USAID
FROM THE AMERICAN PEOPLE

IMPACT EVALUATION PLAN: WATER REPLENISHMENT SUB-ACTIVITY OF THE INDONESIA URBAN WATER, SANITATION, AND HYGIENE PROJECT (WR-IUWASH)

July 30, 2014

(Originally submitted on May 23, 2014)

This publication was produced for review by the United States Agency for International Development. It was prepared by Development & Training Services, Inc. (dTS).

Prepared for the United States Agency for International Development, USAID Contract Number AID-RAN-I-00-09-00015, Task Order Number AID-OAA-TO-12-00001, Global Climate Change Monitoring and Evaluation Project.

Implemented by:
Development & Training Services, Inc. (dTS)
4600 North Fairfax Drive, Suite 402
Arlington, VA 22203

Phone: +1 703-465-9388
Fax: +1 703-465-9344
www.onlinedts.com

IMPACT EVALUATION PLAN: WATER REPLENISHMENT SUB-ACTIVITY OF THE INDONESIA URBAN WATER, SANITATION, AND HYGIENE PROJECT (WR-IUWASH)

July 30, 2014

(Originally submitted on May 23, 2014)

ACRONYMS

CCFI	Coca Cola Fund International
dTS	Development and Training Services
GCC	Global Climate Change
GCC M&E	Global Climate Change Monitoring and Evaluation Project
IUWASH	Indonesia Urban Water, Sanitation, and Hygiene Project
M&E	Monitoring and Evaluation
NGO	Non-governmental organization
PDAMs	Provincial and local government-owned water utilities
SWAT	Soil and Water Assessment Tool
TAM	Technology Acceptance Model
USAID	United States Agency for International Development
WR-IUWASH	Water Replenishment Sub-activity of the Indonesia Urban Water, Sanitation, and Hygiene (IUWASH) Project

CONTENTS

TABLES

1. INTRODUCTION

This study will examine the results of the Water Replenishment Sub-Activity of the Indonesia Urban Water, Sanitation, and Hygiene Project (WR-IUWASH). The water replenishment program is a climate change component of the IUWASH project that seeks to achieve resilience in raw water supply through managed aquifer replenishment. Under this program, IUWASH works with provincial government agencies, local government-owned water utilities (PDAMs), sector associations, non-governmental organizations (NGOs), communities, universities, and the private sector to gain acceptance, mobilize communities to accept the *sumur resapan* and train PDAM staff to oversee and maintain the infrastructure. Therefore, this study is designed to assess the effectiveness of a water resource climate change adaptation program which promotes the use of managed aquifer replenishment as a means to improve raw water supply. It will also contribute to broader scientific and policy knowledge in the use of artificial water replenishment under similar environmental and climatic conditions.

This study is being supported through the Global Climate Change Monitoring and Evaluation Project (GCC M&E). It will provide an essential contribution to the Global Climate Change (GCC) learning agenda by testing assumptions in the development hypotheses underlying the GCC adaptation results framework, which will inform future programming of the Agency's climate change initiative. The adaptation results framework focuses on resilience to climate change, which is defined by USAID as "the ability of people, households, communities, countries and systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth."

One key GCC adaptation hypothesis is that resilience of people, places, and livelihoods will increase if USAID invests in developing, testing, demonstrating, and disseminating climate change adaptation practices and technologies, such as the WR-IUWASH technology. Another GCC hypothesis is that USAID's development outcomes are more likely to be achieved if USAID invests in improving the capacities of individuals and institutions to implement climate change adaptation actions more effectively. The innovative approach of the WR-IUWASH sub-activity includes the introduction of a standard design for infiltration ponds while also building the capacity of NGOs and local government. These stakeholders will be trained and advocate for the construction, monitoring, and maintenance of the infiltration ponds. Additionally, the program will develop water utility oversight to achieve sustainability. The technique, managed aquifer recharge, is embedded in the Indonesian socio-institutional setting.[1]

In discussions with PDAMs and local government officials, it was frequently mentioned that regulations were being instituted to support the concept of infiltration ponds. The intention of these regulations, as well as other local policies and practices is to institutionalize the innovation with supporting policy and good practice regulation. Since the prototype intervention has become popularized, regulations promoting this technology have been issued by various local, provincial, and national entities. Such promotion and regulation provides an opportunity to test the GCC results framework hypotheses regarding the introduction of new technology, capacity building, regulation and policy formation leading to resilience; hypothesis that are integrated into the research questions and their explanatory measures.

[1] The term "managed aquifer recharge" has now gained international standing, but is also termed groundwater replenishment and previously artificial recharge. http://www.samsamwater.com/library/MAR_strategies.pdf

2. ACTIVITY DESCRIPTION

WR-IUWASH is a sixty-month effort designed to support the Government of Indonesia in making significant progress towards ensuring increased and reliable supplies of raw water from springs to enable expanded access to water services, a key component of Indonesia's commitment to achieving the Millennium Development Goals. According to the sub-activity documents, sustainable access to water resources has been impaired by climate change. Specially, PDAMs in Indonesia have experienced a decline in discharge from springs, which has led to the deterioration of raw water supply and impaired the prospect of further extending water supply to poor households.

In Medan (North Sumatra) for example, over the last 10 years, the water discharged by an important spring fell by roughly 5 percent per year prior to the intervention. Indonesian water utilities are, by international norms, unusually dependent on spring water for municipal supplies. Those PDAMs that are heavily dependent on spring and ground water will lose their most reliable water source if discharge rates continue to decline. If the replenishment approach is seen as effective, other PDAMs that are less dependent on raw water may also replicate IUWASH's approach. The water replenishment program is a climate change component of IUWASH that seeks to achieve resilience in raw water supply through managed aquifer replenishment. The program works with local and provincial government agencies, PDAMs, sector associations, NGOs, communities, universities, and the private sector.

The results and causal logic of the intervention, including the assumptions, inputs, main tasks, outputs, and outcomes are set out in Figure 1, below. The program causal logic model reflects the two key areas of advocacy, local government capacity building and community-level promotion, and the convergence of these interventions leads on to the higher level outcomes and results.

The causal logic model is built around the financial and organization inputs provided by Coca Cola Fund International (CCFI) and IUWASH to build capacity, implement the strategy, and improve raw water supplies from springs and wells.[2] The strategy involves IUWASH working with CCFI to introduce the technology to the PDAM, gain acceptance, mobilize communities to accept the *sumur resapan* and train the PDAM to oversee and maintain the infrastructure. The infiltration ponds are 8m^3 pits, according to the IUWASH design (2x2x2), that capture run-off and infiltrate the water into an aquifer.[3] Although the activity is focused primarily at the municipal level, the social mobilization of communities is critical to the success of intervention.

The logic model follows two assumptions:

1) If discharge rates from springs providing raw water for municipal reticulation are improved, the PDAMs will accept the program's strategy. The activity then builds capacity in PDAMs and local government to monitor and maintain the infrastructure at the intervention sites.
2) The acceptance of the strategy by the PDAMs will facilitate community participation in the activity. Acceptance of the strategy by the community is likely be driven by the prospect of reduced flooding. Flooding in Javanese villages is a feature of life during the rainy season. Unlike the situation in many

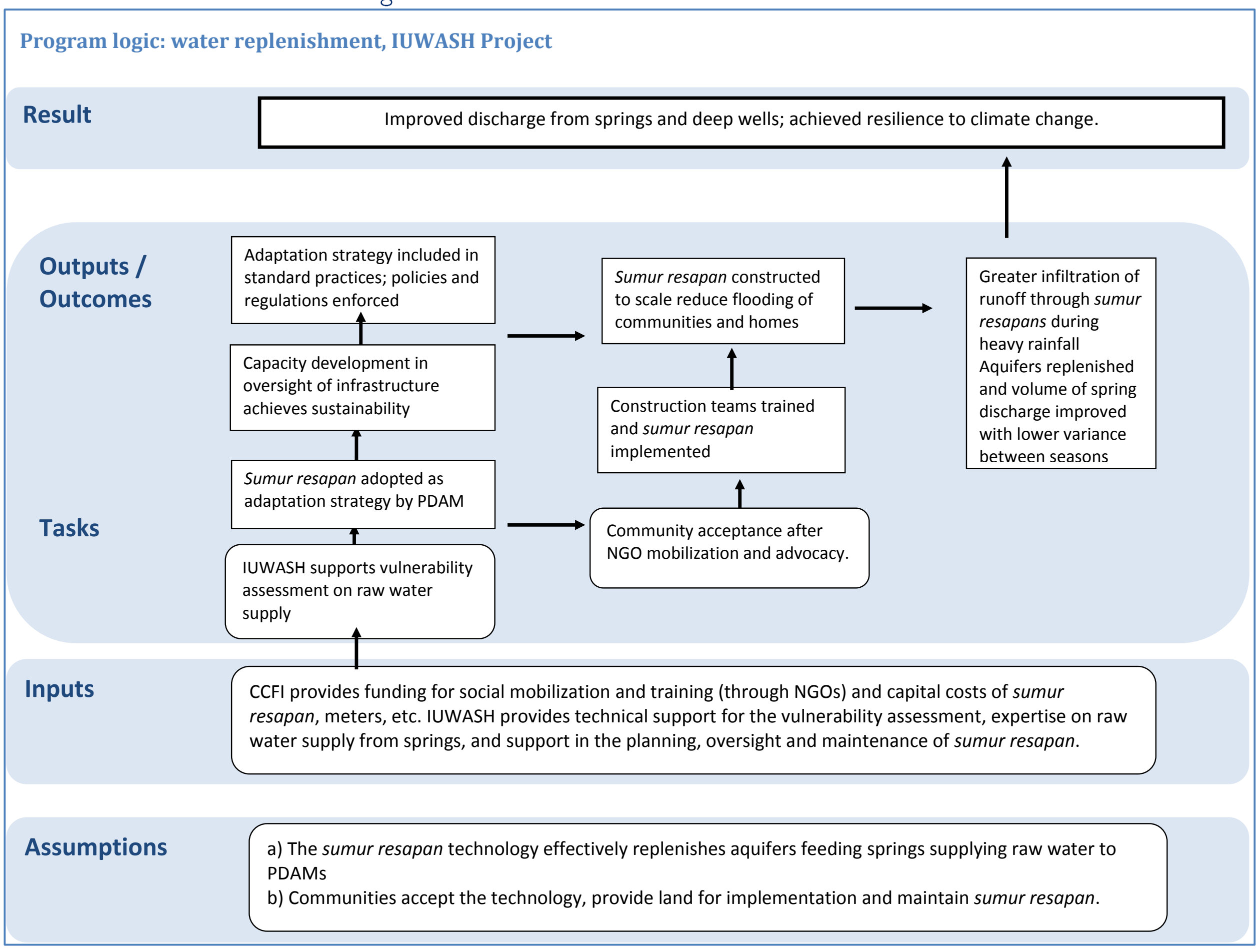
[2] While the focus of the hydrological study is on spring discharge as highlighted in the activity documentation, many municipalities in Indonesia draw their raw water supply from wells which may be replenished by the same aquifers as those which supply the springs.

[3] A full description of the infiltration pond or *sumur resapan* is found in Technical Notes http://iuwash.or.id/wp-content/uploads/downloads/2013/08/Technical-Notes-Infiltration-Pond-EN-updateNov12.pdf

water-stressed regions and countries, a decline in run-off during the rainy season is welcomed, not resented.

Figure 1 below traces these two tracks in the strategy: 1) through the PDAMs; and 2) through the targeted communities in which the *sumur resapan* (infiltration ponds or wells) will be constructed. In the first line of progression, vulnerability assessments (a lower level output) lead to the adoption of the *sumur resapan* strategy by the PDAMs. However, the adoption of the *sumur resapan* has its own momentum and decisions to adopt the strategy may precede the vulnerability assessments. After the technology is accepted by the PDAM, political support is given for the social mobilization and advocacy in target communities. In both tracks advocacy is backed by financial and organizational resources of CCFI and IUWASH.

FIGURE 1: WR-IUWASH Causal Logic



The WR-IUWASH sub-activity goes from March, 2012 to September, 2016. The sub-activity started in North Sumatra and thereafter in Java, the *sumur resapan* strategy is being implemented in Mojokerto and Salatiga. In Mojokerto the *sumur resapan* has been completed, while in Salatiga the construction of the *sumur resapan* is still at a pilot level. A fourth site has been chosen by CCFI and IUWASH and construction will start in that site late this year. There are, thus, in total, four IUWASH sites that will have *sumur resapan* with CCFI and IUWASH support.

3. RESEARCH DESIGN AND IMPACT STUDY METHODS

3.1 STUDY PURPOSE

This study will employ rigorous scientific methods to assess the effectiveness of a water resource climate change adaptation strategy (WR-IUWASH) in promoting managed aquifer replenishment. The purpose of this study is to learn more about the nature of the WR-IUWASH intervention (known in the country as the *sumur resapan* strategy) to replenish aquifers and improve spring discharge, method of implementation, early results, and the potential for adoption more widely in Indonesia and beyond. Although this strategy is not unique, its simplicity, social acceptability, and anticipated impact make it a practice that could be more widely implemented. A study using rigorous scientific methods would establish the effectiveness of this technology as an adaptation measure to climate change in the critical context of municipal raw water supply. There is evidence[4] that change in climate leads to increased hydrologic variability and will have a profound impact on the water sector through the hydrologic cycle, water availability, water demand, and water allocation at manifold levels.

This study also informs the GCC adaptation results framework sub-IR 2.3.1 (Effectiveness of key adaptive strategies tested) and tests the hypothesis that USAID's adaptation strategic objectives are more likely to be achieved if USAID invests in developing, testing, demonstrating, and disseminating to stakeholders climate change adaptation practices and technologies.

This would also contribute to broader scientific and policy knowledge in the use of artificial water replenishment in a number of climate conditions and natural environments. The Indonesian context is decidedly different from many other similar interventions; while many artificial managed aquifer replenishment projects have been undertaken in dry or semi-desert environments, Indonesia has an environment of high rainfall. According to the United States Geological Survey, "Although some artificial-recharge projects have been successful, others have been disappointments; there is still much to be learned about different ground-water environments and their receptivity to artificial-recharge practices."[5] If artificial water replenishment is an effective climate change intervention across a number of environments, the proposed scientific study of its hydrology and the socio-institutional framework in which it is embedded would be a valuable addition to climate change knowledge.

[4] In Vahid Alavian et al, 2009, Water and Climate Change: Understanding the risks and making Climate-smart investment decisions; these impacts are tersely summed up. http://documents.worldbank.org/curated/en/2009/11/11717870/water-climate-change-understanding-risks-making-climate-smart-investment-decisions.
For a detailed examination of hydrological variability see particularly iPCC Technical Paper VI, Climate change and water. http://www.ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf
[5] Found as of May 15, 2014 at http://pubs.usgs.gov/gip/gw/how_a.html.

3.2 STUDY QUESTIONS

The key research questions, agreed upon with the implementer and USAID/Indonesia that guide the study design, methods, and analysis include the following:

1. What effect does demonstrating change from current practices by using infiltration ponds as an adaptation practice have on…
   a. Total volume of water supply to PDAMs and communities?
   b. Regularity of raw water supply across seasons?
   c. Water quality?
   d. Costs?[6]
   e. Flooding?[7]

2. What factors lead to adoption of the *sumur resapan* strategy by PDAMs, ensure the sustainability of the infrastructure and increase resilience to climate change?[8]

3. When the intervention is advocated to communities, what responses are there and, after adoption, what benefits are experienced?

4. How effectively[9] do vulnerability assessments improve PDAM decision making in adaptations to climate change trends?

It should be noted that behind these key research questions are numerous questions, observations, and other data collection activities, as described below in the research design.

3.3 RESEARCH DESIGN

Both quantitative and qualitative methods, as well as administrative data and performance information, are employed in this mixed-methods study. Although qualitative methods do not provide representative results or allow statistically valid comparisons between groups, they are well suited for explaining processes and why impacts occurred. There will be two main parts to the study, a hydrological and socio-institutional component, which will be combined and synthesized within the overall design. The research design and data collection methods vary considerably for each of these components, which is described in further detail in section 3.4 Data Collection Methods.

The hydrological study assesses the effectiveness of the technology in capturing runoff and infiltrating water into aquifers in order to achieve higher spring discharge. The socio-institutional component assesses the extent to which the intervention improves water utility capacity, leads to adoption through vulnerability assessment, achieves social acceptability of the technology, and sustainably improves resilience to climate change.

A synthesis report will provide the overall integration of the hydrological and the socio-institutional components. This report is designed to answer the research questions as to the overall effectiveness of the

---

[6] "Costs" here refers to the unit cost of an additional kiloliter of raw water resulting from the *sumur resapan* comparted to alternative strategies of accessing raw water through other means.
[7] The general problem of flooding in Indonesia is a surplus water in the rainy season; there appears adequate supply during the dry season.
[8] The question of resilience to climate change is not fully addressed in the table below; it will be tested through an examination of a combination of factors that cut across the questions posed in the hydrological, institutional and community fields.
[9] "Effectiveness" here is contextually defined as including the following: ensuring or leading to the assembly of all relevant data to be considered, to the setting out of clear procedures for deliberating decision making, and to the assessment of comparative costs between the *sumur resapan* strategy and other strategies to increase raw water supply.

WR-IUWASH sub-activity in terms of its acceptability in the water sector, effectiveness in improving raw water supply, and acceptability within the targeted communities. The report will also examine the issues of maintenance and sustainability of the infrastructure situated in the communities to ensure continued effectiveness. Additionally, it will explore the replicability of the *sumur resapan* as a climate change adaptation strategy within Indonesia and potentially beyond.

The hydrological component addresses the *sumur resapan* design, location, maintenance, sustainability and impact; focusing on the changes in raw water supply from springs and wells that can be attributed to the intervention. Baselines in spring discharge and well levels from which to measure change will be established from decades of data collection and from Soil and Water Assessment Tool (SWAT) modeling. The quality of some of the data is uneven and a feature of this study will be an inventory and an assessment of prior information from meteorological agencies, government sources, and the PDAMs. The study will set out the hydrological model of precipitation, run-off, infiltration via the *sumur resapan*, and changes in discharge from springs under past, existing, and future climate change assumptions. Field data to provide identified parameters for the model will be collected from the PDAMs and gathered from the deployment of automatic weather stations.

The socio-institutional component will address attitudes, perceptions, capacities, and behaviors of institutions, individuals, and communities. Since the motivation for acceptance at the community level is avoided flooding, disaster risk reduction elements are important to understand for two reasons: first, the impacts of reduced flooding are significant on the communities and may be more immediately noticed; and secondly, this impact reportedly drives increased adoption of the intervention. Thus, this aspect would be implicit in the social aspect of the study.

Overall, the design for the socio-institutional component utilizes the phasing in of the intervention to make a simple pre- (or early-) and post-intervention comparison. The hydrological component is designed to utilize a difference in differences design by collecting data both from treatment and comparison catchment areas and (unevenly) over two time periods. The division of hydrological data pre- and post- is uneven since the intervention has been completed in Mojokerto and there is not the opportunity of contemporary pre- data (although the water utility has daily records of spring discharge for this and earlier periods). In Salatiga the intervention is at an early stage and the pre- data can be assembled from the field (baseline) before the impact (endline) is measured. The phasing in of the intervention and good GIS data maintained by IUWASH also makes it possible for dose-response models to be developed. These models would measure the relationship between the quantity of infiltration ponds implemented and the overall effect (the response) in changes to spring discharge.

3.4 DATA COLLECTION AND METHODS

As noted above, this study will utilize quantitative hydrological data and qualitative data derived from in-depth individual interviews and focus group discussions, as well as observational data. Data collection methods and sources by indicator are provided in tabular format in Table I below. This table provides an alignment of research questions, measures of change, method, data source, and schedule for data collection.

Table 1: WR-IUWASH Study Research Questions, Indicators of Change, Methods and Sources

Research Questions	Measures	Collection Methods	Data Sources	Schedule
1. What effect does demonstrating change from current practices by using infiltration ponds as an adaptation practice have on… a. Total volume of water supply to PDAMs and communities? b. Regularity of raw water supply across seasons? c. Water quality? d. Costs? e. Flooding?	a. Difference in raw water volumes, pre/post intervention Difference in raw water volumes, treatment/control sites b. Difference in 12 month peaks/troughs pre/post intervention Difference in 12 month peaks/troughs in treatment/control sites c. Quality of water infiltration in *sumur resapan*/undisturbed soil d. Additional cost of 1 m^3 water through infiltration ponds/Additional cost of 1 m^3 water from alternative source e.g. dams e. Establish measures of flash flooding and standing water	a. Develop and calibrate a hydrological model that uses ground data to produce monthly estimates of raw water volume for 12 months post intervention b. Develop and calibrate a hydrological model that uses ground data to produce monthly estimates of peaks/troughs over 12 months post intervention c. Compare biological and chemical water quality measurements from model against those of PDAM and observations d. Calculation of ratio cost of intervention to PDAM added to cost of raw water/Calculation of cost of alternative raw water supply e. Compare measures of flash flooding and standing water by using GIS methods in treatment and control settlement undertaken pre/post intervention	a. Hydrological ground data measures b. Hydrological ground data measures c. Water quality readings (biological and chemical) from PDAM and/or from hydrological team d. Cost estimates undertaken by hydrological team e. GIS village maps, filed observations	Prior data over the long term are being collected by a local hydrological contractor Observations of key parameters in sites collected bi-weekly from March to December 2014.

Research Questions	Measures	Collection Methods	Data Sources	Schedule
2. What factors lead to adoption of the *sumur resapan* strategy by PDAM, ensure the sustainability of the infrastructure and achieve resilience to the impact of climate change?	a. Change in proportion of PDAM officials agreeing that raw water supply is not a constraint to providing and expanding water service b. Change in proportion of PDAM and local government policy makers identifying the *sumur resapan* strategy provided anticipated impact and achieved resilience c. Assessment by local government and provincial policy makers of relative cost of the strategy d. Change in the number of personnel who actively participated in planning, construction, monitoring and maintenance activities e. Change in capacity in trained and/or experienced staff allocated to planning, budgetary, construction, monitoring, maintenance, communications and liaison activities f. Change in capacity in personnel who trained others in monitoring and maintenance of *sumur resapan*[10] g. Additional adaptation practices incorporated into the standard practice of PDAM h. New policy instruments linked to the *sumur resapan* strategy considered, implemented, or enforced[11] i. Change in proportion of policy makers who agree financial constraints do not constrain the replication of the WR-IUWASH strategy in other communities	a-i. All collection methods below apply across measures, as appropriate. • Analysis of data from focused questions in semi-structured interviews with key informants. • The concept of sustainability defined as the replication of the *sumur resapan* strategy without financial assistance and support is tested in questions in semi-structured interviews. • Development capacity through training will be compared, where possible, to capacity acquired through experience (i.e. without training) in adaptive and transformative capacity. • Adaptive capacity, measured in terms of human capital formation, attitudes/motivation, etc., is assessed in semi-structured interviews • Transformative capacity, measured in terms of governance mechanisms, policies/regulations, utility/community networks, etc., is assessed in questions in semi-structured interviews	a.-i. Semi-structured interviews with PDAM staff, local government, and NGOs will be undertaken. The selection criteria for FGD and key informant interview participants is described in Annex 2	Focus groups and key informant interviews will be conducted during the last two weeks of June 2014. Follow up interviews will be conducted in September 2014

[10] A capacity development tool will be created to measure this and the previous indicator.
[11] In addition to the Key Informant Interviews, documentation of new policies will be sought.

Research Questions	Measures	Collection Methods	Data Sources	Schedule
3. When the intervention is advocated to communities what responses are there and what benefits are experienced?	a. Type and combination of advocacy initiatives including access to information, public meetings, visits to implementing villages, observation of operating *sumur resapan*, participation in training, and personal testimonies b. Anticipated and unanticipated benefits mentioned by beneficiaries in focus groups c. Proportion of "early adopters" mentioning compliance as leading to decision to adopt d. Proportion of "late adopters" mentioning observation of results in their village e. Proportion of beneficiaries indicating commitment to maintain *sumur resapan* f. Proportion of villagers remaining "permanent skeptics"	a.-f. Analysis of data from focus groups relating to the social mobilization. Focus groups in villages in Mojokerto (intervention complete) and Salatiga (intervention starting) as follows: • Group of households in Mojokerto which implemented the *sumur resapan* • Group of households in treatment villages in Mojokerto which did not request *sumur resapan* ("late adopters" or "skeptics") • Group in village downstream which could have benefited from decline in flooding • Group of households in Salatiga ("early adopters") which have taken the lead in accepting the *sumur resapan* • Group of households in treatment villages in Salatiga which did not request *sumur resapan* ("late adopters" or "skeptics") • Group of households in treatment villages in Salatiga which are opposed to *sumur resapan* ("unpersuaded" or "permanent skeptics") • Group in village downstream are stated to be flooded when there is excessive runoff from upstream village	a.-f. Focus groups, discussions, and records	Focus groups and key informant interviews will be conducted during the last two weeks of June 2014. Follow up interviews will be conducted in September 2014

Research Questions	Measures	Collection Methods	Data Sources	Schedule
4. How effectively do vulnerability assessments improve PDAM decision making in adaptations to climate change trends?	a. Change in capability to understand climate change trends and apply new information in decision making b. Change in capability in raw water supply planning c. Change in capability to define, develop and choose between alternative climate change adaptation strategies	a.-c. Two case studies of vulnerability assessments (Mojokerto and Salatiga) based on interviews with key informants in PDAM and local government	a.-c. Interviews with key informants in PDAM, local government, climate change experts	Focus groups and key informant interviews will be conducted during the last two weeks of June 2014. Follow up interviews will be conducted in September 2014

3.4.1 Stakeholders to be Interviewed

Stakeholders, including individuals, community groups, and PDAM staff will be interviewed. These stakeholders and their acceptance, adoption, and championing of various kinds of technologies will be key to both the success and sustainability of the sub-activity, as well as a test of the hypothesis, as described above. The design and purpose of this stakeholder selection are described more fully below in section 3.4.2 Data Collection, Component 2: Socio-Institutional Methodology.

3.4.2 Data Collection by Study Components

3.4.2.1 Component 1: Hydrological Sub-study

Hydrological Sub-study Design

The hydrological study component will employ scientific observation and modeling techniques to establish the impact of the *sumur resapan* on spring discharge over time (pre and post) and by treatment and control sites. The first phase is to collect historical and contemporary data of spring discharge and of other parameters located or established through observation. A generic model of a watershed will then be created from key parameters to provide estimates of interest, in particular of spring discharge that is a part of groundwater flow. A sensitivity analysis will identify those variables that are reasonable to use, and build confidence in the model by determining the level of accuracy necessary to make the model useful and valid. Finally, the model and estimates will be tested by calibrating results against incoming current field data.

The effects of the *sumur resapan* will be simulated in the model by increasing the infiltration of runoff according to their combined capacity, and then comparing the predicted effects against calibrated groundwater flow and spring discharge observations. Where there has been no intervention, i.e. in control springs, no additional runoff is introduced. Where the intervention has been completed, i.e. *sumur resapan* have been implemented, the prior (pre) conditions can be established by reducing the infiltration of runoff by the combined capacity of the *sumur resapan*.

The impact of the *sumur resapan* will be established in each watershed by inputting local data and undertaking separate analysis of two measures of groundwater flow: in pre and post periods and in treatment and control sites. These double differences will provide the most robust measure of the impact of the *sumur resapan* on groundwater flow at each site

Hydrological Data Sources

The hydrological component will draw on existing data sources, such as the historical data available from water utilities on springs within their jurisdiction, as well as newly initiated, primary hydro-meteorological data collection.

A hydrological study team has the responsibility of setting up automatic weather stations (AWS) to capture meteorological data, assess soil types, measure stream flow, seepage, spring discharge, and well levels. Table 2, below sets out the type of data, source, and required frequency.

Table 2: Hydrological Sub-study Data – Type, Frequency, and Source

Type	Frequency	Source of data
Precipitation	Daily	Automatic weather stations or government service
Spring discharge in intervention site	Daily	PDAM
Spring discharge in control site	More than once during the study	Field visits by team
Stream flow	More than once during the study	Field visits by team
Land use	Once during the study	Field visits by team
Soil types	Once during the study	Field visits by team
Temperature	Daily	Automatic weather stations or government service

Hydrological Data Collection Methods

There are currently four regions identified for the sub-activity, however the focus of the hydrological study is on two provinces, Mojokerto and Salatiga, where the intervention has respectively either been completed or just commenced, respectively. During the August/September 2013 field scoping visit, these provinces were visited and, together with IUWASH regional teams, field visits were made to all intervention springs and to a number of potential control springs. Table 3, below sets out the details of sites relating to the springs and to the villages where the *sumur resapan* are either completed (Mojokerto) or being introduced (Salatiga).

Table 3: Intervention Sites

Province in Java	Name of spring	Intervention villages
Salatiga, Central Java	Senjoyo	Jetak Village, Getasan Sub-district, Semarang District Patemon Village, Tengaran Sub-district, Semarang District Kelurahan Noborejo, Argomulyo Sub-district, Municipality of Salatiga Butuh Village, Tengaran Sub-district, Semarang District
	Ngablak	Gogik Village, Ungaran Barat Sub-district, Semarang District Kelurahan Candirejo, Ungaran Barat Sub-district, Semarang District
Mojokerto, East Java	Jubel (Djoebel)	Claket
	Ubalan	Padusan

The intervention springs are those identified by the PDAM that have been selected for their significance to raw water supply some time ago and, once the *sumur resapan* strategy was adopted, selected for the intervention. The control springs that were visited have lower volumes of discharge and are often less accessible socially (in one case the community vigorously opposed visits) or physically. The hydrological study team has been given the responsibility of further field trips to locate control springs that share a wide range of parameters (such as location in the same catchment area as the intervention spring, rainfall patterns, soil use, etc.).

Soil and water assessment tool modeling, a well-established approach combining GIS capabilities with database management,[12] will be employed to provide specific measures of spring discharge and levels of wells. The method includes sensitivity, calibration, and uncertainty analysis and has been used in a number of climate change impact studies.

Hydrological Data Analysis Plan

To achieve greater rigor in the statistical analysis of the data on spring discharge and well levels, attempts will be made to establish double differences in key variables on a pre/post and treatment and control basis. Comparison sites in the same watershed that share characteristics as similar as feasible will be located and receive a similar level of observation as those of the treatment.[13] Change over time comparisons will also be possible through measures of parameters prior to intervention (pre-treatment) at sites at which implementation has yet to take place. If data are strictly collected and maintained, this will also make dosage-response analysis possible, which could illustrate the process of change measured over successive time periods.

The succession of intervention activities will be analyzed without the infiltration ponds (the counterfactual) and then with the infiltration ponds (the treatment). The values associated with the counterfactuals will be estimated through modeling and calibrated with data from sites on a range of parameters. Calibration techniques may be manual or automated, and can be evaluated with a wide range of graphical and/or statistical procedures. The manual calibration approach requires the user to compare measured and simulated values, and then to use expert judgment to determine which variables to adjust, how much to adjust them, and ultimately assess when reasonable results have been obtained. Automated techniques involve the use of Monte Carlo or other parameter estimation schemes that determine automatically what the best choice of values are for a suite of parameters, usually on the basis of a large set of simulations, for a calibration process.

3.4.2.2 Component 2: Socio-institutional Sub-study

Socio-institutional Sub-study Design

The socio-institutional component will address the broad research questions related to the hypotheses of the GCC results framework - that demonstrated results and official endorsement of the *sumur resapan* lead to greater individual and community acceptance and adoption of these infiltration ponds as an adaptation strategy to the flooding of villages. This flooding and the decline in spring discharge are both linked to more intense precipitation for shorter periods due to climate change. A useful model in structuring the design of the socio-institutional study is the Technology Acceptance Model (TAM), which provides a causal model to understand the behavior of organizations, communities, and individuals in accepting and continuing to use new and improved technologies. TAM was developed primarily in the context of information technology but is more broadly applicable to acceptance and adoption of various kinds of technologies. The model is widely adopted in research based on the acceptance of a wide range of technologies, and 290 articles directly relevant to understanding technology acceptance have been subjected to review. A unified conceptual tool and graphic and mathematical models have been developed as part of the TAM model

---

[12] A full exposition of soil and water assessment tool methods, including their application to the specific hydrology of stream flows and use in climate change impact studies is found in P. W. Gassman, M. R. Reyes, C. H. Green, J. G. Arnold *The Soil and Water Assessment Tool: historical development, applications, and future research directions. American Society of Agricultural and Biological Engineers.* Vol. 50(4): 1211-1250 2007 http://www.card.iastate.edu/environment/items/asabe_swat.pdf.

[13] It is recognized that there will be some generalizability limitations, as comparisons will not be plentiful and ideal

(although in this study qualitative methods are used).[14] The TAM model (and its variations) can be used to understand the level of acceptance of the *sumur resapan* in relation to its implementation and maintenance.

The TAM model provides two main constructs that are most predictive of acceptance and use: 1) attitudinal, relating to perceived usefulness and perceived ease of use; 2) intentional; and 3) behavioral (actual use). Alternative versions of the model include an additional predictive construct – subjective or social norms which identify resources as a variable, or group of variables, affecting acceptance. Briefly, if a new technology is perceived as being useful and easy to use, and is consistent with prevailing social norms, the technology is likely to be accepted.

The *sumur resapan* strategy deploys financial and organizational resources to adjust social norms, resulting in attitudinal acceptance, then intentional acceptance, and finally behavioral change, a model which appears amendable to the conceptual framework of the TAM model. Some of the variables that predict usefulness and ease of use are also instrumental in predicting continuation of use once a technology is adopted. A critical feature of the sustainability of the intervention is the on-going commitment of users to maintain the *sumur resapan* infrastructure.

The objective of the socio-institutional study is to assess the pattern of acceptance of targeted communities in using the infiltration ponds around their land. When a new technology is introduced in a community, social norms are influenced and an acceptance pattern is formed. Following the findings from a second trip, the research team will observe and describe the aspects that influence the community after implementing infiltration pond around their living area:

- Attitude toward use (perceived usefulness and ease of use)
- Intention to use
- Behavioral change (actual use)

In addition, to the aspects of 'attitude toward using' and 'intention', the evaluation will include 'psychological attachment' which contains the influence of social influence processes on users' behavioral intentions and attitudes toward using the technology. These social influence processes affect the individual and results in his or her internalization, identification, and compliance with the advocated behavior.

Socio-institutional Data Sources

Data sources for the socio-institutional study include translated transcriptions, notes, and observations from interviews and discussions with stakeholders, including individuals, community groups, and PDAM staff.

Socio-institutional Data Collection Methods

The socio-institutional study will use qualitative methods to capture and analyze information. GCC M&E will collect, code, and analyze data from key informant interviews and focus group discussions. Questionnaires and transcripts resulting from key informant interviews and focus groups will be subjected to the following coding applications: process, values, evaluation, hypothesis, causation, and pattern.[15] To ensure consistency in coding, the literature on technology acceptance has been consulted, conceptual models developed, and the concepts defined. Coding sheets will be prepared for analysis and reporting. Data coding is, however, an iterative process. These anticipated coding methods align with the research questions and goals. However,

[14] Koert Van Ittersum, Wendy A. Rogers, et al, *Understanding Technology Acceptance: Phase 1 – Literature Review and Qualitative Model Development* (Atlanta, GA: Georgie Institute of Technology, 2006); available at https://smartech.gatech.edu/bitstream/handle/1853/40580/HFA-TR-0602_TechAccept%20PROPRIETARY.pdf.

[15] Saldana, Johnny, The Coding Manual for Qualitative Researchers (London: Sage Publications, 2013), pp. 96, 110, 119, 147, 163, and 209, respectively.

following initial review of the data, the specific coding methods may change in order to analyze the data to the fullest extent possible and for appropriately answering the research questions.

Existing performance information will be utilized in order to determine fidelity to the intervention design and the scope of coverage and exposure to technologies, knowledge, and awareness of climate change. This will be especially important as it informs the extent to which the causal logic can be tested. Existing performance information derives from monitoring records, interim and quarterly reports, field notes, and other sources.

Administrative/Institutional data will be utilized in assessing the degree to which policies, regulations, and standard practice guidance have been introduced as a result of the activity implementation.

The socio-institutional study will focus on two geographic areas of WR-IUWASH: Salatiga Municipality and Semarang District in Semarang Regency, Central Java; and Mojokerto Municipality in East Java. The intervention in Salatiga is currently in its initial stage, while the intervention in Mojokerto has been completed. The different stages of the interventions present the opportunity to select pre and post comparison groups. In other words, the marketing process and the results of the intervention can be captured in different phases.

The subjects under the institutional sphere of this intervention are PDAM officials, local government officials, local NGOs and other institutions associated with the planning, social mobilization, and implementation of the water replenishment intervention. Specifically, the following are regarded as key informants to be interviewed:

- PDAM
- Badan Perencanaan Pembangunan Daerah/Local Development Planning Board in Salatiga Municipality, Semarang District, and Mojokerto Municipality
- IUWASH Regional Office in Central Java Office and Salatiga
- Local NGOs including Serikat Paguyuban Petani Qaryah Thayyibah/Peasants Association United of Qaryah Thayyibah in Salatiga and Semarang; and Yayasan Lingkungan Hidup Seloliman/Seloliman Environmental Foundation in Mojokerto.
- Perhutani (Perusahaan Hutan Negara Indonesia/Indonesia State Forest Company)
- Perseroan Terbatas Perkebunan Nusantara/Archipelago Farming Incorporation

GCC M&E will interview the key informants in June 2014. As Salatiga has yet to implement the *sumur resapan*, a follow-up visit will be scheduled with a reduced questionnaire to provide pre/post data. These follow-ups will take the form of in person interviews and phone interviews.

The beneficiaries are divided into two groups: beneficiaries living in communities where infiltration ponds are installed (upstream villages), and those who benefit from the increasing volume of spring water (downstream villages).

GCC M&E is collecting data to provide evidence in relation to Question 3 (dealing with the acceptance of the technology at a community level) through focus group discussions at selected villages at which the intervention has taken place. Double difference data is not available as control villages were not considered possible as they did not have the prospect of an intervention and most of the issues relating to the intervention would not apply currently or in the future. There is, however, the prospect of pre- data from interviews and focus group discussions in Salatiga where the intervention has yet to be implemented.

Villagers downstream of the intervention sites can be considered to be indirect beneficiaries, as they are stated to have a substantial decrease in flooding in their villages as a result of the implementation of *sumur resapan* upstream. In a sense these villages serve as a comparison group to the intervention.

Table 4: Focus Group Discussions

Village	Spring	Upstream		Downstream		Total # Focus Groups
Salatiga						7
	Senjoyo	1 villages x 3 FG	3	1 village x 1 FG	1	4
	Ngablak	1 villages x 3 FG	3			3
Mojokerto						5
	Djoebel	Claket x 2 FG	2	1 village x 1 FG	1	3
	Ubalan	Padusan x 2 FG	2			2
Total						12

The focus groups will be assembled on the following basis in Salatiga villages to capture data polarized to reflect different perspectives on the acceptance of technology:

1) Early adopters who accepted the technology when it was presented
2) Late adopters who accepted the technology only after it was seen to be effective in reducing flooding
3) Skeptics who do not accept the technology

In the Mojokerto villages the following groups will be assembled:

1) Adopters who have *sumur resapan* on their land
2) Others who do not have *sumur resapan* on their land

To ensure representation of women's voice in the focus group discussions, selected focus groups may be recruited on a woman only basis.

Socio-institutional Data Analysis Plan

The study will utilize grounded theory and qualitative comparative analysis for the analysis, which entails a rigorous coding of the data from key informant interviews and focus groups in order to identify patterns of association and meaning. Data associated with each of the cases (i.e., individuals, groups, communities, PDAM) will be analyzed for the emergent patterns that define sets composed according to the outcomes (as defined by the program logic and goals). Cases (individuals, groups, communities, PDAM) will be assigned to sets in both baseline and endline data analysis, depending on whether the individual or community has experienced the activities making up the intervention. This will allow for a comparison of pre- and post-intervention cases on the basis of refined set memberships. Membership in a set will be determined through an analysis of the results of process, evaluation, hypothesis, causation, values, and patterns coding, as mentioned above.

The table below is a hypothetical example to illustrate what these sets might look from an analysis of the causal conditions relevant to PDAM acceptance of *sumur resapan* strategy.[16]

[16] Ragin, Charles C., *Redesigning Social Inquiry: Fuzzy Sets and Beyond* (Chicago: University of Chicago Press, 2008), p. 24.

Table 5: Hypothetical Example

	Decided on basis of information on climate change	Deforestation causes decline in spring discharge	Consider *sumur resapan* effective improving spring discharge	Decline in raw water supply threatens MDG target	Considered alternatives on cost basis
PDAM 1 pre	no	yes	no	no	yes
PDAM 2 pre	no	yes	no	no	yes
PDAM 1 post	yes	yes	yes	no	no
PDAM 2 post	yes	no	yes	yes	yes

Analysis of membership (and degree of membership) in a set or sets, will allow for the realization of "consistent connections," from which the cases may be compared with one another. Tables, such as the illustrative example above will be constructed such that causal inferences may be drawn.

The coding, analysis, and construction of tables makes rigorous examination of the hypothesis possible. Two methods are proposed here: first, the evidence for the hypothesis will be considered; second, the alternative hypotheses will be examined in order to explore causal inferences. The alternatives may be rejected, partially rejected, or not rejected. Such analysis allows for the identification of necessary and/or sufficient attributes to achieve the expected outcome in the various conditions from which causal inferences are drawn.[17]

For example, a key hypothesis is that the vulnerability assessment leads to informed decision making by PDAM officials in responding to the impact of climate change on water (e.g., access and flood mitigation). Alternative explanations for informed decision making may be that individuals were exposed to such a package of information and advice prior to the vulnerability assessment. An alternative explanation must be rejected in order to confirm the program hypothesis. In the course of hypothesis testing, the vulnerability study (see the example above), may be understood as a necessary, sufficient, both necessary and sufficient, or neither necessary nor sufficient condition to informed decision making.

Similarly, in testing the key hypothesis that individuals or communities will adopt the *sumur resapan* strategy because they are persuaded by changes in social (village) norms, an alternative explanation to consider is that individuals adopt the *sumur resapan* strategy because they believe that flooding is caused by deforestation. Yet another explanation could be that the acceptance of the *sumur resapan* is due to the desire to comply with the bidding of village heads rather than social norms. In order to confirm the key hypothesis, various alternative explanations must be rejected.

Analysis of key informant interviews and focus group data will provide a rigorous examination of the hypotheses, and thereby program logic. Rejection of alternative explanations (either wholly or in part) will determine whether or not the causal inferences hypothesized in the research questions are valid. The strength of the validity of those causal inferences relies on the extent to which alternative explanations can be rejected.

[17] Bennett, Andrew, "Process Tracing and Causal Inference," in *Rethinking Social Inquiry*, ed. Henry E. Brady and David Collier, 207-219. Plymouth, UK: Rowman and Littlefield, 2010, pp. 210-211.

3.5 ANALYSIS PLAN – DATA COLLECTION AND VERIFICATION

Section 3.3 included substantive discussion of the analysis plan by sub-component. This section discusses general processes in analyzing data and trying to maintain as high quality data as feasible.

3.6 ANTICIPATED DATA QUALITY

Data collection and verification will ensure that the data meet standards as identified by USAID (i.e., having validity, reliability, precision, integrity, and timeliness). To achieve credible results from the analysis of data collected and to be able to detect changes and differences in key indicators accurately, dTS maintains the highest standards in methods, quality, and security. In order to achieve this level of data quality, dTS has set out the required standards and procedures, and contractor responsibilities in a guideline document to which all data collectors, enumerators, consultants, and employees are expected to adhere. All activities and deliverables produced by GCC M&E follow the standards and procedures prescribed in the document. The document contains guidelines for: summary of key contractor responsibilities, work planning, instrument design and testing, interviewer training and data collection, data entry and cleaning, and data storage and transmission. Particular attention will be paid to providing intense training of interviewers supported by training manuals and exercises.

There are some data quality challenges in the collection of the hydrological study data. Data on the flow from springs (expressed in liters/second) are uneven, and the meteorological information on rainfall levels does not exist at the level of detail required. There are discontinuous series, various gaps, and a notable lack of weather stations away from the larger urban centers. Despite these limitations, some utilities that are strongly dependent on springs keep good records of spring discharge and daily readings for the past five years or more are available. In some cases, historical records for springs are available only in terms of water levels in specially constructed spillways of currently unknown volume rather than flow rate, although it should be possible to establish the total flow from each spring from this data.

The data quality of interview and focus group discussion data will be ensured through careful design of semi-structured interview and discussion guides, with specifically-designed training modules for the facilitation, probing, and monitoring of responses for relevance to the research questions. Where apparent internal consistencies emerge from respondents (e.g., interviewees or focus group members) in the information they provide about attitudes, values or behaviors; interviewers and facilitators will probe to elicit more information, narrative, or dialogue to explore unexamined or misinterpreted aspects related to the research theme rather than create consistency where none exists.

3.7 STRENGTHS AND LIMITATIONS OF RESEARCH METHODS

Regarding the hydrological component, the selection of comparison sites in the same watershed face the following limitations:

a. There are relatively few potential control springs that are known to the PDAM and readily accessible. Some of the previously identified sites did not have public access or were in remote locations.
b. The control springs tend to be smaller in volume discharged and in other ways. If they had a larger volume, they would probably have been accessed for raw water supply by the PDAM.
c. Prior data on control springs is not available as they are not accessed by the PDAM.

Despite these limitations, controls have been located in the same watersheds as the treatment sites.

While matching controls would be optimal in providing comparative data on spring discharge, the creation of a model with a close fit to the field observations, for each treatment site, is a countervailing strength. If the key parameters of precipitation, land use, soil types, etc. are accurately measured, estimates of spring discharge can be reliably established.

For the socio-institutional component the statistical representation of qualitative data is a limitation to the testing of the hypothesis. However, the coding and analysis of the qualitative data will provide reliable and valid measures which will provide the basis for the rigorous testing of these hypothesis.

4. IMPACT STUDY IMPLEMENTATION

4.1 RESEARCH TEAM

Table 6: GCC M&E Impact Study Team

Name	Role and position	Qualification	Responsibility
Home team			
David Hemson	Project leader, Senior Evaluator	Ph.D., Sociology	Oversee, manage and ensure timeliness and quality of research deliverables
Laura Arntson	Qualitative Methodology, Senior Evaluator	Ph.D., M.P.H.	Contribute to qualitative methodology
Sandra Medina	Research Associate	M.A.	Manage procedures, contracts, communications
Karen Joyce	Consultant	Ph.D.	Contributions to conceptual framework, draft measures, qualitative instruments, training manuals, etc.
Country-based Team			
Ratnayu Sitaresmi	Locally-Based Evaluation Specialist	M.A.	Manage socio-institutional team, responsible for quality of deliverables
Heru Hendrayana	Locally-Based Hydrologist	Prof Dr. Ir.	Access to hydrological data, advice on local data collection

Table 7: Andiny Jaya Lestari Team (Organization Involved in the Study - Locally based Company)

Name	Role and position	Qualification	Responsibility
Nana M. Arifjaya	Team leader, Senior Researcher	Ph.D., M.Si	Manage data collection, responsibility for quality of timeous deliverables
Idung Risdiyanto	Field data researcher, Senior Analyst	S.Si, M.Sc	Field data collection and modeling
Benny Istanto	Program Manager	S.Si	Overall management, GIS modeling

4.2 COORDINATION WITH USAID/E3, MISSION, AND IMPLEMENTING PARTNER

Coordination with USAID/E3 will take place both routinely in regular weekly group calls and in specifically scheduled discussions with individuals in E3 taking responsibility for the study. The coordination with the mission will be through E3 to consult at key points. In response to a request by the mission, dTS has appointed a locally based Communications Coordinator at a senior level to be available to coordinate interaction with the Implementing Partner and for discussion with the mission.

4.3 DOCUMENTS, LOGISTICAL AND OTHER SUPPORT NEEDED FROM USAID/E3 AND MISSION

The study team (at home and locally based) is aware of the demands on the time of the Mission and has achieved a considerable degree of logistical independence.

Quarterly and annual reports would assist in accessing descriptions of the performance of the activity. GCC M&E will request review of and input on select sections of documents periodically.

4.4 COLLABORATION AND SUPPORT NEEDED FROM IMPLEMENTING PARTNER

There has been considerable support from the implementing partner during the early period of the study and the study team now is aware of the need to consult IUWASH but to work towards logistical independence. The hydrological team has had considerable support from IUWASH in the field trips to undertake data collection but is not requesting systematic support. Review of and input on select sections of documents on request would be helpful.

4.5 STEPS UNDERTAKEN TO AVOID CONFLICTS OF INTEREST

There has been an appointment that raised the possibility of a conflict of interest between responsibilities in implementation and in research. This was for Heru Hendrayana, who has a consultancy as well with IUWASH. Changes were introduced to his Scope of Work to ensure that he participated in collection of data but not in analysis, and mechanisms were devised to avoid conflict in the allocation of time.

4.6 ETHICAL RESPONSIBILITY

dTS maintains high standards in methods, quality, and data security by ensuring that dTS and all its local subcontractors adhere to common standards and procedures. Before undertaking data collection, dTS evaluation teams submit study plan, protocol, and data collection instruments to an independent, accredited Institutional Review Board (IRB) for approval. IRB clearance certifies that a study will be undertaken according to standard ethical guidelines and that sufficient protections are in place to safeguard the treatment and privacy of all study participants. dTS, the study team, and the local subcontractor are committed to ensuring ethical standards are met, including, as appropriate, obtaining survey respondents' informed consent and safeguarding the confidentiality and anonymity of their responses.

5. KEY PRODUCTS

5.1 CONTRACTUALLY-REQUIRED DELIVERABLES

- Evaluation SOW
- Baseline draft and final reports
- Interim draft and final reports (if relevant)
- Endline draft report (5 paper copies and electronic copy)
- Endline final report (15 paper copies and electronic copy)
- PowerPoint summary of evaluation including chief findings, conclusions, and recommendations
- Oral briefing(s)
- Flash drive with all survey instruments used and data collected in formats suitable for reanalysis

5.2 OTHER DELIVERABLES

The study does not have other deliverables planned on a fixed schedule, although interim products as sections of planned reports or documentation may be provided when input is sought.

5.3 DISSEMINATION PLAN

In discussion with the mission and the implementing partner, proposals have been made for the presentation of preliminary results to the mission this year at a time convenient to the mission and for presentations at workshops organized by IUWASH early in the coming year. There are also prospects for the publication of an article on the hydrological research in a peer-reviewed journal.

6. OVERALL TIMELINE

Table 8: Evaluation Plan Timeline

Impact Study Design Phase/Process	Period
Scoping and Evaluation Plan Development	
• Scoping trip (travel) • Second trip (travel) • Develop evaluation questions • Develop Evaluation SOW • Submit draft evaluation plan	• August 2013 • February 2014 • Approved on April 22, 2014 • May 2014 • May 2014
Hydrological Component: • Contract local hydrology consultant firm • Select treatment and control springs for hydrological data	 • February 2014 • May 2014
Socio-institutional Component: • Contract local evaluation specialist • Select villages for socio-institutional data	 • February 2014 • May 2014

Table 9: Baseline Timeline

Process/Deliverable	Period
Baseline Data Collection Preparation	
Hydrological Component: • Identify key data to be recorded • Develop model for spring discharge • Draft data collection plan	 • March 2014 • March 2014 • March 2014
Socio-institutional Component: • Develop key informant interview questionnaires • Develop focus group discussion questionnaires • Contract local data collection team • Train local data collection team	 • May 2014 • May 2014 • May 2014 • June 2014
Baseline data collection / cleaning	
Hydrological Component: • Collect historical data from PDAMs • Collect spring discharge, rainfall, water table height, etc. (data will be collected continuously through January 2017) • Data cleaning	 • Mid-March – May 2014 • Mid-March – Nov 2014 • July - Nov 2014
Socio-institutional Component: • Conduct key informant interviews • Conduct focus group discussions • Clean and code data	 • June 2014 • June 2014 • July – August 2014
Baseline Analysis, Report writing, Dissemination	
Hydrological Component: • Test and calibrate model for spring discharge • Run simulation and measure the parameters of the model for spring discharge • Present hydrological model • Impact study baseline draft report (hydrological sections)	 • April – Nov 2014 • August 2014 • August 2014 • August 2014
Socio-institutional Component: • Data analysis • Impact study baseline second draft report (hydrological and socio-institutional sections) • Impact study baseline final report • PowerPoint summary of study (findings, conclusions, and recommendations) • Flash drive with all survey instruments used and data collected in formats suitable for reanalysis	 • July – October 2014 • November 2014 • January 2015 • February 2015 • March 2015

Table 10: Midline Timeline

Process/Deliverable	Period
Midline data collection preparation	
Hydrological Component: • Revision of data collection plan and datasets	• April 2015
Socio-institutional Component: • Review key informant interview and FGD questionnaires • Contract local data collection team • Training local data collection team	• April 2015 • May 2015 • May 2015
Midline data collection	
Hydrological Component: • Collect spring discharge, rainfall, water table height, etc. (data will be collected continuously through January 2017)	• April - August 2015
Socio-institutional Component: • Conduct key informant interviews and FGDs (community) • Clean and code data	• June 2015 • July 2015
Midline Analysis, Report writing, Dissemination (both sections)	
• Data analysis • Impact study midline draft report • Impact study midline final report	• August - Sept 2015 • November 2015 • January 2016

Table 11: Endline Timeline

Process/Deliverable	Period
Endline data collection preparation	
Hydrological Component: • Revision of data collection plan and datasets Socio-institutional Component: • Review of key informant interviews and FGD questionnaires • Contract local data collection team • Training local data collection team	• Feb 2016 • March 2016 • April 2016 • May 2016
Endline data collection / cleaning	
Hydrological Component: • Collect spring discharge, rainfall, water table height, etc. Socio-institutional Component: • Collect socio-institutional data • Clean and code data	• Feb 2016 - January 2017 • June 2016 • July - August 2016
Endline Analysis, Report writing, Dissemination (both sections)	
Hydrological Component: • Test hydrological model for spring discharge • Run simulation and measure the parameters of the model for spring discharge Present hydrological model • Impact study endline draft report (hydrological sections) Socio-institutional Component: • Socio-institutional data analysis • Impact study endline second draft report (hydrological and socio-institutional sections) • Impact study endline final report (hydrological and socio-institutional sections) • PowerPoint summary of study (findings, conclusions, and recommendations) • Flash drive with all survey instruments used and data collected in formats suitable for reanalysis	• February 2017 • March 2017 • March 2017 • Sept - Nov 2016 • January 2017 • March 2017 • May 2017 • May 2017

6.1 SCHEDULE

- The teams' preparation process has largely been completed, a team has been assembled and has undertaken two trips to Indonesia and four field trips;
- The table above indicates these developments and highlights the impending trip (both external and internal) relating to data collection for the socio-institutional study.

6.2 SUB-ACTIVITIES UNDER CURRENT CONTRACTUAL MECHANISM

- Scoping trip undertaken August 23 to September 6, 2013 involved discussions with the mission, with the IP and key stakeholders and site visits to implementation areas one of which had been completed and the other being planned (trip itinerary is included as Annex 1-A);
- Second trip undertaken February 15 to 28, 2014 (trip itinerary is included as Annex 1-B);
- Socio-institutional data collection and training trip undertaken in June 2014: a visit by dTS is needed to supervise training and ensure data quality control;

- Continuous hydrological data collection from April 2014 to January 2015 (continuing post-contract under section 6.3);
- Presentation of preliminary results for both components, January-February 2015
- Impact study baseline draft (with the hydrological and socio-institutional section) will be submitted in November 2014; the impact study baseline final report will be submitted in January 2015;
- The current task order terminates in March 2015.

6.3 POST-CONTRACT SCHEDULE

- Continued data collection of key parameters in the hydrological model to confirm estimates of impact, April 2015 – January 2017;
- Further socio-institutional data collection will be needed in particular in relation to the replication of the intervention strategy. The midline data collection is proposed for June 2015, and the endline data collection for June 2016;
- Schedules that include data collection, cleaning, and coding across the hydrological and socio-institutional studies are scheduled through the November 2016 with reporting and comment periods extending into 2017:
    - Impact study midline draft report submitted by November 2015;
    - Impact study midline final report submitted by January 2015;
    - Impact study endline draft report delivered in January 2017;
    - Impact study endline final report delivered in March 2017.

7. TRANSITION PLAN

- The contracts for the existing home staff and the hydrological team - Andiny Jaya Lestari. Company will need to be extended;
- The contract for the local socio-institutional consultant will need to be extended and the local data collection team will need to be hired for the midline and endline data collection;
- Further extension of the contract with the hydrological team needed from April 2015 – February 2017;
- Compilation of socio-institutional metadata, data from the socio-institutional studies in formatted and unformatted (ASCII) types;
- Compilation of hydrological metadata, hydrological datasets of key parameters for the model (metered spring discharge, total discharge from springs, temperature, precipitation, etc.) and presented to USAID.

ANNEX 1: INITIAL TRIP ITINERARIES

ANNEX 1-A: SCOPING TRIP - 25 AUGUST – 6 SEPTEMBER, 2013

Date	Activities	Overnight
Sunday, August 25	Arrive in Jakarta	Sunday: Jakarta
Monday August 26	8.30 Jessica to meet dTS team at hotel Taxi to USAID in morning and then to IFACS 9.00 – 10.00 In-briefing USAID Team 10-45 - 12.00 Reed Merrill, TetraTech 2.00 -5.00 pm Foort Bustraan, IUWASH: logistics, data, maps, reports, etc Possible meeting with Coca Cola Foundation Indonesia (CCFI) at IUWASH Internal travel arrangements, make arrangements with translators	Monday: Jakarta
Tuesday, August 27	Confirm internal travel arrangements, translators 9.30-11.00 Further discussion on sites (ongoing + possible comparison) + meet senior hydro-geologist , also rep of UGM university in Indonesia 11.15- 12.30 Sabto Sumartono, GIS Specialist 1.00pm *David and Jessica to Bandung (nearby Lembang)* Travel to Bandung Meeting with good local data collection company + other university (some of our staff will accompany you) Tentative 6.00pm: meet with local evaluator Mohamad Rum Ali Marc 2.00-3.00 Discuss sites, map intervention sites and potential comparison sites (matching criteria: similar terrain, spring drawn by utility, comparably sized population, same local government) Tentative 6.30pm: Meet with Mark Fiorello 8.00pm Marc and David on E3 call	Tuesday: Jakarta (Marc) Lembang (David and Jessica)
Wednesday, August 28	Lembang, become familiar with original concept of water replenishment, its implementation and perceived results. 8.30 Meet local government and utility 9.00 Site visit and meetings with community leaders 14:00: return to Jakarta Marc 9.30-11.00 Meet with potential evaluators and local data collection companies; 12-1pm Meeting with other university (Trisakti), Perhutani (Forestry) and Publics Works. Continue discussions GIS spec, as required 2.00-4.30 Further meetings as needed. 5.00pm David, Jessica and Marc meet up for trip to airport 19:40 flight to Semarang and travel (by car) to Salatiga, Central Java	Wednesday: Semarang
Thursday-August 29	9.30-10.30 Meet in Semarang and Salatiga, with university, NGO, utility in local IUWASH office and then to field.	Thursday: Semarang

Date	Activities	Overnight
	11.00 Travel to the site with IP; visit and discuss possible comparison areas; 5.00 Return to hotel	
Friday, August 30	9.30-10.30 Meeting with university personnel in Semarang and Salatiga, with university, NGO, utility in local IUWASH office and then to field. 11.00-4.00pm Visit potential comparison site nearby (Salatiga / Kab Semarang)	Friday: Semarang
Saturday, August 31	**11:15 flight** to Surabaya (East Java) From Surabaya go directly to Probolinggo and afternoon to Bromo (assuming no delays in the travel) Saturday afternoon: travel to Probolinggo	Saturday: Malang or Pasuruan?
Sunday September 1	Sunday visit Mount Bromo – return to Surabaya Sunday afternoon Travel from Probolinggo to Mojokerto, where you can visit field location and meet community, NGO Overnight in Mojokerto	Sunday: Surabaya
Monday- September 2	Some activities below could be divided by team members: 9.30-11.30 am meet with IP, local university, utility, and local government leadership. 11.30 Meetings with IP, rep of G'ment, utility and IUWASH, visit and discuss possibly comparison area(s) (also in Mojokerto) 4.00 Return to hotel	Monday: Surabaya
Tuesday, September 3	9.30am Further discussions with university personnel 11.00pm Visit potential comparison site nearby (within /nearby Mojokerto) Travel to the site with IP, rep of G'ment, utility and IUWASH, visit and discuss possibly comparison area(s) (also in Mojokerto) 7.00pm Dinner with local officials and IUWASH	Tuesday: Surabaya
Wednesday, Sept. 4	**08:50 flight** to Jakarta 9.30-10.30 Discussions of proposed evaluation with USAID team TBD Meet with potential evaluators, hydrologists and local data collection companies; Tentative 2.00pm meet with local evaluator, Vicarna Yasier TBD Sabto Sumartono, GIS Specialist, Access possible baseline data	Wednesday Jakarta
Thursday, Sept. 5	TBD Continue to meet with potential survey companies, M&E specialists and hydrologists to join evaluation team 3.00-5.00 Out-briefing, USAID and Mission	Thursday: Jakarta
Friday, Sept 6	Departure	

ANNEX 1-B: SCOPING TRIP – 17-28 FEBRUARY, 2014

Date	Time	Activities	Location	dTS Participants
Friday, Sunday 14 – 16 Feb		Travel to Jakarta Rest, discussion with local team	Alila Hotel	David and Sandra
Monday 17 Feb	09.00 – 11.00	Meeting local team to discussion of workplan	Alila Hotel	David, Sandra and local team
	TBD	Meet with hydrological agency to discuss work schedule and data exchanges	TBD	David, Sandra and local team
	TBD - Afternoon	Meeting with IUWASH to discuss trip to Salatiga, sites, coordination with PDAM, etc.	IUWASH Jakarta Office	David, Sandra and local team plus
Tuesday 18 Feb	TBD 11 am – 2 pm	Meeting with Mission to discuss scope of the study, main questions, how to address stakeholders, and workplan for the study	USAID OFFICE	David, Sandra and local team
	TBD 11 am	Meeting with Coca Cola	Coca Cola Offices in Jakarta	David, Sandra and local team
Wednesday 19 Feb	TBD	Follow-up Meeting with hydrological agency to discuss site visits	TBD	David, Sandra and local team
Thursday 20 Feb	TBD - Morning	Fly to Semarang, ground travel to Salatiga Meeting with IUWASH team and PDAM to discuss comparison sites, hydrological data and monitoring of precipitation	Laras Asri Hotel, Salatiga	David, Sandra and local team
Friday 21 Feb	TBD	Meeting with PDAM and IUWASH Meeting with PDAM, NGO and IUWASH to discuss with communities and mobilization	TBD	David, Sandra and local team
Saturday 22 Feb	Morning	Field visit with NGO and IUWASH to visit comparison sites Return travel to Semarang	TBD	David, Sandra and local team
Sunday 23 Feb	Afternoon	Fly to Surabaya, ground travel to Mojokerto	Hotel Sativa Sanggraloka	David, Sandra and local team
Monday 24 Feb	TBD	Meeting with PDAM and IUWASH to gather hydrological data and monitor precipitation Field visit with NGO and IUWASH to visit comparison sites		David, Sandra and local team
Tuesday 25 Feb	Morning	Field visit with NGO and IUWASH to visit comparison sites	Hotel Alila	David, Sandra and local team

Date	Time	Activities	Location	dTS Participants
	Afternoon	Travel to Jakarta Write up notes, plan for week		
Wednesday 26 Feb	TBD	Meeting with local team to set up scientific monitoring plan	TBD	David, Sandra and local team
Thursday 27 Feb	TBD	Further discussions with hydrological agency	TBD	David, Sandra and local team
Friday 28 Feb	TBD	Out-brief with Mission	USAID Office	David and Sandra, M&E Manager,

ANNEX 2: FGD AND KEY INFORMANT INTERVIEW SELECTION CRITERIA

ANNEX 2A: SELECTION OF FGD PARTICIPANTS

Early adopters:

7-9 participants are needed. The NGO and/or the village head will be requested to identify those senior members of a household who:

1) Were the very first individuals to pilot the *sumur resapan*;
2) Were among the first of those who accepted the *sumur resapan* after the pilots were completed.

There should be rough equality between male and female early adopters from across the village.

Prepared to adopt:

7-9 participants are needed. The NGO and/or the village head will be requested to identify those senior members of a household who:

1) Have not yet had a *sumur resapan* installed;
2) Are committed to having a *sumur resapan* installed

Among this group will be the late adopters, and those who may no longer have the opportunity to install since funds may have run out. In Salatiga these individuals may have signed an acceptance form. There should be rough equality between male and female late adopters from across the village.

Permanent skeptics

7-9 participants are needed. The NGO and/or the village head will be requested to identify those senior members of a household who:

1) Have always doubted whether the *sumur resapan* will work;
2) Feel that the *sumur resapan* are not worth the use of their land;
3) Do not want to commit themselves to adopt the *sumur resapan*.

If possible this group should be convened before the *sumur resapan* can be viewed during the rainy season. There should be rough equality between male and female participant from across the village.

Have a *sumur resapan*:

7-9 participants are needed. The NGO and/or the village head will be requested to identify those senior members of a household who were among the early adopters. There should be rough equality between male and female adopters from across the village.

Do not have a *sumur resapan*:

7-9 participants are needed. The NGO and/or the village head will be requested to identify those senior members of a household for one reason or another do not have a *sumur resapan*. They may have been skeptical of the technology or have been late adopters who now find that there is no longer funding. There should be rough equality between male and female participants from across the village.

Downstream village (pre):

7-9 participants are needed. The village head will be requested to identify senior members of a household who experience flooding of their yard and/or house. There should be rough equality between male and female participants from across the village.

Downstream village (post)

7-9 participants are needed. The village head will be requested to identify senior members of a household who have experienced flooding of their yard and/or house. There should be rough equality between male and female participants from across the village.

ANNEX 2B: SELECTION OF KEY INFORMANT INTERVIEW PARTICIPANTS

For every case, the interviews will be conducted with each individual not with a group of officials.

Selection for PDAM (Perusahaan Daerah Air Minum/Drinking Water Local Company, Utility)

Interviews are needed with officials who:

1) Had seniority to agree to the intervention; and
2) Exercised oversight of the process and learned or were trained to monitor and maintain the infrastructure.

Selection for IUWASH

Interviews are needed with officials who:

1) Had seniority at national and regional level for the intervention; and
2) Exercised oversight of the process.

Selection for local government

It is not clear how the local government/PDAM administrations coordinate. Thus, the local research team needs to ensure interviews appropriate officials who:

1) Key personnel taking responsibility for climate change adaptation (CCVA); and
2) For line functions in relation expanding water services.

Bappeda/Planning body (Badan Perencanaan Pembangunan Daerah/Local Development Planning Board)

In Salatiga Municipality, Semarang District, and Mojokerto Municipality; interviews are needed with officials who:

1) Have the seniority to initiate or oversee climate change adaptations in the region; and
2) Were directly involved in the CC Vulnerability Assessment.

Perhutani (Perusahaan Hutan Negara Indonesia/Indonesia State Forest Company)

It is not clear how the Forestry Company is integrated into planning and implementation of the *sumur resapan*. The local research team will need to interview a key person taking responsibility for infiltration wells that may not have the same design as the WR-IUWASH *sumur resapan*.

NGOs

1) SPPQT (Serikat Paguyuban Petani Qaryah Thayyibah/Peasants Association United of Qaryah Thayyibah), conducted social mobilization, training and implementation of *sumur resapan* in Salatiga and Semarang;
2) YLHS (Yayasan Lingkungan Hidup Seloliman/Seloliman Environmental Foundation), conducted social mobilization, training and implementation of *sumur resapan* in Mojokerto;
3) PTPN (Perseroan Terbatas Perkebunan Nusantara/Archipelago Farming Incorporation.

Additional stakeholders:

Interviews should be conducted to people taking responsibility for *sumur resapan* and those who has extensive knowledge of the communities, for example:

1) Village head, informal women leader, informal community leader
2) Village heads are "pre-selected" and hopefully available.
3) Informal women leader – on advice from village head or NGO
4) Religious leader – on advice from local residents