unit in full harmony with their tasks made the company and facilitating an effective community-level coordination through the establishment of a CBC aiming at increasing consistency in the targeting of the RF for the most deprived households, and supporting the collection of fees in a timely manner for efficient revolving of funds.**

**Comments (Please include anything else that should be known about this project):**

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Organization</th>
<th>Telephone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tara Varghese</td>
<td>Director, Water and Development programs</td>
<td>GETF</td>
<td>703-379-2713</td>
<td><a href="mailto:tvarghese@getf.org">tvarghese@getf.org</a></td>
</tr>
</tbody>
</table>

**Date:** 7-Oct-13
## Template 3: Project Fact Sheet for Water Access and Sanitation Projects

### Project Name:
Amhara Community Water Supply, Sanitation, and Hygiene Project

#### TCC Group:
- **Central, Eastern and Western Africa**
- **Ethiopia**

#### Type of Project:
- **Water Access**
- **Sanitation**
- **Community Education, Training & Awareness**

### Project Details:
- **Number of Direct Beneficiaries:** [GETF]
- **Organization Contact:** Sandra Vasenda
  - **Phone:** 20 l/d/person
  - **Email:** sandra.vasenda@mwawater.org
- **Access Level:** Full Access
- **Date Installed and Operational:** 30-Apr-09
- **Comments:** Trained on leadership, record-keeping, site management, cost recovery, and financial management systems. Community members were also supported to assume responsibility for the project early on in the process and own completely when it is completed.

### Project Financial Information:
- **Coca-Cola/Bottle Cost Contribution:** $348,223
  - **Coca-Cola System Contact Person:** Tara Varghese
    - **Coca-Cola Cost Share Percentage:** 40%
    - **Coca-Cola/Bottler Cost Share Percentage:** 60%
  - **Organization Telephone:** 703-379-2713
  - **Organization Email:** tara.varghese@gfel.org

### Project Partners:
- **Alliance – World Vision, Food for the Hungry, and Catholic Relief Services**
  - Provided education and training necessary for residents to operate and maintain these systems in a sustainable manner and ensure ongoing health benefits to communities.

### Project Implementation:
- **Post Implementation System Operation and Monitoring Plan:**
  - Summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations.

### Quantification Method Choices:
- **For Sanitation Projects:**
  - **Total Number of Sanitation Systems Installed and Operational:** 74
    - **Method of Estimating Benefits:**
      - (Meter or Engineering Design)
      - [Check All That Apply]:
        - **Annual Replenish Volume:** (Liters Per Year - with cost share)
        - **Method of Estimating Benefits:** (Water or Engineering Design)
        - **Latitude (Decimal Degrees):**
        - **Longitude (Decimal Degrees):**
    - **Benefits are calculated for the volume of wastewater that is treated.**
      - Can be determined based on either of the following:
        - Preferred: Annual meter reading indicating total flow through system for given year, or
        - For Limited Access projects: For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

### Project Details:
- **Type of Project:**
  - **Water Access Projects:**
    - **Method of Estimating Benefits:**
      - [Check All That Apply]:
        - Preferred: Annual meter reading indicating total flow through system for given year, or
        - Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

### Project Implementation:
- **Number of Sanitation Systems Installed and Operational:** 74
  - **Method of Estimating Benefits:**
    - [Check All That Apply]:
      - **Annual Replenish Volume:** (Liters Per Year - with cost share)
      - **Method of Estimating Benefits:** (Water or Engineering Design)
      - **Latitude (Decimal Degrees):**
      - **Longitude (Decimal Degrees):**
  - **Benefits are calculated for the volume of wastewater that is treated.**
    - Can be determined based on either of the following:
      - Preferred: Annual meter reading indicating total flow through system for given year, or
      - For Limited Access projects: For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

### Project Contact:
- **Name:** Tara Varghese
  - **Phone:** 703-379-2713
  - **Email:** tara.varghese@gfel.org

---

**Comments:** (Please include anything else that should be known about this project)
### Template 3: Project Fact Sheet for Water Access and Sanitation Projects

<table>
<thead>
<tr>
<th>Date</th>
<th>Project Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Project Name: Water Supply and Sanitation Project in Textile, Greater Accra

- **Type of Project:** Water Access
- **Organization:** WaterHealth Centers
- **Country:** Ghana
- **Major Activities:** Treatment and Distribution

#### Details:

- **Name of Project Contact:** Naabia Ofosu-Amaah
- **Organization:** Coca-Cola Equatorial Africa Franchise
- **Phone:** (+233) 0263.91.66.17
- **Email:** coca-cola@equatorialafrica.com

#### Comments (Please include anything else that should be known about this project):

- Provide behavior change communication activities in seven communities throughout Ghana.
- Improve access to sanitation facilities for over 12,000 people in schools and communities (1,848 people with household latrines, 3,266 students with K-VIP school latrines, and 8,250 students with biogas sanitation facilities in schools).
- Provide behavior change communication activities in seven communities throughout Ghana.

#### Method of Estimating Benefits

- **(Meter or Engineering Design)**
- **(Liters Per Year - with cost share)**

#### Water Health Center (Tapabotoase)

- **Type:** Water Access
- **Access Type:** Full Access
- **Location:** Textile, Greater Accra
- **Water Source:** Protected Spring
- **Affordable Cost:** $1,801,036
- **Number of Direct Beneficiaries:** 16,000

#### Sanitation

- **Construction of five WaterHealth Centres with two vantage points in each community to provide sustainable access to safe drinking water for the residents.**
- **2 - WASH Training and Household/Institutional Latrines:**
- **3 - Biogas Sanitation Facilities:**

#### Post Implementation System Operation and Monitoring Plan

- **(Check All That Apply):**
  - Water Quality Monitoring
  - Maintenance and Repair
  - Community Engagement

#### List All Partners and Identify A Contact Person:

- **Partner Organization:** TCC Group
- **Organization:** Coca-Cola Equatorial Africa Franchise
- **Phone:** (+233) 0263.91.66.17
- **Email:** smithal@waterhealth.com

#### WaterHealth Center (Nsakina)

- **Type of Water Access Infrastructure:** Protected Spring Box
- **Latitude:** 8.000
- **Longitude:** 9.250
- **Access Type:** Full Access
- **Location:** Textile, Greater Accra
- **Water Source:** Protected Spring

#### Additional Information:

- **Number of Direct Beneficiaries:** 16,000
- **Water Access Projects:**
  - For Full Access projects, there are two choices for quantifying benefits:
    - A. Preferred: Annual Meter Reading indicating total flow through system for given year.
    - B. Engineering design capacity of the system
- **Sanitation Projects:**
  - For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

#### Coca-Cola Cost Share Percentage:

- **Coca-Cola/Bottler Cost Contribution:** $818,266
- **Total Cost of Project:** $1,801,036

#### Project Description (brief): Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

- **Type of Water Access Infrastructure:** Protected Spring Box
- **Location:** Textile, Greater Accra
- **Water Source:** Protected Spring

#### For Water Access Projects:

- **Access Level (Full or Limited):**
  - WaterHealth Center (Tapabotoase): Full Access
  - WaterHealth Center (Nsakina): Full Access

#### For Sanitation Projects:

- **Number of Direct Beneficiaries:** 16,000
- **Sanitation Projects:**
  - For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.
**Project Name:** Trans-boundary Community Water Management

**Type of Project:** Water Access

**Organization:** GETF

**Phone:** 703-379-2713

**Email:** tvarghese@getf.org

**Country:** Ghana and Ivory Coast

**Major Activities:**
- Protected spring box
- Rainwater harvesting
- Community water treatment system
- Household pump systems

**Number of Direct Beneficiaries:** 70

**Access Level:**
- Limited Access
- Full Access

**Date Installed and Operational:** 5-Nov-14

**Total Cost of Project:** $662,140

**Coca-Cola/Bottle Cost Contribution:** $254,357

**Coca-Cola Cost Share Percentage:** 38%

**Name:** Tara Varghese

**Organization:** The Coca-Cola Company

**Phone:** 703-379-2713

**Email:** tvarghese@getf.org

---

**Project Description:** The project aimed to improve watershed management, construct water supply and sanitation infrastructure, capacity building for sustainability, and conflict prevention activities in the Trans-boundary Tano River basin. The project included:

- Water access projects: accomplished through various means, including well construction/rehabilitation, protected spring catchment structures, rainwater harvesting, community water treatment systems, and household pump systems.
- Sanitation projects: focused on constructing waterless toilets and VIP latrines.

**Method of Estimating Benefits:**
- Annual meter reading
- Total flow through volume recorded each year

**Quantification Method Choices:**
- Preferred: Annual meter reading indicating total flow through system for given year, or
- Applying the World Health Organization and UNICEF Joint Monitoring Programme's 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

**Completed or In Development:**
- Completed

**Comments (please include anything else that should be known about this project):**
- The project has not been completed or is planned. Maintain this distinction regarding the statement of Replenish benefits.
- Certain projects, such as Community Education & Awareness, are important local projects, but do not contribute quantifiable Replenish benefits.

---

**Post Implementation System Operation and Monitoring Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations):**

- The project has been linked to all the District Assembly's water and sanitation departments to ensure the provision of technical assistance to the communities for maintenance of the project. The committees have also opened bank accounts where income generated from water infrastructure through community levies is being saved for maintenance of the project.
### Project Fact Sheet for Water Access and Sanitation Projects

<table>
<thead>
<tr>
<th><strong>Template 3: Project Fact Sheet for Water Access and Sanitation Projects</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date:</strong></td>
</tr>
<tr>
<td><strong>Project Name:</strong></td>
</tr>
<tr>
<td><strong>Region:</strong></td>
</tr>
<tr>
<td><strong>Type of Project:</strong></td>
</tr>
<tr>
<td><strong>Contact Person:</strong></td>
</tr>
<tr>
<td><strong>Country:</strong></td>
</tr>
<tr>
<td><strong>Name of Project Contact:</strong></td>
</tr>
<tr>
<td><strong>Total Cost of Project (including co-finance):</strong></td>
</tr>
</tbody>
</table>

**Access Level and Benefit Sharing:**
- **Access Level:** Full or Limited
- **Benefit Sharing:** 100%

**Type of Water Access Infrastructure:**

<table>
<thead>
<tr>
<th><strong>Access Level</strong></th>
<th><strong>Date Installed and Operational</strong></th>
<th><strong>Number of Direct Beneficiaries</strong></th>
<th><strong>Annual Replenish Volume (Liters Per Year - with cost share)</strong></th>
<th><strong>Method of Estimating Benefits (Water or Engineering Design)</strong></th>
<th><strong>Latitude (Decimal Degrees)</strong></th>
<th><strong>Longitude (Decimal Degrees)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Limited</td>
<td>Feb-11</td>
<td>3,250</td>
<td>237/2500 WHO 20 lit per person</td>
<td>WHO 20 lit per person</td>
<td>5.794586111</td>
<td>-0.487368858</td>
</tr>
<tr>
<td>Full Limited</td>
<td>Jun-12</td>
<td>3,250</td>
<td>237/2500 WHO 20 lit per person</td>
<td>WHO 20 lit per person</td>
<td>5.198666667</td>
<td>-0.129166666</td>
</tr>
<tr>
<td>Full Limited</td>
<td>Mar-12</td>
<td>3,250</td>
<td>237/2500 WHO 20 lit per person</td>
<td>WHO 20 lit per person</td>
<td>7.031994444</td>
<td>-3.986394444</td>
</tr>
<tr>
<td>Full Limited</td>
<td>Feb-11</td>
<td>3,250</td>
<td>237/2500 WHO 20 lit per person</td>
<td>WHO 20 lit per person</td>
<td>9.939999999</td>
<td>-8.977999999</td>
</tr>
<tr>
<td>Full Limited</td>
<td>Jun-12</td>
<td>3,250</td>
<td>237/2500 WHO 20 lit per person</td>
<td>WHO 20 lit per person</td>
<td>8.312555555</td>
<td>4.158555555</td>
</tr>
<tr>
<td>Full Limited</td>
<td>Aug-14</td>
<td>3,250</td>
<td>237/2500 WHO 20 lit per person</td>
<td>WHO 20 lit per person</td>
<td>7.089999999</td>
<td>-4.170888888</td>
</tr>
</tbody>
</table>

**Type of Sanitation Infrastructure:**

<table>
<thead>
<tr>
<th><strong>Access Level</strong></th>
<th><strong>Date Installed and Operational</strong></th>
<th><strong>Number of Direct Beneficiaries</strong></th>
<th><strong>Annual Replenish Volume (Liters Per Year)</strong></th>
<th><strong>Method of Estimating Benefits (Water or Engineering Design)</strong></th>
<th><strong>Latitude (Decimal Degrees)</strong></th>
<th><strong>Longitude (Decimal Degrees)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Limited</td>
<td>Feb-11</td>
<td>3,250</td>
<td>237/2500 WHO 20 lit per person</td>
<td>WHO 20 lit per person</td>
<td>5.794586111</td>
<td>-0.487368858</td>
</tr>
<tr>
<td>Full Limited</td>
<td>Jun-12</td>
<td>3,250</td>
<td>237/2500 WHO 20 lit per person</td>
<td>WHO 20 lit per person</td>
<td>5.198666667</td>
<td>-0.129166666</td>
</tr>
<tr>
<td>Full Limited</td>
<td>Mar-12</td>
<td>3,250</td>
<td>237/2500 WHO 20 lit per person</td>
<td>WHO 20 lit per person</td>
<td>7.031994444</td>
<td>-3.986394444</td>
</tr>
<tr>
<td>Full Limited</td>
<td>Feb-11</td>
<td>3,250</td>
<td>237/2500 WHO 20 lit per person</td>
<td>WHO 20 lit per person</td>
<td>9.939999999</td>
<td>-8.977999999</td>
</tr>
<tr>
<td>Full Limited</td>
<td>Jun-12</td>
<td>3,250</td>
<td>237/2500 WHO 20 lit per person</td>
<td>WHO 20 lit per person</td>
<td>8.312555555</td>
<td>4.158555555</td>
</tr>
<tr>
<td>Full Limited</td>
<td>Aug-14</td>
<td>3,250</td>
<td>237/2500 WHO 20 lit per person</td>
<td>WHO 20 lit per person</td>
<td>7.089999999</td>
<td>-4.170888888</td>
</tr>
</tbody>
</table>

**Comments:**

*Please include anything else that should be known about this project.*

**Submitted by:**
- **Name:** Ama Bawuah
- **Title:** President
- **Organization:** GETF
- **Phone:** (703) 379-2713
- **Email:** abawuah@coca-cola.com

**Note:**
- This includes all Coca-Cola Company and Bottler funding contributions (including Company and Bottler Foundations).
- Maintain this distinction regarding the statement of Replenish benefits.
**Template 3: Project Fact Sheet for Water Access and Sanitation Projects**

**Project Name:** Safe Water in Kenya

**Country:** Kenya

**Type of Project:** Shallow Well Construction/Rehabilitation

**Sanitation Activities:**
- Safe water provision
- Community education, training, and awareness

**Coca-Cola/Bottle Cost Contribution:** $100,000

**Coca-Cola Cost Share Percentage:** 2%

**Number of Direct Beneficiaries:** 119,841

**Total Cost of Project (including co-finance):** $3,054,440

**Total Number of Shallow Wells:** 21

**Date Implemented:** 2-Dec-14

**Name:** Subu Athirasala
**Contact Person:** Naabia.Ofosu-Amaah
**Email:** Naabia.Ofosu-Amaah@getf.org
**Phone:** 703 379 4647-293

**Date Implementation will be Complete:** 2-Dec-14

**Project Contact Person:** Naabia.Ofosu-Amaah
**Email:** Naabia.Ofosu-Amaah@getf.org

**Country:** Kenya
**Region:** Central, Easter, Western Africa

**Partner Organization:** World Vision

**Title:** President
**Organization:** Global Environment and Community Education, Training & Awareness
**Phone:** 703 379 4647-293
**Email:** Naabia.Ofosu-Amaah@getf.org

**Date:** 2-Dec-14

---

**Quantification Method Choices:**

**For Water Access Projects:**
- There are two choices for quantifying benefits:
  - Preferred: Annual meter reading indicating total flow through system for given year;
  - Alternative: Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking, and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

**For Sanitation Projects:**
- There are two choices for quantifying benefits:
  - Preferred: Annual meter reading indicating total flow through system for given year;
  - Alternative: The engineering design capacity of the system

**Guidance:**

- Yellow shaded cells require data input from you.
- Water access projects are accomplished through a variety of means, including well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment systems, and household pumps systems.
- Full Access means that the water source is available to beneficiaries less than 1 kilometer away from their place of use and that it is possible to reliably obtain at least 20 liters per person per day. Examples include new boreholes installed in a village.
- Limited Access means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).
- Please make sure it is perfectly clear whether the project has been implemented or is planned. If the project is being implemented in phases, please indicate which phases have already been implemented and which are planned. Maintain this distinction regarding the statement of Replenish benefits.
- Certain projects, such as Community Education & Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.

**For All Partners and Community Benefits:**

- Please provide a brief project description indicating the type of water access being provided and describe the community benefiting from the project.

**Water Access Data:**

- Twenty one shallow wells were drilled to provide full water access to 41,849 direct beneficiaries in Kenya.

**Sanitation Infrastructure:**

- For Sanitation Projects, there are two choices for quantifying benefits:
  - Preferred: Annual meter reading indicating total flow through system for given year;
  - Alternative: The engineering design capacity of the system

**Other (Please Describe):**

- Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:
  - Preferred: Annual meter reading indicating total flow through system for given year;
  - Alternative: The engineering design capacity of the system

**Notes:**

- There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

---

**Comments:**

- The water-users association and community-health workers were trained to be in charge of operations and maintenance of the project post-implementation.

---

**Submit By:**

- Name: Naabia Ofosu-Amaah
- Title: President
- Organization: Global Environment and Technology Foundation
- Date: 2-Dec-14

---

**Technology Foundation:**

- Coca-Cola System Contact Person: Subu Athirasala
- Email: Naabia.Ofosu-Amaah@getf.org
- Phone: 703 379 4647-293

---

**Notes:**

- This includes all Coca-Cola Company and Bottler funding contributions (including Company and Bottler Foundations)
## Water Access and Sanitation Projects

### Date:

**Template 3: Project Fact Sheet for Water Access and Sanitation Projects**

<table>
<thead>
<tr>
<th>Date of Installation</th>
<th>Operational</th>
<th>Name</th>
<th>Organization</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-Oct-10</td>
<td></td>
<td>Tara Varghese</td>
<td>The Coca-Cola Company</td>
<td>203-379-2713</td>
<td><a href="mailto:tvarghese@usaid.gov">tvarghese@usaid.gov</a></td>
</tr>
<tr>
<td>1-Nov-10</td>
<td></td>
<td>Subu Athirasala</td>
<td>The Coca-Cola Company</td>
<td>203-379-2713</td>
<td><a href="mailto:sa@tcc.com">sa@tcc.com</a></td>
</tr>
<tr>
<td>1-Nov-10</td>
<td></td>
<td>Harrigan Mukhongo</td>
<td>The Coca-Cola Company</td>
<td>203-379-2713</td>
<td><a href="mailto:hmukhongo@usaid.gov">hmukhongo@usaid.gov</a></td>
</tr>
</tbody>
</table>

### Description

This project increased community access to improved water supply and sanitation facilities, improved the capacity of community institutions to protect water catchments, and promoted improved health and hygiene behaviors.

### Project Description (Brief)

Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project:

1. **Full Access** means that the water source is available to beneficiaries less than 1 kilometer away from their home or place of work, and that it is available for use 24 hours per day, 365 days per year.
2. **Limited Access** means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example, clean water in schools or in hospitals).
3. **Remote Access** means that the beneficiaries obtain water for consumption from sources that are more than 1 kilometer away.
4. **Limited Access** means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example, clean water in schools or in hospitals).
5. **Full Access** means that the water source or sanitation solution is available to beneficiaries for 24 hours per day, 365 days per year.
6. **Remote Access** means that the beneficiaries obtain water for consumption from sources that are more than 1 kilometer away.
7. **Limited Access** means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example, clean water in schools or in hospitals).

### Access Level

- **Full Access**
- **Limited Access**
- **Remote Access**

### Method of Estimating Benefits

- **Quantification Method Choices:**
  - 1. Yellow shaded cells require data input from you.
  - 2. Water access projects are accomplished through a variety of means, including well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pumps systems.
  - 3. "Limited Access" for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from their home or place of work, and that it is available for use 24 hours per day, 365 days per year.
  - 4. "Full Access" for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from their home or place of work, and that it is available for use 24 hours per day, 365 days per year.
  - 5. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable benefits.
  - 6. Projects are accomplished through a variety of means, including well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pumps systems.
  - 7. Projects are accomplished through a variety of means, including well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pumps systems.

### Benefits

Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:

- **Method of Estimating Benefits:**
  - a. Preferred: Annual meter reading indicating the total flow through the system for a given year.
  - b. The engineering design capacity of the system.
  - c. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable benefits.

### Implementation Schedule

For Sanitation Projects:

- **Implementation Schedule:**
  - a. Preferred: Annual meter reading indicating the total flow through the system for a given year.
  - b. The engineering design capacity of the system.
  - c. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable benefits.

### Notes

**Notes (Please include anything else that should be known about this project):**

- This project increased community access to improved water supply and sanitation facilities, improved the capacity of community institutions to protect water catchments, and promoted improved health and hygiene behaviors.

### Water Access Projects

For Water Access projects, there are two choices for quantifying benefits:

- **Quantification Method Choices:**
  - a. Preferred: Annual meter reading indicating the total flow through the system for a given year.
  - b. Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

### Completion Schedule

For Sanitation Projects:

- **Completion Schedule:**
  - a. Preferred: Annual meter reading indicating the total flow through the system for a given year.
  - b. The engineering design capacity of the system.
  - c. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable benefits.

### Contact Information

- **Coca-Cola System Contact Person:** Tara Varghese
- **Coca-Cola Cost Share Percentage:** 68%
- **Coca-Cola/Bottler Cost Contribution:** $325,229
- **Coca-Cola/Bottler Cost Share Percentage:** 68%
- **Coca-Cola/Bottler Cost Contribution:** $220,982
- **Coca-Cola/Bottler Cost Share Percentage:** 68%
- **Coca-Cola/Bottler Cost Contribution:** $325,229

### List All Partners and Identify a Contact Person:

- **List All Partners and Identify a Contact Person:**
  - TCC BU: Central, Eastern and Western Africa
  - Country: Kenya
  - TCC Group: Sanitation
  - TCC BU: Central, Eastern and Western Africa
  - Name of Project Contact: Joanne Trotter
  - Total Cost of Project (Including co-finance): $68,000
  - Coca-Cola/Bottler Cost Contribution: $220,982

### Access Level

- **Access Level:**
  - Full Access
  - Limited Access
  - Remote Access

### Sanitation Systems Installed and Operational

- **Sanitation Systems Installed and Operational:**
  - Total Number of Sanitation Systems Installed and Operational: 33

### Water Access Points Installed and Operational

- **Water Access Points Installed and Operational:**
  - Total Number of Water Access Points Installed and Operational: 41

### Project Fact Sheet for Water Access and Sanitation Projects

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Post Implementation System Operation and Monitoring Plan (Please provide a brief plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)

**Post Implementation System Operation and Monitoring Plan (briefly):**

Describe Operations and Maintenance Plan (briefly)

**Describe Operations and Maintenance Plan (briefly):**

In order to sustain activities over time, all projects must be designed alongside the government and communities in order to develop local ownership of the activities and strengthen the capacity of local entities. The WADA-Mombasa team trained the ministry of public health staff on the CLTS approaches and established community institutions and trained advocates for health and hygiene to lead sanitation and behavior change within their communities.

### Comments

**Comments (Please include anything else that should be known about this project):**

Please provide a brief description of the project and the community benefiting from the project:

**Comments (Please include anything else that should be known about this project):**

This project increased community access to improved water supply and sanitation facilities, improved the capacity of community institutions to protect water catchments, and promoted improved health and hygiene behaviors.
**Template 3: Project Fact Sheet for Water Access and Sanitation Projects**

**Date:** ____________

**Project Code:** ____________

**Project Name:** Mara River Basin Water & Development Alliance

**TCC Group:** East Africa

**TCC BU:** Central, East and West Africa

**Country:** Kenya

**Name of Project Contact:** Michael McClain

**Total Cost of Project (including co-funding):** $414,511

**Coca-Cola/Bottle Cost Contribution:** $248,124

**Coca-Cola Cost Share Percentage:** 59%

**Community Education, Training & Awareness**

**Number of Direct Beneficiaries:**
- **Full Access:** 3772
- **Limited Access:** 31

**WHO 20 l/d/person**

- **Full Access:** 31-Aug-10
- **Limited Access:** 31-Aug-10

**Sanitation Systems Installed and Operational:**
- **Total Number:** 8704

**Construction/Rehabilitation**
- **Type of Project:** Well Construction/Rehabilitation

**Sanitation**
- **Type of Sanitation Infrastructure:** Latrine Installation

**Water Access**
- **Type of Water Access Infrastructure:** Masonry water tanks and spring protection

**Access Level:**
- **Full Access**
- **Limited Access**

**Date Installed and Operational:**
- **Full Access:** 31-Aug-10
- **Limited Access:** 31-Aug-10

**Number of Direct Beneficiaries:**
- **Full Access:** 8704

**Annual Replenish Volume (Liters Per Year):**
- **Full Access:** 3772975.54

**Method of Estimating Benefits (Meter or Engineering Design):** WHO 20 litres/person

**Latitude (Decimal Degrees):**
- **Full Access:** 3772

**Longitude (Decimal Degrees):**
- **Full Access:** 31-Aug-10

**WHO 20 litres/person**

**Latitude (Decimal Degrees):**
- **Full Access:** 3772

**Longitude (Decimal Degrees):**
- **Full Access:** 31-Aug-10

**Method of Estimating Benefits (Meter or Engineering Design):** WHO 20 litres/person

**Type of Water Access Infrastructure:**
- **Type:** Masonry water tanks and spring protection

**Date Installed and Operational:**
- **Full Access:** 31-Aug-10

**Number of Direct Beneficiaries:**
- **Full Access:** 8704

**Annual Replenish Volume (Liters Per Year):**
- **Full Access:** 3772975.54

**Method of Estimating Benefits (Meter or Engineering Design):** WHO 20 litres/person

**Latitude (Decimal Degrees):**
- **Full Access:** 3772

**Longitude (Decimal Degrees):**
- **Full Access:** 31-Aug-10

**Method of Estimating Benefits (Meter or Engineering Design):** WHO 20 litres/person

**Type of Sanitation Infrastructure:**
- **Type:** Latrine Installation

**Date Installed and Operational:**
- **Full Access:** 31-Aug-10

**Number of Direct Beneficiaries:**
- **Full Access:** 8704

**Annual Replenish Volume (Liters Per Year):**
- **Full Access:** 3772975.54

**Method of Estimating Benefits (Water or Engineering Design):** WHO 20 litres/person

**Latitude (Decimal Degrees):**
- **Full Access:** 3772

**Longitude (Decimal Degrees):**
- **Full Access:** 31-Aug-10

**Method of Estimating Benefits (Water or Engineering Design):** WHO 20 litres/person

**Post Implementation System Operation and Maintenance Plan:**

- The community spring management committees were trained and vetted with the responsibility to manage and ensure proper operations and maintenance of water scheme. The location of the project within the operations area of the Mara River water resource users association provides on-site guidance to the community.

**Comments (Please include anything else that should be known about this project):**

- Improved access to water through construction of masonry water tanks and spring protection, cattle trough construction, rainwater harvesting, community water treatment system and household pumps systems.
- The community spring management committees were trained and vetted with the responsibility to manage and ensure proper operations and maintenance of water scheme.
- The project also provided an up-front testing for implementation of a Mara Basin credit initiative.
- The community spring management committees were trained and vetted with the responsibility to manage and ensure proper operations and maintenance of water scheme.
- The location of the project within the operations area of the Mara River water resource users association provides on-site guidance to the community.

**Notes:**
- This includes all Coca-Cola Company and Bottle funding contributions (including Company and Bottle Foundations).
- Please indicate which phases have already been implemented and which are planned. Maintain this distinction regarding the statement of Replenish benefits.
- Certain projects, such as Community Education & Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.

**Project Description (brief):**

- Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

**Water Access Projects:**

- **For Water Access projects, there are two choices for quantifying benefits:**
  - a. Preferred: Annual Meter Reading indicating total flow through system for given year.
  - b. Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 l/d/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

**Sanitation Projects:**

- **Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:**
  - a. Preferred: Annual meter reading indicating the total flow through the system for a given year.
  - b. Method of Estimating Benefits (Water or Engineering Design)
  - c. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

**Annual Replenish Volume (Liters Per Year):**

- **Full Access:** 3772975.54

**Method of Estimating Benefits (Water or Engineering Design):**

- **Full Access:** WHO 20 litres/person

**Latitude (Decimal Degrees):**

- **Full Access:** 3772

**Longitude (Decimal Degrees):**

- **Full Access:** 31-Aug-10

**Method of Estimating Benefits (Water or Engineering Design):**

- **Full Access:** WHO 20 litres/person

**Type of Water Access Infrastructure:**

- **Type:** Masonry water tanks and spring protection

**Date Installed and Operational:**

- **Full Access:** 31-Aug-10

**Number of Direct Beneficiaries:**

- **Full Access:** 8704

**Annual Replenish Volume (Liters Per Year):**

- **Full Access:** 3772975.54

**Method of Estimating Benefits (Water or Engineering Design):**

- **Full Access:** WHO 20 litres/person

**Latitude (Decimal Degrees):**

- **Full Access:** 3772

**Longitude (Decimal Degrees):**

- **Full Access:** 31-Aug-10

**Method of Estimating Benefits (Water or Engineering Design):**

- **Full Access:** WHO 20 litres/person

**Type of Sanitation Infrastructure:**

- **Type:** Latrine Installation

**Date Installed and Operational:**

- **Full Access:** 31-Aug-10

**Number of Direct Beneficiaries:**

- **Full Access:** 8704

**Annual Replenish Volume (Liters Per Year):**

- **Full Access:** 3772975.54

**Method of Estimating Benefits (Water or Engineering Design):**

- **Full Access:** WHO 20 litres/person

**Latitude (Decimal Degrees):**

- **Full Access:** 3772

**Longitude (Decimal Degrees):**

- **Full Access:** 31-Aug-10

**Method of Estimating Benefits (Water or Engineering Design):**

- **Full Access:** WHO 20 litres/person
The project will establish water treatment, storage and distribution networks in Naivasha's peri-urban settlements. 21 water kiosks will be installed. The project will also rehabilitate boreholes, increasing the area's water supply and expand access to clean water. 2,735 sanitation systems will be installed. The project will also rehabilitate boreholes, increasing the area's water supply and expand access to clean water. 2,735 sanitation systems will be installed.

In 2012, the project was completed in phases. The project is on track to close by the end of November 2014.

The project implemented or planned to implement the following:

- Naivawass: continue to oversee delegated management contracts and quality of services in liaison with the WUAs.
- Rift Valley Water Services Board (RVWSB): (i) ensure pro-poor services are part of the key performance indicators for water operators and Naivawass; (ii) retain ownership of the water service assets constructed under the project (not including the boreholes provided under the project.)
- Water User Associations (WUAs): continue to meet with borehole owners, small local water operators, kiosk operators and Naivawass to feedback on water service provision issues, thus providing an effective accountability mechanism.

Key stakeholders responsible for ensuring sustainability, operations and maintenance of water access systems and their respective roles post-implementation are listed below:

- Water User Associations (WUAs): to continue to oversee delegated management contracts and quality of services in liaison with the WUAs.
- School teachers: to continue to promote hand washing with soap at critical times in supporting school health clubs to remain active.

For Water Access Projects:

- Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:
  - Annual meter reading indicating the total flow through the system for a given year,
  - Using a measurement technique to estimate the flow through the system using the system's capacity and how much the system was used.

- If the project is being completed in phases, please indicate the implementation schedule.

- The project is on track to close by the end of November 2014.
WaterHealth manages the facility after construction and installation for a period of 10 years. WaterHealth ensures the technical soundness of the water treatment plant by maintaining the equipment, regular water quality testing, and technical training for operators and maintenance staff. Costs associated with spare parts and operation and maintenance are covered by revenues collected from water charged to consumers. The WaterHealth centers charge an affordable fee for access to clean water, which is consistent with local customs and realities, and provides employment opportunities for community members who are trained to operate the systems and maintain the equipment.

To summarize, WaterHealth International, in partnership with Coca-Cola, constructed seven WaterHealth Centers in Liberia to provide sustainable access to safe drinking water for the community. The construction of these centers entailed the design, planning, and installation of water treatment facilities, as well as the provision of training for operators and maintenance staff. The success of these projects was indicated by the significant reduction in waterborne disease cases in the communities where the centers were installed. The centers are designed to ensure that no additional funding is required to sustain the business, thus ensuring long-term access to clean water for the residents.
### Template 3: Project Fact Sheet for Water Access and Sanitation Projects

**Date:**

**Project Code:**

<table>
<thead>
<tr>
<th>Project Name: Potable Water Supply and Efficient Small-Scale Agriculture (WADA)</th>
</tr>
</thead>
</table>

**Project Description (brief):** Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

- **For Sanitation projects:** Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:
  - Preferred: Annual meter reading indicating the total flow through the system for a given year, or
  - Applying the World Health Organization and UNICEF Joint Monitoring Programme's 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

- **For Water Access Projects:** Benefits can be quantified, the project must be metered and the annual flow through volume recorded each year.

**Coca-Cola/Cost Share Percentage:**

**Coca-Cola/Bottler Cost Contribution:** $350,000

**Total Cost of Project:** $200,000

**Number of Direct Beneficiaries:** 850

**Phase Number**

<table>
<thead>
<tr>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
</table>

**If Project is Being Completed in Phases, Please Indicate Implementation Schedule:**

**Name of Project Contact:**

- **Fiona James**
- **Omar Bennis**
- **Mustapha El Hamzaoui**
- **Tara Varghese**

**Organization**

- **The Coca-Cola Company - Morocco**
- **CARE International Morocco**

**Country:** Morocco

**TCC BU:** Central, Easter and Western Africa

**TCC Group:** Coca-Cola System

**Major Activities:**

- New water connections
- Protected Spring Box
- Rainwater harvesting
- Community water treatment system
- Household pump systems

**Country**

- Morocco

**Major Activities**

- New water connections
- Protected Spring Box
- Rainwater harvesting
- Community water treatment system
- Household pump systems

**Method of Estimating Benefits**

- For Sanitation projects: Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:
  - Preferred: Annual meter reading indicating the total flow through the system for a given year, or
  - Applying the World Health Organization and UNICEF Joint Monitoring Programme's 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

- For Water Access Projects: Benefits can be quantified, the project must be metered and the annual flow through volume recorded each year.

**Completed or In Development**

- Full Access
- Limited Access
- Not Applicable

**Submit by:** Tara Varghese

**Date:** 31-May-11

**California:**

<table>
<thead>
<tr>
<th>Number</th>
<th>Date</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>850</td>
<td>31-May-11</td>
<td>WHO 20 l/d/person</td>
</tr>
</tbody>
</table>

**Coca-Cola/Cost Share Percentage:**

- 50%

**Total Number of Sanitation Systems Installed and Operational:**

- 31-May-11

**Total Number of Water Access Points Installed and Operational:**

- 31-May-11

**Annual Replenish Volume (Liters Per Year - with cost share):**

- 3102500

**Method of Estimating Benefits (Water or Engineering Design):**

- Water Treatment System

**Latitude (Decimal Degrees):**

- WHO 20 l/dperson

**Longitude (Decimal Degrees):**

- Water Treatment System

**Name**

- Tara Varghese

**Organization**

- CARE International Morocco

**Phone**

- 703-379-2713

**Email**

- tvarghese@caremaroc.org

**Comments (Please Include anything else that should be known about this project):**

- CARE’s approach through beneficiary participation and local government participation will ensure sustainability of the systems that will have been put into place. There was adequate capacity building and training of the local partners and committees to ensure continuity of the project activities.

- Distribution networks were constructed in several villages. In order to meet the goal of providing 20 liters per person per day, new boreholes were installed in several villages. The local government and the community were involved in the planning and implementation of the project, ensuring the sustainability of the systems over time.

- The local government and the community were involved in the planning and implementation of the project, ensuring the sustainability of the systems over time. The project increased access to improved potable water supply sources and sanitation facilities for vulnerable rural populations and improved water use practices by small farmers to enhance livelihoods and ensure environmental sustainability.
### Project Fact Sheet for Water Access and Sanitation Projects

**Template 3: Project Fact Sheet for Water Access and Sanitation Projects**

**Date:** 10/27/2014

<table>
<thead>
<tr>
<th><strong>Project Name:</strong> Strengthening Communities Through Integrated WASH Activities</th>
<th><strong>Coca-Cola/Bottle Cost Contribution:</strong> $997,067</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country:</strong> Central, Eastern and Western Africa</td>
<td><strong>Name of Project Contact:</strong> Kyle Sucher</td>
</tr>
<tr>
<td><strong>Number of Direct Beneficiaries:</strong> 1,997,067</td>
<td><strong>Organization:</strong> GETF</td>
</tr>
<tr>
<td><strong>Total Cost of Project (including in-country):</strong> $1,997,067</td>
<td><strong>Phone:</strong> 703 379 2713</td>
</tr>
<tr>
<td><strong>Access Level:</strong> Full Access</td>
<td><strong>Email:</strong> <a href="mailto:Kyle.sucher@getf.org">Kyle.sucher@getf.org</a></td>
</tr>
<tr>
<td><strong>Completed or In Development:</strong> Full Access Nov-13</td>
<td><strong>Project Name:</strong> Strengthening Communities Through Integrated WASH Activities</td>
</tr>
</tbody>
</table>

#### Quantification Method Choices:

- **For Water Access Projects:**
  - Preferred: Annual meter reading indicating total flow through system for given year, or
  - Applying the World Health Organization and UNICEF Joint Monitoring Programme's 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

- **For Sanitation Projects:**
  - Preferred: Annual meter reading indicating total flow through system for given year, or
  - Method of Estimating Benefits
    - Latrine Installation (Note: waterless toilets and VIP latrines that do not contribute quantifiable Replenish benefits).

**STI Center Contact:**

- **Phone:** 258 21 480 986 | **Email:** Kyle.sucher@getf.org

---

**Guidance:**

- 1. Yellow shaded cells require data input from you.
- 2. Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pumps systems.
- 3. "Full Access" for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from its place of use and that it is possible to reliably obtain at least 20 liters per member of a household per day. Examples include new boreholes installed in a village.
- 4. "Limited Access" means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).
- 5. Please make sure it is perfectly clear whether the project has been implemented or is planned. If the project is being implemented in phases, please indicate which phases have already been implemented and which are planned. Maintain this distinction regarding the statement of Replenish benefits.
- 6. Certain projects, such as Community Education & Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.

---

**Total Number of Sanitation Systems Installed and Operational:**

Please Complete A Row in the Below Table For Each Sanitation System Installed:

<table>
<thead>
<tr>
<th><strong>Type of Sanitation Infrastructure</strong></th>
<th><strong>Access Level:</strong> (Full or Limited)</th>
<th><strong>Date Installed and Operational:</strong></th>
<th><strong>Number of Direct Beneficiaries:</strong></th>
<th><strong>Annual Replenish Volume:</strong> (Liters Per Year - with cost share)</th>
<th><strong>Method of Estimating Benefits:</strong> (Water or Engineering Design)</th>
<th><strong>Latitude (Decimal Degrees):</strong></th>
<th><strong>Longitude (Decimal Degrees):</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Latrine (Community Lat) total sanitation</td>
<td>Full Access</td>
<td>Nov-13</td>
<td>5,732</td>
<td>15374859.4</td>
<td>WHO 20 Litreman</td>
<td>15372531.9</td>
<td>703 379 2713</td>
</tr>
</tbody>
</table>

**Post Implementation System Operation and Maintenance Plan:**

- **WHO is Responsible for Operation and Maintenance of Water Access Point:** Describe Operations and Maintenance Plan (Briefly).
- **WHO is Responsible for Operation and Maintenance of Sanitation System:** Describe Operations and Maintenance Plan (Briefly).

**Comments:** (Please include anything else that should be known about this project)

- The boreholes, distribution networks and latrines were completed throughout the duration of the project, which completed all activities by November 2013. That date is used above as a final date for each set of activities.

---

**Community Contact:**

- **Title:** Program Manager | **Organization:** GETF |
- **Phone:** 703 379 2713 | **Email:** Kyle.sucher@getf.org
Template 3: Project Fact Sheet for Water Access and Sanitation Projects

<table>
<thead>
<tr>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Type of Project</th>
<th>Access Level</th>
<th>Description</th>
<th>Method of Estimating Benefits</th>
<th>Method of Estimating Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-Sep-11</td>
<td>1,459</td>
<td>Full Access</td>
<td>6° 30' 24.984&quot; 124° 25' 11.3664&quot;</td>
<td>Estimate</td>
<td>$2,628,000.00</td>
<td>$120,311</td>
</tr>
<tr>
<td>5-Dec-11</td>
<td>813</td>
<td>Full Access</td>
<td>6° 30' 24.984&quot; 124° 25' 11.3664&quot;</td>
<td>Estimate</td>
<td>$4,876,400.00</td>
<td>$120,311</td>
</tr>
<tr>
<td>12-Jul-12</td>
<td>2,010</td>
<td>Full Access</td>
<td>6° 38' 5.6358&quot; 125° 4' 58.2918&quot;</td>
<td>Estimate</td>
<td>$1,547,600.00</td>
<td>$120,311</td>
</tr>
<tr>
<td>30-Sep-11</td>
<td>1,065</td>
<td>Full Access</td>
<td>6° 38' 5.6358&quot; 125° 4' 58.2918&quot;</td>
<td>Estimate</td>
<td>$4,664,700.00</td>
<td>$120,311</td>
</tr>
<tr>
<td>5-Dec-11</td>
<td>668</td>
<td>Full Access</td>
<td>6° 30' 24.984&quot; 124° 25' 11.3664&quot;</td>
<td>Estimate</td>
<td>$4,876,400.00</td>
<td>$120,311</td>
</tr>
<tr>
<td>12-Jul-12</td>
<td>424</td>
<td>Full Access</td>
<td>6° 20' 8.7252&quot; 124° 46' 26.6844&quot;</td>
<td>Estimate</td>
<td>$1,547,600.00</td>
<td>$120,311</td>
</tr>
</tbody>
</table>

Date: 5-Dec-11
Type of Project: Full Access
Access Level: 6° 30' 24.984" 124° 25' 11.3664"
Description: Estimate
Method of Estimating Benefits: $2,628,000.00
Method of Estimating Costs: $120,311


Template 3: Project Fact Sheet for Water Access and Sanitation Projects

<table>
<thead>
<tr>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Type of Project</th>
<th>Access Level</th>
<th>Description</th>
<th>Method of Estimating Benefits</th>
<th>Method of Estimating Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-Sep-11</td>
<td>1,459</td>
<td>Full Access</td>
<td>6° 30' 24.984&quot; 124° 25' 11.3664&quot;</td>
<td>Estimate</td>
<td>$2,628,000.00</td>
<td>$120,311</td>
</tr>
<tr>
<td>5-Dec-11</td>
<td>813</td>
<td>Full Access</td>
<td>6° 30' 24.984&quot; 124° 25' 11.3664&quot;</td>
<td>Estimate</td>
<td>$4,876,400.00</td>
<td>$120,311</td>
</tr>
<tr>
<td>12-Jul-12</td>
<td>2,010</td>
<td>Full Access</td>
<td>6° 38' 5.6358&quot; 125° 4' 58.2918&quot;</td>
<td>Estimate</td>
<td>$1,547,600.00</td>
<td>$120,311</td>
</tr>
<tr>
<td>30-Sep-11</td>
<td>1,065</td>
<td>Full Access</td>
<td>6° 38' 5.6358&quot; 125° 4' 58.2918&quot;</td>
<td>Estimate</td>
<td>$4,664,700.00</td>
<td>$120,311</td>
</tr>
<tr>
<td>5-Dec-11</td>
<td>668</td>
<td>Full Access</td>
<td>6° 30' 24.984&quot; 124° 25' 11.3664&quot;</td>
<td>Estimate</td>
<td>$4,876,400.00</td>
<td>$120,311</td>
</tr>
<tr>
<td>12-Jul-12</td>
<td>424</td>
<td>Full Access</td>
<td>6° 20' 8.7252&quot; 124° 46' 26.6844&quot;</td>
<td>Estimate</td>
<td>$1,547,600.00</td>
<td>$120,311</td>
</tr>
</tbody>
</table>

Date: 5-Dec-11
Type of Project: Full Access
Access Level: 6° 30' 24.984" 124° 25' 11.3664"
Description: Estimate
Method of Estimating Benefits: $2,628,000.00
Method of Estimating Costs: $120,311
### Template: Project Fact Sheet for Water Access and Sanitation Projects

#### Project Name:
Rehabilitating the TextAfrica Water Treatment Plant and expanding water supply to Bairro 4

#### Type of Project:
Water Access

#### Project Code:
CEWABU

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Access Projects</td>
</tr>
<tr>
<td>Sanitation Projects</td>
</tr>
</tbody>
</table>

#### For Water Access Projects:
- **Full Access**: 35%
- **Limited Access**:
  - Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pumps.

#### For Sanitation Projects:
- **Limited Access** means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).
- **Full Access** for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from their place of use and that it is possible to reliably obtain at least 20 litres per member of a household per day. Examples include new boreholes installed in a village.

#### Quantification Method Choices:
- a. Preferred: Annual meter reading indicating the total flow through the system for a given year.
- b. The engineering design capacity of the system in liters per year.
- c. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

#### Replenish Project Activities:
- **Sanitation Infrastructure**: projects that are not connected to water access systems, but may help to create a supportive environment for improved sanitation.
- **Community Education & Training & Awareness**: projects that increase knowledge and behavior change around improved water access and sanitation.

#### Method of Estimating Benefits:
- **Type of Sanitation Infrastructure**:
  - Access Level: Full Access or Limited
  - Date Installed and Operational
  - Number of Direct Beneficiaries
  - Annual Replenish Volume (Liters Per Year - with cost share)
  - Method of Estimating Benefits: Water or Engineering Design
  - Latitude (Decimal Degrees)
  - Longitude (Decimal Degrees)

#### For Sanitation Systems:
- **Bairro 4 Urban Water Supply Project**:
  - Description: The project supported the extension of a public secondary water distribution network to Bairro 4 providing 4,400 people with access to an improved water supply for the first time.
  - Major Activities: Rehabilitation of the TextAfrica Water Treatment Plant and expanding water supply to Bairro 4.

#### Contact Person:
Tara Varghese
Phone: 703-379-2713
Email: tara.varghese@getf.org

#### Comments:
Please include anything that should be known about this project.
**Community Education, Training & Awareness**

**Full Access 5/31/2011** 15,704 20169078.82 WHO 20 l/d/person

**7033792713 Email**

- Date Installed and Operational
- Rob Eiger
- Access Level
- Tara Varghese
- Disrtibution Network Construction/Rehabilitation
- Completed or In Development
- Sanitation
- Number of Direct Beneficiaries
- 18%

**Number of Direct Beneficiaries**

- 18%

**Project Description (brief):** Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

**Benefits are based on:**

- Project's impact on the volume of wastewater that is treated. (Can be determined based on either of the following):
  - Preferred: Annual meter reading indicating the total flow through the system for a given year, or
  - The engineering design capacity of the system.
  - The number of beneficiaries who use the system.
  - There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

**For Sanitation Projects:**

- The water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).

**Impact on Health:**

- The project's impact on the volume of wastewater that is treated. (Can be determined based on either of the following):
  - Preferred: Annual meter reading indicating the total flow through the system for a given year, or
  - The engineering design capacity of the system.
  - The number of beneficiaries who use the system.

**For Water Access Projects:**

- Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pump systems.

**Post Implementation System Operation and Monitoring Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations):**

- The project's impact on the volume of wastewater that is treated. (Can be determined based on either of the following):
  - Preferred: Annual meter reading indicating the total flow through the system for a given year, or
  - The engineering design capacity of the system.
  - The number of beneficiaries who use the system.

**Comment:**

- Please include anything else that should be known about this project.
**Template 3: Project Fact Sheet for Water Access and Sanitation Projects**

**Date: Project Code:**

<table>
<thead>
<tr>
<th>Project Name: Improved Health and Livelihoods in Rural Communities</th>
<th>Date:</th>
<th>Project Code:</th>
</tr>
</thead>
</table>

**Project Details:**

- **Country:** Nigeria
- **Type of Project:** Water Access, Water, Water, Point of Use Treatment
- **Community Education, Training & Awareness:**
- **Total Cost of Project:** $452,876
- **Coca-Cola/Bottler Cost Contribution:** $452,876
- **Coca-Cola Cost Share Percentage:** 69%

**Coca-Cola System Contact Person:**

- **Name:** Tara Varghese
- **Organization:** GETF
- **Phone:** 7033792713
- **Email:** tara.varghese@getf.org

**Project Description:**

Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

**Quantification Method Choices:**

For Water Access Projects:

- **For Full Access projects, there are two choices for quantifying benefits:**
  - A. Preferred: Annual meter reading indicating total flow through system for given year, or
  - B. Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

- **For Limited Access projects:**
  - For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

**Additional Details:**

- Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:
  - A. Preferred: Annual meter reading indicating the total flow through the system for a given year, or
  - B. The engineering design capacity of the system
  - C. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

**Contact Information:**

- **Phone:** 7033792713

**Limited Access:**

- For Sanitation Projects:
  - Benefits are based on the amount of wastewater that is treated. Can be determined based on either of the following:
    - A. Preferred: Annual meter reading indicating total flow through system for given year, or
    - B.  Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

**Implementation Schedule:**

**Phase Number**

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
</table>

Please Complete A Row in the Below Table For Each Individual Water Access Point (only include access points installed and in operation).

**Total Number of Water Access Points Installed and Operational:**

- **Type of Water Access Infrastructure:**
  - Access Level (Full or Limited)
  - Access Level (Full or Limited)
  - Access Level (Full or Limited)
  - Access Level (Full or Limited)

**Annual Replenish Volume (Liters Per Year - with cost share):**

- **Method of Estimating Benefits (Water or Engineering Design):**
- **Latitude (Decimal Degrees):**
- **Longitude (Decimal Degrees):**

**Post Implementation Sanitation System Operation and Monitoring Plan:**

Describe Operations and Maintenance Plan (Briefly)

The WASH Nigeria project was centered on community ownership and management of the program consistent with national guidelines and standards. Communities were actively engaged and consulted during the decision making process regarding the location and construction of water supply and sanitation facilities. Proper preparatory work before the actual construction of the physical infrastructure was carried out to sensitize and prepare the community for assuming the full responsibility for managing the operation and maintenance of the hardware and also for the collection and accounting of any user fee schemes. Appropriate and government approved technologies were used such as the India Mark III. This technology has affordable spare parts that can be easily replaced by the trained artisans. Furthermore, training of hand pump mechanics was planned around the villages, availability, and ability of communities members involved in the project.

**Comments:**

(Include anything else that should be known about this project)

**Name:**

- **Title:**
- **Organization:**
- **Phone:**
- **Email:**
<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tara Varghese</td>
<td>The Coca-Cola Company-Nigeria</td>
<td><a href="mailto:tara.varghese@afk.com">tara.varghese@afk.com</a></td>
<td></td>
</tr>
<tr>
<td>Bright Ekweremadu</td>
<td>Society For Family Health</td>
<td><a href="mailto:bekeremadu@sfhnigeria.org">bekeremadu@sfhnigeria.org</a></td>
<td></td>
</tr>
<tr>
<td>Nene Esang</td>
<td>USAID/Nigeria</td>
<td><a href="mailto:neneesang@usaidnigeria.gov">neneesang@usaidnigeria.gov</a></td>
<td></td>
</tr>
<tr>
<td>Emeka Mba</td>
<td>Coca-Cola/Bottler</td>
<td><a href="mailto:emba@afr.ko.com">emba@afr.ko.com</a></td>
<td></td>
</tr>
</tbody>
</table>

### Project Description (Brief)

This project increased access to improved community water supply through the construction of nine boreholes, reduced diarrheal disease by distribution, promotion, and use of affordable household water disinfectant products, and increased schoolchildren’s access to improved sanitation facilities through construction of school latrines and hygiene promotion in communities.

### Benefits

- **Improved Community Water Supply**: Increased access to clean water through the construction of boreholes.
- **Reduced Diarrheal Disease**: Promoted hygiene and sanitation practices to reduce diarrheal diseases.
- **Affordable Household Water Disinfectant Products**: Distributed affordable products to ensure water safety.
- **Improved School Children Access**: Enhanced access to improved sanitation facilities in schools.

### Implementation Schedule

- **Phase 1**: Construction of nine boreholes.
- **Phase 2**: Hygiene training and promotion.
- **Phase 3**: Distribution of affordable disinfectant products.

### Operational Plan

- **Annual Replenish Volume**: Determined based on either volume of wastewater treated or volume of water drawn.
- **Quantification Method Choices**:
  - **Limited Access**: Water source or sanitation solution available for part of the day or year.
  - **Full Access**: Water source or sanitation solution available within 1 kilometer.

### Project Benefits

- **Full Access** for water delivery means the water source is available to beneficiaries less than 1 kilometer away.
- **Limited Access** means the water source or sanitation solution is available to beneficiaries for part of the day or year.

### Project Data

<table>
<thead>
<tr>
<th>Boreholes</th>
<th>Access Level</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year - with cost share)</th>
<th>Method of Estimating Benefits</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Access</td>
<td>10-Jun-11</td>
<td>2573</td>
<td>8427247.137</td>
<td>WHO-20 treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please complete A Row in the Below Table For Each Water Access Point (only include access points installed and in operation).

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Template 3: Project Fact Sheet for Water Access and Sanitation Projects

<table>
<thead>
<tr>
<th>Date:</th>
<th>Project Code:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Project Name:** WaterHealth Centers

**Project Contact:**
- Name: Clem Ugorji
- Email: clem.ugorji@coca-cola.com
- Phone: (+234) 8039780391

**Coca-Cola/Bottle Cost Contribution:**
- Total Cost of Project: $1,047,927
- Coca-Cola Cost Share Percentage: 100%

**Type of Project:**
- Safe Water for Africa
- Community Education, Training & Awareness

**Completed or In Development:**
- Completed or In Development

**Sanitation Systems Installed and Operational:**
- Total Number of Sanitation Systems Installed and Operational: 2

**Access Level:**
- Full Access

**Sanitation Projects:**
- Construction of one additional WaterHealth Center to provide sustainable access to safe drinking water for the residents

**Water Access Projects:**
- Construction of two WaterHealth Centers to provide sustainable access to safe drinking water for the residents

**Community Water Treatment System**

**Well Construction/Rehabilitation**

**Point-of-Use Treatment**

**Rainwater Harvesting**

**Post Implementation System Operation and Monitoring Plan:**

**Benefits:**
- Access to and costs of spare parts. Revenues which are collected from water sold cover operations and maintenance expenditures after 1.5 – 2 years, thus ensuring that no additional funding is required to sustain the business.

**Post Implementation System Operation and Monitoring Plan:**

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation Will Be</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - WaterHealth Centers</td>
<td>Construction of two WaterHealth Centers to provide sustainable access to safe drinking water for the residents</td>
<td>Completed</td>
<td>Complete</td>
</tr>
<tr>
<td>2 - WaterHealth Centers</td>
<td>Construction of one additional WaterHealth Center to provide sustainable access to safe drinking water for the residents</td>
<td>In Development</td>
<td>2015/02/01</td>
</tr>
</tbody>
</table>

**Number of Direct Beneficiaries:**
- Annual Replenish Volume (Liters Per Year - with cost share): 232,900 liters
- Method of Estimating Benefits (Water or Engineering Design): WHO 20 Liter/per person
- Latitude (Decimal Degrees): 7.1153927778
- Longitude (Decimal Degrees): 6.453913859

**Other (Please Describe):**
- Safe Water for Africa
- Community Education & Awareness

**Coca-Cola Cost Share Percentage:**
- 100%

**Comments:** (Include anything else that should be known about this project)

**Post Implementation System Operation and Monitoring Plan:**
- Summary the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations

**WHO is Responsible for Operation and Maintenance of Water Access Point:**
- WaterHealth International

**WaterHealth manages:**
- Facility after construction and installation for a period of 10 to 20 years. WaterHealth ensures the overall technical soundness of the water treatment plant including minimal downtime, regular water quality testing, technical training for operators and maintenance staff, and access to and costs of spare parts. Revenue which is collected from water and cover operations and maintenance expenditures after 1.5 – 2 years. Plus ensuring that no additional funding is required to sustain the business.

**TCC Group:**
- Africa

**Coca-Cola System Contact Person:**
- Name: Naabia Ofosu-Amaah
- Email: naabia.ofosu-amaah@getf.org

**TCC BU:**
- Central, Easter and Western Africa

---

1. Yellow shaded cells require data input from you.
2. Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring-catchment structure, rainwater harvesting, community water treatment system and household pumps systems.
3. "Full Access" for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from its place of use and that it is possible to reliably obtain at least 20 liters per member of a household per day. Examples include new boreholes installed in a village.
4. "Limited Access" means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).
5. Please make sure it it perfectly clear whether the project has been implemented or if it is planned. If the project is being implemented in phases, please indicate which phases have already been implemented and which are planned. Maintain this distinction regarding the statement of Replenish benefits.
6. Certain projects, such as Community Education & Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.

**Quantification Method Choices:**
- For Water Access Projects, there are two choices for quantifying benefits:
  a. Preferred: Annual meter reading indicating the total flow through the system for a given year or
  b. Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

**Post Implementation System Operation and Monitoring Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations):**

- Contact WaterHealth Centers in Nigeria and provide WASH education to the community. Each WHO is a decentralized water treatment facility comprising a pre-treatment structure that houses the water treatment equipment, pumps, and tanks and employs sedimentation, filtration, ultraviolet and other appropriate technologies to purify and disinfect contaminated waters. The centers charge an affordable fee for the water and provide employment of three to five community members who operate the system.

---

**Date Installed and Operational:**
- For Sanitation Projects:
  - In Development 2015/02/01
- For Water Access Projects:
  - Completed or In Development

**Number of Direct Beneficiaries:**
- Full Access
- May 14
- 3,250
- 232,900 liters
- WHO 20 Liter/per person
- 7.1153927778
- 6.453913859

---

**Number of Direct Beneficiaries:**
- Annual Replenish Volume (Liters Per Year - with cost share): 232,900 liters
- Method of Estimating Benefits (Water or Engineering Design): WHO 20 Liter/per person
- Latitude (Decimal Degrees): 7.1153927778
- Longitude (Decimal Degrees): 6.453913859

---

**Number of Direct Beneficiaries:**
- Annual Replenish Volume (Liters Per Year - with cost share): 232,900 liters
- Method of Estimating Benefits (Water or Engineering Design): WHO 20 Liter/per person
- Latitude (Decimal Degrees): 7.1153927778
- Longitude (Decimal Degrees): 6.453913859

---

**Number of Direct Beneficiaries:**
- Annual Replenish Volume (Liters Per Year - with cost share): 232,900 liters
- Method of Estimating Benefits (Water or Engineering Design): WHO 20 Liter/per person
- Latitude (Decimal Degrees): 7.1153927778
- Longitude (Decimal Degrees): 6.453913859
## Project Description (brief): Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project

**Project Name:** Water and Sanitation in Gahanga and Masaka

**Type of Project:** Water Access

**Access Level:** Full or Limited

**Access Level:** Full Access

**Date Installed and Operational:** Jan-12

**Number of Direct Beneficiaries:** 17,293

**Annual Replenish Volume:** 448,105.52

**WHO:** 20 liters/day/capita

**Method of Estimating Benefits:** Annual Meter Reading indicating total flow through system for given year.

**Location:** Gahanga water supply system

**Type of Sanitation Infrastructure:** Point-of-Use Treatment

**Access Level:** Full Access

**Date Installed and Operational:** Jan-14

**Number of Direct Beneficiaries:** 3,414

**Annual Replenish Volume:** 88,078.44

**WHO:** 20 liters/day/capita

**Method of Estimating Benefits:** Annual Meter Reading indicating total flow through system for given year.

**Location:** Nyarumwa water supply system

**Country:** Rwanda

**Type of Sanitation Infrastructure:** Rainwater Harvesting

**Access Level:** Full Access

**Date Installed and Operational:** Jan-17

**Number of Direct Beneficiaries:** 10,648

**Annual Replenish Volume:** 274,739

**WHO:** 20 liters/day/capita

**Method of Estimating Benefits:** Annual Meter Reading indicating total flow through system for given year.

**Location:** Gahanga water supply system

Through this project, RAIN improved access to safe drinking water, sanitation and hygiene conditions in the Kicukiro sector by training community/health workers and members of school hygiene clubs, extending government water supply systems, constructing rainwater harvesting systems, providing water and sanitation to schools through rainwater harvesting tanks, handwashing facilities, and eco-san toilets.

### Benefits
- For Water Access Projects:
  - **Full Access** to water delivery means that the water source is available to beneficiaries less than 1 kilometer away from their place of use and that it is 100% reliable and of acceptable quality.
  - **Limited Access** means that the water source or sanitation solution is available to beneficiaries part of the day or part of the year (for example clean water in schools or in hospitals).

- *Limitations*
  - Some Sanitation projects (waterless toilets and VIP latrines) do not contribute quantifiable Replenish benefits.
  - Projects that do not collect data or have incomplete data (e.g., data is not in English or is not available online).

### Data Collection

- **Quantification Method Choices:**
  - (Meter or Estimate): Depending on the type of water access being provided and whether the community is benefiting from the project.

### Analysis

- **Coca-Cola Cost Share Percentage:**
  - 35%

- **Coca-Cola/Bottler Cost Contribution:** $1,129,810

- **Total Cost of Project:** $3,500,233

- **Number of Direct Beneficiaries:** Completed

- **Water Access Projects:** There are two choices for quantifying benefits:
  - Preferred: Annual meter reading indicating total flow through system for given year.
  - Other: Estimate based on engineering design capacity of the system.

- **Sanitation Projects:**
  - There are two choices for quantifying benefits:
    - Preferred: Annual meter reading indicating total flow through system for given year.
    - Other: Estimate based on engineering design capacity of the system.

### Impact

- **Total Number of Water Access Points Installed and Operational:** 3

- **Total Number of Sanitation Systems Installed and Operational:** 1

### Monitoring and Evaluation

- **Dates: 12/18/2014**

### Project Team

- **Coca-Cola System Contact Person:** Stella Kiguta Ng’ang’a

### Support

- **EWSA is also responsible for day to day maintenance of water infrastructure.**

### Comments

- Please include anything else that should be known about this project.
<table>
<thead>
<tr>
<th>Type of Water Access Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual/Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Estimate)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protected Spring Box</td>
<td>Full</td>
<td>28-Jun-12</td>
<td>1,694</td>
<td>2,640.00</td>
<td>Estimate</td>
<td>12° 32' 1.5606&quot;</td>
<td>124° 19' 54.8538&quot;</td>
</tr>
<tr>
<td>Nortehanon Spring Development</td>
<td>Full</td>
<td>28-Jun-12</td>
<td>1,694</td>
<td>2,640.00</td>
<td>Estimate</td>
<td>12° 21' 40.7514&quot;</td>
<td>124° 46' 26.6844&quot;</td>
</tr>
<tr>
<td>Water Access Projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For Sanitation Projects:

Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:

1. The engineering design capacity of the system
2. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:

1. The engineering design capacity of the system
2. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

For Sanitation Projects:

1. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.
2. The engineering design capacity of the system
3. Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:
   a. The engineering design capacity of the system
   b. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

**Comments (Please include anything else that should be known about this project):**

- The Nortehanon Access Center conducted a number of activities aimed to install a community-based mechanism that highlights the responsibilities of the beneficiaries, the Barangay LGU and local partners. The local government unit and water associations were formed which developed their specific policies and regulations regarding the access and management of the unit entrusted to them.

**Submitted by:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Organization</th>
<th>Telephone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monina P. Pacheco</td>
<td>Program Officer - Environment</td>
<td>Coca-Cola Foundation Philippines</td>
<td>(632) 8662120</td>
<td><a href="mailto:monina.pacheco@coca-cola.com.ph">monina.pacheco@coca-cola.com.ph</a></td>
</tr>
</tbody>
</table>
### Template 3: Project Fact Sheet for Water Access and Sanitation Projects

**Date:**

**Project Code:**

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Community Development through Sustainable Water Supply</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Type:</td>
<td>Water Access</td>
<td>Organization:</td>
</tr>
<tr>
<td>Purpose:</td>
<td>Development &amp; Education</td>
<td>Tel:</td>
</tr>
<tr>
<td>Access Level:</td>
<td>Full Access</td>
<td>Email:</td>
</tr>
<tr>
<td>Phase Number:</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**Contact Person:**

**Technology Foundation:**

**Type of Project:**

**Name:**

**Organization:**

**Email:**

**Phone:**

**Address:**

**Country:**

**Coca-Cola Contact Person:**

**Coca-Cola/Bottler Cost Contribution:**

**Total Cost of Project:**

**Number of Direct Beneficiaries:**

**Coca-Cola Cost Share Percentage:**

**Description:**

**Type of Water Access Infrastructure:**

**Access Level:**

**Date Installed and Operational:**

**Number of Direct Beneficiaries:**

**Annual Replenish Volume (Liters Per Year - with cost share):**

**Method of Estimating Benefits (Meter or Engineering Design):**

**Latitude (Decimal Degrees):**

**Longitude (Decimal Degrees):**

**Please Complete A Row in the Below Table For Each Individual Water Access Point (only include access points installed and in operation):**

**Type of Sanitation Infrastructure:**

**Access Level:**

**Date Installed and Operational:**

**Number of Direct Beneficiaries:**

**Annual Replenish Volume (Liters Per Year):**

**Method of Estimating Benefits (Meter or Engineering Design):**

**Latitude (Decimal Degrees):**

**Longitude (Decimal Degrees):**

**Post Implementation System Operation and Monitoring Plan:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Name</th>
<th>Title</th>
<th>Organization</th>
<th>Telephone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brian Banks</td>
<td>Brian Banks</td>
<td>Technology Foundation</td>
<td>503.379.2713</td>
<td><a href="mailto:brian.banks@getf.org">brian.banks@getf.org</a></td>
<td></td>
</tr>
</tbody>
</table>
## Template 3: Project Fact Sheet for Water Access and Sanitation Projects

### Project Name:
- Clean Water for Communities

#### TCC Group:
- Pacific

#### Country:
- Vietnam

#### Name of Project Contact:
- Hoang Thuy Lan

#### Coca-Cola/Bottler Cost Contribution:
- $160,000

### Completed or In Development

#### Full
- Date: 1/8/2014
- Access Level: 1/10/2014 - 20/11/2014
- Number of Direct Beneficiaries: 876
- Total Cost of Project (including co-finance): $19,184,400

#### Type of Project:
- Water Access
- Sanitation
- Community Education, Training & Awareness

#### Quantification Method Choices:
- For Water Access projects, there are two choices for quantifying benefits:
  - Preferred: Annual Meter Reading indicating the total flow through the system for a given year, or
  - Engineering design capacity of the system

#### Project Description (brief):
- Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

#### Method of Estimating Benefits
- a. Preferred: Annual Meter Reading indicating the total flow through the system for a given year, or
- b. The engineering design capacity of the system

#### Post Implementation System Operation and Monitoring Plan
- Please summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations.

#### Comments (Please include anything else that should be known about this project):
- The using manuals will be handed over to the household owners, who are responsible for rinsing if the filtration box is dirty. The used water will then be provided to the project assistance board at commune level, who have been trained by Operation agency to be available for consultation. If problems occur, the technical advisor will provide the operation manual and how to maintain the construction work.
- Thu Duc district and Hoa Vang district: Water Supply Liability company is responsible for Operation and Maintenance. The water pipe and water meter will be fixed if any problems occur.

### List All Partners and Mentor/Contact Person

<table>
<thead>
<tr>
<th>Organization Name</th>
<th>Contact Person</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Center for Family Health &amp; Community Development (CEFACOM)</td>
<td>Hoang Thuy Lan</td>
<td><a href="mailto:cefacom.vn@gmail.com">cefacom.vn@gmail.com</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="mailto:lan.cefacom@gmail.com">lan.cefacom@gmail.com</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>+84-4-35372258</td>
</tr>
</tbody>
</table>

### Completed in/Development
- Date: 1/8/2014
- Implementation Schedule:
  - Phase Number 1: Conduct a needs assessment and draft plan of action
  - Phase Number 2: Implement the civil works

### Please Complete A Row in the Below Table For Each Individual Water Access Point (only include access points installed and in operation)

<table>
<thead>
<tr>
<th>Type of Water Access Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries (Liters Per Year)</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Meter or Estimate)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household connection, water meter in Hoa Vang district</td>
<td>Full</td>
<td>20/8/2014 - 20/11/2014</td>
<td>1,572</td>
<td>45,002,400</td>
<td>Meter</td>
<td>10.98333</td>
<td>109.760657</td>
</tr>
</tbody>
</table>

### Please Complete A Row in the Below Table For Each Individual Sanitation System Installation

<table>
<thead>
<tr>
<th>Type of Sanitation Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries (Liters Per Year)</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Meter or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household connection, water meter in Hoa Vang district</td>
<td>Full</td>
<td>20/8/2014 - 20/11/2014</td>
<td>1,572</td>
<td>45,002,400</td>
<td>Meter</td>
<td>10.98333</td>
<td>109.760657</td>
</tr>
</tbody>
</table>

### Project Implementation System Operation and Monitoring Plan

#### Iso Diagram of System Operation and Monitoring Plan

- Water Supply Limited company is responsible for Operation and Maintenance. The water pipe and water meter will be fixed if any problems occur.

### Comments

- This includes all Coca-Cola Company and Bottler funding contributions (including Company and Bottler Foundations)

### Submitted by:
- Hoang Thuy Lan
- Date: 10/30/2014
### Template 3: Project Fact Sheet for Water Access and Sanitation Projects

<table>
<thead>
<tr>
<th>Date:</th>
<th>Project Code:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

#### Project Name:
- Community Water, Sanitation, and Hygiene

#### Type of Project:
- Water Access
- Training
- Community Education, Testing & Awareness

#### Major Activities:
- Well Construction/Rehabilitation
- Pump Installation
- Sanitation Training
- Data Collection
- Satellite Construction

#### TCC Group:
- Eurasia-Africa
- Central,East and Western Africa

#### Country:
- Senegal

#### Name of Project Contact:
- Dean Swerdlin

#### Total Cost of Project (including co-finance): $1,708,658

#### Coca-Cola/Bottle Cost Contribution: $1,708,658

#### Coca-Cola Cost Share Percentage: 38%

#### Coca-Cola System Contact Person:
- Name: Tara Varghese
- Organization: The Coca-Cola Company
- Phone: 703-379-2713
- Email: t.varghese@ccf.com

#### Description of Project:
This project increased access to water supply and sanitation, strengthened the capacity of local governments and communities, and provided villages with training in well maintenance and management.

#### Project Fact Sheet for Water Access and Sanitation Projects

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed in Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Type of Water Access Infrastructure

<table>
<thead>
<tr>
<th>Type of Water Access</th>
<th>Access Level</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boreholes</td>
<td>Full Access</td>
<td>30-Apr-15</td>
<td>11,100</td>
<td>305068486.21</td>
<td>WHO 20 lipsum</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Type of Sanitation Infrastructure

<table>
<thead>
<tr>
<th>Type of Sanitation</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
</table>

#### Post Implementation System Operation and Monitoring Plan
- System: Water Access Point
- Method: Operations and Maintenance Plan
- Description: Operations and Maintenance Plan (Briefly):
The local government, local NGOs and the community were actively involved in the implementation of the project and will be responsible for the continuous operations of the project.

#### Comments
- Please include anything else that should be known about this project.
- Name: Tara Varghese
- Title: Director, Water Development Programs
- Organization: GETF
- Telephone: 703-379-2713
- Email: tara.varghese@getf.org

#### Submission Date
- Date: 1-May-14
<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limthong - 3</td>
<td>Drinking water activities at school in Limthong (completed in 2010)</td>
<td>Completed</td>
<td></td>
</tr>
<tr>
<td>Limthong - 6</td>
<td>Drinking water system for community (completed in 2012)</td>
<td>Completed</td>
<td></td>
</tr>
<tr>
<td>Mae Tarn Noi - 5</td>
<td>Drinking water system for community (completed in 2010)</td>
<td>Completed</td>
<td></td>
</tr>
<tr>
<td>Nongprue - 4</td>
<td>Improvement of soil surface water system (completed in 2010)</td>
<td>Completed</td>
<td></td>
</tr>
</tbody>
</table>

### Type of Water Access Infrastructure

<table>
<thead>
<tr>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year - with cost share)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piped drinking water at school in Limthong</td>
<td>Limited Access</td>
<td>Jul 08</td>
<td>300</td>
<td>473102.3</td>
<td>Metered</td>
<td>14.89025</td>
</tr>
<tr>
<td>Water towers in Limthong</td>
<td>Full Access</td>
<td>Oct 11</td>
<td>180</td>
<td>2527.772</td>
<td>Metered</td>
<td>14.81049</td>
</tr>
<tr>
<td>Drinking water system for community in Mae Tarn Noi</td>
<td>Full Access</td>
<td>Jan 12</td>
<td>272</td>
<td>1596422.4</td>
<td>WHO 20 lit/person</td>
<td>18.40937</td>
</tr>
</tbody>
</table>

### Type of Sanitation Infrastructure

<table>
<thead>
<tr>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanitation activities at community in Limthong</td>
<td>Full Access</td>
<td>Jun 10</td>
<td>2000</td>
<td>12693580</td>
<td>WHO 20 lit/person</td>
<td>15.10478</td>
</tr>
</tbody>
</table>

**List All Partners and Identify A Contact Person:**
- Coca-Cola System Contact Person: Budsayada Youngfhuengmontra
- TCCC Contact Person: Director of Hydro Informatics
- TCCC BU: Thailand
- TCCC Group: ASEAN
- Organization: Coca-Cola
- Telephone: 66-2-834-1577
- Email: shukayata@cocacola.com

**For Water Access Projects:**
- For Full Access projects, there are two choices for quantifying benefits:
  a. Preferred: Annual meter reading indicating the total flow through the system for a given year, or
  b. Engineering design capacity of the system.
- For Limited Access projects: For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

**For Sanitation Projects:**
- Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:
  a. Preferred: Annual meter reading indicating the total flow through the system for a given year, or
  b. Engineering design capacity of the system.
- There are certain sanitation projects (wastewater toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

**Additional Descriptions (Brief):** Please provide a brief project description, indicate the type of water access being provided and describe the community benefitting from the project.

**Date Implementation will be Complete**

**Please Complete A Row in the Below Table For Each Individual Water Access Point (Only include access points installed and in operation):**

**Please Complete A Row in the Below Table For Each Sanitation System Installed:**

**Describe Operations and Maintenance Plan (Briefly):**

**For Sanitation Projects:**
- Projects are verified in terms of their impact on hygiene and health for the benefit of the users of the system. The project is designed to improve the health and hygiene of the community.
- Projects are monitored and evaluated to ensure the quality and effectiveness of the services provided.
- The maintenance of the systems is ensured through regular inspections and timely repairs.
- The project provides clean and potable drinking water to the community, improving their overall health and well-being.

**For Water Access Projects:**
- Projects are designed to provide clean and safe drinking water to the community.
- The systems are installed to meet the water demand of the community, ensuring that everyone has access to clean water.
- The maintenance of the systems is ensured through regular inspections and timely repairs.
- The project provides clean and safe drinking water to the community, improving their overall health and well-being.

**Maintenance:** Projects are maintained on a regular basis to ensure the ongoing operation of the systems.
Template 3: Project Fact Sheet for Water Access and Sanitation Projects
Project Name:

Date:

TCC Group:

Major Activities
(Check All That Apply):

Eurasia-Africa

TCC BU:

Central, Easter and Western Africa

Country:

South Africa

Name of Project Contact:

Jonathan Timm

Total Cost of Project (including co-finance):

$

1,128,417

Coca-Cola/Bottler Cost Contribution:

$

354,840

Coca-Cola Cost Share Percentage:

Project Code:
Type of Project:

Water Supply, WatergyTM Intervention and Education

Water Access

Sanitation

Well Construction/Rehabilitation

Latrine Installation

Protected Spring Box

Hygeine Training

Rainwater Harvesting

Community Water Treatment System

Point-of-Use Treatment

Disrtibution Network Construction/Rehabilitation

Community Education, Training & Awareness

Other (Please Describe):

Tapstand construction

Note: This includes all Coca-Cola Company and Bottler funding contributions (including Company and Bottler Foundations)

31%

Coca-Cola System Contact Person

Name

Organization

Sammy Mahlaoli

Coca-Cola South Africa

Phone

Email
smohlaoli@afr.ko.com

Guidance
1. Yellow shaded cells require data input from you.
2. Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pump systems.
3. "Full Access"for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from its place of use and that it is possible to reliably obtain at least 20 litres per member of a household per day. Examples include new boreholes installed in a village.
4. "Limited Access" means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals)
5. Please make sure it is perfectly clear whether the project has been implemented or is planned. If the project is being implemented in phases, please indicate which phases have already been implemented and which are planned. Maintain this distinction regarding the statement of Replenish
benefits.
6. Certain projects, such as Community Education & Awareness, can be important local projecs, but do not contribute quantifiable Replenish benefits.
Quantification Method Choices:
For Water Access Projects:
For Full Access projects, there are two choices for quantifying benefits:
a. Preferred: Annual Meter Reading indicating total flow through system for given year, or
b. Applying the World Health Organization and UNICEF Joint Monitoring Programme's 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.
For Limited Access projects: For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.
For Sanitation Projects:
Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:
a. Preferred: Annual meter reading indicating the total flow through the system for a given year, or
b. The engineering design capacity of the system
c. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

Project Description (brief): Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project
This project rehabilitated, repaired, and retrofitted broken and/or unusable plumbing fixtures that contributed to large-scale water wastage, trained school caretakers in basic plumbing skills, and refurbished and extended a rural water system to expand community drinking water supply.

List All Partners and Identify A Contact Person:
Partner Organization
Mvula
USAID/South Africa
Tara Varghese
If Project is Being Completed in Phases, Please Indicate Implementation Schedule.

Contact Person
Jonathan Timm
Thobekile Finger
GETF

Phase Number

Telephone

Email
jonathan@mvula.co.za
tfinger@usaid.gov
tara.varghese@getf.org

Description

703-379-2713

Completed or In Development

Date Implementation will be
Complete

Latitude
(Decimal Degrees)

Longitude
(Decimal Degrees)

Latitude
(Decimal Degrees)

Longitude
(Decimal Degrees)

Please Complete A Row in the Below Table For Each Individual Water Access Point (only include access points installed and in operation)
Total Number of Water Access Points Installed and Operational:
27 tapstands constructed and 694 households with new connections
Type of Water Access Infrastructure
Water pump system

Access Level
(Full or Limited)
Full Access

Date Installed and Operational Number of Direct Beneficiaries
30-Jan-11
4802

Annual Replenish Volume
(Liters Per Year - with cost
share)
11023207.08

Method of Estimating Benefits
(Meter or Estimate)
WHO 20 l/d/person

Date Installed and Operational Number of Direct Beneficiaries

Annual Replenish Volume
(Liters Per Year)

Method of Estimating Benefits
(Meter or Engineering Design)

Please Complete A Row in the Below Table For Each Sanitation System Installed:
Total Number of Sanitation Systems Installed and Operational:
Type of Sanitation Infrastructure

Access Level
(Full or Limited)

Post Implementation System Operation and Monitoring Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)
Who is Responsible for Operation and Maintenance of Water Access Points
District Municipality and village water committee
Describe Operations and Maintenance Plan (Briefly)
This project was planned and implemented in close partnership with the district municipality. Post implementation, the infrastructure will be operated and maintained by the district municipality as part of the their Operation and Maintenance Division. In addition, a village water committee was
established, trained and introduced to the local operation and maintenance team and and will be working together in the continuous operations of the project.

Comments (Please include anything else that should be known about this project)

Title
Director, Water and
Development programs

Name
Submitted by:
Date:

Tara Varghese
5-Nov-14

31

Organization
GETF

Telephone
703-379-2713

Email
tara.varghese@getf.org


### Template 3: Project Fact Sheet for Water Access and Sanitation Projects

**Date:**

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Water Access and Sanitation Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCC BU:</td>
<td>Central, Eastern and Western Africa</td>
</tr>
<tr>
<td>Country:</td>
<td>Swaziland</td>
</tr>
<tr>
<td>Name of Project Contact:</td>
<td>Miles Zinn</td>
</tr>
<tr>
<td>Total Cost of Project (Including co-finance):</td>
<td>$4,071,767</td>
</tr>
<tr>
<td>Coca-Cola/Bird Cost Contribution:</td>
<td>$3,136,000</td>
</tr>
<tr>
<td>Coca-Cola Cost Share Percentage:</td>
<td>77%</td>
</tr>
</tbody>
</table>

#### Guidance:
1. Yellow shaded cells require data input from you.
2. Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pump systems.
3. "Full Access" for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from the place of use and that it is possible to reliably obtain at least 20 liters per person per day. Examples include new boreholes installed in a village.
4. "Limited Access" means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).
5. Please make sure it is perfectly clear whether the project has been implemented or is planned. If the project is being implemented in phases, please indicate which phases have already been implemented and which are planned. Maintain this distinction regarding the statement of Replenish benefits.
6. Certain projects, such as Community Education & Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.

#### Sanitation Projects:
- Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:
  a. Preferred: Annual meter reading indicating total flow through system for given year, or
  b. Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

#### Water Access Projects:
- Benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

#### Description (Briefly):
Provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

### For Water Access Projects:
- Projects: For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type of Water Access Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year) - with cost share</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees) Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water, gravity and hand pumps, boreholes and spring points</td>
<td>Full Access</td>
<td>30-May-13</td>
<td>13140</td>
<td>73877358.9</td>
<td>W18° 20’ 10”</td>
</tr>
</tbody>
</table>

**Please Complete A Row in the Below Table For Each Individual Water Access Point (only include access points installed and in operation)**

**Total Number of Water Access Points Installed and Operational: 15**

### For Sanitation Projects:
- Projects: For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type of Sanitation Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees) Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hygiene Training</td>
<td>Latrine Installation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Please Complete A Row in the Below Table For Each Individual Sanitation System Installed (only include systems installed and in operation)**

**Total Number of Sanitation Systems Installed and Operational: 8**

### Fast Implementation System Operation and Monitoring Plan (outlines the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)

**Operations and Maintenance Plan (Briefly):**

Provide a brief description of the operations and maintenance plan for the water access system. Include information on training and support for stakeholders and community involvement.

### Comments (Please include any information that should be known about this project)

**Name:** Tara Varghese
**Title:** Director, Water and Development programs
**Organization:** GETF
**Telephone:** 703-379-2713
**Email:** tvarghese@getf.org

**Date:** 06/19/13

---

### Project Name:

**Water for a Generation**

<table>
<thead>
<tr>
<th>Organization Telephone Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nazarene Compassionate Ministries Inc. 703-379-2713 <a href="mailto:mzinn@ncmi.org">mzinn@ncmi.org</a></td>
</tr>
<tr>
<td>TCC BU: Central, Eastern and Western Africa</td>
</tr>
<tr>
<td>Country: Swaziland</td>
</tr>
<tr>
<td>Name of Project Contact: Miles Zinn</td>
</tr>
<tr>
<td>Total Cost of Project (Including co-finance): $4,071,767</td>
</tr>
<tr>
<td>Coca-Cola/Bird Cost Contribution: $3,136,000</td>
</tr>
<tr>
<td>Coca-Cola Cost Share Percentage: 77%</td>
</tr>
</tbody>
</table>

#### Guidance:
1. Yellow shaded cells require data input from you.
2. Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pump systems.
3. "Full Access" for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from the place of use and that it is possible to reliably obtain at least 20 liters per person per day. Examples include new boreholes installed in a village.
4. "Limited Access" means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).
5. Please make sure it is perfectly clear whether the project has been implemented or is planned. If the project is being implemented in phases, please indicate which phases have already been implemented and which are planned. Maintain this distinction regarding the statement of Replenish benefits.
6. Certain projects, such as Community Education & Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.

#### Sanitation Projects:
- Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:
  a. Preferred: Annual meter reading indicating total flow through system for given year, or
  b. Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

#### Water Access Projects:
- Benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

#### Description (Briefly):
Provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

### For Water Access Projects:
- Projects: For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type of Water Access Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year) - with cost share</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees) Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water, gravity and hand pumps, boreholes and spring points</td>
<td>Full Access</td>
<td>30-May-13</td>
<td>13140</td>
<td>73877358.9</td>
<td>W18° 20’ 10”</td>
</tr>
</tbody>
</table>

**Please Complete A Row in the Below Table For Each Individual Water Access Point (only include access points installed and in operation)**

**Total Number of Water Access Points Installed and Operational: 15**

### For Sanitation Projects:
- Projects: For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type of Sanitation Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees) Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hygiene Training</td>
<td>Latrine Installation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Please Complete A Row in the Below Table For Each Individual Sanitation System Installed (only include systems installed and in operation)**

**Total Number of Sanitation Systems Installed and Operational: 8**

### Fast Implementation System Operation and Monitoring Plan (outlines the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)

**Operations and Maintenance Plan (Briefly):**

Provide a brief description of the operations and maintenance plan for the water access system. Include information on training and support for stakeholders and community involvement.

### Comments (Please include any information that should be known about this project)

**Name:** Tara Varghese
**Title:** Director, Water and Development programs
**Organization:** GETF
**Telephone:** 703-379-2713
**Email:** tvarghese@getf.org

**Date:** 06/19/13
### Project Fact Sheet for Water Access and Sanitation Projects

**Template 3**

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Improving Access to Water in Mweteni Village</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Project:</strong></td>
<td>Water Access</td>
</tr>
<tr>
<td><strong>Country:</strong></td>
<td>Tanzania</td>
</tr>
<tr>
<td><strong>Access Level:</strong></td>
<td>Full Access</td>
</tr>
<tr>
<td><strong>Method of Estimating Benefits:</strong></td>
<td>Water or Engineering Design</td>
</tr>
<tr>
<td><strong>Latitude:</strong></td>
<td>11° 18' 7.56 &quot;N</td>
</tr>
<tr>
<td><strong>Longitude:</strong></td>
<td>20° 20' 28.97 &quot;E</td>
</tr>
<tr>
<td><strong>Number of Water Access Points Installed and Operational:</strong></td>
<td>Oct-14, 2000</td>
</tr>
<tr>
<td><strong>Annual Replenish Volume (Liters Per Year):</strong></td>
<td>111,817,487.55</td>
</tr>
<tr>
<td><strong>WHO-20 Feedthrough:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Coca-Cola/Bottle Cost Contribution:</strong></td>
<td>$161,580</td>
</tr>
<tr>
<td><strong>Coca-Cola System Contact Person:</strong></td>
<td>Tara Varghese (GETF)</td>
</tr>
<tr>
<td><strong>Type of Sanitation Infrastructure:</strong></td>
<td>Gravity Spring Scheme</td>
</tr>
<tr>
<td><strong>Access Level:</strong></td>
<td>Full Access</td>
</tr>
<tr>
<td><strong>Method of Estimating Benefits:</strong></td>
<td>Water or Engineering Design</td>
</tr>
<tr>
<td><strong>Latitude:</strong></td>
<td>11° 18' 7.56 &quot;N</td>
</tr>
<tr>
<td><strong>Longitude:</strong></td>
<td>20° 20' 28.97 &quot;E</td>
</tr>
<tr>
<td><strong>Number of Sanitation Systems Installed and Operational:</strong></td>
<td>Oct-14, 2000</td>
</tr>
<tr>
<td><strong>Annual Replenish Volume (Liters Per Year):</strong></td>
<td>123,750</td>
</tr>
<tr>
<td><strong>WHO-20 Feedthrough:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Coca-Cola/Bottle Cost Contribution:</strong></td>
<td>$123,750</td>
</tr>
<tr>
<td><strong>Coca-Cola System Contact Person:</strong></td>
<td>Tara Varghese (GETF)</td>
</tr>
</tbody>
</table>

**Guidance**

1. Yellow shaded cells require data input from you.
2. Water access projects are accomplished through a variety of means, including well construction/rehabilitation, protected spring catchment structures, rainwater harvesting, community water treatment system and household pump systems.
3. Full Access for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from its place of use and that it is possible to reliably obtain at least 20 liters per member of a household per day. Examples include new boreholes installed in a village.
4. Limited Access means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).
5. Please make sure it is perfectly clear whether the project has been implemented or is planned. If the project is being implemented in phases, please indicate which phases have already been implemented and which are planned. Maintain this distinction regarding the statement of Replenish benefits.
6. Certain projects, such as Community Education & Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.

### Project Description (brief): Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

**Description**

- **Type of Water Access Infrastructure:** Gravity Spring Scheme
- **Access Level:** Full Access
- **Date Installed and Operational:** Oct-14, 2000
- **Number of Direct Beneficiaries:** 111,817,487.55
- **Method of Estimating Benefits:** Water or Engineering Design
- **Latitude:** 11° 18' 7.56 "N
- **Longitude:** 20° 20' 28.97 "E

**Method of Estimating Benefits**

- Preferred: Annual meter reading indicating total flow through system for given year.
- Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

**Post Implementation System Operation and Monitoring Plan**

(Required: Plan to ensure safe and continuous operation of water access system after construction and commencement of operations)

<table>
<thead>
<tr>
<th><strong>Responsibility:</strong></th>
<th>Describe Operations and Maintenance Plan (Briefly)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WHO:</strong></td>
<td>All standpipes, handed over to the community, are owned and operated by ONEA, the national water utility. ONEA retains responsibility for ongoing water quality testing (monthly at the storage tank and at random points in the distribution system). The water stand post committees have received training on O&amp;M of the infrastructure and contact ONEA with any issues needing attention beyond their capabilities. Further details can be found in the project close-out report.</td>
</tr>
</tbody>
</table>

**Comments**

(Include any other information essential for the project)

Please contact GETF with any further questions on project documentation.

| **Name:** | Tara Varghese |
| **Title:** | Director, Water & Development Programs |
| **Organization:** | Global Environment & Technology Foundation (GETF) |
| **Phone:** | 703-379-2713 |
| **Email:** | tara.varghese@geaf.org |

**Date:** 14-Oct-14
### Template 3: Project Fact Sheet for Water Access and Sanitation Projects

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Community Managed Potable Water Supply</th>
<th>Date:</th>
<th>Project Code:</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCC Group:</td>
<td>Local Authority (Check All That Apply):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access Level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Project</td>
<td>Water Access</td>
<td>Training</td>
<td>Education, Training &amp; Awareness</td>
</tr>
<tr>
<td>Country:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name of Project Contact:</td>
<td>Cecile Alcantara</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cost of Project (excluding co-finance):</td>
<td>$44,677.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coca-Cola/Bottle Cost Contribution:</td>
<td>$44,677.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name of Project Contact:</td>
<td>Cecile Alcantara</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization:</td>
<td>Coca-Cola Philippines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phone:</td>
<td>+63917 0791070</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:cecile.alcantara@coca-cola.com.ph">cecile.alcantara@coca-cola.com.ph</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Description

- **Type of Water Access Infrastructure**: Community Managed Potable Water Supply
- **Type of Sanitation Infrastructure**: Community Managed Potable Water Supply
- **Shade**: Yellow shaded cells require data input from you.
- **South**: Total Number of Sanitation Systems Installed and Operational:
- **East**: Total Number of Water Access Points Installed and Operational:
- **North**: For Sanitation Projects:
- **West**: Access to water is available to beneficiaries less than 1 kilometer away from the source, or the flow rate is greater than 5 liters per second.

#### Method of Estimating Benefits

- **For Water Access Projects**: There are two choices for quantifying benefits:
  - Preferred: Annual meter reading indicating total flow through the system for a given year, or
  - Estimate: Ratio of people served to the number of beneficiaries.

#### Post Implementation System Operation and Monitoring Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)

- **Phase Number**: 1
- **Phase Description**: Establishment of community water associations.
- **Date Implementation will be Complete**: 30-Jun-13

#### Final Implementation System Operation and Monitoring Plan

- **Observer**: Greggo Uriarte
- **Date**: 9° 51' 56.5272" 125° 57' 58.1328"

#### Contact Person

- **Name**: Cecile Alcantara
- **Organization**: Coca-Cola Philippines
- **Phone**: +63917 0791070
- **Email**: cecile.alcantara@coca-cola.com.ph

#### List All Partners and Identify A Contact Person:

- **Partner Organization**: Coca-Cola System Contact Person
- **Contact Person**: Cecile Alcantara
- **Phone**: +63917 0791070
- **Email**: cecile.alcantara@coca-cola.com.ph

#### Sanitation Projects

- **Completed or In Development**: Completed
- **Phase Number**: 2
- **Phase Description**: Establishment of community water associations.
- **Date Implementation will be Complete**: 30-Jun-13

### Example of Data Input

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Establishment of community water associations.</td>
<td>Completed</td>
<td>30-Jun-13</td>
</tr>
<tr>
<td>2</td>
<td>Establishment of community water associations.</td>
<td>Complete</td>
<td>30-Jun-13</td>
</tr>
</tbody>
</table>

#### Contact Person

- **Name**: Cecile Alcantara
- **Organization**: Coca-Cola Philippines
- **Phone**: +63917 0791070
- **Email**: cecile.alcantara@coca-cola.com.ph

#### List All Partners and Identify A Contact Person:

- **Partner Organization**: Coca-Cola System Contact Person
- **Contact Person**: Cecile Alcantara
- **Phone**: +63917 0791070
- **Email**: cecile.alcantara@coca-cola.com.ph
### Project: Northern Uganda Watersprings Initiative

**Type of Project:** Water Access  
**Date Installed and Operational:** 31-May-08  
**Number of Direct Beneficiaries:** 35090  
**Full Access:** Yes  
**WHO 20 l/d/capita:** Yes  
**Water Access System:**  
**Location:** Uganda  
**Enrollment:** Full Access  
**Country:** Central, Eastern and Western Africa  
**Total Cost:** $708,670

### Contacts

- **Name:** Susan Watkins  
- **Community Education, Training & Awareness:**  
- **Phone:** 703-939-8227  
- **Email:** susanwatkins@ccf.or.ug

### Description

- **Coca-Cola System Contact Person:** Maureen Karych indentify a contact person  
- **Coca-Cola Cost Share Percentage:** 62%  
- **Coca-Cola/Bottler Cost Contribution:** $441,954  
- **Total Cost of Project:** $708,670

### Additional Information

- **Completed or In Development:** Completed  
- **Comments:** There were 35090 beneficiaries; of which 3950 were school children.

### Quantification Method Choices:

- **Quantification Method Choices:**  
  1. **Preferred:** Annual meter reading indicating the total flow through the system for a given year, or  
  2. **Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.**

### References

1. Yellow shaded cells require data input from you.  
2. Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring catchment structures, rainwater harvesting, community water treatment system and household pumps systems.

### Post Implementation System Operation and Monitoring Plan

- **Describe Operations and Maintenance Plan (Briefly):** The community and the Uganda Ministry of water  
- **A Use fee is collected at avg. 300 Uganda Shillings per month per household to help in maintenance and repair of the borehole and ensure sustainable water access to the community.**

### Additional Description (Briefly): Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

- **Provide clean water, sanitation facilities, and hygiene promotion for persons displaced by conflict in rural regions of Northern Uganda. Construction of 18 deep wells to ensure full water access to the internally displaced communities.**

### Sanitation Systems

- **Type of Sanitation Infrastructure:** (Full or Limited)  
- **Access Level:** Full Access  
- **Date Installed and Operational:** 31-May-08  
- **Number of Direct Beneficiaries:** 35090  
- **Annual Replenish Volume (Liters Per Year):** 159749404.9  
- **Method of Estimating Benefits:** WHO 20 l/d/capita  
- **Latitude:** 0.00000000000000  
- **Longitude:** 0.00000000000000

### Water Access Points

- **Type of Water Access Infrastructure:** (Full or Limited)  
- **Access Level:** Full Access  
- **Date Installed and Operational:** 31-May-08  
- **Number of Direct Beneficiaries:** 35090  
- **Annual Replenish Volume (Liters Per Year):** 159749404.9  
- **Method of Estimating Benefits:** WHO 20 l/d/capita  
- **Latitude:** 0.00000000000000  
- **Longitude:** 0.00000000000000

### Implementation Schedule

- **If Project is Being Completed in Phases, Please Indicate Implementation Schedule:**  
- **Post Implementation System Operation and Monitoring Plan:** (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)

### Comments

- **(Please include anything else that should be known about this project):**

- **There were 35090 beneficiaries, of which 3950 were school children.**

### Contact Information

- **Name:** Tara Varghese  
- **Title:** Director, Water and Development Programs  
- **Organization:** GET  
- **Telephone:** 703-939-8227  
- **Email:** tara.varghese@getf.org

---

35
Coca-Cola System Contact Person

Maureen Kyomuhendo

Century Bottling Company

Phone: 256-772-735101

Email: Maureen.Kyomuhendo@ccsabco.co.za

Organization Telephone Email

Name Organization Phone Email

Sanitation Type of Water Access Infrastructure Access Level
(All or Limited) Date installed and Operational Number of Direct Beneficiaries

Annual Replenish Volume (Liters Per Year - with cost share)

Method of Estimating Benefits (Water or Engineering Design)

Latitude (Decimal Degrees)

Longitude (Decimal Degrees)

For Water Access Projects: there are two choices for quantifying benefits:

a. Preferred: Annual Meter Reading indicating the total flow through system for given year, or

b. Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

For Sanitation Projects:

Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:

a. Preferred: Annual meter reading indicating the total flow through system for given year, or

b. The engineering design capacity of the system

c. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

Please complete A Row in the Below Table For Each Individual Water Access Point (only include access points installed and in operation): Total Number of Water Access Points installed and Operational: 145 pre-pay meter connections

Type of Water Access Infrastructure Access Level (Full or Limited) Date installed and Operational Number of Direct Beneficiaries

Annual Replenish Volume (Liters Per Year - with cost share)

Method of Estimating Benefits (Water or Engineering Design)

Latitude (Decimal Degrees)

Longitude (Decimal Degrees)

Coca-Cola System Contact Person

Maureen Kyomuhendo

Century Bottling Company

Phone: 256-772-735101

Email: Maureen.Kyomuhendo@ccsabco.co.za

Organization Telephone Email

Name Organization Phone Email

Sanitation Type of Sanitation Infrastructure Access Level
(All or Limited) Date installed and Operational Number of Direct Beneficiaries

Annual Replenish Volume (Liters Per Year)

Method of Estimating Benefits (Water or Engineering Design)

Latitude (Decimal Degrees)

Longitude (Decimal Degrees)

Post Implementation System Operation and Maintenance Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)

Who is Responsible for Operation and Maintenance of Water Access Point

National water and sewerage corporation and the community

Describe Operations and Maintenance Plan (Briefly)

The participation of the community and its leadership structure was encouraged in the design and implementation of the project. Management arrangement developed for water supply system involves community members and customer care by N/WSC.

Comments (Please include anything else that should be known about this project)

Name Title Organization Telephone Email

Submitted by: Tara Varghese Director, Water Development programs GETF 703-379-2713 tara.varghese@getf.org

Date: 3-28-14
### Project Description (Briefly)

The project aimed to improve waste water treatment in the local communities (residential municipal housing) through implementation of community partnerships on water replenishment to ameliorate environmental, hygiene and sanitation situation. The project has achieved its goal through mobilization of municipal community members through involving them in community projects on water replenishment. The project was built upon the successful experience of the previous activities and established network of partnerships with regional and local government, communities and municipalities.

#### Key Partners and Beneficiary System Location

<table>
<thead>
<tr>
<th>Partner Organization</th>
<th>Contact Person</th>
<th>Email</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Cooperative “Vesna”, Saky municipality, Ukraine</td>
<td>Tatiana Kudina</td>
<td><a href="mailto:tatyana.kudina@undp.org">tatyana.kudina@undp.org</a></td>
<td>+38 044 254 0035</td>
</tr>
<tr>
<td>Service Cooperative “Brovozers” , Tuhyn municipality, Ukraine</td>
<td>Tatiana Kudina</td>
<td><a href="mailto:tatyana.kudina@undp.org">tatyana.kudina@undp.org</a></td>
<td>+38 044 254 0035</td>
</tr>
<tr>
<td>Service Cooperative “Brovozers” , Tuhyn municipality, Ukraine</td>
<td>Tatiana Kudina</td>
<td><a href="mailto:tatyana.kudina@undp.org">tatyana.kudina@undp.org</a></td>
<td>+38 044 254 0035</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maryna Chyketa</td>
<td>The Coca-Cola Company</td>
<td>+38 044 254 0035</td>
<td><a href="mailto:mchyketa@coca-cola.com">mchyketa@coca-cola.com</a></td>
</tr>
</tbody>
</table>

### Phase Number

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or in Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

#### Access Level

- Full Access
- Limited Access
- No Access

#### Method of Estimating Benefits

- Annual Replenish Volume (Liters Per Year)
- Method of Estimating Benefits (Water or Estimate)
- Latitude (Decimal Degrees)
- Longitude (Decimal Degrees)

#### Type of Water Access Infrastructure

<table>
<thead>
<tr>
<th>Type of Water Access Infrastructure</th>
<th>Access Level</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Type of Sanitation Infrastructure

<table>
<thead>
<tr>
<th>Type of Sanitation Infrastructure</th>
<th>Access Level</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes

- **Limited Access** means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals)
- **Full Access** for water delivery means that the water source is available to beneficiaries within 1 km of the source, while not exceeding the population or the maximum flow rate of the system.

### Water Access Projects

For **Full Access** projects, there are two choices for quantifying benefits:

a. Preferred: Annual meter reading indicating total flow through system for given year, or

b. Applying the World Health Organization and UNICEF Joint Monitoring Programme's 20 liters/day/capita for domestic purposes, drinking, cooking and personal hygiene for each beneficiary within 1km of the source, while not exceeding the population or the maximum flow rate of the system.

For **Limited Access** projects: For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

### Sanitation Projects

Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:

a. Preferred: Annual meter reading indicating the total flow through the system for a given year, or

b. The engineering design capacity of the system

c. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

### Post Implementation System Operation and Monitoring Plan

- A summary plan to ensure safe and continuous operation of water access systems after construction and commencement of operations.
- The operations and maintenance plan is to ensure that community members have access to safe and continuous operation of water access systems.
- The operations and maintenance plan is to ensure that community members have access to safe and continuous operation of water access systems.

### Comments

- Please include any other data that should be known about this project.
### Project Fact Sheet for Water Access and Sanitation Projects

<table>
<thead>
<tr>
<th>Date</th>
<th>Project Code:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Water Access Projects

For **Full Access** projects, there are two choices for quantifying benefits:

- a. **Preferred:** Annual meter reading indicating total flow through system for given year.
- b. **Applying the World Health Organization and UNICEF Joint Monitoring Programme’s 20 litres/day/capita for domestic purposes, drinking, and personal hygiene for each beneficiary within 1km of the source, with the maximum flow rate of the system.**

For **Limited Access** projects: For benefits to be quantified, the project must be metered and the annual flow through volume recorded each year.

### Sanitation Projects

Benefits are based on the volume of wastewater that is treated. Can be determined based on either of the following:

- **Preferred:** Annual meter reading indicating the total flow through the system for a given year.
- **or**
- **Method of Estimating Benefits**
  - a. **Preferred:** Annual meter reading indicating total flow through system for given year, or
  - b. **Engineering design capacity of the system**
  - c. **There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.**

### Project Description (Brief)

Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.

- **a.** Preferred: Annual meter reading indicating the total flow through the system for a given year, or
- **b.** Engineering design capacity of the system
- **c.** There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

### Project Implementation Schedule

- **Phase 1 (2010-2011):** 6 mountain water supply systems (installed April 2011)
- **Phase 2 (2011-2012):** 5 mountain water supply systems (installed December 2013)
- **Phase 3 (2012-2013):** 2 water tanks (installed December 2013)

### Water Access

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or in Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1 (2010-2011)</td>
<td>6 mountain water supply systems (completed April 2011)</td>
<td>Completed</td>
<td></td>
</tr>
<tr>
<td>Phase 2 (2011-2012)</td>
<td>5 mountain water supply systems (completed December 2013)</td>
<td>Completed</td>
<td></td>
</tr>
<tr>
<td>Phase 3 (2012-2013)</td>
<td>2 water tanks (completed December 2013)</td>
<td>Completed</td>
<td></td>
</tr>
</tbody>
</table>

#### Please Complete A Row in the Below Table For Each Individual Water Access Point (only include access points installed and in operation)

<table>
<thead>
<tr>
<th>Type of Water Access Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries (Liters Per Year - with cost share)</th>
<th>Annual Replenish Volume (Liters Per Year - with cost share)</th>
<th>Method of Estimating Benefits (Meter or Estimate)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bean Wang Pak Wan</td>
<td>Full Access</td>
<td>Apr-11</td>
<td>320</td>
<td>232000</td>
<td>WHO-20hppm</td>
<td>9.1854</td>
<td>98.8605</td>
</tr>
<tr>
<td>Bean Sang Mui</td>
<td>Full Access</td>
<td>Apr-11</td>
<td>160</td>
<td>118000</td>
<td>WHO-20hppm</td>
<td>9.2061</td>
<td>98.8606</td>
</tr>
<tr>
<td>Bean Sang Wai</td>
<td>Full Access</td>
<td>Apr-11</td>
<td>60</td>
<td>432000</td>
<td>WHO-20hppm</td>
<td>9.3148</td>
<td>98.8677</td>
</tr>
<tr>
<td>Bean Sang Moi</td>
<td>Full Access</td>
<td>Apr-11</td>
<td>200</td>
<td>144000</td>
<td>WHO-20hppm</td>
<td>9.2283</td>
<td>98.8654</td>
</tr>
<tr>
<td>Bean Sang Lan</td>
<td>Full Access</td>
<td>Apr-11</td>
<td>120</td>
<td>876000</td>
<td>WHO-20hppm</td>
<td>9.2345</td>
<td>98.9211</td>
</tr>
<tr>
<td>Bean Wai</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>40</td>
<td>28000</td>
<td>WHO-20hppm</td>
<td>9.3632</td>
<td>98.6859</td>
</tr>
<tr>
<td>Bean Wang Tham</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>382</td>
<td>288000</td>
<td>WHO-20hppm</td>
<td>9.1550</td>
<td>98.8846</td>
</tr>
<tr>
<td>Bean Sang Nok</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>180</td>
<td>1344000</td>
<td>WHO-20hppm</td>
<td>9.3681</td>
<td>98.9057</td>
</tr>
<tr>
<td>Bean Sang Pak Wan</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>40</td>
<td>35000</td>
<td>WHO-20hppm</td>
<td>9.156</td>
<td>98.8840</td>
</tr>
<tr>
<td>Bean Sang Khi</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>150</td>
<td>105000</td>
<td>WHO-20hppm</td>
<td>9.282</td>
<td>98.841</td>
</tr>
<tr>
<td>Bean Sang Pak</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>40</td>
<td>29500</td>
<td>WHO-20hppm</td>
<td>9.2258</td>
<td>98.8935</td>
</tr>
<tr>
<td>Bean Sang Pak</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>80</td>
<td>59000</td>
<td>WHO-20hppm</td>
<td>9.2544</td>
<td>98.8719</td>
</tr>
<tr>
<td>Bean Sang Pak</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>60</td>
<td>438000</td>
<td>WHO-20hppm</td>
<td>9.0257</td>
<td>98.6947</td>
</tr>
</tbody>
</table>

### Sanitation

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or in Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1 (2010-2011)</td>
<td>6 mountain water supply systems (completed April 2011)</td>
<td>Completed</td>
<td></td>
</tr>
<tr>
<td>Phase 2 (2011-2012)</td>
<td>5 mountain water supply systems (completed December 2013)</td>
<td>Completed</td>
<td></td>
</tr>
<tr>
<td>Phase 3 (2012-2013)</td>
<td>2 water tanks (completed December 2013)</td>
<td>Completed</td>
<td></td>
</tr>
</tbody>
</table>

#### Please Complete A Row in the Below Table For Each Individual Sanitation Point

<table>
<thead>
<tr>
<th>Type of Sanitation Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries (Liters Per Year - with cost share)</th>
<th>Annual Replenish Volume (Liters Per Year - with cost share)</th>
<th>Method of Estimating Benefits (Meter or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bean Wang Pak Wan</td>
<td>Full Access</td>
<td>Apr-11</td>
<td>320</td>
<td>232000</td>
<td>WHO-20hppm</td>
<td>9.1854</td>
<td>98.8605</td>
</tr>
<tr>
<td>Bean Sang Mui</td>
<td>Full Access</td>
<td>Apr-11</td>
<td>160</td>
<td>118000</td>
<td>WHO-20hppm</td>
<td>9.2061</td>
<td>98.8606</td>
</tr>
<tr>
<td>Bean Sang Wai</td>
<td>Full Access</td>
<td>Apr-11</td>
<td>60</td>
<td>432000</td>
<td>WHO-20hppm</td>
<td>9.3148</td>
<td>98.8677</td>
</tr>
<tr>
<td>Bean Sang Moi</td>
<td>Full Access</td>
<td>Apr-11</td>
<td>200</td>
<td>144000</td>
<td>WHO-20hppm</td>
<td>9.2283</td>
<td>98.8654</td>
</tr>
<tr>
<td>Bean Sang Lan</td>
<td>Full Access</td>
<td>Apr-11</td>
<td>120</td>
<td>876000</td>
<td>WHO-20hppm</td>
<td>9.2345</td>
<td>98.9211</td>
</tr>
<tr>
<td>Bean Wai</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>40</td>
<td>28000</td>
<td>WHO-20hppm</td>
<td>9.3632</td>
<td>98.6859</td>
</tr>
<tr>
<td>Bean Wang Tham</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>382</td>
<td>288000</td>
<td>WHO-20hppm</td>
<td>9.1550</td>
<td>98.8846</td>
</tr>
<tr>
<td>Bean Sang Nok</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>180</td>
<td>1344000</td>
<td>WHO-20hppm</td>
<td>9.3681</td>
<td>98.9057</td>
</tr>
<tr>
<td>Bean Sang Pak Wan</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>40</td>
<td>35000</td>
<td>WHO-20hppm</td>
<td>9.156</td>
<td>98.8840</td>
</tr>
<tr>
<td>Bean Sang Khi</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>150</td>
<td>105000</td>
<td>WHO-20hppm</td>
<td>9.282</td>
<td>98.841</td>
</tr>
<tr>
<td>Bean Sang Pak</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>40</td>
<td>29500</td>
<td>WHO-20hppm</td>
<td>9.2258</td>
<td>98.8935</td>
</tr>
<tr>
<td>Bean Sang Pak</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>80</td>
<td>59000</td>
<td>WHO-20hppm</td>
<td>9.2544</td>
<td>98.8719</td>
</tr>
<tr>
<td>Bean Sang Pak</td>
<td>Full Access</td>
<td>Dec-13</td>
<td>60</td>
<td>438000</td>
<td>WHO-20hppm</td>
<td>9.0257</td>
<td>98.6947</td>
</tr>
</tbody>
</table>

### Post Implementation System Operation and Monitoring Plan

- **Describe Operations and Maintenance Plan (Daily)**
  - Each household should pay a water fee of 20 baht per month to get access. This money is for maintenance of this water supply system.

### Comments (Please include anything else that should be known about this project)

- **Submit by:**
  - **Name:**
  - **Title:**
  - **Organization:**
  - **Telephone:**
  - **Email:**
### Template: Project Fact Sheet for Water Access and Sanitation Projects

**Type of Project:** Water Access

**Project Code:** [ ]

**Project Name:** Environment Conservation & Watershed Management

**TCCC BU:** Pacific

**Country:** Pakistan

**Major Activities:** (Check All That Apply):
- [ ] Well Construction/Rehabilitation
- [ ] Protected Spring Box
- [ ] Rainwater harvesting
- [ ] Community Water Treatment System
- [ ] Household Pump Systems

**Name of Project Contact:** Fahad Qadir

**Email:** fqadir@apac.ko.com

**Organization:** The Coca-Cola Export Corporation - Pakistan Branch

**Phone:** Fax

**Date:** [ ]

**Submitted by:** [ ]

#### Post Implementation System Operation and Monitoring Plan

Describe Operations and Maintenance Plan (Briefly):

- **Who is Responsible for Operation and Maintenance of Water Access Point?**
- **Description**

**Quantification Method Choices:**

- [ ] Limited Access
- [ ] Full Access

**Benefits are based on the volume of wastewater that is treated.**

**Annual Replenish Volume (Liters Per Year):**

- [ ] Metered
- [ ] Engineering Design

**Coca-Cola Cost Share Percentage:**

**Coca-Cola/Bottler Cost Contribution:**

**Total Cost of Project:**

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Complete A Row in the Below Table For Each Water Access Point (only include access points installed and in operation)

**Total Number of Water Access Points Installed and Operational:**

<table>
<thead>
<tr>
<th>Type of Water Access Infrastructure</th>
<th>Access Level</th>
<th>Date Installed and Operational</th>
<th>Annual Replenish Volume (Liters Per Year - with cost share)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainwater harvesting systems</td>
<td>Limited Access</td>
<td>Jun-10</td>
<td>7932000</td>
<td>Metered</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

#### Complete A Row in the Below Table For Each Sanitation System Installed

**Total Number of Sanitation Systems Installed and Operational:**

<table>
<thead>
<tr>
<th>Type of Sanitation Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Date Installed and Operational</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
</table>

**Post Implementation System Operation and Monitoring Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations):**

Describe Operations and Maintenance Plan (Briefly):

**Comments (Please include anything else that should be known about this project):**

- **Name**
- **Title**
- **Organization**
- **Telephone**
- **Email**

**Submitted by:** Fahad Qadir

**PAC Manager**

**The Coca-Cola Export Corporation**

**pqadir@apex-bio.com**

---

### A total of 61 roof water harvesting schemes were established in three sites: Namli Mera, Kundla and Tauheedabad where a total of 2000m² roof-water harvesting scheme consists of collection channels around the roof and a storage tank connected with a washroom or a washing tap.

### Project Description (brief):

- **Please provide a brief project description, indicate the type of water access being provided and describe the community benefiting from the project.**

**Type of Water Access Infrastructure**

- [ ] Rainwater harvesting systems

**Type of Sanitation Infrastructure**

- [ ] Latrine Installation
- [ ] Community Education & Awareness

---

### Benefits are based on the volume of wastewater that is treated.

- **Benefits are based on the volume of wastewater that is treated.**

**Annual Replenish Volume (Liters Per Year):**

- [ ] Metered
- [ ] Engineering Design

---

### Method of Estimating Benefits

- **Method of Estimating Benefits**

**Annual Replenish Volume (Liters Per Year):**

- [ ] Metered
- [ ] Engineering Design

---

### Limited Access

- **Limited Access**

**Annual Replenish Volume (Liters Per Year):**

- [ ] Metered
- [ ] Engineering Design

---

### Full Access

- **Full Access**
## Template 3: Project Fact Sheet for Water Access and Sanitation Projects

**Project Name:** Egypt Livelihood Program (ELP) Developing 100 Villages  
**Type of Project:** Water Access  
**Date:**  
**Project Code:**  

### Project Details

- **Total Cost of Project (including co-finance):** $357,143.00
- **Coca-Cola/Bottle Cost Contribution:** $357,143.00
- **Coca-Cola Cost Share Percentage:** 100% Coca-Cola Egypt Budget

### Access Level

- **Community Education, Training & Awareness**
- **Distribution Network Construction/Rehabilitation**
- **Sanitation**

### Access Level

- **Full Access**
  - 2014
  - 100% Coca-Cola Egypt Budget

### Benefits

1. **Annual Replenish Volume**
2. **Method of Estimating Benefits**
3. **Latitude**
4. **Longitude**

### Completed or In Development

- **Completed or In Development**

### Operations Plan

- **Hygiene Training**
- **Latrine Installation**
- **Other (Please Describe):**

### Water Access Projects

- **Total Number of Water Access Points Installed and Operational:** 1122

### Phase Number

- **Phase Number:**
- **Date Implementation will be Complete:**

### Please Complete A Row in the Below Table For Each Individual Water Access Point (Only include access points installed and in operation)

<table>
<thead>
<tr>
<th>Water Access Point</th>
<th>Access Level</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Estimate)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Water Connections to homes in Al Faesa</td>
<td>Full Access</td>
<td>2014 82</td>
<td>396620</td>
<td>WHO 20 l/d/person</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02 Water connections to homes in Al Faesa</td>
<td>Full Access</td>
<td>2014 168</td>
<td>1204500</td>
<td>WHO 20 l/d/person</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 Water connections to homes in Al Faesa</td>
<td>Full Access</td>
<td>2014 1368</td>
<td>8132450</td>
<td>WHO 20 l/d/person</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04 Water connections to homes in S.Rawana</td>
<td>Full Access</td>
<td>2014 916</td>
<td>1505500</td>
<td>WHO 20 l/d/person</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05 Water connections to homes in S.Read</td>
<td>Full Access</td>
<td>2014 1691</td>
<td>2245350</td>
<td>WHO 20 l/d/person</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 Water connections to homes in S.Mahmoudbake</td>
<td>Full Access</td>
<td>2014 1519</td>
<td>224920</td>
<td>WHO 20 l/d/person</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 Water connection to a primary school in S.Mahmoudbake</td>
<td>Limited Access</td>
<td>2014 508</td>
<td>not available</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Please Complete A Row in the Below Table For Each Sanitation System Installed:

<table>
<thead>
<tr>
<th>Sanitation System</th>
<th>Access Level</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qolosona</td>
<td>Clean water connection to a primary school in Qolosona</td>
<td>2014</td>
<td>210</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Water connections to homes in Qolosna</td>
<td>Full Access</td>
<td>2014</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Water connections to homes in Sareereya</td>
<td>Full Access</td>
<td>2014</td>
<td>175</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Water connections to homes in El Gazayer</td>
<td>Full Access</td>
<td>2014</td>
<td>274</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Water connections to homes in Beni Mohamadeyat</td>
<td>Full Access</td>
<td>2014</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Water connections to homes in Al Basra</td>
<td>Full Access</td>
<td>2014</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Post Implementation System Operation and Monitoring Plan

- **System Operation and Monitoring Plan**: (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations)

- **Date Implementation will be Complete**:

### Completed or In Development

- **Completed or In Development**

### Please Complete A Row in the Below Table For Each Individual Sanitation Point

<table>
<thead>
<tr>
<th>Sanitation Point</th>
<th>Access Level</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

### Project Contact Person

- **Name**: Ghada Makady, Senior Public Affairs and Communications Manager
- **Organization**: Coca-Cola
- **Phone**: 2022781533
- **Email**: gmakady@coca-cola.com

### Guidance

- **Coca-Cola System Contact Person**: Ghada Makady, Senior Public Affairs and Communications Manager
- **Coca-Cola Cost Share Percentage**: 100% Coca-Cola Egypt Budget

### Project Description (brief)

- **Connecting 1,122 clean water connections to houses in 8 villages benefiting a total of 6357 beneficiaries for a total cost of 2,500,000 EGP. As a part of the 100 Villages project that aims to developing 100 villages in Egypt by the year 2020.**

### Completed or In Development

- **Completed or In Development**
### Template 3: Project Fact Sheet for Water Access and Sanitation Projects

**Date:**

<table>
<thead>
<tr>
<th>Project Code:</th>
</tr>
</thead>
</table>

**Project Name:** Environmental Services for Improving Water Quality/Management

**Type of Project:** Water Access

**Coca-Cola Cost Share Percentage:** 33%

**Total Cost of Project (including co-finance):** $250,000

**Coca-Cola/Bottler Cost Contribution:** $250,000

**Coca-Cola System Contact Person:** Tara Varghese

**Name of Project Contact:** Tara Varghese

**Country:** Central, Eastern and Western Africa

**Country:** Egypt

**State:** (Check All That Apply): Well Construction/Rehabilitation, Irrigation Training, Sanitation

**Network:** Community Education, Training & Awareness

**Other (Please Describe):**

**Number of Direct Beneficiaries:** 33%

**Number of Water Access Points Installed and Operational:**

**Total Number of Sanitation Systems Installed and Operational:**

**Total Number of Water Access Points Installed and Operational:**

**Type of Water Access Infrastructure:**

<table>
<thead>
<tr>
<th>Water Access Infrastructure</th>
<th>Access Level</th>
<th>Date Installed and Operational</th>
<th>Number of Direct Beneficiaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Construction/Rehabilitation</td>
<td>Full Access</td>
<td>11/30/2008</td>
<td>125 (250/20)</td>
</tr>
<tr>
<td>Irrigation Training</td>
<td>Irrigation Training</td>
<td>12/20/2020</td>
<td>15 (250/20)</td>
</tr>
<tr>
<td>Sanitation</td>
<td>Sanitation</td>
<td>12/20/2020</td>
<td>15 (250/20)</td>
</tr>
</tbody>
</table>

**Annual Replenish Volume (Liters Per Year - with cost share):**

**Method of Estimating Benefits (Water or Engineering Design):**

**Latitude (Decimal Degrees):**

**Longitude (Decimal Degrees):**

**Phase Number**

<table>
<thead>
<tr>
<th>Phase Number</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Date Implementation will be Complete</th>
</tr>
</thead>
</table>

**If Project is Being Completed in Phases, Please Indicate Implementation Schedule.**

**For Sanitation Projects:**

- **Benefits are based on:**
  - The volume of wastewater that is treated.
  - Can be determined based on either of the following:
    - Preferred: Annual meter reading indicating the total flow through system for given year, or
    - Engineering design capacity of the system
  - Some sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

**Post Implementation System Operation and Monitoring Plan (summarize the plan to ensure safe and continuous operation of water access systems after construction and commencement of operations):**

- **Describe Operations and Maintenance Plan Briefly:**
  - To ensure project sustainability, the CDA, local government authorities, Branch Canal Water Users Associations and all other stakeholders in the selected pilot areas were involved in all stages of the process. Training and public awareness initiatives built necessary awareness and capacity of local participating organizations, including special attention to women.

**Comments (Please include anything else that should be known about this project):**

**Name:**

**Title:**

**Organization:** GETF

**Telephone:** 703-379-2713

**Email:** tara.varghese@getf.org

**Date Submitted:** 12/20/14

---

1. Yellow shaded cells require data input from you.

2. Water access projects are accomplished through a variety of means, including well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pump systems.

3. "Full Access" for water delivery means that the water source is available to beneficiaries less than 1 kilometer away from its source of use and that it is possible to reliably obtain at least 20 liters per member of a household per day. Examples include new boreholes installed in a village.

4. "Limited Access" means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).

5. Please make sure it is perfectly clear whether the project has been implemented or is planned. If the project is being implemented in phases, please indicate which phases have already been implemented and which are planned. Maintain this distinction regarding the statement of Replenish benefits.

6. Certain projects, such as Community Education & Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.

**Sanitation:**

- **Benefits are based on:**
  - The volume of wastewater that is treated.
  - Can be determined based on either of the following:
    - Preferred: Annual meter reading indicating the total flow through system for given year, or
    - Engineering design capacity of the system
  - Some sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.

**In collaboration with the Egyptian Ministry of Water Resources and Irrigation, RAIN partners worked to improve water quality management in Gharbia Governorate, Lower Egypt and Giza Governorate. Upper Egypt wastewater treatment facilities were designed and constructed in those rural communities to serve a population of about 80,000. The project introduced technologies featuring a vertical design that reduced costs and the land area needed for construction.**
### Template: Project Fact Sheet for Water Access and Sanitation Projects

**Project Name:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Project Code</th>
<th>Project Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Dec-14</td>
<td>2,000</td>
<td>Water Access and Sanitation Projects, Basco</td>
</tr>
<tr>
<td>1-Dec-14</td>
<td>750</td>
<td>Sanitation Systems, Basco</td>
</tr>
<tr>
<td>1-Dec-14</td>
<td>4,260</td>
<td>Water Access Systems, Basco</td>
</tr>
<tr>
<td>1-Dec-14</td>
<td>10,000</td>
<td>Sanitation Systems, Basco</td>
</tr>
<tr>
<td>1-Dec-14</td>
<td>9,280</td>
<td>Water Access Systems, Basco</td>
</tr>
<tr>
<td>1-Dec-14</td>
<td>11,000</td>
<td>Sanitation Systems, Basco</td>
</tr>
<tr>
<td>1-Dec-14</td>
<td>14,600</td>
<td>Water Access Systems, Basco</td>
</tr>
<tr>
<td>1-Dec-14</td>
<td>31,098</td>
<td>Sanitation Systems, Basco</td>
</tr>
</tbody>
</table>

**Phase:**

- **Development**
- **Implementation**
- **In Operation**

**Organization:**

- Coca-Cola Foundation Philippines
- Habitat for Humanity
- Coca-Cola/Bottler Cost Contribution

**Contact Person:**

- Monina P. Pacheco
- Gina Virtusio
- Cecile Alcantara

**Country:**

- Philippines
- Indonesia

**Type of Project:**

- Water Access
- Sanitation

**Name of Project Contact:**

- Cecile Alcantara
- Gina Virtusio
- Monina P. Pacheco

**Phone:**

- 63(0)7248987
- 63(0)9178102160
- 63(0)9178102160

**Email:**

- monina.pacheco@coca-cola.com.ph
- Gina.Virtusio@hfh.org
- cecile.alcantara@coca-cola.com.ph

**Notes:**

- This includes all Coca-Cola Company and other funding contributions (including Company and Wather Foundations).

**Project Description (brief):**

- Partnership project of Coca-Cola Foundation and Habitat for Humanity (H4H) in the rebuilding of water systems of seven (7) project sites (covering several barangays from adjacent provinces) destroyed by Bohol Earthquake in 2013.

**Method of Estimating Benefits:**

- For Water Access Projects:
  - Annual meter reading, indicating total flow through the system for given year.
  - Project description includes method of estimating benefits.

- For Sanitation Projects:
  - Annual meter reading, indicating total flow through the system for given year.
  - Project description includes method of estimating benefits.

**Quantification Method Choices:**

- Annual meter reading indicating total flow through system for given year.
- Project description includes method of estimating benefits.

**Latitude and Longitude:**

- 6° 57' 35.9958" 122° 10' 59.2284"
- 9° 45' 0" 123° 49' 59.9982"
- 11° 14' 47.3856" 124° 1' 2.3118"
- 11° 15' 0" 125° 0' 0"

**Type of Project:**

- Water Access
- Sanitation

**Type of Water Access Infrastructure:**

- Protected Spring Box
- Point-of-Use Treatment
- Protected Spring Box, Protected Spring Box, Protected Spring Box

**Type of Sanitation Infrastructure:**

- Latrine Installation
- Community Water Treatment System
- Latrine Installation, Latrine Installation, Latrine Installation

**Method of Estimating Benefits:**

- Water Access
- Sanitation

**Annual Replenish Volume (Liters Per Year):**

- 11,038,000
- 13,489,000
- 12,063,000
- 15,100

**Method of Estimating Benefits:**

- Water Access
- Sanitation

**Latitude and Longitude:**

- 11° 15' 0" 125° 0' 0"
- 11° 15' 0" 125° 0' 0"

**Comments:**

- Please include any other information that should be known about this project.
## Project Fact Sheet for Water Access and Sanitation Projects

<table>
<thead>
<tr>
<th>Date Implementation will be Complete</th>
<th>Description</th>
<th>Completed or In Development</th>
<th>Phase Number</th>
<th>Type of Water Access Infrastructure</th>
<th>Access Level (Full or Limited)</th>
<th>Number of Direct Beneficiaries</th>
<th>Annual/Replenish Volume (Liters Per Year)</th>
<th>Method of Estimating Benefits (Water or Engineering Design)</th>
<th>Method of Estimating Benefits (Meter or Estimate)</th>
<th>Latitude (Decimal Degrees)</th>
<th>Longitude (Decimal Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q4 2014</td>
<td>Please Complete A Row in the Below Table For Each Water Access Point Installed</td>
<td>Please Complete A Row in the Below Table For Each Sanitation System Installed</td>
<td>6. Certain projects, such as Community Education &amp; Awareness, can be important local projects, but do not contribute quantifiable Replenish benefits.</td>
<td>1. There are certain sanitation projects (waterless toilets and VIP latrines) that do not contribute quantifiable Replenish benefits.</td>
<td>1. Preferred: Annual Meter Reading indicating total flow through system for given year, or</td>
<td>2. Water access projects are accomplished through a variety of means, including: well construction/rehabilitation, protected spring catchment structure, rainwater harvesting, community water treatment system and household pump systems.</td>
<td>3. &quot;Full Access&quot; means that the water source is available to beneficiaries less than 1 kilometer away from its place of use and that it is possible to reliably obtain at least 20 litres per member of a household per day. Examples include new boreholes installed in a village.</td>
<td>4. &quot;Limited Access&quot; means that the water source or sanitation solution is available to beneficiaries for part of the day or part of the year (for example clean water in schools or in hospitals).</td>
<td>5. Please make sure it is perfectly clear whether the project has been implemented or is planned. If the project is being implemented in phases, please indicate which phases have already been implemented and which are planned. Maintain this distinction regardless of the statement of Replenish benefits.</td>
<td>11° 5' 20.256” 125° 30' 44.2758”</td>
<td>13° 27’ 21.999” 123° 21’ 50.0004”</td>
</tr>
</tbody>
</table>

### Method of Estimating Benefits

- **Quantification Method Choices:**
  - **Annual Replenish Volume**
  - **Method of Estimating Benefits (Water or Engineering Design)**
  - **Method of Estimating Benefits (Meter or Estimate)**

### Project Details

- **Partnership:**
  - **Coca-Cola Foundation Philippines**
  - **PRRM**

### Project Description (Brief)

```
PRRM and CCFPI jointly facilitate the project for the construction of spring development gravity-fed water systems in selected five (5) rural communities in the provinces of Aklan, Camarines Norte, Camarines Sur, Eastern Samar, and Nueva Ecija.
```

### Project Contact Details

- **Name:** Isagani R. Serrano
- **Email:** info@prrm.org
- **Project Name:** Agos Gravity-fed Water Access System
**Project Name:** Community Clean Water Supply and Sanitation 2014  
**Project Code:** TCC BI  
**TCC BI:** Asia/Pacific  
**Country:** Cambodia  
**Project Contact:** Mrs. Meach Sotheary  
**Completion Date:** 30-Oct-14

### Project Facts

**Number of Direct Beneficiaries:** 366 Households  
**Total Cost of Project:** $80,000

**Coca-Cola/Bill & Melinda Gates Foundation**

**Coca-Cola/Cost Share Percentage:** 100%

---

### Project Activities

**Community Engagement:**

- **Sanitation Committee:**
  - Village Chief, Deputy Village Chief, Member
- **Sanitation Education Session:**
- **Tool and Material Development:**

**Post Implementation System Operation and Monitoring Plan:**

*Dependent on Actual Project Completion and Operation Modalities*

**Baseline Survey**

- Conduct base line survey to get the data related to beneficiary before project start so that we can compare it to the endline data in order to know the contribution of the project involvement.

**Project Evaluation-End Line Survey**

- Monitor the project implementation
- Conduct End line survey to analyse the project result by comparing to the baseline data

---

### Project Budget Management

**Total Cost of Project:** $80,000

**Revenue:**

- **Water Access Projects:**
  - Water pipe connection
  - Full Access

**Cost:**

- **Sanitation Projects:**
  - Community Education, Training & Awareness
  - Sanitation

**Method of Estimating Benefits:**

- Annual Replenish Volume (Liters per year)

**Quantification Method Choices:**

- Annual Meter Reading indicating total flow through system for a given year, or
- Time of Use Metering

---

### Project Evaluation

**Project Evaluation-End Line Survey**

- Monitor the project implementation
- Conduct End line survey to analyse the project result by comparing to the baseline data

---

### Project Management

**Project Management Plan:**

- Conduct Assessment to project site to find out all related information regarding beneficiary and supplier.

**Baseline Survey**

- Conduct baseline survey to get the data related to beneficiary before project start so that we can compare it to the endline data in order to know the contribution of the project involvement.

**Monitor and Evaluation Plan:**

- Conduct monitoring and evaluation to assess the project progress and outcomes.

---

### Project Details

- **Project Site Assessment:**
  - Conduct site assessment to project site to find out all related information regarding beneficiary and supplier.

**Baseline Survey:**

- Conduct baseline survey to get the data related to beneficiary before project start so that we can compare it to the endline data in order to know the contribution of the project involvement.

**Project Implementation Plan:**

- Develop a project implementation plan to ensure the successful implementation of the project.

---

### Project Implementation

**Sanitation Projects:**

- Conduct assessment to project site to find out all related information regarding beneficiary and supplier.

**Baseline Survey:**

- Conduct baseline survey to get the data related to beneficiary before project start so that we can compare it to the endline data in order to know the contribution of the project involvement.

---

### Project GIS

**Type of Water Access Infrastructure:**

- Access Level (Full or Limited)

**Type of Sanitation Infrastructure:**

- Access Level (Full or Limited)

---

### Project Organization

**TCC Group:**

- **Pacific:**
  - Coca-Cola Southeast Asia, Inc.

**Project Fact Sheet for Water Access and Sanitation Projects**

**Date:** 30-Oct-14

---

### Project Evaluation

**Sanitation Projects:**

- Conduct assessment to project site to find out all related information regarding beneficiary and supplier.

**Baseline Survey:**

- Conduct baseline survey to get the data related to beneficiary before project start so that we can compare it to the endline data in order to know the contribution of the project involvement.

---

### Project Details

- **Project Site Assessment:**
  - Conduct site assessment to project site to find out all related information regarding beneficiary and supplier.

**Baseline Survey:**

- Conduct baseline survey to get the data related to beneficiary before project start so that we can compare it to the endline data in order to know the contribution of the project involvement.

---

### Project Implementation

**Sanitation Projects:**

- Conduct assessment to project site to find out all related information regarding beneficiary and supplier.

**Baseline Survey:**

- Conduct baseline survey to get the data related to beneficiary before project start so that we can compare it to the endline data in order to know the contribution of the project involvement.

---

### Project GIS

**Type of Water Access Infrastructure:**

- Access Level (Full or Limited)

**Type of Sanitation Infrastructure:**

- Access Level (Full or Limited)
Appendix G
Fact Sheets for Continuing Projects Previously Validated by Others
<table>
<thead>
<tr>
<th>LTI ID</th>
<th>TCCC ID</th>
<th>Country</th>
<th>Partner / Lead</th>
<th>Project Name</th>
<th>Description of Activity</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>154</td>
<td>U.S. TX</td>
<td>TNC</td>
<td>Tallgrass Prairie Watershed Restoration in North Texas</td>
<td>Conservation of native prairie land, Invasive species removal and revegetation</td>
<td>1, 6</td>
</tr>
<tr>
<td>04</td>
<td>156</td>
<td>U.S. GA</td>
<td>TNC</td>
<td>Etowah River Watershed Conservation Partnership</td>
<td>Raccoon Creek floodplain restoration, Riparian buffer planting for Raccoon Creek, Stormwater Infiltration Project</td>
<td>12, 16, 19</td>
</tr>
<tr>
<td>15</td>
<td>91</td>
<td>U.S. PA</td>
<td>WLC</td>
<td>Wildlands Conservancy Lehigh River Restoration</td>
<td>Treatment wetland for abandoned mine drainage, Jordan Creek stream stabilization project, Little Lehigh Stream Bank Stabilization Project at Pool Wildlife Sanctuary, Monocacy Creek Stream Restoration Projects</td>
<td>22, 28, 31, 34</td>
</tr>
<tr>
<td>16</td>
<td>478</td>
<td>U.S. PA</td>
<td>ClearWater Conservancy</td>
<td>ClearWater Community Watershed Partnership – Scotia Barrens Halfmoon Wildlife Corridor</td>
<td>Land protection and conservation</td>
<td>38</td>
</tr>
</tbody>
</table>
### Appendix G Table of Contents

<table>
<thead>
<tr>
<th>LTI ID</th>
<th>TCCC ID</th>
<th>Country</th>
<th>Partner / Lead</th>
<th>Project Name</th>
<th>Description of Activity</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>18</td>
<td>Mexico</td>
<td>U.S. NM</td>
<td>WWF</td>
<td>TCCC-WWF Partnership: Rio Grande/Rio Bravo Basin (Caballo Dam to American Dam) Removal of invasive plants and natural levees, increasing high or pulse flows, bankline destabilization, and other restoration activities</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>U.S. Texas</td>
<td></td>
<td></td>
<td>57</td>
</tr>
<tr>
<td>25</td>
<td>221</td>
<td>Honduras Central America</td>
<td>WWF</td>
<td>Rio Chamelecon River Watershed Protection Initiative</td>
<td>Improved agricultural practices: cropland/farmland management</td>
<td>60</td>
</tr>
<tr>
<td>28</td>
<td>340</td>
<td>Vietnam/Thailand</td>
<td>WWF-Greater Mekong Program</td>
<td>Conserving the Mekong</td>
<td>Chi River reforestation Tram Chim water level management Chi River improved agricultural practices</td>
<td>67 73 77</td>
</tr>
<tr>
<td>31</td>
<td></td>
<td>Croatia</td>
<td>WWF</td>
<td>Reconnecting the Lifeline</td>
<td>Podunavljé fish ponds - Wetland restoration Gornje Podunavljé - Wetland restoration</td>
<td>82 87</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Serbia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>185</td>
<td>Pakistan</td>
<td>WWF-Pakistan</td>
<td>Environment Conservation &amp; Watershed Management</td>
<td>Afforestation, forest conservation, treatment of eroding streams, improved agricultural lands</td>
<td>91</td>
</tr>
<tr>
<td>38</td>
<td>120</td>
<td>Mexico</td>
<td>TCCC</td>
<td>Mexico Restoration and Reforestation Program</td>
<td>Reforestation Infiltration trenches</td>
<td>95 104</td>
</tr>
<tr>
<td>39</td>
<td>130</td>
<td>Mexico</td>
<td>TCCC</td>
<td>Reforestation Efforts at the Monarcha Butterfly Bioreserve</td>
<td>Reforestation</td>
<td>107</td>
</tr>
<tr>
<td>40</td>
<td>247</td>
<td>Philippines</td>
<td>WWF-Philippines</td>
<td>Ilagan Watershed Conservation Project in Isabela</td>
<td>Improved agricultural practices: cropland/farmland management</td>
<td>109</td>
</tr>
<tr>
<td>41</td>
<td>358</td>
<td>Turkey</td>
<td>TCCC</td>
<td>Every Drop Matters - in Saraykoy and Beypazari</td>
<td>Leak repair</td>
<td>115</td>
</tr>
<tr>
<td>43</td>
<td>261</td>
<td>Thailand</td>
<td>HAII</td>
<td>Conservation and Rehabilitation of the Klong Yan Watershed in Surat Thani</td>
<td>Conservation of forest land</td>
<td>117</td>
</tr>
<tr>
<td>73</td>
<td>227</td>
<td>Australia</td>
<td>Reef Catchments</td>
<td>Great Barrier Reef Project (Project Catalyst)</td>
<td>Precision agriculture</td>
<td>121</td>
</tr>
<tr>
<td>LTI ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Page #</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>---------------</td>
<td>----------------</td>
<td>--------------------------------------------------</td>
<td>-------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>74</td>
<td>323</td>
<td>Belarus</td>
<td>TCCC</td>
<td>Let’s Save Yelnya Together!</td>
<td>Blockage of artificial drainage canals</td>
<td>134</td>
</tr>
<tr>
<td>76</td>
<td>21</td>
<td>Guatemala</td>
<td>Programa de Agua Dulce</td>
<td>Protecting the Mesoamerican Reef</td>
<td>Pueblo Viejo sub-watershed Agroforestry management practices Teculutan sub-watershed Flood to drip irrigation</td>
<td>137</td>
</tr>
<tr>
<td>77</td>
<td>190</td>
<td>Philippines</td>
<td>Boy Scouts of the Philippines</td>
<td>Go Green! Go for the Real Thing!</td>
<td>Reforestation/revegetation</td>
<td>141</td>
</tr>
<tr>
<td>80</td>
<td>308</td>
<td>Philippines</td>
<td>Haribon Foundation</td>
<td>Caliraya Native Tree Nursery</td>
<td>Reforestation</td>
<td>144</td>
</tr>
<tr>
<td>82</td>
<td>134</td>
<td>Thailand</td>
<td>HAII</td>
<td>Village that Learns and Earns</td>
<td>Water supply for community use/agriculture</td>
<td>154</td>
</tr>
<tr>
<td>85</td>
<td>410</td>
<td>Brazil</td>
<td>Fundação Amazonas Sustentável</td>
<td>Bolsa Floresta Program</td>
<td>Conservation</td>
<td>158</td>
</tr>
<tr>
<td>88</td>
<td>365</td>
<td>Costa Rica</td>
<td>EARTH University</td>
<td>Siembra de Arboles</td>
<td>Reforestation</td>
<td>168</td>
</tr>
<tr>
<td>90</td>
<td>435</td>
<td>Turkmenistan</td>
<td>TCCC</td>
<td>Turkmenistan'da Forest Irrigation Project</td>
<td>Irrigation</td>
<td>172</td>
</tr>
<tr>
<td>94</td>
<td>427</td>
<td>China</td>
<td>UNDP</td>
<td>Guangxi Sustainable Sugarcane Initiative: Phase II</td>
<td>Conversion of flood irrigation to spray irrigation Conversion of flood irrigation to drip irrigation New irrigation supply and improved irrigation efficiency</td>
<td>194</td>
</tr>
<tr>
<td>96</td>
<td>549</td>
<td>U.S. CA</td>
<td>TNC</td>
<td>Sacramento River Riparian Habitat Restoration at La Barranca</td>
<td>Riparian habitat restoration</td>
<td>203</td>
</tr>
<tr>
<td>100</td>
<td>480</td>
<td>China</td>
<td>UNDP</td>
<td>Water Resources Management and Ecological Rehabilitation in the Mainstream Area of Tarim River Basin</td>
<td>Irrigation water for productive use Conversion from flood irrigation to drip irrigation</td>
<td>211</td>
</tr>
<tr>
<td>LTI ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Page #</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>---------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>101</td>
<td>448</td>
<td>Mexico</td>
<td>TCCC</td>
<td>Rain Water Harvesting Program in Mexico for Artificial Aquifer Recharge</td>
<td>Rainwater harvesting and artificial aquifer recharge</td>
<td>218</td>
</tr>
<tr>
<td>106</td>
<td></td>
<td>Indonesia</td>
<td>TCCC</td>
<td>Restoration of Water Resources as an Adaptation to Climate Change</td>
<td>Establishment of infiltration wells for artificial aquifer recharge of rainwater</td>
<td>223</td>
</tr>
<tr>
<td>109</td>
<td></td>
<td>Canada</td>
<td>WWF</td>
<td>St. Lawrence Restoration (Saint-Eugene Marsh)</td>
<td>Wetland restoration</td>
<td>228</td>
</tr>
<tr>
<td>113</td>
<td></td>
<td>U.S. CA</td>
<td>USFS</td>
<td>Indian Valley High Mountain Meadow Restoration</td>
<td>Hydrological restoration</td>
<td>232</td>
</tr>
<tr>
<td>114</td>
<td></td>
<td>U.S. CO</td>
<td>USFS</td>
<td>Trail Creek Restoration, Colorado</td>
<td>Construction of sediment detention basins and rehabilitation</td>
<td>237</td>
</tr>
<tr>
<td>115</td>
<td></td>
<td>U.S. GA</td>
<td>TNC</td>
<td>Dawson Forest Acquisition</td>
<td>Conservation</td>
<td>242</td>
</tr>
<tr>
<td>118</td>
<td></td>
<td>U.S.</td>
<td>TCCC</td>
<td>Coca-Cola Rain Gardens</td>
<td>Construction of rain gardens</td>
<td>248</td>
</tr>
<tr>
<td>119</td>
<td></td>
<td>Ecuador</td>
<td>TNC</td>
<td>Chongón-Colonche – Cerro Blanco Ecological Corridor: An Initiative to Conserve and Restore Key Water Sources and Biodiversity in Ecuador</td>
<td>Reforestation</td>
<td>253</td>
</tr>
<tr>
<td>122</td>
<td></td>
<td>U.S., IA</td>
<td>TNC</td>
<td>Mississippi River Basin Treatment Wetlands</td>
<td>Construction of treatment wetland</td>
<td>257</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U.S. MN</td>
<td></td>
<td></td>
<td></td>
<td>261</td>
</tr>
<tr>
<td>124</td>
<td></td>
<td>Spain</td>
<td>TCCC</td>
<td>Wet Lagoon Conservation Cobega</td>
<td>Wastewater reuse for conservation</td>
<td>265</td>
</tr>
<tr>
<td>130</td>
<td></td>
<td>Turkey</td>
<td>Life plus Youth Program</td>
<td>Four Seasons Water to Gölçihan (Life plus Youth Program)</td>
<td>Wetland restoration</td>
<td>268</td>
</tr>
<tr>
<td>131</td>
<td></td>
<td>Turkey</td>
<td>Life plus Youth Program</td>
<td>Caper, Forest’s Lover (Life plus Youth Program)</td>
<td>Revegetation of eroded slopes</td>
<td>272</td>
</tr>
<tr>
<td>LTI ID</td>
<td>TCCC ID</td>
<td>Country</td>
<td>Partner / Lead</td>
<td>Project Name</td>
<td>Description of Activity</td>
<td>Page #</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>-------------</td>
<td>----------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>---------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>132</td>
<td></td>
<td>Turkey</td>
<td>Life Plus Youth Program</td>
<td>Environmentally Friendly Earthworms (Life plus Youth Program)</td>
<td>Soil improvement to reduce irrigation demand</td>
<td>275</td>
</tr>
<tr>
<td>133</td>
<td></td>
<td>Turkey</td>
<td>TCCC</td>
<td>Rainwater Harvesting for Gediz Basin (Every Drop Matters)</td>
<td>Rainwater harvesting</td>
<td>279</td>
</tr>
<tr>
<td>135</td>
<td></td>
<td>Indonesia</td>
<td>WWF</td>
<td>Reforestation at Upper Ciliwung Watershed through NEWtrees program</td>
<td>Reforestation</td>
<td>282</td>
</tr>
<tr>
<td>136</td>
<td></td>
<td>U.S., MI</td>
<td>NFF</td>
<td>Stream Crossing Improvement on North Branch White River in Huron-Manistee National Forest, Michigan</td>
<td>In-stream flow restoration through culvert removal</td>
<td>286</td>
</tr>
<tr>
<td>137</td>
<td></td>
<td>U.S., NM</td>
<td>NFF</td>
<td>Placer Creek Restoration, Carson National Forest, New Mexico</td>
<td>Re-wetting high mountain meadows through hydrological restoration</td>
<td>290</td>
</tr>
<tr>
<td>142</td>
<td></td>
<td>U.S., GA</td>
<td>TNC</td>
<td>Boyles Island Acquisition (Georgia for Generations)</td>
<td>Conservation of Boyles Island</td>
<td>294</td>
</tr>
<tr>
<td>146</td>
<td></td>
<td>Spain</td>
<td>TCCC</td>
<td>Aquifer recharge in Valencia Spain</td>
<td>Establishment of infiltration wells for artificial aquifer recharge</td>
<td>298</td>
</tr>
<tr>
<td>148</td>
<td></td>
<td>China</td>
<td>UNDP</td>
<td>Urban wetland restoration in Zhengzhou City</td>
<td>Wastewater reuse for conservation</td>
<td>302</td>
</tr>
<tr>
<td>151</td>
<td></td>
<td>Kenya</td>
<td>GETF</td>
<td>Supplying Irrigation Water to Maximize Food Security in the Mara River Basin</td>
<td>Irrigation water supply</td>
<td>306</td>
</tr>
<tr>
<td>152</td>
<td></td>
<td>Niger</td>
<td>GETF</td>
<td>Supplying Irrigation Water to Strengthen Human Capacity for Income Generation</td>
<td>Irrigation water supply</td>
<td>310</td>
</tr>
<tr>
<td>153</td>
<td></td>
<td>Malawi</td>
<td>GETF</td>
<td>Community Watershed Support Project (C-WASP), Malawi</td>
<td>Reforestation</td>
<td>313</td>
</tr>
</tbody>
</table>
### Appendix G Table of Contents

<table>
<thead>
<tr>
<th>LTI ID</th>
<th>TCCC ID</th>
<th>Country</th>
<th>Partner / Lead</th>
<th>Project Name</th>
<th>Description of Activity</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>155</td>
<td></td>
<td>Indonesia</td>
<td>TCCC</td>
<td>Construction of infiltration wells in Mojokerto, Indonesia</td>
<td>Establishment of infiltration wells for artificial aquifer recharge of rainwater</td>
<td>317</td>
</tr>
<tr>
<td>157</td>
<td></td>
<td>Kyrgyzstan</td>
<td>NDWMD</td>
<td>Rehabilitation of Canal Kara-Talaa and Canal Kyzyl-Jyldyz in Naryn Region, Kyrgyzstan</td>
<td>Rehabilitation of two man-made canals to enhance water supply for regional irrigation</td>
<td>322</td>
</tr>
<tr>
<td>158</td>
<td></td>
<td>U.S., ID</td>
<td>BEF</td>
<td>Jesse Creek Restoration</td>
<td>In-stream flow restoration</td>
<td>327</td>
</tr>
<tr>
<td>160</td>
<td></td>
<td>Russian Federation</td>
<td>UNDP</td>
<td>Restoration of Sotovo Lake in the Volga-Akhtuba Floodplain</td>
<td>Restoration of natural flooding regime of Sotovo Lake to enhance biodiversity</td>
<td>331</td>
</tr>
<tr>
<td>161</td>
<td></td>
<td>Ecuador</td>
<td>TNC</td>
<td>Adaptation to the Impact of the Accelerated Retreat of Glaciers in the Tropical Andean Region - PRAA</td>
<td>Revegetation</td>
<td>335</td>
</tr>
<tr>
<td>163</td>
<td></td>
<td>Great Britain</td>
<td>WWF</td>
<td>River Cray Habitat Improvements</td>
<td>Modify stream flows for habitat improvement</td>
<td>339</td>
</tr>
<tr>
<td>164</td>
<td></td>
<td>U.S. TX</td>
<td>TNC</td>
<td>Brazos Watershed – Nash Prairie Stewardship and Seed Increase Project</td>
<td>Invasive species removal and revegetation with native species</td>
<td>345</td>
</tr>
</tbody>
</table>

Notes:
- BEF = Bonneville Environmental Foundation
- TCCC = The Coca-Cola Company
- GETF = Global Environment & Technology Foundation
- TNC = The Nature Conservancy
- HAII = Hydro and Agro Informatics Institute
- UNDP = United Nations Development Program
- NDWMD = Naryn District Water Management Department
- WLC = Wildlands Conservancy
- NFF = National Forest Foundation
- WWF = World Wildlife Fund
PROJECT NAME: Tallgrass Prairie Watershed Restoration in North Texas
PROJECT ID #: 02

DESCRIPTION OF ACTIVITY: Conservation of native prairie land (130 acres)

LOCATION: The Clymer Meadow Preserve located within East Fork Trinity River watershed
(approximately 20 miles northeast of Dallas, Texas).

PRIMARY CONTACT:
Jim Eidson
The Nature Conservancy
903-568-4139
jeidson@tnc.org

Brad Cozart
Coca-Cola Company – Dallas Syrup Plant, Grand Prairie Plant
214-869-4522
bcozart@coca-cola.com

Rena Stricker
Ecologist for Coca-Cola North America, Watershed Sustainability
404-395-6250
rstricker@coca-cola.com

Jon Radtke
Water Resources Manager, Coca-Cola North America
404-676-9112
jradtke@coca-cola.com

OBJECTIVES:
• Open space conservation
• Protection of water resources (including reduction in runoff and increase in infiltration)

BACKGROUND & ACTIVITY DESCRIPTION: The Nature Conservancy is pursuing several activities at its Clymer Meadow Preserve, including the conservation of 1,300 acres (526 ha) of native prairie grassland, with 24 acres of wetlands. The conservation effort is in direct response to the ongoing conversion of large, native grassland tracts to rural residential development. This activity involves obtaining a conservation easement to prevent land conversion of 130 acres.

SUMMARY OF REPLENISH BENEFIT:
• 2011 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 42.4 ML/YR
ACTIVITY TIMELINE:

- This is an ongoing project. At the beginning of the grant program in 2009, The Nature Conservancy had 377 acres of potential conservation buyer tracts. These are held by the Conservancy and sold to buyers under conservation easement. The tracts are old fields which buffer the remnant prairie. During the grant funding, the Conservancy has sold a tract and acquired an easement on a tract of 130 acres. This is referred to as the Barrett Pierce tract.

COCA-COLA CONTRIBUTION: 100%

Costs associated with the conservation easement establishment:

- Northeast Texas Program Manager, easement development and travel = $4,530
- Clymer Meadow Preserve Manager, baseline documentation report and environmental assessment = $2,500
- Associated costs (aerial photography, radius search, closing costs) = $1200

Total $8,230

WATERSHED RESTORATION BENEFITS CALCULATED:

1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff that would occur by preventing the conversion of grasslands to rural residential land. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers (CN) for the pre- and post-project conditions were estimated as follows based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **“Pre-project”**: rural residential development
  - Herbaceous cover (grass/weed mixture) in “fair” condition, 30-75% cover (CN = 89)
  - Hydrologic soil group “D”

- **“Post-project”**: native grassland
  - Grassland/range in “good” condition, >75% cover (CN = 80)
  - Hydrologic soil group “D”

Hourly meteorological data for Dallas, TX (Love Field) were obtained from the database provided as part of USEPA’s BASINS 4 watershed modeling software package. Hourly data were used to compute total daily precipitation, maximum hourly rainfall intensity, daily average and maximum air temperature, and daily total potential evapotranspiration (PET).
Curve numbers and processed meteorological data were used to compute daily runoff for the pre- and post-project cases for a 12-year period (1995-2006). Total annual average runoff volumes and the resulting water quantity benefit for preserving the 130 acre (52.6 ha) native grassland area were estimated as follows:

- **“Pre-project” (rural residential development)**: 121.3 ML/yr (231 mm/yr)
- **“Post-project” (grassland/range - “good” condition)**: 78.9 ML/yr (150 mm/yr)
- **Benefit (runoff reduction)**: 42.4 ML/yr

The total (ultimate) benefit is: 42.4 ML/yr

**TCCC total (ultimate) benefit taken as a function of cost share is:** 42.4 ML/yr

The current (2011) benefit and projected benefits are presented below. It is assumed that the projected benefits will remain the same as 2011 in each future year.

### 2011 Replenish Benefit

The 2011 benefit is the performance based benefit from this activity as of the end of the calendar year 2011. The total 2011 benefit is 42.4 ML/yr and TCCC’s benefit (adjusted for cost share) is 42.4 ML/yr.

### Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>42.4</td>
<td>42.4</td>
</tr>
<tr>
<td>2013</td>
<td>42.4</td>
<td>42.4</td>
</tr>
<tr>
<td>2014</td>
<td>42.4</td>
<td>42.4</td>
</tr>
<tr>
<td>2015</td>
<td>42.4</td>
<td>42.4</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>42.4</td>
<td>42.4</td>
</tr>
</tbody>
</table>

### Data Sources:

- **Size** of revegetated prairie area: 130 acres (52.6 ha)
- **Slope**: 2% (estimated average based on local topographic datasets)
- **Soil type**: predominantly hydrologic soil group (HSG) “D”
  - Characterized by low infiltration rates
  - Based on STATSGO soils database available through BASINS
- **Meteorological data:**
  - All meteorological data obtained via USEPA’s BASINS version 4 software
Hourly precipitation, air temperature, and evapotranspiration data were obtained for the Dallas Love Field weather station (ID: TX412244) for the 1995-2006 period.

Assumptions:

- “Pre-project” (i.e., post-development) conditions were assumed to be 30-75% herbaceous cover (“fair” condition), and “post-project” (conserved land) was assumed to have greater than 75% native grass cover (“good” condition).
- SWAT model parameter “CNCOEF” was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting rural residential area to native grassland area. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated based on hourly precipitation data for the 1995-2006 period.

The Cover/Management Factors ($C_{usle}$) for the MUSLE were estimated as follows based on information available in Haith (1992):

- “Pre-project”: prairie with ~60% cover as weeds/grass mixture ($C = 0.06$)
- “Post-project”: prairie with ~80% cover as grass ($C = 0.01$)

Total annual sediment yields for the cropland were estimated as follows:

- **Pre-project**: 183.7 MT/yr (3.5 MT/ha/yr)
- **Post-project**: 20 MT/yr (0.4 MT/ha/yr)
- **Benefit (reduced sediment yield)**: 163.7MT/yr

Data Sources:

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.
- STATSGO soils data obtained from USEPA BASINS 4 were used to estimate a soil erodibility factor (K) of 0.32 for use in MUSLE equation.

Assumptions:

- The Cover Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and among years).

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED

- Increase in infiltration and baseflow
- Improvements in terrestrial habitat and biodiversity
NOTES

- Estimations are preliminary. Monitoring is being conducted as part of the project.

REFERENCES


PROJECT NAME: Tallgrass Prairie Watershed Restoration in North Texas
PROJECT ID #: 02

DESCRIPTION OF ACTIVITY: Restoring tallgrass prairie via removal of invasive plant species and revegetation with native grassland species (1,164 acres)

LOCATION: The Clymer Meadow Preserve located within East Fork Trinity River watershed (approximately 20 miles northeast of Dallas, Texas).

PRIMARY CONTACTS:
Jim Eidson  Sonia Najera  Rena Stricker  Jon Radtke
The Nature  The Nature  CCNA Group Environment  CCNA Group Environment
Conservancy  Conservancy & Sustainability  & Sustainability
Grasslands Program  Contract Ecologist  Manager, Water
Manager  903-568-4139  361-882-3584  404-395-6250  404-676-9112
jeidson@tnc.org  snajera@tnc.org  Rstricker@coca-cola.com  Jradtke@coca-cola.com

OBJECTIVES:
- Increase infiltration and reduce sediment erosion
- Eliminate monocultural stands of invasive plant species
- Promote expansion of native prairie grass species and overall biodiversity

BACKGROUND & ACTIVITY DESCRIPTION: The 1,400-acre Clymer Meadow Preserve contains some of the largest and most diverse remnants of the Blackland Prairie—the Texas version of the tallgrass prairie that once stretched from near the Texas Coast to southern Manitoba. Because of its rich agricultural soils, historically over 99% of the prairie has been cultivated, making the tallgrass the most-endangered large ecosystem in North America.

Much of central and north-central Texas is covered by old world bluestems (*Bothriochloa ischaemum; King Ranch bluestem*), and this exotic species composes much of the cover of old field revegetation sites at Clymer Meadow. Land cover dominated by King Ranch bluestem is characterized by interstitial bare ground between clumps, which promotes soil loss, soil crusting, and enhanced runoff / decreased infiltration. Other invasive plant species, such as tall fescue and Johnsongrass, develop into monocultural stands, lowering species diversity and decreasing overall function.

In contrast, native grasslands have a remarkable ability to capture and store water, affecting the way the water moves through the landscape. The primary benefit of prairie vegetation is its generally positive effect on hydrology at the watershed scale. Prairies/native grasslands impact water supply in two ways: 1) protection from evaporation via storage in the soil; and 2) relative lack of “leakiness” of sediment and nutrients. Clymer Meadow, for example, can produce an estimated 7,000 pounds of dried herbage per acre (USDA Soil Survey Staff, 1981), an estimated 14,000 pounds of root mass per acre, and provide soil cover at levels exceeding 100% (i.e., overlapping plant canopies). Rainfall is intercepted by the native plant canopy, soil crusting/sealing by raindrop impact is negligible, and micro and macro channels produced by the root mass create conditions for rapid infiltration and allow storage at depth. There is very little runoff within this system. There is little soil loss from the site, and, as evidenced in large prairie landscapes, flashy hydrology resulting in accelerated stream bank erosion is minimal. The loss of
water as an ecosystem service lies primarily in the loss to evaporation and the loss of capacity of surface water reservoirs by sedimentation.

The Nature Conservancy is pursuing several activities at its Clymer Meadow Preserve to convert areas with exotic grasses into restored native tallgrass prairie. Invasive woody plants and non-native invasive grass species, such as tall fescue, Johnsongrass, and King Ranch bluestem are removed using fire, mechanical means, and herbicide. Oftentimes, a prescribed burn will stimulate the lands’ native seed bed, and native species will regrow without seeding. Other times, it is necessary to reseed the treated area with native species such as Little bluestem, Big bluestem, Switchgrass, and Indian grass.

**SUMMARY OF REPLENISH BENEFIT:**
- **2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE:** 138.2 ML/yr

**ACTIVITY TIMELINE:**
- In FY 2008, 130 acres were treated with fire and an additional 130 acres were treated with herbicide. Herbicide application included treatment of 100 acres of tall fescue, 30 acres of King Ranch bluestem, and less than one acre of Johnsongrass.
- In FY 2009, 140 acres at Clymer Meadow were burned to suppress tall fescue and woody species encroachment. An additional 25 acres received herbicide application for the suppression of tall fescue, King Ranch Bluestem and Johnsongrass.
- In FY 2010, more than 80 acres were herbicide-treated for suppression of the same species prior to re-seeding with native species, an additional 140 acres were burned, and another 43 acres were re-seeded.
- In FY 2011, 6 acres were re-seeded with native species.
- In FY 2012, 67 acres were re-seeded with native species.
- In FY 2013, 340 acres were burned for seed bed preparation, and another 63 acres were re-seeded in December.

Table 1 provides a year-by-year accounting of the treated areas. A total of **1,164 acres** have been treated as of the end of 2013. It is important to note that the total of 1,164 acres and the areas presented in Table 1 represent the “unique” acres treated (i.e., areas where both burning and re-
For example, 1,210 acres were subject to fire treatment during this span of time, but acreage burned twice or more within the time period is counted once.

### Table 1. Clymer Meadow Preserve Treatment Areas

<table>
<thead>
<tr>
<th>Year</th>
<th>Herbicide Areas (acres)</th>
<th>Burned Areas (acres)</th>
<th>Re-seeded Areas (acres)</th>
<th>Total Annual Treatment Area (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>130</td>
<td>130</td>
<td>0</td>
<td>260</td>
</tr>
<tr>
<td>2009</td>
<td>25</td>
<td>140</td>
<td>0</td>
<td>165</td>
</tr>
<tr>
<td>2010</td>
<td>80</td>
<td>140</td>
<td>43</td>
<td>263</td>
</tr>
<tr>
<td>2011</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2012</td>
<td>0</td>
<td>0</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>2013</td>
<td>0</td>
<td>340</td>
<td>63</td>
<td>403</td>
</tr>
<tr>
<td>Totals</td>
<td>235</td>
<td>750</td>
<td>179</td>
<td>1,164</td>
</tr>
</tbody>
</table>

**COCA-COLA CONTRIBUTION:** 96%
- Total project cost: $92,000
- Coca-Cola cost: $88,479

**WATERSHED BENEFITS CALCULATED:**
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

---

**1. DECREASE IN RUNOFF**

**Approach & Results:**

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff that would occur by removal of invasive prairie species and succession by native grassland species. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers (CN) for the pre- and post-project conditions were estimated as follows based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **“Pre-project”:** grassland area dominated by invasive species
  - Grassland in “fair” condition, 50-75% cover (CN = 84)
  - Hydrologic soil group “D”
- **“Post-project”:** native grassland
  - Grassland/range in “good” condition, >75% cover (CN = 80)
  - Hydrologic soil group “D”
Hourly meteorological data for Dallas, TX (Love Field) were obtained from the database provided as part of USEPA’s BASINS 4 watershed modeling software package. Hourly data were used to compute total daily precipitation, maximum hourly rainfall intensity, daily average and maximum air temperature, and daily total potential evapotranspiration (PET).

Curve numbers and processed meteorological data were used to compute daily runoff for the pre- and post-project cases for a 12-year period (1995-2006). Total annual average runoff volumes and the resulting water quantity benefit for restoration of the 1,164-acre native grassland area were estimated as follows:

- “Pre-project” (invasive species): 850 ML/yr (180.4 mm/yr)
- “Post-project” (native grassland): 706 ML/yr (149.9 mm/yr)
- **Benefit (runoff reduction): 144 ML/yr**

*The total (ultimate) benefit = 144 ML/yr*

**TCCC total (ultimate) benefit taken as a function of cost share = 138.2 ML/yr**

The current (2013) benefit and projected benefits are presented below. It is assumed that the projected benefits will remain the same as 2013 in each future year.

**2013 Replenish Benefit**

The 2013 benefit is the performance based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 144 ML/yr, and TCCC’s benefit (adjusted for cost share) is 138.2 ML/yr.

**Projected Replenish Benefits**

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>144</td>
<td>138.2</td>
</tr>
<tr>
<td>2015</td>
<td>144</td>
<td>138.2</td>
</tr>
<tr>
<td>2016</td>
<td>144</td>
<td>138.2</td>
</tr>
<tr>
<td>2017</td>
<td>144</td>
<td>138.2</td>
</tr>
<tr>
<td>2018</td>
<td>144</td>
<td>138.2</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>144</td>
<td>138.2</td>
</tr>
</tbody>
</table>

**Data Sources:**

- Size of invasive species treatment/removal/re-seeding area: 1,164 acres (471 ha)
- **Slope**: 2% (estimated average based on local topographic datasets)
• **Soil type**: predominantly hydrologic soil group (HSG) “D”
  - Vertisols (Pellusterts) and Mollisols (Haploquolls)
  - Characterized by low infiltration rates
  - Based on STATSGO soils database available through BASINS

• **Meteorological data:**
  - All meteorological data obtained via USEPA’s BASINS version 4 software
  - Hourly precipitation, air temperature, and evapotranspiration data were obtained for the Dallas Love Field weather station (ID: TX412244) for the 1995-2006 period.

**Assumptions:**
- “Pre-project” (i.e., area dominated by invasive species) conditions were assumed to be grassland in “fair” condition (50-75% cover), and “post-project” (native grassland) was assumed to be in “good” condition (> 75% vegetative cover).
- SWAT model parameter “CNCOEF” was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. **DECREASE IN SEDIMENT EROSION/RUNOFF**

**Approach & Results:**

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting invasive prairie species to native grassland area. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated based on hourly precipitation data for the 1995-2006 period.

The Cover/Management Factors (Cusle) for the MUSLE were estimated as follows based on information available in Haith (1992):
- “Pre-project”: prairie with ~80% cover as weeds (C = 0.04)
- “Post-project”: prairie with ~80% cover as grass (C = 0.01)

Total annual sediment yields for the cropland were estimated as follows:
- **Pre-project**: 846 MT/yr (1.8 MT/ha/yr)
- **Post-project**: 177 MT/yr (0.37 MT/ha/yr)
- **Benefit (reduced sediment yield)**: 669 MT/yr
- **TCCC benefit (reduced sediment yield) as a function of cost share**: 642.2 MT/yr
Data Sources:

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.
- STATSGO soils data obtained from USEPA BASINS 4 were used to estimate a soil erodibility factor (K) of 0.32 for use in MUSLE equation.

Assumptions:

- The Cover Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and among years).

OTHER WATERSHED BENEFITS NOT QUANTIFIED

- Increase in infiltration and baseflow
- Improvements in terrestrial habitat and biodiversity

NOTES

- This fact sheet updates the December 2011 fact sheet to incorporate information regarding additional restoration activities.

REFERENCES


PROJECT NAME: Etowah River Watershed Conservation Partnership
PROJECT ID #: 04

DESCRIPTION OF ACTIVITY: Raccoon Creek floodplain restoration

LOCATION: Paulding County, Georgia

PRIMARY CONTACTS:

Kathleen Owens
The Nature Conservancy
kowens@TNC.ORG

Rena Ann Stricker
Contract Ecologist
CCNA Group Environment & Sustainability
404-395-6250
rstricker@coca-cola.com

Jon Radtke
Manager, Water Resources
CCNA Group Environment & Sustainability
404-676-9112
jradtke@coca-cola.com

Steve Glickauf
Corblu
sglickauf@corblu.com

OBJECTIVES:
- Increase floodplain connectivity
- Restore floodplain habitat
- Control flooding

BACKGROUND & ACTIVITY DESCRIPTION: Raccoon Creek is a tributary of the Etowah River, Georgia. An approximately 1 mile stretch of this creek was previously channelized in an area located in an existing power line easement. The creek flows through former agricultural lands. Impacts from the power line easement and agricultural practices led to conditions where the stream became channelized, was lacking a riparian buffer and the banks were instable. Identified instability issues included but were not limited to down valley migration of many meanders, reach wide erosion, and incision of the stream. There are areas within the channel with substantial amounts of bedrock. These areas have provided a nick point to stop further stream incision and in places have helped to stop further erosion on the banks. Restoration of this portion of the creek has involved work to restore a pool and riffle system, reintroduce meanders and protect outside banks from erosion, and construct floodplain benches to facilitate cutting a new floodplain and reconnecting to the historic floodplain during 1 to 1.5 year rain events (Figure 1).

Figure 1. Site 3 before (left) and after (right) photos
SUMMARY OF REPLENISH BENEFIT

- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 1.90 ML/yr

ACTIVITY TIMELINE:

- 2011 and 2012 – Floodplain benches completed at sites 2, 3 and 4
- 2013 – Floodplain benches completed at sites 5 and 6

COCA-COLA CONTRIBUTION: 31%

- Total cost (USD) for floodplain restoration: $260,000 USD
  - TCCC contribution: $80,000 USD
  - Contribution from other partners: $180,000 USD
    (Partners include US Fish and Wildlife Service, the Upper Coosa Riverkeeper and Georgia Power)

WATERSHED BENEFITS CALCULATED:

1. Increase in floodplain inundation volume

1. INCREASE IN FLOODPLAIN INUNDATION VOLUME

Approach and Results

The approach taken for the Raccoon Creek restoration project was to estimate the annual average increase in floodplain inundation volume (i.e., the volume of water that would have otherwise flowed downstream without serving important floodplain functions) established by the project. The water quantity benefit estimate is based on floodplain inundation areas and depths associated with a “bankfull” event, which occurs every 1 to 1.5 years in Raccoon Creek, according to TNC staff. For simplicity, it is assumed that a “bankfull” event occurs approximately once per calendar year for the purpose of this benefit estimate.

Following the initial installation of floodplain bench areas in 2011-12, TNC and its contractors have observed one “bankfull” event in Raccoon Creek and were able to collect measurements of inundation areas and depths associated with the various bench areas constructed for this project. These area and depth estimates were used to compute inundation volumes associated with each of the bench areas. Table 1 below summarizes the data and the estimated inundation volume for each bench area that was fully constructed in 2011 and by the end of 2012.
Table 1. “Bankfull” Event Data and Inundation Volume Estimates for Bench Areas (2011 and 2012 only)

<table>
<thead>
<tr>
<th>Site ID</th>
<th>Area (acre)</th>
<th>Depth (ft)</th>
<th>Volume (ft$^3$/yr)</th>
<th>Volume (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Left Bank</td>
<td>0.10</td>
<td>2.80</td>
<td>12,196.8</td>
<td>0.35</td>
</tr>
<tr>
<td>3-4 right bank</td>
<td>0.11</td>
<td>3.75</td>
<td>17,968.5</td>
<td>0.51</td>
</tr>
<tr>
<td>3-4 left bank</td>
<td>0.20</td>
<td>4.00</td>
<td>34,848</td>
<td>0.99</td>
</tr>
<tr>
<td>Darter Creek</td>
<td>0.40</td>
<td>1.00</td>
<td>17,424.0</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Total Volume (ML/yr): 2.33

Additional bench areas were constructed in February 2013, according to the TNC contact. Area and depth measurements were also collected for these bench sites during the last “bankfull” event. The data and floodplain inundation volumes for the 2013 bench areas are provided in Table 2 below.

Table 2. “Bankfull” Event Data and Inundation Volume Estimates for Bench Areas Constructed by February 2013

<table>
<thead>
<tr>
<th>Site ID</th>
<th>Area (acre)</th>
<th>Depth (ft)</th>
<th>Volume (ft$^3$/yr)</th>
<th>Volume (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Left Bank</td>
<td>0.35</td>
<td>3.6</td>
<td>54885.6</td>
<td>1.55</td>
</tr>
<tr>
<td>5 right bank</td>
<td>0.20</td>
<td>2.0</td>
<td>17424</td>
<td>0.49</td>
</tr>
<tr>
<td>6 left bank</td>
<td>0.60</td>
<td>1.7</td>
<td>44431.2</td>
<td>1.26</td>
</tr>
<tr>
<td>6 right bank</td>
<td>0.40</td>
<td>1.0</td>
<td>17424</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Total Volume (ML/yr): 3.79

The bench areas constructed through 2013 and described above are assumed to provide a constant water quantity benefit (via additional floodplain inundation volume) in future years beyond 2013. Based on these calculations, the total water quantity benefit (additional floodplain inundation volume) for Raccoon Creek is: $(2.33 + 3.79) = 6.12$ million liters per year (ML/yr).

The total (ultimate) benefit: 6.12 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 1.90 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 6.12 ML/yr and TCCC’s benefit (adjusted for cost share) is 1.90 ML/yr.
Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 3. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>6.12</td>
<td>1.90</td>
</tr>
<tr>
<td>2015</td>
<td>6.12</td>
<td>1.90</td>
</tr>
<tr>
<td>2016</td>
<td>6.12</td>
<td>1.90</td>
</tr>
<tr>
<td>2017</td>
<td>6.12</td>
<td>1.90</td>
</tr>
<tr>
<td>2018</td>
<td>6.12</td>
<td>1.90</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>6.12</td>
<td>1.90</td>
</tr>
</tbody>
</table>

Data Sources:
- Estimates of acreage and water depth for floodplain inundation were collected by TNC and its contractors and provided by the TNC contact.

Assumptions:
- A “bankfull” event in Raccoon Creek occurs approximately once per calendar year.

OTHER BENEFITS NOT QUANTIFIED
- Reduced erosion and sediment load

NOTES
- Companion activities on Raccoon Creek are described in a separate fact sheet.
- This fact sheet updates the November 2012 fact sheet to reflect additional work completed at the end of 2012, and confirms additional work completed in 2013.

REFERENCES
PROJECT NAME: Etowah River Watershed Conservation Partnership

PROJECT ID #: 04

DESCRIPTION OF ACTIVITY: Riparian buffer planting for Raccoon Creek

LOCATION: Raccoon Creek within the Etowah River watershed

PRIMARY CONTACT:

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Contact Information</th>
</tr>
</thead>
</table>
| Katie Owens               | Upper Coosa River Program Director,  | 706-767-0497
|                           | The Nature Conservancy,              | kowens@tnc.org      |
|                           | P.O. Box 737, Amuchee, GA            |                     |
|                           | Ecologist for Coca-Cola North America, Delta Consultants | 404-723-2433 rstricker@na.ko.com |
|                           | Water Resources Manager, Coca-Cola North America | 404-676-9112 jradtke@na.ko.com |

OBJECTIVES:
- Streambank stabilization to reduce instream erosion
- Improved riparian shading for fish habitat

BACKGROUND & ACTIVITY DESCRIPTION: Raccoon Creek, a tributary to the Etowah River, is located adjacent to a 300-foot Georgia Power right of way. An approximately 6,700 foot reach of Raccoon Creek is currently void of riparian vegetation due to overlap with the right of way. The project will involve planting a 25-foot wide riparian buffer along the west and east banks of this reach. The riparian buffer is primarily intended to improve stream stabilization and improve the quality of fish habitat via improved shading.

ACTIVITY TIMELINE:
- Project will be implemented during a 3-year period from April 2009 through May 2012.

COCA-COLA CONTRIBUTION: 100%
- Project is fully funded by Coca-Cola (see note below)

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in sediment runoff

1. DECREASE IN SEDIMENT RUNOFF

Approach & Results:
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the current sediment erosion and washoff for the land areas adjacent to Raccoon Creek that drain directly to Raccoon Creek for the reach where the buffer is planned. The direct drainage areas were delineated manually in GIS and overlain with lands use, soils, and topography data. The characteristics of this area can be summarized as follows:
• Total drainage area: 226 acres (91 ha)
• Land use: 58% forest, 24% pasture, 8% open space, 9% herbaceous cover
• Average slope: 1.5%
• Hydrologic soil group “B” (moderate infiltration)

For simplicity, 33% of the total area was assumed to be pasture and 67% was assumed to be forested. The cover and management factors (C_{usle}) for pasture and forest were estimated as 0.090 and 0.003, respectively.

Hourly precipitation, air temperature, and potential evapotranspiration (PET) data were obtained for Dallas, GA (station ID: GA092485) for the 1970-2006 period. These datasets were used to calculate daily total precipitation and PET and average/maximum air temperature.

The Curve Number (USDA-NRCS, 1986) and MUSLE methods were used to estimate total annual sediment yield for the direct drainage area based on the physical characteristics and meteorological datasets described above. The total land-based sediment load to Raccoon Creek was estimated to be 150 MT/yr. The SWAT model also provides an equation to estimate the reduction in sediment load due to the presence of a riparian buffer (Equation 6:1.11.2; Neitsch et al. 2005). Using this equation, a trapping efficiency of 67% is calculated for a buffer width of 25 feet (7.6 m). Therefore, the reduction in sediment load is estimated as 100 MT/yr.

Data Sources:
• Size of direct drainage area: 226 acres (91 ha) (estimated from GIS)
• Slope: 1.5% (estimated based on local topographic datasets)
• Soil type: predominantly hydrologic soil group (HSG) “B”
  • Characterized by moderate to high infiltration rates
  • Based on STATSGO soils database available through BASINS
• Meteorological data:
  • All meteorological data were obtained via USEPA’s BASINS (version 4) software.
  • Hourly precipitation, air temperature, and PET data were obtained for Dallas, GA for the 1970-2006 period.
  • STATSGO soils data obtained from USEPA BASINS 4 were used to estimate a soil erodibility factor (K) of 0.28 for use in MUSLE equation.

Assumptions:
• Riparian buffer was assumed to have optimal filtering efficiency.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
• Reduction of instream bank sediment erosion
• Improvements in fish habitat quality due to riparian shading
NOTES: [per Katie Owens email, 5/18/09] TNC submitted a $100,000 grant proposal to USFWS to assist in the restoration of Raccoon Creek. A number of sites need actual streambank stabilization using Geomatting, which would be paid for through these additional funds. The TCCC funds are being used for plantings.]

REFERENCES


PROJECT NAME: Etowah River Watershed Conservation Partnership
PROJECT ID #: 04

DESCRIPTION OF ACTIVITY: Stormwater Infiltration Project

LOCATION: Etowah River watershed

PRIMARY CONTACT:

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Katie Owens</td>
<td>Upper Coosa River Program Director,</td>
</tr>
<tr>
<td></td>
<td>The Nature Conservancy, P.O. Box 737, Amuchee, GA</td>
</tr>
<tr>
<td>Rena Stricker</td>
<td>Ecologist for Coca-Cola North America, Delta Consultants</td>
</tr>
<tr>
<td>Jon Radtke</td>
<td>Water Resources Manager, Coca-Cola North America</td>
</tr>
<tr>
<td></td>
<td>404-723-2433</td>
</tr>
<tr>
<td></td>
<td>404-676-9112</td>
</tr>
<tr>
<td><a href="mailto:kowens@tnc.org">kowens@tnc.org</a></td>
<td><a href="mailto:rstricker@na.ko.com">rstricker@na.ko.com</a></td>
</tr>
<tr>
<td></td>
<td><a href="mailto:jradtke@na.ko.com">jradtke@na.ko.com</a></td>
</tr>
</tbody>
</table>

OBJECTIVES:
- Improved infiltration characteristics, dissipation of energy in the ditch.
- Reduction of sediment bank erosion and gullying within the stormwater ditch.
- Reduction of sediment bank erosion within the Etowah River downstream of the ditch outlet.

BACKGROUND & ACTIVITY DESCRIPTION: The stormwater infiltration project involved stabilizing and improving stormwater infiltration surrounding the Upper Etowah River Alliance’s office, which is located just outside of downtown Canton on the mainstem Etowah.

The stormwater infiltration project focused primarily on a large drainage ditch and the development of an environmentally friendly parking pad. In its’ current state the drainage ditch was rapidly eroding and causing downstream streambank instability.

The goal of the stormwater infiltration project was to slow water in the ditch down to allow for infiltration, especially after high rain flow events. This was accomplished by reshaping the channel of the ditch, removing invasives in and along the ditch, replanting native vegetation along the ditch, and placing Channel Soxx within the ditch bed in order to slow water and allow for infiltration. This particular ditch is downstream of McLure Street and multiple homes so this project should reduce non point source pollution entering the Etowah River. In addition to work on the ditch, a porous parking lot was also established, rather than using the typical concrete pad. This project involved using environmentally friendly porous material that allows water to infiltrate rather than increasing stormwater flows to the adjacent ditch and Etowah River.

This project is also considered Phase 1 in the stabilization of a major streambank erosion site, located just downstream of the UERA office and drainage ditch. Increasing infiltration of stormwater immediately upstream of the streambank erosion site will reduce downstream streambank erosion, thus reducing sediment loads entering the river.

ACTIVITY TIMELINE:
- Project will be implemented during a 3-year period from April 2009 through May 2012.
COCA-COLA CONTRIBUTION: 100%
  • Project is fully funded by Coca-Cola

WATERSHED RESTORATION BENEFITS CALCULATED:
  1. Decrease in instream sediment erosion

1. DECREASE IN INSTREAM SEDIMENT EROSION

Approach & Results:
Instream erosion rates are highly site-specific and require monitoring data to accurately quantify. Examples of monitoring data that could be used to support a sediment erosion calculation include 1) suspended sediment concentrations at the ditch outlet for storm events, and/or 2) estimates of bank retreat rates. These data are not available at this time; however, the typical dimensions of the ditch and the dimensions of the eroded section of the ditch were provided by TNC staff:

  • Typical dimensions:
    o Depth: ~4 ft
    o Width: ~3-5 ft
  • Eroded reach:
    o Length: ~30 ft
    o Maximum depth: 12 ft
    o Width: 18 ft

The timeline for the erosion and gullying of the lower 30 feet of the ditch is unknown. If it is assumed that the erosion has occurred over a period of approximately 10 years, then the annual rate of erosion from the banks and the bottom of the ditch is roughly 1 foot/year. Based on this estimate and the average dimensions of the eroded section of the ditch, the annual volume of sediment erosion within the ditch can be approximated as: \((16 \text{ ft}^2) \times (30 \text{ ft}) = 480 \text{ ft}^3 = 13.6 \text{ m}^3\). Assuming a sediment bulk density of 2,400 kg/m3, the total sediment mass eroded is 32,600 kg/yr (32.6 MT/yr). It is anticipated that the ditch improvements will essentially eliminate erosion; therefore, the total benefit in terms of reduction of sediment delivery to the Etowah is 32.6 MT/yr.

Data Sources:
  • TNC staff provided the physical dimensions of the stormwater ditch (including “typical” dimensions and the dimensions of the eroded section – see above).

Assumptions:
  • Erosion of the banks and downcutting into the ditch has been occurring at a rate of approximately 1 foot per year.
  • Ditch improvements will essentially eliminate sediment erosion due to downcutting and bank erosion.
OTHER BENEFITS NOT QUANTIFIED

- Enhanced infiltration within the stormwater ditch.
- Reduced instream bank erosion in the Etowah River downstream of the ditch outlet.

NOTES

- Increases in infiltration of stormwater delivered to the ditch were not quantified because these rates will be site-specific and require direct or indirect measurement.
- Decreases in bank erosion within the Etowah River downstream of the ditch outlet were not quantified because data on bank retreat rates or a detailed model would be required to support this estimate.

REFERENCES:
PROJECT NAME: Wildlands Conservancy Lehigh River Restoration
PROJECT ID #: 15

DESCRIPTION OF ACTIVITY: Wetland system for treatment of abandoned mine drainage from Lausanne Tunnel

LOCATION: Lehigh Gorge State Park, Borough of Jim Thorpe, Carbon County, PA

PRIMARY CONTACT:
Kristie Fach
Biologist
Wildlands Conservancy
610-965-4397 ext. 124
kfach@wildlandspa.org

Rena Ann Stricker
Contract Ecologist
CCR Environment & Sustainability
404-395-6250
rstricker@coca-cola.com

Jon Radtke
Manager, Water Resources
CCR Environment & Sustainability
404-676-9112
jradtke@coca-cola.com

OBJECTIVE:
• Reduce loads of acid mine drainage constituents into Nesquehoning Creek

BACKGROUND & ACTIVITY DESCRIPTION: Abandoned mine drainage (AMD) contributes to the largest negative impact to water quality in the Lehigh River watershed. Each day the Lehigh River receives approximately 75,000 lbs of AMD-related heavy metals. The Lehigh River watershed contains numerous strip mines, pits, and underground workings being drained by eight discharges that enter four major Lehigh tributaries. Treatment of AMD is not required by law in Pennsylvania.

The Lausanne Tunnel Abandoned Mine Drainage Restoration Project involves a 1.5-acre constructed passive wetland treatment system to treat AMD from the Lausanne Tunnel discharge into Nesquehoning Creek, a tributary of the Lehigh River. The design and construction activities were completed in June 2004. Beginning in 2004, Wildlands Conservancy, along with Pennsylvania Department of Environmental Protection (PA DEP) Bureau of Abandoned Mine Reclamation, conducted visual site inspections, water flow and water quality sampling and analysis, and vegetation inspections to determine the effectiveness of the passive wetland treatment system and to address any issues. Invasive/exotic plant species were identified and removed before they spread to an extent that could impair the functionality of the system.

Lausanne Tunnel Discharge (Photo: Wildlands Conservancy)
The ability to increase retention time is critical because the longer that water is allowed to remain in the system the more opportunity there is for the heavy metals to be removed and absorbed by aquatic plants of the wetland. In 2006 a dye tracer was used to study water flow through the system, resulting in the installation of hay bales between the wetland segments to retard water flow. In 2009 a new weir was installed to further increase water retention time in the wetland system and facilitate collection of more accurate water quality and flow data.

Water quality sampling has been conducted for several years at the Lausanne Tunnel, within the wetlands, and in Nesquehoning Creek. Flows through the system have also been measured. The treatment system has been demonstrated to remove significant quantities of heavy metals from the discharge. Upon analysis of annual data gathered from 2004 to 2007, the removal of metals from the water increased significantly. In 2007, more than 48% of the total iron concentration was removed compared to 2006 when 26% was removed from the Lausanne Tunnel discharge. In 2007, 56% of the aluminum concentration was removed compared to 29% in 2006. Sulfate, aluminum and iron removal rates have all improved since the treatment system was completed in 2004 (Figure 1).

SUMMARY OF REPLENISH BENEFIT:
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 61.2 ML/yr

ACTIVITY TIMELINE:
- June 2004 – completion of treatment system design and construction activities
- 2004-Present – water quality and flow monitoring (most recent reported data is from 2012)
- 2006 – water flow dye study and installation of hay bales between wetland segments to increase water retention time in wetlands
- 2009 – installation of weir to increase water retention time in wetlands and provide for more accurate flow measurements

COCA-COLA CONTRIBUTION: 1.5%
- Total cost: $650,000
- Coca-Cola: $10,000
Figure 1. Data collected from 2004-2007 demonstrate the effectiveness of the treatment system

WATERSHED BENEFITS CALCULATED:

1. Volume of water treated
2. Decreased pollutant load

1. VOLUME OF WATER TREATED

Approach & Results

The water quantity benefit was calculated as the volume of contaminated water treated to standards. Data collected at the outlet of Wetland B in 2011 and 2012 (PA DEP, 2011 and 2012) demonstrate that the treated water is meeting Pennsylvania’s standard effluent limits for treatment pond effluent (PA DEP, 2009) as shown in Table 1. Metals concentrations in untreated water flowing from the tunnel have exceeded standards at times. A downward trend over time reflects improvements due to ongoing remediation activities upstream.
Table 1. Water Quality Data Collected in Untreated Water and Outlet of Wetland System

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum (mg/l)</td>
<td>&lt;0.75</td>
<td>0.46 – 1.24</td>
<td>0.48</td>
<td>0.38</td>
</tr>
<tr>
<td>Iron, Fe (mg/l)</td>
<td>&lt;3.0</td>
<td>2.8 – 4.8</td>
<td>2.8</td>
<td>2.4</td>
</tr>
<tr>
<td>Manganese, Mn (mg/l)</td>
<td>&lt;2.0</td>
<td>1.9 – 2.6</td>
<td>2.0</td>
<td>1.9</td>
</tr>
<tr>
<td>pH</td>
<td>6.0 &lt;= pH &lt;= 9.0</td>
<td>6.6 – 7.0</td>
<td>6.9</td>
<td>7.1</td>
</tr>
</tbody>
</table>

The flow through the treatment wetland system is highly variable because it is driven by precipitation. The long-term average flow through the system is estimated conservatively by Wildlands Conservancy to be 2,000 gallons per minute. Maximum flows through the system can be as high as 4,000 gallons per minute. The long-term average flow was used in the benefit calculation as follows:

Benefit = 2,000 gal/minute = 10,902,000 liters/day = 3,979 ML/yr

Total (ultimate) benefit is: 3,979 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 61.2 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 61.2 ML/yr and TCCC’s benefit (adjusted for cost share) is 61.2 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>3,979</td>
<td>61.2</td>
</tr>
<tr>
<td>2014</td>
<td>3,979</td>
<td>61.2</td>
</tr>
<tr>
<td>2015</td>
<td>3,979</td>
<td>61.2</td>
</tr>
<tr>
<td>2016</td>
<td>3,979</td>
<td>61.2</td>
</tr>
<tr>
<td>2017</td>
<td>3,979</td>
<td>61.2</td>
</tr>
<tr>
<td>Ultimate Benefit</td>
<td>3,979</td>
<td>61.2</td>
</tr>
</tbody>
</table>
2. **DECREASED POLLUTANT LOAD**

Daily load reductions were reported in the LTI CWP survey for iron, aluminum and sulfates. Based on data collected between 2004 and 2007, the effectiveness of the system improved as plants grew and improvements were made (Figure 1). These data indicate that the system is preventing approximately 120 lbs of iron, 45 lbs of aluminum, and 8,000 lbs of sulfates from entering Nesquehoning Creek and Lehigh River each day.

Additional monitoring data for alkalinity, pH, total suspended solids, manganese and hot acidity were reported in units of concentration, but flow data and/or loads associated with these parameters was not reported; therefore reduced loads for these additional parameters could not be quantified.

The total water quality benefits are estimated as follows:

- The total benefit (total iron decrease) is: 20 MT/yr and TCCC’s benefit (adjusted for cost share) is 0.3 MT/yr.
- The total benefit (aluminum decrease) is: 7.5 MT/yr and TCCC’s benefit (adjusted for cost share) is 0.1 MT/yr.
- The total benefit (sulfate decrease) is: 1,324 MT/yr and TCCC’s benefit (adjusted for cost share) is 19.9 MT/yr.

The 2012 benefits are as follows:

- The 2012 benefit (total iron decrease) is: 20 MT/yr and TCCC’s benefit (adjusted for cost share) is 0.3 MT/yr.
- The 2012 benefit (aluminum decrease) is: 7.5 MT/yr and TCCC’s benefit (adjusted for cost share) is 0.1 MT/yr.
- The 2012 benefit (sulfate decrease) is: 1,324 MT/yr and TCCC’s benefit (adjusted for cost share) is 19.9 MT/yr.

**Data sources**
- Average flow through treatment system provided by Wildlands Conservancy
- Water quality data provided in references as cited.

**Assumptions**
- It is assumed that the treatment system is operating as designed, based on information provided by Wildlands Conservancy.

**OTHER BENEFITS NOT QUANTIFIED**
- Improvements to quality of downstream waters

**NOTES:**
- This is an update of a fact sheet prepared in 2009 when only water quality benefits were estimated.

**REFERENCES**


PROJECT NAME: Wildlands Conservancy Lehigh River Restoration
PROJECT ID #: 15

DESCRIPTION OF ACTIVITY: Jordan Creek stream stabilization project

LOCATION: Jordan Creek located within Lowhill Township, Lehigh County, Pennsylvania (long: -75.6331, lat: 40.6522)

PRIMARY CONTACT: Rena Stricker
Coca-Cola North America Ecologist
Delta Consultants
Cell: 404-723-2433
rstricker@deltaenv.com

OBJECTIVES:
• Streambank stabilization to reduce instream erosion
• Reduce runoff of sediment and nutrients
• Reduce pollutant loading to waterbodies from mines or other sources
• Enhance riparian habitat
• Provide shading/reduce water temperatures

BACKGROUND & ACTIVITY DESCRIPTION:
The Jordan Creek Stream Bank Stabilization Project includes design, permitting and construction of stream bank stabilization improvements, and the installation of native riparian plantings along approximately 1,000 linear feet of the Jordan Creek, at the Trexler Nature Preserve in Lowhill Township, Lehigh County.

This project is the first phase of a multi-phase restoration strategy throughout a one mile stretch of stream characterized by severely eroded, bare soil stream banks (4-6 feet in height) and an almost complete lack of in-stream structural habitat. Because of the degraded bank riparian zone, each storm event further entrenches the stream and erodes the banks. The project involved installation of multiple stream bank stabilization and aquatic habitat improvement structures, and management of invasive species. The buffer helps to create a functioning floodplain, filter runoff and decrease sedimentation of the Jordan Creek watershed. This project improves stream bank stability along the Jordan Creek, reduces non-point source pollution in the form of sediment and excess nutrients, improves water quality within the Little Lehigh watershed, and provides a model for best management practices.

Jordan Creek, pre- and post- project conditions (photo provided by Rena Stricker/Delta Consultants)
ACTIVITY TIMELINE:
- This project was completed in fall 2009.

COCA-COLA CONTRIBUTION: 50%
- Total cost: $30,000
- Coke contribution: $15,000
- Additional partner funding and in-kind services: $15,000

WATERSHED RESTORATION BENEFITS CALCULATED:
- Decrease in sediment runoff

1. DECREASE IN SEDIMENT RUNOFF

Approach & Results:
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate pre-project sediment erosion and washoff for the land areas adjacent to Jordan Creek that drain directly to the creek for the reach where the revegetation occurred. The direct drainage areas were delineated manually in GIS and overlain with land use, soils, and topography data. The characteristics of this area, including land uses and associated Curve Numbers (CN) and Cover/Management Factors (C_usle) can be summarized as follows:
- Total drainage area: 24.6 acres (9.9 ha) (west side of the creek only)
- Average slope: 11%
- Hydrologic soil group “C” (low infiltration rates)
- Land use:
  - 46% forest (CN = 70, C_usle = 0.001)
  - 36% pasture / open space, “fair” condition (CN = 79, C_usle = 0.06)
  - 18% straight row crop, “good” condition (CN = 85, C_usle = 0.20)

Hourly precipitation, air temperature, and potential evapotranspiration (PET) data were obtained for the Allentown, PA weather station (station ID: PA360106) for the 1970-2006 period. These datasets were used to calculate daily total precipitation and PET and average/maximum air temperature.

The Curve Number (USDA-NRCS, 1986) and MUSLE methods were used to estimate total annual sediment yield for the direct drainage area based on the physical characteristics and meteorological datasets described above. To simplify the calculations, area-weighted average CN (75.9) and C_usle (0.058) values were computed based on the land use distribution presented above. The total direct drainage sediment load to Jordan Creek for the reach of interest was estimated to be 225 MT/yr.

The SWAT model provides an equation to estimate the reduction in sediment load due to the presence of a riparian buffer (Equation 6:1.11.2; Neitsch et al. 2005). Using this equation, a trapping efficiency of 92% is calculated for a buffer width of 22 meters. Therefore, the total benefit (reduction in sediment load) is estimated as 207 MT/yr.
Data Sources:

- **Size of direct drainage area:** 24.6 acres (9.9 ha) (estimated from GIS, for the west side of the creek only)
- **Slope:** 11% (estimated via GIS based on local topographic datasets)
- **Soil type:** predominately hydrologic soil group (HSG) “C”
  - Characterized by low infiltration rates
  - Based on STATSGO soils database available through BASINS
- **Meteorological data:**
  - All meteorological data were obtained via USEPA’s BASINS (version 4) software.
  - Hourly precipitation, air temperature, and PET data were obtained for Allentown, PA for the 1970-2006 period.
- **STATSGO soils data obtained from USEPA BASINS 4 were used to estimate an average soil erodibility factor (K) of 0.24 for use in the MUSLE equation.**

Assumptions:

- Buffer width was assumed to be 22 meters (on the west side of the creek only).
- Riparian buffer was assumed to be sufficiently mature in order to optimally filter sediment.
- The SWAT-based “CNCOEF” parameter was assumed to be 0.0 (parameter used to calculate change in soil moisture capacity based on daily PET).

OTHER BENEFITS NOT QUANTIFIED

- Reduction of instream bank sediment erosion and accompanying loading of sediments and nutrients into stream
- Improvements in quality of fish habitat

NOTES

- This fact sheet updates the January 2010 fact sheet, by including updated information on buffer width and location on one side of the creek.

REFERENCES


PROJECT NAME: Wildlands Conservancy Lehigh River Restoration
PROJECT ID #: 15

DESCRIPTION OF ACTIVITY: Little Lehigh Stream Bank Stabilization Project at Pool Wildlife Sanctuary

LOCATION: Jordan Wildlands Conservancy/Pool Wildlife Sanctuary in Emmaus, Pennsylvania (long: -75.5124, lat: 40.5486)

PRIMARY CONTACT: Rena Stricker
Coca-Cola North America Ecologist
Delta Consultants
Cell: 404-723-2433
rstricker@deltaenv.com

OBJECTIVES:
• Reduce runoff of sediment and nutrients
• Streambank stabilization to reduce instream erosion
• Reduce pollutant loading to waterbodies from mines or other sources
• Enhance riparian habitat
• Provide shading/reduce water temperatures

BACKGROUND & ACTIVITY DESCRIPTION:
The Little Lehigh Stream Bank Stabilization Project at Pool Wildlife Sanctuary project involved the installation and maintenance of a brush revetment structure along approximately 250 linear feet of stream bank, and maintenance of previously constructed stream bank stabilization and fish habitat enhancement structures. Implementation of this project has improved stream bank stability along approximately 250 linear feet of stream bank of the Little Lehigh Creek, reduced non-point source pollution (in the form of sediment) and improved water quality within the Little Lehigh Creek. It also improved protection of the Wildlands Conservancy’s floodplain boardwalk structure, public safety and future access to Wildlands Conservancy/Pool Wildlife Sanctuary’s floodplain trails which are utilized for public recreation and educational programming activities. Finally, it serves as a “Best Management Practices” demonstration site for local municipalities, private landowners and the general public.

Photos show an eroded bank in Little Lehigh Creek before and after project implementation (photos provided by Rena Stricker)
ACTIVITY TIMELINE:
- Project was implemented by the end of 2008.

COCA-COLA CONTRIBUTION: 50%
- Total cost: $20,000
- Coke contribution: $10,000
- Additional partner funding and in-kind services: $10,000

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in sediment runoff

1. DECREASE IN SEDIMENT RUNOFF

Approach & Results:
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the current sediment erosion and runoff for the land areas adjacent to Little Lehigh Creek that drain directly to the creek for the reach where the revegetation is planned. The direct drainage areas were delineated manually in GIS and overlain with lands use, soils, and topography data. The characteristics of this area, including land uses and associated Curve Numbers (CN) and Cover/Management Factors (C_usle) can be summarized as follows:
- Total drainage area: 13.1 acres (5.3 ha)
- Average slope: 4%
- Hydrologic soil group “B” (moderate infiltration rates)
- Land use:
  - 5% low-density residential
    - 80% open space, fair condition (CN = 69, C_usle = 0.06)
    - 20% impervious (CN = 98, C_usle = 0)
  - 78% forest (CN = 55, C_usle = 0.001)
  - 17% pasture / open space, “fair” condition (CN = 69, C_usle = 0.06)

Hourly precipitation, air temperature, and potential evapotranspiration (PET) data were obtained for the Allentown, PA weather station (station ID: PA360106) for the 1970-2006 period. These datasets were used to calculate daily total precipitation and PET and average/maximum air temperature.

The Curve Number (USDA-NRCS, 1986) and MUSLE methods were used to estimate total annual sediment yield for the direct drainage area based on the physical characteristics and meteorological datasets described above. To simplify the calculations, area-weighted average CN (58.4) and C_usle (0.013) values were computed based on the land use distribution presented above. The total direct drainage sediment load to Little Lehigh Creek for the reach of interest was estimated to be 33 MT/yr.

The SWAT model provides an equation to estimate the reduction in sediment load due to the presence of a riparian buffer (Equation 6.11.2; Neitsch et al. 2005). Using this equation, a trapping efficiency of
roughly 100% is calculated for an assumed buffer width of 75 meters. Therefore, the **total benefit (reduction in sediment load)** is estimated as 33 MT/yr.

Data Sources:

- **Size of direct drainage area**: 13.1 acres (5.3 ha) (estimated from GIS, for the north side of the stream only)

- **Slope**: 4% (estimated via GIS based on local topographic datasets)

- **Soil type**: predominantly hydrologic soil group (HSG) “B”
  - Characterized by moderate infiltration rates
  - Based on STATSGO soils database available through BASINS

- **Meteorological data**:
  - All meteorological data were obtained via USEPA’s BASINS (version 4) software.
  - Hourly precipitation, air temperature, and PET data were obtained for Allentown, PA for the 1970-2006 period.

- STATSGO soils data obtained from USEPA BASINS 4 were used to estimate an average soil erodibility factor (K) of 0.32 for use in the MUSLE equation.

Assumptions:

- Buffer width was assumed to be approximately 75 meters on the north side of the creek.

- Riparian buffer was assumed to be sufficiently mature in order to optimally filter sediment.

- The SWAT-based “CNCOEF” parameter was assumed to be 0.0 (parameter used to calculate change in soil moisture capacity based on daily PET).

---

**OTHER BENEFITS NOT QUANTIFIED**

- Reduction of instream bank sediment erosion

- Improvements in quality of fish habitat

**NOTES**

- This fact sheet updates the January 2010 fact sheet, by including updated information on buffer width and location on one side of the creek.

**REFERENCES**


PROJECT NAME: Wildlands Conservancy Lehigh River Restoration  
PROJECT ID #: 15

DESCRIPTION OF ACTIVITY: Monocacy Creek Stream Restoration Projects

LOCATIONS: Two project sites within the Monocacy Creek watershed, Pennsylvania:  
1. Just Enuff Angus Farm, East Allen Township, Northampton County  
2. Edgewood Valley Farms, Bushkill Township, Northampton County

PRIMARY CONTACT:  
Rena Stricker  
Coca-Cola North America Ecologist  
Delta Consultants  
Cell: 404-723-2433  
rstricker@deltaenv.com

OBJECTIVES:  
• Reduce runoff of sediment and nutrients  
• Stabilize streambank to reduce instream erosion  
• Reduce pollutant loading to waterbodies from mines or other sources  
• Enhance riparian habitat  
• Provide shading/reduce water temperatures

BACKGROUND & ACTIVITY DESCRIPTION:  
The Monocacy Creek Stream Restoration Projects were implemented to improve water quality and aquatic habitat conditions in two tributaries of the Monocacy Creek. These projects also serve as education/demonstration projects for similar stream and riparian buffer enhancement projects on agricultural lands. The projects collectively included establishment of riparian buffer areas with native plants, enhancement of existing riparian buffer areas, construction of stream fencing for livestock exclusion, and construction of stabilized agricultural crossings. The projects resulted in improved stream and riparian corridor habitat conditions and establishment and enhancement of riparian buffer habitats. In addition 250 linear feet of upland stream bank was repaired at Edgewood Valley Farms through storm water best management practices.

Edgewood Valley Farms: Pre-project (left) & Post-Project (right) Conditions
ACTIVITY TIMELINE:
- Project was implemented prior to the end of 2008.

COCA-COLA CONTRIBUTION: 50%
- Total cost: $50,000
- Coke contribution: $25,000
- Additional partner funding and in-kind services: $25,000

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in sediment runoff

1. DECREASE IN SEDIMENT RUNOFF

Approach & Results:
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the current sediment erosion and runoff for the land areas adjacent to Monocacy Creek that drain directly to the creek for the reach where the revegetation is planned. The direct drainage areas were delineated manually in GIS and overlain with lands use, soils, and topography data. The characteristics of this area, including land uses and associated Curve Numbers (CN) and Cover/Management Factors (C_{usle}) are summarized below.

Hourly precipitation, air temperature, and potential evapotranspiration (PET) data were obtained for the Allentown, PA weather station (station ID: PA360106) for the 1970-2006 period. These datasets were used to calculate daily total precipitation and PET and average/maximum air temperature.

The Curve Number (USDA-NRCS, 1986) and MUSLE methods were used to estimate total annual sediment yield for the direct drainage area based on the physical characteristics and meteorological datasets described above. To simplify the calculations, area-weighted average CN (Edgewood: 83.6, Just Enuff: 85.9) and C_{usle} (Edgewood: 0.15, Just Enuff: 0.16) values were computed based on the land use distribution presented above. The total direct drainage sediment load to Monocacy Creek tributaries for the reaches of interest was estimated to be 540 MT/yr.

The SWAT model provides an equation to estimate the reduction in sediment load due to the presence of a riparian buffer (Equation 6:1.11.2; Neitsch et al. 2005). Using this equation, a trapping efficiency of 93% is calculated for a buffer width of 23 meters. Therefore, the total benefit (reduction in sediment load) is estimated as 502 MT/yr.

Drainage Area Characteristics:
- Total drainage area: 91 acres (36.8 ha)
  - Edgewood Valley Farm: 18 acres
  - Just Enuff Angus Farm: 73 acres
- Average slope:
  - Edgewood Valley Farm: 7.5%
Just Enuff Angus Farm: 2.5%

- **Hydrologic soil group:**
  - Edgewood Valley Farm: “PA033” – type “C” (low infiltration rates), $K = 0.24$
  - Just Enuff Angus Farm: “PA076” – type “B” (moderate infiltration rates), $K=0.32$

- **Land use:**
  - **Edgewood Valley Farms:**
    - 64% row crop ($CN = 88, C_{usle} = 0.20$)
    - 13% pasture – “fair” condition ($CN = 79, C_{usle} = 0.06$)
    - 11% low/medium-density residential
      - 80% pervious ($CN = 79, C_{usle} = 0.06$)
      - 20% impervious ($CN = 98, C_{usle} = 0.00$)
    - 10% open space ($CN = 79, C_{usle} = 0.06$)
  - **Just Enuff Angus Farm:**
    - 72% row crop ($CN = 88, C_{usle} = 0.20$)
    - 4% pasture – “fair” condition ($CN = 79, C_{usle} = 0.06$)
    - 9% low/medium-density residential
      - 80% pervious ($CN = 79, C_{usle} = 0.06$)
      - 20% impervious ($CN = 98, C_{usle} = 0.00$)
    - 15% open space ($CN = 79, C_{usle} = 0.06$)

**Data Sources:**

- Size of direct drainage area: 91 acres (36.8 ha) (estimated from GIS)
- **Slope:** 4% (estimated via GIS based on local topographic datasets)
- **Soil type:** predominantly hydrologic soil group (HSG) “B”
  - Characterized by moderate infiltration rates
  - Based on STATSGO soils database available through BASINS
- **Meteorological data:**
  - All meteorological data were obtained via USEPA’s BASINS (version 4) software.
  - Hourly precipitation, air temperature, and PET data were obtained for Allentown, PA for the 1970-2006 period.
  - STATSGO soils data obtained from USEPA BASINS 4 were used to estimate an average soil erodibility factor (K) of 0.32 for use in the MUSLE equation.
Assumptions:

- Buffer width was assigned as 23 meters on either side of the creek.
- Riparian buffer was assumed to be sufficiently mature in order to optimally filter sediment.
- The SWAT-based “CNCOEF” parameter was assumed to be 0.0 (parameter used to calculate change in soil moisture capacity based on daily PET).

OTHER BENEFITS NOT QUANTIFIED

- Reduction of instream bank sediment erosion
- Reductions in delivery of nutrients to the streams
- Improvements in quality of fish habitat

NOTES

- This fact sheet updates the January 2010 fact sheet by including updated information on buffer width.

REFERENCES


PROJECT NAME: ClearWater Community Watershed Partnership – Scotia Barrens Halfmoon Wildlife Corridor (US PA)

PROJECT ID #: 16

DESCRIPTION OF ACTIVITY: Land protection and conservation

LOCATION: Adjoining land parcels in the Spring Creek watershed of Halfmoon Township near State College, PA. The land consists of 2 subparcels containing crop fields, mixed deciduous and coniferous forest:
- 40 acres (16.2 ha) previously was going to be converted to LDR
- 66 acres (26.7 ha) of forested, agricultural, and pasture land

PRIMARY CONTACT:
Rena Stricker
Coca-Cola North America Ecologist
Delta Consultants
404-723-2433 (cell)
rstricker@deltakenv.com

OBJECTIVES:
- Conservation/protection of a corridor for wildlife passage

BACKGROUND & ACTIVITY DESCRIPTION: “ClearWater Conservancy is working with the community to complete a critical conservation project. A pocket of ecological treasures, the Scotia Barrens is an exceptional ecosystem of rare natural community types. Many of the wildlife species which call the Scotia Barrens home would disappear from the region if the barrens habitat were lost. Because of its close proximity to the growing community of State College, residential development threatens to consume large pockets of this rare habitat and isolate it from other nearby nature areas. To balance this growth and to maintain our community’s sense of place, ClearWater Conservancy has initiated the Scotia Barrens Conservation Project to prevent isolation of Scotia Barrens from encroaching development, to increase the size of protected barrens habitat, and to educate the community about this valuable resource.

As part of the larger Scotia Barrens Conservation Project, we are working to maintain natural connections between Scotia Barrens and Tussey and Bald Eagle Mountains. Significant development pressure from the north imminently threatens to isolate the Barrens from the large forested tracts of Bald Eagle Mountain, itself an important natural resource. Even though there appears to be open space remaining as one makes the drive from Route 322 west along Route 550 towards Stormstown, the fact is that future developments are on the books for all but a sliver between Scotia Barrens and the ridge. Ecological isolation of Scotia Barrens threatens viable populations of wildlife, including many neotropical bird species. According to the Pennsylvania Game Commission, Western Pennsylvania Conservancy, Audubon Pennsylvania, and Partners-in-Flight, connections between Scotia Barrens and Bald Eagle Mountain must be maintained to allow wildlife populations to flourish within Scotia Barrens.

Time is of the essence. There remains only one potential wildlife corridor connecting Scotia Barrens with Bald Eagle Mountain. ClearWater recognized this opportunity and has been working diligently over the past several years to proactively lay the foundations for land acquisitions to ensure that this wildlife corridor is maintained and protected. ClearWater Conservancy now has the opportunity to protect 106
acres of this last wildlife corridor through a combination of land purchase and the Halfmoon Township Open Space Preservation Program (lease of development rights). Protection of this 106-acre property is key to protecting two additional adjacent properties.”

[Text and figure from ClearWater Conservancy website - http://www.clearwaterconservancy.org/Halfmoon%20Wildlife%20Corridor.htm]
ACTIVITY TIMELINE:
• Agreement of Sale signed March 2009
• Still fundraising; have until March 2010 to complete the purchase
• After purchase of the property and conservation easements are in place, intention is to work with adjoining conservation landowner on riparian buffer plantings, etc.

COCA-COLA CONTRIBUTION: 0.71%
• Total cost: $700,000 (confirmed by Rena Stricker, 5/22/09 email)
• TCCC contribution: $5,000 (reported in LTI CWP survey)

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment load

1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the change in runoff for the conversion of woodland area low-density residential development (40 acres) and open range/pasture (66 acres). Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers (CN) for the pre- and post-project conditions were estimated as follows based on information provided in the TR-55 document (USDA-NRCS, 1986):

For the 40-acre (16.2 ha) parcel:
• “Pre-project”: low-density residential use (post-development)
  o Open space in “good” condition, >75% cover (CN = 74, soil group “C”)
    ▪ 80% of area (13.0 ha)
  o Impervious surfaces – roofs, pavement, etc. (CN = 98, soil group “C”)
    ▪ 20% of area (3.2 ha)
• “Post-project”: woodlands
  o Woods in good condition (CN = 70, soil group “C”)
    ▪ Assume eventual complete reforestation of preserved area

For the 66-acre (26.7 ha) parcel:
• “Pre-project”: open range (post-development)
  o Open space in “good” condition, >75% cover (CN = 74, soil group “C”)
• “Post-project”:
  o Woods in good condition (CN = 70, soil group “C”)
    ▪ Assume eventual complete reforestation of preserved area
Hourly meteorological data for the weather station located at State College, PA were obtained from the database provided as part of USEPA’s BASINS 4 watershed modeling software package. Hourly data were used to compute total daily precipitation, maximum hourly rainfall intensity, daily average and maximum air temperature, and daily total potential evapotranspiration (PET).

Curve numbers and processed meteorological data were used to compute daily runoff for the pre- and post-project cases for a 12-year period (1995-2006), including the effects of seasonal snow accumulation and melt. Total annual average runoff volumes and the resulting water quantity benefit were estimated as follows:

- **“Pre-project” (post-development):** 162.1 ML/yr
- **“Post-project” (preserved, reforested):** 150.2 ML/yr
- **Benefit (runoff reduction):** 11.9 ML/yr

**Data Sources:**
- Size of area targeted for conservation/reforestation: 106 acres (42.9 ha)
- **Slope:** 5% for 40-ac parcel, 15% for 66-ac parcel (estimated based on local topographic datasets)
- **Soil type:** predominantly hydrologic soil group (HSG) “C”
  - Characterized by low infiltration rates
  - Based on STATSGO soils database available through BASINS
- **Meteorological data:**
  - All meteorological data obtained via USEPA’s BASINS version 4 software
  - Hourly meteorological data were obtained for State College, PA for the 1995-2006 period.

**Assumptions:**
- Of the conserved area, the 40-acre parcel was assumed to be subject to low-residential residential development, and the 66-acre parcel was assumed to be “open range”.
- SWAT model parameter “CNCOEF” was set to 0.0 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. **DECREASE IN SEDIMENT EROSION/RUNOFF**

**Approach & Results:**
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting woodland to low-density residential and open range land. The meteorological and physical datasets described above for the runoff calculation were used. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were calculated based on hourly precipitation data for the 1970-1998 period.
The Cover/Management Factors ($C_{usle}$) for the MUSLE were estimated as follows based on Haith (1992):

- **“Pre-project”: post-development condition**
  - Open space (80% grass cover): $C = 0.01$
  - Impervious area – roofs, pavement, etc.: $C = 0.00$ (conservatively assume minimal sediment availability)

- **“Post-project”: conserved condition**
  - Woods with 75-100% canopy: $C = 0.001$

Total annual sediment yields for the cropland were estimated as follows:

- **Pre-project**: 248.1 MT/yr
- **Post-project**: 24.9 MT/yr
- **Benefit (reduced sediment yield)**: 223.2 MT/yr

**Data Sources:**

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.
- STATSGO soils data obtained from USEPA BASINS 4 were used to estimate a soil erodibility factor ($K$) of 0.30 for use in MUSLE equation.

**Assumptions:**

- Land slope was assumed to be 5% on average for the 40-acre parcel and 15% on average for the 66-acre parcel.
- The Cover Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and among years).

**OTHER BENEFITS NOT QUANTIFIED**

- Terrestrial habitat benefits

**NOTES**

- 

---

42
REFERENCES

ClearWater Conservancy website -  
http://www.clearwaterconservancy.org/Halfmoon%20Wildlife%20Corridor.htm


Res. Serv., USDA. Washington DC. pp. 244-252.

planning.” USDA-ARS Agriculture Handbook No. 537, Washington DC.
PROJECT NAME: TCCC-WWF Partnership: Rio Grande/Rio Bravo Basin
PROJECT ID #: 21

DESCRIPTION OF ACTIVITY: Removal of invasive plants and natural levees, bankline destabilization, and other restoration activities.

LOCATION: Middle Pecos River, New Mexico (Bitter Lake Restoration): Reaches 2 and 3

PRIMARY CONTACT:
Beth Bardwell
elizabeth.bardwell@wwfus.org
(575) 640-3415

OBJECTIVES
• Reestablish channel morphology and river-floodplain connectivity

BACKGROUND & DESCRIPTION OF ACTIVITY:
The loss of floodplain connectivity in the Middle Pecos River contributes to degradation of the habitat of numerous aquatic and riparian species including the native New Mexico Pecos bluntnose shiner. Dense thickets of an invasive plant, salt cedar, pose a fire risk (FWS, 2007). Birds, fish, amphibians, and native riparian plant communities will benefit from a connected floodplain.

This project involves restoration of a 5.7 mile reach. The primary activities are “removal of bank line levees and associated tamarisk thickets, removal of tamarisk thickets on point bars, and the reconnection of a small oxbow lake at the north end of Reach 2.” (FWS, 2007)

These modifications are “designed to work within the modern hydrology of the Pecos River.” (FWS, 2007)

ACTIVITY TIMELINE: (based on FWS, 2007 and personal communications with B. Bardwell)
• Technical studies have been completed and project is ready to proceed.
• Final EA and FONSI- completed February 2009
• Saltcedar Removal – completed Spring 2009
• Bankline Destabilization—anticipated Fall 2009
• Additional salt cedar removal, revegetation and construction anticipated through 2011.

COKE CONTRIBUTION: TBD
• WWF matching funds from TCCC for state River Ecosystem Restoration Initiative Grant: $25,000 over life of grant
• WWF also used TCCC funds to lobby for New Mexico state appropriations to the River Ecosystem Restoration Initiative which awarded a $513,000 grant to U.S. FWS for this project: $25,000 including third party contracts for lobbyist and % of B.Bardwell’s salary.
• Assumed 1% for current estimate.

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Increase in direct streamflow
1. **INCREASE IN DIRECT STREAMFLOW**

**Approach and Results**

The approach was to estimate the volume of anticipated floodplain inundation (the volume of water that would have otherwise flowed downstream without serving important floodplain functions). It is estimated that 100 acres of floodplain will be enhanced for annually-recurring floods between 1200 and 3700 cfs (FWS, 2007). The floodplain will also be flooded during rarer floods above 3700 cfs, but these were not included in the analysis, so the estimate is conservative.

\[ 100 \text{ acres flooded annually} \times 1 \text{ foot average depth} = 100 \text{ ac-ft/yr} \]

\[ 100 \text{ ac-ft/yr} = 123 \text{ ML/yr} \]

**Data sources**

- Acreage flooded under different flow conditions - provided in FWS, 2007.

**Assumptions**

- It was assumed that reoccurring floods between 1200 and 3700 cfs occur on average only once a year
- An average water depth of 1 foot in the floodplain was assumed.
- It was assumed that restoration will proceed according to the FWS proposed schedule.

**OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED**

- Removal of invasive plants and revegetation with native species will expand habitat availability and quality, and lead to increased abundance of birds, mammals, reptiles, and fish.
- The risk of fire associated with dense salt cedar stands will be reduced.
- Reconnecting spring flows to the river.
- Attenuation of flooding downstream from restoration site from increased storage of flood flows on the floodplain

**NOTES**

- TCCC percent cost contribution is unknown – requires further investigation.

**REFERENCES**

PROJECT NAME: TCCC-WWF Partnership: Rio Grande/Rio Bravo Basin
PROJECT ID #: 21

DESCRIPTION OF ACTIVITY: Modernization of Delicias Irrigation District to improve water use efficiency

LOCATION: Rio Conchos Basin, Mexico

PRIMARY CONTACT:
Mauricio De La Maza Benignos
Director Programa Desierto Chihuahuense
WWF Programa México
Tel. +52 (614) 4157526, 4157413 ext. 102
www.wwf.org.mx
mmaza@wwfmex.org

OBJECTIVES
• Stabilize flows in the Rio Conchos and Rio Grande

BACKGROUND & DESCRIPTION OF ACTIVITY: Prolonged drought in 1994-2005 reduced river flows and led to shortages for irrigation. The drought, along with 1944 Treaty obligations led to conservation measures. Modernization of the Delicias Irrigation District (90,589 Ha) addressed water losses in transmission, distribution, and irrigation systems due to unlined canals, deteriorating infrastructure, and poor irrigation techniques.

ACTIVITY TIMELINE:
• Project improvements began in 2002 and were completed in 2005
• Evaluation of interaction between surface and ground-water in the irrigation district (ongoing and to be completed in 2009)
COCA-COLA CONTRIBUTION: 0.03%
- Total cost: $143,600,000 (USD)
- TCCC contribution: Annual contribution in 2008 = $52,000

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in surface water use

1. DECREASE IN SURFACE WATER USE

Approach
Water usage provided by WWF staff. The savings were computed as the difference between pre-project water usage and post-project usage:

2008 water savings based on farmers’ estimates and project estimates (5/7/09 email from Alfredo Rodríguez, hydrologist of the WWF-Chihuahuan Desert Program).

According to NADBANK, the expected water savings for the three irrigation districts were 396 hm³ = 396 million m³/year = 396 billion liters/year. For the Delicias Irrigation district-05 the expected savings were 343 hm³. Actual savings are still unknown (WWF is currently requesting the official tally from CONAGUA).

Data sources
- No data used – water savings were reported.

Assumptions
- Assumed no depreciation in savings over 5 years (system continues to function as in 2008).

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
From NADB Fact Sheet:
- Reduction of agrochemicals in runoff
- Higher crop yields & better crop quality

NOTES
- The Mexican Water Agency (CONAGUA) has not yet released the official savings for 2008, so 2008 savings are based on best estimates.
- Higher land values & lower maintenance costs are other benefits mentioned in NADB Fact Sheet.

REFERENCES
PROJECT NAME: TCCC-WWF Partnership: Rio Grande/Rio Bravo Basin
PROJECT ID #: 21

DESCRIPTION OF ACTIVITY: Acquisition of water rights, and conservation of spring and its endemic biota.

LOCATION: Rio Conchos Basin, Mexico (Pandeño Spring, Julimes)

PRIMARY CONTACT:
Mauricio De La Maza Benignos
Director Programa Desierto Chihuahuense
WWF Programa México
Tel. +52 (614) 4157526, 4157413 ext. 102
www.wwf.org.mx
mmaza@wwfmex.org

OBJECTIVES
• Reestablish a viable population of endemic pupfish in Pandeño Spring
• Demonstration project for legal and administrative framework authorizing environmental flows
• Establish the spring as a protected area

BACKGROUND & DESCRIPTION OF ACTIVITY: The Pandeño Spring is a small (~200 square meters) thermal spring that is home to an endemic fish, the Julimes pupfish (*Cyprinodon julimes*), a new species being currently described and considered to be among the three vertebrates that live at the highest temperatures on the planet (WWF, 2007). It is among several springs impacted by increasing pumping that depletes the local groundwater supply.

Technical studies to support water rights acquisition were conducted to determine the needs of the fish. It was determined that 70-80 L/sec in water rights needs to ultimately be secured.

*Pandeño spring in Julimes and one of the land owners belonging to the San José de Pandos farmers association, main WWF partner (Photo Jürgen Hoth /WWF Mexico Program).*
ACTIVITY TIMELINE:
- Basic technical studies completed by February, 2009 (WWF, 2009)
- As of April 2009, 50 L/sec have been secured (per M. De La Maza Benignos).
- Establish the Pandeño Spring Protected Area in 2009.
- Additional 20-30 L/sec water rights acquisition is anticipated by (2011)

COKE CONTRIBUTION: 51%
- Approximate total cost of project: ($1,294,200 pesos)
- Coke contribution: ($664,200 pesos)

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in groundwater pumping

1. DECREASE IN GROUNDWATER PUMPING

Approach and Results
The 2009 savings was based on the quantity of water that was recently secured (50 L/sec). Projected future acquisitions 25 l/sec (resulting in a total of 75 L/sec) were assumed to take place by 2011.

50 L/sec = 1,580 ML/yr in 2009
75 L/sec = 2,370 ML/yr by 2011

Data sources
- Water acquisition estimates provided by WWF, and confirmed data provided by official documentation (National Water Commission)

Assumptions
- Future projections assume that a quantity of 75 L/sec is successfully secured by 2011.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
- Physical protection of the of the pupfish’s habitat was achieved through voluntary designation of four hectares of land as a protected area and fencing of its perimeter. Its additional designation as a Federally recognized protected area is underway.
- The water that is acquired flows through the spring and into the river, and is available for downstream uses including irrigation.
- Establishment of a local NGO “Amigos del Paneño, A.C.”, as a step to develop local water stewardship.

NOTES
- The framework developed for Pandeño Spring is a model for protection of other threatened springs, water-related areas and resources in Mexico.
- Many legal, social, and political challenges have been overcome. Support from local owners and municipal authorities has been the key of success
REFERENCES


WWF 2008, Conservación de Cyprinodon nov sp. Julmes: Taxonomía, filogenia molecular, etología reproductiva y coloración críptica comparada del Género Cyprinodon (Pisces: Cyprinodontidae) en la cuenca del Río Conchos, By Lourdes Lozano and Susana Favela, UANL,


**PROJECT NAME:** TCCC-WWF Partnership: Rio Grande/Rio Bravo Basin – Rainwater harvesting for irrigation of orchards

**PROJECT ID #:** 21

**DESCRIPTION OF ACTIVITY:** Rainwater harvesting

**LOCATION:** Tarahumara region, Rio Conchos Basin, State of Chihuahua, Mexico

**PRIMARY CONTACT:**
Mauricio De La Maza Benignos
Director Programa Desierto Chihuahuense
WWF Programa México
Tel. +52 (614) 4157526, 4157413 ext. 102
www.wwf.org.mx
mmaza@wwfmx.org

**OBJECTIVES**
- Augment domestic and irrigation water supplies during the dry season using stored rainwater

**BACKGROUND & DESCRIPTION OF ACTIVITY:** A rainwater harvesting project was implemented in 2007 in the Tarahumara region of the southwestern portion of the Mexican State of Chihuahua. Rainwater is captured from the rooftops of 26 participating households with average roof size of 35 square meters each. The water is collected in a 10,000 liter domestic tank which usually completely fills during the rainy season. Prior to rainwater harvesting, the only source of water was Sisoguichi creek. The harvested rainwater is used in equal proportions to supply 60% of the domestic and orchard irrigation needs (the average orchard size is 50 square meters) during the four months of the dry season (March through June). An average Tarahumara household of 5 individuals consumes 70 liters of water per day or 8,400 liters of water during the dry season. The water tank provides 60% of their drinking needs (i.e., 5,040 l) and the remaining 40% (3,360 liters) is obtained from the creek. Similarly for orchard irrigation needs of approximately 8,500 liters during the dry season, the tank provides 4,960 liters and the remaining 3,570 liters are obtained from the creek.

Rainwater Harvesting in the Tarahumara region of Chihuahua, Mexico - orchard in foreground; tank and roof catchment in background (photo WWF-CDP. 2007).
ACTIVITY TIMELINE:
- Project implemented in 2007 and is ongoing

COCA-COLA CONTRIBUTION: 35%
- Total cost: $1,869,000 Pesos
- Coca-Cola contribution: 651,000 Pesos

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in surface water use

1. DECREASE IN SURFACE WATER USE

Approach
Water harvesting and usage rates were provided by WWF staff. The water benefit is equal to the amount of water harvested in the 10,000 liter collection tank.
- Total yearly benefit (decreased surface water use): 0.01 ML/year

Data sources
- No data used – water savings were reported in email from Jurgan Hoth/WWF on May 17, 2009.

Assumptions
- Assumed no depreciation in savings over 5 years (system continues to function as in 2008).

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED: None

NOTES: None

REFERENCES: None
PROJECT NAME: TCCC-WWF Partnership: Rio Grande/Rio Bravo Basin
PROJECT ID #: 21

DESCRIPTION OF ACTIVITY: Reforestation in Upper Conchos Basin

LOCATION: Mexico: Río Conchos headwaters (Ejido Panalachi, Sierra Tarahumara); Upper portion of Ureyna micro-basin and Resonachi micro-basin of Panalachi

PRIMARY CONTACT:
Mauricio De La Maza Benignos
Director Programa Desierto Chihuahuense
WWF Programa México
Tel. +52 (614) 4157526, 4157413 ext. 102
www.wwf.org.mx
mmaza@wwfmex.org

OBJECTIVES:
• Reduce erosion and associated sedimentation in river & above dams
• Restore forest habitat

BACKGROUND & ACTIVITY DESCRIPTION: Extensive forest fires in 2001 and 2003 cleared the land. A total of 122.5 ha of land was reforested with native pine (Pinus arizonica).

ACTIVITY TIMELINE:
• 122.5 ha reforested in September, 2008
• Future reforestation goals will depend on the forestry management plan under development, so extent of future reforestation is currently unknown and was not quantified.

COKE CONTRIBUTION: 35%
• Total cost: 660,000 pesos
• Coca-Cola contribution: 320,000 pesos

Areas showing 100 ha of reforestation efforts in the upper Conchos basin.
The remaining 22 hectares are scattered and located nearby.
WATERSHED RESTORATION BENEFITS CALCULATED:

1. Decrease in runoff water quantity
2. Decrease in sediment runoff

1. DECREASE IN RUNOFF WATER QUANTITY

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff for the conversion of unforested land to forested land. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **Pre-project**:
  - Hydrologic soil group (HSG) “B”
  - Herbaceous – grass/weeds/brush mixture in “fair” condition (CN = 71)

- **Post-project**:
  - Hydrologic soil group (HSG) “B”
  - Woodland in “good” condition (CN = 55)

Daily precipitation and air temperature data were obtained from the meteorological database available from WaterBase (www.waterbase.org) for the 2000-05 period, although sufficiently complete precipitation data were only available for year 2000. The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases for year 2000. Total annual runoff volumes and the resulting water quantity benefit were estimated as follows:

- **Pre-project (open space)**: 14.7 ML/yr (12 mm/yr)
- **Post-project (reforested land)**: 0.1 ML/yr (0.1 mm/yr)
- **Benefit (runoff reduction)**: 14.6 ML/yr (12 mm/yr)

Data Sources:

- Size of reforested land area: 122.5 ha (provided by contact)
- Slope: 12% (provided by contact)
- Soil type:
  - primarily Regosol eutrico, Luvisol, and feozem (provided by contact)
  - Available water content (AWC) = 8 mm/meter (hydrologic soil group “B”)
- Daily precipitation data for year 2001 obtained from WaterBase meteorological database for Parral, Mexico (lat: 26.93, long: -105.66, elev: 1661 meters) for year 2000 (411 mm).
Assumptions:
- The tree canopy in the reforested areas was assumed to be mature.
- Precipitation data obtained for Parral, Mexico for year 2000 are generally representative of average annual precipitation conditions for the area where reforestation is occurring.
- Soil drainage properties can be represented using Hydrologic Soil Group (HSG) “B” for the purpose of runoff calculations.
- SWAT model parameter “CNCOEF” was set to 2.0 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. DECREASE IN SEDIMENT RUNOFF

Approach & Results:
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting unforested land to forested land. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for year 2000.

The Cover/Management Factors (C_{usle}) used in the MUSLE were estimated as follows based on Haith (1992):
- Pre-project: grass/weeds mixture, 60-80% cover (C_{usle} = 0.05)
- Post-project: woodland with 75-100% tree canopy (C_{usle} = 0.001)

Total annual sediment yields for the unforested and forested land areas were estimated as follows:
- Pre-project (unforested): 220 MT/yr
- Post-project (forested): ~0 MT/yr
- Benefit (reduced sediment yield): 220 MT/yr

Data Sources:
- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:
- The tree canopy in the reforested areas was assumed to be mature.
- The Cover/Management Factor (C_{usle}) was assumed to remain constant through time (both seasonally and across years).
- The soil erodibility factor (K) was assumed to be 0.28 for use in MUSLE equation.
OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED

- Habitat improvements benefiting terrestrial wildlife
- Shading of streams lowers water temperatures and improves fishery
- Subsistence agricultural practices including low impact tilling and use of organic fertilizers will be proposed to local communities using native/traditional corn. Anticipated benefits include reduced runoff and reduced pollutant concentrations in runoff.

NOTES

- Quantification does not include future restoration efforts because details are not currently known.

REFERENCES


PROJECT NAME: TCCC-WWF Partnership: Rio Grande/Rio Bravo Basin
PROJECT ID #: 21

DESCRIPTION OF ACTIVITY: Removal of invasive plants and natural levees, increasing high or pulse flows, bankline destabilization, and other restoration activities.

LOCATION: Rio Grande, New Mexico (Caballo Dam to American Dam)

PRIMARY CONTACT:
Beth Bardwell
elizabeth.bardwell@wwfus.org
(575) 640-3415

OBJECTIVES
• Enhance native riparian habitat and aquatic diversity, and reestablish river-floodplain connectivity

BACKGROUND & DESCRIPTION OF ACTIVITY: Following extensive scientific studies, a conceptual restoration plan was developed for up to 30 sites. The plan addresses problems due to alteration of the natural hydrograph, historical canalization, historical vegetative management, invasive plants, dam operations, and other causes.

Measures to reestablish floodplain connectivity are targeted at increasing the frequency and duration of overbank inundation through bank excavation, removal of invasive plants and natural levees, increasing high or pulse flows, bankline destabilization, and other activities, which vary by location.

ACTIVITY TIMELINE: (per B. Bardwell, WWF)
• Scientific studies and conceptual planning largely completed by March, 2009
• Final Record of Decision authorizing implementation anticipated in May-August, 2009 period.
• Implementation schedule for bringing 30 restoration sites online and undertaking environmental water transactions: 2-10 year timeframe
• Additional agreements needed to authorize environmental peak release – anticipated to occur over 5-10 year timeframe.

COKE CONTRIBUTION: TBD
• Assumed 30% for current estimate based on rough approximation from contact.
• WWF staff: 50% FTE Beth Bardwell

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Increase in direct streamflow
1. INCREASE IN DIRECT STREAMFLOW

Approach and Results

The volume was computed as the total amount of water or water right transferred to restoration sites or for peak release. This is assumed to be equal to the projected volume of floodplain inundation (acre-ft/year). The floodplain will stay connected and water will flow through the site. Floodplain inundation that results from restoration activities may occur only periodically and not on an annual basis.

Changes in vegetation communities associated with the restoration activities (invasive plants to native plants) are anticipated to result in a net increase in annual depletions due to evapotranspiration (ET). This quantity is estimated to be 429 ac-ft. In some cases, supplemental annual irrigation of restoration sites will be necessary to sustain and enhance productivity of native riparian vegetation, because at some restoration sites the depth to groundwater has decreased as a result of canalization, irrigation drains and groundwater pumping. This quantity is estimated to be 227 ac-ft, but the quantity may increase under an adaptive management program.

The restoration plan includes voluntary water transactions (donations, leases and permanent acquisition) that would transfer water and/or water rights from farmland or lands taken out of production for housing development to offset annual depletions and/or irrigate restoration sites on an annual basis. If agreements with irrigators and federal agencies can be reached, there will also be periodic supplemental peak flows through dam releases. This quantity is estimated to be on average 9,500 ac-ft per augmentation event, and reoccur on the order of 3 to 5 years as determined under an adaptive management program.

Calculations

- 450 ac-ft/yr to offset depletion quantity
- 227 ac-ft/yr supplemental irrigation
- 2,375 ac-ft/yr peak flow release from dam (on annual basis assuming once every 4 years)

**TOTAL = 3,052 ac-ft/yr = 3,765 ML/yr**

Data sources

- Water transfer quantities provided by B. Bardwell, WWF.

Assumptions

- It is assumed that agreements are reached and projected water and water rights transfers will occur as anticipated.
- Peak flow release was converted into an annual volume for the purpose of estimating an annual average. This quantity of water will not be put in the river on an annual basis; rather it will be banked and the cumulative amount will be released periodically once every 3 to 5 years.
OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED

- Removal of invasive plants and revegetation with native species will expand habitat availability and quality, and lead to increased abundance of birds, mammals, reptiles, and fish.
- The risk of fire associated with dense salt cedar stands will be reduced.

NOTES
- Project also involves establishment of a legal framework for these types of projects (WWF, 2007).

REFERENCES
PROJECT NAME: TCCC-WWF Partnership: Rio Grande/Rio Bravo Basin
PROJECT ID #: 21

DESCRIPTION OF ACTIVITY: Acquisition of water rights to support environmental flows

LOCATION: Rio Bosque Wetland Park: El Paso, Texas

PRIMARY CONTACT:
Rena Ann Stricker
Contract Ecologist for Coca-Cola Refreshments
Watershed Sustainability LLC
rstricker@coca-cola.com

Mark Briggs
World Wildlife Fund
mark.briggs@wwfus.org

OBJECTIVE:
• Secure a water supply for the park to sustain year-round wetland and native riparian habitat

BACKGROUND & DESCRIPTION OF ACTIVITY: Rio Bosque Wetland Park is 372 acres in size. It provides the “largest expanse of native habitat along a several hundred-mile-long stretch of the Rio Grande.” While treated wastewater is routinely diverted to flow through the park in the late fall and winter, the park does not reliably receive water during the growing season and breeding season for resident waterfowl. No permanent water rights are currently allocated to the park. (WWF, 2008).

The plan includes voluntary water transactions (donations, leases, and permanent acquisition) to transfer water and/or water rights from farmlands or public water utilities to flow through two wetland cells covering 30 acres.

The following photos represent depict temporal changes in plant composition and productivity along the 2-mile long old river channel that was rebuilt to deliver water to the wetland cells within Rio Bosque Park. 2002 was the last year that water was delivered to the Rio Bosque Wetland Park during the growing season. The park receives treated effluent during the fall and winter now, but has not received water during the growing season for seven years now.

These represent “before” pictures, the “after” pictures would document changes once an environmental water transactions program was in place to dedicate water to the Rio Bosque Wetland Park.
SUMMARY OF REPLENISH BENEFIT:

- 2011 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 370 ML/yr

ACTIVITY TIMELINE: (per B. Bardwell, WWF)

- Scientific studies and conceptual planning largely completed by March, 2009
- The water delivery infrastructure and environmental water transactions are planned to be implemented on a timeframe of 1-5 years, but schedule and likelihood of future additional acquisitions is currently unknown.

COKE CONTRIBUTION: 50%

- Exact costs are unknown so assumed 50% for current estimate.
- WWF has contributed funding in the form of grants to UTEP and third party contracts for legal research, environmental education and communication, and other activities that benefit the Rio Bosque Wetland Park: $23,000
- WWF staff time: 5%-10% of FTE Beth Bardwell

WATERSHED RESTORATION BENEFITS CALCULATED:

1. Increase in floodplain inundation

1. INCREASE IN FLOODPLAIN INUNDATION

Approach and Results
The volume was computed as the total amount of water or water rights transferred to the park. The original goal was to acquire 5,400 acre-ft/yr through acquisitions & donations. An estimated 2,552 acre-feet would flow through the park and be returned to the irrigation network for use by downstream irrigators. 2,862 acre-feet would percolate to groundwater, evaporate or be transpired by vegetation within the park (WWF, 2008).

As of the end of 2011, 600 acre-feet of water/year (equal to 740 ML/yr) has been secured for the park during the growing season to keep the main channel wet. Work is continuing to secure additional water but future acquisitions are not known and are not reflected in this fact sheet. The 2011 benefit is
therefore also the total (ultimate) benefit, because until data become available for future years, it is assumed that the projected benefits will remain the same as 2011 in each future year.

The total (ultimate) benefit is: 740 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 370 ML/yr

The current (2011) benefit and projected benefits are presented below.

2011 Replenish Benefit
The 2011 benefit is the performance-based benefit from this activity as of the end of calendar year 2011. The total 2011 benefit is 740 ML/yr and TCCC’s benefit (adjusted for cost share) is 370 ML/yr.

Projected Replenish Benefits
The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>740</td>
<td>370</td>
</tr>
<tr>
<td>2013</td>
<td>740</td>
<td>370</td>
</tr>
<tr>
<td>2014</td>
<td>740</td>
<td>370</td>
</tr>
<tr>
<td>2015</td>
<td>740</td>
<td>370</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>740</td>
<td>370</td>
</tr>
</tbody>
</table>

Data sources
- Water transfer quantities provided by M. Briggs, WWF.

Assumptions
- It is assumed that agreements are reached and projected water and water rights transfers will occur on schedule as anticipated.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
- Improved wetland and riparian habitat provides important habitat for aquatic life and birds.

NOTES
- This is an update of January 2011 fact sheet and it includes more recent information on water transactions.

REFERENCES
PROJECT NAME: Rio Chamelecon River Watershed Protection Initiative
PROJECT ID #: 25

DESCRIPTION OF ACTIVITY: Implementation of improved agricultural practices: cropland/farmland management

LOCATION: Manchaguala sub-watershed near San Pedro Sula, Cortes, Honduras- (15.5° N, 88.1° W)
- Specifically selected areas in seven communities (Nueva Santa Elena, Buena Vista, Guadalupe de Bañaderos, Laguna de Bañaderos, Santa Elena Viejo, Monte Alegre y San José Manchaguala)

PRIMARY CONTACT:
Jose Vasquez
World Wildlife Fund - Central America
jvasquez@wwfca.org

OBJECTIVES
- Increase infiltration/aquifer recharge and/or increase baseflows
- Reduce erosion and associated sedimentation of receiving waters

BACKGROUND & DESCRIPTION OF ACTIVITY: (from WWF, 2008; WWF, 2009)
The Chamelecon watershed encompasses 4,350 square kilometers in the Merendon mountains and provides water to industry and residents of San Pedro Sula (approximately 600,000 inhabitants), as well as 15 other municipalities which represent one fifth of Honduras’s total population. The Merendon mountains host many subsistence agriculture farming communities, dedicated mainly to agriculture and livestock. The upper watershed is threatened by illegal logging, poor agriculture practices, and the presence of pests and diseases among its forests. The lower watershed is threatened by unregulated industrial and residential effluents, an ineffective water commission, and unplanned economic urban residential growth. WWF’s commitment to conserving the integrity of the Mesoamerican Reef identifies effluent reduction as a fundamental conservation strategy and the Rio Chamelecon Watershed Protection Initiative project directly addresses this need by reducing farmland erosion and runoff.

This project is a pilot effort to implement the Payment for Watershed Services program in Honduras by establishing a community-based integrated watershed management program. Efforts to achieve this goal include engaging key communities in sustainable land-use management practices that reduce erosion, control water flow and protect water and soil integrity while sustaining local livelihoods. This project is expected to include the following results: 21 parcels under agro forestry systems implemented with the participation of 21 small producers, construction of 21 efficient fuel wood stoves and 2 kilometers of live barriers (from tccgws.com project database).

ACTIVITY TIMELINE:
- Start Date: November 2008
- End Date: 2009
**COCA-COLA CONTRIBUTION:** 30.5%
- Total Cost of Project: $3,020,000USD
- Coca-Cola Foundation $920,000USD
- from tccgws.com project database

**WATERSHED RESTORATION BENEFITS CALCULATED:**

1. **DECREASE IN RUNOFF**

**Approach & Results**

The water quantity benefit from implementation of the improved agricultural practices was estimated for water quantity (runoff reduction) and water quality (soil erosion reduction) using data provided in the survey responses. The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff for the conversion of unvegetated/eroded land to agroforestry land. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **Pre-project:**
  - Hydrologic soil group (HSG) “B”
  - Grassland in “fair” condition (CN = 69)
- **Post-project:**
  - Hydrologic soil group (HSG) “B”
  - Orchard/tree farm in “good” condition (CN = 58)

Daily precipitation and air temperature data were obtained from the TuTiempo.net online meteorological database for the Tela, Honduras station during the 2006-08 time period ([http://www.tutiempo.net/en/Climate/Tela/787060.htm](http://www.tutiempo.net/en/Climate/Tela/787060.htm)). The Hamon method was used to estimate daily potential evapotranspiration (PET) for this year based on daily average air temperature and latitude (Hamon, 1963).

Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases. Total annual runoff volumes and the resulting water quantity benefit were estimated as follows:

- **Pre-project (open space) runoff volume:** 201 ML/yr
- **Post-project (agroforestry) runoff volume:** 183 ML/yr
- **Benefit (runoff reduction):** 18 ML/yr
**Data Sources/Site-specific Characteristics:**

- Pre-project: eroded areas with no crop or forest cover
- Post-project: agroforestry with crop rotation practices, etc.
- Surface area: 21 hectares
- Slope: 32-55%
- Soil type: silty/clay soil (Franco)
- Daily precipitation and air temperature data were obtained from the online “TuTiempo.net” meteorological database (http://www.tutiempo.net/en/) for the Tela station (ID: 787060).

**Assumptions:**

- Precipitation data for the Tela station (2006-08) are representative of precipitation conditions for the unvegetated areas converted to cropland.
- SWAT model parameter “CNCOEF” was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

**2. DECREASE IN SEDIMENT EROSION/RUNOFF**

**Approach & Results:**

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting unvegetated/eroded land to agroforestry land. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for years 2006-08.

The Cover/Management Factors ($C_{usle}$) used in the MUSLE were estimated as follows based on Haith (1992):

- **Pre-project:** ~60% cover as grass ($C_{usle} = 0.04$)
- **Post-project:** 20-40% tree canopy cover ($C_{usle} = 0.01$)

Total annual sediment yields for the unvegetated/eroded land and crop land areas were estimated as follows:

- **Pre-project (open space) sediment yield:** 18,903 MT/yr
- **Post-project (crop land) sediment yield:** 4,332 MT/yr
- **Benefit (sediment yield reduction):** 14,571 MT/yr

**Data Sources:**

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.
Assumptions:

- The Cover/Management Factor (C_{usle}) was assumed to remain constant through time (both seasonally and across years).
- The soil erodibility factor (K) was assumed to be 0.24 for use in MUSLE equation.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED

- Protection of forest cover through use of fuel efficient stoves to reduce firewood consumption (no data provided).
- Any benefits realized through the use of live barriers.

NOTES

- None

REFERENCES


PROJECT NAME: Conserving the Mekong
PROJECT ID #: 28

DESCRIPTION OF ACTIVITY: Reforestation

LOCATION: Chi River watershed in Thailand (Tha Sala, Kam Kan, Nong Pan, and Pon Pek districts)

PRIMARY CONTACT:
Rebecca Ng, Program Officer
World Wildlife Fund, Greater Mekong Program
1250 24th Street NW
Washington, DC 20037 USA
+1.202.495.4717
rebecca.ng@wwfus.org

OBJECTIVES:
• Improve biodiversity
• Reduce sediment erosion & runoff (stabilize soils)

BACKGROUND & ACTIVITY DESCRIPTION: The Chi River watershed includes a significant amount of agricultural lands, including plots for sugar cane, rubber plantations, and pulp and paper generation. Current farming practices in the region are generally poor and unsustainable and have resulted in a degraded condition for the watershed. Reforestation of the Chi River watershed is being undertaken to improve the condition of the watershed, while enhancing biodiversity and stabilizing soils to reduce sediment erosion and runoff.
SUMMARY OF REPLENISH BENEFIT:
- 2011 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 121.6 ML/yr

ACTIVITY TIMELINE:
- 2007: Reforestation initiated
- 2008: Reforestation completed
  - Future reforestation efforts are not known at this point.

COCA-COLA CONTRIBUTION: 95%

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff for the conversion of unforested (e.g., pasture/range) land to forested land. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers (CN) for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):
- **Pre-project:**
  - Hydrologic soil group (HSG) “B”
  - Pasture/grassland in “fair” condition: 50-75% vegetative cover (CN = 69)
    - Curve Number estimate is conservative for agricultural lands
- **Post-project:**
  - Hydrologic soil group (HSG) “B”
  - Woodland in “good” condition (CN = 55)

Daily precipitation and air temperature data were obtained for a meteorological station located at Kabinburi, Thailand (ID: 484390). The data for this station (and other stations in the region) were incomplete or of poor quality for many of the available years; however, the 2003-04 period provided a reasonably complete time series of precipitation and air temperature. The average precipitation for 2003-04 is 1640 mm/yr. By comparison, the long-term annual average precipitation for this region is approximately 1800 mm/yr (Hearn et al. 2003); therefore, the selected years provide a generally representative (yet somewhat conservative) case for rainfall, and this time period was selected for the analysis. The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).
Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases for years 2003-04. The total water quantity benefit was estimated as the difference between the annual pre-project and post-project runoff volumes.

- **Pre-project (open range):** 450 ML/yr (572 mm/yr)
- **Post-project (reforested land):** 322 ML/yr (409 mm/yr)

  **Total (ultimate) benefit (runoff reduction) is:** 128 ML/yr (163 mm/yr)

  **TCCC total (ultimate) benefit taken as a function of cost share is:** 121.6 ML/yr

The current (2011) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2011 Replenish Benefit**

The 2011 benefit is the performance-based benefit from this activity as of the end of the calendar year 2011. The total 2011 benefit is 128 ML/yr and TCCC’s benefit (adjusted for cost share) is 121.6 ML/yr.

**Projected Replenish Benefits**

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

**Projected Water Quantity Benefits Summary**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>128</td>
<td>121.6</td>
</tr>
<tr>
<td>2013</td>
<td>128</td>
<td>121.6</td>
</tr>
<tr>
<td>2014</td>
<td>128</td>
<td>121.6</td>
</tr>
<tr>
<td>2015</td>
<td>128</td>
<td>121.6</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>128</td>
<td>121.6</td>
</tr>
</tbody>
</table>

**Data Sources:**

- **Size of reforested land area:** 492 rai = 78.7 hectares (provided by contact)
- **Slope:** variable, but 2% on average
- **Soil type:**
  - “Available water content” of ~8 mm per meter of soil depth (Batjes, 1996) – consistent with hydrologic soil group “B” characteristics.
- Daily precipitation data for years 2003-04 were obtained for Kabinburi, Thailand from the WaterBase meteorological database (http://www.waterbase.org).
Assumptions:

- The pre-project land cover can be appropriately characterized as open pasture/rangeland with approximately 50-75% vegetative cover. (Note that this provides a conservative estimate of Curve Number for areas that have been utilized as crop land.)
- The slope conditions for the reforested area are approximately 2% on average.
- SWAT model parameter “CNCOEF” was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting unforested land to forested land. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for year 2000.

The Cover/Management Factors ($C_{usle}$) used in the MUSLE were estimated as follows based on Haith (1992):

- **Pre-project**: grass/weeds mixture, 60-80% cover ($C_{usle} = 0.02$)
- **Post-project**: woodland with 75-100% tree canopy ($C_{usle} = 0.001$)

Total annual sediment yields for the unforested and forested land areas were estimated as follows:

- **Pre-project (pasture/range)**: 177.0 MT/yr (2.2 MT/ha/yr)
- **Post-project (forested)**: 6.3 MT/yr (0.1 MT/ha/yr)

**The total benefit (reduced sediment yield) is**: 170.7 MT/yr and TCCC’s benefit (adjusted for cost share) is 162.2 MT/yr.

**The 2011 benefit is**: 170.7 MT/yr and TCCC’s benefit (adjusted for cost share) is 162.2 MT/yr.

Projected Water Quality Benefits

The table that follows shows the projected water quality benefits (i.e., sediment yield reduction) that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
### Projected Water Quality Benefits Summary (Sediment)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (MT/yr)</th>
<th>Adjusted for TCCC Cost Share (MT/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>170.7</td>
<td>162.2</td>
</tr>
<tr>
<td>2013</td>
<td>170.7</td>
<td>162.2</td>
</tr>
<tr>
<td>2014</td>
<td>170.7</td>
<td>162.2</td>
</tr>
<tr>
<td>2015</td>
<td>170.7</td>
<td>162.2</td>
</tr>
<tr>
<td><strong>Ultimate Benefit:</strong></td>
<td><strong>170.7</strong></td>
<td><strong>162.2</strong></td>
</tr>
</tbody>
</table>

**Data Sources:**
- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

**Assumptions:**
- The tree canopy in the reforested areas was assumed to be mature.
- The Cover/Management Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and across years).
- The soil erodibility factor ($K$) was assumed to be 0.24 for use in MUSLE equation.

**OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED**
- Corresponding increases in infiltration and groundwater baseflow to local stream networks.
- Habitat improvements benefiting aquatic and terrestrial wildlife.

**NOTES**
- This fact sheet updates a 2009 fact sheet by including updated costs.

**REFERENCES**


PROJECT NAME: Conserving the Mekong
PROJECT ID #: 28

DESCRIPTION OF ACTIVITY: Water level management

LOCATION: Tram Chim National Park, Vietnam

PRIMARY CONTACT:
Rebecca Ng, Program Officer
World Wildlife Fund, Greater Mekong Program
1250 24th Street NW
Washington, DC 20037 USA
+1.202.495.4717
rebecca.ng@wwfus.org

OBJECTIVES
• Rehabilitate ecosystem processes and associated habitats;
• Legitimize community access to wetland resources;
• Demonstration project to change the way of thinking, management practices, and reflect this in policy

BACKGROUND & DESCRIPTION OF ACTIVITY: Tram Chim National Park in Vietnam was the site of a demonstration project of the Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme, a joint programme of Cambodia, Lao PDR, Thailand, and Vietnam that aimed to strengthen capacity for wetland conservation and sustainable use in the Lower Mekong Basin by working at regional, national and local levels. The MWBP program ended in 2005 and was followed up by a project under the WWF-TCCC partnership from 2006 to present.

Tram Chim National Park (7,300 ha) is situated in a low lying area within one of the largest floodplains in the Mekong Delta: the Plain of Reeds. Virtually the entire Plain has been converted to agriculture; only the park’s protected grasslands and Melaleuca forests still offer valuable habitat for the myriad of local species, including the rare Sarus Crane (Grus Antigone). Even these last habitats were deteriorating due to poor management and low capacity of staff. The single management objective of the park was to suppress fire. The prevalent fire suppression practice was to retain water throughout the year. (Though park management sought to inundate all park zones permanently, failure of control structures in two zones (750+ ha) resulted in excessive drying and drought).

Optimization of water level management—moving towards a more natural hydroperiod—in each of the park’s five zones resulted in significant recovery of wetland vegetation and associated functions, and will help mitigate flood and drought impacts in the Plain of Reeds and the downstream Mekong Delta. It will also contribute to maintenance of groundwater levels in the Tram Chim vicinity.

SUMMARY OF REPLENISH BENEFIT
• 2011 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 10,944 ML/YR

ACTIVITY TIMELINE:
• 2006: Project initiation
Revised January 2012

- 2011: Project completion
  - Assumed 80% complete (2008); 90% complete (2009); 95% complete (2010); 100% complete (2011)

**COCA-COLA CONTRIBUTION:** 96%

**WATERSHED RESTORATION BENEFITS CALCULATED:**
  1. Change in direct streamflow

### 1. CHANGE IN DIRECT STREAMFLOW

**Approach and Results**
The replenishment volume for the largest zone (Zone A1) was calculated as the added volume of water discharged from Zone A1 when operating under the revised Tram Chim target water levels (Table 2 in Ni et al.). Monthly discharge volumes under the revised levels were calculated as the difference between beginning-of-month and end-of-month volume as estimated from park elevation zone data (Table 1 in Thien et al.) in conjunction with the targets. The discharge volumes under the previous management plan were calculated using water levels for the years 2002-2006 reported in Figure 5 of Ni et al.). The discharge volumes for 2002-2006 were calculated by converting monthly water levels into volumes, then averaging.

**The added January-April discharge volume for Zone A1 = 2.90 BG = 10,980 ML**

Replenishment for the smaller zones (A3 and A4) was calculated as the added volume of water stored in Zones A3 and A4, which were previously dry. Target water levels of 123 cm for Zone A3 and 137 cm for Zone A4 were selected as the comparison points.

**The added volume of water stored in A3 = 7.32 million gallons = 27.7 ML**  
**The added volume of water stored in A4 = 116 MG = 439 ML**

The total annual water quantity benefit is the sum of added volume for Zones A1, A3 and A4, which is calculated as: 10,980 + 27.7 + 439 = 11,400 ML/yr

- **Total (ultimate) benefit is:** 11,400 ML/yr
- **TCCC total (ultimate) benefit taken as a function of cost share is:** 10,944 ML/yr

The current (2011) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2011 Replenish Benefit**

The 2011 benefit is the performance-based benefit from this activity as of the end of calendar year 2011. The total 2011 benefit is 11,400 ML/yr and TCCC’s benefit (adjusted for cost share) is 10,944 ML/yr.
Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in this table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>11,400</td>
<td>10,944</td>
</tr>
<tr>
<td>2013</td>
<td>11,400</td>
<td>10,944</td>
</tr>
<tr>
<td>2014</td>
<td>11,400</td>
<td>10,944</td>
</tr>
<tr>
<td>2015</td>
<td>11,400</td>
<td>10,944</td>
</tr>
<tr>
<td>Ultimate Benefit</td>
<td>11,400</td>
<td>10,944</td>
</tr>
</tbody>
</table>

Data sources
- All data and information were taken from references cited above.

Assumptions
- As noted above

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
- Improved ecosystem health. WWF monitoring data indicates a five-fold increase in waterbird populations since 2001.
- Benefits to communities from increased fish productivity and legitimized access.

NOTES
- This fact sheet updates a 2009 fact sheet by including updated costs.
- [5/12/09 Email from Nguyen Huu Thien] “The ultimate goal of the work at Tram Chim is for ecosystem health and our approach is to demonstrate and change the way of thinking, management practices, and policy uniformly applied across protected areas despite the differences in the needs of different ecosystems. The policy and management practices were originally developed for upland forests which are not suitable for wetlands and that’s what should be counted as the “main feature” of the project.”
REFERENCES


PROJECT NAME: Conserving the Mekong

PROJECT ID #: 28

DESCRIPTION OF ACTIVITY: Pilot testing for a suite of improved agricultural practices, including pesticide reductions, fertilizer improvements, and strip cropping.

LOCATION: Chi River subwatershed in Thailand (including the Tha Sala, Kam Kan, Nong Pan, and Phon Pek districts). Longitude/Latitude: (102.56, 16.24)

PRIMARY CONTACT:
Rattaphon Pitakthepsombat
Project Manager
Chi Watershed Restoration Project, WWF Greater Mekong
Thailand Country Programe
404-406 Moo 13, Kasetwattana Rd,
Kudkao, Manjakhiri District
Khon Kaen, Thailand 40160
Tel: +66 43381158
Fax: +66 43381159
Mobile: +668 17024537
Email: rpitakthepsombat@wwfgreatermekong.org
Website: http://thailand.panda.org/

OBJECTIVES:
• Reduce nutrient loadings to receiving waters
• Reduce excess chemicals in runoff
• Reduce sediment erosion & runoff (stabilize soils)

BACKGROUND & ACTIVITY DESCRIPTION: The Chi River watershed includes a significant amount of agricultural lands, including plots for sugar cane, Cassava, rice paddies, rubber plantations, and pulp and paper generation. Current farming practices in the region are generally poor and unsustainable and have resulted in degraded conditions for the watershed. Agriculture best management volunteers were mobilized to test a number of sustainable agricultural practices aimed at reducing chemical use on the farm and reducing soil erosion and runoff from agricultural fields into local water sources. The volunteers selected were all interested in establishing alternative agricultural plots on their farms. In each case, the alternative plot covers a portion of the total farm area and not the total land cultivated by each farmer. This is for two reasons: 1) to reduce the risk of each farmer to a level that the project can guarantee if the alternative plot crop fails, and 2) by only working on part of the farmers land they can compare and contrast between the alternative plot and their regular fields to better understand the costs and benefits of the alternative practice compared to regular practice. Once the volunteer farmers were selected, a study tour was organized to instruct the farmers about the alternative farming systems that are possible for each crop and land type.

The alternative agricultural practices were individually designed based upon the local conditions and the farmer’s interests. For example, some farmers were interested in reducing their fertilizer costs so were keen on testing organic fertilizers, whereas other farmers wanted to try soil stabilization techniques to protect their soil. A total of 40 farmers are engaged in this activity with 144 Rai (23 ha) of rice, 49 Rai (7.8 ha) of sugarcane and 123 Rai (20 ha) of Cassava represented. A working group has been established
to support, advise and monitor these alternative agriculture practice activities comprising representatives from Khon Kaen University, Khon Kaen crop research center, Green Manja Kheio Kajee Network, the Sub-district councils, and the agriculture volunteer in each village assisted by project staff.

---

Agricultural areas within the Chi River watershed.

SUMMARY OF REPLENISH BENEFIT:
- 2011 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 0 ML/YR (only water quality benefits are applicable).

ACTIVITY TIMELINE:
- Pilot activities began in February 2008 and are ongoing.
  - 2008: 25% complete
  - 2009: 100% complete

COCA-COLA CONTRIBUTION: 95%*

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in sediment erosion/runoff
1. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al., 2005) was used to estimate the original sediment erosion and washoff for the farm plots prior to implementation of the pilot projects. Supporting estimates of water runoff volume were based on the Curve Number method (USDA-NRCS, 1986), and daily maximum hourly rainfall intensities were estimated for years 2006-08 based on local meteorological data. Daily precipitation and air temperature data were obtained for the Khan Kaen, Thailand meteorological station for the 2006-08 period from TuTiempo.net (http://www.tutiempo.net/en/Climate/Khon_Kaen/483810.htm). Data for this time period are generally representative of the long-term annual average meteorological conditions for the region. The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

To date, strip cropping practices have been implemented for 20 rice paddy plots (16 ha), 19 Cassava plots (8.3 ha), and 6 sugar cane plots (8.5 ha) for a total crop land area of 32.8 ha. The Runoff Curve Numbers (CN) and the Cover/Management Factors (Cusle) used in the MUSLE was estimated for these farm plots as follows based on Haith et al. (1992):

- **Curve Number:**
  - **Rice paddies**: CN = 73 (small grains, “good condition”, hydr. soil group “B”)
  - **Sugar cane / Cassava**: CN = 75 (contoured row crop, “good condition”, hydr. soil group “B”)

- **Cover/Management Factor (Cusle):**
  - **Rice paddies**: Cusle = 0.40
  - **Sugar cane / Cassava**: Cusle = 0.10

Total annual sediment yields for the pre-project (i.e., no practices) and post-project (strip cropping practice) crop land areas were estimated as shown below. The post-project estimate is based on an assumed 70% reduction in soil erosion/runoff based on implementation of strip cropping practices (Table B-13 in Haith et al., 1992):

- **Pre-project (no practices)**: 4,080 MT/yr (124 MT/ha/yr on average)
- **Post-project (strip cropping)**: 1,224 MT/yr (37 MT/ha/yr on average)

The total benefit (reduced sediment yield) is: **2,856 MT/yr** and TCCC’s benefit (adjusted for cost share) is **2,713 MT/yr**.

The 2011 benefit is: **2,856 MT/yr** and TCCC’s benefit (adjusted for cost share) is **2,713 MT/yr**.

Projected Water Quality Benefits

The table that follows shows the projected water quality benefits (i.e., sediment yield reduction) that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Projected Water Quality Benefits Summary (Sediment)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (MT/yr)</th>
<th>Adjusted for TCCC Cost Share (MT/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>2,856</td>
<td>2,713</td>
</tr>
<tr>
<td>2013</td>
<td>2,856</td>
<td>2,713</td>
</tr>
<tr>
<td>2014</td>
<td>2,856</td>
<td>2,713</td>
</tr>
<tr>
<td>2015</td>
<td>2,856</td>
<td>2,713</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>2,856</td>
<td>2,713</td>
</tr>
</tbody>
</table>

Data Sources:
- Total area of farm land where strip cropping is being tested (32.8 ha) – provided by contact.
- Slope: variable (2% for rice paddies, 5-15% for Cassava and sugar cane plots) – provided by contact.
- Soil type:
  - Sand/clay mixture (provided by contact)
  - Available water content” of ~8 mm per meter of soil depth (Batjes, 1996) – consistent with hydrologic soil group “B” characteristics.
- Daily precipitation data for years 2006-09 were obtained for Khan Kaen, Thailand from TuTiempo.net (http://www.tutiempo.net/en/Climate/Khon_Kaen/483810.htm).

Assumptions:
- Precipitation data obtained for years 2006-08 (mean: 1,534 mm) are generally representative of average annual precipitation conditions for the areas where pilot testing is occurring.
- SWAT model parameter “CNCOEF” was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).
- Selected values for the Cover/Management Factor (Cusle) were assumed to be representative of field conditions. In addition, these factors were assumed to remain constant through time (both seasonally and across years).
- The soil erodibility factor (K) was assumed to be 0.24 for use in MUSLE equation.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
- Potential reduction in nutrient loadings to soils and to receiving waters resulting from the use of organic fertilizers in place of traditional fertilizers.
- Reduction in pesticide loadings to receiving waters (note that pesticide loading data are required to support this estimate).
- Possible water quantity and/or quality benefits associated with wetland conservation (more information needed on this activity).
- Habitat improvements benefiting aquatic and terrestrial wildlife.
NOTES

• This fact sheet updates a 2010 fact sheet by including updated costs.

REFERENCES


PROJECT NAME: Reconnecting the Lifeline
PROJECT ID #: 31

DESCRIPTION OF ACTIVITY: Wetland restoration

LOCATION: Podunavlje fish ponds in Kopacki Rit Nature Park
Mura-Drava Danube Area, near the village of Kopacevo in the Baranja region of Croatia
(covers area from N 45° 32’ to 45° 47’ and E 18° 45’ to 18° 59’)

PRIMARY CONTACTS:
Duska Dimovic, Serbia Programme Manager
WWF Danube-Carpathian Programme
Palmotičeva 17, 11000 Belgrade, Serbia
Tel: +381 11 3349479, Mob:+381 63 381 490
Skype: d.dimovic
ddimovic@wwfdcp.org

Rudi Sueys
Coca-Cola Europe
rusueys@coca-cola.com

OBJECTIVES
• Restore open water ponds to increase habitat and biodiversity

BACKGROUND & DESCRIPTION OF ACTIVITY: Kopacki Rit Nature Park is a Ramsar Site, an Important Bird Area, and part of the newly designated UNESCO Transboundary Biosphere Reserve “Mura-Drava-Danube.” The park is part of an extensive floodplain area of global significance, where fluctuating water levels create a mosaic of habitats (floodplain forests, open water ponds, river islands, sand banks and oxbows) that support high biodiversity. The region’s waterways provide refuge for fish spawning and support numerous species of rare and threatened waterfowl and other birds and plant species. The park is home to the highest density of breeding pairs of rare white-tailed eagles in Europe (WWF, 2012a).

When the Podunavlje fish ponds were abandoned in approximately 2005, they dried out and became overgrown with woody vegetation, leading to loss of ecological functions and values. A gradual lowering of the groundwater table in the region due to regulations and dredging of the Danube River for navigation has compounded the problem. The fish pond restoration project involves removal of vegetation to allow flood waters and precipitation to fill the ponds once again and restore open water habitat. The main vegetation removed was White and Purple willow (“Salix alba and S. purpurea”) stands that developed in the pond areas in island-like formations.

The ponds are used for commercial fish production, a use that has been demonstrated to be compatible with other ecosystem uses. The project brings economic benefits to the region through jobs (e.g., tree removal, fish production) and ecotourism.

Figure 1 shows an educational sign that was recently installed along new trails built in the project area.

Figure 1. Trails and observation towers provide access for visitors and signs demonstrate the benefits of wetland habitat and restoration
Figure 2 depicts an aerial photo of the ponds showing key features.

Figure 2. The three fishponds (A, B and C) are partly divided by small dykes, so the subdivisions are named A1, A2, etc. Highlighted in red are the areas where woody vegetation has been removed through the project.

Removal of vegetation allows water from flood waters and precipitation to fill the ponds (Figure 3). Pumps have been installed for pumping water out during fish harvest and to provide supplemental water when needed.

Biological monitoring has indicated that the project is already demonstrating success. Numerous water birds including breeding pairs of Greylag Geese, ducks, eagles, cormorants and wading birds such as black-winged stilts have been observed using the ponds (WWF, 2012b). Prior to restoration, 90 species were observed, and after restoration a total of 116 bird species were observed (an increase of 28%).

Figure 3. Open water in ponds after restoration
SUMMARY OF REPLENISH BENEFIT:
- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 8,550 ML/YR

ACTIVITY TIMELINE:
- 2010: Stakeholder alignment and analyses conducted
- Early 2011: Documents signed, restoration initiated
- October and November 2011: 105,589 m² (10.55 ha) of shrubby and wooded vegetation were removed in ponds A2, B1, C1 and C2.
- January through June 2012: 424,431 m² (42.44 ha) of vegetation was removed and by June 2012, vegetation was removed from all ponds except pond A1.
- June 2012: Filling of ponds in B area began and about 897,000 m³ water filled the ponds
- By November 2012: 2 ha of vegetation removed and 320 hectares of pond area were fully restored.
- January 2013: All vegetation removal in pond A1 was completed
- 2013 and beyond: Commercial fish production was initiated

COCA-COLA CONTRIBUTION: 100%
- $137,000 USD provided by Coca-Cola Foundation

WATERSHED BENEFITS CALCULATED:
1. Increase in storage volume

1. INCREASE IN STORAGE VOLUME

Approach and Results
The replenish benefit was calculated as the average annual storage volume restored in the fish ponds due to restoration measures. Water storage is a function of the volume of water from precipitation and flood water that can be stored in the ponds after vegetation has been removed. The ponds were dry prior to restoration.

This method was selected for simplification purposes and is considered to be a conservative approach. More complex methods to estimate storage volume exist (accounting for retention time and volumes of inflow and outflow), but the required data inputs are not available.

The depth of the ponds is variable across the surface and throughout the year and they periodically dry out. However, WWF has stated that the ponds fill with water every year and sustain commercial fish production. WWF estimates conservatively that the average annual depth across all the ponds and across all seasons is 1.5 meters. Using this depth, the volume of water storage over 570 ha of the fishpond’s surface area translates to a total water quantity benefit of 8,550 ML/yr.

The total (ultimate) benefit: 8,550 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 8,550 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.
2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is based on 570 ha of pond area restored by January 2013 and is estimated to be 8,550 ML/yr and TCCC’s benefit (adjusted for cost share) is 8,550 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>8,550</td>
<td>8,550</td>
</tr>
<tr>
<td>2015</td>
<td>8,550</td>
<td>8,550</td>
</tr>
<tr>
<td>2016</td>
<td>8,550</td>
<td>8,550</td>
</tr>
<tr>
<td>2017</td>
<td>8,550</td>
<td>8,550</td>
</tr>
<tr>
<td>2018</td>
<td>8,550</td>
<td>8,550</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>8,550</td>
<td>8,550</td>
</tr>
</tbody>
</table>

Data Sources

- Area flooded by January 2013: 570 ha (WWF, 2012b) and confirmed by Duska Dimovik on November 10, 2103.

Assumptions

- An average pond depth of 1.5 meter in the floodplain was conservatively assumed based on observations provided by the project contact. The ponds are deeper around the edges (up to 2.5 m) in the areas that serve as fish harvest ditches, and 1.0 to 1.5 m deep in the center.

OTHER BENEFITS NOT QUANTIFIED

- Habitat for migrating birds, spawning fish and other high-value flora and fauna
- Benefits to local economy when ponds are used as commercial fish ponds
- Recreational benefits (e.g., bird watching) and ecotourism
- Increased incomes due to jobs (e.g., tree removal) and ecotourism
- Flood protection benefits

NOTES

- This fact sheet updates a 2012 fact sheet to account for an additional 250 hectares of ponds that has been restored, for a total of 570 ha.
REFERENCES
PROJECT NAME: Reconnecting the Lifeline
PROJECT ID #: 31

DESCRIPTION OF ACTIVITY: Wetland restoration (11 ha)

LOCATION: Strbac Area of the Special Nature Reserve (SNR) Gornje Podunavlje
Mura-Drava Danube Area, near the village of Backi Monostor in Serbia

PRIMARY CONTACTS:
Duska Dimovic, Serbia Programme Manager
WWF Danube-Carpathian Programme
Palmotičeva 17, 11000 Belgrade, Serbia
Tel: +381 11 3349479, Mob:+381 63 381 490
Skype: d.dimovic
ddimovic@wwfdcp.org

Rudi Sueys
Coca-Cola Europe
rusueys@coca-cola.com

OBJECTIVES
- Restore open water ponds to increase habitat and biodiversity

BACKGROUND & DESCRIPTION OF ACTIVITY:
Gornje Podunavlje is 200 km² in size and part of an extensive floodplain area located in the Mura-Drava-Danube Vojvodina Province of Serbia. The reserve contains high valuable habitats including natural willow, poplar and oak forests, wet meadows and oxbows and swamps (WWF, undated). Gornje Podunavlje is designated as a Special Nature Reserve, Ramsar Site, Important Plant Area, Prime Butterfly Area, Emerald site and Important Bird Area.

Despite its protected status, numerous factors including drainage, irrigation and forestry have adversely impacted ecosystems in the reserve. The Strbac restoration project is part of a larger initiative focused on reestablishment of a mosaic of wet meadows and shallow ponds throughout the landscape. The ponds have dried out and filled in with woody vegetation, leading to loss of ecological functions and values.

The project area is shown in Figure 1. To date, shrubby and woody vegetation has been removed from 5 hectares of wet meadow and shallow pond. The main vegetation removed was Purple willow (*Salix purpurea*) and Goat willow (*Salix caprea*). Restoration was implemented by the Public Enterprise Vojvodinašume, the managing authority of Gornje Podunavlje SNR.

This project has piloted a new technology in removing shrubby and woody vegetation. Tested in other wetlands in Europe, this methodology has been applied for the first time in Serbia. The project team has undertaken comprehensive consultations with the project partners in finding the most effective way to remove vegetation. This has taken some time but the result is that the new technology has proven effective with a number of

Figure 1. Three wet meadows/ponds of project area
trained experts capable of applying it in the future.

Since the restoration of open water habitat (Figure 2), the number of migrating waterbirds has increased from a maximum of 100 (before restoration) to 890 (recorded in April 2012). Among these, Wigeon, Shoveler, Ferruginous Duck, Pochard were dominantly represented. Starting in April 2012, the pond has been frequently visited by breeding herons and it was most likely one of few key feeding sites for herons from a nearby colony including Night Herons, Little Egret, Squaco Heron and Grey Heron. The newly open water has remained free of the vegetation in 2012 and the pond is expected to attract more key indicator species in Autumn/Winter 2012.

Figure 2. Aerial photo showing partially restored area in summer 2011

SUMMARY OF REPLENISH BENEFIT:
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 104.5 ML/YR

ACTIVITY TIMELINE:
- Spring 2011: Project initiation
- Spring 2012: Project completion (11 ha restored)

COCA-COLA CONTRIBUTION: 95%
- $153,000 USD provided by Coca-Cola Foundation
- $8,000 USD provided by Provincial Secretariat of Urbanisam, Construction and Environmental Protection
WATERSHED BENEFITS CALCULATED:

1. Increase in storage volume

1. INCREASE IN STORAGE VOLUME

Approach and Results

The replenish benefit was calculated as the average annual storage volume restored in the pond due to restoration measures. Water storage is a function of the volume of water from precipitation and groundwater that can be stored in the pond after vegetation has been removed. The area was dry prior to restoration.

The depth of the ponds is variable across the surface and throughout the year, and an average and conservative depth of 1 meter was used to calculate storage volume. The volume of water storage over 11 ha of the ponds’ surface area translates to a total water quantity benefit of 110 ML/yr.

The total (ultimate) benefit: 110 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 104.5 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is based on 11 ha of pond area restored by October 2012 and is estimated to be 110 ML/yr and TCCC’s benefit (adjusted for cost share) is 104.5 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>110</td>
<td>104.5</td>
</tr>
<tr>
<td>2014</td>
<td>110</td>
<td>104.5</td>
</tr>
<tr>
<td>2015</td>
<td>110</td>
<td>104.5</td>
</tr>
<tr>
<td>2016</td>
<td>110</td>
<td>104.5</td>
</tr>
<tr>
<td>2017</td>
<td>110</td>
<td>104.5</td>
</tr>
</tbody>
</table>

Ultimate Benefit: 110 104.5

Data Sources

- Size of restored area: 11 ha (WWF, 2012)
Assumptions

• An average pond depth of 1 meter in the floodplain was conservatively assumed based on WWF’s observations (WWF, 2012)

OTHER BENEFITS NOT QUANTIFIED

• Habitat for migrating birds, spawning fish and other high-value flora and fauna
• Recreational benefits (e.g., bird watching)
• Increased incomes due to jobs (e.g., tree removal) and ecotourism
• Flood protection benefits

NOTES

• None

REFERENCES

WWF, Undated. WWF Fact Sheet: Gornje Podunavlje Special Nature Reserve.

**PROJECT NAME:** Environment Conservation & Watershed Management  
**PROJECT ID #:** 33

**DESCRIPTION OF ACTIVITY:** Afforestation, forest conservation, treatment of eroding streams, improved agricultural lands

**LOCATION:** Western Himalayan Ecoregion, Pakistan  
1) Namli Mera Khurd subcatchment of Nala Mandri along Ayubia National Park (34° 25’ 40” N, 73° 23’ 52” E); 2) Namli Kundla (34° 02’ 14” N, 73° 23’ 08” E); 3) Saiful Malook Lake (34° 52’ N, 73° 41’ E).

**PRIMARY CONTACT:**  
Fahad Qadir  
Public Affairs & Communications Manager (Pakistan & Afghanistan)  
The Coca-Cola Export Corporation – Pakistan Branch  
Lahore, Pakistan  
fqadir@apac.ko.com

**OBJECTIVES**  
- Reduce runoff and associated sedimentation  
- Increase groundwater recharge  
- Protect drinking water supply  
- Improve habitat/increase biodiversity

**BACKGROUND & DESCRIPTION OF ACTIVITY:**

Ayubia National Park (ANP) covers an area of approximately 3,312 ha and is located within the Western Himalayan global ecoregion. The Western Himalayas is also the catchment area for 70-80% of water from the melting of snow and glaciers to the Indus Delta. Its significance in watershed management is critical; deforestation in the area will have far reaching consequences that will have negative impact in the Indus and Ganges deltas. [http://www.wwfpak.org/wwf-projects/ayubia_national_park.php](http://www.wwfpak.org/wwf-projects/ayubia_national_park.php).

World Wide Fund for Nature-Pakistan (WWF-P) is working on subwatershed management, community development and awareness raising and capacity building involving communities that are dependent on the natural resources in and around the Ayubia National Park (TCCC, 2009). In support of this overall effort, WWF-P launched a “Sub-Watershed Management and Environmental Awareness Project in and around Ayubia National Park, North-West Frontier Province (NWFP)” with the financial collaboration of the Coca-Cola Foundation. The project aims to improve and sustain the perennial flow of clean water in springs and streams of the area through an integrated watershed management approach. Moreover, it supports the key stakeholders in the waste management and cleaning of the Saif-ul-Malook National Park ([http://www.wwfpak.org/101109_watershed_management.php](http://www.wwfpak.org/101109_watershed_management.php)). There are several activities underway in Namli Mera Khurd and Kundla that are working toward achievement of the project goals. These sites are situated on the Northwestern edge of Ayubia National Park in the North-West Frontier Province (NWFP) of Pakistan (LTI, 2009).

Within Namli Mera Khurd, several projects are underway to stabilize eroding slopes through revegetation, bioengineering and biological techniques, including revegetating 16 hectares of a previously bare hill slope with grass cover (see before and after photos below). Other activities include...
protection of 50 hectares of degraded forest through watch and ward, fencing and community vigilance, and 0.74 hectares of agricultural land treated under different interventions (i.e., orchards, improved vegetables, cut flowers, etc.). Instream check dams have also been installed to reduce sedimentation.

**ACTIVITY TIMELINE:**
- **Start Date:** November 2008
- **End Date:** June 2010
WATERSHED RESTORATION BENEFITS CALCULATED:

1. Increase in groundwater recharge

1. INCREASE IN GROUNDWATER RECHARGE

Approach & Results

The quantification approach is outlined in a WWF-P report (Khan, et al., 2010) and summarized below.

Surface flow (runoff) was calculated using the Rational Formula (FAO 2010) as follows:

\[ \text{[Yearly total runoff (mm)]} = [K] \times \text{[Yearly total rainfall (ppt) (mm)]} \]

where: \( K \) = runoff coefficient (a function of vegetation condition, land surface slope, and soil type)

Pre and post-project values for \( K \) were calculated based on survey data and FAO’s drainage basin factor table (1988).

The increased recharge was calculated as the increase in water absorbed by the soil as a result of the project. The water absorbed by the soil was calculated by subtracting the total runoff and evapotranspiration losses from total annual precipitation as follows:

\[ \text{[Total annual ppt per unit area]} - \text{[total runoff per unit area]} - \text{[ET losses (10% of total annual ppt)]} \]

Precipitation (ppt) data from the Murree station were used in the analysis. The assumption that evapotranspiration (ET) losses are equal to 10% of total annual precipitation is based on studies by Haigh (1990) which indicated that in the moist temperate zone of the Himalayas, ET losses range from 7 to 10% of the total rainfall. The estimated increased recharge by land use type is shown in the table below.

<table>
<thead>
<tr>
<th>Land Use Type</th>
<th>Net Change in Water Recharge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cubic meter</td>
</tr>
<tr>
<td>Sparse forest</td>
<td>38,578</td>
</tr>
<tr>
<td>Grassland</td>
<td>11,430</td>
</tr>
<tr>
<td>Agricultural land</td>
<td>2,411</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>52,419</strong></td>
</tr>
</tbody>
</table>

The total benefit (increased groundwater recharge) is **52.42 ML/yr**

Data Sources

- Daily precipitation data were obtained for Murree, Pakistan from website of World Weather Information Service.
- Vegetation and land characteristics based on WWF-P survey data.
OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED

- Water quality benefits will be calculated after additional data are collected.
- Habitat improvements benefiting terrestrial wildlife

NOTES

- This fact sheet updates the January 2010 fact sheet to account for reported activities in 2010 and the analysis in the WWF-P report.

REFERENCES

**PROJECT NAME:** México Restoration and Reforestation Program  
**PROJECT ID #:** 38

**DESCRIPTION OF ACTIVITY:** Reforestation of 54,432 hectares of deforested land in México

**LOCATION:** 31 States in México (various locations, including Coahuila, Durango, Hidalgo, Tlaxcala, and Veracruz, etc.)

**PRIMARY CONTACT:**  
Oscar Martinez  
Coca-Cola de México  
52-55-5262-2663  
osmartinez@coca-cola.com

**OBJECTIVES:**  
- Reduce runoff / increase infiltration  
- Reduce sediment erosion/runoff  
- Restore forest habitat

**BACKGROUND & ACTIVITY DESCRIPTION:** Coca-Cola, the Comision Nacional Forestal (CONAFOR), Pronatura México, A.C., and Natural Protected Areas National Commission (CONANP) have reforested approximately 54,400 hectares of lands across México to sustain water supplies and priority ecosystems. More than 60 million trees have been planted in deforested lands to mitigate climate effects, restore habitat and biodiversity, rehabilitate aquifers and watersheds, and promote economic and community growth (Figures 1 and 2).

![Figure 1. Before (left) and after (right) photos showing reforestation in Veracruz](image-url)
SUMMARY OF REPLENISH ACTIVITY

- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 10,301 ML/yr

ACTIVITY TIMELINE:

A total of 54,432 hectares have been reforested between 2008 and 2013, representing 118% more area than the original planned reforestation area of 25,000 hectares. Table 1 summarizes the reforestation areas by year for the project.

Table 1. Reforestation Schedule

<table>
<thead>
<tr>
<th>Phase</th>
<th>Year</th>
<th>Area Reforested (ha)</th>
<th>% of Total Reforestation Area (54,432 ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>2008</td>
<td>1,688(^1)</td>
<td>3.1%</td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>7,697</td>
<td>14.1%</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>10,890</td>
<td>20.0%</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>12,408</td>
<td>22.8%</td>
</tr>
<tr>
<td>II</td>
<td>2012</td>
<td>15,287</td>
<td>28.1%</td>
</tr>
<tr>
<td>III</td>
<td>2013</td>
<td>6,462</td>
<td>11.9%</td>
</tr>
<tr>
<td></td>
<td>Totals:</td>
<td>54,432</td>
<td>100%</td>
</tr>
</tbody>
</table>

\(^1\) Includes 250 ha of area where “infiltration ditches” were constructed. This 250-ha area is treated as a separate activity and was not included in the water quantity reforestation calculations here to avoid double-counting of quantity benefits.

COCA-COLA CONTRIBUTION (2008-2013): varies by phase, as outlined below:

- **Phase I (2008-11):** 63.48%
  - Total cost: $11,106,703 USD
  - TCCC cost contribution: $7,050,000 USD
- **Phase II (2012):** 26.40%
  - Total cost: $6,438,996 USD
  - TCCC cost contribution: $1,700,000 USD
- **Phase III (2013):** 11.74%
  - Total cost: $7,434,508 USD
  - TCCC cost contribution: $873,077 USD
Coca-Cola’s cost contribution for this activity has been calculated based on the total Coca-Cola funding contributions and the total combined funding provided by all of the project partners for each of the three phases of the reforestation program. The funding sources associated with the individual phases of the reforestation project are provided in Tables 2, 3, and 4 below.

Table 2. Project Funding for Phase I (2008-2011 reforestation + maintenance (in 2013))

<table>
<thead>
<tr>
<th>Partner</th>
<th>Funding Contribution (USD)</th>
<th>% Contribution for Phase I</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONAFOR (including in-kind)</td>
<td>3,846,560.60</td>
<td>34.63%</td>
</tr>
<tr>
<td>CONANP</td>
<td>123,016.00</td>
<td>1.11%</td>
</tr>
<tr>
<td>SEDESOL</td>
<td>43,150.00</td>
<td>0.39%</td>
</tr>
<tr>
<td>INDESOL</td>
<td>30,570.00</td>
<td>0.28%</td>
</tr>
<tr>
<td>Disney</td>
<td>13,406.00</td>
<td>0.12%</td>
</tr>
<tr>
<td>Coca-Cola de México</td>
<td>7,050,000.00</td>
<td>63.48%</td>
</tr>
<tr>
<td>Total</td>
<td>11,106,702.60</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Table 3. Project Funding for Phase II (2012 reforestation)

<table>
<thead>
<tr>
<th>Partner</th>
<th>Funding Contribution (USD)</th>
<th>% Contribution for Phase II</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONAFOR (including in-kind)</td>
<td>4,738,996.00</td>
<td>73.60%</td>
</tr>
<tr>
<td>Coca-Cola de México</td>
<td>1,700,000.00</td>
<td>26.40%</td>
</tr>
<tr>
<td>Total</td>
<td>6,438,996.00</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Table 4. Project Funding for Phase III (2013 reforestation)

<table>
<thead>
<tr>
<th>Partner</th>
<th>Funding Contribution (USD)</th>
<th>% Contribution for Phase III</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONAFOR (including in-kind)</td>
<td>6,349,653.40</td>
<td>85.41%</td>
</tr>
<tr>
<td>INDESOL</td>
<td>11,778.00</td>
<td>0.16%</td>
</tr>
<tr>
<td>Coca-Cola de México</td>
<td>850,000.00</td>
<td>11.43%</td>
</tr>
<tr>
<td>Coca-Cola FEMSA</td>
<td>23,077.00</td>
<td>0.31%</td>
</tr>
<tr>
<td>Municipalities (in-kind)</td>
<td>200,000.00</td>
<td>2.69%</td>
</tr>
<tr>
<td>Total</td>
<td>7,434,508.40</td>
<td>100.00%</td>
</tr>
</tbody>
</table>
WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff for the conversion of unforested land to forested land. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **Pre-project:**
  - Hydrologic soil group (HSG) “B”
  - Herbaceous – grass/weeds/brush mixture in “fair” to “good” condition (CN = 67)
- **Post-project:**
  - Hydrologic soil group (HSG) “B”
  - Woodland in “good” condition (CN = 55)

Daily precipitation and air temperature data were obtained from the TuTiempo.net online meteorological database for various locations during the 2000-2008 time period. The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963). A concerted effort was made to ensure that the precipitation data used for each reforestation location were representative of long-term annual average climate patterns for the region.

Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases based on the areas reforested during 2008-2013. Total annual runoff volumes and the resulting water quantity benefit were estimated as follows for work completed to date:

- **Pre-project (open space):** 99,006 ML/yr
- **Post-project (reforested land):** 77,225 ML/yr
- **Benefit (runoff reduction):** 21,781 ML/yr
The total (ultimate) benefit is calculated as the sum of benefits for all areas reforested to date. The total benefits by individual phase of the project are as follows:

- **Phase I**: 13,259 ML/yr
- **Phase II**: 6,025 ML/yr
- **Phase III**: 2,497 ML/yr

The total (ultimate) benefit is: 21,781 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 10,301 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

### 2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of calendar year 2013. The total 2013 benefit is 21,781 ML/yr, and TCCC’s benefit (adjusted for cost share) is 10,301 ML/yr.

### Projected Replenish Benefits

Table 5 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

#### Table 5. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>21,781</td>
<td>10,301</td>
</tr>
<tr>
<td>2015</td>
<td>21,781</td>
<td>10,301</td>
</tr>
<tr>
<td>2016</td>
<td>21,781</td>
<td>10,301</td>
</tr>
<tr>
<td>2017</td>
<td>21,781</td>
<td>10,301</td>
</tr>
<tr>
<td>2018</td>
<td>21,781</td>
<td>10,301</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>21,781</td>
<td>10,301</td>
</tr>
</tbody>
</table>

**Data Sources:**

- **Size of reforested land area**: 54,432 ha (provided by contact)
- **Slope**: highly variable and site-dependent (0-40%) (provided by contact)
- **Soil type**: highly variable, but generally characterized by “available water content” (AWC) of 7 to 8 mm per meter of soil depth (Batjes, 1996).
- Daily precipitation and air temperature data were obtained from the online “TuTiempo.net” meteorological database ([http://www.tutiempo.net/en/](http://www.tutiempo.net/en/)) for representative locations throughout México, including Jalapa, Cuernavaca, Chihuahua, Queretaro, Puebla, and Saltillo (Table 6).
- A table summarizing the reforestation surface area by México State for 2008-2013 is provided in Table 7.
Table 6. Meteorological Stations for Water Runoff Analysis

<table>
<thead>
<tr>
<th>Station Location</th>
<th>Station ID</th>
<th>Selected Years¹</th>
<th>Average Rainfall for Selected Years (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jalapa</td>
<td>766870</td>
<td>2000-02</td>
<td>1,402</td>
</tr>
<tr>
<td>Cuernavaca</td>
<td>767260</td>
<td>2003-08</td>
<td>1,018</td>
</tr>
<tr>
<td>Chihuahua</td>
<td>762250</td>
<td>2000, 2006-08</td>
<td>335</td>
</tr>
<tr>
<td>Queretaro</td>
<td>766250</td>
<td>2003-04, 2007</td>
<td>601</td>
</tr>
<tr>
<td>Puebla</td>
<td>766850</td>
<td>2000-01, 2004-05</td>
<td>718</td>
</tr>
<tr>
<td>Puebla (high)</td>
<td>766850</td>
<td>2000, 2004 only</td>
<td>897</td>
</tr>
<tr>
<td>Saltillo</td>
<td>763900</td>
<td>2007-10</td>
<td>437</td>
</tr>
<tr>
<td>Sonora²</td>
<td>762250</td>
<td>2000, 2006-08</td>
<td>180</td>
</tr>
</tbody>
</table>

¹Years selected based on recent data availability, completeness, and representativeness.
²The long-term annual precipitation at Sonora reforestation locations is 180 mm. The meteorological station with the next lowest rainfall, Chihuahua, was selected as representative of Sonora. The daily precipitation values for Chihuahua were proportionally scaled by a factor of 0.537 (180/335) to obtain daily values for Sonora.

Table 7. Summary of Reforestation Locations for 2008-2013

<table>
<thead>
<tr>
<th>Location</th>
<th>Area Fraction¹</th>
<th>Assigned Met. Station</th>
<th>Assumed Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aguascalientes</td>
<td>0.3%</td>
<td>Saltillo</td>
<td>10%</td>
</tr>
<tr>
<td>Baja California Sur</td>
<td>1.8%</td>
<td>Chihuahua</td>
<td>8%</td>
</tr>
<tr>
<td>Campeche</td>
<td>0.4%</td>
<td>Jalapa</td>
<td>20%</td>
</tr>
<tr>
<td>Chiapas</td>
<td>0.1%</td>
<td>Cuernavaca</td>
<td>15%</td>
</tr>
<tr>
<td>Chihuahua</td>
<td>4.0%</td>
<td>Chihuahua</td>
<td>8%</td>
</tr>
<tr>
<td>Coahuila</td>
<td>3.4%</td>
<td>Saltillo</td>
<td>10%</td>
</tr>
<tr>
<td>Colima</td>
<td>1.2%</td>
<td>Puebla (high)</td>
<td>10%</td>
</tr>
<tr>
<td>Distrito Federal</td>
<td>0.2%</td>
<td>Puebla</td>
<td>10%</td>
</tr>
<tr>
<td>Durango</td>
<td>7.6%</td>
<td>Saltillo</td>
<td>10%</td>
</tr>
<tr>
<td>Estado de México</td>
<td>7.1%</td>
<td>Puebla</td>
<td>10%</td>
</tr>
<tr>
<td>Guanajuato</td>
<td>9.4%</td>
<td>Queretaro</td>
<td>10%</td>
</tr>
<tr>
<td>Guerrero</td>
<td>2.5%</td>
<td>Puebla (high)</td>
<td>10%</td>
</tr>
<tr>
<td>Hidalgo</td>
<td>3.3%</td>
<td>Puebla</td>
<td>10%</td>
</tr>
<tr>
<td>Jalisco</td>
<td>3.8%</td>
<td>Cuernavaca</td>
<td>15%</td>
</tr>
<tr>
<td>Michoacán</td>
<td>13.3%</td>
<td>Puebla (high)</td>
<td>10%</td>
</tr>
<tr>
<td>Morelos</td>
<td>1.0%</td>
<td>Puebla</td>
<td>15%</td>
</tr>
<tr>
<td>Nayarit</td>
<td>0.6%</td>
<td>Puebla (high)</td>
<td>10%</td>
</tr>
<tr>
<td>Nuevo Leon</td>
<td>3.8%</td>
<td>Saltillo</td>
<td>10%</td>
</tr>
<tr>
<td>Oaxaca</td>
<td>0.3%</td>
<td>Cuernavaca</td>
<td>15%</td>
</tr>
<tr>
<td>Puebla</td>
<td>8.7%</td>
<td>Puebla</td>
<td>15%</td>
</tr>
<tr>
<td>Queretaro</td>
<td>1.9%</td>
<td>Queretaro</td>
<td>10%</td>
</tr>
<tr>
<td>Quitana Roo</td>
<td>0.8%</td>
<td>Cuernavaca</td>
<td>15%</td>
</tr>
<tr>
<td>San Luis Potosí</td>
<td>6.2%</td>
<td>Saltillo</td>
<td>10%</td>
</tr>
<tr>
<td>Sinaloa</td>
<td>0.6%</td>
<td>Saltillo</td>
<td>10%</td>
</tr>
<tr>
<td>Sonora</td>
<td>0.3%</td>
<td>Sonora</td>
<td>8%</td>
</tr>
<tr>
<td>Tabasco</td>
<td>0.1%</td>
<td>Cuernavaca</td>
<td>15%</td>
</tr>
<tr>
<td>Location</td>
<td>Area Fraction</td>
<td>Assigned Met. Station</td>
<td>Assumed Slope</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>-----------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Tamaulipas</td>
<td>1.5%</td>
<td>Querétaro</td>
<td>10%</td>
</tr>
<tr>
<td>Tlaxcala</td>
<td>3.8%</td>
<td>Puebla</td>
<td>15%</td>
</tr>
<tr>
<td>Veracruz</td>
<td>9.5%</td>
<td>Jalapa</td>
<td>20%</td>
</tr>
<tr>
<td>Yucatán</td>
<td>2.4%</td>
<td>Jalapa</td>
<td>20%</td>
</tr>
<tr>
<td>Zacatecas</td>
<td>0.6%</td>
<td>Chihuahua</td>
<td>8%</td>
</tr>
</tbody>
</table>

\[1\] Based on “LAND AREAS and TREES REFORESTED FROM 2008 TO 2012.docx” document and the “Poligonos Nacional 2012.shp” and “CONCENTRADO FINAL OK.shp” (for 2013) shapefiles provided by Pronatura.

Assumptions:

- The distribution of reforested land among the various states in México (shown in Table 7) was based on the “LAND AREAS and TREES REFORESTED FROM 2008 TO 2012.docx” document (provided by Pronatura in early December, 2012), the “Poligonos Nacional 2012.shp” shapefile (provided by Pronatura in early December, 2012), and the “CONCENTRADO FINAL OK.shp” shapefile (provided by Pronatura in late November, 2013).

- Precipitation patterns for meteorological stations are representative of conditions for reforested areas. In reality, we expect that the precipitation data are biased low and the air temperature data are biased high relative to actual conditions at reforestation sites occurring on mountain slopes at higher elevations. Therefore, it is reasonable to expect that the current estimates are somewhat conservative relative to actual runoff reduction benefits for the reforested areas. Collection of daily precipitation data for specific reforestation locations would allow for a refined estimate of runoff reduction.

- The pre-project land cover can be appropriately characterized by herbaceous (grass/weeds/brush) with approximately 30-80% vegetative cover. (Note that this provides a conservative estimate of Curve Number for areas that have been utilized as crop land prior to reforestation.)

- Land slopes were conservatively assumed to be 10% unless otherwise determined based on available latitude/longitude locations and global slope datasets. Slope estimates (e.g., 10%) are likely conservative relative to actual slope conditions for some sites; specific latitude/longitude coordinates for all reforestation locations and a fine-scale digital elevation model (DEM) would be required to refine slope estimates.

- The SWAT model parameter “CNCOEF” is used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates. This parameter was set to 0.5 for all sites with the exception of those based on the Chihuahua or Saltillo meteorological stations (CNCOEF was to 2.0 for these locations).

- According to the contact, the survival rate for trees planted through 2011 was roughly 40%. Approximately 1200 trees per hectare are planted, and about 400 to 500 trees are expected to grow to maturity and the intended tree cover at each site will still be reached. A maintenance program has recently been started by CONAFOR (and partially funded by Coca-Cola de México) to ensure that reforestation areas achieve tree density and maturation objectives. The total cost and TCCC contribution for the maintenance program have been included in the cost numbers presented above in the “COCA-COLA CONTRIBUTION” section.
2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting unforested land to forested land. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for year 2000.

The Cover/Management Factors ($C_{use}$) used in the MUSLE were estimated as follows based on Haith (1992):
- **Pre-project**: grass/weeds, 60-80% cover ($C_{use} = 0.02$)
- **Post-project**: woodland with 75-100% tree canopy ($C_{use} = 0.001$)

Annual sediment yields for the unforested and forested land areas were estimated as follows for work completed to date:
- **Pre-project (pasture/rangeland)**: 1,336,419 MT/yr
- **Post-project (forested)**: 56,435 MT/yr
- **Benefit (reduced sediment yield)**: 1,279,984 MT/yr

The total benefits by individual phase of the project are as follows:
- **Phase I**: 799,341 MT/yr
- **Phase II**: 324,334 MT/yr
- **Phase III**: 156,309 MT/yr

Therefore, the total water quality benefit associated with reforestation of 54,432 hectares is estimated as:

*The total benefit (reduced sediment yield) for 2008-2013 is: 1,279,984 MT/yr and TCC’s benefit (adjusted for cost share) is 611,397 MT/yr.*

*The 2013 benefit is: 1,279,984 MT/yr and TCC’s benefit (adjusted for cost share) is 611,397 MT/yr.*

Data Sources:
- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:
- The tree canopy in the reforested areas was assumed to be mature.
- The Cover/Management Factor ($C_{use}$) was assumed to remain constant through time (both seasonally and across years).
- The soil erodibility factor (K) was assumed to be 0.24 for use in MUSLE equation.
OTHER BENEFITS NOT QUANTIFIED

- Corresponding increases in infiltration and groundwater baseflow to local stream networks
- Habitat improvements benefiting terrestrial wildlife

NOTES

- Collection of daily precipitation data for specific reforestation locations would allow for a more accurate estimate of runoff reductions and sediment erosion/yield.
- Specific latitude/longitude coordinates and a fine-scale digital elevation model (DEM) could potentially be used to better estimate local slope conditions.
- Model calculations resulted in zero runoff and sediment benefits for reforestation locations at Sonora. The extreme arid conditions as reflected by low annual rainfall (180 mm) did not result in any runoff being generated in the model for either pre-project or post-project conditions. However, reforestation locations at Sonora accounted for only 0.4% of the total areas reforested during 2012.
- This fact sheet updates a February 2013 fact sheet to include new information related to expanded reforestation work and updated cost share information.
- The contact indicated the trees planted prior to 2011 have roughly a 40% survival rate; however they noted that a sufficient number of trees are planted to offset the loss. A maintenance program has been initiated by CONAFOR (and funded in part by TCCC) to help ensure that tree density and maturity objectives are achieved in the reforested areas. The project funding discussion above accounts for these maintenance activities as part of the Phase I funding.

REFERENCES


PROJECT NAME: Mexico Restoration and Reforestation Program
PROJECT ID #: 38

DESCRIPTION OF ACTIVITY: Ground restoration (infiltration trenches)

LOCATION: Amecameca, Mexico

PRIMARY CONTACT:
Oscar Martinez
Sustentabilidad Ambiental
Coco-Cola de Mexico
52-55-5262-2663
osmartinez@coco-cola.com

OBJECTIVE:
• Increase infiltration

BACKGROUND & DESCRIPTION OF ACTIVITY: This ground restoration project has involved the digging of 162,500 infiltration trenches on 250 hectares. The trenches are hand dug in deforested areas, to maintain the humidity of the ground, increase infiltration, and reduce ground erosion. The trenches are 2 feet wide and 7 feet long.

SUMMARY OF REPLENISH BENEFIT:
• 2011 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 590.2 ML/yr

ACTIVITY TIMELINE:
• Project was completed in 2008

COKE CONTRIBUTION: 47.14%
WATERSHED RESTORATION BENEFITS CALCULATED:

1. Increase in infiltration

1. INCREASE IN INFILTRATION

Approach and Results:
The total infiltration rate was calculated as the sum of direct infiltration (the quantity of water that falls directly in each trench each year) plus infiltration of runoff from untrenched areas of the 250 ha (i.e., “drain surface”).

Average annual rainfall = 800 mm/year (measured)

Direct infiltration = surface area of trenches (162,500 m²) x annual precipitation (0.8 m/yr) = 130,000 m³/yr.

Runoff/drainage surface = surface area (2,337,500 m²) x average precipitation (0.8 m/yr) x runoff capture coefficient (0.6) = 1,122,000 m³. (Runoff capture coefficient estimated based on slope and soil type.)

Total infiltration = (direct infiltration) + (drain volume) = (130,000 m³/yr) + (1,122,000 m³/yr) = 1,252,000 m³/yr = 1,252 ML/yr (for 250 ha).

Total (ultimate) benefit is: 1,252 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 590.2 ML/yr

The current (2011) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2011 Replenish Benefit
The 2011 benefit is the performance-based benefit from this activity as of the end of the calendar year 2011. The total 2011 benefit is 1,252 ML/yr and TCCC’s benefit (adjusted for cost share) is 590.2 ML/yr.

Projected Replenish Benefits
The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>1,252</td>
<td>590.2</td>
</tr>
<tr>
<td>2013</td>
<td>1,252</td>
<td>590.2</td>
</tr>
<tr>
<td>2014</td>
<td>1,252</td>
<td>590.2</td>
</tr>
<tr>
<td>2015</td>
<td>1,252</td>
<td>590.2</td>
</tr>
<tr>
<td>Ultimate Benefit</td>
<td>1,252</td>
<td>590.2</td>
</tr>
</tbody>
</table>

Data Sources:
- Project information was obtained from TCCC, 2009.
- Updated information regarding cost share and implementation schedule was obtained via e-mail communication with Oscar Martinez in 2011.

Assumptions:
- None.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
- Decreased sediment erosion/runoff.

NOTES
- This fact sheet updates a 2009 fact sheet to include updated information regarding cost-share and implementation.

REFERENCES

PROJECT NAME: Reforestation Efforts at the Monarch Butterfly Bioreserve
PROJECT ID #: 39

DESCRIPTION OF ACTIVITY: Reforestation

LOCATION: Monarch Butterfly Reserve, Michoacan, Mexico

PRIMARY CONTACT: Vivian Alegria Gallo
Directora Asuntos Comunitarios
Coca-Cola de Mexico
52-55-5262-2339 (phone)
valegria@la.ko.com

OBJECTIVES
• Rehabilitate degraded forest areas
• Protect wintering habitat for monarch butterfly

BACKGROUND & DESCRIPTION OF ACTIVITY: Project involves the production of 100,000 Oyamel trees/year for planting on 1,000 hectares of the reserve each year during a 2-year program.

ACTIVITY TIMELINE:
• Project initiation: 2007
• Current status: 2-year program was completed in 2009. Program is ongoing but no information currently available related to future production.

COKE CONTRIBUTION: 100%
• TCCC supported nursery, FEMSA supported tree plantings

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Increase in recharge rate

1. INCREASE IN RECHARGE

Approach and Results
According to an Acción Planeta fact sheet prepared for the nearby Nevado de Toluca project, it is expected that the aquifer will be replenished with 540 cubic meters per hectare as a result of a reforestation effort. The supporting technical studies for this rate were not available, but it is considered a reasonable estimate for the location.

Water Quantity Benefit:
2,000 hectares * 540 m³/ha/yr = 1,080,000 m³/yr = 1,080 ML/yr

Data sources:
• All information used in the estimate was provided in the fact sheets, and in a 4/27/09 email from V. Alegria Gallo.
**Assumptions**
- Assumed reforestation is completed in 2009.

**OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED**
- Improved biodiversity

**NOTES**
- Estimated recharge rate can be re-evaluated if technical studies are provided.
- Oyamel trees are difficult to find in Mexico, and the local government is going to buy the trees for other areas that need “oyamel.” The nursery supports the local economy.

**REFERENCES**

Accion Planeta. Fact Sheet on Monarca Butterfly project.

Accion Planeta. Fact Sheet on Nevado de Toluca project.
PROJECT NAME: Ilagan Watershed Conservation Project in Isabela
PROJECT ID #: 40
DESCRIPTION OF ACTIVITY: Implementation of improved agricultural practices: cropland/farmland management

LOCATION: Abuan River sub-watershed, City of Ilagen, Isabela Province, Philippines (17.089 N, 122.068 E)

PRIMARY CONTACT:
Edgardo Tongson
World Wildlife Fund – Philippines
etongson@wwf.org.ph

OBJECTIVES
- Increase infiltration/aquifer recharge and/or increase baseflows
- Reduce erosion and associated sedimentation of receiving waters

BACKGROUND & DESCRIPTION OF ACTIVITY:
This project will help to protect the Abuan River watershed, near the City of Ilagan, and benefit water users in the province of Isabela, Philippines including industries, irrigation farmers, water districts, recreationists/eco-tourists and future mini-hydro project(s). The goals of the project are to:
- Identify and assess threats to the watershed and facilitate stakeholder planning for the conservation and sustainable use of the watershed.
- Develop plans to rehabilitate denuded areas in this watershed of the Northern Sierra Madre through agro-forestry schemes and assisted natural regeneration.
- Develop schemes for Payments for Watershed Services involving user/buyers to provide sustainable financing for watershed activities.
- Increase awareness of local communities on the importance of protecting watersheds and conserving water resources.

The Abuan watershed is located on the western edge of the Northern Sierra Madre and is characterized by mountainous to hilly terrain. Annual rainfall in this area is 2900 mm. Of this, 67% ends up as surface runoff, 28% as evapotranspiration and only 5% goes into groundwater recharge. The 63.79 sq km watershed is still well forested with 89% forest cover. The remainder consists of lands planted to corn (4.35%), open grasslands (3.36%), and less than one percent each of kaingin (swidden or slash and burn farms), shrubs, built-up area and rice lands. Some 5,581 residents live in 5 villages, or barangays, in the lower catchment area.

Soil erosion from illegal logging is threatening the watershed, and the resulting water pollution and sedimentation are reducing the amount of water available to farmers and other users. Achievements of the program include the following:
- Characterized the watershed as to geology, soils, land use, hydrology, hydro-geology; including population, farming practices, water supplies.
- Distributed 16,000 fruiting seedlings to 29 farmer household beneficiaries covering 58 hectares.
- Completed reconnaissance, field research and tour packages for eco-tourism.
- Deployed the collection and planting of some 90,000 seedlings in designated reforestation sites.
Impact on Water Quantity
The project facilitated the planting of 16,000 seedlings on 58 hectares of farm land within a Community Based Forest Management area. This is located in sub-basin no. 1410 with an area of 1099 hectares. The present land use of the sub-basin is 60% agro-forest, 11% corn land and 29% consisting of open grass lands and or swidden farms (kaingin). Assuming 20% or 220 has of the existing grasslands and swidden farms in the sub-basin are converted to agro-forestry, and assuming a 24 hour 50-year storm return period, the hydrograph shows a reduction in peak discharge by 6 cubic meters per second and reduction in run off by 80,450 cubic meters per day. Adding vegetation cover will reduce flood risks downstream during a heavy rainfall event.

Impact to Water Quality
Soil erosion is major threat to the watershed. Topsoil removal reduces soil productivity, infiltration capacities and diminishes base flows. Siltation also reduces capacities of irrigation canals and hydropower plants and pollutes drinking water. Swidden farming is the biggest contributor to soil erosion with erosion rates ranging from 2617 tons/ha-year. This is followed by open grassland with erosion rates ranging from 20 to 97 tons/ha-year. In contrast, a well maintained forest cover has an erosion rate ranging from 1.54 to 7.49 tons/ha-year. Converting open grasslands into mango areas in the sub-basin can reduce erosion rates from 69.44 to 18.52 tons/ha-year. For 220 hectares of grasslands converted to mango tree farms, this means 11,202 tons of soil material conserved. This volume of soils holds a sizable volume of infiltrated water in the form of interflow which then contributes to base flows.
ACTIVITY TIMELINE:
- Start Date: February 2009
- End Date: February 2010

COCA-COLA CONTRIBUTION: 72.3%
- Total Cost of Project: $154,918 USD
- Coca-Cola Foundation $112,000 USD

WATERSHED RESTORATION BENEFITS CALCULATED:

1. DECREASE IN RUNOFF

Approach & Results
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff for the conversion of existing grasslands and swidden farms to agro-forestry land. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.
Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986) and Haith et al. (1992):

- **Pre-project:**
  - Hydrologic soil group (HSG) “B”
  - Grassland in “fair” condition (CN = 69)

- **Post-project:**
  - Hydrologic soil group (HSG) “B”
  - Mango orchard/tree farm in “good” condition (CN = 58)

Daily precipitation and air temperature data were obtained from the TuTiempo.net website for the Casiguran station (http://www.tutiempo.net/en/Climate/Tuguegarao/983360.htm) during the 2006-08 time period. The Hamon method was used to estimate daily potential evapotranspiration (PET) for this year based on daily average air temperature and latitude (Hamon, 1963).

Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases. Total annual runoff volumes and the resulting water quantity benefit were estimated as follows:

- **Pre-project (open space) runoff volume:** 4,383 ML/yr
- **Post-project (agro-forest land) runoff volume:** 4,247 ML/yr
- **Benefit (runoff reduction):** 136 ML/yr

**Data Sources/Site-specific characteristics:**

- Pre-project: open grasslands in fair condition with no forest cover
- Post-project: agro-forested land (mango orchard/tree farms)
- Surface area: 220 ha (total area targeted) – planting of mango trees on 58 ha so far.
- Slope: Terrain is steep to very steep with 54% of the area having slopes of 30-50% followed by 35% of the area with slopes exceeding 50%. Milder slopes of less than 30% are found in the lower catchment area in the flood zone, alluvial plains and upper banks to the right of the Abuan river.
- Soil type: Rugao clay loam, found in 30-50% slopes is a well drained moderately deep (≥ 60 cm depth) with moderate permeability subangular blocky structured clay loam soils. Soil surface is fairly stony.
- Daily precipitation and air temperature data were obtained from TuTimpo.net for the Casiguran station (ID: 983360).

**Assumptions:**

- Used future projection of 220 ha of grassland converted to agro-forestry (mango trees)
- Used approximate average slope of 50%.
• Precipitation data for the Casiguran station (2006-08) are representative of precipitation conditions for the agro-forested areas. Average annual precipitation for these 3 years was 3,226 mm, which is similar to the 2,900 mm cited in the project survey.

• SWAT model parameter “CNCOEF” was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

• Soil erodibility factor (K) was assumed to be 0.24 for both pre- and post-project conditions.

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results (per the CWP survey response):

Soil erosion is major threat to the watershed. Topsoil removal reduces soil productivity, infiltration capacities and diminishes base flows. Siltation also reduces capacities of irrigation canals and hydropower plants and pollutes drinking water. The ESTimation of ONsite ERosion or ESONER, a GIS-based model developed by the Bureau of Soils and Water Management for Philippine conditions was adapted and used for this study. The ESONER model enables the estimation of the source erosion rate from the product of four parameters considered such as rainfall data, topographic or slope condition, soil characteristics and the vegetative cover or land use.

Kaingin (i.e., swidden farms) is the biggest contributor to soil erosion with erosion rates ranging from 2,617 tons/ha-year. This is followed by open grassland with erosion rates ranging from 20 to 97 tons/ha-year. In contrast, a well maintained forest cover has an erosion rate ranging from 1.54 to 7.49 tons/ha-year. Converting open grasslands into mango areas in the sub-basin can reduce erosion rates from 69.44 to 18.52 tons/ha-year. For 220 hectares of grasslands converted to mango tree farms, this means 11,202 tons of soil material conserved.

Benefit (sediment yield reduction): 11,200 MT/yr

Data Sources:

• See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:

• See above discussion in “Approach & Results” section.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED

• None

NOTES

• None

REFERENCES


PROJECT NAME: Every Drop Matters - in Saraykoy and Beypazari

PROJECT ID #: 41

DESCRIPTION OF ACTIVITY: Leak repair

LOCATION: Saray district of Ankara, Turkey

PRIMARY CONTACT:
Omar Bennis
Public Affairs and Communications
Coca-Cola Eurasia & Africa Group
Tel. +90.216.556.2039
ombennis@eur.ko.com

OBJECTIVES
- Reduce water loss from aging water distribution system

BACKGROUND & DESCRIPTION OF ACTIVITY: This project is replacing aging water mains to reduce water loss (50,000 tons per year) and ensure water safety.

ACTIVITY TIMELINE:
- Pilot implemented in 2006 and is ongoing

COCA-COLA CONTRIBUTION: 89%
- Project total cost: 360,000
- Coca-Cola contribution: 320,000

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in surface water/groundwater usage

1. DECREASE IN SURFACE WATER USE

Approach
- Water saved from leak repairs (water main replacement), as reported in survey
- Leak repairs save 50,000 tons of water per year = 100,000,000 lbs water / 62.4 lb/ft³ = 1,602,564 ft³ water * 28.3 L/ft³ = 45,379,562 L water savings after 2007
- Total yearly benefit (decreased surface water use): 45.38 million L/year

Data sources
- No data used – water savings were reported in survey.

Assumptions
- Assumed no depreciation in savings over 5 years (systems continues to function as in 2008).

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED: None
NOTES: None

REFERENCES: None
PROJECT NAME: Conservation and Rehabilitation of the Klong Yan Watershed in Surat Thani
PROJECT ID #: 43

DESCRIPTION OF ACTIVITY: Conservation of forest land (3,040 hectares)

LOCATION: Surat Thani, Thailand (latitude: 9.10°-9.42°, longitude: 98.80°-99.00°)

PRIMARY CONTACT:
Budsayada Youngfuengmontra (Nan)
Corporate Citizenship Manager
Coca-Cola (Thailand) Limited
Tel. 66-2-835-1477
Mobile. 66-81-752-1787
Fax. 66-2-835-1021
ybudsayada@apac.ko.com

OBJECTIVES:
• Conservation of existing forest land
• Reduce runoff
• Conserve local watershed and promote environmental awareness

BACKGROUND & ACTIVITY DESCRIPTION: Villagers in the Surat Thani region intrude on tropical rain forest land in order to expand their farmland. The activity that could be quantified involves conserving 19,000 rais (3,040 hectares) of forest area, thereby preventing further expansion of agricultural areas.

ACTIVITY TIMELINE:
• Conservation action was completed by August 2008.

COCA-COLA CONTRIBUTION: 100%
• Fully funded by Coca-Cola.

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in runoff water quantity
2. Decrease in sediment runoff

1. DECREASE IN RUNOFF WATER QUANTITY

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff for the conversion of unforested land to forested land. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.
Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **“Pre-project”:**
  - Agricultural development
    - Hydrologic soil group (HSG) “B”
    - Pasture in “fair” condition (CN = 69)
- **“Post-project”:**
  - Conserved forest land
    - Hydrologic soil group (HSG) “B”
    - Woodland in “good” condition (CN = 55)

Daily precipitation and air temperature data were obtained for Surat Thani, Thailand (station ID: VTSB, #485510) from the meteorological database available from WaterBase (www.waterbase.org) for the 2000-05 period, although sufficiently complete precipitation data were only available for years 2003-04. The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases for year 2000. Total annual runoff volumes and the resulting water quantity benefit were estimated as follows:

- **“Pre-project” (agricultural land):** 11,729 ML/yr (386 mm/yr)
- **“Post-project” (conserved forest land):** 9,651 ML/yr (318 mm/yr)
- **Benefit (runoff reduction):** 2,078 ML/yr (68 mm/yr)

**Data Sources:**

- **Size of reforested land area:**
  - 3,040 ha (provided by contact)
- **Slope:**
  - 27-47% (15-25°) in most areas, 60-70° in steepest areas (provided by contact)
  - Average slope of 37% used for all calculations (conservative)
- **Soil type:**
  - Described as “loose” soil by contact
  - Available water content (AWC) = 8 mm/meter (hydrologic soil group “B”)
- **Meteorological data:**
  - Daily precipitation and air temperature data for years 2003-04 obtained from WaterBase meteorological database for Surat Thani, Thailand.
  - Precipitation totals for 2003 and 2004 are 2,174 mm and 2004 1,364 mm, respectively.

**Assumptions:**

- The tree canopy in the reforested areas was assumed to be mature.
- 100% of conserved forest land area would have been developed for agricultural use (eventually).
The agricultural land for the “post-project” condition was conservatively assumed to be represented by pasture land in “fair” condition (CN = 69). In reality, the Curve Number could be higher for more intensive agricultural use, including farming of row crops, etc.

SWAT model parameter “CNCOEF” was conservatively set to 0.0 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. **DECREASE IN SEDIMENT RUNOFF**

**Approach & Results:**

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting unforested land to forested land. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for year 2000.

The Cover/Management Factors ($C_{usle}$) used in the MUSLE were estimated as follows based on Haith (1992):

- **“Pre-project”:** agricultural land ($C_{usle} = 0.10$)
- **“Post-project”:** woodland with 75-100% tree canopy ($C_{usle} = 0.001$)

Total annual sediment yields for the unforested and forested land areas were estimated as follows:

- **Pre-project (unforested):** 2,701,900 MT/yr (889 MT/ha/yr)
- **Post-project (forested):** 22,300 MT/yr (7 MT/ha/yr)
- **Benefit (reduced sediment yield):** 2,679,600 MT/yr

**Data Sources:**

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

**Assumptions:**

- The tree canopy in the reforested areas was assumed to be mature.
- 100% of conserved forest land area would have been developed for agricultural use (eventually).
- The Cover/Management Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and across years).
- The soil erodibility factor (K) was conservatively assumed to be 0.17 for use in MUSLE equation.

**OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED**

- Habitat improvements benefiting terrestrial wildlife
NOTES

• None

REFERENCES


PROJECT NAME: Great Barrier Reef Project (Project Catalyst)

PROJECT ID #: 73

DESCRIPTION OF ACTIVITY: Implement GPS-based precision agriculture involving soil, nutrient, pesticide and irrigation management with a group of innovative sugarcane farmers

LOCATION: Mackay Whitsunday region of Australia

PRIMARY CONTACT:
Will Higham
Land and Water Operations Manager
Reef Catchments
1/174 Victoria St,
Mackay 4740, Australia
+61 (0)437-640-186
will.higham@reefcatchments.com.au

Michelle Allen
Public Affairs & Communication Manager
Coca-Cola South Pacific Pty Limited
L9, 40 Mount Street, PO Box 388
North Sydney NSW 2060
+ 61-2-9291-3427
miallen@apac.ko.com

OBJECTIVES:
• Reduce sediment, nutrient and chemical loss in freshwater entering the Great Barrier Reef Lagoon
• Reduce runoff and increase infiltration/baseflow

BACKGROUND & ACTIVITY DESCRIPTION: Project Catalyst is currently working with 53 individual sugarcane growers to fast track the development and implementation of innovative, cutting edge (A Class) management practices. The 53 growers manage 15,531 hectares of sugarcane land across the Great Barrier Reef catchment, including 31 growers in the Mackay Whitsunday region, 10 growers in the Burdekin region, and 12 growers in the Wet Tropics region. (See the tables in Appendix A for information on activities undertaken by each grower). Implementing “A class” soil management is expected to: 1) reduce loss of sediment, particulate nitrogen and particulate phosphorus, and 2) reduce runoff quantities and enhance groundwater baseflow. Implementing “A class” nutrient management is expected to reduce loss of dissolved inorganic nitrogen and filterable reactive phosphorus. Implementing “A class” pesticide management is expected to reduce loss of residual herbicides (eg. atrazine, diuron and hexazinone). Implementing “A class” irrigation management is expected to: 1) improve the effectiveness (placement and timing) of the soil, nutrient and pesticide management activities, and 2) reduce irrigation losses to runoff and deep drainage.

SUMMARY OF REPLENISH BENEFIT
• 2011 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 3,745 ML/YR

ACTIVITY TIMELINE:
• Year 1 of the project was implemented during the 2009 calendar year.
• Year 2 of the project was implemented during the 2010/11 financial year.
• Subject to continuing funding, the project has a 5 year workplan up to the end of 2013.
COCA-COLA CONTRIBUTION: varies by year (see detailed schedule below)

- Project would not have occurred without TCCC funding.
- Cost contribution schedule:
  - **Year 1 (2009): 50%**
    - In the 2009 calendar year, the Australian Government’s Reef Rescue Program contributed $380,000AU for individual landholder water quality grants and $370,000AU for paddock scale modeling and monitoring.
  - **Year 2 (2010): 25%**
    - In the 2010/11 financial year, the Australian Government’s Reef Rescue Program contributed over $850,000AU for individual landholder water quality grants and $650,000AU for paddock scale modeling and monitoring.
  - **Years 3, 4, 5 (2011-13):**
    - As a result of significant co-investment from other sources, the TCCC contribution will decrease as a percentage of total funding in Year 3 and subsequent project years, although the decrease is not known at this time. However, the decrease in % cost contribution will be offset by increases in the project’s overall water quantity and quality benefits during those years (i.e., as more land area is added).
    - For simplicity, Will Higham has suggested that the TCCC cost-adjusted water quantity and quality benefits calculated for Year 2 should be used to represent future TCCC quantity/quality benefits for all future years. The cost-adjusted Year 3 and Year 4 benefits shown in the water quantity and water quality benefit tables later in this fact sheet are therefore set equal to those calculated for Year 2.

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Reduction in runoff volume
2. Reduction in soil, nutrients, and chemicals entering the Great Barrier Reef Lagoon

1. REDUCTION IN RUNOFF VOLUME

Approach:
Paddock scale sugarcane experimental results were used to generate runoff coefficients for conventional practice of sugarcane for representative soil types in the Wet Tropics, Burdekin and Mackay Whitsunday regions (see Table 1). These runoff coefficients for conventional practice range from 0.23 for sugarcane grown on a Brown Dermosol soil in the Wet Tropics region to 0.68 for sugarcane grown on a Mulgrave soil in the Burdekin region. Because intensity and seasonal distribution of rainfall has a strong effect on the runoff coefficients, it is not recommended to use these runoff coefficients outside the region (climatic conditions) that they were generated from.
Table 1. Runoff as a percentage of total annual rainfall for sugarcane grown using conventional practice

<table>
<thead>
<tr>
<th>Region</th>
<th>Soil type</th>
<th>Runoff as a percentage of rainfall</th>
<th>Conventional practice runoff coefficient</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Tropics</td>
<td>Brown Dermosol</td>
<td>23%</td>
<td>0.23</td>
<td>Webster et al, 2011</td>
</tr>
<tr>
<td>Burdekin</td>
<td>Delta</td>
<td>27%</td>
<td>0.27</td>
<td>Thorburn et al, 2010</td>
</tr>
<tr>
<td></td>
<td>Mulgrave</td>
<td>68%</td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td>Mackay</td>
<td>Marian</td>
<td>40%*</td>
<td>0.40</td>
<td>Rohde &amp; Bush, 2010</td>
</tr>
<tr>
<td>Whitsunday</td>
<td>Victoria Plains</td>
<td>47%</td>
<td>0.47</td>
<td></td>
</tr>
</tbody>
</table>

*Rainfall plus overhead irrigation; calculated from controlled traffic farming treatment 3

The runoff coefficients for conventional practice of sugarcane were combined with average annual rainfall and a controlled traffic farming improvement coefficient of 0.15 (generated from the experiments at Eton on a Victoria Plains soil (Rohde, 2011)) to calculate annual water quantity improved by controlled traffic farming (ML/ha/yr) for specific soil types and locations within the Wet Tropics, Burdekin and Mackay Whitsunday regions (see Table 2). Annual water quantity improved by controlled traffic farming ranges from 0.4 ML/ha/year for a Delta soil at Ayr to 1.4 ML/ha/year for a Brown Dermosol soil at Tully. The mean annual water quantity improved by controlled traffic farming across the range of soil types and locations is 1 ML/ha/yr. Additional context and approach details are provided in Higham (2011).

Results:

The per hectare annual water quantity improved by controlled traffic farming (ML/ha/yr) is presented in the right column of Table 2. These values were combined with grower information to calculate the annual water quantity improved by controlled traffic farming by the cane growers involved in Project Catalyst (see Appendix A). The cane growers involved in Project Catalyst in Year 2 (2010/2011) have adopted controlled traffic farming on 14,032 ha. Therefore the reduced volume of rainfall runoff equals 14,979 ML/year for Year 2, based on average annual rainfall. A summary of the sugarcane areas improved through Project Catalyst is presented in Table 3.
Table 2. Area-normalized water quantity improved by controlled traffic farming for different soil types and locations in the Great Barrier Reef Catchment Region

<table>
<thead>
<tr>
<th>Region</th>
<th>Location</th>
<th>Average Annual Rainfall (mm/yr)*</th>
<th>Soil type</th>
<th>Annual runoff reduction via controlled traffic farming (mm)</th>
<th>Annual area-normalized water quantity improved by controlled traffic farming (ML/ha/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Tropics</td>
<td>Tully</td>
<td>4136</td>
<td>Brown Dermosol</td>
<td>143</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>Ingham</td>
<td>2109</td>
<td>Brown Dermosol</td>
<td>73</td>
<td>0.7</td>
</tr>
<tr>
<td>Burdekin</td>
<td>Ayr</td>
<td>954</td>
<td>Delta</td>
<td>39</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>954</td>
<td>Mulgrave</td>
<td>97</td>
<td>1.0</td>
</tr>
<tr>
<td>Mackay Whitsunday</td>
<td>Proserpine</td>
<td>1792</td>
<td>Victoria Plains</td>
<td>126</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1792</td>
<td>Marian</td>
<td>108</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>Mackay</td>
<td>1606</td>
<td>Victoria Plains</td>
<td>113</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1606</td>
<td>Marian</td>
<td>96</td>
<td>1.0</td>
</tr>
</tbody>
</table>

* Average annual rainfall data was sourced from Furnas (2003) (see Appendix 1 in Higham 2011)

Table 3. Sugarcane farm surface areas affected by Project Catalyst

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Area in Year 1 (ha)</th>
<th>Total Area in Year 2 (ha)</th>
<th>Total Area in Year 3 (ha)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mackay Whitsunday</td>
<td>4,491</td>
<td>6,975</td>
<td>6,975</td>
</tr>
<tr>
<td>Burdekin</td>
<td>0</td>
<td>4,282</td>
<td>6,760</td>
</tr>
<tr>
<td>Wet Tropics</td>
<td>0</td>
<td>2,775</td>
<td>4,365</td>
</tr>
<tr>
<td><strong>Totals:</strong></td>
<td><strong>4,491</strong></td>
<td><strong>14,032</strong></td>
<td><strong>18,100</strong></td>
</tr>
</tbody>
</table>

* Total surface areas for Year 3 are estimated based on information included in the Year 3 application submitted by the World Wildlife Fund U.S. to the Coca-Cola Foundation.

The total (ultimate) water quantity benefit is: 19,172 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share is: 3,745 ML/yr.

The current (2011) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2011 Replenish Benefit

The 2011 benefit is the performance-based benefit from this activity as of the end of calendar year 2011. The total 2011 benefit is 19,172 ML/yr and TCCC’s benefit (adjusted for cost share) is 3,745 ML/yr.
Projected Replenish Benefits

Table 4 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in this table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 4. Projected water quantity benefits summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Project Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share* (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 4 (2012)</td>
<td>19,172</td>
<td>3,745</td>
</tr>
<tr>
<td>Year 5 (2013)</td>
<td>19,172</td>
<td>3,745</td>
</tr>
<tr>
<td>Year 6 (2014)</td>
<td>19,172</td>
<td>3,745</td>
</tr>
<tr>
<td>Year 7 (2015)</td>
<td>19,172</td>
<td>3,745</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>19,172</td>
<td>3,745</td>
</tr>
</tbody>
</table>

Per Will Higham, the cost share for Year 3 (2011) and beyond is calculated assuming that the quantity benefits associated with TCCC’s cost share remain the same as in Year 2 (2010) for the duration of the project and beyond.

2. DECREASE IN SOIL, NUTRIENTS, CHEMICALS ENTERING THE GREAT BARRIER REEF LAGOON
Approach & Results:

Reinterpretation of existing catchment scale modeling (SedNet and Annex) developed to set water quality targets and objectives for the Mackay Whitsunday region was used to estimate the reduction in the “end of catchment” loads resulting from this project. The SedNet and Annex models predict long term annual average loads of sediment and nutrients at the end of catchment and as such are useful for predicting the long term benefits of different management practice scenarios. Details of the modeling used to support the Water Quality Improvement Plan are presented in (Drewry et al., 2008).

Table 5. Year 2 outputs expressed as areas of improved management and Year 2 outcomes expressed as annual “End of Catchment” load reductions

<table>
<thead>
<tr>
<th>Year 2 Outputs (2010)</th>
<th>Year 2 Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Soil Management: adoption of A Class on 13,995 ha and B Class nutrient management on a further 1,536 ha</td>
<td>• Particulate Nitrogen load reduced by 55 t/yr</td>
</tr>
<tr>
<td>2. Nutrient Management: adoption of A Class on 4,799 ha and B Class nutrient management on a further 10,732 ha</td>
<td>• Particulate Phosphorus load reduced by 26 t/yr</td>
</tr>
<tr>
<td>3. Pesticide Management: adoption of A Class on</td>
<td>• Dissolved Inorganic Nitrogen load reduced by 48 t/yr</td>
</tr>
<tr>
<td></td>
<td>• Filterable Reactive Phosphorus load reduced by 10 t/yr</td>
</tr>
<tr>
<td>Year 2 Outputs (2010)</td>
<td>Year 2 Outcomes</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>4,799 ha and B Class nutrient management on a further 10,732 ha</td>
<td>• Total pesticide loads reduced by <strong>420 kg/yr</strong></td>
</tr>
<tr>
<td>4. Irrigation Management: adoption of A Class on 1,036 ha and B Class nutrient management on a further 11,200 ha</td>
<td></td>
</tr>
</tbody>
</table>

As the project progresses it is proposed to use a combination of paddock scale monitoring, rainfall simulation and paddock scale modeling to estimate the paddock scale benefits of the project. It is anticipated that the paddock scale monitoring and modeling data will be synthesized to update the estimates of benefits every October (the first synthesis will occur in October 2011). It is important to note that the end of catchment benefits presented below are likely to be more conservative (i.e. much lower) than paddock scale benefits that will be calculated in the future.

**Water Quality Benefit Summary:**

**The total (ultimate) water quality benefits of this project are:**

- The total benefit (nitrogen decrease) is: 121 MT/yr and TCCC’s benefit (adjusted for cost share) is 25.8 MT/yr.
- The total benefit (phosphorus decrease) is: 41 MT/yr and TCCC’s benefit (adjusted for cost share) is 9 MT/yr.
- The total benefit (pesticide decrease) is 0.490 MT/yr and TCCC’s benefit (adjusted for cost share) is 0.105 MT/yr.

**The 2011 water quality benefits of this project are:**

- The 2011 benefit (nitrogen decrease) is: 121 MT/yr and TCCC’s benefit (adjusted for cost share) is 25.8 MT/yr.
- The 2011 benefit (phosphorus decrease) is: 41 MT/yr and TCCC’s benefit (adjusted for cost share) is 9 MT/yr.
- The 2011 benefit (pesticide decrease) is 0.490 MT/yr and TCCC’s benefit (adjusted for cost share) is 0.105 MT/yr.

**Projected Water Quality Benefits**

The tables that follow show the projected water quality benefits that this activity will provide if the project remains in productive service. While not shown in the tables, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 6. Projected water quality benefits summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Project Benefit (MT/yr)</th>
<th>Adjusted for TCCC Cost Share* (MT/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nitrogen</td>
<td>Phosphorus</td>
</tr>
<tr>
<td>Year 4 (2012)</td>
<td>121</td>
<td>41</td>
</tr>
<tr>
<td>Year 5 (2013)</td>
<td>121</td>
<td>41</td>
</tr>
<tr>
<td>Year 6 (2014)</td>
<td>121</td>
<td>41</td>
</tr>
<tr>
<td>Year 7 (2015)</td>
<td>121</td>
<td>41</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>121</td>
<td>41</td>
</tr>
</tbody>
</table>

* Per Will Higham, the cost share for Year 3 (2011) and beyond is calculated assuming that the quantity benefits associated with TCCC’s cost share remain the same as in Year 2 (2010) for the duration of the project and beyond.

OTHER BENEFITS NOT QUANTIFIED:
1. Annual decrease in soil, nutrients, chemicals leaving the paddock
2. Annual decrease in runoff leaving the paddock

NOTES:
- This is a preliminary end of catchment estimate. Paddock scale monitoring and modeling are being conducted as part of the project. It is anticipated that up to date estimates of benefits will be calculated in October each year (starting in 2010).
- This fact sheet updates a 2010 fact sheet in that water quantity benefits were computed and the implementation schedule and cost data were revised based on new information.
REFERENCES


### Appendix A

#### Table A-1: Mackay Whitsunday grower’s activities and areas

<table>
<thead>
<tr>
<th>Mackay Whitsunday Growers Name</th>
<th>Specific Innovation Activity being Validated</th>
<th>Hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew Auld, Norm Large, Tony Large, Mark Orr</td>
<td>Economics: Benefits of forming a grower group to adopt A class management practices</td>
<td>600+ ha Lethebrook, Proserpine Main Channel, Myrtle Creek</td>
</tr>
<tr>
<td>John Fox</td>
<td>Irrigation: Variable Rate Low Pressure Overhead irrigation through Centre Pivot</td>
<td>310 ha Blackrock Creek</td>
</tr>
<tr>
<td>John Simpson</td>
<td>Soil: Minimizing cultivation in the controlled traffic system</td>
<td>364 ha Blackrock Creek</td>
</tr>
<tr>
<td>Joe Muscat</td>
<td>Soil: Alternative fallow crops</td>
<td>180 ha Sandy Creek</td>
</tr>
<tr>
<td>Phil and John Deguara</td>
<td>Chemical: Site Specific Grub control,</td>
<td>320 ha Sandy Creek and Mackay City</td>
</tr>
<tr>
<td>David Ellwood</td>
<td>Chemical: Improved Chemical Application with banded residual and knockdown in the inter-row</td>
<td>150 ha Sandy Creek</td>
</tr>
<tr>
<td>Brian and John Stevens</td>
<td>Soil: Benefits of adopting A Class soil management from B Class</td>
<td>710 ha Sandy Creek</td>
</tr>
<tr>
<td>Neil Walpole</td>
<td>Soil: Technology linked to Controlled Traffic Farming system like GPS, rotational cropping within a controlled traffic farming system</td>
<td>170 ha Rocky Dam Creek</td>
</tr>
<tr>
<td>Rob Sluggett</td>
<td>Chemical: Site Specific and Variable Rate application for Grub Control</td>
<td>45 ha Rocky Dam Creek</td>
</tr>
<tr>
<td>Sergio Berardi</td>
<td>Nutrient: Site Specific and Variable Rate Nutrient application</td>
<td>175 ha Rocky Dam Creek</td>
</tr>
<tr>
<td>Mark Blair</td>
<td>Soil: Adoption of GPS guidance on a Controlled Traffic farming system</td>
<td>309 ha Myrtle Creek</td>
</tr>
<tr>
<td>Mackay Whitsunday Growers Name</td>
<td>Specific Innovation Activity being Validated</td>
<td>Hectares</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Bill Blair</td>
<td>Soil: Rotational Cropping including growing out of season soybean crop for seed</td>
<td>300 ha Myrtle Creek</td>
</tr>
<tr>
<td>Lou Raiteri</td>
<td>Soil: Laying out a new farm with A and B class cane management practices for precision agriculture</td>
<td>352 ha Myrtle Creek</td>
</tr>
<tr>
<td>Tony Jeppesen, Gary and Ian Consedine, Scott Simpson</td>
<td>Soil: Single Skip row planting on 1.9m system</td>
<td>1053 ha O’Connell River</td>
</tr>
<tr>
<td>Andrew Guy</td>
<td>Economics: Economics of adopting A class cane management practices on a small farm</td>
<td>270 ha O’Connell River</td>
</tr>
<tr>
<td>David and Phil Blackburn</td>
<td>Chemical: Improved chemical management with high clearance tractors and shielded sprayers</td>
<td>247 ha Sandy Creek</td>
</tr>
<tr>
<td>Gerry Deguara (Sam and Joe)</td>
<td>Nutrients: Site Specific and Variable Rate ash &amp; mill mud application</td>
<td>340 ha Sandy Creek</td>
</tr>
<tr>
<td>John Pastega</td>
<td>Chemicals: Air shear sprayer for reduced chemical application</td>
<td>430 ha Sandy Creek</td>
</tr>
<tr>
<td>Tony and John Bugeja (Mark)</td>
<td>Soil: Automatic harvester base cutter height controller</td>
<td>420 ha Bakers Creek</td>
</tr>
<tr>
<td>Lee and Chris Blackburn</td>
<td>Soil: 2-row Skip Row planting with alternative cropping opportunities on 1.8m system</td>
<td>230 ha Sandy Creek</td>
</tr>
<tr>
<td>31 Growers</td>
<td>10 Soil activities, 2 Nutrient activities , 5 Chemical activities, 1 Irrigation activity, 2 Economics activities</td>
<td>6975 ha in Mackay Whitsunday Region</td>
</tr>
<tr>
<td>Burdekin Growers Name</td>
<td>Specific Innovation Activity being Validated</td>
<td>Hectares</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Denis Pozzebon</td>
<td>Chemical: Variable rate Chemical Application – Yield maps and ground truth</td>
<td>126ha Sheep Station Creek</td>
</tr>
<tr>
<td>Ian Haigh</td>
<td>Nutrient: Variable Rate Nutrient Management (Granular)</td>
<td>240ha Sheep Station Creek</td>
</tr>
<tr>
<td>Paul Villis</td>
<td>Irrigation: Trickle Irrigation WQ and Economic Benefits</td>
<td>40ha plus 360 ha managed Alva Creek</td>
</tr>
<tr>
<td>Rob Ahern</td>
<td>Soil: Soil Biology/ Microbes – adding bacteria, humus through a liquid brew</td>
<td>113 ha Border the Burdekin River</td>
</tr>
<tr>
<td>Joe Linton</td>
<td>Irrigation: Trickle Irrigation WQ and Economic Benefits</td>
<td>59 ha Wetland/ Lagoon system before entering Burdekin River</td>
</tr>
<tr>
<td>Joe Tama</td>
<td>Irrigation: Site specific soil type management - irrigation, cultivation etc</td>
<td>220ha Iyah Creek</td>
</tr>
<tr>
<td>Paul Hatch</td>
<td>Economics: Utilisation of a data management system for precision agriculture</td>
<td>143 ha Baratta Creeks</td>
</tr>
<tr>
<td>Ian Shepherdson</td>
<td>Irrigation: Pump efficiency to improve irrigation operations and energy consumption</td>
<td>160 ha Iyah Creek</td>
</tr>
<tr>
<td>Shane Butler (manager for Structured Investment Solutions Limited)</td>
<td>Soil: Implementation of a 2m wide shute single row controlled traffic system</td>
<td>1400ha Horse shoe Lagoon</td>
</tr>
<tr>
<td>David Cox (and Evan Shannon)</td>
<td>Soil: Implementation of a 2.4m controlled traffic system with 2 single rows 1m apart</td>
<td>2400ha Baratta Creek</td>
</tr>
<tr>
<td>10 Growers</td>
<td>3 Soil activities, 1 Nutrient activity, 1 Chemical activity, 4 Irrigation activities, 1 Economics activity</td>
<td>5261 ha in Burdekin Region</td>
</tr>
<tr>
<td>Wet Tropics Growers Name</td>
<td>Specific Innovation Activity being Validated</td>
<td>Hectares</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Tom Gilbert</td>
<td>Soil: Overcome the problem of establishing legume crops in a cane growing system in the wet tropics</td>
<td>125 ha</td>
</tr>
<tr>
<td></td>
<td>Seymour River (Herbert River)</td>
<td></td>
</tr>
<tr>
<td>Norm Reid</td>
<td>Soil: Evaluate methods of re-planting existing control traffic 1.9m beds.</td>
<td>210 ha</td>
</tr>
<tr>
<td></td>
<td>Cattle Creek Trebonne Creek</td>
<td></td>
</tr>
<tr>
<td>Orazio and Anthony Marino</td>
<td>Soil: Assessing different legume types on mounds (especially on heavy clay soils), while establishing a farming system to manage legume stubble.</td>
<td>220 ha</td>
</tr>
<tr>
<td></td>
<td>Stone River (Herbert River)</td>
<td></td>
</tr>
<tr>
<td>Reinaudo Family</td>
<td>Nutrient: Variable rate nutrient application</td>
<td>650 ha</td>
</tr>
<tr>
<td></td>
<td>Herbert River and Cattle Creek/Trebonne Creek</td>
<td></td>
</tr>
<tr>
<td>Mario Raccanello</td>
<td>Economics: Desk top study- To convert to a 2.4m centre farming system (with 2 rows 1m apart on each bed).</td>
<td>320 ha</td>
</tr>
<tr>
<td></td>
<td>Murray and Tully River Floodplain</td>
<td></td>
</tr>
<tr>
<td>Nick Stipis (manager on behalf of Sweet Cane Pty Ltd)</td>
<td>Nutrient: Develop a high clearance machine to apply liquid nutrients to accommodate split rate applications.</td>
<td>540 ha</td>
</tr>
<tr>
<td></td>
<td>Murray and Tully River Floodplain</td>
<td></td>
</tr>
<tr>
<td>Gerard Dore</td>
<td>Soil: Assess the use of molasses applications to the root zone of cane to improve soil microbial activity and improve soil nutrient holding capacities.</td>
<td>300 ha</td>
</tr>
<tr>
<td></td>
<td>Murray and Tully River Floodplain</td>
<td></td>
</tr>
<tr>
<td>Brian and Greg Dore</td>
<td>Nutrient: Assess the benefits of variable rate application of nitrogen and phosphorus.</td>
<td>550 ha</td>
</tr>
<tr>
<td></td>
<td>Murray and Tully Floodplain</td>
<td></td>
</tr>
<tr>
<td>Ian and Robert Brooks</td>
<td>Chemical: Optimise the use of hooded sprayers.</td>
<td>380 ha</td>
</tr>
<tr>
<td></td>
<td>Buckley/Meeriman/Liverpool and Maria</td>
<td></td>
</tr>
<tr>
<td>Creeks</td>
<td>12 Growers</td>
<td>4 Soil activities, 3 Nutrient activities, 1 Chemical activity, 0 Irrigation activities, 1 Economics activity</td>
</tr>
</tbody>
</table>
PROJECT NAME: Let’s Save Yelnya Together!
PROJECT ID #: 74

DESCRIPTION OF ACTIVITY: Canals that artificially drain Yelnya Bog have been blocked to increase the local groundwater storage/level, thereby reducing the threat of significant habitat destruction caused by annual fires.

LOCATION: Vitebsk region (Miory, Sharkovshina District), Belarus (coordinates: 55° 34’ N, 27° 55’ E)

PRIMARY CONTACT:
Anastasya Goroshko
External Affairs Supervisor,
Coca-Cola Beverages Belorussiya FE, a member of Coca-Cola Hellenic Group
Kolyadichi, Minsk district, 203010, Republic of Belarus
Tel.: +375 (17) 210 0210
E-mail: anastasya.goroshko@cchellenic.com
Website: http://www.coca-colahellenic.com

OBJECTIVES
• Protect habitat by preventing further damage to Yelnya Bog’s natural cover and peat layer caused by annual forest fires.
• Restore bird populations and natural vegetative cover.

BACKGROUND & DESCRIPTION OF ACTIVITY:
The Yelnya Bog, which is one of Europe’s largest peat bogs, covers 24,000 hectares in northern Belarus. The bog is a designated Nature Preserve, an Important Bird Area (IBA), and a Ramsar territory, and it provides habitat for 98 bird species (including 23 endangered) and 11 plant species listed in the National Red Data Book.

Irrigation canals constructed in the early 20th century caused a significant drop in Yelnya’s groundwater table, resulting in annual fires that significantly affect vegetative cover and habitat for birds and other fauna. In 2002, a major fire destroyed approximately 70% of the bog’s natural vegetative cover. Subsequent major fires likely would have burned the peat layer, resulting in irreparable ecological damage.

Beginning in October 2007, Coca-Cola Beverages Belorussiya, in Partnership with APB-Birdlife Belarus, organized volunteer teams to manually construct dams out of damaged trees and peat material to block flow through the three main irrigation canals. By the end of 2008, groundwater levels in the 14,000 hectares of the bog affected by the restoration efforts had increased by 1 meter. During 2010, efforts were mainly focused on consolidation of achieved success by maintaining...
and strengthening the existing dams. There are currently 40 cascade dams that have been constructed in the bog. The success of the project has been evidenced by the lack of destructive fires during the summers of 2008, 2009, and 2010, an extremely dry year.

**Map Showing the Yelnya Bog Area**

**ACTIVITY TIMELINE:**
- Volunteer organization and work initiated in October 2007.
- Recovery efforts are ongoing as of 2010.
- Local Coca-Cola employees took part in three missions per season (May-October)
- In total, about 150 other volunteers took part in the project.

**COKE CONTRIBUTION:** 100%
- Total cost: $10,500 USD
- Coca-Cola contribution: $3,800 USD
- Coca-Cola Hellenic Belarus (local bottler) contribution: $6,700 USD

**WATERSHED RESTORATION BENEFITS CALCULATED:**
1. Increase in water storage
1. INCREASE IN WATER STORAGE

Approach and Results:
The increase in groundwater storage was calculated based on the estimated 1-meter increase in groundwater levels over the 14,000 ha bog area affected by the blocking of irrigation canals. This corresponds to a water quantity benefit of 140,000 ML/yr.

Data Sources:
• Estimates of areal coverage and increases in groundwater levels were provided by Alexander Yaroshevich (Coca-Cola Belarus)

Assumptions:
• Canals will remain blocked by the constructed dam structures for the foreseeable future.
• The 1-meter increase in groundwater levels within the bog can be expected to be maintained for each year that the irrigation canals remain blocked.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
• Preservation/restoration of unique habitat for many bird species and other fauna.
• CO₂ impact: every hectare of over-dry bog discharges up to 10 tonnes of CO₂ per year. The full restoration of the bog in the future will completely reverse the CO₂ dynamic from emission towards absorbing a minimum 1 tonne of greenhouse gases per one hectare per year.

NOTES
• This fact sheet updates the January 2010 fact sheet by including the total cost of the project. Furthermore, it was noted that the existing dams constructed of peat and fire-burned trees are permanent. Built of natural materials, they will become a part of the landscape and will be strengthened with grass growing and inwash of sediments.
• Coca-Cola Beverages Belorussiya is planning to continue to upgrade and maintain the dams.

REFERENCES
PROJECT NAME: Protecting the Mesoamerican Reef – Pueblo Viejo sub-watershed, Guatemala
PROJECT ID #: 76

DESCRIPTION OF ACTIVITY: Implement management practices for agroforestry lands

LOCATION: Three communities in the Pueblo Viejo sub-watershed, Panzo, Alta Verapaz, Guatemala -
- Pueblo Viejo (15° 16’ 6.925” N, 89° 41’ 3.166” W)
- Cancoy (15° 14’ 26.677” N, 89° 42’ 32.386” W)
- Rio Chiquito (15° 14’ 326.925” N, 89° 40’ 21.676” W)

PRIMARY CONTACT:
María Amalia Porta
Oficial del Programa de Agua Dulce
15 avenida 13-45 Oakland, zona 10
Ciudad de Guatemala, Guatemala
Tel/Fax: (502) 23665856
mporta@wwfca.org

OBJECTIVES
- Reduce erosion and associated sedimentation of receiving waters

BACKGROUND & DESCRIPTION OF ACTIVITY:
A project aligned with the results of the first phase of the Program of Compensation by Hydrologic Services facilitated by WWF and CARE, and with the objectives of the Water Fund, which involves land use and conservation, was carried out in the Pueblo Viejo River watershed in Guatemala. The Pueblo Viejo watershed (14,892.5 hectares in area) is one of the 63 sub-basins of the Motagua-Polochic River complex in northern Guatemala, which in turn affects the health of the Mesoamerican Reef, the second longest barrier reef in the world. The primary problem in this watershed is soil erosion and sedimentation to the Pueblo Viejo River caused by inadequate agricultural and soil conservation practices that contribute to elevated erosion rates (38.7 TM/ha/year) that are three times that of the natural system. The erosion will ultimately reduce cropland soil quality and local crop yields. The resulting sedimentation to streams contributes to increased flooding and crop loss downstream along the Polochic River.

The communities in the Pueblo Viejo watershed that contribute most to the erosion problem include Pueblo Viejo, Cancoy, Santo Toribio, and Rio Chiquito I and II. These communities include 2,715 persons (from the 6,759 people living in the river basin) that are of Mayan origin (Q’eqchi’ ethnic group) whose primary occupation is agriculture, producing subsistence crops (maize and kidney beans) and commercial crops (cardamom, rubber, coffee and citrus). The land area of these communities comprises 29% of the total river basin and corresponds to 42% of the area that has a negative impact on water quality. The annual precipitation in this area is 4,357.7 mm/year, with area soil types and rates of rainfall volume and frequency that facilitate cropland erosion. The program is designed to implement sound practices for soil conservation, agroforestry, and reforestation in critical areas of the watershed that have the greatest erosion. A major program goal is to achieve a sedimentation reduction of 12%, from 138,061 MT/year (14.868 m³/year) to 121,818 MT/year (1,749 m³/year).
Erosion Evaluation Results for the Pueblo Viejo Sub-Watershed  
(Table 1, Figure 1 & Figure 3 from WWF 2007a)

<table>
<thead>
<tr>
<th>No.</th>
<th>Scenario</th>
<th>Erosion</th>
<th>Sedimentation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TM total</td>
<td>Change TM</td>
</tr>
<tr>
<td>1</td>
<td>Present situation</td>
<td>138,061</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Contrast Situation (without forest)</td>
<td>331,176</td>
<td>+193,114</td>
</tr>
<tr>
<td>3</td>
<td>Scenario with intervention</td>
<td>121,818</td>
<td>-16,244</td>
</tr>
<tr>
<td>4</td>
<td>Deforestation by advance of agricultural frontier in 600 has</td>
<td>154,922</td>
<td>+16,861</td>
</tr>
<tr>
<td>5</td>
<td>Total reforestation of the river basin</td>
<td>11,820</td>
<td>-126,242</td>
</tr>
<tr>
<td>6</td>
<td>Scenario with intervention (3) and to avoid advance of agricultural frontier (4)</td>
<td>104,957</td>
<td>-33,104</td>
</tr>
</tbody>
</table>

Pueblo Viejo Sub-watershed (Lower Part)  
(Photo Credit: © Claudio VÁSQUEZ BIANCHI, © Peter ROCKSTROH; Photo Source: Figure 4, WWF 2007b)
ACTIVITY TIMELINE:
- Start Date: July 2007
- End Date: June 2009

COCA-COLA CONTRIBUTION: 30%
- Total Cost of the Project: US$142,929
- Coca-Cola’s share: US$42,488

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in sediment erosion/runoff

1. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:
Cropland management practices are being implemented for 60.9 ha of coffee agroforestry land in the Pueblo Viejo subwatershed (terracing) and 140 ha of cardamom-coffee-agroforestry land in the Cancoy subwatershed (contoured strip cropping). The CWP survey responses indicated that 15% and 12% reductions in sediment yield have been estimated for the Pueblo Viejo and Cancoy locations, respectively (WWF, 2008).

The hydrologic evaluation report developed for the region indicated that sediment yields for Pueblo Viejo and Cancoy are 10-50 MT/ha/yr and 50-150 MT/yr, respectively (WWF, 2008). The water quality benefits were calculated in terms of sediment reduction using the midpoint of the sediment yield range reported for Pueblo Viejo and Cancoy:

- **Pre-project**: 15,827 MT/yr
  - Pueblo Viejo: [30 MT/ha/yr] * [60.9 ha] = 1,827 MT/yr
  - Cancoy: [100 MT/ha/yr] * [140 ha] = 14,000 MT/yr

- **Post-project**: 13,873 MT/yr
  - Pueblo Viejo: [1,827 MT/yr] * [0.85] = 1,552.95 MT/yr
  - Cancoy: [14,000 MT/ha/yr] * [0.88] = 12,320 MT/yr

- **Benefit (reduced sediment yield)**: 1,954 MT/yr
  - Pueblo Viejo: [1,827 MT/yr] * [0.15] = 274 MT/yr
  - Cancoy: [14,000 MT/ha/yr] * [0.12] = 1,680 MT/yr

Data Sources:
- Estimates of present-day sediment yield and anticipated percent reductions obtained from project contact and the hydrologic evaluation report (WWF, 2008).
Assumptions:

- The estimated reductions in sediment yield (12-15%) will be achieved through the planned management actions and stay in effect for the foreseeable future.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED

- Possible reductions in water runoff volumes due to implementation of best management practices for agricultural land areas.

NOTES

- None

REFERENCES


PROJECT NAME: Protecting the Mesoamerican Reef – Teculutan sub-watershed, Guatemala
PROJECT ID #: 76

DESCRIPTION OF ACTIVITY: Irrigation Water Management - flood irrigation system converted to drip irrigation

LOCATION: Teculutan sub-watershed, Teculutan, Zacapa, Guatemala - (14° 58´ 10” N, 89° 41´ 30” W)

PRIMARY CONTACT:
María Amalia Porta
Oficial del Programa de Agua Dulce
15 avenida 13-45 Oakland, zona 10
Ciudad de Guatemala, Guatemala
Tel/Fax: (502) 23665856
mporta@wwfca.org

OBJECTIVES
• Convert from flood irrigation to drip irrigation to decrease quantity of water withdrawals from surface waters and improve crop yields

BACKGROUND & DESCRIPTION OF ACTIVITY:
The Teculutan sub-watershed has an area of 216 km², drains via the Teculutan River, and discharges into the Montagua River, which flows to the Caribbean Sea (WWF 2008). The Teculutan River provides water originating from the Sierra de las Minas Biosphere Reserve that supports the livelihoods of the rural communities within its borders. The water in the general region of the Sierra de las Minas Biosphere Reserve is used for irrigation of subsistence crops and small scale cattle pastures, processing of coffee and fruit for exports, and the production of hydroelectric energy. However, inappropriate agricultural and cattle ranching practices are degrading the land, causing deforestation that has resulted in reducing the water supply, especially during the dry season (Goldberg 2007).

This project was conducted as part of the Program of Compensation by Hydrologic Services (facilitated by WWF-CA and CARE-Guatemala) to reduce the amount of water used and increase crop yields in the project area by implementing drip irrigation practices where, previously, flood irrigation had been the standard practice. The project will also prevent the expansion of the agricultural frontier in the middle-upper part of the river basin. The project area is 8.8 hectares in size and supports 6.0 hectares of okra and 2.8 of corn production. In addition, management practices were implemented to reduce the amounts of fertilizers, herbicides and pesticides used, to use more environmentally friendly products, and to clean application equipment in the fields rather than directly in the river.
ACTIVITY TIMELINE:
- Start Date: December 2008
- End Date: July 2009

COCA-COLA CONTRIBUTION: 30%
- Total Cost of Project: US$89,000
- Coca-Cola’s Cost Share: US$27,000

WATERSHED RESTORATION BENEFITS CALCULATED:

DECREASE IN SURFACE/GROUND WATER USAGE

Approach & Results
The water quantity benefit was estimated as the water savings resulting from conversion from flood to drip irrigation. Irrigation water usage was provided in the survey response. The water savings were computed as the difference between pre-project water usage and post-project usage at the project cropland location.

Site-specific characteristics:
- Surface area: 8.8 hectares (okra – 6.0 ha, corn – 2.8 ha)
Project Conditions:
- Pre-project water use (flood irrigation): 8,575 m³/ha/cycle
- Post-project water use (drip irrigation): 3,000 m³/ha/cycle
- Change in water use = 5,575 m³/ha/cycle

Quantification Results:
- \[ \text{Water Savings} = [5,575 \text{ m}^3/\text{ha/cycle}] \times [8.8 \text{ ha}] \times [2 \text{ cycles/yr}] = 98,120 \text{ m}^3/\text{yr} \]
- Estimated water quantity benefit is 98 ML/yr

Data Sources:
- Water usage data were provided in survey responses.

Assumptions
- Two full irrigation cycles are conducted per year.
- Assumed no depreciation in savings over 5 years (system continues to function as in 2009).

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
- Reduction in nutrient/chemical runoff to streams (no monitoring data provided)

NOTES
- None

REFERENCES

PROJECT NAME: Go Green! Go for the Real Thing!
PROJECT ID #: 77

DESCRIPTION OF ACTIVITY: Reforestation - Tree planting to help alleviate the denudation of mountains, forests, mangroves, and watershed areas

LOCATION: 30 sites across the Philippines

PRIMARY CONTACT:
Victor Z. Manlapaz
Project Officer, Environment
Coca-Cola Foundation Philippines, Inc.
1890 Paz Guazon Ave.
Paco, Manila 1007
Philippines
Tel. +632 866-2582; 0917 886-6054
victor.manlapaz@ccbp.com.ph

OBJECTIVES
- Decrease sediment erosion and surface water runoff

BACKGROUND & DESCRIPTION OF ACTIVITY:
This tree planting project was initiated by the Boy Scouts of the Philippines in partnership with Coca-Cola and will help alleviate the denudation of mountains, forests, mangroves, and watershed areas throughout the Philippines. The trees planted included hardwood and fruit-bearing varieties endemic to each locality. After establishing a nursery and a seedling bank (funded by Coca-Cola), more than 6,000 Scouts and other volunteers conducted tree planting activities over a two day period in 2009 at 30 locations throughout the country with a total of 10,466 trees planted. This included 381 volunteers from Coca-Cola Bottlers Philippines, Inc. (CCBPI) who participated in planting 5,640 trees at 13 sites in Bacolod, Calasiao, Carlatan, Cebu, Ilagan, Iloilo, Maycauayan, Naga, Sta. Rosa, Tacloban, Tagbilaran, and Zamboanga. On June 19, 2010, volunteers planted an additional 4,670 trees at 17 different sites located in Luzon, Visayas and Mindanao.

Zamboanga Tree planting site
Tagbilaran Mangrove planting site
ACTIVITY TIMELINE:
- June 2009 – July 2009: Planted 10,466 trees at 30 sites (30 hectares)
- June 2010: Planted 4,670 trees at 17 sites (9.5 hectares)

COCA-COLA CONTRIBUTION: 57%
- Total Cost of Project: $12,925.06 USD
  - 2009: $5,387.06 USD
  - 2010: $7,538 USD
- Coca-Cola Foundation $7,362.06 USD
  - 2009: $2,362.06 USD
  - 2010: $5,000 USD

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff for the conversion of open, unforested land to forested land. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):
• **Reforestation in 2009**: (~30 hectares)
  - **Pre-project**:
    - Hydrologic soil group (HSG) “D”
    - Grassland in “fair to poor” condition (CN = 87)
  - **Post-project**:
    - Hydrologic soil group (HSG) “D”
    - Woods/grass mixture in “fair” condition (CN = 82)

• **Reforestation in 2010**: (~9.5 hectares)
  - **Pre-project**:
    - Hydrologic soil group (HSG) “B”
    - Grassland in “fair to poor” condition (CN = 74)
  - **Post-project**:
    - Hydrologic soil group (HSG) “B”
    - Woods/grass mixture in “fair” condition (CN = 65)

Daily precipitation and air temperature data were obtained from the TuTiempo.net website for the Calapan station (http://www.tutiempo.net/en/Climate/Calapan/984310.htm) during the 2000-05 time period. The Hamon method was used to estimate daily potential evapotranspiration (PET) for this year based on daily average air temperature and latitude (Hamon, 1963).

Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases. Total annual runoff volumes and the resulting water quantity benefit were estimated as follows:

- **Pre-project (open space) runoff volume**: 446.2 ML/yr
- **Post-project (agro-forest land) runoff volume**: 427.0 ML/yr

**The total benefit (runoff reduction) is**: 19.2 ML/yr

**Data Sources/Site-specific characteristics:**

- Land condition pre-project: bare or grassland (assumed 50% of each)
- Land condition post-project: various native trees planted (Mahogany, Narra, Jackfruit, etc.)
- **Slope**:
  - 2009 reforestation: mostly “flat” (assume 5% slope)
  - 2010 reforestation: representative slopes of 5%, 25%, and 50% used for grouped sites
- **Soil type**:
  - 2009 reforestation: primarily clay (assume HSG type “D”)
  - 2010 reforestation: typically loam (assume HSG type “B”)
- Daily precipitation and air temperature data were obtained from TuTimpo.net for the Calapan station (ID: 984310).
Assumptions:

- Surface area for 2009 reforestation was approximately 30 ha (10,466 trees planted) based on 30 locations and a surface area of approximately 1 hectare per location.
- Surface area reforested in 2010 was approximately 9.5 ha, per information provided by contact.
- Assumed pre-project land condition was 50% grassland and 50% bare land
- Precipitation data for the Calapan station (2000-05) are representative of precipitation conditions for the agro-forested areas. (Average annual precipitation for these 6 years at this station was 2,254 mm.)
- SWAT model parameter “CNCOEF” was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).
- Soil erodibility factor (K) was assumed to be 0.24 for both pre- and post-project conditions.

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting open, unforested land to forested land. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for years 2000-05.

The Cover/Management Factors (C_{usle}) used in the MUSLE were estimated as follows based on Haith (1992):

- **Pre-project**: 60-80% cover as grass/weeds mixture (C_{usle} = 0.02)
- **Post-project**: 40-75% tree canopy cover (C_{usle} = 0.003)

Total annual sediment yields for the pre- and post-project conditions were estimated as follows:

- **Pre-project (unforested) sediment yield**: 1574 MT/yr
- **Post-project (forested) sediment yield**: 226 MT/yr

The total benefit (sediment yield reduction) is: 1,348 MT/yr

Data Sources:

- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:

- The Cover/Management Factor (C_{usle}) was assumed to remain constant through time (both seasonally and across years).
- The soil erodibility factor (K) was assumed to be 0.24 for use in MUSLE equation.
OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED

- None

NOTES

- This fact sheet updates the January 2010 fact sheet, by including additional benefits resulting from the June 2010 tree-planting activities, and accounts for new data indicating steeper slopes and more erodible land areas.

REFERENCES


PROJECT NAME: Caliraya Native Tree Nursery
PROJECT ID #: 80

DESCRIPTION OF ACTIVITY: Reforestation

LOCATION: Caliraya-Lumot watershed, city of Cavinti, province of Laguna, Philippines (14.306222°, 121.488472°)

PRIMARY CONTACT:
Victor Manlapaz  
Project Officer, Environment  
Coca-Cola Foundation Philippines, Inc. 
1890 Paz Guazon Ave. 
Paco, Manilla 1007 
Philippines 
Tel. +63 2 866-2582 
victor.manlapaz@ccbp.com.ph

Blas R. Tabaranza Jr.  
Haribon Foundation COO  
btabaranza@haribon.org.ph

OBJECTIVES
- Reforestation/revegetation

BACKGROUND & DESCRIPTION OF ACTIVITY:
This project aims to establish a native tree nursery on 2 hectares of land in Barangay Lewin, Municipality of Lumban, Province of Laguna. This project will enhance native tree species diversity and forest cover at the nursery site, which is predominantly grassland with small patches of open secondary-growth forest. The nursery is expected to propagate 12,500 seedlings per year, suitable for planting within the Caliraya-Lumot watershed, and reforest a total of 10 hectares at the end of a 2-year period. The project is part of a larger campaign, Haribon’s ROAD to 2020.

Additional activities include the education and initiation of active participation of various stakeholders (communities and local NGOs) in forest restoration.
A map of the Buhay Punlaan Nursery is shown below.

**ACTIVITY TIMELINE:**
- Start Date: April 2010
- Year 1 effort completed: March 2011
- Year 2 effort completed: 2012

**COCA-COLA CONTRIBUTION:** 100%*
- Total Cost of Project: $44,000 USD
- Coca-Cola Foundation ($44,000 USD, CCF-Atlanta Grant)

**WATERSHED RESTORATION BENEFITS CALCULATED:**
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

### 1. DECREASE IN RUNOFF

**Approach & Results**
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff for the conversion of open, unforested land to forested land. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.
Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **Pre-project:**
  - Hydrologic soil group (HSG) "C" (clay / clay loam)
  - Grassland in “good” condition (CN = 74)

- **Post-project:**
  - Hydrologic soil group (HSG) “C” (clay / clay loam)
  - Woods/grass mixture in “good” condition (CN = 70)

Daily precipitation and air temperature data were obtained from the TuTiempo.net website for the INFANTA station ([http://www.tutiempo.net/en/Climate/INFANTA/984340.htm](http://www.tutiempo.net/en/Climate/INFANTA/984340.htm)) during the 1991-94 time period. Average annual precipitation for this period was 3,180 mm, which is consistent with annual averages indicated by global GIS datasets (Hearn et al. 2003). The Hamon method was used to estimate daily potential evapotranspiration (PET) for this year based on daily average air temperature and latitude (Hamon, 1963). The annual average PET estimate for the 1991-94 period is 1,316 mm, which is consistent with global GIS datasets.

Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases. Total annual runoff volumes and the resulting water quantity benefit were estimated as follows:

- **Pre-project (open grasslands) runoff volume:** 195.2 ML/yr
- **Post-project (forested land) runoff volume:** 193.7 ML/yr

**The total benefit (runoff reduction) is:** 1.5 ML/yr

**Data Sources/Site-specific characteristics:**

- Land condition pre-project: grassland (assumed approximately 100% cover based on site photos)
- Land condition post-project: various native trees planted – 40-75% canopy cover once trees mature
- Slope: highly variable (assumed to be 25% slope on average)
- Soil type: primarily clay and clay loam (assume HSG type “C”)
- Daily precipitation and air temperature data were obtained from TuTimpo.net for the INFANTA station (ID: 984340).

**Assumptions:**

- Surface area for reforestation is approximately 10 ha (provided by contact).
- Assumed pre-project land condition was 100% grassland (grass/weed mixture).
- Used approximate average slope of 25%.
- Precipitation data for the INFANTA station for 1991-94 are representative of precipitation conditions for the reforested area. (Average annual precipitation for these 4 years at this station was 3,180 mm.)
• SWAT model parameter "CNCOEF" was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).
• Soil erodibility factor (K) was assumed to be 0.24 for both pre- and post-project conditions.

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting unforested land to forested land. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for years 1991-94.

The Cover/Management Factors ($C_{usle}$) used in the MUSLE were estimated as follows based on Haith (1992):
• Pre-project: grassland with 80% cover as grass/weeds ($C_{usle} = 0.01$)
• Post-project: woodland with 40-75% tree canopy ($C_{usle} = 0.003$)

Total annual sediment yields for the unforested and forested land areas were estimated as follows:
• Pre-project (open space) sediment yield: 1,599 MT/yr
• Post-project (forested) sediment yield: 476 MT/yr
• Benefit (sediment yield reduction): 1,123 MT/yr

Data Sources:
• See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:
• The tree canopy in the reforested areas was assumed to be mature.
• The Cover/Management Factor ($C_{usle}$) was assumed to remain constant through time (both seasonally and across years).
• The soil erodibility factor (K) was assumed to be 0.24 for use in MUSLE equation.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
• None

NOTES
• This fact sheet updates the January 2010 fact sheet by including quantification results.
REFERENCES


PROJECT NAME: Village that Learns and Earns
PROJECT ID #: 82

DESCRIPTION OF ACTIVITY: Water supply for community use/agriculture

LOCATION: Buriram, Thailand (villages of Ban Lim Thong and Ban Nong Thong Lim)

PRIMARY CONTACT:
Budsayada Youngfuengmontra (Nan)
Corporate Citizenship Manager
Coca-Cola (Thailand) Limited
Tel. 66-2-835-1477
Mobile. 66-81-752-1787
Fax. 66-2-835-1021
ybudsayada@apac.ko.com

OBJECTIVES
- Capture and store water for community and agricultural irrigation use
- Mitigate flood and drought impacts
- Maintain groundwater levels

BACKGROUND & DESCRIPTION OF ACTIVITY:
Thailand is an agricultural country and water resources in this country can be divided into three different areas: head watershed areas, water scarcity areas, and flooding areas. The linkage between water management and better living in villages is a sustainable success factor. Within Thailand, the heaviest precipitation falls in May and September. During periods of heavy rainfall, runoff depth can exceed one foot. Two primary activities have been implemented in Ban Lim Thong and Ban Nong Thong Lim, Buriram to capture excess runoff and make it available for productive uses in water scarce areas and/or during water scarce periods. These include:

1. Construction of pond storages for farmers (“monkey cheeks”); and
2. Canal restoration and vetiver grass planting.

The development of a clean water supply for the communities and the school is also part of this project; however, the benefits of these activities are quantified separately. Other components of this project are implementation of improved agricultural practices including cultivation, fertilization and irrigation measures that increase productivity. These agricultural practices include crop rotation and use of organic fertilizer and drip irrigation. Information technology (IT) training is being conducted for young leaders, as is training on the management of an IT center. A description of the quantified activities follows below.

1. **Monkey Cheeks** are a water retention concept championed by King Bhumibol Adulyadej to store water for the community. The Monkey Cheeks Project involves the construction of new water storage facilities (water retention ponds or Monkey Cheeks), water filtration treatment facilities, piping systems, and distribution canals. The term Monkey Cheeks comes from a monkey’s eating behavior whereby it collects food in both cheeks. The constructed water retention units store water and are connected to an existing main water canal and will fill, primarily, by capturing rainwater during the rainy season.
The project has two major benefits: 1) during periods of water shortage, the collected water will be used for agricultural purposes to increase crop production, especially in water scarcity areas (northeast region of Thailand); and 2) during the rainy season, the water retention units will help prevent flooding on farmlands.

Concept of Monkey Cheeks Reservoir Network

2. **Canal renovation** has been conducted for 3 km of canals, including 72 points of fortified barrages enlarging community’s catchment to store water in the rainy season and in the summer. This work involved the removal of sediments to improve water flow.

This project also includes the planting of vertiver grass and trees along the banks of the newly constructed retention ponds and irrigation canals to prevent soil erosion into the ponds and canals.

 Canal Renovation before (left) and after (right).
ACTIVITY TIMELINE:

- Project initiation: June 2006
- Project completion:
  - 2006 clean water supply for community
  - 2007 seven pond storages for farmers + vetiver grass
  - 2008 water supply for students
  - 2008 canal renovation 3 km + vetiver grass
  - 2008 eight pond storages for farmers + vetiver grass

COCA-COLA CONTRIBUTION: 95%

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Water provided for irrigation (monkey cheeks and canal renovation)
2. Decrease in sediment erosion/runoff (vetiver grass planting)

1. DECREASE IN RUNOFF

Approach & Results

**Monkey Cheeks:** The flood peak removal benefit of the 15 storage ponds was calculated by the Hydro and Agro Informatics Institute (HAIi) using a simple water budgeting model. This model calculates the flood peak removal based on pond volume and climate data from the Nang Rong station.

<table>
<thead>
<tr>
<th>Completion date</th>
<th>Pond No.</th>
<th>Area (m²)</th>
<th>Depth (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>1</td>
<td>3,600</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3,000</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2,400</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>6,400</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2,400</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>3,000</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>2,100</td>
<td>3</td>
</tr>
<tr>
<td>2008</td>
<td>8</td>
<td>6,000</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>1,600</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>1,600</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>1,600</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>8,100</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>6,000</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>2,000</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>2,250</td>
<td>3</td>
</tr>
</tbody>
</table>

The water for productive use benefit was computed based on the volume of irrigation water distributed to farms from the ponds during dry weather. This calculation was based on changes in pond storage, accounting for evaporation.
Water storage in all ponds for the 16-month period February 2009-May 2010

Water storage in all ponds (m³)

15 ponds total storage 132,941 m³

Jan-09 Feb-09 Mar-09 Apr-09 May-09 Jun-09 Jul-09 Aug-09 Sep-09 Oct-09 Nov-09 Dec-09 Jan-10 Feb-10 Mar-10 Apr-10 May-10

Irrigation water withdrawal 43,937 m³ (Feb 09 to May 10)

Flood peak removal 45,940 m³

Annual water quantity benefits for irrigation water distribution from the ponds

<table>
<thead>
<tr>
<th></th>
<th>7 ponds completed in 2007</th>
<th>8 ponds completed in 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yearly average</td>
<td>16.019</td>
<td>16.934</td>
</tr>
<tr>
<td>(ML/yr)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The total water quantity benefit (irrigation water distribution) of ponds (Monkey Cheeks) is 32.953 ML/yr.

Canal Renovation: The water quantity benefits of the canal renovations were calculated based on the additional storage of water available during the rainy season following sediment removal from the canals.

The total water quantity benefit (runoff reduction) of canal renovation is 120 ML/yr.

The total water quantity benefit of both the monkey cheeks ponds and the canal renovation is: 32.95 ML/yr + 120 ML/yr = 152.95 ML/yr.

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:

The decrease in sediment yield resulting from the planting of vetiver grass was calculated by HAII using the Universal Soil Loss Equation (USLE). The USLE was calculated for 5 subwatersheds totaling 12.91 km². Site-specific characteristics were input along with 2009-2010 climate data to calculate sediment erosion. The sediment yield after vetiver grass planting was calculated using a sediment removal efficiency of 90%.
The total water quality benefit (reduced sediment yield) of planting vetiver grass is 308 MT/yr.

<table>
<thead>
<tr>
<th>Subwatershed Area (km²)</th>
<th>Sediment Yield 2009 (MT)</th>
<th>Reduced sediment (MT/yr)</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.9</td>
<td>105.4</td>
<td>94.8</td>
<td>Phase 1 (2007)</td>
</tr>
<tr>
<td>1.2</td>
<td>68.4</td>
<td>61.5</td>
<td>Phase 1 (2007)</td>
</tr>
<tr>
<td>1.9</td>
<td>27.8</td>
<td>25.0</td>
<td>Phase 2 (2008)</td>
</tr>
<tr>
<td>1.8</td>
<td>85.3</td>
<td>76.8</td>
<td>Phase 2 (2008)</td>
</tr>
<tr>
<td>1.9</td>
<td>55.5</td>
<td>50.0</td>
<td>Phase 2 (2008)</td>
</tr>
</tbody>
</table>

OTHER BENEFITS NOT QUANTIFIED

- Additional financial profits of 4.75 million baht/yr (148,000 USD/yr) gained through improvements to the irrigation system.
- Improved agricultural practices and farmland productivity
- Water table increased due to increased infiltration.
- IT training aimed at improving approach for farming.

NOTES

- This fact sheet updates the January 2010 fact sheet by including quantification results based on information provided by HAII.

REFERENCES

- Buriram_USLE.xls
- Buriram_WaterBalance.xls
- Reviewing local initiatives to quantify water benefits from projects_2.ppt
- SWAT Fundamental Info.xls
PROJECT NAME: Bolsa Floresta Program
PROJECT ID #: 85

DESCRIPTION OF ACTIVITY: Conservation of tropical forests to maintain environmental services

LOCATION: State of Amazonas, Brazil

PRIMARY CONTACT:
Gabriel Ribenboim, Project Manager
Fundação Amazonas Sustentável
Technical Coordination Department for Carbon-related Projects
Rua Álvaro Braga, 351
Parque 10 de Novembro, Manaus
Amazonas, Brazil

Tel. +55 92 3648 4393
Fax: +55 92 3648 7425
E-mail: gabriel.ribenboim@fas-amazonas.org

OBJECTIVES
- Prevent deforestation and maintain hydrologic condition and environmental services provided by tropical forests
- Protect native habitat and support biodiversity.
- Improve the quality of life for residents of the protected areas.
- Protect water supply
- Reduce greenhouse gas emissions

BACKGROUND & DESCRIPTION OF ACTIVITY:
Historically, the State of Amazonas has had the lowest rate of deforestation in the Brazilian Amazon, and 98% of the State’s original forest cover is currently intact. Over the past few years, however there has been a trend of migration towards the central region of the Amazon, primarily in the State of Amazonas. In the future, significant deforestation is predicted to occur within the Brazilian State of Amazonas, with forest being converted into pasture and agricultural fields.

The Amazonas Sustainable Foundation (Fundação Amazonas Sustentável, FAS) has a mission to promote sustainable involvement, environmental conservation and life quality improvement for resident communities and users of the Amazonas State Conservation Units. The FAS actions are therefore directed to reduce deforestation and eradicate poverty, support social organization, improve social indicators and generate income based on sustainable activities.

FAS implements the Bolsa Floresta Program (Forest Allowance Program), which rewards traditional and indigenous populations for the maintenance of the environmental services provided by the tropical forests. Environmental Services are the benefits provided by the standing forests, such as climate stability, rain maintenance, carbon storage in the trees and biodiversity conservation.

The four components of the Forest Allowance Program are:
- Income: Payments to the local population for production of sustainable forest products;
• Social: Investments (payments) to improve education, health, communication and transportation for residents in the conservation units, to enhance their ability to serve as forest guardians;
• Family: Payments to mothers in the conservation units for their commitment to sustainable development and the environment; and
• Association: Financial support for local associations to strengthen their organization and social control of the Forest Allowance Program.

The Forest Allowance Program currently covers 14 Conservation Units and roughly 12.5 million hectares. The figure below shows the location of the 14 Conservation Units within the State of Amazonas and the predicted extent of deforestation by 2050. The projected deforestation schedule for the conservation units is also presented, with 2009 representing initial conditions in each reserve.

![Diagram of conservation units](image)

**Table 1. Reserve Areas and Projected Deforestation Schedule (% Deforestation)**

<table>
<thead>
<tr>
<th>Conservation Area</th>
<th>Total Area (ha)</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amana</td>
<td>2,221,864</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.14</td>
<td>0.17</td>
<td>0.72</td>
<td>1.07</td>
</tr>
<tr>
<td>Amapa</td>
<td>214,315</td>
<td>0.67</td>
<td>2.50</td>
<td>11.63</td>
<td>25.88</td>
<td>40.18</td>
<td>53.55</td>
<td>70.16</td>
<td>85.71</td>
<td>93.09</td>
</tr>
<tr>
<td>Canuma</td>
<td>22,758</td>
<td>4.70</td>
<td>11.47</td>
<td>22.14</td>
<td>36.29</td>
<td>46.65</td>
<td>60.30</td>
<td>68.42</td>
<td>70.89</td>
<td>72.13</td>
</tr>
<tr>
<td>Catua-Ipixuna</td>
<td>212,323</td>
<td>4.96</td>
<td>4.96</td>
<td>4.96</td>
<td>4.96</td>
<td>4.96</td>
<td>10.43</td>
<td>22.02</td>
<td>38.00</td>
<td>67.00</td>
</tr>
<tr>
<td>Cajubim</td>
<td>2,421,926</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.07</td>
<td>0.15</td>
</tr>
<tr>
<td>Juma Reserve</td>
<td>580,783</td>
<td>0.85</td>
<td>2.57</td>
<td>8.36</td>
<td>14.73</td>
<td>20.93</td>
<td>28.77</td>
<td>42.18</td>
<td>54.57</td>
<td>76.55</td>
</tr>
<tr>
<td>Mamiraua</td>
<td>1,310,802</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
<td>0.83</td>
<td>1.17</td>
<td>1.71</td>
</tr>
<tr>
<td>Maues</td>
<td>449,899</td>
<td>1.40</td>
<td>1.40</td>
<td>1.40</td>
<td>1.59</td>
<td>3.97</td>
<td>12.14</td>
<td>23.75</td>
<td>42.03</td>
<td>66.73</td>
</tr>
<tr>
<td>Piaguca/Purus</td>
<td>800,898</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.39</td>
<td>0.88</td>
<td>2.56</td>
<td>11.35</td>
</tr>
<tr>
<td>Rio Gregorio</td>
<td>466,797</td>
<td>1.65</td>
<td>10.79</td>
<td>30.05</td>
<td>46.13</td>
<td>63.24</td>
<td>77.10</td>
<td>83.63</td>
<td>87.09</td>
<td>90.09</td>
</tr>
<tr>
<td>Rio Madeira</td>
<td>279,632</td>
<td>3.86</td>
<td>3.96</td>
<td>5.35</td>
<td>7.03</td>
<td>8.46</td>
<td>11.73</td>
<td>18.29</td>
<td>35.52</td>
<td>71.11</td>
</tr>
<tr>
<td>Rio Negro</td>
<td>102,978</td>
<td>8.05</td>
<td>28.78</td>
<td>59.06</td>
<td>73.34</td>
<td>81.40</td>
<td>85.98</td>
<td>88.36</td>
<td>88.36</td>
<td>88.36</td>
</tr>
<tr>
<td>Uacari</td>
<td>620,300</td>
<td>0.55</td>
<td>0.55</td>
<td>0.55</td>
<td>0.55</td>
<td>0.55</td>
<td>0.55</td>
<td>0.55</td>
<td>0.58</td>
<td>1.59</td>
</tr>
<tr>
<td>Uatuma</td>
<td>423,459</td>
<td>0.64</td>
<td>1.61</td>
<td>4.89</td>
<td>8.98</td>
<td>12.92</td>
<td>21.89</td>
<td>33.66</td>
<td>48.97</td>
<td>69.95</td>
</tr>
</tbody>
</table>

*Source: Protected_Areas_DeforestationRate_FAS.xlsx provided on June 17, 2010.*
Because goals and activities within the 14 Conservation Units are similar, more detailed information for one project is provided below to represent all project activities.

The Juma Sustainable Development Reserve Project for Reducing Greenhouse Gas Emissions from Deforestation (Juma Reserve RED Project). The Juma Reserve RED Project is located in the southeastern region of the Brazilian State of Amazonas and encompasses 580,783 hectares. The project area is covered almost entirely by well-preserved, dense tropical forest. Simulation models project that up to 76.55% of the forest within the Juma Reserve will be deforested by the year 2050, under a “business as usual” scenario (personal communication, Pedro Fraga). Within the context of the Amazon, the felling of the forest is preceded by fire, which kills the trees and leaves a layer of ash on the forest floor. The ground is left unprotected and is more susceptible to erosion. The loss of vegetation also interrupts the flow of water into the atmosphere through evapotranspiration.

![Figure 1. Vegetation within the Juma Sustainable Development Reserve](image)

By 2050, the implementation of project activities will result in conservation of 444,589 hectares of tropical forest, which are otherwise predicted to be deforested. The activity that could be quantified
within the Juma Reserve involves conservation of 444,589 hectares of tropical forest, thereby preventing further expansion of agricultural and forest areas.

**COKE CONTRIBUTION:** 33% for all 14 conservation units

- The Coca-Cola Brazil contribution is an endowment fund to FAS, with FAS managing the investment interest supporting all 14 conservation reserves. Coca-Cola’s percent contribution varies between conservation units, with the average for all 14 conservation units equal to 33%.

**WATERSHED RESTORATION BENEFITS CALCULATED:**
1. Decrease in runoff water quantity
2. Decrease in sediment runoff

---

### 1. DECREASE IN RUNOFF WATER QUANTITY

**Approach & Results:**

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff by comparing the current (forested) to the future projected (deforested) condition for each reserve. Water quantity calculations were focused on estimating the change in runoff volume because runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield.

Curve numbers for the pre-project condition and the post-project condition for all reserve areas were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **Current Condition (native rainforest):**
  - Hydrologic soil group (HSG) “A”
  - Woodland in “good” condition (CN = 30)

- **Degraded Condition (mixed land use):**
  - Hydrologic soil group (HSG) “A”
  - Land use/cover distribution based on the Juma project design report (FAS, 2008):
    - Productive pasture – 43.8% (CN = 39);
    - Degraded pasture – 5.2% (CN = 68);
    - Cropland – 4.0% (CN = 60);
    - Secondary forest derived from pasture – 44.9% (CN = 36);
    - Secondary forest derived from cropland – 2.0% (CN = 40).

Historical daily precipitation data were provided by the project contact for various meteorological stations located in the vicinity of the reserve areas. Reserve areas were grouped based on their location and assigned a 10-year precipitation dataset that was judged to be representative of the region. Table 3 lists the precipitation dataset selected for each reserve area. A daily air temperature time series was developed for each of the reserve area groups shown in Table 2 based on historical monthly average air temperature obtained from global GIS datasets (Hearn et al. 2003). The Hamon method was used initially to estimate daily potential evapotranspiration (PET) for this year based on estimated daily
average air temperature and latitude (Hamon, 1963). These estimates compared favorably to summaries available from Hearn et al. (2003).

<table>
<thead>
<tr>
<th>Conservation Area(s)</th>
<th>Meteorological Station</th>
<th>Time Period</th>
<th>Mean Annual Rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amapa, Juma Reserve, Rio Madeira, Piaguca/Purus</td>
<td>SÃO PEDRO</td>
<td>1999-2008</td>
<td>2,486</td>
</tr>
<tr>
<td>Maues, Canuma</td>
<td>NOVA OLINDA DO NORTE</td>
<td>1999-2008</td>
<td>2,318</td>
</tr>
<tr>
<td>Amana, Mamiraua</td>
<td>SÃO PEDRO</td>
<td>1999-2008</td>
<td>2,486</td>
</tr>
<tr>
<td>Uacari, Cajubim</td>
<td>COLOCAÇÃO CAXIAS VERIFICAR COORD</td>
<td>1999-2008</td>
<td>2,941</td>
</tr>
<tr>
<td>Catua-Ipixuna</td>
<td>BARRO ALTO-SÃO RAIMUNDO DO IPIXUNA</td>
<td>1999-2008</td>
<td>2,226</td>
</tr>
</tbody>
</table>

Water quantity benefit estimates were developed for the 2010-15 time period based on the Curve Number approach for each of the 14 reserve areas. These results are summarized in Table 3 below.

<table>
<thead>
<tr>
<th>Conservation Area</th>
<th>Water Quantity Benefit as Reduced Runoff (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
</tr>
<tr>
<td>Amana</td>
<td>4,757</td>
</tr>
<tr>
<td>Amapa</td>
<td>2,318</td>
</tr>
<tr>
<td>Canuma</td>
<td>1,807</td>
</tr>
<tr>
<td>Catua-Ipixuna</td>
<td>17,374</td>
</tr>
<tr>
<td>Cajubim</td>
<td>2,278</td>
</tr>
<tr>
<td>Juma Reserve</td>
<td>7,950</td>
</tr>
<tr>
<td>Mamiraua</td>
<td>16,384</td>
</tr>
<tr>
<td>Maues</td>
<td>10,619</td>
</tr>
<tr>
<td>Piaguca/Purus</td>
<td>4,131</td>
</tr>
<tr>
<td>Rio Gregorio</td>
<td>11,462</td>
</tr>
<tr>
<td>Rio Madeira</td>
<td>17,376</td>
</tr>
<tr>
<td>Rio Negro</td>
<td>13,974</td>
</tr>
<tr>
<td>Uacari</td>
<td>5,631</td>
</tr>
<tr>
<td>Uatuma</td>
<td>4,533</td>
</tr>
<tr>
<td><strong>Total Benefit:</strong></td>
<td><strong>120,593</strong></td>
</tr>
</tbody>
</table>
Example Calculation:

Using Juma Reserve as an example, the “with conservation” and “without conservation” runoff was calculated as:

- **“Without Conservation” (degraded rainforest)**: 1,114 mm/yr
- **“With Conservation” (native rainforest)**: 953 mm/yr
- **Benefit (runoff reduction)**: 161 mm/yr

This estimate is multiplied by the total cumulative surface area of native rainforest where deforestation was prevented, as projected for a specific year. For example, as shown in Table 1, by the end of 2015 it is projected that deforestation will have been prevented for 2.57% of the total Juma Reserve area (580,783 ha = 5.81e9 m²). Therefore, the total water quantity benefit realized for the Juma Reserve in 2015 is estimated to be: (0.0257) * (5.81e9 m²) * (0.161 m/yr) =~ 2.40e7 m³/yr or 24,000 ML/yr.

Data Sources:

- Size of reserve areas and schedule for deforestation - see Table 1.
- Type and proportion of land use/cover following deforestation – based on Table 06 in the Juma project design report (FAS, 2008)
- Land surface slope - assumed to be 2% for all reserve areas.
- Soil type – assumed to be Hydrologic Soil Group type “A” based on a review of global soil drainage estimates (Batjes, 1996).
- Meteorological stations – daily precipitation datasets provided by contact (see summary in Table 2); daily air temperature estimates based on monthly data summaries provided in Hearn et al. (2003).

Assumptions:

- Water quantity benefits were calculated according the projected deforestation schedule estimated by Amazonas Sustainable Foundation (FAS) for the 2010-2050 period.
- Best estimates of Curve Numbers were developed for the native rainforest condition and the deforested / degraded rainforest land use/cover types.
- SWAT model parameter “CNCOEF” was conservatively set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. **DECREASE IN SEDIMENT RUNOFF**

Approach & Results:

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur if the reserves were protected (i.e., as native rainforest) and not deforested as anticipated without this project. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for the time periods summarized in Table 2 for each reserve area.
The Cover/Management Factors (\(C_{usle}\)) used in the MUSLE were estimated as follows based on Haith (1992):

- **“With Conservation”:** native rainforest (\(C_{usle} = 0.001\))
- **“Without Conservation”:** deforested condition
  - Productive pasture – 43.8% (\(C_{usle} = 0.02\));
  - Degraded pasture – 5.2% (\(C_{usle} = 0.04\));
  - Cropland – 4.0% (\(C_{usle} = 0.05\));
  - Secondary forest derived from pasture – 44.9% (\(C_{usle} = 0.003\));
  - Secondary forest derived from cropland – 2.0% (\(C_{usle} = 0.003\)).

Water quality benefit estimates were calculated for the 2010-15 time period based on the MUSLE-based approach described above for each of the 14 reserve areas. These results are summarized in Table 4 below.

**Table 4. Estimated Water Quality Benefits by Reserve Area for 2010-15**

<table>
<thead>
<tr>
<th>Conservation Area</th>
<th>Water Quality Benefit as Reduced Sediment Yield (MT/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
</tr>
<tr>
<td>Amana</td>
<td>4,302</td>
</tr>
<tr>
<td>Amapa</td>
<td>2,097</td>
</tr>
<tr>
<td>Canuma</td>
<td>1,342</td>
</tr>
<tr>
<td>Catua-Ipxuna</td>
<td>12,738</td>
</tr>
<tr>
<td>Cajubim</td>
<td>2,926</td>
</tr>
<tr>
<td>Juma Reserve</td>
<td>7,190</td>
</tr>
<tr>
<td>Mamiraua</td>
<td>14,818</td>
</tr>
<tr>
<td>Maues</td>
<td>7,888</td>
</tr>
<tr>
<td>Piaguca/Purus</td>
<td>3,736</td>
</tr>
<tr>
<td>Rio Gregorio</td>
<td>11,397</td>
</tr>
<tr>
<td>Rio Madeira</td>
<td>15,715</td>
</tr>
<tr>
<td>Rio Negro</td>
<td>9,735</td>
</tr>
<tr>
<td>Uacari</td>
<td>7,233</td>
</tr>
<tr>
<td>Uatuma</td>
<td>3,158</td>
</tr>
<tr>
<td><strong>Total Benefit:</strong></td>
<td><strong>104,274</strong></td>
</tr>
</tbody>
</table>
Example Calculation:
Using the Juma Reserve as an example, the “with conservation” and “without conservation” sediment yields were estimated as:

- “With Conservation” (native rainforest): 0.108 MT/ha/yr (metric ton per hectare per year)
- “Without Conservation” (degraded rainforest): 1.564 MT/ha/yr
- Benefit (reduced sediment yield): 1.456 MT/ha/yr

The approach for calculating the total sediment benefit based on deforestation schedule is analogous to the approach used for the water quantity (runoff) calculations. The sediment yield reduction estimate of 1.456 MT/ha/yr is multiplied by the total cumulative surface area of native rainforest where deforestation was prevented (as projected for a specific year). For example, as shown in Table 1, by the end of 2015 it is projected that deforestation will have been prevented for 2.57% of the total Juma Reserve area (580,783 ha). Therefore, the total water quality benefit realized for the Juma Reserve in 2015 is estimated to be: (0.0257) * (580,783 ha) * (1.456 MT/ha/yr) =~ 21,700 MT/yr.

Data Sources:
- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:
- The Cover/Management Factor (Cusle) was assumed to remain constant through time (both seasonally and across years).
- The soil erodibility factor (K) was conservatively assumed to be 0.24 for use in MUSLE equation.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
- Protection of forests with high conservation value: protect species at risk of extinction while also preserving the quality of life for families that live in these areas.
- Reduction of greenhouse gas emissions
- Maintenance of the natural hydrologic cycle of the Amazon, which contributes to the distribution of precipitation in the entire southeastern area of South America as well as Central and North America (FEARNSIDE, 2004).
REFERENCES


PROJECT NAME: Siembra de Arboles
PROJECT ID #: 88

DESCRIPTION OF ACTIVITY: Reforestation of 2.5 acres of livestock pasture


PRIMARY CONTACT:
Mónica Cartín
Gerente de Asumtos Cientificos Regulatorios y Ambientales para Centroamerica
Tel: (506) 2299 3411
mcartin@la.ko.com

OBJECTIVES:
- Reduce runoff and associated sedimentation
- Protect drinking water supply
- Improve habitat/increase biodiversity
- Reestablish or protect corridor for wildlife passage

BACKGROUND & ACTIVITY DESCRIPTION:
The project area is located in the Parismina River sub-basin in eastern Costa Rica. The project area was previously used for livestock pasture and is very flat (slope < 3%). In June 2010, 816 Coral Oak (Terminalia amazonia) trees were planted on 2.5 acres. The trees were planted 3.5 meters apart. This area is part of a project of 20 hectares that were planted on the same day. Earth University continues to manage and care for the trees.

Photos of the project area and Coral Oak are shown below.
ACTIVITY TIMELINE:

- June 17, 2010 - Reforestation of 2.5 acres (816 trees planted). EARTH University will provide for maintenance during the lifetime of the trees.

COCA-COLA CONTRIBUTION: 100%

- Project is fully funded by Coca-Cola ($39,801 USD)

WATERSHED RESTORATION BENEFITS CALCULATED:

1. Decrease in runoff
2. Decrease in sediment erosion/runoff

1. DECREASE IN RUNOFF

Approach & Results:

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff for the conversion of unforested pasture to forested land. Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **Pre-project**: (pasture)
  - Hydrologic soil group (HSG) “C”
  - Pasture/grassland in “poor” condition (CN = 86)

- **Post-project**: (forested)
  - Hydrologic soil group (HSG) “C”
  - Woodland in “good” condition (CN = 70)

Daily precipitation and air temperature data were obtained from the TuTiempo.net online meteorological database for the Puerto Limon station for the 1974-2009 period (http://www.tutiempo.net/en/Climate/Puerto_Limon/787670.htm). Data were incomplete for most of the years during this time period. Ultimately, year 2006 was selected for the analysis because 1) precipitation and temperature data were available for 98% of the days for this year, and 2) the total precipitation of 3,446 mm for this year was representative of annual/monthly summaries provided by the contact, as well as information available from global GIS datasets (Hearn et al. 2003). The Hamon method was used to estimate daily potential evapotranspiration (PET) for this year based on daily average air temperature and latitude (Hamon, 1963). The precipitation, air temperature, and PET time series for 2006 were repeated 10 times to provide a 10-year simulation of water and sediment runoff.
Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases. Total annual runoff volumes and the resulting water quantity benefit were estimated as follows:

- **Pre-project (open space) runoff volume**: 23.2 ML/yr
- **Post-project (reforested land) runoff volume**: 22.6 ML/yr

**The total benefit (runoff reduction) is: 0.6 ML/yr**

**Data Sources:**
- Size of reforested land area: 1.01 ha or 2.5 acres (provided by contact)
- **Slope**: ~3% (provided by contact)
- **Soil type**: moderately clayey (assigned as HSG “C”)
- Daily precipitation and air temperature data were obtained from the online “TuTiempo.net” meteorological database (http://www.tutiempo.net/en/) for the Puerto Limon station (ID: 787670).

**Assumptions:**
- SWAT model parameter “CNCOEF” was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

### 2. DECREASE IN SEDIMENT EROSION/RUNOFF

**Approach & Results:**

The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the Soil & Water Assessment (SWAT) model was used to compute the change in sediment erosion and washoff that would occur as a result of converting unforested land to forested land. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for year 1987.

The Cover/Management Factors (Cusle) used in the MUSLE were estimated as follows based on Haith (1992):

- **Pre-project**: pasture with 60% grass cover assumed (Cusle = 0.04)
- **Post-project**: woodland with approximately 75% tree canopy (Cusle = 0.002)

Total annual sediment yields for the unforested and forested land areas were estimated as follows:

- **Pre-project (open space) sediment yield**: 19.5 MT/yr
- **Post-project (forested) sediment yield**: 1.0 MT/yr

**The total benefit (sediment yield reduction) is: 18.5 MT/yr**
Data Sources:
- See previous runoff section for a description of supporting meteorological and physical datasets and sources.

Assumptions:
- The tree canopy in the reforested areas was assumed to be mature.
- The Cover/Management Factor (C_{usle}) was assumed to remain constant through time (both seasonally and across years).
- The soil erodibility factor (K) was assumed to be 0.24 for use in MUSLE equation.

OTHER BENEFITS NOT QUANTIFIED
- Corresponding increases in infiltration and groundwater baseflow to local stream networks
- Habitat improvements benefiting terrestrial wildlife

NOTES
- None

REFERENCES


PROJECT NAME: Turkmenistan'da Forest Irrigation Project
PROJECT ID #: 90

DESCRIPTION OF ACTIVITY: Irrigation of forest lands (water for productive use)

LOCATION: Turkmenistan

PRIMARY CONTACT:
Emin Dostiyari
Senior EOSH Specialist
Coca-Cola Southern Eurasia BU
Tel: +994 12 3460984
Fax: +994 12 3460989
Mob: +994 50 3741440
E-mail: EDostiyari@eur.ko.com

OBJECTIVES

- Reduce runoff and associated pollutant loads
- Provide habitat/increase biodiversity

BACKGROUND & DESCRIPTION OF ACTIVITY:

City authorities allocated 47.3 hectares of land for planting of trees by the Turkmenistan Coca-Cola plant. Currently 15,200 trees have been planted in the allocated territory. The plant pumps and transports water from the plant’s wells to irrigate the forest.

ACTIVITY TIMELINE:

- Start Date: Approximately 2005
- End Date: Project is ongoing

COCA-COLA CONTRIBUTION: 100%

- Project is fully funded by Coca-Cola

WATERSHED RESTORATION BENEFITS CALCULATED:

1. Water provided for productive use
1. WATER PROVIDED FOR PRODUCTIVE USE

Approach & Results
The plant provided an estimate of the volume of water provided (9,940 cubic meters/year)

The total benefit (water provided) is: 9.94 ML/year.

Data Sources:
Data were provided by the Turkmenistan plant.

Assumptions
- None

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
- Water quantity and water quality benefits of reforestation activity will be calculated when required data are available.

NOTES
- None

REFERENCES
**PROJECT NAME:** Improving River Management Practices in the Yangtze

**PROJECT ID #:** 91

**DESCRIPTION OF ACTIVITY:** Irrigation system and habitat improvements

**LOCATION:** Anlong Village, Pi County, Sichuan Province, China

**PRIMARY CONTACT:**
Lindsay Bass
WWF – US
(202) 495-4334
Lindsay.Bass@wwfus.org

**OBJECTIVES:**
- River and wetland restoration and enhancement
- Improve availability of irrigation water
- Improve habitat/increase biodiversity

**BACKGROUND & ACTIVITY DESCRIPTION:** This project area is part of the vast Dujiangyan Irrigation System of the Chengdu Plain, which has operated for more 2200 years. The irrigation system is made up of thousands of small interconnected rivers. These “fan-shaped river nets” irrigate the entire Chengdu Plain, and sustain a rich agricultural landscape and provide habitat for numerous plant and animal species. Rapid development in the Chengdu Plain has contributed to physical alterations, agricultural and domestic pollution, degradation of the waterways and riparian areas and loss of wetland function.

In Anlong Village, sluice gates control water that flows via gravity from the Zouma River into the Power Station Canal (Figure 1). Water flows through the canal and some water is used to irrigate local fields. The canal flows through the Unnamed Lake and back into the Zouma River.

![Figure 1. Anlong Village Project Area](image)
The canal was originally wide and deep but it has silted up as agricultural activities have increased in the region over the past half-century. Sluice gates were also not functioning properly and farmers were not getting enough water during the dry season and fields were flooded during the wet season. The lake was silted up and degraded. The local government had planned to address these issues by dredging and solidifying the canals with cement.

This WWF project was designed to demonstrate an alternate approach to irrigation improvements that also improves ecosystem function. Restoration activities focused on cleaning out the sediment, widening and deepening the riverbed, sluice gate improvements, dredging the lake, along with other restoration activities such as riparian plantings (Figure 2). As a result, there have been significant improvements to the ecosystem, less water wasted, and improved and more reliable water supply for farmers.

**SUMMARY OF REPLENISH BENEFIT:**
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 286.16 ML/yr

**ACTIVITY TIMELINE:**
- June 2010: Project initiation
- 2011: Project completion

**COCA-COLA CONTRIBUTION:** 100%
- Project is fully funded by Coca-Cola ($556,547USD)

**WATERSHED BENEFITS CALCULATED**
1. Increased flow

1. **INCREASE IN FLOW**

**Approach & Results:**

The increased volume of irrigation water provided to nature and farmers due to sluice gate repair and channel improvements was calculated based on the difference in pre and post-project monitoring data (WWF, 2012).

Pre-project Irrigation water volume:
- Zone A1: 132710.4 m$^3$/year = 132.7104 ML/yr
- Zone A2: 106168.3 m$^3$/year = 106.1683 ML/yr
- Zone A3: 212336.6 m$^3$/year = 212.3366 ML/yr
- Zone A4: 159252.5 m$^3$/year = 159.2525 ML/yr

**Subtotal:** 610467.8 m$^3$/year = 610.4678 ML/yr

Post-project irrigation water volume:
- Zone A1: 194918.4 m$^3$/year = 194.9184 ML/yr
- Zone A2: 155934.7 m$^3$/year = 155.9347 ML/yr

Figure 2. Riparian restoration activities
Zone A3: 311869.4m³/year = 311.8694 ML/yr
Zone A4: 233902.1m³/year = 233.9021 ML/yr
Subtotal: 896624.6m³/year = 896.6246 ML/yr

Total increased volume: (896.6246 ML/yr - 610.4678 ML/yr) = 286.1568 ML/yr

The total (ultimate) benefit is: 286.16 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 286.16 ML/yr

The current (2011) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 286.16 ML/yr and TCCC’s benefit (adjusted for cost share) is 286.16 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

### Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>286.16</td>
<td>286.16</td>
</tr>
<tr>
<td>2014</td>
<td>286.16</td>
<td>286.16</td>
</tr>
<tr>
<td>2015</td>
<td>286.16</td>
<td>286.16</td>
</tr>
<tr>
<td>2016</td>
<td>286.16</td>
<td>286.16</td>
</tr>
<tr>
<td>2017</td>
<td>286.16</td>
<td>286.16</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>286.16</td>
<td>286.16</td>
</tr>
</tbody>
</table>

Data Sources:

- Pre and post-project volumes: WWF 2012

Assumptions:

- It is assumed that the system continues to be maintained. This will be verified on an annual basis.

OTHER BENEFITS NOT QUANTIFIED

- Improved habitat/increase biodiversity
- Education and awareness
NOTES

- Increased flow through the system combined with habitat enhancements provides more water for farmers and ecosystem benefits.

REFERENCES


PROJECT NAME: Improving River Management Practices in the Yangtze
PROJECT ID #: 91

DESCRIPTION OF ACTIVITY: Wetland restoration in Yunqiao Village

LOCATION: Yunqiao Village in Chengdu City, China (Latitude/Longitude: 30.8751, 103.89)

PRIMARY CONTACTS:
Xu Changjiang, WWF China
Room 603 Wu Ding Yuan, Shan Yang Zuo
No.100 Ber Er Duan Yi Huan Lu
Chengdu 610081, P.R. China
+86 28 68003625 Ext.816
chjxu@wwfchina.org

Lindsay Bass, WWF-US
1250 24th St.,
NWWashington, DC 20037-1193
202-495-4334
lindsay.bass@wwfus.org

OBJECTIVES
- Protect drinking water source from agricultural non-point source pollution
- Improve wetland habitat/increase biodiversity
- Help recharge a groundwater aquifer for local village use

BACKGROUND & DESCRIPTION OF ACTIVITY: The project site, Yunqiao Village, is shown below and is part of the Dujiangyan Irrigation Systems, an ancient irrigation system that has been in operation for more than 2,200 years. Fed by the Min River in the Upper Yangtze basin, the Dujiangyan System creates a network of small rivers and irrigation channels that irrigate the Chengdu Plain and support abundant agriculture activity. The water that flows through Yunqiao Village provides about 80 percent of the drinking water for Chengdu City, and are a government priority for source water protection.
Development activities across the Chengdu Plain have degraded wetland and riparian habitats, increased agricultural and domestic wastewater pollution, and increased sedimentation of rivers and ancient irrigation channels.

Since 2007, WWF has been implementing conservation projects to protect water source areas in Chengdu City. These activities have helped preserve the natural functioning of small rivers and irrigation channels, while also providing examples of rural pollution control through the implementation of biogas digesters, constructed wetlands, environmental-friendly farming and community-based environmental management in Yuantian and Yunqiao villages.

Starting in 2011, WWF implemented several additional activities in Yunqiao village to address non-point source pollution, create wetland habitat, and recharge the local groundwater aquifer in a sensitive source water area. Project work focused on: 1) the conversion of five hectares from rice paddy farming to natural habitat, 2) the creation of a 1.33 hectare wetland within the project site to restore habitat for local wildlife and remove nutrient pollution from existing soils and overland flow from surrounding farms, 3) removal of invasive plants (such as Alternanthera philoxeroides) and establishment of native wetland species across more than three hectares of the project site, and 4) diversion of irrigation channel water into the wetland area to support healthy functioning of the system.
Transitioning the area near the water plant’s intake pipe from farming to natural habitat is expected to reduce the amount of non-point source pollution in the immediate vicinity, create a natural wetland landscape, and help recharge the groundwater aquifer used by local villagers. The project team has, in collaboration with the Chinese Academy of Sciences (CAS), established a monitoring plan that will track wetland health through transect assessments of wetland plant distribution and composition changes. The team is also working with CAS to assess water quantity and quality changes over time. With government support, the team has been able to enlist the assistance of local villagers in monitoring the project site through trainings and use of simple, yet effective monitoring techniques.

The recent launch of the TCCC Volunteer Program brought employees from one of Coca-Cola Greater China’s largest bottlers, the Bottlers Investment Group (BIG) and representatives from the company’s business unit to Yunqiao to assist with continued restoration of the wetland area.
SUMMARY OF REPLENISH BENEFIT

• 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 504.9 ML/yr

ACTIVITY TIMELINE:

• 2011: 100 % complete

COCA-COLA CONTRIBUTION: 100%

• Total Cost of Project: $80,645 USD
  o Coca-Cola: $80,645 USD (500,000 Chinese Yuan)

WATERSHED BENEFITS CALCULATED:

1. Added water quantity

1. ADDED WATER QUANTITY

Approach & Results:
To supplement the influx of water to the wetland via overland flow from nearby farms in the watershed, the team negotiated the diversion of a small portion of flow from an adjacent irrigation channel to supplement the water levels of the secondary wetland area. The additional water flows into the core wetland area, which is approximately 1.33 hectares in area. To support better wetland health, the team also increased the storage capacity of the core zone by increasing the depth by 1.0 meter. At the inlet of core wetland area, the influent volume is 0.2 meters per second – a volume necessary to maintain healthy water levels in the wetland’s core zone.

The establishment of the secondary wetland creates water quantity benefits through the addition of water into the wetland that was absent previously and improving the storage capacity of the core wetland area.

The replenish benefit is estimated as the total volume of water diverted from the irrigation channel annually to the wetland area to promote ecological functioning and groundwater recharge. The water quantity benefit is calculated as follows:

\[
\text{Influent water volume (m}^3/\text{s)} = \text{channel width (m) } \times \text{ channel depth (m) } \times \text{ velocity (m/s)}
\]

\[
= 0.4 \text{ m} \times 0.2 \text{ m} \times 0.2 \text{ m/s} = 0.016 \text{ m}^3/\text{s}
\]

\[
0.016 \text{ m}^3/\text{s} \times 3.15569 \times 10^7 \text{ seconds/year} = 504,910,000 \text{ L/year} = 504.9 \text{ ML/yr}
\]

It is expected that the water will flow into the wetland throughout the year. The flow rate of 0.016 m³/s was measured during the dry season. Therefore, the replenish benefit is a conservative estimate.

Total (ultimate) benefit is: 504.9 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 504.9 ML/yr
The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2012 Replenish Benefit**

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 504.9 ML/yr and TCCC’s benefit (adjusted for cost share) is 504.9 ML/yr.

**Projected Replenish Benefits**

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>504.9</td>
<td>504.9</td>
</tr>
<tr>
<td>2014</td>
<td>504.9</td>
<td>504.9</td>
</tr>
<tr>
<td>2015</td>
<td>504.9</td>
<td>504.9</td>
</tr>
<tr>
<td>2016</td>
<td>504.9</td>
<td>504.9</td>
</tr>
<tr>
<td>2017</td>
<td>504.9</td>
<td>504.9</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>504.9</td>
<td>504.9</td>
</tr>
</tbody>
</table>

Data sources

- Calculations were provided by WWF.
- The flow rate of 0.016 cubic meters/second was measured during the dry season.

Assumptions

- Wetland water levels will be maintained each year through steady water flows from the adjacent irrigation channel that reflect WWF’s calculated average flow cited above (0.016 cubic meters/sec).

**OTHER BENEFITS NOT QUANTIFIED**

- None

**NOTES**

- None

**REFERENCES**


PROJECT NAME: Improving River Management Practices in the Yangtze
PROJECT ID #: 91

DESCRIPTION OF ACTIVITY: Reforestation in 150 ha of the Nibashan Panda Corridor

LOCATION: Nibashan Mountain in Siping Town, Yingjing County, Ya’an City, Sichuan Province

PRIMARY CONTACT: Lindsay Bass
WWF –US
(202) 495-4334
Lindsay.Bass@wwfus.org

OBJECTIVES:
- Restore important Panda corridor connection
- Reduce runoff / increase infiltration
- Reduce flooding and drought impacts
- Reduce local climate change

BACKGROUND & ACTIVITY DESCRIPTION: Reforestation has been completed on about 150 ha of the Nibashan Panda corridor. The area is a vital landscape for giant Panda migration. The project area is currently affected due to deforestation and the disturbance of No 108 National Highway. Reforestation involved growing Cathay poplar (P. cathayana) trees, which are native to this area.

SUMMARY OF REPLENISH ACTIVITY
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 66 ML/YR

ACTIVITY TIMELINE:
- Project initiation: June 2011
- 2012: 100% complete

COCA-COLA CONTRIBUTION: 100 %
- Project is fully funded by Coca-Cola

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff

1. DECREASE IN RUNOFF

Approach & Results:
The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff for the conversion of unforested land (unmanaged grassland) to forested land. Water quantity calculations were focused on estimating the change in runoff volume because: 1) runoff serves as a useful indicator for hydrologic improvements (e.g., enhanced baseflow); and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.
Curve numbers for the pre-project condition and the post-project condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

- **Pre-project:**
  - Hydrologic soil group (HSG) “B”
  - Pasture, grasslands or range in “poor” condition (CN = 79)

- **Post-project:**
  - Hydrologic soil group (HSG) “B”
  - Woodland in “good” condition (CN = 55)

Daily precipitation and air temperature data for climate station located in the city of Ya’an was obtained from the TuTiempo.net online meteorological database for the 1958-2008 time period. The data for this station were incomplete for many of the available years; however, climate data for 10 years within the 1958 – 2008 period provided a reasonably complete time series of precipitation and air temperature. The long-term annual average precipitation, based on 10 years of data, is 1,723 mm. The Hamon method was used to estimate daily potential evapotranspiration (PET) based on daily average air temperature and latitude (Hamon, 1963).

Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases. The total water quantity benefit was estimated as the difference between the annual pre-project and post-project runoff volumes.

- **Pre-project (unmanaged land):** 1,389 ML/yr
- **Post-project (reforested land):** 1,323 ML/yr
- **Benefit (runoff reduction for 2012):** 66 ML/yr

The total (ultimate) benefit is: 66 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 66 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2011 Replenish Benefit**

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 66 ML/yr, and TCCC’s benefit (adjusted for cost share) is 66 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>2014</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>2015</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>2016</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>2017</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>66</td>
<td>66</td>
</tr>
</tbody>
</table>

Data Sources:
- **Size of reforested land area**: 150 ha (provided by contact)
- **Slope**: typically less than 30 degrees or 57.7% (provided by contact)
- Daily precipitation and air temperature data were obtained from the online “TuTiempo.net” meteorological database for climate station located at the City of Ya’an [http://www.tutiempo.net/en/Climate/YAAN/562870.htm](http://www.tutiempo.net/en/Climate/YAAN/562870.htm).

Assumptions:
- The pre-project land cover can be characterized as open grassland/pasture/rangeland with approximately less than 50% vegetative cover.
- The slope conditions for the reforested area are approximately 30% on average.
- SWAT model parameter “CNCOEF” was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

OTHER BENEFITS NOT QUANTIFIED
- Corresponding increases in infiltration and groundwater baseflow to local stream networks
- Habitat improvements benefiting terrestrial wildlife
- Decrease in sediment erosion

NOTES
- None

REFERENCES


PROJECT NAME: Improving River Management Practices in the Yangtze  
PROJECT ID #: 91

DESCRIPTION OF ACTIVITY: Construction of three biogas digesters

LOCATION: Yuantian Village in Ande Town in Pi County in Chengdu City, China  
(Latitude/Longitude: 30.86963 / 103.831955)

PRIMARY CONTACT: 
Ye Li  
WWF China  
Room 603 Wu Ding Yuan, Shan Yang Zuo  
No.100 Ber Er Duan Yi Huan Lu, Chengdu 610081, P.R. China  
Tel:+86 28 68003625 Ext.816  
yli@wwfchina.org

OBJECTIVES
- Reduce nutrient loadings to receiving waters (from animal feces and urine)
- Generate biogas
- Reduce the use of firewood and coal

BACKGROUND & DESCRIPTION OF ACTIVITY:
Three households within Yuantian Village are using biogas digesters to convert animal waste (pig feces and urine) to biogas. These digesters help reduce the amount of animal waste discharged to the environment, resulting in decreased nutrient loading to receiving waters. The use of firewood (5 kg/household/day) and coal (3 kg/household/day) is also reduced through the production of biogas.

ACTIVITY TIMELINE:
- Completed in 2009

COCA-COLA CONTRIBUTION: 100%
- Project is fully funded by Coca-Cola ($1,850 USD)

WATERSHED RESTORATION BENEFITS CALCULATED:
1. Decrease in nutrient load
1. **DECREASE IN NUTRIENT LOAD**

**Approach & Results:**

The annual production (mass) of pig feces and urine and associated nutrient load is calculated for 10 pigs. The nutrient load associated with this waste was previously discharged to the environment. Instead, the pig waste is now collected and used in biogas digesters. The benefit is therefore equal to the nutrient load generated by the pigs, which is no longer discharged to the environment.

Based on the discharge coefficients of pollutants for livestock and poultry breeding which is issued by Environmental Protection in China in 2004, every pig can produce 1,204.5 kg urine/year and 730 kg feces/year in China. For 10 pigs, this translates to 12,045 kg urine/year and 7,300 kg feces/year. Thus the biogas digesters for the pilot households in Yuantian Village can capture and remove the nutrient load associated with 12,045 kg urine/year and 7,300 kg feces/year from the environment.

This nutrient load is calculated by multiplying the mass of urine and feces by published nutrient concentrations. Information used to calculate these annual nutrient loads is presented below. The first table below shows the nitrogen and phosphorus concentration in pig feces and urine. The second table shows the annual nutrient load based on mass of feces and urine produced and published values nutrient discharge coefficients (Total Bureau of National Environmental Protection in China, 2004).

<table>
<thead>
<tr>
<th>Average Nutrient Concentrations in Pig Feces and Urine in Yangtze River Watershed (Shujun Xu, 2004; Zhenyao Sheng, 2008)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TN (kg/ton)</strong></td>
</tr>
<tr>
<td>Feces</td>
</tr>
<tr>
<td>Urine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual Nutrient Load from Ten Pigs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mass (kg/yr)</strong></td>
</tr>
<tr>
<td>Feces</td>
</tr>
<tr>
<td>Urine</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

The water quality benefit (total nitrogen decrease) is: 84.68 kg/year = 0.08 MT/yr

The water quality benefit (total phosphorus decrease) is: 31.16 kg/year = 0.03 MT/yr

**Data Sources:**

- Calculations were provided by WWF, using discharge coefficients from Total Bureau of National Environmental Protection in China (2004). The average nutrient concentrations in urine and feces from pigs in Yangtze River Watershed were obtained from Shujun Xu (2004) and Zhenyao Sheng (2008).

**Assumption:**

- These three biogas digesters operate well every day.
OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED

- None

NOTES

REFERENCES


PROJECT NAME: Improving River Management Practices in the Yangtze
PROJECT ID #: 91

DESCRIPTION OF ACTIVITY: Construction of treatment wetlands

LOCATION: Yuantian Village in Chengdu City, China (Latitude/Longitude: 30.86963 103.831955)
Yunqiao Village in Chengdu City, China (Latitude/Longitude: 30.874722 103.89083)

PRIMARY CONTACT:
Ye Li       Lindsay Bass
WWF China     WWF
Room 603 Wu Ding Yuan, Shan Yang Zuo 1250 24th St., NW
No. 100 Bei Er Duan Yi Huan Lu
Chengdu 610081, P.R. China Washington, DC 20037-1193
+86 28 68003625 Ext.816 202-495-4334
yli@wwfchina.org Lindsay.Bass@wwfus.org

OBJECTIVES:
• Improve water quality for aquatic life
• Reduce human health risks

BACKGROUND & DESCRIPTION OF ACTIVITY: Rural areas such as Yuantian Village and Yunqiao Village are often located upstream of city water sources. Discharges of domestic grey water in these rural areas may contain nutrients and oxygen-demanding substances. Domestic grey water includes all domestic waste water from showering, dish washing, laundry, and other uses except flushing toilets. Because these discharges are typically scattered, they can be difficult to treat.

There are two kinds of constructed wetlands in Yuantian village: a courtyard constructed wetland for 4 households (13 people); and a community constructed wetland with an anaerobic digester for 200 people. The community constructed wetland treats the grey water effluent from the anaerobic digester, as well as the community’s local hospital.

In Yunqiao Village, there are three constructed wetlands serving three households (10 people). In total, there are 223 people in two villages that are served by the constructed wetlands.

The objective of the constructed wetlands is to treat the domestic wastewater for 223 farmers, using a process of sedimentation, filtration, plant absorption and microorganism decomposition, so that the effluent meets irrigation quality standards in China. The effluent is discharged to a nearby stream and reused for irrigation water in the two villages.

SUMMARY OF REPLENISH BENEFIT:
• 2011 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 15.2 ML/yr

ACTIVITY TIMELINE:
• 2009: 20%
• 2010: 80%
• 2011: 100%

COCA-COLA CONTRIBUTION: 100%
• Project is fully funded by Coca-Cola ($40,000 USD)
WATERSHED RESTORATION BENEFITS CALCULATED:

1. Water quantity benefits
2. Decrease in nutrients and oxygen-demanding substances
1. WATER QUANTITY BENEFITS

Approach & Results:

The treatment wetlands are cleaning water that otherwise would not have been available for other uses, due to its water quality. The volume of water treated by the wetlands therefore equals the water quantity benefit. The water quantity benefits from the small household treatment wetlands were calculated by WWF based on the number of people served and assumptions about water use per person. The large scale wetland for 200 people was outfitted with a water meter that measures the volume of water entering the wetland for treatment. Project team measurements estimate the average daily use to be 40 cubic meters.

Yuantian Village:
13 people * 90 liters/person*day * 0.8 * 365 days/yr = 341,640 liters/yr = 0.34 ML/yr
40,000 L *365 days/yr = 14,600,000 liters/yr = 14.6 ML/yr

Yunqiao Village
10 people * 90 liters/person*day * 0.8 * 365 days/yr = 262,800 liters/yr = 0.26 ML/yr

The total water quantity benefit equals the sum of benefits from Yuantian Village and Yunqiao Village, which is: 0.34 ML/yr + 14.6 ML/yr + 0.26 ML/yr = 15.2 ML/yr.

Total (ultimate) water quantity benefit is: 15.2 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 15.2 ML/yr

The current (2011) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2011 Replenish Benefit

The 2011 benefit is the performance-based benefit for this activity as of the end of calendar year 2011. The total 2011 benefit is 15.2 ML/yr and TCCC’s benefit (adjusted for cost share) is 15.2 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>15.2</td>
<td>15.2</td>
</tr>
<tr>
<td>2013</td>
<td>15.2</td>
<td>15.2</td>
</tr>
<tr>
<td>2014</td>
<td>15.2</td>
<td>15.2</td>
</tr>
<tr>
<td>2015</td>
<td>15.2</td>
<td>15.2</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>15.2</td>
<td>15.2</td>
</tr>
</tbody>
</table>

Data Sources:
- Data were provided by WWF.

Assumptions:
- The constructed wetlands are maintained and operate as planned.
- Treated volume assumes
  - Per capita water use equals 90 liters/person/day for all of the treatment wetlands
  - Per capita water use was multiplied by 0.8 to exclude water from flushing toilets.
  - Average values recorded from regular monitoring of the metered wetland accurately reflect daily use.

2. DECREASE IN NUTRIENTS AND OXYGEN-DEMANDING SUBSTANCES

Approach & Results:
The reduction in annual pollutant loads was calculated by WWF based on available data. The average pollutant removal ratio was more than 90%.

The total benefits are estimated as follows:
- The total benefit (total nitrogen decrease) is: 2.642 MT/yr and TCCC’s benefit (adjusted for cost share) is 2.642 MT/yr.
- The total benefit (total phosphorus decrease) is: 0.2599 MT/yr and TCCC’s benefit (adjusted for cost share) is 0.2599 MT/yr.
- The total benefit (chemical oxygen demand decrease) is: 23.566 MT/yr and TCCC’s benefit (adjusted for cost share) is 23.566 MT/yr.
- The total benefit (biochemical oxygen demand decrease) is: 5.9 MT/yr and TCCC’s benefit (adjusted for cost share) is 5.9 MT/yr.

The 2011 benefits are as follows:
- The 2011 benefit (total nitrogen decrease) is: 2.642 MT/yr and TCCC’s benefit (adjusted for cost share) is 2.642 MT/yr.
- The 2011 benefit (total phosphorus decrease) is: 0.2599 MT/yr and TCCC’s benefit (adjusted for cost share) is 0.2599 MT/yr.
- The 2011 benefit (chemical oxygen demand decrease) is: 23.566 MT/yr and TCCC’s benefit (adjusted for cost share) is 23.566 MT/yr.
• The 2011 benefit (biochemical oxygen demand decrease) is: 5.9 MT/yr and TCCC’s benefit (adjusted for cost share) is 5.9 MT/yr

Projected Water Quality Benefits

The tables that follow show the projected water quality benefits that this activity will provide if the project remains in productive service. While not shown in the tables, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

### Projected Water Quality Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (MT/yr)</th>
<th>Adjusted for TCCC Cost Share (MT/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>2.642</td>
<td>2.642</td>
</tr>
<tr>
<td>2013</td>
<td>2.642</td>
<td>2.642</td>
</tr>
<tr>
<td>2014</td>
<td>2.642</td>
<td>2.642</td>
</tr>
<tr>
<td>2015</td>
<td>2.642</td>
<td>2.642</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>2.642</td>
<td>2.642</td>
</tr>
</tbody>
</table>

### Projected Water Quality Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (MT/yr)</th>
<th>Adjusted for TCCC Cost Share (MT/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>23.566</td>
<td>23.566</td>
</tr>
<tr>
<td>2013</td>
<td>23.566</td>
<td>23.566</td>
</tr>
<tr>
<td>2014</td>
<td>23.566</td>
<td>23.566</td>
</tr>
<tr>
<td>2015</td>
<td>23.566</td>
<td>23.566</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>23.566</td>
<td>23.566</td>
</tr>
</tbody>
</table>

Data Sources:

• Calculations were provided by WWF.

Assumptions:

• The constructed wetlands are maintained and operate as planned.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED

• Improved irrigation water and instream water quality improvements

NOTES

• This fact sheet updates the November 2010 fact sheet by including water quantity benefits.

REFERENCES
PROJECT NAME: Guangxi Sustainable Sugarcane Initiative: Phase II
PROJECT ID: 94

DESCRIPTION OF ACTIVITY: Conversion of flood irrigation to spray irrigation

LOCATIONS: Linyou, Fusui County of Guangxi Zhuang Autonomous Region
(Latitude: 22°38'06.27"; Longitude: 107°54'14.4")

PRIMARY CONTACTS:
Kevin Jiang  Weidong Zhang
Coca-Cola China  KO Project Leader, UNDP
Beijing, china  China
kejiang@coca-cola.com  weidong.zhang@undp.org

PARTNER: United Nations Development Program (UNDP)

OBJECTIVES:
• Improve crop yields by providing reliable irrigation water supply
• Support sustainable agriculture development
• Improve water use efficiency

BACKGROUND & ACTIVITY DESCRIPTION:
The Guangxi Autonomous Region plays an important role in China’s sugar industry, with more than 20 million people working in sugarcane agriculture and sugar production. More than 60% of China’s sugar production comes from this region, including sugar supplied to The Coca-Cola Company. Beginning in late 2009, Guangxi and four other provinces of southwest China experienced a severe drought of historic proportions, with significant impacts on crop yields. Historically, water resources have not been used efficiently in Fusui County due to lack of water efficient irrigation practices and use of open earthen ditches for transporting water rather than pipeline. This project is a Public-Private Partnership demonstration project with the United Nations Development Program (UNDP) that addresses the need for reliable and efficient irrigation of sugarcane.

This phase of the initiative in Fusui County has involved: 1) construction of pipelines to deliver water to sugarcane fields (Figure 1); and 2) replacement of flood irrigation with sprinkler irrigation for sugarcane production (Figure 2). A total land area of 153.3 ha has been covered by the project activity. The implementation of spray irrigation will substantially reduce the irrigation water requirement compared to flood irrigation.

Figure 1. New pipelines installed for transmitting irrigation water
SUMMARY OF REPLENISH BENEFIT:

- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 915.3 ML/yr

ACTIVITY TIMELINE:

- Project initiation: 2011
- 98% of the project completed in 2012
- 100% of the project completed by 2013

COCA-COLA CONTRIBUTION: 50%

- Total cost: 591,000 RMB
- TCCC cost contribution: 295,000 RMB
- Guangxi Department of Commerce (GXDOFCOM): 295,000 RMB

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Improved irrigation efficiency
2. Leak reduction

1. Improved irrigation efficiency

Approach and Results:

The replenish benefit was estimated based on the area of farmland irrigated and irrigation water requirement per unit of farmland area. Irrigation water requirement for the pre-and post-project conditions were based on the crop water requirement and irrigation efficiencies of flood and spray irrigation.

- Crop water requirement for sugarcane in the project area: 3,450 m³/ha. This estimate was provided by the local contact and it is consistent with the average blue water footprint for raw sugarcane grown in China of 51 m³/tonne (Mekonnen, M.M. and Hoekstra, A.Y., Appendix II, 2010) and the 2001-2010 average sugarcane crop yield in China of 66,191 kg/ha (FAO, 2013).

- Irrigation efficiencies were provided by the local contact and they are consistent with literature values as follows:
  - Irrigation efficiency of flood irrigation: 25% (consistent with FAO, 1989 estimate of irrigation efficiency for “poor” irrigation schemes)
Irrigation efficiency of spray irrigation: 80% (consistent with FAO, 1989 estimate of irrigation efficiency of “good” irrigation schemes)

- Irrigation requirement with flood irrigation = \(\frac{3,450}{0.25} = 13,800\) m³/ha
- Irrigation requirement with spray irrigation = \(\frac{3,450}{0.8} = 4,313\) m³/ha

The total volume of water applied for irrigation can be divided into two main fractions (Foster and Perry, 2010); consumed and non-consumed fraction. Consumed fraction refers to the beneficial transpiration being consumed by the crop and the non-beneficial evaporation from wet soil. Non-consumed fraction refers to the recoverable seepage infiltrating as a ‘return flow’ to a fresh water aquifer. In order to estimate water savings in terms of water consumption, the benefit quantification approach described below accounts for the volume of water that infiltrates as ‘return flow’ to the freshwater aquifer when water is applied for irrigation. The fraction of return flow is dependent on hydrogeological conditions and other site-specific factors and can be difficult to estimate. No local information on return flow was available, so the following default assumptions were used based on Foster and Perry (2010), assuming that the irrigation system is well-maintained:

- For traditional irrigation (e.g., flood irrigation), 25% of the volume of water applied to the crops is return flow.
- For micro-irrigation (e.g., drip or sprinkler irrigation), 5% of the volume of water applied is return flow.

The calculations are as follows:

- **Pre-project: (flood irrigation)**
  - Water applied for irrigation = farmland area irrigated x annual irrigation water requirement per unit of farmland
  - Water applied for irrigation = 13,800 m³/ha
  - Consumed fraction = (1-fraction of return flow) x water applied
    - = \((1-0.25) \times 13,800\) m³/ha = 10,350 m³/ha

- **Post-project: (spray irrigation)**
  - Water applied for irrigation = farmland area irrigated x annual irrigation water requirement per unit of farmland
  - Water applied for irrigation = 4,313 m³/ha
  - Consumed fraction = (1-fraction of return flow) x water applied
    - = \((1-0.05) \times 4,313\) m³/ha = 4,097 m³/ha

- Water savings = \((10,350 - 4,097)\) m³/ha = 6,253 m³/ha
- Area of cultivation = 153.3 ha

Total benefit = Water savings x Area of cultivation
  - = 6,253 m³/ha x 153.3 ha = 958,531 m³ = 959 ML

2. **Leak reduction**

**Approach and Results:**

The water savings associated with pipeline construction is calculated as follows:
Benefit from pipework project = (transmitted water × water loss rate before the project) – (transmitted water × water loss rate after the project)

The loss rate before the project (earthen open channel) was 30% and the loss rate after the project was completed (closed pipe) is 5%. These loss rates are consistent with the typical conveyance efficiencies corresponding to earthen and lined canals reported by FAO (FAO, 1989). The total volume of water delivered from the source under pre-project conditions (i.e., water delivered through earthen canals for flood irrigation, factoring in conveyance efficiency) was reported by the local contact to be 3,022.2 ML/yr, and the volume of water delivered under post-project conditions (i.e., water delivered through pipeline for spray irrigation, factoring in conveyance efficiency) was reported by the local contact to be 700.8 ML/yr. Therefore the benefit is calculated as follows:

Benefit = (3,022.2 ML/yr × 0.3) – (700.8 ML/yr × 0.05) = 871.6 ML/yr.

Sum of benefits due to pipeline and irrigation efficiency projects:

**Total benefit = 959 ML/yr + 871.6 ML/yr = 1,830.6 ML/yr**

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

- **The total (ultimate) benefit is:** 1,830.6 ML/yr.
- **TCCC total (ultimate) benefit taken as a function of cost share is:** 915.3 ML/yr.

**2013 Replenish Benefit**

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 1,830.6 ML/yr and TCCC’s benefit (adjusted for cost share) is 915.3 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. If additional projects are added or projects are expanded, the future benefits will increase. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>1,830.6</td>
<td>915.3</td>
</tr>
<tr>
<td>2015</td>
<td>1,830.6</td>
<td>915.3</td>
</tr>
<tr>
<td>2016</td>
<td>1,830.6</td>
<td>915.3</td>
</tr>
<tr>
<td>2017</td>
<td>1,830.6</td>
<td>915.3</td>
</tr>
<tr>
<td>2018</td>
<td>1,830.6</td>
<td>915.3</td>
</tr>
<tr>
<td><strong>Ultimate Benefit:</strong></td>
<td><strong>1,830.6</strong></td>
<td><strong>915.3</strong></td>
</tr>
</tbody>
</table>
Data Sources:

- All data used in the calculations are provided by Fushui Project Management Office of the UNDP-Coca-Cola Sustainable Sugarcane Initiative.

Assumptions:

- Projected benefits assume project will continue as currently designed.

OTHER BENEFITS NOT QUANTIFIED

- Economic and social benefits to sugarcane farmers
- Increased yields due to conversion from flood irrigation to spray irrigation.
- Reduced flooding due to improved drainage
- Reduced vulnerability to droughts and climate change
- Benefits of scaling the demonstration sites for replication throughout China.

NOTES

- Impact assessments are conducted for all UNDP projects in China, and no adverse environmental or social impacts due to this project were identified

REFERENCES

Power Point presentation provided by Gongchen Li titled “Replenishment Calculations for Water Programme” dated September 11, 2012


PROJECT NAME: Guangxi Sustainable Sugarcane Initiative: Phase II
PROJECT ID #: 94

DESCRIPTION OF ACTIVITY: Conversion of flood irrigation to drip irrigation

LOCATION: Xinhe sub-district of Jiangzhou District (Chongzuo City), Guangxi China

PRIMARY CONTACTS:
Jasmine Tian  
KO/PAC China  
KO Project Leader, UNDP  
jatian@apac.ko.com

Gongchen Li  
United Nations Development Program (UNDP)  
gongchen.li@gmail.com

Weidong Zhang  
Weidong.zhang@undp.org

OBJECTIVES:
• Support government efforts to improve water resources management

BACKGROUND & ACTIVITY DESCRIPTION: The Guangxi Autonomous Region plays an important role in China’s sugar industry, with more than 20 million people working in sugarcane agriculture and sugar production. More than 60% of China’s sugar production comes from this arid region, including sugar supplied to The Coca-Cola Company. Beginning in late 2009, Guangxi and four other provinces of southwest China experienced a severe drought of historic proportions, with significant impacts on crop yields. This project is a Public-Private Partnership demonstration project with the United Nations Development Program (UNDP) that addresses the need for reliable and efficient irrigation of sugarcane.

The second phase of the initiative involved the replacement of flood irrigation with drip irrigation for 146 ha of sugarcane production in the Xinhe sub-district of Jiangzhou District, Guangxi. The project also involves the use of treated wastewater from the Xianggui Sugar Company and Fulaishun Yeast Company combined with river water (Figure 1) for irrigation. The implementation of drip irrigation substantially reduces the abstraction of river water for irrigation requirement compared to flood irrigation.

Figure 1. Treated wastewater (left) is combined with river water for irrigation (right)

SUMMARY OF REPLENISH BENEFIT:
• 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 508 ML/YR
ACTIVITY TIMELINE:

- Project initiation: 2011
- Nali irrigation area: 100% converted July-Dec 2011
- Xiangguix irrigation area: 100% converted July-Dec 2011

COCA-COLA CONTRIBUTION: 50%

- Total cost: $599,000 USD
- TCCC cost contribution: $299,500 USD

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Improved irrigation efficiency

1. Water Savings through improved irrigation efficiency

Approach and Results:

The replenish benefit was estimated based on the reduction in water consumption due to conversion to drip irrigation, calculated as follows.

The irrigation water requirements for the pre-and post-project conditions were based on the crop water requirement and irrigation efficiencies of flood and drip irrigation.

- Crop water requirement for sugarcane in the project area: 3,578 m³/ha
- Irrigation efficiency of flood irrigation: 25%
- Irrigation efficiency of drip irrigation: 90%
- Irrigation requirement with flood irrigation = 3,578/0.25 = 14,312 m³/ha
- Irrigation requirement with drip irrigation = 3,578/0.9 = 3,976 m³/ha

The total volume of water applied for irrigation can be divided into two main fractions (Foster and Perry, 2010); consumed and non-consumed fraction. Consumed fraction refers to the beneficial transpiration being consumed by the crop and the non-beneficial evaporation from wet soil. Non-consumed fraction refers to the recoverable seepage infiltrating as a ‘return flow’ to a fresh water aquifer. In order to estimate water savings in terms of water consumption, the benefit quantification approach described below accounts for the volume of water that infiltrates as ‘return flow’ to the freshwater aquifer when water is applied for irrigation. A reasonable assumption of return flow for flood irrigation and micro-irrigation are 25% and 5%, respectively of the applied water. The calculations are as follows.

- Pre-project: (flood irrigation)
  - Water applied for irrigation = farmland area irrigated × annual irrigation water requirement per unit of farmland
  - Water applied for irrigation = 14,312 m³/ha
  - Consumed fraction = (1-fraction of return flow) × water applied
    = (1-0.25) × 14,312 m³/ha = 10,734 m³/ha
• Post-project: (drip irrigation)
  o Water applied for irrigation = farmland area irrigated \times \text{annual irrigation water requirement per unit of farmland}
  o Water applied for irrigation = 3,976 m³/ha
  o Consumed fraction = (1-\text{fraction of return flow}) \times \text{water applied}
    = (1-0.05) \times 3,976 \text{ m³/ha} = 3,777.2 \text{ m³/ha}
• Water savings = (10,734 – 3,777.2) m³/ha = 6,956.8 m³/ha
• Area of cultivation = 146 ha

Total benefits = \text{Water savings} \times \text{Area of cultivation}
= 6,956.8 \text{ m³/ha} \times 146 \text{ ha} = 1,015,693 \text{ m³} = 1,016 \text{ ML}

The total (ultimate) benefit is: 1,016 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 508 ML/yr.

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 1,016 ML/yr and TCCC’s benefit (adjusted for cost share) is 508 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>1,016</td>
<td>508</td>
</tr>
<tr>
<td>2014</td>
<td>1,016</td>
<td>508</td>
</tr>
<tr>
<td>2015</td>
<td>1,016</td>
<td>508</td>
</tr>
<tr>
<td>2016</td>
<td>1,016</td>
<td>508</td>
</tr>
<tr>
<td>2017</td>
<td>1,016</td>
<td>508</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>1,016</td>
<td>508</td>
</tr>
</tbody>
</table>
Data Sources:
• All data used in the calculations were provided by UNDP China.

Assumptions:
• Projected benefits assume project will continue as currently designed.
• Return flow is assumed to be 25% for flood irrigation and 5% for drip irrigation

OTHER BENEFITS NOT QUANTIFIED
• Improved technological standards for recycling waste water in sugar industry and strengthening of water resource protection
• Economic and social benefits to sugarcane farmers
• Increased yields due to conversion from flood irrigation to drip irrigation.
• Reduced flooding due to improved drainage.
• Reduced vulnerability to droughts and climate change
• Benefits of scaling the demonstration sites for replication throughout China.

NOTES
• Impact assessments are conducted for all UNDP projects in China, and no adverse environmental or social impacts due to this project were identified

REFERENCES
Power Point presentation provided by Gongchen Li titled “Replenishment Calculations for Water Programme” dated September 11, 2012
UNDP. 2012 Coca-Cola programs in Guangxi Autonomous Region.
**PROJECT NAME:** Guangxi Sustainable Sugarcane Initiative: Phases I and II  
**PROJECT ID #:** 94

**DESCRIPTION OF ACTIVITY:** Water for productive use: new irrigation supply and improved irrigation efficiency

**LOCATION:** Shangsi County in Fangchenggang City of Guangxi Autonomous Region

**PRIMARY CONTACTS:**  
Jasmine Tian  
KO/PAC China  
KO Project Leader, UNDP  
jatian@apac.ko.com
  
Gongchen Li  
United Nations Development Program (UNDP)  
gongchen.li@gmail.com
  
Weidong Zhang  
Weidong.zhang@undp.org

**OBJECTIVES:**  
- Improve crop yields by proving reliable supply of irrigation water  
- Improve water use efficiency  
- Support economic and social stability and development

**BACKGROUND & ACTIVITY DESCRIPTION:** The Guangxi Autonomous Region plays an important role in China’s sugar industry, with more than 20 million people working in sugarcane agriculture and sugar production. More than 60% of China’s sugar production comes from this region, including sugar supplied to The Coca-Cola Company. Beginning in late 2009, Guangxi and four other provinces of southwest China experienced a severe drought of historic proportions, with significant impacts on crop yields and livelihoods in a region with high poverty levels. This project is a Public-Private Partnership demonstration project with the United Nations Development Program (UNDP) that addresses the need for reliable and efficient irrigation of sugarcane.

Treated water from a sugar plant is reused to irrigate sugarcane fields. The water is combined with Ming River water before it is used in irrigation. A sprinkler irrigation system is provided to improve water efficiency over traditional flood irrigation. A total of 433.3 mu are being irrigated in 2012. (Note that 15 mu are equivalent to 1 ha).

Impact assessments are conducted for all UNDP projects in China, and no adverse environmental or social impacts due to this project were identified.

**SUMMARY OF REPLENISH BENEFIT**  
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 650.0 ML/YR
ACTIVITY TIMELINE:
- January 2011: Project initiated
- July 2011: Phase I completed
- December 2012: Phase II 100% completed

COCA-COLA CONTRIBUTION: 50%
Total project cost: $320,000 USD
- Coca-Cola: $160,000 USD
- Other Partners: $160,000 USD

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:
1. Increase in irrigation water supply

1. INCREASE IN IRRIGATION WATER SUPPLY

Approach and Results:
Based on metering data, 1,299.9 ML/yr of combined sugar plant reused water and river water is delivered to the fields. The total area surface area for irrigation is 433.3 ha.

Total (ultimate) benefit is: 1,299.9 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 650.0 ML/yr

2012 Replenish Benefit
The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 1,299.9 ML/yr and TCCC’s benefit (adjusted for cost share) is 650.0 ML/yr.
Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in this table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

### Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>1299.9</td>
<td>650.0</td>
</tr>
<tr>
<td>2014</td>
<td>1299.9</td>
<td>650.0</td>
</tr>
<tr>
<td>2015</td>
<td>1299.9</td>
<td>650.0</td>
</tr>
<tr>
<td>2016</td>
<td>1299.9</td>
<td>650.0</td>
</tr>
<tr>
<td>2017</td>
<td>1299.9</td>
<td>650.0</td>
</tr>
</tbody>
</table>

Ultimate Benefit: 1299.9

It is unknown at this time if the project will expand in the future so it is assumed that benefits will continue to be generated at the 2012 rate.

Data Sources:

- Metered data and estimates from farmers

Assumptions

- It is assumed that irrigation water was provided to farmers throughout the 2012 growing season (June through August).
- It is assumed that the irrigation water will be provided from June to August every year at the same rate as estimated for 2012.

OTHER BENEFITS NOT QUANTIFIED

- Economic and social benefits to sugarcane farmers
- Improved irrigation efficiencies and increased yields due to conversion from flood irrigation to drip and channel irrigation.
- Reduced flooding due to improved drainage
- Reduced vulnerability to droughts and climate change
- Demonstration sites are scalable and replicable throughout China

NOTES

- This factsheet updates the November 2011 factsheet to provide a new project contact and document an increase in the area irrigated since 2011 in Shangsi County. The work in Longzhou County was removed from this updated fact sheet because it does not currently meet replenish project requirements for irrigation projects.
Names of Program Partners:

- United Nations Development Program
- Coca-Cola China
- Ministry of Water Resources
- China International Centre for Economic and Technical Exchanges (CIETE)

REFERENCES

Power Point presentation provided by Gongchen Li titled “Replenishment Calculations for Water Programme” dated September 11, 2012

UNDP. 2012 Coca-Cola programs in Guangxi Autonomous Region.
PROJECT NAME: Sacramento River Riparian Habitat Restoration at La Barranca
PROJECT ID #: 96

DESCRIPTION OF ACTIVITY: Riparian habitat restoration

LOCATION: Red Bluff, California

PRIMARY CONTACT:

Ryan Luster
Project Director-Sacramento River
The Nature Conservancy
500 Main Street
Chico, California 95928
530-897-6370, ext. 213
rluster@tnc.org

Rena Ann Stricker
Contract Ecologist
CCR Environment & Sustainability
404-395-6250
rstricker@coca-cola.com

Jon Radtke
Manager, Water Resources
CCR Environment & Sustainability
404-676-9112
jradtke@coca-cola.com

OBJECTIVES:

• Reduce water consumption
• Improve ecological health and long-term viability of at-risk species and riparian communities
• Improve water quality

BACKGROUND & DESCRIPTION OF ACTIVITY: Healthy riparian zones provide both water quality benefits and habitats for riparian communities. Much of the riparian habitat along the Sacramento River has been lost due to selective logging, agriculture, urban development, flood control and power generation projects. Although severely degraded, the Sacramento River is still the most diverse and extensive river ecosystem in California (TNC, 2011), and a number of organizations have begun implementing ecosystem restoration programs along the river.

Large portions of the La Barranca Unit were developed for orchards between 1978 and 1984 and this unit is comprised of a walnut orchard surrounded by existing remnant habitat. In 1991, this unit was purchased for conservation ownership.

This project has restored roughly 143 acres of riparian habitat on the U.S. Fish and Wildlife-owned La Barranca unit of the Sacramento River National Wildlife Refuge in California. In total, the following communities have been established in the project area: 56.7 acres of valley oak riparian forest, 28.9 acres of valley oak woodland, 12.7 acres valley oak elderberry savanna and 44.5 acres of grassland. This project involved removal of the walnut orchard, reforestation/revegetation, maintenance and monitoring. Flood irrigation (volume estimated to equal approximately 429 ac-ft or 529.16 ML annually) was previously used for the walnut orchard.
La Barranca walnut orchard

SUMMARY OF REPLENISH BENEFIT:
• 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 61.7 ML/YR

ACTIVITY TIMELINE:
• Project start: November 2011 (removed walnut orchard)
• June 2012: Planted native riparian vegetation
• 2012 -2014: Maintain site to ensure survival of planted vegetation

COCA-COLA CONTRIBUTION: 11%
Total Cost of Project: $636,000 USD
• Coca-Cola Foundation: $70,000 USD
• Wildlife Conservation Board of California: $566,000 USD

WATERSHED BENEFITS CALCULATED:
1. Decrease in groundwater consumption

1. DECREASE IN GROUNDWATER CONSUMPTION

Approach & Results
The Water Footprint Network’s water footprint method was followed to estimate the decrease in water consumption resulting from the conversion of the walnut orchard to native vegetation (forested land and grassland). Water quantity calculations were based on estimating the change in the blue component of crop water use, which is the consumptive loss of irrigation water through crop evapotranspiration. The volume of water conserved is estimated by calculating the change in the volume of blue component of crop water use (i.e., irrigation water consumed) during the production of the walnuts and after the conversion to native vegetation at this location.

The blue crop water use for walnut cultivation is estimated by considering the local climate including effective rainfall and the reference evapotranspiration, and crop coefficient. The consumptive loss of irrigation water for growing walnuts was calculated based on the crop water use and the size of the orchard. It was assumed that the restoration activity will not require irrigation after the initial establishment of the native vegetation.
- **Pre-project:**
  Crop water use from flood irrigation: 9,693 m³/ha
  Orchard area: 143 acres (58 ha)
  Crop water consumption from flood irrigation = 9,693 m³/ha x 58 ha = 560,905 m³ = 561 ML/yr

- **Post-project:**
  Crop water requirement from flood irrigation: 0 m³/ha
  Revegetated area: 143 acres (58 ha)
  Crop water consumption from flood irrigation = 0 ML/yr

The total annual water quantity benefit resulting from the elimination of flood irrigation was calculated as the difference in the pre-project and post-project water consumption.

- **Pre-project (walnut orchard):** 561 ML/yr
- **Post-project (re-vegetated land):** 0 ML/yr

**Total (ultimate) benefit is:** 561 ML/yr

**TCCC total (ultimate) benefit taken as a function of cost share:** 61.7 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

### 2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 561 ML/yr and TCCC’s benefit (adjusted for cost share) is 61.7 ML/yr.

### Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>561</td>
<td>61.7</td>
</tr>
<tr>
<td>2014</td>
<td>561</td>
<td>61.7</td>
</tr>
<tr>
<td>2015</td>
<td>561</td>
<td>61.7</td>
</tr>
<tr>
<td>2016</td>
<td>561</td>
<td>61.7</td>
</tr>
<tr>
<td>2017</td>
<td>561</td>
<td>61.7</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>561</td>
<td>61.7</td>
</tr>
</tbody>
</table>
Data Sources/Site-specific characteristics:

- Crop coefficient (Kc) and reference crop evapotranspiration (ET₀) values are based on walnut cultivation in the San Joaquin Valley.
- Rainfall is based on the long term monthly precipitation for a climate station in the Sacramento Valley.

Assumptions:

- Kc and ET₀ values for walnut cultivation in San Joaquin Valley and Sacramento Valley are similar
- Assumed minimal irrigation (microdrip system) necessary to establish native vegetation

OTHER BENEFITS NOT QUANTIFIED

- Promote the recovery of neotropical migrant and resident birds and other terrestrial species
- Improve floodplain and in-channel conditions for anadromous fish
- Improve water quality and aesthetics
- Flood damage reduction
- Increased recreational opportunities

NOTES

- This fact sheet updates the November 2011 fact sheet to reflect that this project is now generating benefits.

REFERENCES

PROJECT NAME: Water Resources Management and Ecological Rehabilitation in the Mainstream Area of Tarim River Basin  
PROJECT ID #: 100

DESCRIPTION OF ACTIVITY: Water for productive use (irrigation water supply)

LOCATION: Yuli County in Xinjiang Autonomous Region

PRIMARY CONTACTS:  
Jasmine Tian  
KO/PAC China  
KO Project Leader, UNDP  
jatian@apac.ko.com

Gongchen Li  
United Nations Development Program (UNDP)  
gongchen.li@gmail.com

Weidong Zhang  
Weidong.zhang@undp.org

OBJECTIVE:  
• Provide water for irrigation

BACKGROUND & ACTIVITY DESCRIPTION: The Tarim River basin (1.02 million km²) is one of the longest inland river basins in China and home to a population of roughly 10 million. It is also one of the most arid and fragile regions in western China and in central Asia. The Tarim River relies heavily on water from snowmelt in high-altitude areas to provide flow through the desert. This river suffers from severe and frequent water shortages that have impacted ecosystems and contributed to significant poverty in villages that rely on the river for water supply.

This project involved several activities including: 1) pilot water resource management and allocation; 2) water provided for productive use through increased irrigation; and 3) decreased water use through the implementation of water saving irrigation techniques. This pilot approach may be extended to other similar arid/semi-arid areas in western China and central Asian countries in the future.

This fact sheet describes the benefits related to the second activity, water provided for productive use.

The project was designed to address major conflicts between farmers over the fairness of irrigation water allocations that have led to injuries and deaths. The project involves improved irrigation water management, reasonable water quota management, and provision of more irrigation of lower order streams. During the project, 8.5 km of anti-leakage channels were installed, which substantially reduced water loss during delivery. At the same time, water quotas were established, thereby providing increased irrigation in the lower order streams. Impact assessments are conducted for all UNDP projects in China, and no adverse environmental or social impacts due to this project were identified.
SUMMARY OF REPLENISH BENEFIT

• 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 172.9 ML/yr

ACTIVITY TIMELINE:

• October 2007 - December 2010

COCA-COLA CONTRIBUTION: 10%

Total project cost: $1.5 million USD

- Coca-Cola: $150,000 USD
- Other Partners: $1.35 million USD

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:

1. Volume of water provided for farmland irrigation

1. VOLUME OF WATER PROVIDED FOR FARMLAND IRRIGATION

Approach & Results

The quantity of water provided for productive use (irrigation) was estimated as the difference in irrigation water provided for 427 ha farmland during pre-project and post-project conditions.

- Pre-project: (conflict with water allocation in lower order streams)
  - Irrigation water provided = 5,400 m³/ha/yr x 427 ha = 2,305.8 ML/yr

- Post-project: (increased water allocation in lower order streams)
  - Irrigation water provided = 9,450 m³/ha/yr x 427 ha = 4,035.2 ML/yr

The total (ultimate) water quantity benefit is: 1,729.4 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share is: 172.9 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 1,729.4 ML/yr and TCCC’s benefit (adjusted for cost share) is 172.9 ML/yr.

Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in this table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
**Projected Water Quantity Benefits Summary**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>1,729.4</td>
<td>172.9</td>
</tr>
<tr>
<td>2014</td>
<td>1,729.4</td>
<td>172.9</td>
</tr>
<tr>
<td>2015</td>
<td>1,729.4</td>
<td>172.9</td>
</tr>
<tr>
<td>2016</td>
<td>1,729.4</td>
<td>172.9</td>
</tr>
<tr>
<td>2017</td>
<td>1,729.4</td>
<td>172.9</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>1,729.4</td>
<td>172.9</td>
</tr>
</tbody>
</table>

**Data Sources:**
- All data were provided by UNDP

**Assumptions:**
- The area irrigated and quantity of irrigation water in 2012 and beyond equals the amount in 2010. No information was available regarding an expansion of this project.

**OTHER BENEFITS NOT QUANTIFIED**
- Social and economic benefits

**NOTES**
- This factsheet updates the November 2011 factsheet, based on information provided by UNDP in September 2012. The major difference is in the description of the project activity. The 2012 replenish benefit reported in this update is 44.7 ML/year less than those reported in the previous fact sheet. This revision to the fact sheet also provides updated contact information.

**REFERENCES**
- Power Point presentation provided by Gongchen Li titled “Replenishment Calculations for Water Programme” dated September 11, 2012
PROJECT NAME: Water Resources Management and Ecological Rehabilitation in the Mainstream Area of Tarim River Basin

PROJECT ID: 100

DESCRIPTION OF ACTIVITY: Conversion from flood irrigation to drip irrigation

LOCATIONS: Yuli County in Xinjiang Autonomous Region

PRIMARY CONTACTS:
Jasmine Tian
KO/PAC China
KO Project Leader, UNDP
jatian@apac.ko.com

Gongchen Li
United Nations Development Program (UNDP)
gongchen.li@gmail.com

Weidong Zhang
Weidong.zhang@undp.org

OBJECTIVES:
• Support government efforts to improve water resources management

BACKGROUND & ACTIVITY DESCRIPTION: The Tarim River basin (1.02 million km²) is the longest inland river basin in China and is home to a population of roughly 10 million. It is also one of the most arid and fragile regions in western China and in central Asia. The Tarim River relies heavily on water from snowmelt in high-altitude areas to provide flow through the desert. This river suffers from serious water shortages that have impacted ecosystems and caused many counties and villages to become the most poverty-stricken in the country.

This project activity involves introduction of drip irrigation kits to improve water-use efficiency on 226.7 ha of farmland which was previously irrigated with flood irrigation (Figure 1). The type of crop affected by this project activity is cotton, which is the major crop in the region.

Figure 1. Water gates and canals on left and drip irrigation on right

SUMMARY OF REPLENISH BENEFIT:
• 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE - 50.8 ML/YR
ACTIVITY TIMELINE:
- 2007 – 2011 (completed in 2011)

COCA-COLA CONTRIBUTION: 10%

WATERSHED FOR PRODUCTIVE USE BENEFITS CALCULATED:
1. Decrease in consumption

1. DECREASE IN CONSUMPTION

Approach and Results

The replenish benefit was estimated based on the reduction in water consumption due to conversion to drip irrigation. The irrigation water requirements for the pre-and post-project conditions were based on the crop water requirement for cotton and irrigation efficiencies of flood and drip irrigation.

Irrigation requirement with flood irrigation = 9,450 m³/ha

Irrigation requirement with drip irrigation = 5,100 m³/ha

The total volume of water applied for irrigation can be divided into two main fractions (Foster and Perry, 2010); consumed and non-consumed fraction. Consumed fraction refers to the beneficial transpiration being consumed by the crop and the non-beneficial evaporation from wet soil. Non-consumed fraction refers to the recoverable seepage infiltrating as a ‘return flow’ to a fresh water aquifer. In order to estimate water savings in terms of water consumption, the benefit quantification approach described below accounts for the volume of water that infiltrates as ‘return flow’ to the freshwater aquifer when water is applied for irrigation. Reasonable assumptions of return flow for flood irrigation and micro-irrigation are 25% and 5% of the applied water, respectively. The calculations are as follows.

- Pre-project: (flood irrigation)
  - Water applied for irrigation = farmland area irrigated x annual irrigation water requirement per unit of farmland
  - Water applied for irrigation = 9,450 m³/ha
  - Consumed fraction = (1-fraction of return flow) x water applied
    - = (1-0.25) X 9,450 m³/ha = 7,088 m³/ha

- Post-project: (drip irrigation)
  - Water applied for irrigation = farmland area irrigated x annual irrigation water requirement per unit of farmland
  - Water applied for irrigation = 5,100 m³/ha
  - Consumed fraction = (1-fraction of return flow) x water applied
    - = (1-0.05) X 5,100 m³/ha = 4,845 m³/ha

- Water savings = (7,088 – 4,845) m³/ha = 2,243 m³/ha

- Area of cultivation = 226.7 ha
Total benefits = Water savings (m3/ha) x Area (ha) of cultivation

= 2,243 m3/ha x 226.7 ha = 508,375 m3 = 508.4 ML

The total (ultimate) benefit is: 508.4 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 50.8 ML/yr.

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 508.4 ML/yr and TCCC’s benefit (adjusted for cost share) is 50.8 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>508.4</td>
<td>50.8</td>
</tr>
<tr>
<td>2014</td>
<td>508.4</td>
<td>50.8</td>
</tr>
<tr>
<td>2015</td>
<td>508.4</td>
<td>50.8</td>
</tr>
<tr>
<td>2016</td>
<td>508.4</td>
<td>50.8</td>
</tr>
<tr>
<td>2017</td>
<td>508.4</td>
<td>50.8</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>508.4</td>
<td>50.8</td>
</tr>
</tbody>
</table>

Data Sources:

- All data used in the calculations are provided by UNDP China.
- Water applied for irrigation was estimated based on local monitoring.

Assumptions:

- Return flow is assumed to be 25% for flood irrigation and 5% for drip irrigation

OTHER BENEFITS NOT QUANTIFIED

- Economic and social benefits to sugarcane farmers
- Increased yields due to conversion from flood irrigation to drip irrigation.
- Reduced flooding due to improved drainage
- Reduced vulnerability to droughts and climate change
- Benefits of scaling the demonstration sites for replication throughout China.
NOTES

- Impact assessments are conducted for all UNDP projects in China, and no adverse environmental or social impacts due to this project were identified

REFERENCES


Power Point presentation provided by Gongchen Li titled “Replenishment Calculations for Water Programme” dated September 11, 2012
PROJECT NAME: Rain Water Harvesting Program in Mexico for Artificial Aquifer Recharge  
PROJECT ID #: 101

DESCRIPTION OF ACTIVITY: This fact sheet covers four rainwater harvesting (RWH) for artificial aquifer recharge (AAR) projects in the regions of State of Mexico and Nayarit, Mexico.

LOCATION(S): Tepic, Toluca, and Zinacantepec

PRIMARY CONTACT:  
Oscar Martinez  
Sustentabilidad Ambiental  
Coco-Cola de Mexico  
52-55-5262-2663  
osmartinez@coco-cola.com

OBJECTIVE:  
• Increase in recharge during wet periods for use during dry periods

BACKGROUND & ACTIVITY DESCRIPTION: Coca-Cola, in conjunction with partner organizations, is installing, restoring and maintaining rainwater harvesting and aquifer recharge structures to increase access to clean water and provide water for aquifer recharge. Structures include rooftop catchments that collect water for storage and distribution and/or infiltration to recharge aquifers. Artificial aquifer recharge structures utilized in the project include percolation pits and recharge wells/shafts. Maintenance activities are performed at the structure to promote efficient operation and prolonged lifespan. A brief description of the individual projects is given in Table 1.

Table 1. Narrative description of individual projects

<table>
<thead>
<tr>
<th>Location</th>
<th>Project Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tepic, Nayarit</td>
<td>A metal roof catchment with an area of approximately 30,500 m$^2$ is utilized for RWH. The roof catchment has gutters that are in good condition that do not leak or overflow. The system is maintained periodically (every 1 - 3 years). The catchment does not have a first flush system. A combination of technologies, including recharge shafts and percolation pits, is used for artificial aquifer recharge. A total of 41 structures are used. 100% of the rainwater collected is directed to aquifer recharge. The site is located at the Acuífero Valle de Matatipac. Average annual rainfall at this site is 1254 mm.</td>
</tr>
<tr>
<td>Toluca, Mexico</td>
<td>A concrete/cement roof catchment with an area of approximately 24,234 m$^2$ is utilized for RWH. The roof catchment has gutters that are in good condition that do not leak or overflow. A combination of technologies, including recharge shafts and percolation pits, is used for artificial aquifer recharge. The catchment does not have a first flush system. A total of 6 structures are used, and 100% of the rainwater collected is directed to aquifer recharge. The site is located in the Acuífero Lerma Santiago watershed. Annual average rainfall at this site is 810 mm.</td>
</tr>
</tbody>
</table>
Zinacantepec, Mexico

A concrete/cement roof catchment with an area of approximately 26,473 m² is utilized for RWH. The roof catchment has gutters that are in good condition that do not leak or overflow. A combination of technologies including recharge shafts and percolation pits are used for artificial aquifer recharge. A total of 2 structures are used. The site has a covered, below-ground storage tank with a volume of approximately 87 m³. 100% of the rainwater collected is directed to aquifer recharge. The site is located at the Acuífero Lerma Santiago watershed. Annual average rainfall at this site is 810 mm.

SUMMARY OF REPLENISH BENEFIT:

- 2011 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 54.8 ML/YR

ACTIVITY TIMELINE:

- 2004 – 2005: construction and maintenance activities initiated at the Toluca facility in the State of Mexico, Mexico. The site was fully functional in 2008.
- 2003 – 2004: construction and maintenance activities initiated at 2 facilities in Zinacantepec in the State of Mexico, Mexico. The sites were fully functional in 2008.
- 2010: construction and maintenance activities initiated at the Tepic facility in the State of Nayarit, Mexico. The sites were fully functional in 2011.

COCA-COLA CONTRIBUTION: 100%

- Project is fully funded by Coca-Cola

WATERSHED RESTORATION BENEFITS CALCULATED:

1. Increase in recharge during wet periods for use during dry periods.

DECREASE IN STORMWATER RUNOFF

Approach:

The RWH/AAR Probabilistic Model, Version 1.5 was used to estimate the volume of precipitation captured and successfully used for either AAR and/or community water access end uses. The Coca-Cola Company partnered with the Global Corporate Consultancy (GCC), formerly known as Delta Consultants, to develop the RWH/AAR model. The RWH/probabilistic model was developed using Microsoft Excel 2003 and Crystal Ball Version 11.1.1.3.00. For this application, the RWH/AAR model was not run in a probabilistic mode (i.e., uncertainty in model inputs are not evaluated). Instead, data obtained from the RWH-AAR system survey and a mid-range of default model coefficients were used to estimate the benefits. The assumptions used in the model application are described in the following sections. RWH/AAR model is split into three modules based upon: 1) the flow of water from precipitation to the
catchment, 2) water volume stored in structures, and 3) delivery of water to the desired end use (i.e., community access or AAR).

**Rainwater Harvesting Module:**

To calculate the potential rainwater available for harvest, the model utilizes the following formula and variables:

\[(\text{Catchment Size}) \times (\text{Total Precipitation}) \times (\text{Catchment Runoff Coefficient}) \times (\text{First Flush Efficiency}) \times (\text{Conveyance Coefficient}) \times (\text{Maintenance Efficiency})\]

**Catchment Size** – The size of the roof catchment at different sites evaluated is included in Table 1.

**Total Precipitation** – The model requires monthly rainfall data. Monthly rainfall was provided in the survey for the Tepic site. However, only annual rainfall totals were provided for the Toluca and Zinacantepec locations. Long-term monthly climate data for this region were obtained by LimnoTech through a global climate dataset (Hearn et al. 2003). The percent of precipitation by month for the Toluca and Zinacantepec locations was estimated based on the global climate dataset, and then used to scale the total annual rainfall amount indicated in the survey.

**Catchment Runoff Coefficient** – The runoff coefficient for each catchment was assigned based on the material construction of the catchment. A runoff coefficient of 85% was selected for the metal roof at the Tepic site. Similarly, a runoff coefficient of 0.70 was selected for the cement/concrete roofs at the Toluca and Zinacantepec sites.

**First Flush Efficiency** – A first flush system was not installed at any of the sites evaluated. Because there is no loss of water associated with the first flush system, an efficiency of 100% was assumed.

**Conveyance coefficient** – No leaks or overflows are indicated to occur in the RWH conveyance system for the sites evaluated. Therefore, a conveyance coefficient of 100% was assumed.

**Maintenance Efficiency** – Based on the frequency of maintenance for the Tepic (1 – 3 years) site, a coefficient of 89% was used. The RWH systems at Toluca and the Zinacantepac sites are maintained annually; therefore, a coefficient value of 90% was used for these locations.

**Storage Capacity Water Balance Module:**

The RWH/AAR model uses a water balance approach and monthly precipitation data to estimate the volume of water not lost due to insufficient storage from the RWH storage structure. During each month the model calculates the rainwater available to meet community demand and/or AAR. If the combined community and AAR demand is less than the available water in a given month, it is assumed both demands would be completely met, and any excess water would remain in the storage tank or structure (up to the volume of structure, with any water beyond that volume assumed to be lost due to insufficient storage). Water loss due to insufficient storage did not occur at any of the sites evaluated.

**Artificial Aquifer Recharge Water Balance Module:**

At one of the sites at Zinacantepec, Mexico, 20% of the harvested water is directed toward community use and 80% directed to AAR (Table 1). At all other sites evaluated, 100% of the rain water harvested is used for AAR. The RWH/AAR model estimates the volume of water successfully used for AAR dependent on the recharge mechanism used. Based on response provided in the questionnaire, it was determined that main mechanism of AAR is through recharge wells/shafts or percolation pits. The volume of water successfully recharged to the aquifer through recharge wells/shafts or percolation pits was estimated by the model using the following formula:

\[(Q_{\text{AAR}} - P_{\text{PRW}}) \times (\text{Efficiency of the AAR processes}) \times (\text{Maintenance Efficiency})\]
where $Q_{AAR-PRW}$ is the annual volume of water transferred to recharge wells/shafts or percolation pits.

For all sites evaluated, an AAR process efficiency of 88% corresponding to recharge via wells/shafts/percolation pits was used. A maintenance efficiency of 89% was used for the Tepic site corresponding to the maintenance frequency of 1 – 3 yrs. For Toluca and Zinacantepec sites, an efficiency of 95% was used based on annual maintenance.

Data Sources
- RWH surveys completed by the Mexico division for the 4 sites evaluated.

Assumptions:
- Assumptions and limitations of the RWH/AAR probabilistic model as defined within a document developed by Global Corporate Consultancy (2010).

Results:
A summary of benefits calculated using the RWH/AAR model is provided in Table 2 below.

<table>
<thead>
<tr>
<th>Location</th>
<th>Nayarit</th>
<th>Mexico</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tepic</td>
<td>Toluca</td>
<td>Zinacantepec</td>
</tr>
<tr>
<td>Catchment area (m$^2$)</td>
<td>30,500</td>
<td>24,234</td>
<td>26,473</td>
</tr>
<tr>
<td>Estimated rainfall on the catchment (ML)</td>
<td>38.2</td>
<td>19.6</td>
<td>21.4</td>
</tr>
<tr>
<td>Volume captured (ML)</td>
<td>28.8</td>
<td>13.0</td>
<td>14.2</td>
</tr>
<tr>
<td>Volume successfully used (ML)</td>
<td>22.3</td>
<td>10.8</td>
<td>11.7</td>
</tr>
<tr>
<td>Community Uses</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>% of captured rainwater recharged</td>
<td>77%</td>
<td>83%</td>
<td>82%</td>
</tr>
<tr>
<td>% of total precipitation falling on catchment(s) successfully captured and recharged</td>
<td>58%</td>
<td>55%</td>
<td>55%</td>
</tr>
</tbody>
</table>

$^1$Note that this volume for community water access is not included in the watershed restoration benefit reported below because this is a “water access” benefit and addressed separately.

The estimated annual capture in the following states of Mexico is presented below, and the total water quantity benefit is calculated as the sum of these volumes.

- Nayarit (Tepic): 22.3 ML/yr
- Mexico (Toluca and Zinacantepec): 32.5 ML/yr

**Total (ultimate) benefit is:** 54.8 ML/yr

**TCCC total (ultimate) benefit taken as a function of cost share is:** 54.8 ML/yr

The current (2011) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2011 Replenish Benefit**

The 2011 benefit is the performance-based benefit from this activity as of the end of calendar year 2011. The total 2011 benefit is 54.8 ML/yr and TCCC’s benefit (adjusted for cost share) is 54.8 ML/yr.
Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in this table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>54.8</td>
<td>54.8</td>
</tr>
<tr>
<td>2013</td>
<td>54.8</td>
<td>54.8</td>
</tr>
<tr>
<td>2014</td>
<td>54.8</td>
<td>54.8</td>
</tr>
<tr>
<td>2015</td>
<td>54.8</td>
<td>54.8</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>54.8</td>
<td>54.8</td>
</tr>
</tbody>
</table>

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED
- Reduction in storm water runoff and associated pollutant load

NOTES
- None

REFERENCES

PROJECT NAME: Restoration of Water Resources as an Adaptation to Climate Change

PROJECT ID #: 106

DESCRIPTION OF ACTIVITY: Establishment of infiltration wells for artificial aquifer recharge of rainwater

LOCATION: Sibolangit and Bah Bolon watersheds, North Sumatra Province, Indonesia

PRIMARY CONTACTS:
Mr. Triyono Prijosoesilo
Public Affair Manager – Indonesia Region
Tel. 62-21-5798 8264
tprijosoesilo@coca-cola.com

Sombat Jungsaitakul
ASEAN BU EOSH Manager
Tel. +6628351425
jsombat@coca-cola.com

OBJECTIVES:
• Increase recharge of local aquifer which provides 20% of the water for Medan City

BACKGROUND & ACTIVITY DESCRIPTION: A spring aquifer provides 20% of the water for Medan City, which has a population of 3 million. Over the last ten years, discharge from this aquifer has been deteriorating at a rate of 5% per year. If this continues, the water utility (PDAM Tirtanadi) will lose one of their most reliable water sources, with an immediate effect on the people of Medan.

Coca-Cola, in conjunction with partner organizations, has established infiltration wells to increase aquifer recharge. The main purpose of this project was to provide clean water for residents of Medan City, by increasing infiltration of rainwater through the construction of 690 infiltration wells in the catchment area. The infiltration wells were constructed in two different locations (Figure 1): Sibolangit watershed (449 infiltration wells), and the neighboring Bah Bolon watershed (241 infiltration wells).

The project was initiated in the catchment area of PDAM Tirtanadi in the villages of Puangaja, Rumah, Sumbal, Sibolangit and Rumah Pil Pil dan Batu Layang in Sibolangit sub-district. Project locations are shown below in red circles.

Figure 1. Project location
Figure 2 shows infiltration well construction and a completed well.

![Figure 2. Construction of infiltration wells in North Sumatra Province](image)

**SUMMARY OF REPLENISH BENEFIT:**

- **2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE:** 746 ML/YR

**ACTIVITY TIMELINE:**

- January 2012 - October 2013

**COCA-COLA CONTRIBUTION:** 88.3%

- Total project cost: $254,822 USD
- TCCC contribution: $224,978 USD

**WATERSHED BENEFITS CALCULATED:**

1. **INCREASE IN RECHARGE**

**Approach:**

The Rain Water Harvesting/Artificial Aquifer Recharge (RWH/AAR) Probabilistic Model, Version 1.5 was used to estimate the volume of water successfully used for artificial aquifer recharge based on available rainfall. The model has been used to quantify replenish benefits for similar projects in India (GCC, 2010). The Coca-Cola Company partnered with the Global Corporate Consultancy (GCC), formerly known as Delta Consultants, to develop the RWH/AAR model. Data obtained from the RWH/AAR system survey were used with the model to estimate the benefits for this project. The assumptions used in the model application are described in the following sections. RWH/AAR model is split into three modules based upon: 1) the flow of water from precipitation to the catchment, 2) storage capacity water balance, and 3) delivery of water to the desired end use (i.e., community access or AAR).

**Rainwater Available for AAR:**

To calculate the potential rainwater collected and made available for AAR, the model utilizes the following formula and variables:

\[(\text{Catchment Size}) \times (\text{Total Precipitation}) \times (\text{Catchment Runoff Coefficient})\]
Catchment Size – The size of the surface catchment evaluated is 2,388,429 m² at Sibolangit Watershed and 473,238 m² at Bah Bolon Watershed.

Total Precipitation – The model requires monthly rainfall data. Average annual rainfall totals were provided for the project area. Long-term monthly climate data for this region were obtained by LimnoTech through a global climate dataset (Hearn et al. 2003). The percent of precipitation by month for the project area was estimated based on the global climate dataset, and then used to apportion the total annual rainfall amount indicated in the survey.

Catchment Runoff Coefficient – The runoff coefficient represents the efficiency of a catchment in producing runoff. A runoff coefficient of 30%, typically used for unpaved surfaces (GCC, 2010), was selected for the calculations.

Storage Capacity Water Balance Module:
The RWH/AAR model uses a water balance approach and monthly precipitation data to estimate the volume of water not lost due to insufficient storage or infiltration rate of structure used for AAR. During each month the model calculates the rainwater available to meet community demand and/or AAR. If the combined community and AAR demand is less than the available water in a given month, it is assumed both demands would be completely met, and any excess water would remain in the AAR structure (up to the volume of structure, with any water beyond that volume assumed to be lost due to insufficient storage). This project does not incorporate any storage structures but utilizes water recharge through infiltration wells. Therefore each well was assigned to have a recharge rate of 4 m³/day. This recharge rate translates to a percolation rate of 1 m/day for the 2m x 2m infiltration wells. It should be noted that the recharge rate of 4 m³/day for the infiltration wells is a reasonable assumption of potential rate. It was also assumed that all available water is utilized for AAR (i.e., no community demand).

Artificial Aquifer Recharge Water Balance Module:
For this project, 100% of the captured water is used for AAR. The RWH/AAR model estimates the volume of water successfully used for AAR based on the recharge mechanism used. Based on information provided, it was determined that the primary mechanism of AAR is through percolation pits or infiltration wells. The volume of water successfully recharged to the aquifer through percolation pits or recharge wells/shafts was estimated by the model using the following formula:

\[(Q_{\text{AAR}} - P_{\text{PRW}}) \times (\text{Efficiency of the AAR processes}) \times (\text{Maintenance Efficiency})\]

where \(Q_{\text{AAR}} - P_{\text{PRW}}\) is the annual volume of water received by the infiltration wells.

For this project, an AAR process efficiency of 95% corresponding to recharge via infiltration wells was used. A maintenance efficiency of 95% was used for the project corresponding to annual maintenance frequency.

Results:
A summary of benefits calculated using the RWH/AAR model is provided in Table 1 below.
Table 1. Summary of Project Model Inputs and Outputs

<table>
<thead>
<tr>
<th>Location within North Sumatra Province</th>
<th>Sibolangit watershed</th>
<th>Bah Bolon watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catchment area (m²)</td>
<td>2,388,429</td>
<td>473,238</td>
</tr>
<tr>
<td>Annual rainfall (mm/year)</td>
<td>2,263</td>
<td>2,263</td>
</tr>
<tr>
<td>Estimated rainfall on the catchment (ML/yr)</td>
<td>5,405</td>
<td>1,071</td>
</tr>
<tr>
<td>Catchment supply (ML/yr)</td>
<td>1,622</td>
<td>321</td>
</tr>
<tr>
<td>Infiltration capacity of the wells (ML/yr)</td>
<td>647</td>
<td>347</td>
</tr>
<tr>
<td>Volume captured (ML/yr)</td>
<td>647</td>
<td>290</td>
</tr>
<tr>
<td>AAR</td>
<td>584</td>
<td>261</td>
</tr>
<tr>
<td>Total Benefit (ML/yr)</td>
<td>845</td>
<td></td>
</tr>
</tbody>
</table>

Note: Catchment supply varies by month based on precipitation. The total catchment supply on a monthly basis may be less than the infiltration capacity of the wells. As such, the actual volume captured and recharged annually may be less than the estimated annual catchment supply.

The total (ultimate) water quantity benefit is: 845 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 746 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit
The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 845 ML/yr and TCCC’s benefit (adjusted for cost share) is 746 ML/yr.

Projected Water Quantity Benefits Summary
Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 2. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>845</td>
<td>746</td>
</tr>
<tr>
<td>2015</td>
<td>845</td>
<td>746</td>
</tr>
<tr>
<td>2016</td>
<td>845</td>
<td>746</td>
</tr>
<tr>
<td>2017</td>
<td>845</td>
<td>746</td>
</tr>
<tr>
<td>2018</td>
<td>845</td>
<td>746</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>845</td>
<td>746</td>
</tr>
</tbody>
</table>
Data Sources

- RWH survey completed by the Indonesia Division. An annual rainfall of 2,263 mm/yr was reported in the survey, which is very similar to the value obtained from the global database (2,062 mm; Hearn et al., 2003). Monthly values from the global database were used to apportion the annual rainfall provided in the survey.
- Catchment areas - provided by contact.

Assumptions:

- Assumptions and limitations of the RWH/AAR model as defined within a document developed by Global Corporate Consultancy (2010).
- Without this project, a negligible amount of water infiltrates at the site where the infiltration wells are constructed.
- A recharge rate of 4 m³/day was assumed for use in the RWH model, which corresponds to percolation rate of 1 m/day characteristics of loamy-sand (ASCE, 2001). This value generates benefits that are comparable to, and slightly lower than those provided by the Indonesia Division with their own calculations.
- It is assumed that the infiltration wells will be maintained at least on an annual basis to prevent clogging.

OTHER BENEFITS NOT QUANTIFIED

- Reduction in storm water runoff and associated pollutant load

NOTES

- This factsheet updates the November, 2012 factsheet to reflect a change in the number and location of infiltration wells. The original plan was to construct 800 infiltration wells in Sibolangit area; however, due to challenges on the ground, 690 were constructed, with 449 wells built in the Sibolangit area and 241 wells built in the neighboring area of Pematang Sintar (Bah Bolon watershed). Revised watershed drainage areas were also provided. This information and project benefits were updated in this factsheet.
- The AAR process efficiency of 95% and maintenance efficiency of 95% are based on the default database within the RWH/AAR model.

REFERENCES


**PROJECT NAME:** St. Lawrence Restoration (Saint-Eugene Marsh)  
**PROJECT ID #:** 109

**DESCRIPTION OF ACTIVITY:** Wetland restoration (34 ha)

**LOCATION:** North shore of Lake St. Pierre Quebec, Canada.  
Coordinates (latitude/longitude): 46.28231, 72.65156

**PRIMARY CONTACT:**
- Marie-Claude Lemieux  
  WWF-Canada  
  50, Ste-Catherine Street W  
  Suite 340  
  Montréal, QC, H2X 3V4  
  514-394-1142  
  mclemieux@wwfcanada.org
- Rena Ann Stricker  
  Contract Ecologist  
  CCR Environment & Sustainability  
  404-395-6250  
  rstricker@coca cola.com
- Jon Radtke  
  Manager, Water Resources  
  CCR Environment & Sustainability  
  404-676-9112  
  jradtke@coca cola.com
- Dave Moran  
  damoran@coca cola.com

**OBJECTIVES**
- Preserve water in the marsh, improving habitat.  
- Allow better circulation of water and fish throughout the marsh.  
- Improve water quality.

**BACKGROUND & DESCRIPTION OF ACTIVITY:** The 34-hectare Saint-Eugene marsh is hydrologically connected to Lac Saint Pierre, and offers exceptional wildlife habitat. This marsh is located in an urban area and receives sediment and agrochemical loads from several tributaries during spring floods. In 1994, the hydrology of the marsh was significantly altered by installation of three structures fitted with a control system to manage water levels. Furthermore, the marsh is divided by a road, with a culvert connecting the east and west sections of the marsh.
Prior to this restoration project, water entered the marsh from the east end, but due to the size and placement of the culvert under the road, circulation between the east and west portions of the marsh was poor. There was no control structure at the east end of the marsh, and water left the marsh naturally at the low point in the far eastern part of the marsh. The western portion of the marsh dried out from roughly the end of June through September. It was dry for approximately 90 days each year.

The map below shows the tributaries that bring water to the marsh (blue lines), on which the sediment retention structures were installed. This map also shows the structures that were installed in 1994.

Between September and November 2012, a larger culvert was installed under the road, and a water control structure was installed at the eastern end of the marsh where it exchanges water with Lake St. Pierre. These are shown by red arrows. The culvert allows circulation between the two sections of the marsh, and the control structure prevents water from flowing out of the marsh to Lake St. Pierre when the marsh water level is at or below 4.4 meters. The control structure does not prevent water from entering the marsh during the spring flooding period.

SUMMARY OF REPLENISH BENEFIT:
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 7.6 ML/YR

ACTIVITY TIMELINE:
- September 10, 2012 – Project initiation
- November 9, 2012 – Project completion

COKE CONTRIBUTION: 32%
WATERSHED BENEFITS CALCULATED:

1. Increase in water storage

1. INCREASE IN WATER STORAGE

Approach and Results:
The increase in water storage was calculated based on bathymetry/topography information provided for
the marsh and the difference in marsh volume between 4.4 meters (i.e., the elevation of the proposed
control structure) and 3.8 meters, which represents the elevation at which the marsh typically recedes
during the summer months. The estimated additional water volume that will be retained annually in
the marsh due to placement of the new control structure results in a water quantity benefit of 23.7
ML/yr.

The total (ultimate) benefit is: 23.7 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 7.6 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for
implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year
2012. The total 2012 benefit is 23.7 ML/yr, and TCCC’s benefit (adjusted for cost share) is 7.6 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive
service. While not shown in the table, the benefits are anticipated to continue to be generated through
the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual
benefits. The benefits are scaled for implementation schedule in the second column and scaled further
for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>23.7</td>
<td>7.6</td>
</tr>
<tr>
<td>2014</td>
<td>23.7</td>
<td>7.6</td>
</tr>
<tr>
<td>2015</td>
<td>23.7</td>
<td>7.6</td>
</tr>
<tr>
<td>2016</td>
<td>23.7</td>
<td>7.6</td>
</tr>
<tr>
<td>2017</td>
<td>23.7</td>
<td>7.6</td>
</tr>
</tbody>
</table>

Ultimate Benefit: 23.7

Data Sources:

- Hypsography for Saint-Eugene marsh – the hypsograph summarizes the bathymetry/topography
  for the marsh by expressing the marsh wetted surface area as a function of water surface
elevation in the marsh.
- Elevation of the spillway invert for the proposed control structure (4.4 meters).
- Estimate of the water elevation that the marsh typically draws down to in the summer months
  under current conditions (i.e., without a control structure in place).
Assumptions:

- The sill of the control structure will be constructed at the planned elevation of 4.4 meters.
- There is sufficient flow input from Lake St. Pierre to St. Eugene marsh each year to inundate the marsh to an elevation of 4.4 meters. (Note: historical water level data for 1900-2000 indicate that the peak spring water level exceeds 4.4 meters by at least 20-cm 99% of all years.)
- The water level in the marsh typically declines to 3.8 meters, primarily as the result of water lost from the marsh system via outflow to Lake St. Pierre during the summer months (estimate provided by WWF contact, and also supported by review of historical water level data).

OTHER BENEFITS NOT QUANTIFIED

- Improved habitat for aquatic species.

NOTES

- None

REFERENCES

PROJECT NAME: Indian Valley High Mountain Meadow Restoration  
PROJECT ID #: 113

DESCRIPTION OF ACTIVITY: Re-wetting high mountain meadows through hydrological restoration

LOCATION: The project area is located atop the Sierra Crest of the Sierra Nevada Divide in Alpine County, California, in the Eldorado National Forest adjacent to Mokelumne Wilderness, approximately 9 miles southeast of Carson Pass and Highway 88.

PRIMARY CONTACT:
Chuck Loffland  
26820 Silver Drive  
Pioneer, CA 95666  
cloffland@fs.fed.us  
Tel. 209-295-5954

Rena Ann Stricker  
CCR Environment & Sustainability  
Stricker@coca-cola.com  
Tel. 404-395-6250

Jon Radtke  
CCR Environment & Sustainability  
Jradtke@coca-cola.com  
Tel. 404-676-9112

OBJECTIVES:
• Restore floodplain connectivity, groundwater recharge, and flood attenuation
• Restore wet meadow habitat
• Provide a clean and consistent water supply for human use

BACKGROUND & ACTIVITY DESCRIPTION: Indian Valley is a sensitive, high mountain (elevation) meadow that has been degraded due to past human activities (water development, recreational use, roads, animal grazing) and natural processes. The degraded condition consists of stream channel erosion with gullying and headcutting, sedimentation in the stream channel, lowering of the ground water table in the meadow, drying of the meadow vegetation, loss of willows, and sagebrush encroachment (Bakker 2009, USDA FS 2012a).

The desired condition for the meadow is for it to be hydrologically functional, to maintain and enhance habitat to support desired plants and wildlife, and to provide water that meets the goals of the Clean Water Act and Safe Water
Drinking Act to support downstream uses (i.e., fishable, swimmable, and drinkable after normal treatment) (USDA FS 2012a,b).

To achieve the desired condition, sites of accelerated erosion, such as gullies and headcuts, need to be stabilized and recovering. Vegetation roots also need to be established through the available soil profile. Finally, meadows with perennial streams need the following characteristics: 1) stream energy from high flows is dissipated, reducing erosion and improving water quality, 2) streams filter sediment and capture bedload to aid floodplain development, 3) meadow conditions enhance floodwater retention and groundwater recharge, and 4) root masses stabilize stream banks against cutting action) (USDA FS 2012a,b).

The restoration activities were completed in 2012 and consist of a “plug and pond” remediation method of approximately 6,000 feet of low gradient stream. Deep gullies were filled or “plugged” to encourage flows to reconnect with the remnant or historic stream channel. Shallow “ponds” were created to connect the stream channel to its floodplain, increase groundwater replenishment and improve aquatic habitat. Volunteer labor was used for revegetation, seeding, planting, and monitoring of project effectiveness (USDA FS 2012a,b).

These restoration activities have restored channel connections to the floodplain, attenuated peak floods and increased groundwater recharge during spring snowmelt. The increased groundwater allows for increased summer baseflow and restoration of wet meadow habitat to maintain and enhance plants and wildlife. The created ponds add complexity to the floodplain and provide amphibian rearing and breeding habitat with warmer, shallow edges for tadpoles, and deeper pools with boulders for amphibian escape cover. A reduction in sediment erosion will also improve water quality.

**SUMMARY OF REPLENISH BENEFIT**

- **2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 305 ML/YR**

**ACTIVITY TIMELINE:**

- August 2012 – Project initiation
- October 2012 – Project completion

**COCA-COLA CONTRIBUTION:  100%**

- Total cost (USD) for meadow restoration 2012: $350,000 USD

**WATERSHED BENEFITS CALCULATED:**

1. Increase in annual groundwater storage
1. INCREASE IN ANNUAL GROUNDWATER STORAGE

Approach & Results:
The Replenish benefit was calculated as the increase in annual groundwater storage resulting from meadow restoration. This volume was predicted based on the following equation (National Fish and Wildlife Foundation 2010):

\[ \text{Storage change} = \text{meadow area} \times \text{average gully depth} \times \text{specific yield} \times \text{shape factor} \]

where:

- \( \text{Storage change} \) (acre-ft)
  Increase in annual ground water storage as a result of meadow restoration

- \( \text{Meadow area} \) (acres)
  Total area of the meadow affected by restoration = 500 acres

- \( \text{Average gully depth} \)
  Estimate of an average gully depth = 3 feet

- \( \text{Specific yield} \) (%)
  Average specific yield of the meadow alluvium = 33%.
  Specific yield is defined as the ratio of the volume of water that a saturated soil will yield by gravity to the total volume of soil. Based on soil properties of similar meadows in the project area, silty, fine sand was assumed as the most prevalent texture of the alluvial deposit in the meadow (ICF Jones and Stokes 2008). Typical average specific yield corresponding to fine sand is 33% (ICF Jones and Stokes 2008).

- \( \text{Shape factor} \) (unitless)
  A shape factor of 0.5 was assumed to account for the shape of the alluvium that extends from the incised stream to the edge of the basin (ICF Jones and Stokes 2008).

Increase in annual ground water storage as a result of meadow restoration = 247.5 acre-ft = 305 ML/yr

The total benefit for this project is: 305 million liters per year (ML/yr).

- \( \text{Total (ultimate) benefit is:} \) 305 ML/yr
- \( \text{TCCC total (ultimate) benefit taken as a function of cost share is:} \) 305 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit
The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 305 ML/yr and TCCC’s benefit (adjusted for cost share) is 305 ML/yr.
Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>305</td>
<td>305</td>
</tr>
<tr>
<td>2014</td>
<td>305</td>
<td>305</td>
</tr>
<tr>
<td>2015</td>
<td>305</td>
<td>305</td>
</tr>
<tr>
<td>2016</td>
<td>305</td>
<td>305</td>
</tr>
<tr>
<td>2017</td>
<td>305</td>
<td>305</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>305</td>
<td>305</td>
</tr>
</tbody>
</table>

Data Sources:

- The US Department of Agriculture Forest Service (USDA FS) provided the total area of the meadow affected by restoration and the estimate of an average gully depth.
- The average specific yield of the meadow alluvium and the shape factor was based on guidance provided in ICF Jones and Stokes (2008).

Assumptions:

- The most prevalent texture of the alluvial deposit in the meadow was assumed to consist of silty, fine sand based on soil properties of similar meadows in the project area.
- To account for the shape of the alluvium that extends from the incised stream to the edge of the basin, a shape factor of 0.5 was assumed.

OTHER BENEFITS NOT QUANTIFIED

- Reduction in sediment loading
- Improve water quality
- Provide shading/reduce water temperatures
- Improve habitat/increase biodiversity
- Protect drinking water supply
NOTES

• None

REFERENCES


PROJECT NAME: Trail Creek Restoration, Colorado
PROJECT ID #: 114

DESCRIPTION OF ACTIVITY: Construction of sediment detention basins and rehabilitation of alluvial fans.

LOCATION: The Trail Creek Watershed is located in the Pike National Forest, approximately 55 miles south of Denver, Colorado.

PRIMARY CONTACT:
Rena Ann Stricker Jon Radtke
Contract Ecologist Manager, Water Resources
CCR Environment & CCR Environment &
Sustainability Sustainability
404-395-6250 404-676-9112
rstricker@coca-cola.com jradtke@coca-cola.com

OBJECTIVES:
- Positively impact the water supply and storage capacity for the Denver Metro water supply
- Reduce erosion
- Improve water quality

BACKGROUND & ACTIVITY DESCRIPTION: The Trail Creek Watershed is located within the Hayman Fire area. The 2002 Hayman Fire, until recently, was the largest and most destructive in Colorado’s history. The fire burned a total of 137,760 acres in the Pike National Forest, as well as on state, county and private lands, eradicating ground cover and allowing the transportation of bare soils into the source water watershed of Denver’s water supply. The fire consumed 600 structures and damaged habitat for numerous threatened or endangered species, and severely impacted the water source for more than 75% of Colorado’s 4.3 million residents and states downstream (Vail Resorts et al., 2012). The US Forest Service (USFS) is addressing post-fire restoration needs through a public-private partnership, The Hayman Restoration Partnership. This partnership is helping to reduce erosion and improve water quality, replenishing water for Colorado residents by positively impacting the water supply and storage capacity for the Denver Metro water supply.
The Hayman Fire area contains 59 sub-watersheds, and sub-watershed 6 is the number one priority due to large sediment yields from roads, surface erosion, streambank erosion and post-fire excess peak flows (Rosgen 2011a). Sub-watershed 6 drains to Trail Creek. The restoration approach for this sub-watershed addresses three major sources of sediment to Trail Creek: channel processes; surface erosion; and roads and trails. Most of the restoration activities within sub-watershed 6 are related to channel processes, as the channels within this sub-watershed are incised, confined and associated with headcuts (Rosgen 2011a,b).

The major restoration activities include construction of sediment detention basins and rehabilitation of alluvial fans of two impaired tributaries that drain to Trail Creek (Rosgen 2011a,b). These activities are projected to restore the function of alluvial fans to naturally store sediment directly below high sediment supply and high transport stream types; reduce accelerated streambank erosion rates; and eliminate any advancing headcuts (Rosgen 2011a,b). Restoration activities also include slope revegetation efforts to increase ground cover density to reduce surface erosion on exposed stream slopes (Rosgen 2011a,b).

**SUMMARY OF REPLENISH BENEFIT**
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 232 ML/YR

**ACTIVITY TIMELINE:**
- March 2012 – Project initiation
- November 2012 - Project completion

**COCA-COLA CONTRIBUTION:** 100%
- Total cost (USD) for stream channel restoration 2012: $150,000 USD

**WATERSHED BENEFITS CALCULATED:**
1. Decrease in runoff
2. Decrease in sediment load

1. **DECREASE IN RUNOFF**

**Approach & Results:**
Table 1 presents modeled flows for three different conditions in sub-watershed 6. These are pre-fire condition, post-fire condition, and post-restoration condition. The water “restoration benefits” are defined as the decrease in runoff, or runoff, expected to occur after restoration activities are complete. These benefits were estimated as the difference between “post-fire” and the estimated “post-
restoration” conditions using modeled flow results from Rosgen (2011b), and are presented in Table 1 for sub-watershed 6.

Table 1. Estimates of Runoff from Sub-Watershed 6 (Source: Rosgen, 2011b)

<table>
<thead>
<tr>
<th>Runoff (acre-ft/yr)</th>
<th>Pre-Fire</th>
<th>Post-Fire</th>
<th>Total Increase</th>
<th>Post-Restoration</th>
<th>Water Restoration Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,069</td>
<td>2,421</td>
<td>352</td>
<td>2,152</td>
<td>269</td>
</tr>
</tbody>
</table>

Using the values from Table 1, the water “restoration benefits” were estimated as the difference between “post-fire” and the estimated “post-restoration” conditions.

\[
\text{Runoff (acre-ft/yr)} = 2,421 \text{ [Post-Fire]} - 2,152 \text{ [Post-Restoration]} = 269 \text{ acre-ft/yr}
\]

The “restoration benefits” presented in Table 1 represent an upper bound estimate resulting from all of the restoration activities in sub-watershed 6. It was assumed that 70% of the estimated water “restoration benefits” would result from the activities identified above and described in Rosgen (2011a,b) (i.e., restoration of alluvial fan in impaired reaches and revegetation in stream adjacent slopes).

\[
\text{Runoff (acre-ft/yr)} = 269 \text{ acre-ft/yr} \times 0.70 = 188 \text{ acre-ft/yr}
\]

Estimated Replenish Benefit = 188 acre-ft/yr = 232 ML/yr

The total benefit for this project is: 232 million liters per year (ML/yr).

Total (ultimate) benefit is: 232 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 232 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2012 Replenish Benefit
The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 232 ML/yr and TCCC’s benefit (adjusted for cost share) is 232 ML/yr.

Projected Replenish Benefits
Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 2. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>232</td>
<td>232</td>
</tr>
<tr>
<td>2014</td>
<td>232</td>
<td>232</td>
</tr>
<tr>
<td>2015</td>
<td>232</td>
<td>232</td>
</tr>
<tr>
<td>2016</td>
<td>232</td>
<td>232</td>
</tr>
<tr>
<td>2017</td>
<td>232</td>
<td>232</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>232</td>
<td>232</td>
</tr>
</tbody>
</table>

Data Sources:
- Modeled flow results for sub-watershed 6 were obtained from Page D-33 of Appendix-D of the Rosgen (2011b) report.

Assumptions:
- It was assumed that 70% of the estimated “restoration benefits” would result from the activities described in the “Background & Description of Activity” section above and in Rosgen (2011a,b) (i.e., restoration of alluvial fan in impaired reaches and revegetation in stream adjacent slopes).

2. DECREASE IN SEDIMENT LOAD

Approach & Results:
Table 3 presents modeled flows for three different conditions in sub-watershed 6. These are pre-fire condition, post-fire condition, and post-restoration condition. The sediment “restoration benefits” are defined as the decrease in sediment load expected to occur after restoration activities are complete. These benefits were estimated as the difference between “post-fire” and the estimated “post-restoration” conditions using modeled sediment results from Rosgen (2011b), are presented in Table 3 below for sub-watershed 6.

Table 3. Estimates of Sediment Load from Sub-Watershed 6

<table>
<thead>
<tr>
<th>Sediment (ton/yr)</th>
<th>Pre-Fire</th>
<th>Post-Fire</th>
<th>Total Increase</th>
<th>Post-Restoration</th>
<th>Restoration Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>65</td>
<td>1,705</td>
<td>1,640</td>
<td>460</td>
<td>1,245</td>
</tr>
</tbody>
</table>

Using the values from Table 3, sediment “restoration benefits” were estimated as the difference between “post-fire” and the estimated “post-restoration” conditions.

\[ \text{Sediment (tons/yr)} = 1,705 \text{ [Post-Fire]} - 460 \text{ [Post-Restoration]} = 1,245 \text{ tons/yr} \]
The “restoration benefits” presented in Table 3 represent an upper bound estimate resulting from all of the restoration activities in sub-watershed 6. It was assumed that 70% of the estimated sediment “restoration benefits” would result from the activities identified above and described in Rosgen (2011a,b) (i.e., restoration of alluvial fan in impaired reaches and revegetation in stream adjacent slopes).

\[
\text{Sediment (tons/yr)} = 1,245 \text{ tons/yr} \times 0.70 = 871.5 \text{ tons/yr}
\]

Estimated reduction in sediment load as a result of restoration activities: 871.5 tons/yr

The total benefit (sediment load reduction) is: 871.5 tons per year (tons/yr).

\[
\text{The total benefit (reduced sediment load) is: } 871.5 \text{ tons/yr and TCCC’s benefit (adjusted for cost share) is } 871.5 \text{ tons/yr}
\]

\[
\text{The 2012 benefit is: } 871.5 \text{ tons/yr and TCCC’s benefit (adjusted for cost share) is } 871.5 \text{ tons/yr}
\]

Data Sources:

- Modeled sediment yield results for sub-watershed 6 were obtained from Page D-33 of Appendix-D of the Rosgen (2011b) report.

Assumptions:

- It was assumed that 70% of the estimated “restoration benefits” would result from the activities described in the “Background & Description of Activity” section above and in Rosgen (2011a,b) (i.e., restoration of alluvial fan in impaired reaches and revegetation in stream adjacent slopes).

OTHER BENEFITS NOT QUANTIFIED

- Reestablish a functional riparian corridor
- Provide ecological restoration (including birds, fish, mammals and amphibians)
- Improve fish habitat diversity and function
- Reduce road and trail maintenance
- Provide for improved recreational opportunities

NOTES

- None

REFERENCES


PROJECT NAME: Dawson Forest Acquisition (Georgia for Generations)
PROJECT ID #: 115

DESCRIPTION OF ACTIVITY: Conservation of Dawson Forest

LOCATION: Dawson Forest is located in the Etowah River watershed, a subbasin of the Coosa River Basin in the state of Georgia

PRIMARY CONTACT:
Tami Willadsen
Senior Associate Director of Philanthropy
The Nature Conservancy
404-253-7205
twilladsen@tnc.org

Michelle B. Lakly, Ph.D.
State Director
The Nature Conservancy
404-253-7256
mlakly@tnc.org

Rena Ann Stricker
Contract Ecologist
CCR Environment & Sustainability
404-395-6250
rstricker@coca-cola.com

Jon Radtke
Manager, Water Resources
CCR Environment & Sustainability
404-676-9112
jradtke@coca-cola.com

OBJECTIVES:
• Maintain natural hydrologic regime and water quality
• Ensure habitat connectivity
• Protect biodiversity

BACKGROUND & ACTIVITY DESCRIPTION: Dawson Forest is an oasis for both people and wildlife, providing a wide range of outdoor recreational opportunities for out-of-state visitors and the metro-Atlanta population. The scenic beauty and abundant wildlife are important to the economic vitality of the local counties and the state, and the forest serves as an active wildlife corridor for both game (black bear, deer, turkey, doves, quail, rabbits) and non-game species (migratory birds). Important for its ecological diversity, this property contains mature hardwood forests and nearly two miles of Amicalola Creek, a vital tributary to the Etowah River (TNC, 2012).

The stunning beauty of Dawson Forest and its proximity to the metro-Atlanta area make this tract highly desirable for residential development and limited agriculture. In support of the conservation of Dawson Forest, The Nature Conservancy (TNC) secured a 469-acre (189.8 hectare) parcel that is an in-holding within the state-owned Dawson Forest Wildlife Management Area (WMA). Sources of funding for conservation in the area and along the Etowah River have come from United States Fish and Wildlife Service grants, mitigation funds from the Georgia Wetland Trust Fund administered by the Georgia Land Trust Service Center, grants and low-interest loans from the Georgia Land Conservation Program, private funds from the Woodruff Foundation, and Coca Cola’s “Georgia For Generations” grant program (TNC 2012).

The acquisition of this forest brings the land under state ownership and prevents land conversion from forestland to residential and agricultural uses that would negatively impact the natural hydrologic regime.
and water quality of Amicalola Creek and the Etowah River. The acquisition also protects tributaries of the upper Etowah, which harbor many endangered, threatened, and rare aquatic species. In addition, the tract fills the gap between 15,000 acres of state owned property to the north and 10,000 acres of state managed property to the south, creating over 25,000 acres of connected, protected forest. The acquisition of this tract maintains contiguous buffers along Amicalola Creek and its tributaries. Furthermore, since this tract fills in the gap between the WMA’s Wildcat Creek area and Amicalola area, it extends the length of contiguous corridor protection for Amicalola Creek, safeguarding downstream habitat (TNC, 2012).

**SUMMARY OF REPLENISH BENEFIT**
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 29.7 ML/yr

**ACTIVITY TIMELINE:**
- 2008 – Project initiation
- 2012 – Project completion

**COCA-COLA CONTRIBUTION:** 14%
- TCCC contribution: $700,000 USD
- Total cost (USD) for forest acquisition 2012: $5,000,000 USD

**WATERSHED BENEFITS CALCULATED:**
1. Decrease in runoff
2. Decrease in sediment erosion/runoff

---

1. **DECREASE IN RUNOFF**

**Approach & Results:**

The Curve Number Runoff method as implemented in the Soil & Water Assessment (SWAT) model (Neitsch et al. 2005) was used to estimate the decrease in runoff that would occur by preventing the conversion of forest to residential development (assumed to be 290.8 acres of pervious surface and 178.2 acres of impervious surface for a total of 469 acres). Water quantity calculations were focused on estimating the change in runoff volume because 1) runoff serves as a useful indicator for both hydrologic improvements (e.g., enhanced baseflow) and reductions in sediment erosion/yield; and 2) predictions of runoff are more certain than predictions for changes in baseflow for relatively small land areas.

Curve numbers (CN) for the without protection condition and the with protection condition were estimated based on information provided in the TR-55 document (USDA-NRCS, 1986):

*For the 290.8 acre (117.7 hectare) pervious residential development parcel:*

- **Without protection:** (pervious residential development)
Hydrologic soil group (HSG) “C”
- Lawns in “good” condition, grass cover >75% (CN = 74)

**With protection:** (forested)
- Hydrologic soil group (HSG) “C”
- Woodland in “good” condition (CN = 70)

For the 178.2 acre (72.1 hectare) impervious residential development parcel:

- Without protection: (impervious residential development)
  - Hydrologic soil group (HSG) “C”
  - Pavement, driveways, rooftops, etc. (CN = 98)

- With protection: (forested)
  - Hydrologic soil group (HSG) “C”
  - Woodland in “good” condition (CN = 70)

Daily precipitation and air temperature data were obtained from the EPA’s Better Assessment Science Integrating Point and Non-point Sources (BASINS) meteorological database for the 3 Miles NNW Dahlonega (COOP ID: 2479) station for the 1970 to 2006 time period (http://www.epa.gov/waterscience/ftp/basins/met_data/). Years 1997 to 2006 were selected for the analysis because the average precipitation for these ten years (1,449 mm) was consistent with the annual average precipitation range (~1,320 to 1,626 mm) reported for the area by GDNR EPD (1998). The Hamon method was used to estimate daily potential evapotranspiration (PET) for this year based on daily average air temperature and latitude (Hamon, 1963). Processed meteorological data were used to estimate daily runoff for the pre- and post-project cases. Total annual runoff volumes and the resulting water quantity benefit were estimated as the difference in the without conservation and with conservation runoff volume.

- **Without conservation (pervious plus impervious residential development)**
  - runoff volume: 1,454 ML/yr

- **With conservation (mature forest) runoff volume:** 1,242 ML/yr

  **The total (ultimate) benefit is:** 212.2 ML/yr
  **TCCC total (ultimate) benefit taken as a function of cost share is:** 29.7 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2012 Replenish Benefit**

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 212.2 ML/yr and TCCC’s benefit (adjusted for cost share) is 29.7 ML/yr.

**Projected Replenish Benefits**

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be
generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>212.2</td>
<td>29.7</td>
</tr>
<tr>
<td>2014</td>
<td>212.2</td>
<td>29.7</td>
</tr>
<tr>
<td>2015</td>
<td>212.2</td>
<td>29.7</td>
</tr>
<tr>
<td>2016</td>
<td>212.2</td>
<td>29.7</td>
</tr>
<tr>
<td>2017</td>
<td>212.2</td>
<td>29.7</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>212.2</td>
<td>29.7</td>
</tr>
</tbody>
</table>

Data Sources:
- Size of protected land area: 469 acres (189.8 hectares) (provided by contact)
- Slope: ~10% (conservative estimate from global GIS datasets)
- Soil type: assigned as HSG “C” (low infiltration rates) based on the NRCS Soil Survey Geographic (SSURGO) database (http://soils.usda.gov/survey/geography/ssurgo/)
- Daily precipitation and air temperature data were obtained from the BASINS meteorological database for the 3 Miles NNW Dahlonega (COOP ID: 2479) station (http://www.epa.gov/waterscience/ftp/basins/met_data/).

Assumptions:
- If the land were not protected, it would become medium-density residential development
- The medium-density residential development area is assumed to be 62% pervious (290.8 acres) and 38% impervious (178.2 acres)(Neitsch et al., 2011).
- SWAT model parameter “CNCOEF” was set to 0.5 (used to calculate the daily change in the retention parameter based on daily potential evapotranspiration rates).

2. DECREASE IN SEDIMENT EROSION/RUNOFF

Approach & Results:
The Modified Universal Soil Loss Equation (MUSLE) method (Williams, 1975) as implemented in the SWAT model was used to compute the change in sediment erosion and washoff that would occur as a result if the land were not protected from residential development. The meteorological and physical datasets described above for the runoff calculation were used to support application of the MUSLE equation. Estimates of runoff volume were based on the Curve Number method described in the previous section, and daily maximum hourly rainfall intensities were estimated for years 1997 to 2006.

The Cover/Management Factors ($C_{usle}$) used in the MUSLE were estimated as follows based on Haith (1992):
• **Without protection**: pervious residential development, open space with ~80% grass cover assumed \((C_{usle} = 0.01)\)

• **Without protection**: impervious residential development; rooftops, driveways, rooftops, etc. with minimum sediment availability assumed \((C_{usle} = 0.0)\)

• **With protection**: woodland with 75-100% tree canopy \((C_{usle} = 0.001)\)

Total annual sediment yields for the residential and forested land areas were estimated as follows:

• **Without protection** (residential) sediment yield: 1,691 MT/yr

• **With protection** (forested) sediment yield: 282 MT/yr

**The total benefit (sediment yield reduction) is: 1,409 MT/yr**

The total benefit (reduced sediment yield) is: 1,409 MT/yr and TCCC’s benefit (adjusted for cost share) is 197 MT/yr.

The 2012 benefit is: 1,409 MT/yr and TCCC’s benefit (adjusted for cost share) is 197 MT/yr.

**Data Sources:**

• See previous runoff section for a description of supporting meteorological and physical datasets and sources.

**Assumptions:**

• The tree canopy in the forested areas was assumed to be mature.

• The Cover/Management Factor \((C_{usle})\) was assumed to remain constant through time (both seasonally and across years).

• The soil erodibility factor \((K)\) was assumed to be 0.24 for use in MUSLE equation.

---

**OTHER BENEFITS NOT QUANTIFIED**

• Protection of habitat and biodiversity

**NOTES**

• None

**REFERENCES**


PROJECT NAME: Coca-Cola Rain Gardens
PROJECT ID #: 118

DESCRIPTION OF ACTIVITY: Construction of rain gardens in the United States

LOCATION: Village of Niles, IL; Lexington, KY, St. Louis, MO, Atlanta, GA, Etowah, GA, Canton, GA, Seminole County, GA, Montgomery, AL, Trussville, AL, Birmingham, AL, Grand Rapids, MI, Jacksonville, FL

PRIMARY CONTACT:
Rena Ann Stricker             Jon Radtke
Contract Ecologist            Manager, Water Resources
CCR Environment & Sustainability CCR Environment & Sustainability
rstricker@coca-cola.com       jradtke@coca-cola.com
404-395-6250                 404-676-9112

OBJECTIVES:
• Reduction of sediment and other pollutant run-off
• Improved stormwater infiltration

BACKGROUND & ACTIVITY DESCRIPTION: A rain garden is a shallow depression that is designed to capture rainfall and stormwater runoff. It is usually a small garden of plants that can withstand the extremes of moisture and elevated levels of nutrients found in stormwater runoff. Rain gardens are ideally located close to the source of the runoff and they serve to slow the stormwater as it travels downhill, giving the water more time to infiltrate and less opportunity to gain momentum and erosive power.

Coca-Cola has funded rain gardens at various locations in the United States to reduce stormwater runoff, and help prevent erosion downstream in the project watersheds. In some locations such as Lexington, KY, the use of native wildflower and grass species provides food for numerous pollinators and birds.
Diagrams of some of the rain gardens are shown below.

Village of Niles, conceptual plan

---

**SUMMARY OF REPLENISH BENEFIT:**
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 44.42 ML/YR

**ACTIVITY TIMELINE:**
- Through 2012 - Fifteen rain gardens have been completed.

**COCA-COLA CONTRIBUTION:** Variable, as shown below.

<table>
<thead>
<tr>
<th>Name</th>
<th>TCCC cost share (% of total cost)</th>
<th>Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village of Niles (IL)</td>
<td>100%</td>
<td>Village of Niles</td>
</tr>
<tr>
<td>Lexington Rain Garden #1 (KY)</td>
<td>100%</td>
<td>Bluegrass Rain Garden Alliance</td>
</tr>
<tr>
<td>Lexington Rain Garden #2 (KY)</td>
<td>11%</td>
<td>Bluegrass Rain Garden Alliance</td>
</tr>
<tr>
<td>St. Louis - 2 gardens (MO)</td>
<td>100%</td>
<td>Maryland Heights CCR</td>
</tr>
<tr>
<td>Etowah - 2 gardens (GA)</td>
<td>100%</td>
<td>WWF, Upper Etowah River Alliance</td>
</tr>
<tr>
<td>Bioswales in Jacksonville (FL)</td>
<td>100%</td>
<td>St. Johns Riverkeeper</td>
</tr>
<tr>
<td>Canton Fire Station (GA)</td>
<td>71%</td>
<td>TNC, WWF, Upper Etowah River Alliance</td>
</tr>
<tr>
<td>Montgomery (AL)</td>
<td>100%</td>
<td>WWF, Alabama Clean Water Partnership</td>
</tr>
<tr>
<td>Trussville Library (AL)</td>
<td>100%</td>
<td>WWF, Cahaba River Society</td>
</tr>
<tr>
<td>Grand Rapids (MI)</td>
<td>*</td>
<td>West Michigan Environmental Action Committee</td>
</tr>
<tr>
<td>Birmingham (AL)</td>
<td>100%</td>
<td>United Bottling Company</td>
</tr>
<tr>
<td>Seminole County/Donalsonville (GA)</td>
<td>100%</td>
<td>TNC</td>
</tr>
<tr>
<td>Fernbank Rain Garden (GA)</td>
<td>100%</td>
<td>WWF</td>
</tr>
</tbody>
</table>

*Note: information is not yet available for the rain garden in Grand Rapids, MI*
WATERSHED BENEFITS CALCULATED:
  1. Decrease in stormwater runoff into sewers and streams

1. DECREASE IN STORMWATER RUNOFF INTO SEWERS AND STREAMS

Approach & Results:
The water quantity benefit was calculated separately for each rain garden, using the CCNA Rain Garden Calculator. Based on annual average rainfall, the CCNA Rain Garden tool estimates the volume captured based on the area of rain garden and the runoff that flows into the rain garden from pervious and impervious surfaces.

Inputs

Annual Average Precipitation:
The user inputs annual precipitation in inches/year. If the annual precipitation is not known, the user can input location information by either selecting the location of interest from ‘location/region’ or by inputting the latitude and longitude of the site. The CCNA Rain Garden Calculator then provides an estimate of annual precipitation for that location.

Catchment Area:
Catchment area is the drainage area that will contribute runoff to the rain garden. The areas of pervious and impervious surfaces that are contributing runoff to the rain garden are entered by the user.

Total Area of Rain Garden:
This input represents the total area of the rain garden designed to capture rainfall and runoff

Calculator
The CCNA Rain Barrel Calculator calculates the total volume of runoff captured by the rain garden in million liters per year (ML/yr), based on the following equation:

Runoff = runoff from pervious catchment surfaces + runoff from impervious catchment surfaces + rainfall volume directly on rain garden

Runoff (ML/yr) = [annual rainfall (in/yr) x area of pervious surface (acres) x 0.25] + [annual rainfall (in/yr) x area of impervious surface (acres) x 0.85] + [annual rainfall (in/yr) x area of rain garden (acres) x 1 x 0.0254] x 4046.8564/1000
Revised November 2012

<table>
<thead>
<tr>
<th>Rain Garden Location</th>
<th>Total estimated 2012 benefit (ML/yr)</th>
<th>TCCC estimated 2012 benefit adjusted for cost share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village of Niles (IL)</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td>Lexington Rain Garden #1 (KY)</td>
<td>3.2</td>
<td>3.20</td>
</tr>
<tr>
<td>Lexington Rain Garden #2 (KY)</td>
<td>6.84</td>
<td>0.75</td>
</tr>
<tr>
<td>St. Louis -2 gardens (MO)</td>
<td>4.35</td>
<td>4.35</td>
</tr>
<tr>
<td>Etowah - 2 gardens (GA)</td>
<td>5.15</td>
<td>5.15</td>
</tr>
<tr>
<td>Bioswales in Jacksonville (FL)</td>
<td>1.75</td>
<td>1.75</td>
</tr>
<tr>
<td>Canton Fire Station (GA)</td>
<td>0.59</td>
<td>0.42</td>
</tr>
<tr>
<td>Montgomery (AL)</td>
<td>0.72</td>
<td>0.72</td>
</tr>
<tr>
<td>Trussville Library (AL)</td>
<td>0.24</td>
<td>0.24</td>
</tr>
<tr>
<td>Grand Rapids (MI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birmingham (AL)</td>
<td>21.40</td>
<td>21.40</td>
</tr>
<tr>
<td>Seminole County/Donalsonville (GA)</td>
<td>0.60</td>
<td>0.60</td>
</tr>
<tr>
<td>Fernbank Rain Garden (GA)</td>
<td>0.34</td>
<td>0.34</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>50.68</strong></td>
<td><strong>44.42</strong></td>
</tr>
</tbody>
</table>

*Note: information is not yet available for the rain garden in Grand Rapids, MI

**Total (ultimate) benefit is:** 50.68 ML/yr

**TCCC total (ultimate) benefit taken as a function of cost share is:** 44.42 ML/yr

The current (2012) benefit and project benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2012 Replenish Benefit**

The 2012 benefit is the performance-based benefit from this activity as of the end of calendar year 2012. The total 2012 benefit is 50.68 ML/yr and TCCC’s benefit (adjusted for cost share) is 44.42 ML/yr.

**Projected Replenish Benefits**

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>50.68</td>
<td>44.42</td>
</tr>
<tr>
<td>2014</td>
<td>50.68</td>
<td>44.42</td>
</tr>
<tr>
<td>2015</td>
<td>50.68</td>
<td>44.42</td>
</tr>
<tr>
<td>2016</td>
<td>50.68</td>
<td>44.42</td>
</tr>
<tr>
<td>2017</td>
<td>50.68</td>
<td>44.42</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>50.68</td>
<td>44.42</td>
</tr>
</tbody>
</table>

Data Sources:
- LTI CWP Survey
- Precipitation and runoff coefficients are documented in the “Assumptions and References” worksheet of the CCNA Rain Garden Calculator.

Assumptions:
- Runoff coefficients tell what percent of the rainfall might occur as runoff from a given surface. Runoff coefficients for pervious and impervious surfaces are obtained from the literature. For impervious surfaces including concrete, metal, gravel, asphalt and fiberglass, the coefficient values typically range from 0.7 - 1.0. A value of 0.85 is used in the calculations. Likewise, runoff coefficients for bare soils range from 0.2 - 0.75. Therefore, for pervious surfaces, a conservative value of 0.25 is used in the calculations. A runoff coefficient of 1 is used for rainfall directly on the rain garden.
- The CCNA Rain Garden Calculator is designed to provide a reasonable estimate of the amount of runoff generated from pervious and impervious surfaces in a catchment. It is assumed that this runoff will be intercepted by the rain garden.
- It is assumed the design of the rain garden is such that it will be located close to the runoff source, will be able to withstand extremes of moisture conditions, and is capable of storing precipitation and snowmelt runoff events of any size. If the rain garden is underdesigned for certain runoff events, then it may be necessary to use more advanced (e.g., daily) calculations to estimate the volume of water effectively captured by the rain garden over the course of an average year.

OTHER BENEFITS NOT QUANTIFIED
- Decreased pollutant loading to sewers/streams.

NOTES
- This fact sheet replaces fact sheets #18 (Niles Community Rain Garden), #78 (Coca-Cola Lexington Rain Garden), #84 (Birmingham Three Parks Initiative) and #89 (Fernbank Rain Garden), combining these in a single fact sheet. This fact sheet also includes other rain gardens.

REFERENCES
PROJECT NAME: Chongón-Colonche – Cerro Blanco Ecological Corridor: An Initiative to Conserve and Restore Key Water Sources and Biodiversity in Ecuador

PROJECT ID #: 119

DESCRIPTION OF ACTIVITY: Reforestation of 32.6 hectares in the Cerro Blanco Protected Forest

LOCATION: The Cerro Blanco Protected Forest located near Guayaquil, Ecuador

PRIMARY CONTACT:
Silvia Benítez P.
Conservation Strategies Manager
Northern Andes & Southern Central America
The Nature Conservancy
(593) 2-2257 138 ext. 104
sbenitez@tnc.org

OBJECTIVES:
• Water flow regulation
• Improving water quality
• Protect and improve biodiversity

BACKGROUND & ACTIVITY DESCRIPTION: The Cerro Blanco Protected Forest is an Ecuadorian dry tropical forest. The seasonal dry forests of Ecuador are among the most threatened and biologically important ecosystems in South America, with a high percentage of endemic and threatened species. These forests are home to threatened jaguars, jaguarundis, pumas, brocket deer, howler monkeys and great green macaws. The forests are also natural suppliers and regulators of water for nearby towns and rural communities. The forests are currently threatened by clearing for agriculture, urban expansion, and market hunting of native wildlife.

The long-term vision of this project is to restore watersheds and increase the hydrological and ecological connectivity. The overall project entails designing an ecological corridor between two important conservation areas: Cerro Blanco Protected Forest and Chongón-Colonche Protected Forest. Environmental services (principally water) are a key attribute in the design. The main activities to be implemented are reforestation and restoration of natural forests, and conservation of key zones through conservation agreements to avoid deforestation. These activities serve to increase the capacity of the ecosystems to capture water, regulate flows, and improve water quality through reduction of sedimentation and other pollutants such as nitrogen.
and phosphorus. This project is in collaboration with The Nature Conservancy (TNC), Fundación Pro-Bosque and Coca-Cola.

The outcome for the first year is 32.6 hectares of reforestation in the Cerro Blanco Protected Forest. The areas selected for reforestation were degraded areas that needed to be enriched with native species. This work was done from October 2011 to March 2012 and included preparation of the land, transportation of the plants, and the planting itself. A total of 34,780 trees, consisting of more than 22 native species, were planted.

**SUMMARY OF REPLENISH BENEFIT**

- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE – 5.6 ML/YR

**ACTIVITY TIMELINE:**

- October 2011 – Project initiation
- March 2012 – Reforestation of 32.6 ha completed

**COCA-COLA CONTRIBUTION:** 47.4%

**WATERSHED BENEFITS CALCULATED:**

1. Decrease in runoff
1. **DECREASE IN RUNOFF**

**Approach & Results:**

The water quantity benefit was calculated using the “Alternative Annual Method” as described in Redder and Larson (2012). The water quantity benefit is calculated as the difference in the estimated “pre-project” and “post-project” runoff depths multiplied by the total surface area:

\[
\text{Water quantity benefit (m}^3/\text{yr}) = [\Delta \text{Runoff (m/yr)}] * [\text{Surface Area (m}^2)]
\]

where the change in runoff (\(\Delta \text{Runoff}\)) is calculated as follows:

\[
[\Delta \text{Runoff (m/yr)}] = \{ [\text{Pre-project Runoff Depth (m/yr)}] – [\text{Post-project Runoff Depth (m/yr)}] \}
\]

“Pre-project” is defined as the deforested condition of the land that existed prior to reforestation, while “post-project” is defined as the reforested condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

\[
[\Delta \text{Runoff (m/yr)}] = \Delta K * [\text{Annual Rainfall Depth (m/yr)}]
\]

where \(\Delta K\) is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical reforestation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (\(\Delta K\)) is solely due to a change in the vegetation condition. A conservative value of 0.04 was selected for \(\Delta K\) consistent with the recommendations made in the “Alternative Annual Method” memorandum (Redder and Larson, 2012).

For the Cerro Blanco site, the estimated average annual rainfall depth is 904 mm (0.904 m/yr) (Hearn et al. 2003). The surface area is 32.6 hectares (326,000 m\(^2\)).

Therefore, the water quantity benefit is calculated as follows:

\[
\text{Water quantity benefit (m}^3/\text{yr}) = [\Delta \text{Runoff (m/yr)}] * [\text{Surface Area (m}^2)]
\]

\[
11,788 \text{ (m}^3/\text{yr}) = [0.04*0.904 \text{ (m/yr)}]*[326,000 \text{ (m}^2\text{) )}] = 11.78 \text{ ML/yr}
\]

- **The total (ultimate) benefit is:** 11.78 ML/yr
- **TCCC total (ultimate) benefit taken as a function of cost share is:** 5.6 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2012 Replenish Benefit**

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is 11.78 ML/yr and TCCC’s benefit (adjusted for cost share) is 5.6 ML/yr.
Projected Replenish Benefits

The table that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>11.78</td>
<td>5.6</td>
</tr>
<tr>
<td>2014</td>
<td>11.78</td>
<td>5.6</td>
</tr>
<tr>
<td>2015</td>
<td>11.78</td>
<td>5.6</td>
</tr>
<tr>
<td>2016</td>
<td>11.78</td>
<td>5.6</td>
</tr>
<tr>
<td>2017</td>
<td>11.78</td>
<td>5.6</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>11.78</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Data Sources:

- Size of protected land area: 32.6 hectares (provided by contact and TNC et al., 2012)
- Average annual precipitation from “Global GIS” database (Hearn et al., 2003)

Assumptions:

- $\Delta K$ (difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition) is assumed to be 0.04 as a conservative and simplifying assumption.

OTHER BENEFITS NOT QUANTIFIED

- Water quality improvements, including reduced sedimentation
- Protection and improvement of habitat and biodiversity
- Carbon footprint reduction

NOTES

- None

REFERENCES


PROJECT NAME: Mississippi River Basin Treatment Wetlands
PROJECT ID #: 122

DESCRIPTION OF ACTIVITY: Construction of treatment wetland

LOCATION: Mitchell County, Cedar River, Iowa

PRIMARY CONTACTS:
Matt Fisher
The Nature Conservancy
1620 231st Street
Letts, IA 52754
matt_fisher@TNC.ORG

Rena Ann Stricker
CCNA Group Environment & Sustainability
404-395-6250
rstricker@coca-cola.com

Jon Radtke
CCNA Group Environment & Sustainability
404-676-9112
jradtke@coca-cola.com

OBJECTIVES
• Reduce pollutants in runoff from agricultural fields
• Increase habitat and biodiversity

BACKGROUND & DESCRIPTION OF ACTIVITY: The Nature Conservancy (TNC) is constructing treatment wetlands in agricultural watersheds of the Mississippi River watershed. A primary objective is to reduce pollutants including nitrate-nitrogen in leachate and runoff to local waterways. A larger goal is to reduce nitrogen loads in the Mississippi River and Gulf of Mexico where nutrient enrichment contributes to algal blooms and hypoxia. The wetlands are generally located in low lying areas that are not well-suited for planting. Water drains to the wetlands through tile drains where it is retained to reduce nutrient and sediment loads. This treatment is not required by law.

Contamination due to nitrogen in agricultural runoff is a water quality concern in the northern Iowa watersheds (Iovanna et al., 2008). Constructed treatment wetlands can be a cost effective approach to reducing nitrogen loads in watersheds dominated by tile drained cropland. The practice has potential to enhance water quality in the regions such as the Corn Belt that are extensively tile-drained. The Iowa Conservation Reserve Enhancement Program (CERP) has already initiated construction of treatment wetlands in the northern Iowa. It has been suggested that these treatment wetlands remove up to 90% of the nitrate flowing into the wetlands (Iovanna et al., 2008).

The Coca-Cola Company and WWF have funded TNC to collaborate with its field partners and install cornfield runoff filtration wetlands in the Cedar River watershed in northeastern Iowa. Treatment wetlands were constructed during fall 2012. The wetland complex treats the watershed drainage area of approximately 1,450 acres. The watershed draining to the wetland complex is extensively tile drained. Greater than 90% of the watershed has subsurface tile-drainage system.

Similar wetlands have been constructed by TNC in the Mackinaw River watershed in Illinois, where extensive data have been collected on demonstration wetlands in collaboration with University of Illinois and Illinois State University (TNC, 2012). Water quality data collected in the demonstration wetlands have shown that nitrate concentrations in the inflow have been measured as high as 33 mg/l. The nitrate concentration in effluent from the wetlands is consistently below the U.S. EPA standard of 10 mg/l, with rare exceptions during large storm events. Nitrate concentrations reductions were found to range from 52% to 94%.
SUMMARY OF REPLENISH BENEFIT:
- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 654 ML/YR

ACTIVITY TIMELINE:
- September 26 – October 1 2012: Wetland construction
- Seeding completed: December 7, 2012
- Wetland was fully functional when the vegetation was established by July 2013

COCA-COLA CONTRIBUTION: 78%
- Total cost: $61,150
- Coca-Cola contribution: $47,800
- In kind contributions by other parties including Mitchell County Conservation Board and NRCS: $13,350

WATERSHED BENEFITS CALCULATED:
1. Volume of water treated

1. VOLUME OF WATER TREATED

Approach and Results
The replenish benefit was calculated as the average annual volume of water treated by the wetland. No measurements of flow are available so flow was estimated based on NRCS guidance (NRCS, 1980) using a drainage coefficient. The drainage coefficient is expressed as inches of water depth to be removed from cropland in 24 hours. NRCS uses a 3/8” drainage coefficient (D) for most cropland. This represents the maximum amount of water that would typically be pulled from a soil profile. During a wet period, the tile line will be full and it will not be removing that amount from all of the soil, but a prolonged flow in the tile line will occur after a rain. No water flows through the wetland during dry periods.

The design flow rate (Q) from the tile drainage system is estimated as follows:
\[ Q = D \times A \]

where:
- D is the drain coefficient = 3/8” = 0.375 inch/day
- A is subsurface drainage area = 1,450 acres

\[ Q = 0.375 \text{ inch/day} \times 1,450 \text{ acres} = 543.75 \text{ acre-inch/day} = 45.31 \text{ acre-ft/day} = 55,892 \text{ m}^3/\text{day} \]

Calculating the annual flow volume through the drain tiles requires an estimate of the duration for which the tile drains will function at full capacity, which was estimated by calculating the subsurface flow expected of a 1,450 acres watershed. A modeling study conducted in the agriculture-dominated (more than 85% of land use) South Fork Watershed in Iowa (Green et al., 2006) evaluated the effects tile drainage on annual water yield. Approximately 80% of the watershed is tile drained. Tile drainage in this watershed was found to contribute to approximately 70% of the annual stream flow volume. For this analysis the annual stream flow reported for South Fork Watershed was scaled to 1,450 acre watershed using a drainage area ratio. Similar to the South Fork Watershed, it was assumed that tile drainage accounts for 70% of the stream flow. Following this approach, the estimated subsurface flow volume is estimated to be 828,495 m3. Using the drain coefficient, the duration that the tile network will need to function to drain the subsurface flow was calculated to be 355 hours (about 15 days).
The volume of tile drainage entering the wetland complex is calculated as follows:

55,892 m$^3$/day x 15 days/yr = 838,380 m$^3$/yr = 838 ML/yr

The total (ultimate) benefit is: 838 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 654 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is estimated to be 838 ML/yr and TCCC’s benefit (adjusted for cost share) is 654 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>838</td>
<td>654</td>
</tr>
<tr>
<td>2015</td>
<td>838</td>
<td>654</td>
</tr>
<tr>
<td>2016</td>
<td>838</td>
<td>654</td>
</tr>
<tr>
<td>2017</td>
<td>838</td>
<td>654</td>
</tr>
<tr>
<td>2018</td>
<td>838</td>
<td>654</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>838</td>
<td>654</td>
</tr>
</tbody>
</table>

Data Sources

- TNC and Mitchell County NRCS provided area of the watershed
- TNC provided drainage coefficient of 0.375 inches/day

Assumptions

- It is recognized that the wetland also receives water from surface runoff. But conservatively, the calculations only count the subsurface drainage water to be treated by the wetlands.
- The wetland complex will function effectively to reduce the nitrate concentrations below established water quality standard
- The entire volume of water treated by the wetland can be treated as replenish benefit.
- Wetland has the capacity to treat the full volume of water that it intercepts annually from the tile drainage
- The drainage system will be maintained properly
OTHER BENEFITS NOT QUANTIFIED

- Reduced sedimentation
- Improved wetland habitat
- Flood protection benefits

NOTES

- None.

REFERENCES


PROJECT NAME: Mississippi River Basin Treatment Wetlands
PROJECT ID #: 122

DESCRIPTION OF ACTIVITY: Construction of treatment wetland

LOCATION: Root River, MN

PRIMARY CONTACTS:
Richard Biske
SE MN Conservation Coordinator
The Nature Conservancy
PO Box 405, 136 St. Anthony St.
Preston, MN 55965
rbiske@tng.org
404-395-6250

Rena Ann Stricker
Contract Ecologist
CCR Environment & Sustainability
rstricker@coca-cola.com
404-676-9112

Jon Radtke
Manager, Water Resources
CCR Environment & Sustainability
jradtke@coca-cola.com

OBJECTIVES
• Reduce pollutants in runoff from agricultural fields
• Increase habitat and biodiversity

BACKGROUND & DESCRIPTION OF ACTIVITY: The Nature Conservancy (TNC) is constructing treatment wetlands in agricultural watersheds of the Mississippi River watershed. A primary objective is to reduce pollutants including nitrate-nitrogen in leachate and runoff to local waterways. A larger goal is to reduce nitrogen loads in the Mississippi River and Gulf of Mexico where nutrient enrichment contributes to algal blooms and hypoxia. The wetlands are generally located in low lying areas that are not well-suited for planting. Water drains to the wetlands through tile drains where it is retained to reduce nutrient and sediment loads. This treatment is not required by law.

Contamination due to agricultural runoff is a long-term problem in the Root River watershed, and karst geology compounds the problem by allowing rapid flow between surface and groundwater. Nitrogen concentrations are increasing in the Root River and high concentrations of nitrate are common in private wells. Approximately 19% of samples collected in 2008 and 2009 showed nitrate concentrations greater than the drinking water standard of 10 mg/l (NRCS, 2010).

TNC constructed one wetland in the Root River watershed in the fall of 2012. The wetland is approximately 1.5 acres in area, treating 23 acres of subsurface watershed and approximately 15 acres of surface runoff before it enters the Root River near Sargent, MN. The wetland was designed by NRCS engineers using NRCS CP-39 practice standards. A berm was constructed downslope of an agricultural field in an area at the edge of a field. Tile line draining the field was intercepted and ‘daylighted’ to drain into an excavated area upslope of the berm.

Similar wetlands have been constructed by TNC in the Mackinaw River watershed in Illinois, where extensive data have been collected on demonstration wetlands in collaboration with University of Illinois and Illinois State University (TNC, 2010). Water quality data collected in the demonstration wetlands have shown that nitrate concentrations in the inflow have been measured as high as 33 mg/l. The nitrate concentration in effluent from the wetlands is consistently below the U.S. EPA standard of 10 mg/l, with rare exceptions during large storm events.
SUMMARY OF REPLENISH BENEFIT:
- 2012 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 53.28 ML/yr

ACTIVITY TIMELINE:
- September 26 – October 1 2012: Wetland construction
- Seeding completed: December 7, 2012
- Wetland will be fully functional when the vegetation is established in July 2013

COCA-COLA CONTRIBUTION: 100%
- $13,000 provided by Coca-Cola

WATERSHED BENEFITS CALCULATED:
1. Volume of water treated

1. VOLUME OF WATER TREATED

Approach and Results
The replenish benefit was calculated as the average annual volume of water treated by the wetland. No measurements of flow are available so flow was estimated based on NRCS guidance (NRCS, 1980) using a drainage coefficient. The drainage coefficient is expressed as inches of water depth to be removed from cropland in 24 hours. NRCS uses a 3/8” drainage coefficient (D) for most cropland. This represents the maximum amount of water that would typically be pulled from a soil profile. During a wet period, the tile line will be full and it will not be removing that amount from all of the soil, but a prolonged flow in the tile line will occur after a rain. No water flows through the wetland during dry periods.

The design flow rate (Q) from the tile drainage system is estimated as follows:

\[ Q = D \times A \]

where:
D is the drain coefficient = 3/8” = 0.375 inch/day
A is subsurface drainage area = 23 acres

\[ Q = 0.375 \text{ inch/day} \times 23 \text{ acres} = 8.625 \text{ acre-inch/day} = 0.72 \text{ acre-ft/day} = 888 \text{ m}^3/\text{day} \]

Conservatively assuming that water flows through the wetland 60 days per year, the volume of flow is estimated as follows:

888 m³/day x 60 days/yr = 53,280 m³ = 53.28 ML/yr

The total (ultimate) benefit is: 53.28 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 53.28 ML/yr

The current (2012) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.
2012 Replenish Benefit

The 2012 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2012 benefit is estimated to be 53.28 ML/yr and TCCC’s benefit (adjusted for cost share) is 53.28 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>53.28</td>
<td>53.28</td>
</tr>
<tr>
<td>2014</td>
<td>53.28</td>
<td>53.28</td>
</tr>
<tr>
<td>2015</td>
<td>53.28</td>
<td>53.28</td>
</tr>
<tr>
<td>2016</td>
<td>53.28</td>
<td>53.28</td>
</tr>
<tr>
<td>2017</td>
<td>53.28</td>
<td>53.28</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>53.28</td>
<td>53.28</td>
</tr>
</tbody>
</table>

Data Sources

- TNC provided size of wetland (approximately 1.5 acres) and acres of subsurface and surface runoff
- TNC provided drainage coefficient of 0.375 inches/day

Assumptions

- In the absence of flow data it was conservatively assumed that water flows through the wetland 60 days a year and that all water is from the tile drains.
- It is recognized that the wetland also receives water from approximately 15 acres of surface runoff. But conservatively, the calculations only count the subsurface drainage water to be treated by the wetlands
- The wetland complex will function effectively to reduce the nitrate concentrations below established water quality standard
- The entire volume of water treated by the wetland can be treated as replenish benefit.
- Wetland has the capacity to treat the full volume of water that it intercepts annually from the tile drainage
- The drainage system will be maintained properly
OTHER BENEFITS NOT QUANTIFIED

- Improved wetland habitat
- Flood protection benefits

NOTES

- TNC plans to monitor water quality at the outlet in 2013.
- During the 2013 & 2014 growing season mowing will be necessary to control annual weeds while native vegetation is established. The control and outlet structures will be monitored annually for function.

REFERENCES


PROJECT NAME: Wet Lagoon Conservation Cobega
PROJECT ID #: 124

DESCRIPTION OF ACTIVITY: Wastewater reuse for conservation

LOCATION: Mollet del Vallés, Spain

PRIMARY CONTACTS:
Susana Pliego
Environment and Safety Manager
Coca-Cola Iberia
Ribera del Loira 20-22
28042 Madrid, Spain
spliego@coca-cola.com
Tel. +34-91-396-93-34

OBJECTIVES

• Maintain ecological flow
• Increase habitat and biodiversity

BACKGROUND & DESCRIPTION OF ACTIVITY: A portion of the wastewater from the Cobega-Vallés bottling plant is treated to standards and discharged to a lagoon. The lagoon is part of a biological corridor between the Park of the Sierra Litoral and the Besos River. The corridor was integrated into the construction of the Cobega-Vallés Plant, and it facilitates the exchange of living organisms between the mountains and the river that would otherwise be isolated due to the barrier effect of industrial parks, infrastructures and housing projects existing in the zone (TCCC, 2012).

The primary objective of the project is to maintain water levels in the lagoon by replacing water lost to evaporation and to support a healthy ecosystem. An increase in fish and bird populations has been observed since the project was initiated. The project also includes planting of native vegetation and construction of a platform for birdwatchers and other visitors.
The Cobega- Vallés bottling plant obtains its water from the municipality, which draws from a surface water source. The wastewater that is not discharged to the lagoon is pumped to the municipal treatment plant where it is further treated and discharged to surface water. Compliance with all regulatory requirements has been demonstrated.

**SUMMARY OF REPLENISH BENEFIT:**
- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 9.4 ML/yr

**ACTIVITY TIMELINE:**
- Project initiation: 2008
- Continuous discharge to the lagoon every year since 2008 and continuing into the future

**COCA-COLA CONTRIBUTION:** 100%
- All costs are covered by the bottler

**WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:**
1. Volume of wastewater reused

---

### 1. VOLUME OF WASTEWATER REUSED

**Approach and Results**

The replenish benefit was calculated as the annual average volume of treated wastewater reused through discharge to the lagoon. The discharge quantity varies from year to year depending on the capacity of the lagoon, which is a function of precipitation and evaporation. This volume is metered and volumes reported to date are as follows:

- 2010: 4,961 m³/yr
- 2011: 11,433 m³/yr
- 2012: 11,859 m³/yr
- 2013 (through September): 2,240 m³/yr

The average volume for 2010-2012 equals 9,400 m³/yr = 9.4 ML/yr

The total (ultimate) benefit: 9.4 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 9.4 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2013 Replenish Benefit**

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is estimated to be 9.4 ML/yr and TCCC’s benefit (adjusted for cost share) is 9.4 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual
benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>9.4</td>
<td>9.4</td>
</tr>
<tr>
<td>2015</td>
<td>9.4</td>
<td>9.4</td>
</tr>
<tr>
<td>2016</td>
<td>9.4</td>
<td>9.4</td>
</tr>
<tr>
<td>2017</td>
<td>9.4</td>
<td>9.4</td>
</tr>
<tr>
<td>2018</td>
<td>9.4</td>
<td>9.4</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>9.4</td>
<td>9.4</td>
</tr>
</tbody>
</table>

Data Sources
- Volume of treated wastewater provided by TCCC

Assumptions
- None

OTHER BENEFITS NOT QUANTIFIED
- Improved wetland habitat and biodiversity
- Increased aquifer recharge

NOTES
- This fact sheet updates a 2012 fact sheet, which utilized an estimated volume of treated wastewater reused through discharge to the lagoon. Volumes discharged to the lagoon have been metered since 2010.
- The replenish benefit is based on the 2010-2012 average rather than actuals due to lack of complete data for 2013 at the time of this writing.
- The storage capacity of the lagoon, and the volume of water that can be discharged to it, is a function of precipitation and evaporation. Since 2013 was a very wet year, the 2013 metered volume of treated wastewater discharged to the lagoon is below average. Projected benefits will be verified by TCCC before they are reported as actual benefits.

REFERENCES
PROJECT NAME: Four Seasons Water to Gölcihan (Life plus Youth Program)
PROJECT ID #: 130

DESCRIPTION OF ACTIVITY: Wetland restoration

LOCATION: Gölcihan Lake (N 36.659606, E 35.266113) in the Adana District of Yumurtalik (Turkey)

PRIMARY CONTACTS:
Erdal Kiraz
Fahrettin Kerim Gokay Cad. No: 35
Altunizade Istanbul
Tel: +00902165562470
ekiraz@coca-cola.com

OBJECTIVES
- Primary objective is restore flow to Gölcihan Lake, an important wetland
- Secondary objectives are to restore fish passage to the wetland, support noncommercial fishing and provide irrigation water

BACKGROUND & DESCRIPTION OF ACTIVITY: Gölcihan Lake is an oxbow lake, and is one of the most important wetlands of Adana District of Yumurtalik. This wetland was historically connected to the Ceyhan River. However, flows into this lake were blocked by a flood decades ago, and the lake became a wetland. Irrigation withdrawals in combination with evaporation and blocked inflows have resulted in conversion of the wetland into dry land (Figure 1).

Figure 1. Illustration of Gölcihan Lake formation (left) and pre-project condition (right)
In order to restore water to Gölcihan Lake, a channel was constructed that diverts water from the Ceyhan River to Gölcihan Lake during periods of high river flow, typically in early summer.

A photo showing construction of the channel and a map showing the connection of the channel to the Ceyhan River and Gölcihan Lake are presented in Figure 2. As a result of this wetland restoration project, water levels are maintained at a depth of 2.75 meters throughout the year. Figure 3 shows a photo of the Gölcihan Lake following completion of this project.

Figure 2. Construction of the connecting channel (left) and a map showing the connecting channel (canal) and Gölcihan Lake (right).

Figure 3. Gölcihan Lake, following project completion

SUMMARY OF REPLENISH BENEFIT:
- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 577.5 ML/YR

ACTIVITY TIMELINE:
- 2011:
  - Meetings with local population and authorities to reach consensus on the need for the project.
  - All required permissions obtained to connect the Ceyhan River and Gölcihan Lake
  - Project approved by the State Hydraulic Works.
- 2012:
  - Construction to connect the Ceyhan River to Gölcihan Lake initiated
  - Construction completed
COCA-COLA CONTRIBUTION: 84%
- $56,226 USD total project cost
- $47,365 USD provided by Coca-Cola

WATERSHED BENEFITS CALCULATED:
1. Increase in storage volume

1. INCREASE IN STORAGE VOLUME

Approach and Results
The replenish benefit was calculated as the average annual storage volume restored to Gölcihan Lake due to connection of the Ceyhan River to Gölcihan Lake. Water storage is a function of the volume of water from precipitation and diverted Ceyhan River flood water that was restored to Gölcihan Lake after the connecting channel was completed. Gölcihan Lake was dry prior to restoration. This method was selected for simplification purposes and is considered to be a conservative approach. More complex methods to estimate storage volume exist (accounting for retention time and volumes of inflow and outflow), but the required data inputs are not available.

The contact has provided assurance that a stable lake volume is sustained as a result of the project, and that the average depth of Gölcihan Lake is 2.75 meters. This is considered to be a conservative estimate of the average annual depth across the lake and across all seasons. Using this depth, the average annual volume of water storage over 250,000 m² of the wetland’s surface area translates to a total water quantity benefit of 687.5 ML/yr.

The total (ultimate) benefit: 687.5 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 577.5 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit
The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2012. The total 2013 benefit is based on the entire surface area of Gölcihan Lake being restored by the end of 2013 and is estimated to be 687.5 ML/yr and TCCC’s benefit (adjusted for cost share) is 577.5 ML/yr.

Projected Replenish Benefits
Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>687.5</td>
<td>577.5</td>
</tr>
<tr>
<td>2015</td>
<td>687.5</td>
<td>577.5</td>
</tr>
<tr>
<td>2016</td>
<td>687.5</td>
<td>577.5</td>
</tr>
<tr>
<td>2017</td>
<td>687.5</td>
<td>577.5</td>
</tr>
<tr>
<td>2018</td>
<td>687.5</td>
<td>577.5</td>
</tr>
<tr>
<td>Ultimate Benefit</td>
<td>687.5</td>
<td>577.5</td>
</tr>
</tbody>
</table>

Data Sources
- Data survey
- Communication with TCCC Turkey

Assumptions
- It is assumed that water flows through the channel at a sufficient rate every year to sustain a lake depth of 2.75 meters across 250,000 square meters.

OTHER BENEFITS NOT QUANTIFIED
- Wildlife habitat
- Benefits to local community when Gölcihan Lake is used for non-commercial fishing
- Recreational benefits (e.g., bird watching)

NOTES
- All information provided by TCCC Turkey.

REFERENCES
PROJECT NAME: Caper, Forest’s Lover (Life plus Youth Program)
PROJECT ID #: 131

DESCRIPTION OF ACTIVITY: Revegetation of eroded slopes

LOCATION: Erenler Village in Artvin Province, Turkey (Latitude: 41°10’57’’; Longitude: 41°49’5’’)

PRIMARY CONTACT:
Erdal Kiraz
Fahrettin Kerim Gokay Cad. No: 35
Altunizade Istanbul
Tel: +00902165562470
ekiraz@coca-cola.com

OBJECTIVES
• Primary objective is to control erosion of steep slopes
• A secondary objective is to provide economic benefits to the community.

BACKGROUND & DESCRIPTION OF ACTIVITY: Artvin province is one of the most important ecological areas of Turkey due to its forests. This area is very mountainous and erosion of steep slopes is a significant problem. This project involves construction of terraces on steep slopes and planting the terraces with caper. Caper is effective at combatting erosion and this plant also provides economic benefits. Capers were planted in the terraces in Erenler Village and are being irrigated using drip irrigation. Figure 1 shows the steep slopes prior to planting.

A total of 250 terraces have been planted with capers.

SUMMARY OF REPLENISH BENEFIT:
• 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 0.03 ML/YR

ACTIVITY TIMELINE:
• 2012 – 250 terraces were constructed and 1,000 m² were planted with capers.
COCA-COLA CONTRIBUTION: 100%

- $15,399 USD total project cost
- $15,399 USD provided by Coca-Cola

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff

1. DECREASE IN RUNOFF

**Approach & Results:**
The water quantity benefit was calculated using the “Alternative Annual Method” as described in Redder and Larson (2012). The water quantity benefit is calculated as the difference in the estimated “pre-project” and “post-project” runoff depths multiplied by the total surface area:

\[
\text{[Water quantity benefit (m}^3/\text{yr}) = [\Delta \text{Runoff (m/yr)}] * \text{[Surface Area (m}^2)]}
\]

where the change in runoff (\(\Delta \text{Runoff}\)) is calculated as follows:

\[
[\Delta \text{Runoff (m/yr)}] = [\text{Pre-project Runoff Depth (m/yr)}] – [\text{Post-project Runoff Depth (m/yr)}]
\]

“Pre-project” is defined as the barren condition of the land that existed prior to revegetation, while “post-project” is defined as the revegetated condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

\[
[\Delta \text{Runoff (m/yr)}] = \Delta K * [\text{Annual Rainfall Depth (m/yr)}]
\]

where \(\Delta K\) is the difference between the pre- and post-project annual runoff coefficients due to changes in the vegetation condition.

For a typical revegetation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (\(\Delta K\)) is solely due to a change in the vegetation condition. A conservative value of 0.04 was selected for \(\Delta K\).

For the project site, the estimated average annual rainfall depth is 716 mm (0.72 m/yr). The surface area planted with capers is 1,000 m\(^2\). Therefore, the water quantity benefit is calculated as follows:

\[
28.8 \text{ (m}^3/\text{yr}) = [0.04*0.72 \text{ (m/yr)}]*[1,000 \text{ (m}^2)] = 0.03 \text{ ML/yr}
\]

The total (ultimate) benefit is: 0.03 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 0.03 ML/yr
The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 0.03 ML/yr and TCCC’s benefit (adjusted for cost share) is 0.03 ML/yr.

Projected Replenish Benefits

Table 3 that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share and percent complete in the second column.

Table 3. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>2015</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>2016</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>2017</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>2018</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>0.03</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Data Sources:
- Area of revegetated land provided by contact
- Schedule for revegetation provided by contact
- Average annual precipitation provided by contact

Assumptions:
- A conservative value of 0.04 was selected for $\Delta K$, consistent with the recommendations made in the “Alternative Annual Method” memorandum (Redder and Larson 2012)."

OTHER BENEFITS NOT QUANTIFIED

- Reduced erosion
- Improved water quality, including sedimentation
- Economic benefits to the local community resulting from caper production

NOTES

REFERENCES

PROJECT NAME: Environmentally Friendly Earthworms (Life plus Youth Program)
PROJECT ID #: 132

DESCRIPTION OF ACTIVITY: Soil improvement to reduce irrigation demand

LOCATION: Gediz River basin

PRIMARY CONTACT:
Erdal Kiraz
Fahrettin Kerim Gokay Cad. No: 35
Altunizade Istanbul
Tel: +00902165562470
ekiraz@coca-cola.com

OBJECTIVES
- Decrease irrigation water requirements
- Decrease chemical fertilizer use and runoff

BACKGROUND & DESCRIPTION OF ACTIVITY: The Gediz River basin is home to almost 2 million people. In recent years, agricultural runoff has increased levels of nickel, copper, zinc and mercury in the Gediz River. Additionally, many experts have forecast water shortages caused by decreasing precipitation.

This project was initiated to increase the use of worm fertilizer in the basin, in order to reduce the use and pollution caused by chemical fertilizers, and to also increase the water-holding capacity of the soil, and decrease irrigation water needs. In 2011, a pilot study was conducted at Aegean University to produce vermicompost, demonstrate its benefits to farmers, and to analyze and share results. In 2012, four additional vermicompost production pools were constructed in Manisa and the compost was distributed to local farmers. Vermicompost is shown in Figure 1.

To date, 7 tonnes of vermicompost have been produced and distributed to farmers for use on a total of 1 hectare of agricultural land within the Gediz River basin. The vermicompost is applied three times per year to each location. Figure 2 shows the application of the vermicompost by farmers. In addition to adding compost to the land, the method of irrigation has been improved from traditional irrigation to drip irrigation, reducing the amount of irrigation water needed.
SUMMARY OF REPLENISH BENEFIT:
- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 2.0 ML/YR

ACTIVITY TIMELINE:
- 2010 – Establishment of a network of farmers
- 2011 – Production of pilot vermicompost pool, analysis of water savings and increased productivity
- 2012 – Meetings with farmers, production of vermicompost production pools, dissemination of vermicompost to farmers.

COCA-COLA CONTRIBUTION: 100%
- $76,038 USD total project cost
- $76,038 USD provided by Coca-Cola

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:
1. Decrease in water usage

1. DECREASE IN WATER USAGE

Approach & Results:
The water quantity benefit was estimated as the water savings resulting from application of vermicompost to the soil, which increases the water-holding capacity of the soil and reduces irrigation needs. Irrigation water usage was provided in the survey response. The water savings were computed as the difference between pre-project water usage and post-project usage at the project cropland location, assuming a 40-60% reduction in the volume of irrigation water needed.

Site-specific characteristics
Site-specific characteristics, including area planted with each crop and irrigation water requirements are shown in Table 1 and described below.
Table 1. Site Details and Irrigation Water Needs Before and After the Project

<table>
<thead>
<tr>
<th>Crop</th>
<th>Area planted (m²)</th>
<th>Reported pre-project irrigation requirement</th>
<th>Growing period length</th>
<th>Annual pre-project irrigation requirement (m³/yr)</th>
<th>Annual post-project irrigation requirement (m³/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pepper</td>
<td>2,500</td>
<td>5 liters/m²/day</td>
<td>124 days</td>
<td>775</td>
<td>388</td>
</tr>
<tr>
<td>Lettuce</td>
<td>5,000</td>
<td>27,225 gallons/acre/week</td>
<td>23.6 weeks</td>
<td>1,501</td>
<td>750</td>
</tr>
<tr>
<td>Cucumber</td>
<td>2,500</td>
<td>665 liters/m²/season</td>
<td>1 season</td>
<td>1,663</td>
<td>831</td>
</tr>
<tr>
<td>Total (m³/yr) &gt;&gt;</td>
<td></td>
<td></td>
<td></td>
<td>3,938</td>
<td>1,969</td>
</tr>
</tbody>
</table>

Project Conditions:
Pre-project water use was calculated for each crop grown, based on the area planted, the crop-specific pre-project irrigation water requirement and the length of the growing period. For pepper and lettuce, and the irrigation application requirements were provided in units of per day and per week. These were adjusted for the number of irrigation events over the growing season and it was conservatively assumed that irrigation is needed during half of the growing season. For cucumber, the application rate is provided in units of per season, so the adjustment is not needed.

- The pre-project water use (no vermicompost use) on 10,000 m²: 3,938 m³/yr

Post-project water use (soil amended with vermicompost on 10,000 m²) was calculated based on information from the contact that 40-60% water savings result when soil is amended with vermicompost. An average water savings of 50% was used for this calculation.

- Post-project water use on 10,000 m²: 1,969 m³/yr

The reduction in water use was calculated as the difference in pre-project water use and post-project water use.
- Reduction in water use = 3,938 m³/yr – 1,969 m³/yr = 1,969 m³/yr = **2 ML/yr**

The total (ultimate) benefit is: **2 ML/yr**
TCCC total (ultimate) benefit taken as a function of cost share is: **2 ML/yr**

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit
The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 2 ML/yr and TCCC’s benefit (adjusted for cost share) is 2 ML/yr.
Projected Replenish Benefits

Table 2 that follows shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share and percent complete in the second column.

Table 2. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2015</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2016</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2017</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2018</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Data Sources:

- All data provided by contact.

Assumptions:

- Conservatively assumed that irrigation events are needed for one half of the length of the growing season for peppers and lettuce.

OTHER BENEFITS NOT QUANTIFIED

- Reduction in nutrient/chemical runoff to streams (no monitoring data provided)

NOTES

- None.

REFERENCES

PROJECT NAME: Rainwater Harvesting for Gediz Basin (Every Drop Matters)
PROJECT ID #: 133

DESCRIPTION OF ACTIVITY: Rainwater Harvesting

LOCATION: Gülbahçe City in Muradiye Region, Turkey

PRIMARY CONTACT:
Erdal Kiraz
Fahrettin Kerim Gökay Cad. No:35
Altunizade. Istanbul
00902165562470
ekiraz@coca-cola.com

OBJECTIVES:
• Provide source water for irrigation

BACKGROUND & ACTIVITY DESCRIPTION: Irrigation water is scarce in the Muradiye region of Turkey, where rainfall averages 700 mm/yr. Rainwater harvesting systems can provide distributed storm water runoff containment while simultaneously storing water which can be used for irrigation.

The objective of this project was to create a new water resource for the Muradiye Region in Turkey for agricultural irrigation, replacing a groundwater aquifer as the source of irrigation water. This pilot project involved construction of a 3,500 cubic meter storage pool (Figure 1). The storage pool was constructed at a downstream location preferable for the collection of storm water runoff. Hillside runoff is collected in a 200 meter channel that drains to this pool. The catchment area that drains into the storage pool is approximately 5 ha.

Figure 1. Rainwater Harvesting System
SUMMARY OF REPLENISH BENEFIT:
- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 6.47 ML/yr

ACTIVITY TIMELINE:
- Project initiation: October 1, 2011
- Project completion: July 30, 2012

COCA-COLA CONTRIBUTION: 92.4%
- Total project cost: $129,840
- Coca-Cola contribution: $120,000

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:
1. Increase in irrigation water supply

1. INCREASED IN IRRIGATION WATER SUPPLY

Approach & Results:
The volume of water captured by the rain water harvesting system is estimated based on the supply of available runoff from the catchment. The supply from the catchment is compared to the storage potential of the pond. Storage potential was estimated by considering the number of times the pond will fill to its volume. It was conservatively assumed that the pond will be filled twice annually, based on information provided by the contact that the water in the pond is used continuously, as soon as it is available. The volume of water captured by the pond is estimated as the minimum of annual supply and annual storage potential.

The supply from the catchment is estimated with the following equation.

\[ \text{Supply (m}^3/\text{yr)} = \text{Catchment Area (m}^2) \times \text{Annual Rainfall (m/yr)} \times \text{Runoff Coefficient} \]

The storage pool volume, catchment area, catchment characteristics and annual rainfall were provided TCCC Turkey. The catchment was characterized as hilly with land cover predominantly grass (80%). A runoff coefficient of 25% (or 0.25) corresponding to untreated natural catchments (Pacey and Cullis, 1986) was used in the calculations. The estimated annual runoff supply from the catchment was 8,750 m³/yr.

The storage potential of the pond is the volume of the pond multiplied by the number of times the pond fills each year = 3,500 m³/yr * 2 = 7,000 m³/yr.

Therefore, the estimated annual benefit is equal to the minimum of the supply from the catchment and the storage potential of the pond, and equals 7,000 m³/yr or 7 ML/yr.

The total (ultimate) benefit is: 7 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 6.47 ML/yr

The current (2013) benefit and projected benefits are presented below. It is assumed that the projected benefits will remain the same as 2013 in each future year.
2013 Replenish Benefit

The 2013 benefit is the performance based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 7 ML/yr and TCCC’s benefit (adjusted for cost share) is 6.47 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. If additional projects are added or projects are expanded, the future benefits will increase. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>7</td>
<td>6.47</td>
</tr>
<tr>
<td>2015</td>
<td>7</td>
<td>6.47</td>
</tr>
<tr>
<td>2016</td>
<td>7</td>
<td>6.47</td>
</tr>
<tr>
<td>2017</td>
<td>7</td>
<td>6.47</td>
</tr>
<tr>
<td>2018</td>
<td>7</td>
<td>6.47</td>
</tr>
<tr>
<td><strong>Ultimate Benefit:</strong></td>
<td><strong>7</strong></td>
<td><strong>6.47</strong></td>
</tr>
</tbody>
</table>

Data Sources:

- Data on pond storage capacity, catchment area, rainfall and irrigation withdrawal were provided by Coca-Cola Turkey.

Assumptions:

- The pond is maintained properly to prevent silting.
- The pond fills twice per year.
- Irrigation water is used efficiently.
- The harvested water is used continually for irrigation.

OTHER WATERSHED RESTORATION BENEFITS NOT QUANTIFIED

- Economic benefits to the community.

NOTES

- None.

REFERENCES

**PROJECT NAME:** Reforestation at Upper Ciliwung Watershed through NEWtrees program WWF-Indonesia

**PROJECT ID #:** 135

**DESCRIPTION OF ACTIVITY:** Reforestation of 5 hectares in the Upper Ciliwung Forest

**LOCATION:** Upper Ciliwung Watershed, Bogor Regency, West Java, Indonesia

**PRIMARY CONTACT:**
- Sombat Jungsaitakul
- Dudi Rufendi
- Jerry Q. Mentang
- ASEAN BU EOSH Manager
- Program Cordinator
- Program Officer
- Coca-Cola ASEAN
- WWF Indonesia
- WWF Indonesia
- +6628351425
- +62 21-7829461
- +62 21-7829461
- jsombat@coca-cola.com
- drufendi@wwf.or.id

**OBJECTIVES:**
- Reduce runoff/erosion
- Improve infiltration
- Protect drinking water supply
- Improve habitat/increase biodiversity

**BACKGROUND & ACTIVITY DESCRIPTION:** The Ciliwung River runs north from the Puncak Mountains, flowing through Bogor and Jakarta, and ending at Marina Beach in Jakarta Bay. The watershed is approximately 146 km², encompassing a mountainous region with elevations ranging from 300 to 3,000 meters above sea level. The upper part is characterized by fast-flowing mountain stream and slopes ranging from 2% to more than 45%.

The Ciliwung watershed had been degraded by deforestation, agriculture and land development, and is categorized as critical zone by the Ministry of Forestry. Environmental conditions in the Ciliwung watershed are important for the downstream regions, including the capital city of Jakarta. Flooding in downstream regions is associated with the deforestation in the Ciliwung watershed.

WWF-Indonesia is reforesting the upstream portion of the Ciliwung watershed by planting ~2,000 trees (agathis, nutmeg and quinine) through the NEWtrees program to improve infiltration, reduce erosion and prevent flooding downstream, including the capital city of Jakarta. These trees will also serve a source of fruit and sap. Figures 1-3 show the project location and seedlings.

Maintenance activities and replanting have been completed six times between February 2012 and May 2013. Recent measurements indicate the average height of the plants is 95 cm (agathis) and 75 cm (quinine and nutmeg).
SUMMARY OF REPLENISH BENEFIT

- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 0.70 ML/YR

ACTIVITY TIMELINE:

- Project Start Date: December 2011
- Project Completion Date: December 2013

COCA-COLA CONTRIBUTION: 12%

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff

1. DECREASE IN RUNOFF

Approach & Results:

The water quantity benefit was calculated using the “Alternative Annual Method” as described in Redder and Larson (2012). The water quantity benefit is calculated as the difference in the estimated “pre-project” and “post-project” runoff depths multiplied by the total surface area:

\[ \text{Water quantity benefit (m}^3/\text{yr)} = [\Delta \text{Runoff (m/yr)}] \times [\text{Surface Area (m}^2)] \]

where the change in runoff (\(\Delta \text{Runoff}\)) is calculated as follows:

\[ [\Delta \text{Runoff (m/yr)}] = \{ [\text{Pre-project Runoff Depth (m/yr)}] - [\text{Post-project Runoff Depth (m/yr)}] \} \]

“Pre-project” is defined as the deforested condition of the land that existed prior to reforestation, while “post-project” is defined as the reforested condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

\[ [\Delta \text{Runoff (m/yr)}] = \Delta K \times [\text{Annual Rainfall Depth (m/yr)}] \]

where \(\Delta K\) is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical reforestation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (\(\Delta K\)) is solely due to a change in the vegetation condition. A conservative value of 0.04 was selected for \(\Delta K\) consistent with the recommendations made in the “Alternative Annual Method” memorandum (Redder and Larson, 2012).

For the Upper Ciliwung watershed, the estimated average annual rainfall depth is 2,896 mm (2.896 m/yr). The surface area is 5 hectares (50,000 m\(^2\)).

Therefore, the water quantity benefit is calculated as follows:

\[ \text{Water quantity benefit (m}^3/\text{yr)} = [\Delta \text{Runoff (m/yr)}] \times [\text{Surface Area (m}^2)] \]

\[ 5,792 \text{ (m}^3/\text{yr)} = [0.04 \times 2.896 \text{ (m/yr)}] \times [50,000 \text{ (m}^2)] = 5.79 \text{ ML/yr} \]
The total (ultimate) benefit is: 5.79 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 0.70 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 5.79 ML/yr and TCCC’s benefit (adjusted for cost share) is 0.70 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>5.79</td>
<td>0.70</td>
</tr>
<tr>
<td>2015</td>
<td>5.79</td>
<td>0.70</td>
</tr>
<tr>
<td>2016</td>
<td>5.79</td>
<td>0.70</td>
</tr>
<tr>
<td>2017</td>
<td>5.79</td>
<td>0.70</td>
</tr>
<tr>
<td>2018</td>
<td>5.79</td>
<td>0.70</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>5.79</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Data Sources:

- Size of protected land area: 5 hectares (provided by contact)
- Average annual precipitation: 2,896 mm/yr (provided by contact)

Assumptions:

- $\Delta K$ (difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition) is assumed to be 0.04 as a conservative and simplifying assumption.

OTHER BENEFITS NOT QUANTIFIED

- Water quality improvements, including reduced sedimentation
- Protection and improvement of habitat and biodiversity

NOTES

- None

REFERENCES

PROJECT NAME: Stream Crossing Improvement on North Branch White River in Huron-Manistee National Forest, Michigan
PROJECT ID #: 136

DESCRIPTION OF ACTIVITY: In-stream flow restoration through culvert removal

LOCATION: North Branch White River in Huron-Manistee National Forest, Michigan

PRIMARY CONTACT:
Wes Swaffar
Ecosystem Services Program Manager
National Forest Foundation
406-830-3356
wswaffar@nationalforests.org

Rena Ann Stricker
Contract Ecologist
CCNA Group Environment & Sustainability
National Forest Foundation
404-395-6250
rstricker@coca-cola.com

Jon Radtke
Manager, Water Resources
CCNA Group Environment & Sustainability
National Forest Foundation
404-676-9112
jradtke@coca-cola.com

OBJECTIVES:
• Enhance stream flows to allow river to regain a more natural hydrograph and re-establish ecological function
• Increase road crossing safety
• Allow for fish passage
• Reduce flooding

BACKGROUND & DESCRIPTION OF ACTIVITY: Failing road stream crossings (RSX) contribute to aquatic habitat fragmentation and impair fish passage by narrowing the stream channel and increasing water velocities. Furthermore, perched culverts often result in a ‘waterfall’ flowing from its outlet that makes it difficult for small aquatic organisms to migrate up and through. Poorly designed crossings also contribute to erosion and deposition of sediments, which can have an adverse impact on spawning habitat for important fish species (USFS, 2013).

This project involved the removal of three (3) culverts and their replacement with a bridge, allowing the river to flow freely. Figure 1 show the culverts (the one on the left is not visible because vegetation is growing from it). The new triple span timber bridge is shown in the photo on the right.

Figure 1. Culverts at 148th Avenue RSX on North Branch White River (left), and the new bridge (right)
In addition to impairing passage by fish and other aquatic species, the culverts also contributed to flooding during extreme weather events. Accumulation of debris at the opening of the culverts contributes to flooding (Figure 2).

Figure 2. Looking upriver from 148th Avenue on the N. Branch White River - January 2013 rainfall and snowmelt event (left). Accumulated debris upstream of the culvert at Pierce Road/Cobmoosa Creek crossing during flood event of May 2009. Culvert removed, timber bridge was built in 2012 (right).

This project removed the final set of culverts in a series of eight (8) crossings replaced, allowing the river to flow freely, and reconnecting approximately 7 miles of river from the North Branch White River to the upper reaches of Cobmoosa Creek. Following project completion, the autumn run of migratory fish, salmonids and late-season lake trout was the strongest in decades, lasting well into November. Prior to this removal, migratory fish passage was fragmented and sporadic.

SUMMARY OF REPLENISH BENEFIT:
• 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 150 ML/yr

ACTIVITY TIMELINE:
• Project ground-breaking: September 5, 2013
• Project completion: November 8, 2013

COCA-COLA CONTRIBUTION: 66.7%
Total Cost of Project: $200,000
TCCC Contribution: $133,333

WATERSHED BENEFITS CALCULATED:
1. Increase in streamflow

1. INCREASE IN STREAMFLOW

Approach & Results

The replenish benefit was calculated as the difference in the average annual hydrograph between the pre-project and post-project conditions. This is an appropriate method as it measures the improvement in streamflow in the affected stretch of river across a range of conditions during a typical year.
Hydrograph Approach

The HEC-RAS model (USACE, 2013) was used to simulate the hydraulics of water flow through the affected reach for the pre-project condition (culverts) and the post-project (free-flowing river) conditions. The model was used to generate average annual hydrographs for each condition and the difference in the hydrographs equals the benefit. The difference in the hydrograph was estimated at a cross section just upstream of the crossing.

Variations in flow across an average year were assumed for the model runs. Since there is no gage located at or near the project site, the time series of flows from a nearby gage (East Branch Pine River near Tustin, MI) with a similar drainage area was used in the analysis. The 2012 flows were scaled down by 30% to adjust for the smaller size of the modeled watershed. The year 2012 was a dry year, so the time series of flows from 2012 was scaled up by 15% based on rainfall data collected at Grand Rapids to estimate a long-term time series of flows for an average year.

Input Data

Streamflow time series based on gage #4124500 (East Branch Pine River near Tustin, MI)

River geometry data were obtained from USDA Geospatial Data Gateway (DEM)

Estimated diameter of culvert: 6.5 feet (assumed 3 feet of sediment and debris accumulate on upstream end of culvert during flood events)

Roughness coefficients:
  - Channel Manning’s n value = 0.045
  - Overbank Manning’s n value = 0.1

Benefit Results

The total benefit is calculated as: **225 ML/yr**

*Total (ultimate) benefit is: 225 ML/yr*

*TCCC total (ultimate) benefit taken as a function of cost share is: 150 ML/yr*

The current (2013) benefit and project benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of calendar year 2013. The total 2013 benefit is 225 ML/yr and TCCC’s benefit (adjusted for cost share) is 150 ML/yr.
Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>225</td>
<td>150</td>
</tr>
<tr>
<td>2015</td>
<td>225</td>
<td>150</td>
</tr>
<tr>
<td>2016</td>
<td>225</td>
<td>150</td>
</tr>
<tr>
<td>2017</td>
<td>225</td>
<td>150</td>
</tr>
<tr>
<td>2018</td>
<td>225</td>
<td>150</td>
</tr>
</tbody>
</table>

Ultimate Benefit: 225 150

Data Sources/Site-specific characteristics:
- Streamflow data: USGS gage #4124500 (East Branch Pine River near Tustin, MI
- River geometry data were obtained from USDA Geospatial Data Gateway (DEM)

Assumptions:
- Estimated diameter of culvert: 6.5 feet (assumed 3 feet of sediment and debris accumulate on upstream end of culvert during flood events)

OTHER BENEFITS NOT QUANTIFIED
- Increased road crossing safety
- Fish passage
- Reduced flooding

NOTES
- None.

REFERENCES


PROJECT NAME: Placer Creek Restoration, Carson National Forest, New Mexico
PROJECT ID #: 137

DESCRIPTION OF ACTIVITY: Re-wetting high mountain meadows through hydrological restoration

LOCATION: Carson National Forest, New Mexico

PRIMARY CONTACTS:
Wes Swaffar
National Forest Foundation
Manager
wswoffar@nationalforests.org
406-830-3356

Rena Ann Stricker
CCNA Group Environment & Sustainability
Contract Ecologist
Rstricker@coca-cola.com
404-395-6250

Jon Radtke
CCNA Group Environment & Sustainability
Manager, Water Resources
Jradtke@coca-cola.com
404-676-9112

OBJECTIVES:
• Restore floodplain connectivity, groundwater recharge, and flood attenuation
• Restore wet meadow habitat

BACKGROUND & ACTIVITY DESCRIPTION: Placer Creek was historically a lush high-elevation wetland flanked by wet meadows, wallows, and thick stands of herbaceous wetland vegetation (NMED, 2013). Recreational and historic mining activities in this high montane wet meadow have significantly altered the hydrology and wetland habitat. Eroding gullies are adding excessive sediment to Rio Vallecitos, a 303(d)-listed waterbody. Figure 1 shows the condition of the project site before restoration.

Figure 1. Photos of Placer Creek Project Area, Before Restoration

Project restoration activities consisted of the following:
• Construction of 9 hand-built rock structures placed in the meadow channel to spread flows and hydrate low areas adjacent to the channel;
• Installation of rolling road dips to divert runoff off of the road, away from the headcuts and onto adjacent meadow;
• Diversion of the creek flow away from the larger headcuts, towards new headcuts that direct water toward the center of the meadow.
• Reshaping of the channel and construction of a log and rock stepdown that was planted with willows.
• Construction of a berm to ensure water enters the reconstructed headcut.

The restoration has raised the groundwater elevation adjacent to the creek, and created 4 acres of new wetland and riparian area, within a larger 20-acre wetland area that benefits from the restoration. The activities also increase shallow groundwater storage capability in wetland soils and reduce current gully erosion, wetland loss, and sediment contribution to Placer Creek. Figure 2 shows the restored project area.

**Figure 2. Restored project area**

**SUMMARY OF REPLENISH BENEFIT**
- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 32.7 ML/YR

**ACTIVITY TIMELINE:**
- October 2013 – Project initiation
- November 2013 – Project completion

**COCA-COLA CONTRIBUTION:** 66.7%
- Total cost for meadow restoration: $48,000
- TCCC cost: $32,000

**WATERSHED BENEFITS CALCULATED:**
1. Increase in annual groundwater storage
1. **INCREASE IN ANNUAL GROUNDWATER STORAGE**

**Approach & Results:**

The Replenish benefit was calculated as the increase in annual groundwater storage resulting from meadow restoration. This volume was predicted based on the following equation (National Fish and Wildlife Foundation, 2010):

\[
\text{Storage change} = \text{meadow area} \times \text{average gully depth} \times \text{specific yield} \times \text{shape factor}
\]

where:

- Storage change (acre-ft) = Increase in annual ground water storage as a result of meadow restoration
- Meadow area (acres) = Total area of the meadow affected by restoration = 20 acres
- Average gully depth = 12 feet
- Specific yield (%) = average specific yield of the meadow alluvium. Specific yield is defined as the ratio of the volume of water that a saturated soil will yield by gravity to the total volume of soil. Silty fine sand was assumed as the most prevalent texture of the alluvial deposit in the meadow. Typical average specific yield corresponding to fine sand is 33% (ICF Jones and Stokes, 2008).
- Shape factor (unitless) = 0.5 and accounts for the shape of the alluvium that extends from the incised stream to the edge of the basin (ICF Jones and Stokes, 2008).

Increase in annual ground water storage as a result of meadow restoration = 39.6 acre-ft = 49 ML/yr

**The total replenish benefit = 49 ML/yr**

**Total (ultimate) benefit is:** 49 ML/yr  
**TCCC total (ultimate) benefit taken as a function of cost share is:** 32.7 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2013 Replenish Benefit**

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 49 ML/yr and TCCC’s benefit (adjusted for cost share) is 32.7 ML/yr.

**Projected Replenish Benefits**

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>49</td>
<td>32.7</td>
</tr>
<tr>
<td>2015</td>
<td>49</td>
<td>32.7</td>
</tr>
<tr>
<td>2016</td>
<td>49</td>
<td>32.7</td>
</tr>
<tr>
<td>2017</td>
<td>49</td>
<td>32.7</td>
</tr>
<tr>
<td>2018</td>
<td>49</td>
<td>32.7</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>49</td>
<td>32.7</td>
</tr>
</tbody>
</table>

Data Sources:

- The US Department of Agriculture Forest Service (USDA FS) provided the total area of the meadow affected by restoration and the estimate of an average gully depth.
- The average specific yield of the meadow alluvium and the shape factor was based on guidance provided in ICF Jones and Stokes (2008).

Assumptions:

- The most prevalent texture of the alluvial deposit in the meadow was assumed to consist of silty, fine sand based on soil properties of similar meadows in the project area.
- To account for the shape of the alluvium that extends from the incised stream to the edge of the basin, a shape factor of 0.5 was assumed.

OTHER BENEFITS NOT QUANTIFIED

- Reduction in sediment loading
- Improved water quality
- Provision of shading/reduce water temperatures
- Improved habitat/increase biodiversity

NOTES

- None.

REFERENCES


New Mexico Environment Department’s Surface Water Quality Bureau. Watershed Protection Section. 2013. Clearing the Waters Newsletter. www.nmenv.state.nm.us/swqb/wps

PROJECT NAME: Boyles Island Acquisition (Georgia for Generations)
PROJECT ID #: 142

DESCRIPTION OF ACTIVITY: Conservation of Boyles Island

LOCATION: Boyles Island is located in the Altamaha River watershed, near Jesup, Georgia

PRIMARY CONTACT:
Tami Willadsen       Rena Ann Stricker       Jon Radtke
Senior Associate Director       Contract Ecologist       Manager, Water Resources
The Nature Conservancy       CCNA Group Environment       CCNA Group Environment &
& Sustainability       Sustainability
404-253-7205       404-395-6250       404-676-9112
twilladsen@tnc.org       rstricker@coca-cola.com       jradtke@coca-cola.com

OBJECTIVES:
• Maintain natural hydrologic regime and water quality
• Protect water supply
• Reestablish or protect corridor for wildlife passage
• Protect native habitat/support biodiversity

BACKGROUND & ACTIVITY DESCRIPTION: Boyles Island (6,278 acres) is located in the Lower Altamaha River basin in southeast Georgia. The Boyles Island tract has been used as a timber resource for approximately a century. The most recent landowner implemented a ‘small clear-cut’ program, followed by natural re-vegetation, for a sustainable flow of hardwood timber and fiber from this area. Figure 1 shows the location of the Boyles Island tract and a clear-cut within this tract.

Figure 1. Site Map (left) and Clear-cut within Boyles Island (right)
Over the long-term, clear-cut practices result in loss of natural diversity, limited opportunities for old-growth trees, and increased frequency of invasive species. Harvesting impacts also lead to increased erosion and sedimentation, and private recreational access can lead to sprawl of hunting and fishing camps, as well as additional unmanaged roads and trails.

Boyles Island has been acquired by The Nature Conservancy on behalf of Georgia Department of Natural Resources. This will assure recovery of the forest, improvement of habitat and hydrology and better management of recreational access.

The acquisition of this forest brings the land under state ownership and prevents land conversion from forestland to residential and agricultural uses that would negatively impact the natural hydrologic regime and water quality of Amicalola Creek and the Etowah River. The acquisition also protects tributaries of the upper Etowah, which harbor many endangered, threatened, and rare aquatic species. In addition, the tract fills the gap between 15,000 acres of state owned property to the north and 10,000 acres of state managed property to the south, creating over 25,000 acres of connected, protected forest. The acquisition of this tract maintains contiguous buffers along Amicalola Creek and its tributaries. Furthermore, since this tract fills in the gap between the WMA’s Wildcat Creek area and Amicalola area, it extends the length of contiguous corridor protection for Amicalola Creek, safeguarding downstream habitat (TNC, 2013).

SUMMARY OF REPLENISH BENEFIT

- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 0.28 ML/yr

ACTIVITY TIMELINE:

- 2012 – Acquisition of 6,278 acres of land
- 2012 – Logging ceased
- 2013 - 2015 – development of recreation management programs and invasive species-control programs

COCA-COLA CONTRIBUTION: 0.6%

- Total cost (USD) for forest acquisition: $8,004,073 USD
- TCCC contribution: $50,000 USD

WATERSHED BENEFITS CALCULATED:

1. Decrease in runoff

1. DECREASE IN RUNOFF

Approach & Results:

The water quantity benefit was calculated using the “Alternative Annual Method” as described in Redder and Larson (2012). This method is recommended for land use/land cover activities that are expected to generate water quantity benefits of less than 150 ML/yr. The water quantity benefit is calculated as the difference in the estimated “with-conservation” and “without-conservation” runoff depths multiplied by the total surface area:
[Water quantity benefit (m$^3$/yr)] = [Δ Runoff (m/yr)] * [Surface Area (m$^2$)]
where the change in runoff (Δ Runoff) is calculated as follows:

[Δ Runoff (m/yr)] = [Without-conservation Runoff Depth (m/yr)] – [With-conservation Runoff Depth (m/yr)]

“Without-conservation” is defined as the condition of the land without protection from clear-cut (see Table 1), while “With-conservation” is defined as the protected forest condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

[Δ Runoff (m/yr)] = ΔK * [Annual Rainfall Depth (m/yr)]

where ΔK is the difference between the pre- and post-project annual runoff coefficients due to changes in the vegetation condition.

For a typical conservation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (ΔK) is solely due to a change in the vegetation condition. A conservative value of 0.04 was selected for ΔK. An annual average rainfall value of 46 inches corresponding to the Altamaha Watershed (GDNR, 2003) was used in the calculations.

<table>
<thead>
<tr>
<th>Year</th>
<th>Cumulative area that would be logged (as % total protected area)</th>
<th>Cumulative area that would be logged (acres)</th>
<th>Total Benefit (ML)</th>
<th>TCCC Cost-Share Adjusted Benefit (ML)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>4</td>
<td>250</td>
<td>47.3</td>
<td>0.28</td>
</tr>
<tr>
<td>2014</td>
<td>8</td>
<td>500</td>
<td>94.6</td>
<td>0.57</td>
</tr>
<tr>
<td>2015</td>
<td>12</td>
<td>750</td>
<td>141.9</td>
<td>0.85</td>
</tr>
<tr>
<td>2016</td>
<td>16</td>
<td>1,000</td>
<td>189.1</td>
<td>1.13</td>
</tr>
<tr>
<td>2017</td>
<td>20</td>
<td>1,250</td>
<td>236.4</td>
<td>1.42</td>
</tr>
<tr>
<td>2018</td>
<td>24</td>
<td>1,500</td>
<td>283.7</td>
<td>1.70</td>
</tr>
<tr>
<td>2019</td>
<td>28</td>
<td>1,750</td>
<td>331.0</td>
<td>1.99</td>
</tr>
<tr>
<td>2020*</td>
<td>32</td>
<td>2,000</td>
<td>378.3</td>
<td>2.27</td>
</tr>
<tr>
<td>Ultimate</td>
<td>100</td>
<td>6,278</td>
<td>1,187.4</td>
<td>7.12</td>
</tr>
</tbody>
</table>

*Although this table only shows annual results through 2020, it is expected that that logging would have continued at a rate of 4% per year beyond 2020, if this area were not protected.

The total (ultimate) benefit is: 1,187.4 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share is: 7.12 ML/yr.

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 47.3 ML/yr and TCCC’s benefit (adjusted for cost share) is 0.28 ML/yr.
Projected Replenish Benefits

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>94.6</td>
<td>0.57</td>
</tr>
<tr>
<td>2015</td>
<td>141.9</td>
<td>0.85</td>
</tr>
<tr>
<td>2016</td>
<td>189.1</td>
<td>1.13</td>
</tr>
<tr>
<td>2017</td>
<td>236.4</td>
<td>1.42</td>
</tr>
<tr>
<td>2018</td>
<td>283.7</td>
<td>1.70</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>1,187.4</td>
<td>7.12</td>
</tr>
</tbody>
</table>

Data Sources:
- Size of protected land area and expected deforestation schedule provided by contact.
- Mean precipitation for the project area was obtained from GDNR (2003).

Assumptions:
- If the land were not protected, it would be clear-cut at a rate of 4% per year. This estimated rate is based on an analysis of present forest cover, which suggested approximately 20% of the area was ‘disturbed woody wetland” including recent clear-cuts. Under the reasonable assumption that this acreage was comprised of 5 years of past harvesting (i.e. regrowth up to 5 years old), an average of 4% deforestation per year, or about 250 acres per year, was calculated.
- A conservative value of 0.04 was selected for $\Delta K$, consistent with the recommendations made in the “Alternative Annual Method” memorandum (Redder and Larson 2012).”
- The ultimate benefit calculation assumes that the 20% of the land that was cut prior to protection would have regrown and been logged.

OTHER BENEFITS NOT QUANTIFIED
- Protection of habitat and biodiversity, and protection of a corridor for wildlife passage
- Water quality benefits

NOTES
- None

REFERENCES
PROJECT NAME: Aquifer recharge in Valencia Spain  
PROJECT ID #: 146  

DESCRIPTION OF ACTIVITY: Establishment of infiltration wells for artificial aquifer recharge  

LOCATION: Vall d’Uxó, Castellón, Valencia, Spain (latitude: 39.825; longitude: 0.18)  

PRIMARY CONTACT:  
Josep Molas  
c/ Ribera del Loira 20  
Madrid, Spain  
Tel. 34-91-396-9635  
jmolaspages@coca-cola.com  
Rudi Sueys  
Coca-Cola Europe  
Brussels, Belgium  
Tel. +32 (0)2 559 2596  
rusueys@coca-cola.com  

OBJECTIVES:  
• Improve quality of groundwater affected by saline intrusion  

BACKGROUND & ACTIVITY DESCRIPTION: Salt water intrusion is occurring in coastal aquifers in the Valencia area as a result of many years of significant ground water abstraction by local farmers for irrigation (Figure 1). The area of Valencia is reputed for its fruits (oranges, peaches), and this activity is one of the economic drivers of the region. These fruits are consumed internally and exported to other European countries.  

The objective of the project is to reduce the salinity of the ground water by infiltrating regenerated waters (i.e., treated wastewater) from municipal wastewater plants that would otherwise be discharged into rivers and then to the sea. Prior to infiltration, the water undergoes tertiary treatment (electrodialysis and UV disinfection) to ensure compliance with local regulations. Figure 2 shows the project site.
To date, project activities have included: identification of potential aquifers and infiltration areas for future study, a hydrogeological study of coastal aquifers, salinity curves and infiltration potential. One aquifer was selected and an infiltration infrastructure was put in place and tested as a pilot study. A total of 265,000 cubic meters was infiltrated in 2013, and a total of 500,000 cubic meters of water will be infiltrated in 2014. A comprehensive study of the response of the aquifer to the infiltration will also be conducted. Figure 3 shows an infiltration/control well and measurement of aquifer levels.

Based on the results of the pilot study, the expectation is that these types of projects can be implemented in other locations in the community and along the Spanish Mediterranean coast.
SUMMARY OF REPLENISH BENEFIT:

- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 265 ML/yr

ACTIVITY TIMELINE:

Project activities are being implemented over a three year period (September 2011 through September 2014):

- Phase 1 (2011): Identification of potential aquifers and infiltration areas for future study
- Phase 2 (2013): Hydrogeological study of coastal aquifers, salinity curves and infiltration potential was completed. Based on study results, one aquifer was selected and an infiltration infrastructure was put in place and tested. A total of 265,000 cubic meters was infiltrated in 2013.
- Phase 3 (2014): A total of 500,000 cubic meters of water is projected to be infiltrated in 2014. A comprehensive study of the response of the aquifer to the infiltration will then be conducted. Based on the results of the pilot study, these types of projects can be implemented in other locations in the community and in the wider Spanish Mediterranean coastal area

COCA-COLA CONTRIBUTION: 100%

All costs associated with the hydrological study and infrastructure construction were provided by TCCC.

- Total cost: $420,000 USD
- $280,000 USD (Phases 1 and 2) through grant from The Coca-Cola Foundation
- Approval of funding for Phase 3 ($140,000 USD) is pending

WATERSHED BENEFITS CALCULATED:

1. INCREASE IN INFILTRATION

Approach:

The replenish benefit is calculated as the annual volume of water infiltrated to the aquifer as a result of the project. These volumes are metered, and infiltration tests conducted in 2013 measured an infiltration volume of 265,000 cubic meters. A total of 500,000 cubic meters of water is projected to be infiltrated in 2014.

- The total (ultimate) water quantity benefit is: 500 ML/yr
- TCCC total (ultimate) benefit taken as a function of cost share is: 500 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 265 ML/yr and TCCC’s benefit (adjusted for cost share) is 265 ML/yr.

Projected Water Quantity Benefits Summary

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. If additional projects are added or projects are expanded, the future benefits will increase. While not shown in the table, the benefits are anticipated to continue to be generated through the year.
2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>2015</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>2016</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>2017</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>2018</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>

Data Sources
- All information including metered recharge data were provided by TCCC.

Assumptions:
- Projected recharge volumes assume the project proceeds as currently planned.

OTHER BENEFITS NOT QUANTIFIED
- Improved quality of irrigation water used in orchards and for other purposes

NOTES
- This fact sheet is draft pending confirmation of project status and infiltration volumes.

REFERENCES
- None
PROJECT NAME: Urban wetland restoration in Zhengzhou City
PROJECT ID #: 148

DESCRIPTION OF ACTIVITY: Wastewater reuse for conservation

LOCATION: Lianhu Wetland Park in Zhengzhou City, Henan Province, China

PRIMARY CONTACTS:
Kevin Jiang                  Weidong Zhang
Coca-Cola China            KO Project Leader, UNDP
Beijing, china             China
kejiang@coca-cola.com      Weidong.zhang@undp.org

OBJECTIVES
• Reconstruct degraded urban pocket wetland
• Productively use 100% of treated wastewater from bottling plant
• Increase habitat and biodiversity
• Improve urban environment

BACKGROUND & DESCRIPTION OF ACTIVITY: Many urban wetlands in China are in decline due to rapid urbanization and shortage of water supply. The Lianhu Wetland, a typical urban pocket wetland located in Zhengzhou City, offers green space and recreation for the nearby residents. However, the wetland was degraded due to insufficient water supply from the municipal water supply system and poor water quality. Prior to project implementation, the northern portion of the wetland was mostly dry year-round, and the southern portion was stagnant.

To improve the wetland, the Swire Coca-Cola Zhengzhou (SCCZZ) Plant partnered with the local government to provide all its treated wastewater to the wetland as an exclusive new source of water. The bottling plant obtains its water from the municipality, which draws from an aquifer. Prior to the project, the SCCZZ plant discharged to the municipal wastewater treatment plant. The plant provides 0.60 million liters per day (ML/day) of treated wastewater to the wetland. Prior to discharge to the wetland park, the treated wastewater undergoes biological treatment and has demonstrated that the effluent complies with all discharge standards established by the government (TN 4.88 mg/L, TP 0.08 mg/L, pH 8.15).

Water resources in the region are significantly stressed. The project has helped alleviate water shortages in the city because the municipality no longer needs to provide water to the wetland and municipal water can be used for other purposes. As a result of the revitalization of the Lianhu wetland, the project provides an improved recreation environment for the urban community, and enhances public awareness of water reuse and environment conservation.

The figures below show pre- and post-project conditions. Figure 1 presents the project plan. Figures 2 and 3 show the conditions of the wetland before, during and after reconstruction.
SUMMARY OF REPLENISH BENEFIT:

- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 219 ML/yr
ACTIVITY TIMELINE:
- Project initiation: April 2013
- Project completion: September 2013

COCA-COLA CONTRIBUTION: 100%
- Total cost: $190,000 USD
- TCCC cost contribution: $190,000 USD

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:
  1. Volume of wastewater reused

1. VOLUME OF WASTEWATER REUSED

   Approach and Results

   The replenish benefit was calculated as the annual average volume of treated wastewater reused by discharging the water to the wetland. The SCCZZ plant operates 365 days per year, and the treated wastewater discharged to the wetland is metered:

   \[
   0.60 \text{ ML/day} \times 365 \text{ days/year} = 219 \text{ ML/yr}
   \]

   The full volume of flow from the SCCZZ Plant (219 ML/yr) is now being provided to the wetland. In 2014 and beyond, the full volume of 219 ML/yr will be provided to the wetland.

   The total (ultimate) benefit: 219 ML/yr
   TCCC total (ultimate) benefit taken as a function of cost share is: 219 ML/yr

   The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

   The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is estimated to be 219 ML/yr and TCCC’s benefit (adjusted for cost share) is 219 ML/yr.

Projected Replenish Benefits

   Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.
Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>219</td>
<td>219</td>
</tr>
<tr>
<td>2015</td>
<td>219</td>
<td>219</td>
</tr>
<tr>
<td>2016</td>
<td>219</td>
<td>219</td>
</tr>
<tr>
<td>2017</td>
<td>219</td>
<td>219</td>
</tr>
<tr>
<td>2018</td>
<td>219</td>
<td>219</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>219</td>
<td>219</td>
</tr>
</tbody>
</table>

Data Sources

- All data including volume of treated wastewater were provided by TCCC contact.

Assumptions

- Projected benefits assume that the full volume of flow will be provided to the wetland in 2014 and beyond.

OTHER BENEFITS NOT QUANTIFIED

- Improved water quality in wetland
- Increased public awareness on water reuse and conservation
- Improved wetland habitat and biodiversity
- Increased aquifer recharge

NOTES

- None

REFERENCES

- None
PROJECT NAME: Supplying Irrigation Water to Maximize Food Security in the Mara River Basin, Kenya
PROJECT ID #: 151

DESCRIPTION OF ACTIVITY: Irrigation water supply for vegetable cultivation (0.4 hectares)

LOCATION: Mara River Basin, Kenya

PRIMARY CONTACT:
Tara Varghese
Global Environment & Technology Foundation
Tara.Varghese@getf.org

Naabia Ofosu-Amaah
Global Environment & Technology Foundation
naabia.ofosu-amaah@getf.org

OBJECTIVES:
- Implement drip irrigation and supply irrigation water
- Increase food security

BACKGROUND & ACTIVITY DESCRIPTION: Agriculture in the Mara River basin is almost entirely rain-fed, leaving the nutrition and livelihoods of small-scale farmers and their families vulnerable to the variability of the weather. Irrigation is an important means of increasing food security in this basin. However, irrigation must be conducted wisely, because the amount of available water is limited. Traditional, highly consumptive modes of irrigation could rapidly exhaust the flow of water in the Mara River, leading to severe ecological decline in the Mara Serengeti Ecosystem. The Mara Water and Development Alliance, with funding from The Coca-Cola Company (TCCC) and USAID, partnered with the Ministry of Agriculture and local schools to install highly efficient drip irrigation systems (Figure 1). There has been very limited application of this technology in the Mara Region, and through the Mara Water Resource Users Association these newly irrigated fields will serve as a demonstration site for how food security can be increased with minimal impacts on the region’s water resources.

SUMMARY OF REPLENISH BENEFIT
- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 0.09 ML/YR

ACTIVITY TIMELINE:
- January 2009: Project initiation
- August 2010: Project completed
COCA-COLA CONTRIBUTION:  59.4%
- Total project cost: $414,511 USD
- TCCC contribution: $246,134 USD

Note: The irrigation improvement activity is part of a larger integrated water resources management project.
Costs for the irrigation activity alone were not available; therefore the costs above represent the cost for all project activities.

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:
1. Irrigation water supply

1. IRRIGATION WATER SUPPLY

Approach & Results:
This project is conducted in the Mara River Basin (USAID-TCCC, 2010). In Kenya, the Mara River Basin lies within the southern section of Rift Valley Province. The crops affected by this project are predominantly vegetables. The major vegetable crops grown within the Mara River Basin include cabbage, tomato and sweet potato (ReSAKSS, 2007). Publicly available information (FAO; Mekonnen and Hoekstra, 2010) was used to estimate the average irrigation requirements for growing these crops in the Rift Valley Province. The irrigation requirements were calculated in the following steps.

- The water footprint associated with irrigation (i.e., blue water footprint) for growing the above-mentioned crops in the Rift Valley Province were obtained from Mekonnen and Hoekstra (2010).
- The average crop yield data for growing the above-mentioned vegetables were obtained from Food and Agriculture Organization (FAO) database.
- The water footprint, yield information and a drip irrigation efficiency factor (FAO, 1989) were used to estimate irrigation water requirements with drip irrigation.

The estimated average irrigation water requirements for growing the vegetable crops was 379 m³/ha.

The total volume of water applied for irrigation can be divided into two main fractions (Foster and Perry, 2010); consumed and non-consumed fraction. The consumed fraction refers to the beneficial transpiration being consumed by the crop and the non-beneficial evaporation from wet soil. The non-consumed fraction refers to the recoverable seepage infiltrating as a ‘return flow’ to a fresh water aquifer. In order to describe irrigation water use in terms of water consumption, the benefit quantification approach described below accounts for the volume of water that infiltrates as ‘return flow’ to the freshwater aquifer when water is applied for irrigation. A reasonable assumption of return flow for drip-irrigation is 5% of the applied water (Foster and Perry, 2010).

- Water applied for irrigation = 379 m³/ha
- Consumed fraction = (1-fraction of return flow) x water applied
  = (1-0.05) X 379 m³/ha = 360 m³/ha
- Area of cultivation = 0.4 ha

Total benefit (Irrigation Supply) = Consumed fraction x Area of cultivation
= 360 m³/ha x 0.4 ha = 144 m³ = 0.14 ML
The total (ultimate) benefit is: 0.14 ML/yr.

TCCC total (ultimate) benefit taken as a function of cost share is: 0.09 ML/yr.

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 0.14 ML/yr and TCCC’s benefit (adjusted for cost share) is 0.09 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>0.14</td>
<td>0.09</td>
</tr>
<tr>
<td>2015</td>
<td>0.14</td>
<td>0.09</td>
</tr>
<tr>
<td>2016</td>
<td>0.14</td>
<td>0.09</td>
</tr>
<tr>
<td>2017</td>
<td>0.14</td>
<td>0.09</td>
</tr>
<tr>
<td>2018</td>
<td>0.14</td>
<td>0.09</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>0.14</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Data Sources:
- Project area: provided by contact.
- Blue water footprint for vegetables obtained from Mekonnen and Hoekstra (2010).
- Crop yield obtained from FAOSTAT database.
- Drip irrigation efficiency factor obtained from FAO (FAO, 1989).

Assumptions:
- Projected benefits assume project will continue as currently designed

OTHER BENEFITS NOT QUANTIFIED
- Increased crop yield
- Economic benefits and food security

NOTES
- None
REFERENCES


PROJECT NAME: Supplying Irrigation Water to Strengthen Human Capacity for Income Generation
PROJECT ID #: 152

DESCRIPTION OF ACTIVITY: Irrigation water supply for vegetable cultivation on 2.78 ha

LOCATION: Zinder Region, Niger

PRIMARY CONTACT:
Tara Varghese
Global Environment & Technology Foundation (GETF)
Tara.Varghese@getf.org

Naabia Ofosu-Amaah
Global Environment & Technology Foundation (GETF)
naabia.ofosu-amaah@getf.org

OBJECTIVES:
• Supply irrigation water
• Increase food security

BACKGROUND & ACTIVITY DESCRIPTION: At the time this project was developed, Niger ranked 174 of 177 countries on the UN’s Human Development Index. Over 85% of the population survives on less than $2 per day, mostly from subsistence rain-fed agriculture and livestock. This project was developed to address a need for improving productivity due to increased water scarcity. This Multiple-Use Water Services project has been implemented in several villages within the Zinder Region, Niger. The project area covers the departments of Kantche and Magaria and includes the communes of Matameye, Doungou, Irchirnawa, Bande and Magaria. One main objective of the project is to increase annual incomes and diversify livelihoods through productive water use activities by implementing vegetable gardens. This project involves training of farmers on production techniques, improving irrigation systems, and improving access to seeds, pesticides and fertilizers. As part of this project, vegetable gardens were established in several villages in the Zinder Region and irrigation water was supplied. The primary crops grown were onions, tomato, lettuce and cabbage. This project also established gardens for 48 women from the villages of Kereni, Ayraye, and Garin Sarin Noma Iidi.

SUMMARY OF REPLENISH BENEFIT
• 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 0.83 ML/YR

ACTIVITY TIMELINE:
• 2009: Project initiation
• 2010: Project completed

COCA-COLA CONTRIBUTION: 17.6%
• Total project cost: $1,989,368 USD
• TCCC contribution: $350,000 USD

Note: The irrigation improvement activity is part of a larger integrated water resources management project. Costs for the irrigation activity alone were not available; the costs above represent the cost for all project activities.

WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:
1. Irrigation water supply
1. **IRRIGATION WATER SUPPLY**

**Approach & Results:**

The crops affected by this project include onion, tomatoes, cabbage and lettuce. Publicly available information (FAO; Mekonnen and Hoekstra, 2010) was used to estimate the average irrigation requirements for growing these crops in Niger. The irrigation requirements were calculated in the following steps.

- The water footprint associated with irrigation (i.e., blue water footprint) for growing the above-mentioned crops in Niger were obtained from Mekonnen and Hoekstra, 2010.
- The average crop yield data for growing the above-mentioned vegetables were obtained from Food and Agriculture Organization (FAO) database.
- The water footprint, yield information and a surface irrigation efficiency factor (FAO, 1989) were used to estimate irrigation water requirements with surface irrigation.

The estimated average irrigation water requirements for growing the vegetable crops was 2,261.6 m$^3$/ha.

The total volume of water applied for irrigation can be divided into two main fractions (Foster and Perry, 2010); consumed and non-consumed fraction. The consumed fraction refers to the beneficial transpiration being consumed by the crop and the non-beneficial evaporation from wet soil. The non-consumed fraction refers to the recoverable seepage infiltrating as a ‘return flow’ to a fresh water aquifer. In order to describe irrigation water use in terms of water consumption, the benefit quantification approach described below accounts for the volume of water that infiltrates as ‘return flow’ to the freshwater aquifer when water is applied for irrigation. A reasonable assumption of return flow for surface-irrigation is 25% of the applied water (Foster and Perry, 2010).

- Water applied for irrigation = 2,261.6 m$^3$/ha
- Consumed fraction = (1-fraction of return flow) x water applied
  \[ = (1-0.25) \times 2,261.6 \, m^3/ha = 1,696.2 \, m^3/ha \]
- Area of cultivation = 2.78 ha

Total benefit (Irrigation Supply) = Consumed fraction x Area of cultivation

\[ = 1,696.2 \, m^3/ha \times 2.78 \, ha = 4,715 \, m^3 = 4.72 \, ML \]

**The total (ultimate) benefit is:** 4.72 ML/yr.

**TCCC total (ultimate) benefit taken as a function of cost share is:** 0.83 ML/yr.

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

**2013 Replenish Benefit**

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 4.72 ML/yr and TCCC’s benefit (adjusted for cost share) is 0.83 ML/yr.
Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

### Table 1. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>4.72</td>
<td>0.83</td>
</tr>
<tr>
<td>2015</td>
<td>4.72</td>
<td>0.83</td>
</tr>
<tr>
<td>2016</td>
<td>4.72</td>
<td>0.83</td>
</tr>
<tr>
<td>2017</td>
<td>4.72</td>
<td>0.83</td>
</tr>
<tr>
<td>2018</td>
<td>4.72</td>
<td>0.83</td>
</tr>
<tr>
<td><strong>Ultimate Benefit:</strong></td>
<td><strong>4.72</strong></td>
<td><strong>0.83</strong></td>
</tr>
</tbody>
</table>

Data Sources:
- Area of cultivation: provided by contact
  - 86 producers with an average plot size of 300 m²
  - 2000 m² for women’s gardens
- Blue water footprint for vegetables obtained from Mekonnen and Hoekstra (2010).
- Crop yield obtained from FAOSTAT database.
- Surface irrigation efficiency factor obtained from FAO (FAO, 1989).

Assumptions:
- Projected benefits assume the project will continue as currently designed.

OTHER BENEFITS NOT QUANTIFIED
- Increased crop yield
- Economic benefits and food security

NOTES
- None.

REFERENCES


PROJECT NAME: Community Watershed Support Project (C-WASP), Malawi
PROJECT ID #: 153

DESCRIPTION OF ACTIVITY: Reforestation

LOCATION: Rumphi and Nkhotakota, Malawi

PRIMARY CONTACT:
Tara Varghese Naabia Ofosu-Amaah
Global Environment & Technology Foundation Global Environment & Technology Foundation (GETF) (GETF)
Tara.Varghese@getf.org naabia.ofosu-amaah@getf.org

OBJECTIVES:
• Reduce degradation associated with tree cutting
• Increase the capacity of community institutions to protect water catchments

BACKGROUND & ACTIVITY DESCRIPTION: Malawi is a small, densely populated country. The growing population and associated resource demands have resulted in deterioration of the natural environment. Deforestation is a major environmental issue in Malawi. Between 1972 and 2005, Malawi’s forest cover was cut in half from increasing demands for farmland and wood. As a result of deforestation, topsoil is lost at an average rate of over 20 tons per ha per year, and rates of 100 tons per hectare per year are common on steep slopes. Until recently, most of this deforestation occurred on customary land where trees are regarded as a free resource. However, due to increasing difficulties in enforcing government policies, encroachment and exploitation of protected areas and watersheds are now common. The loss of biodiversity in these areas is accompanied by adverse changes in climatic and hydrological regimes with diminished stream flows, increased flooding and the siltation of rivers, dams and lakes. Malawi’s future depends on its ability to support a growing population and soundly manage its natural resources.

To address this problem, native tree species are being planted in two locations, Nkhotakota and Rumphi. The reforestation activities are being implemented on steep mountainous slopes. Elevations (above sea level) typically range from 475 to 1,000 m in Nkhotakota and 900 to 2,500 m in Rumphi. The number of hectares put under community-managed woodlots/individually conserved woodlots, and replanted with seedlings are shown in Table 1 for 2011 through 2013.

<table>
<thead>
<tr>
<th>Location</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rumphi</td>
<td>227</td>
<td>104.52</td>
<td>52.5</td>
<td>384.02</td>
</tr>
<tr>
<td>Nkhotakota</td>
<td>198.15</td>
<td>20</td>
<td>42</td>
<td>260.15</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td></td>
<td></td>
<td>644.17</td>
</tr>
</tbody>
</table>

SUMMARY OF REPLENISH BENEFIT
• 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 156.2 ML/yr

ACTIVITY TIMELINE:
• 2011: Project initiation and reforestation of 425.15 hectares
• 2012: Reforestation of an additional 124.5 hectares
• 2013: Project completion and reforestation of an additional 94.5 hectares, for a cumulative total of 644.17 hectares.
COCA-COLA CONTRIBUTION: 49.9%
- Total project cost: $1,197,689 USD
  - TCCC contribution: $597,688.89 USD

Reforestation is part of a larger project; however, costs for the reforestation activity alone were not available. The costs above represent the cost for all project activities.

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff

1. DECREASE IN RUNOFF

Approach & Results:
The water quantity benefit was calculated using the “Alternative Annual Method” as described in Redder and Larson (2012). Although the area affected by the project exceeds the threshold area described in Redder and Larson, this estimate is conservative and appropriate for benefit calculations due to the lack of long-term daily meteorological data needed to apply the “SWAT” method. The water quantity benefit is calculated as the difference in the estimated “pre-project” and “post-project” runoff depths multiplied by the total surface area:

\[
\text{[Water quantity benefit (m}^3/\text{yr})] = \Delta \text{Runoff (m/yr)} \times \text{[Surface Area (m}^2\text{)]}
\]

where the change in runoff (\(\Delta \text{Runoff}\)) is calculated as follows:

\[
\Delta \text{Runoff (m/yr)} = \{ \text{[Pre-project Runoff Depth (m/yr)]} - \text{[Post-project Runoff Depth (m/yr)]} \}
\]

“Pre-project” is defined as the deforested condition of the land that existed prior to reforestation, while “post-project” is defined as the reforested condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

\[
\Delta \text{Runoff (m/yr)} = \Delta K \times \text{[Annual Rainfall Depth (m/yr)]}
\]

where \(\Delta K\) is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical reforestation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (\(\Delta K\)) is solely due to a change in the vegetation condition. A conservative value of 0.04 was selected for \(\Delta K\) consistent with the recommendations made in the “Alternative Annual Method” memorandum (Redder and Larson, 2012).

For the project site, the estimated average annual rainfall depth is 1200 mm (1.2m/yr) at Nkhotakota and 1225 mm (1.225 m) at Rumphi. The surface area is 260.15 hectares at Nkhotakota and 384.02 hectares at Rumphi.

Therefore, the water quantity benefit is calculated as follows:

\[
\text{[Water quantity benefit (m}^3/\text{yr})] = \Delta \text{Runoff (m/yr)} \times \text{[Surface Area (m}^2\text{)]}
\]
Nkhotakota

\[ 124,872 \text{ (m}^3\text{/yr)} = [0.04 \times 1.200 \text{ (m/yr)}] \times [2,601,500 \text{ (m}^2\text{)}] = 124.87 \text{ ML/yr} \]

Rumpi

\[ 188,170 \text{ (m}^3\text{/yr)} = [0.04 \times 1.225 \text{ (m/yr)}] \times [3,840,200 \text{ (m}^2\text{)}] = 188.17 \text{ ML/yr} \]

The total (ultimate) benefit is: 313.0 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 156.2 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

### 2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 313.0 ML/yr and TCCC’s benefit (adjusted for cost share) is 156.2 ML/yr.

### Projected Replenish Benefits

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share in the second column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>313.0</td>
<td>156.2</td>
</tr>
<tr>
<td>2015</td>
<td>313.0</td>
<td>156.2</td>
</tr>
<tr>
<td>2016</td>
<td>313.0</td>
<td>156.2</td>
</tr>
<tr>
<td>2017</td>
<td>313.0</td>
<td>156.2</td>
</tr>
<tr>
<td>2018</td>
<td>313.0</td>
<td>156.2</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>313.0</td>
<td>156.2</td>
</tr>
</tbody>
</table>

### Data Sources:

- Size of reforested land area: provided by contact
- Annual average precipitation for the Rumpi and Nkhotakota locations provided by the contact.

### Assumptions:

- The reforested area is assumed to have reached mature vegetation.

### OTHER BENEFITS NOT QUANTIFIED

- Water quality improvements, including reduced sedimentation
- Protection and improvement of forest habitat and biodiversity

### NOTES

- The conservative Alternative Annual Method (Redder and Larson, 2012) was used to estimate change in runoff, due to the lack of long-term daily meteorological data necessary to apply a more complex approach (“SWAT” method).
REFERENCES
PROJECT NAME: Construction of infiltration wells in Mojokerto, Indonesia  
PROJECT ID #: 155

DESCRIPTION OF ACTIVITY: Establishment of infiltration wells for artificial aquifer recharge of rainwater

LOCATION: Mojokerto District, East Java Province, Indonesia

PRIMARY CONTACTS:  
Mr. Triyono Prijosoesilo  
Public Affair Manager – Indonesia Region  
Tel. 62-21-5798 8264  
tprijosoesilo@coca-cola.com

Sombat Jungsaitakul  
ASEAN BU EOSH Manager  
Tel. +6628351425  
jsombat@coca-cola.com

OBJECTIVES:  
• Increase recharge of the local aquifer in Mojokerto

BACKGROUND & ACTIVITY DESCRIPTION: Mojokerto District is located in the East Java Province, approximately 40 km southwest of Surabaya, the second largest city in Indonesia. Mojokerto plays a strategic position in East Java where it serves as a reliable food source and tourist destination and as an important water source for Mojokerto City and portions of the East Java Province. Water shortages have been a serious issue in the Mojokerto District. This project was designed to promote replenishment of ground water. This effort is similar to the establishment of infiltration wells in North Sumatera Province to replenish local aquifer (JKM and CCF, 2010).

Based on the local conditions and surveys conducted by a USAID funded program (IUWASH), The Coca-Cola Company (TCCC) constructed 650 infiltration wells in the area of Pacet in Mojokerto District. The wells are designed to capture runoff from the catchment, and each well holds a volume of 8 m3 (2m x 2m x 2m). Figure 1 shows construction of an infiltration well.

![Figure 1. Infiltration well construction in Mojokerto District, Indonesia.](image)

SUMMARY OF REPLENISH BENEFIT:  
• 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 392 ML/YR
ACTIVITY TIMELINE:
• An additional 225 wells are planned to be constructed in 2014.

COCA-COLA CONTRIBUTION: 84.9%
• Total Cost (USD): $264,978
• Coca-Cola Cost Contribution (USD): $224,978

WATERSHED BENEFITS CALCULATED:
1. Increase in recharge

1. INCREASE IN RECHARGE

Approach:
The Rain Water Harvesting/Artificial Aquifer Recharge (RWH/AAR) Probabilistic Model, Version 1.5 was used to estimate the volume of water successfully used for artificial aquifer recharge based on available rainfall. The model has been used to quantify replenish benefits for similar projects in India (GCC, 2010). TCCC partnered with the Global Corporate Consultancy (GCC), formerly known as Delta Consultants, to develop the RWH/AAR model. Data obtained from the RWH/AAR system survey were used with the model to estimate the benefits for this project. The assumptions used in the model application are described in the following sections. The RWH/AAR model is split into three modules based upon: 1) the flow of water from precipitation to the catchment, 2) storage capacity water balance, and 3) delivery of water to the desired end use (i.e., community access or AAR).

Rainwater Available for AAR:
To calculate the potential rainwater collected and made available for AAR, the model utilizes the following formula and variables:

\[(\text{Catchment Size}) \times (\text{Total Precipitation}) \times (\text{Catchment Runoff Coefficient})\]

**Catchment Size** – Based on the 650 absorption wells already constructed, the size of the surface catchment evaluated is 1,015,720 m² (provided by the project contact).

**Total Precipitation** – The model requires monthly rainfall data. Average annual rainfall totals were provided for the project area. Long-term monthly climate data for this region were obtained by LimnoTech through a global climate dataset (Hearn et al. 2003). The percent of precipitation by month for the project area was estimated based on the global climate dataset, and then used to apportion the total annual rainfall amount indicated in the survey.

**Catchment Runoff Coefficient** – The runoff coefficient represents the efficiency of a catchment in producing runoff. A runoff coefficient of 30%, typically used for unpaved surfaces (GCC, 2010), was selected for the calculations.

Storage Capacity Water Balance Module:
The RWH/AAR model uses a water balance approach and monthly precipitation data to estimate the volume of water not lost due to insufficient storage or infiltration rate of structure used for AAR. During each month the model calculates the rainwater available to meet community demand and/or AAR. If the combined community and AAR demand is less than the available water in a given month, it is assumed
both demands would be completely met, and any excess water would remain in the AAR structure (up to the volume of structure, with any water beyond that volume assumed to be lost due to insufficient storage). This project does not incorporate any storage structures but utilizes water recharge through infiltration wells. Therefore, each well was assigned to have a recharge rate of 4 m$^3$/day. This recharge rate translates to a percolation rate of 1 m/day for the 2m x 2m infiltration wells. It should be noted that the recharge rate of 4 m$^3$/day for the infiltration wells is a reasonable assumption of potential rate. It was also assumed that all available water is utilized for AAR (i.e., no community demand).

**Artificial Aquifer Recharge Water Balance Module:**

For this project, 100% of the captured water is used for AAR. The RWH/AAR model estimates the volume of water successfully used for AAR based on the recharge mechanism used. Based on responses provided in the questionnaire, it was determined that the primary mechanism of AAR is through percolation pits or recharge wells/shafts. The volume of water successfully recharged to the aquifer through percolation pits or recharge wells/shafts was estimated by the model using the following formula:

\[(Q_{AAR} - PPRW) \times (\text{Efficiency of the AAR processes}) \times (\text{Maintenance Efficiency})\]

where $Q_{AAR} - PPRW$ is the annual volume of water received by the infiltration wells.

For this project, an AAR process efficiency of 95% corresponding to recharge via infiltration wells was used. A maintenance efficiency of 95% was used for the project corresponding to annual maintenance frequency.

**Results:**

A summary of benefits calculated using the RWH/AAR model is provided in Table 1.

<table>
<thead>
<tr>
<th>Location</th>
<th>Mojokerto, East Java Province</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catchment area (m²)</td>
<td>1,015,720</td>
</tr>
<tr>
<td>Annual rainfall (mm/year)</td>
<td>1,900</td>
</tr>
<tr>
<td>Estimated annual rainfall on the catchment (ML)</td>
<td>1,930</td>
</tr>
<tr>
<td>Catchment Supply (ML/yr)</td>
<td>579</td>
</tr>
<tr>
<td>Infiltration capacity of the wells (ML/yr)</td>
<td>936</td>
</tr>
<tr>
<td>Volume captured (ML/yr)</td>
<td>511</td>
</tr>
<tr>
<td>AAR Volume recharged (ML/yr)</td>
<td>461.7</td>
</tr>
</tbody>
</table>

Note: Catchment supply varies by month based on precipitation. The total catchment supply on a monthly basis may be less than the infiltration capacity of the wells. As such, the actual volume captured and recharged annually may be less than the estimated annual catchment supply.

The total (ultimate) water quantity benefit is: 461.7 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 392 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.
2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 461.7 ML/yr and TCCC’s benefit (adjusted for cost share) is 392 ML/yr.

Projected Water Quantity Benefits Summary

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>461.7</td>
<td>392</td>
</tr>
<tr>
<td>2015</td>
<td>461.7</td>
<td>392</td>
</tr>
<tr>
<td>2016</td>
<td>461.7</td>
<td>392</td>
</tr>
<tr>
<td>2017</td>
<td>461.7</td>
<td>392</td>
</tr>
<tr>
<td>2018</td>
<td>461.7</td>
<td>392</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>461.7</td>
<td>392</td>
</tr>
</tbody>
</table>

Data Sources

- RWH survey completed by the Indonesia Division. An annual rainfall of 1,900 mm/yr was reported in the survey, which is similar to the value that was obtained from the global database (1,477 mm; Hearn et al. 2003). Monthly values from the global database were used to apportion the annual rainfall provided in the survey.

Assumptions:

- Assumptions and limitations of the RWH/AAR model as defined within a document developed by Global Corporate Consultancy (2010).
- Without this project, a negligible amount of water infiltrates at the site where the infiltration wells are constructed.
- A recharge rate of 4 m³/day was assumed for the infiltration wells, which corresponds to percolation rate of 1 m/day characteristics of loamy-sand (ASCE, 2001).
- The infiltration wells will be maintained at least on an annual basis to prevent clogging.

OTHER BENEFITS NOT QUANTIFIED

- Reduction in storm water runoff and associated pollutant load

NOTES

- The AAR process efficiency of 95% and maintenance efficiency of 95% are based on the default database within the RWH/AAR model.
REFERENCES


PROJECT NAME: Rehabilitation of Canal Kara-Talaa and Canal Kyzyl-Jylidy in Naryn Region, Kyrgyzstan  
PROJECT ID: 157  
DESCRIPTION OF ACTIVITY: Rehabilitation of two man-made canals to enhance water supply for regional irrigation  
LOCATION: Naryn District, Kyrgyzstan  
PRIMARY CONTACT:  
Dr. Oleg Piletsky  
Public Affairs and Communication Manager, Caucasus and Central Asia Republics Region  
Turkey, Caucasus and Central Asia Business Unit  
Istanbul, Turkey  
opiletsky@coca-cola.com  
OBJECTIVE:  
• Improve crop yields by providing reliable irrigation water supply  
BACKGROUND & ACTIVITY DESCRIPTION:  
The Kyzyl-Jylidy and Kara-Talaa irrigation canals located in the Naryn Region of Kyrgyzstan were built by the Soviet Union in the 1970s. Prior to this project, no major repairs or cleaning had been conducted on the canals since the 1990s. As a result, the canals were silted in and some parts were damaged, inhibiting the water delivery capacity of the canals and negatively affecting farmers’ harvest in the region.  
Canal Kara-Talaa provides irrigation water for 4,358 people in Jerge-Tal, Kazan-Kuigan, and Kara-Kujur villages of Kazan-Kuigan Ayil Aimak who farm and generate income from a total of 980 hectares. The length of the canal is 10 km, of which 3.1 km is earthen and 6.9 km is concrete-reinforced. Before the implementation of the project, the earthen bed of the canal was silted and overgrown with grass, and the concrete bed was damaged. As a result, the canal was unable to deliver the amount and level of water needed for the proper irrigation of lands dependent on it. Due to lack of government funds and the necessary equipment, the canal had not been cleaned for a long time, and four water distribution facilities had become dilapidated. Moreover, farmers did not have a gauging station to measure the water velocities and level in the irrigation canal.  
Canal Kyzyl-Jylidy provides irrigation water for 2,420 people in Kara-Chiy and Jerge-Tal villages of Jerge-Tal Aiyl Aimak who farm and generate income from a total of 700 hectares. The length of the canal is 16.2 km, of which 11.2 km is earthen and 5 km is concrete-reinforced. The condition of Canal Kyzyl-Jylidy before the project was similar to that of Canal Kara-Talaa, with the earthen bed silted and the concrete-reinforced bed damaged.  
Rehabilitation activities on Canal Kara-Talaa and Canal Kyzyl-Jylidy began in September 2012 following the completion of the irrigation season, in order to avoid disruption to farming activities in the region. The specific activities conducted for the rehabilitation of each canal are summarized below.  
Kara-Talaa main irrigation canal activities:  
The following activities were conducted on Canal Kara-Talaa:  
• Mechanical cleaning of 3.1 km-long earthen bed of the canal, which involved excavation of 3,000 m³ of earth;
January 2014

- Mechanical cleaning of 1.9 km section of the concrete-reinforced bed, which involved excavation of 798 m³ of earth;
- Manual cleaning of 1.9 km section of the concrete-reinforced bed, which involved removal of 342 m³ of earth; and
- Construction of two gauging stations.

The implemented activities have significantly improved the availability and stability of irrigation water in Canal Kara-Talaa. Rehabilitation of Canal Kara-Talaa has directly benefited 2,657 people through improved access to irrigation water and indirectly benefited 4,358 people through increased agricultural production.

![Figure 1. Canal Kara-Talaa before and after the construction of the gauging station](image)

Kyrgyzstan main irrigation canal activities:

The following activities were conducted on Canal Kyrgyz-Jyldyz:

- Mechanical cleaning of 4 km section of the earthen bed, which involved excavation of 4,000 m³ of earth; and
- Repaired 100 m of the concrete bed of the canal.

Rehabilitation of Canal Kyrgyz-Jyldyz has directly benefited 1,408 people through improved access to irrigation water and indirectly benefited 2,420 people through increased agricultural production.

![Figure 2. Canal Kyrgyz-Jyldyz before and after repairs](image)
All planned activities were completed by mid-November, 2012, and the rehabilitated irrigation infrastructures were formally handed over to NDWMD, who will be responsible for the proper use and maintenance of the canals.

**SUMMARY OF REPLENISH BENEFIT:**
- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 2,478 ML/YR

**ACTIVITY TIMELINE:**
- Project initiation: September 2012
- Project completion: November 2012

**COCA-COLA CONTRIBUTION:** 59.2%
- Total cost: $26,000 USD
- The Coca-Cola Foundation: $15,379 USD
- Naryn District Water Management Department: $9,956 USD

**WATER FOR PRODUCTIVE USE BENEFITS CALCULATED:**
1. Improved irrigation efficiency

### 1. Improved irrigation efficiency

**Approach and Results:**

The water quantity benefit for this project is calculated as the increase in water delivery by the canals to irrigation points as a result of the rehabilitation activities completed during fall 2012. Based on flow data collected during the 2012 and 2013 irrigation seasons (April-August), the Naryn District Water Management Department (NDWMD) estimated that the flows in the canals increased as follows:

- **Canal Kara-Talaa:** increased from 0.4-0.5 m³/s to 0.6-0.7 m³/s, and
- **Canal Kyzyl-Jyldyz:** increased from 0.7 m³/s to 1.1-1.2 m³/s.

Monthly flows measured during the 2012 irrigation and the 2013 irrigation season are summarized in Table 1 for Canal Kara-Talaa and in Table 2 for Cana Kyzyl-Jyldyz.

#### Table 1. Canal Kara-Talaa Monthly Irrigation Supply Volumes Before and After Rehabilitation

<table>
<thead>
<tr>
<th>Month</th>
<th>Irrigation Volume Before Rehabilitation (2012) (m³)</th>
<th>Irrigation Volume After Rehabilitation (2013) (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>0</td>
<td>405,000</td>
</tr>
<tr>
<td>May</td>
<td>1,283,040</td>
<td>1,729,422</td>
</tr>
<tr>
<td>June</td>
<td>1,198,743</td>
<td>1,259,760</td>
</tr>
<tr>
<td>July</td>
<td>1,057,070</td>
<td>1,681,360</td>
</tr>
<tr>
<td>August</td>
<td>0</td>
<td>1,054,980</td>
</tr>
<tr>
<td>Total</td>
<td>3,538,853</td>
<td>6,130,522</td>
</tr>
</tbody>
</table>

Note: Zeros in the table above indicate a lack of irrigation water.
Table 2. Canal Kyzyl-Jyldyz Monthly Irrigation Supply Volumes Before and After Rehabilitation

<table>
<thead>
<tr>
<th>Month</th>
<th>Irrigation Volume Before Rehabilitation (2012) (m$^3$)</th>
<th>Irrigation Volume After Rehabilitation (2013) (m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>0</td>
<td>287,100</td>
</tr>
<tr>
<td>May</td>
<td>125,100</td>
<td>687,700</td>
</tr>
<tr>
<td>June</td>
<td>340,000</td>
<td>708,300</td>
</tr>
<tr>
<td>July</td>
<td>413,200</td>
<td>600,300</td>
</tr>
<tr>
<td>August</td>
<td>172,900</td>
<td>362,300</td>
</tr>
<tr>
<td>Total</td>
<td>1,051,200</td>
<td>2,645,700</td>
</tr>
</tbody>
</table>

Note: The zero in the table above indicates a lack of irrigation water.

The water quantity benefit for each canal can be estimated by calculating the difference in irrigation volume between the “before rehabilitation” and “after rehabilitation” conditions:

For Canal Kara-Talaa: [Benefit] = (6,130,522 m$^3$) – (3,538,853 m$^3$) = 2,591,669 m$^3$ = 2,591 ML/yr

For Canal Kyzyl-Jyzyl: [Benefit] = (2,645,700 m$^3$) – (1,051,200 m$^3$) = 1,594,500 m$^3$ = 1,595 ML/yr

Therefore, the total water quantity benefit is: (2,591 ML/yr) + (1,595 ML/yr) = 4,186 ML/yr.

The total (ultimate) benefit is: 4,186 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 2,478 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 4,186 ML/yr, and TCCC’s benefit (adjusted for cost share) is 2,478 ML/yr.

Projected Replenish Benefits

Table 3 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

Table 3. Projected Water Quality Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>4,186</td>
<td>2,478</td>
</tr>
<tr>
<td>2015</td>
<td>4,186</td>
<td>2,478</td>
</tr>
<tr>
<td>2016</td>
<td>4,186</td>
<td>2,478</td>
</tr>
<tr>
<td>2017</td>
<td>4,186</td>
<td>2,478</td>
</tr>
<tr>
<td>2018</td>
<td>4,186</td>
<td>2,478</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>4,186</td>
<td>2,478</td>
</tr>
</tbody>
</table>
Data Sources:

- All data used in the calculations were provided by the Naryn District Water Management Department and Dr. Oleg Piletsky.

Assumptions:

- Monthly flow data collected for 2012 and 2013 are representative of pre-rehabilitation and post-rehabilitation flow conditions in the canals.
- Projected benefits assume that the canals will be adequately maintained in coming years by NDWMD to ensure that the benefits (irrigation water delivery) obtained by the canal rehabilitation project are not reduced.

OTHER BENEFITS NOT QUANTIFIED

- Economic and social benefits to farmers in the region (e.g., increased harvest yields):
  - For Canal Kara-Talaa it is estimated that crop yield has increased from 1.8-2.0 ton/ha to 2.5-3.0 ton/ha, and perennial plant yield has increased from 3.5-4.0 ton/ha to 7-8 ton/ha.
  - For Canal Kyzyl-Jyldyz it is estimated that crop yield has increased from 1-1.5 ton/ha to 2.5-3 ton/ha, and perennial plant yield will increase from 2.5-3 ton/ha to 6-7 ton/ha.
- Reduced vulnerability of crops to droughts and climate change.

NOTES

- Project partner: Mountain Societies Development Support Program (MSDSP), Naryn District Water Management Department (NDWMD)

REFERENCE

“Rehabilitation of Canal Kara-Talaa and Canal Kyzyl-Jyldyz in Naryn Region, Kyrgyzstan.” Project summary document provided by Dr. Oleg Piletsky on November 5, 2013.
PROJECT NAME: Jesse Creek Restoration
PROJECT ID #: 158

DESCRIPTION OF ACTIVITY: In-stream flow restoration

LOCATION: Jesse River, Idaho

PRIMARY CONTACTS:
Todd Reeve, CEO  Rena Ann Striker  Jon Radtke
Bonneville Environmental  Contract Ecologist  Manager, Water Resources
Foundation  CCNA Group Environment & Sustainability  CCNA Group Environment & Sustainability
240 SW 1st Avenue  Portland, OR 97204
541-760-6658  404-395-6250  404-676-9112
treeve@b-e-f.org  rstricker@coca-cola.com  jradtke@coca-cola.com

OBJECTIVES:
• Rewater a one-mile reach of Jesse Creek
• Improve critical habitat for native fish
• Improve water quality and regulate water temperature

BACKGROUND & DESCRIPTION OF ACTIVITY: Jesse Creek is a cold-water tributary to Henry’s Fork of the Snake River, and is located on the Flat Ranch Preserve, just outside Yellowstone National Park. The preserve is a biologically diverse native grassland with an intricate web of wetlands, springs, and creeks along three miles of the Henry’s Fork of the Snake River. Jesse Creek represents a critical network of intact habitat for the at-risk Yellowstone Cutthroat trout. The project area also serves as one of the most important long billed curlew nesting sites in eastern Idaho, and a key range for expanding grizzly bear populations moving into the Centennial Mountains to the west and the central Idaho wilderness.

Historically, Jesse Creek stream flow was diverted away from the natural stream channel into an artificial channel, leaving one mile of Jesse Creek permanently dewatered, and limiting access to native fish to this critical habitat. Figure 1 shows the pre-project condition of Jesse Creek.

This stream restoration project is a collaborative effort among The Nature Conservancy, Idaho Fish and Game, the United States Fish and Wildlife Service (USFWS), Brigham Young University Idaho and the USDA’s Natural Resources Conservation Service (NRCS). This project involved the use of heavy equipment to fill in approximately 980 feet of straightened channel with fill material from the local area and installation of three bentonite plugs to divert stream flow back into the historic, natural Jesse Creek channel. This permanently restores natural flow to the dewatered section of lower Jesse Creek and reconnects high quality habitat with the Henry’s Fork of the Snake River system. In addition, in 2014 this project will re-establish riparian vegetation along the entire one-mile stretch of restored channel to ensure long-term bank stability, improved riparian habitat and the return of natural ecological processes.
SUMMARY OF REPLENISH BENEFIT:
• 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 267.2 ML/YR

ACTIVITY TIMELINE:
• Fall 2013 – Project initiation and permits were secured.
• November 2013 – Excavation work complete and flow restored to natural channel.
• Fall 2014 – project complete, including riparian revegetation.

COCA-COLA CONTRIBUTION: 35.7%
• Total Cost: $56,000
• Swire: $20,000

WATERSHED BENEFITS CALCULATED:
1. Increase in streamflow to the natural Jesse Creek channel

1. INCREASE IN STREAMFLOW

Approach & Results
Yellowstone Cutthroat trout are an iconic and imperiled species that use Jesse Creek habitat. Replenishing flows to the sinuous natural channel results in a wide diversity of flow velocities including areas of slow moving and backwater currents. The rewatering of the natural channel roughly doubles
the habitat available to these fish. In this region of Idaho, the five month period from May through September is critical for Yellowstone Cutthroat trout spawning, incubation and rearing.

The benefit of restoring flows to the natural Jesse Creek channel is calculated as the difference between the pre-project and post-project condition.

- **Pre-project**: A one mile reach of Jesse Creek was dewatered due to the diversion of flows to a straightened channel/ditch.

- **Post-project**: Natural streamflow was returned to the Jesse Creek channel, permanently restoring natural flows to the dewatered section.

The post-project flows in the natural Jesse Creek channel that are critical for the Yellowstone Cutthroat trout are the summer base flows of 2 cfs that are available during the spawning, incubation and rearing stages. These are the flows used to calculate the replenish benefit. Post-project flows are calculated as follows:

\[
\text{Post-project flows} = \text{Base flow} \times \text{duration} \times \text{conversion factor}
\]

\[
\text{Post-project flows} = 2 \text{ cfs} \times 153 \text{ days} \times 2445984 = 748471104 \text{ liters} = 748.47 \text{ ML}
\]

The total benefit is calculated as the difference between the pre-project and post-project flows, or 748.47 ML – 0 ML = **748.47 ML**

**The total (ultimate) benefit is**: 748.47 ML/yr

**The total (ultimate) benefit taken as a function of cost share is**: 267.2 ML/yr

The current (2013) TCCC benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

### 2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of calendar year 2013. The total 2013 benefit is 748.47 ML/yr and TCCC’s benefit (adjusted for cost share) is 267.2 ML/yr.

### Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. Projected benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)*</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>748.47</td>
<td>267.2</td>
</tr>
<tr>
<td>2015</td>
<td>748.47</td>
<td>267.2</td>
</tr>
<tr>
<td>2016</td>
<td>748.47</td>
<td>267.2</td>
</tr>
<tr>
<td>2017</td>
<td>748.47</td>
<td>267.2</td>
</tr>
<tr>
<td>2018</td>
<td>748.47</td>
<td>267.2</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>748.47</td>
<td>267.2</td>
</tr>
</tbody>
</table>
Data Sources/Site-specific characteristics:
  • All data provided by contact.

Assumptions:
  • None.

OTHER BENEFITS NOT QUANTIFIED
  • Restoration of natural sediment regimes
  • Improved water quality
  • Regulated water temperature
  • Restored habitat for aquatic species.
  • Decreased runoff benefits associated with revegetation.

NOTES
  • None.

REFERENCES
PROJECT NAME: Restoration of Sotovo Lake in the Volga-Akhtuba Floodplain
PROJECT ID #: 160

DESCRIPTION OF ACTIVITY: Restoration of natural flooding regime of Sotovo Lake to enhance biodiversity

LOCATION: Lower Volga Watershed, Russia

PRIMARY CONTACTS:
Maryna Chyketa CSR and International Communications Coca-Cola Ukraine Limited 17G, Skovorody St Kyiv, 04070, Ukraine Tel: +38 044 490 0892 mchyketa@coca-cola.com
Irina Boguk Environmental Affairs and Sustainability Manager The Coca-Cola Export Corporation 8 Ivana Franko str., 121008, Moscow, Russia Tel: +7 985 761 3570 ibogouk@coca-cola.com

OBJECTIVES
• Restore hydrologic regime of Sotovo Lake
• Improve biodiversity
• Restore fish spawning grounds

BACKGROUND & DESCRIPTION OF ACTIVITY: The Volga-Akhtuba floodplain is one of the largest floodplains in Europe. Sotovo Lake is located in Volga-Akhtuba floodplain and is characterized by aquatic and terrestrial ecosystem features that are crucially important for maintaining biodiversity. It is a shallow lake which plays an important role in life cycles of aquatic and terrestrial flora and fauna, especially birds (both migrating and nesting in the floodplain). Sotovo Lake is representative of shallow lakes that are found throughout the Volga-Akhtuba floodplain. However, the ecosystem and hydrologic functioning of the lake has been altered due to anthropogenic influences. In particular the construction of dikes around the lake prevented flood waters from entering the lake. The dikes were constructed during the Soviet times for irrigation purposes. However, the dikes are no longer used (since 2000) and the lake area is now designated as the “Volga-Akhtuba nature area.” However, the presence of dikes hindered flow to the lake. As a result the lake was left dry during most of the year.

The main objective of this project was to supply water to Sotovo Lake to restore the natural hydrologic regime. This was accomplished by removing an earthen dike and constructing a water regulation dam. This project was completed in April 2012. The removal of the dike resulted in significant inflow of flood waters to the lake, and the regulation dam prevented water from flowing out of the lake thereby maintaining a stable lake volume. The location of Sotovo Lake including the water pathway is shown in Figure 1. The location of the regulation dam is shown in Figure 2.
SUMMARY OF REPLENISH BENEFIT:
- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 40.7 ML/yr

ACTIVITY TIMELINE:
- Dam construction began in 2011
- Dam construction completed in 2012

COCA-COLA CONTRIBUTION: 39.5%
- Total Project Cost: $126,484
- Coca-Cola Cost: $50,000

WATERSHED BENEFITS CALCULATED:
1. Increase in volume of Sotovo Lake
1. INCREASE IN VOLUME OF SOTOVO LAKE

Approach and Results

The water quantity benefit is calculated as the average increase in volume of Sotovo Lake due to the inflow of flood waters. This method was selected for simplification purposes and is considered to be a conservative approach. More complex methods to estimate storage volume exist (accounting for retention time and volumes of inflow and outflow), but the required data inputs are not available.

Prior to the project the lake was filled only during spring flood but dried out quickly due to the retreat of flood waters. The contact has provided assurance that a stable lake volume is sustained as a result of the project, and they reported that the water depth in the lake increased by as much as 3 meters after project completion. A conservative estimate of an annual average lake depth of 1 meter over the entire area of the lake was used in the calculations.

The surface area of the lake is 102,915.83 m². Therefore, the total increase in lake volume can be calculated as:

\[
[\text{Lake Volume}] = (1 \text{ m}) \times (102,916 \text{ m}^2) = 102,916 \text{ m}^3 = 103 \text{ ML}
\]

The total (ultimate) benefit: 103 ML/yr
TCCC total (ultimate) benefit taken as a function of cost share is: 40.7 ML/yr

The 2013 benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 103 ML/yr and TCCC’s benefit (adjusted for cost share) is 40.7 ML/yr.

Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>103</td>
<td>40.7</td>
</tr>
<tr>
<td>2015</td>
<td>103</td>
<td>40.7</td>
</tr>
<tr>
<td>2016</td>
<td>103</td>
<td>40.7</td>
</tr>
<tr>
<td>2017</td>
<td>103</td>
<td>40.7</td>
</tr>
<tr>
<td>2018</td>
<td>103</td>
<td>40.7</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>103</td>
<td>40.7</td>
</tr>
</tbody>
</table>

Data Sources

- All data used in the calculations are provided by contact
Assumptions

- The water regulation dam is operational and maintained properly
- The average water depth in the lakes is at least 1 meter.

OTHER BENEFITS NOT QUANTIFIED

- Improved biodiversity
- Development of bird, fish and other wildlife habitat

NOTES

- None.

REFERENCES

**PROJECT NAME:** Adaptation to the Impact of the Accelerated Retreat of Glaciers in the Tropical Andean Region - PRAA

**PROJECT ID #:** 161

**DESCRIPTION OF ACTIVITY:** Revegetation (150 hectares)

**LOCATION:** El Tambo, Jamanco and Papallacta Communities within the Papallacta watershed in the State of Canton Quijos in the Napo Province, Ecuador

**PRIMARY CONTACT:**
Carolina Martinez
Fundacion Coca-Cola de Ecuador
Av. Republica del Salvador
N36-230 y NNUU
Edif. Citibank-1er. Piso
Quito-Ecuador
593-2-297-0298
carolmartinez@fundacioncoca-cola.com.ec

**OBJECTIVES:**
- Recover native vegetation
- Promote agro-forestry systems
- Protect natural hydrology
- Improve ecosystem function and conserve biodiversity

**BACKGROUND & ACTIVITY DESCRIPTION:** Climate change is impacting glaciers worldwide, including those in the Andes Mountains of Ecuador. Temperature variations are expected to reduce ice cover and alter glacial runoff, ultimately having a negative effect on fragile ecosystems such as the high altitude Andean plateaus, and their ability to store water and provide ecosystem services. Runoff from tropical glaciers plays a critical role in the integrity of the high elevation mountain ecosystems, and reductions in glacial runoff will impact not only the ecosystems, but also economic activities in the highlands.

This project was designed to strengthen the resilience of both the ecosystem and local economies to the impacts of climate change and glacial retreat. This has been accomplished through implementation of pilot activities that have demonstrated the costs and benefits of adaptation to climate change in selected watersheds in Bolivia, Ecuador and Peru.

In Ecuador, the PRAA involved the planting of native plant and tree species in areas degraded by firewood extraction and livestock. The resulting land condition is a mixture of healthy ground vegetation, pasture and trees (Figures 1 and 2). In addition, commitments have been obtained from the landowners and local communities to maintain and protect the trees and plants. Furthermore, under the umbrella of the local development plan, the local government is encouraging reforestation with a focus on functionality and ecosystem restoration. A separate activity completed as part of this project is the establishment of agro-ecological gardens containing native Andean edible and medicinal plants to promote the health of the local environment and provide diverse food sources. Finally, a hydrology monitoring system has been implemented to establish baseline conditions and monitor the improvement of average water retention in the revegetated areas.
SUMMARY OF REPLENISH BENEFIT:
- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 30.3 ML/YR

ACTIVITY TIMELINE:
August 2009 – December 2013
- 150 hectares revegetated
- 100 hectares agroecological gardens planted

2013 - 2014
- Maintenance of 150 revegetated hectares and 100 hectares agroecological gardens
- Collection of hydrological monitoring data

COCA-COLA CONTRIBUTION: 36.7%
- Overall Project Funding (2009-2013): $776,715 USD
  - Coca-Cola Cost Contribution: $285,171 USD
Watershed Benefits Calculated:

1. Decrease in runoff

1. Decrease in Runoff

Approach & Results:

The water quantity benefit was calculated using the “Alternative Annual Method” as described in Redder and Larson (2012). The water quantity benefit is calculated as the difference in the estimated “pre-project” and “post-project” runoff depths multiplied by the total surface area:

\[
\text{[Water quantity benefit (m}^3/\text{yr}] = [\Delta \text{Runoff (m/yr)}] \times [\text{Surface Area (m}^2)]
\]

where the change in runoff (\(\Delta \text{Runoff}\)) is calculated as follows:

\[
[\Delta \text{Runoff (m/yr)}] = [\text{Pre-project Runoff Depth (m/yr)}] - [\text{Post-project Runoff Depth (m/yr)}]
\]

“Pre-project” is defined as the condition of the land that existed prior to revegetation, while “post-project” is defined as the revegetated condition. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:

\[
[\Delta \text{Runoff (m/yr)}] = \Delta K \times [\text{Annual Rainfall Depth (m/yr)}]
\]

where \(\Delta K\) is the difference between the pre- and post-project annual runoff coefficients due to changes in the vegetation condition.

For a typical revegetation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition \(\Delta K\) is solely due to a change in the vegetation condition. A conservative value of 0.04 was selected for \(\Delta K\) (Redder and Larson, 2012).

For the project area, the average annual precipitation is 1,375 mm/yr (1.375 m/yr). The surface area is 150 hectares (1,500,000 m\(^2\)).

Therefore, the water quantity benefit is calculated as follows:

\[
[\text{Water quantity benefit (m}^3/\text{yr}]) = [\Delta \text{Runoff (m/yr)}] \times [\text{Surface Area (m}^2)]
\]

\[
[0.04 \times 1.375 (\text{m/yr})] \times [1,500,000 (\text{m}^2)] = 82,500 (\text{m}^3/\text{yr}) = 82.5 \text{ ML/yr}
\]

The total (ultimate) benefit is: 82.5 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 30.3 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 82.5 ML/yr and TCCC’s benefit (adjusted for cost share) is 30.3 ML/yr.
Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The total benefits are in the first column and are adjusted for TCCC cost share and percent complete in the second column.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>82.5</td>
<td>30.3</td>
</tr>
<tr>
<td>2015</td>
<td>82.5</td>
<td>30.3</td>
</tr>
<tr>
<td>2016</td>
<td>82.5</td>
<td>30.3</td>
</tr>
<tr>
<td>2017</td>
<td>82.5</td>
<td>30.3</td>
</tr>
<tr>
<td>2018</td>
<td>82.5</td>
<td>30.3</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>82.5</td>
<td>30.3</td>
</tr>
</tbody>
</table>

Data Sources:

- Size of revegetated land areas provided by contact
- Schedule for revegetation provided by contact
- Average annual precipitation provided by contact

Assumptions:

- A conservative value of 0.04 was selected for ΔK, consistent with the recommendations made in the “Alternative Annual Method” memorandum (Redder and Larson 2012)."

OTHER BENEFITS NOT QUANTIFIED

- Improved water quality, including sedimentation
- Improved habitat and increased biodiversity
- Economic and ecological benefits of agroecological gardens

NOTES

- None.

REFERENCES

**PROJECT NAME:** River Cray Habitat Improvements  
**PROJECT ID #:** 163

**DESCRIPTION OF ACTIVITY:** Modify stream flows for habitat improvement

**LOCATION:** River Cray, Sidcup, London, UK

**PRIMARY CONTACTS:**
- Kathy Hughes  
  Freshwater Project Manager  
  WWF – UK  
  Living Planet Centre  
  Brewery Road  
  GU21 4LL  
  KHughes@wwf.org.uk

- Laure Droual  
  Environment Senior Manager, Water Stewardship  
  Coca-Cola Enterprises  
  27 rue Camille Desmoulins  
  92784 Issy Les Moulineaux  
  ldroual@cokecce.com

- Rudi Sueys  
  EUG Manager Water Stewardship & Sustainable Sourcing  
  Coca-Cola Services nv  
  Bergense Steenweg 1424 Ch de Mons  
  B-1070 Brussels  
  rusueys@coca-cola.com

**OBJECTIVES**
- Create more diverse flow regimes
- Improve habitat and restore natural biodiversity

**BACKGROUND & DESCRIPTION OF ACTIVITY:** The Cray is an urban river flowing through the south eastern part of the Greater London urban area. It is 14km long running from Orpington in the south to join the River Darent to the north, 2km before the Darent joins the River Thames near Dartford, and with an elevation drop from 54 to 2 meters. Its catchment is predominantly chalk (soft white limestone) overlain by sand and gravel. Its route follows a mixture of mainly residential and industrial land and parkland. The main pressures within the catchment come from over-abstraction, channel alteration impoundment and urbanization. These have a strong influence on flow regime, responsiveness, morphology and water quality. It has been extensively modified over the centuries, previously to serve water mills and more recently by channeling (for flood defense), and is officially classed as ‘heavily modified’ under the Water Framework Directive.

Biodiversity has been impacted by a combination of pollution and physical modifications, which have reduced the natural flow diversity. This project aims to restore a more natural flow diversity.

The project, in partnership with WWF-UK and the North West Kent Countryside Partnership (NWKCP), consists of a range of physical interventions aimed at increasing depth and velocity diversity within the channel of two reaches of the River Cray – the Sidcup reach and Hall Place reach. Each section is about 1 km of river, with the Sidcup reach running close to the CCE Sidcup bottling plant. The banks of the river and its sinuosity and flow route cannot be modified. Therefore, interventions are restricted to in-stream installations.

There are a range of interventions including gravel mobilization (gravel shifting) island creation (using river bed gravels or branch bundles) and installation of flow deflectors (wood chopped from nearby woodland). See Figure 1.
Figure 1. Before and after interventions

(1, 2) typical river stretch prior to interventions, (3) example wooden flow deflector (4) example gravel ‘islands’ (5) series of flow deflectors, (6) wood bundles to soften gabion basket edges and pinch river together

SUMMARY OF REPLENISH BENEFIT:

- 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 0.6 ML/yr

ACTIVITY TIMELINE:

Sidcup reach interventions
- Autumn 2012 to December 2012 flow monitoring in Sidcup reach prior to installation of interventions (as pre-modification control)
- July to December 2013: gained land owner permissions and environmental consents (Land Drainage Consent)
- October to December 2013: installed interventions in Sidcup reach

Hall Place reach interventions
- January to May 2012: gained land owner permissions and environmental consents (Land Drainage Consent)
- May to June 2013: installed interventions in Hall Place reach

Modeling
- October to December 2013: developed and ran computer model
- February 2014: Begin validation flow monitoring in Sidcup reach following installation of interventions (to include low, median and high flow conditions).

COCA-COLA CONTRIBUTION: 100%
- Total cost: $123,000 USD (£75,000)
- Coca-Cola contribution: $123,000 USD
In kind contributions by other parties: none

WATERSHED BENEFITS CALCULATED:

1. Volume of water contributing to improved habitat.

1. VOLUME OF WATER CONTRIBUTING TO IMPROVED HABITAT

Approach and Results

The replenish benefit is calculated by evaluating the volume of water that becomes ‘improved habitat’ as a result of the project. The exact quantification methodology is still to be agreed amongst the steering group. Therefore, for 2013, a conservative estimate was applied providing a minimum replenish achievement, based on the low flow condition. The quantification approach, which includes direct flow measurement and computer modeling, is described below.

The habitat quality is assessed on the basis of preferred conditions for brown trout. Although this species is not present in the project area, its use as a benchmark is a typical and acknowledged convention. This is because their physical habitat requirements are well defined and they are sensitive to habitat change. Thus, if conditions are appropriate for brown trout, they are also likely to be so for other less sensitive native species.

Computer development and validation was based on conditions on the Sidcup reach.

A description of the approach is as follows:

1. Computer modeling was carried out with PHABSIM software (Physical Habitat Simulation System), developed by the US Geological Survey. Described purpose: to simulate a relationship between streamflow and physical habitat for various life stages of a species of fish.

2. The first step was to measure the geometry and flow at 15 cross-sections along the target river reach prior to any physical modifications. This was repeated for conditions of low, median and high flow – which meant waiting for the right conditions during the year. Flow was measured using a standard mobile flow meter, which is placed to record flow at points across a cross-section, and summed to get the total.

3. The second step was to design and install physical features along the reach for the purpose of modifying the flow regime. This included a range of interventions, such as small island creation (using river bed gravels or branch bundles) and flow deflectors (with sheet piling or wood). The intention is not to change average flow, but instead to create a greater range of flow conditions and water depths. This supports greater biodiversity because some species prefer specific flow rates or river depth, either in general, or at certain stages in their life cycle.

4. The third step was to update the computer model to reflect the changed physical conditions. The model was then run for different flow conditions (low, median, high).

5. There are four main outputs from the model used as follows:
   a. To show the before and after diversity of water depth (Figure 2)
   b. To show the before and after diversity of water flow velocity (Figure 2)
   c. To show if the flow range falls within the ‘ideal’ envelope for brown trout (Figure 3)
   d. To calculate the volume of water along the reach that has achieved an improved habitat condition.
6. The intention is to eventually use an average value for volume of improved habitat based on median flow conditions. The current estimate is conservatively based on the low flow condition until greater confidence in the model results is validated.

For the Sidcup reach, new flow measurements will be carried out during 2014 to use for model validation. Following this, there may be some adjustment of the replenishment volumes.

For the Hall Place reach, it is assumed the character of the river and the nature of installations are similar enough to the Sidcup reach that the same replenishment volume applies.

Figure 2. Before (left) and after (right) conditions as modeled.

The target is to get a more even spread of depth and flow and avoid dominant conditions (as shown)

Figure 3. Model results for low flow condition.

The red line is the ‘ideal’ envelope for brown trout. Blue bars show the range of modeled flow and depth for low flow condition after interventions. It is expected that they are a lower magnitude than the envelope, but important they fall within it.

The results of modeling provide replenishment volumes as shown in Table 1.
Table 1. Modeled water volumes providing improved habitat

<table>
<thead>
<tr>
<th>Flow condition</th>
<th>Sidcup reach</th>
<th>Hall Place reach</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low flow</td>
<td>0.3</td>
<td>0.3</td>
<td>0.6</td>
</tr>
<tr>
<td>Median flow</td>
<td>0.5*</td>
<td>0.5*</td>
<td>1.0*</td>
</tr>
<tr>
<td>High flow</td>
<td>&gt;0.5*</td>
<td>&gt;0.5*</td>
<td>&gt;1.0*</td>
</tr>
<tr>
<td>Annual average</td>
<td>0.5*</td>
<td>0.5*</td>
<td>1.0*</td>
</tr>
</tbody>
</table>

* Preliminary and dependent on model validation during 2014

The total (ultimate) benefit of habitat improvement is calculated as the benefit in the Sidcup and Hall Place reaches, following completion of all interventions in 2013. Based on model runs that calculate the volume of water providing improved habitat conditions, under median flow conditions, the total benefit equals 1 ML/yr. This is a preliminary estimate and may change following model validation.

The total (ultimate) benefit is: 1.0 ML/yr

TCCC total (ultimate) benefit taken as a function of cost share is: 1.0 ML/yr

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

2013 Replenish Benefit

The 2013 benefit is the performance-based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is estimated to be 0.6 ML/yr and TCCC’s benefit (adjusted for cost share) is 0.6 ML/yr.

Projected Replenish Benefits

Table 2 shows the projected benefits that this activity will provide if the project remains in productive service. Following model validation during 2014, the projected volumes may be adjusted.

The benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The scheduled benefits are totaled for the Sidcup and Cray reaches in the second column and scaled for TCCC cost share in the third column.

Table 2. Projected Water Quantity Benefits Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2015</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2016</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2017</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2018</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Note: Values are dependent on model validation during 2014 for median flow conditions, which should give a higher value than for the ‘low flow’ condition assumed for 2013
Assumptions

- Habitat conditions suitable for brown trout are also suitable for other native species
- The results for Sidcup reach can be applied to Hall Place reach due to the similarity in condition, length and types of interventions
- Results for the median flow condition is representative of the average volume of water achieving improved habitat.
- The model reliably represents the river and habitat interventions we are implementing (this will be tested through field samples in 2014).

OTHER BENEFITS NOT QUANTIFIED

- Improved river habitat for a range of species, resulting in improved biodiversity
- It has already been observed that the water vole has returned to the Hall Place reach following interventions in summer 2013.
- Cultural and recreational benefits.

NOTES

- None.

REFERENCES


WWF-UK (2012), Understanding the value of proposed in-stream habitat improvements on the River Cray in South London, report authored by R. Clapham & Martin Janes of the River Restoration Centre (RRC)
PROJECT NAME: Brazos Watershed - Nash Prairie Stewardship and Seed Increase Project
PROJECT ID #: 164

DESCRIPTION OF ACTIVITY: Restoring native prairie via removal of invasive plant species and revegetation with native grassland species (83 acres)

LOCATION: Nash Prairie Preserve, approximately 70 miles south of Houston in the Brazos River watershed.

PRIMARY CONTACTS:
Sonia Najera
The Nature Conservancy Grasslands Program Manager
361-882-3584
snajera@tnc.org

Rena Stricker
CCNA Group Environment & Sustainability Manager
404-395-6250
Rstricker@coca-cola.com

Jon Radtke
CCNA Group Environment & Sustainability Contract Ecologist Manager, Water Resources
404-676-9112
Jradtke@coca-cola.com

OBJECTIVES:
• Reduce runoff
• Eliminate invasive plant species
• Restore and enhance key coastal habitats

BACKGROUND & ACTIVITY DESCRIPTION: The Nature Conservancy established the 428-acre Nash Prairie Preserve in 2011, located about 70 miles south of Houston in the Brazos River watershed. This tract of land is one of the last remaining segments of the Great Coastal Prairie, which once encompassed six million acres between Lafayette, Louisiana and Corpus Christi, Texas. Nash Prairie is a pristine piece of prairieland, largely unaltered by man or machine. More than 300 plant species have been documented there, including several rare species and at least one type of grass thought to be extinct in Texas since the 1800s.

Coastal prairies function as natural flood control and water filtration. New research indicates that prairie potholes along the Upper Gulf Coast that potholes are more hydrologically connected to bays and local waterways than previously thought. (http://today.agrilife.org/2011/03/01/research-demonstrates-relationship-of-texas-coastal-prairie-pothole-wetlands-to-galveston-bay/).

This project involved the removal of scattered woody exotic and invasive plants by hand cutting and herbicide treatment, and prescribed burning. Native plant response after burning has been positive so far, precluding the need to replant the area with native plant species. Monitoring will continue to assess progress. Figure 1 shows the 2013 prescribed burn at Bull Pasture, during and after the fire.

In addition to the removal of exotic vegetation and prairie restoration, TNC is also restoring depressional wetlands/prairie potholes through the removal of Chinese Tallow. These are separate areas from the prairie restoration, but were not quantified in this fact sheet because information regarding additional volume captured was not available.
SUMMARY OF REPLENISH BENEFIT:
• 2013 COCA-COLA REPLENISH BENEFIT AS A FUNCTION OF COST SHARE: 17 ML/yr

ACTIVITY TIMELINE:
• 2013: 83 acres were treated, including 45-acres in Bull Pasture and 38 acres in the Corn Whiskey pasture. Treatment included burning, herbicide and reseeding where needed, to eliminate exotic species and restore native species.
• 2014: Treatment of an additional 12-acre area (Bull trap pasture)

COCA-COLA CONTRIBUTION: 100%
• Total project cost: $5,000
• Coca-Cola cost: $5,000

WATERSHED BENEFITS CALCULATED:
1. Decrease in runoff

1. DECREASE IN RUNOFF

Approach & Results:
The water quantity benefit was calculated using the “Alternative Annual Method” as described in Redder and Larson (2012). The water quantity benefit is calculated as the difference in the estimated “pre-project” and “post-project” runoff depths multiplied by the total surface area:

\[
\text{Water quantity benefit (m}^3/\text{yr}) = [\Delta \text{Runoff (m/yr)}] \times [\text{Surface Area (m}^2)]
\]

where the change in runoff (\(\Delta \text{Runoff}\)) is calculated as follows:

\[
[\Delta \text{Runoff (m/yr)}] = \{[\text{Pre-project Runoff Depth (m/yr)}] - [\text{Post-project Runoff Depth (m/yr)}]\}
\]

“Pre-project” is defined as the condition of the land that existed prior to restoration efforts (i.e., dominated by invasive species), while “post-project” is defined as land condition with the native grass species restored. Because the annual rainfall depth is the same for the pre- and post-project conditions, the difference in pre- and post-project runoff depth can be calculated as:
\[ \Delta \text{Runoff (m/yr)} = \Delta K \times [\text{Annual Rainfall Depth (m/yr)}] \]

where \( \Delta K \) is the difference between the pre- and post-project annual runoff coefficient due to changes in the vegetation condition.

For a typical reforestation activity, soil condition and topography are not substantially affected by the activity; therefore, the difference in the annual runoff condition (\( \Delta K \)) is solely due to a change in the vegetation condition. A value of 0.04 was selected for \( \Delta K \) based on recommendations provided in Redder and Larson (2012). Annual precipitation for the Houston, TX area is 49.8 inches (1,265 mm) per year (via: http://www.srh.noaa.gov/hgx/?n=climate_iah_normals_summary). The water quantity benefit is calculated as follows, based on these inputs and the total restoration area of 83 acres (33.6 hectares, or 336,000 m\(^2\)):

\[
[\text{Water quantity benefit (m}^3/\text{yr})] = (0.04) \times (1.265 \text{ m/yr}) \times (336,000 \text{ m}^2) = 17,000 \text{ m}^3
\]

**The total (ultimate) benefit = 17 ML/yr**

**TCCC total (ultimate) benefit taken as a function of cost share = 17 ML/yr**

The current (2013) benefit and projected benefits are based on the total benefit, adjusted to account for implementation schedule and TCCC cost share. These are presented below.

### 2013 Replenish Benefit

The 2013 benefit is the performance based benefit from this activity as of the end of the calendar year 2013. The total 2013 benefit is 17 ML/yr, and TCCC’s benefit (adjusted for cost share) is 17 ML/yr.

### Projected Replenish Benefits

Table 1 shows the projected benefits that this activity will provide if the project remains in productive service. While not shown in the table, the benefits are anticipated to continue to be generated through the year 2020, but all projected benefits will be verified by TCCC before they are reported as actual benefits. The benefits are scaled for implementation schedule in the second column and scaled further for TCCC cost share in the third column.

**Table 1. Projected Water Quality Benefits Summary**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Benefit (ML/yr)</th>
<th>Adjusted for TCCC Cost Share (ML/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>2015</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>2016</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>2017</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>2018</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Ultimate Benefit:</td>
<td>17</td>
<td>17</td>
</tr>
</tbody>
</table>

*If additional area is treated in the future, the total benefit may increase.*

**Data Sources:**

- Annual precipitation for Houston, TX: 49.8” (1,265 mm) per the National Weather Service Forecast Office website for Houston/Galveston, TX: http://www.srh.noaa.gov/hgx/?n=climate_iah_normals_summary.
- Project area provided by contact
Assumptions:
  • None

OTHER WATERSHED BENEFITS NOT QUANTIFIED
  • Elimination of invasive plant species
  • Restoration and enhancement of key coastal habitats

NOTES
  • None.

REFERENCES