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REPORT

FINAL REPORT

The Water, Sanitation, and Hygiene (WASH) Project in Cabo Verde: Evaluation Design Report

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ACKNOWLEDGEMENTS

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ACRONYMS

ADA	Agência de Distribuição de Água
AdS	Águas de Santiago
ANAS	Agência Nacional de Água e Saneamento
ARE	Agência de Regulação Económica
ATAS	Assistência Técnica à Águas de Santiago
CNAS	Conselho Nacional de Água e Saneamento
DGA	Direcção Geral do Ambiente
ERR	Economic rate of return
FAS	Fundo de Acceso Social
FASA	Fundo de Agua e Saneamiento
GDP	gross domestic product
IEC	information, education, and communication
IGF	Infrastructure Grant Facility
INE	Instituto Nacional de Estatística de Cabo Verde
IRB	institutional review board
M&E	monitoring and evaluation
MCA-CV	Millennium Challenge Account Cabo Verde II
MCC	Millennium Challenge Corporation
MDD	minimum detectable difference
MMU	multi-municipal utility
NGO	non-governmental organization
NITA	National Institutions Technical Assistance
NIRR	National Institutional and Regulatory Reform
RASAS	Relatório Anual dos Serviços de Água e Saneamento
SAAS	Serviços Autónomos de Água e Saneamento
SESA	Strategic Environmental and Social Assessment
URA	Utility Reform Activity
WASH	water, sanitation and hygiene

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I. INTRODUCTION

Cabo Verde has succeeded in establishing a thriving democracy, but it has limited natural resources and infrastructure to support its widely dispersed population of roughly 500,000 (World Bank 2016). The archipelago off the coast of West Africa is made up of 10 geophysically and economically diverse islands (only nine are inhabited), with 56 percent of the population concentrated on the largest island, Santiago (AfDB 2014). Despite its small size, Cabo Verde has greater economic resources than many countries in Africa, with an estimated gross domestic product (GDP) per capita of $6,500 in purchasing power parity (CIA 2016). This is despite the fact that water scarcity is a constraint on economic growth for many parts of Cabo Verde (Government of Cabo Verde 2010). Low rainfall levels have had a significant impact on the primarily rain-fed agriculture sector (USGS 2010), which is the main source of livelihood for rural residents (AfDB 2014). The service sector, which represents about 70 percent of GDP and is dominated by tourism, relies on the expensive production of desalinated water to meet its water needs (Government of Cabo Verde 2010).

Access to water and sanitation services is also a problem, although Cabo Verde has made gains in connecting households to infrastructure. Approximately 70 percent of the population has access to piped water, but close to half of those who rely on utility water access it through public fountains known as *chafaris* rather than through household connections to the network (Briceño-Garmendia and Benitez 2011). About half of the population has access to flush toilets, but the other half has no access to any kind of sanitation (Briceño-Garmendia and Benitez 2011). There are also significant gaps between urban and rural areas (UNICEF and WHO 2012).

Finally, Cabo Verde also struggles with poor management of water and sanitation services. Inefficiencies such as water leaking out of the piped network and bloated staff levels at utilities are passed on to consumers, leading Cabo Verdeans to have to pay almost three times as much for water as residents of any other country in Africa (Banerjee et al. 2010), despite poor quality of service delivery, with frequent outages (EBES 2013). The largest operator in the country is ELECTRA, a partially privatized multi-utility (power, water, and sewerage), which serves the city of Praia—the national capital where a quarter of the country's population resides—as well as several islands, serving close to 40 percent of the population in total (Marques et al. 2013). ELECTRA's performance on indicators such as the collection ratio (outstanding revenues at year end compared to the total billed revenue for the year), technical losses (water that leaks out of the system), commercial losses (water that is consumed by not paid for by the user), and cost recovery (the ratio of the utility's revenues to expenses) is below the utility performance benchmarks for African middle-income countries (Briceño-Garmendia and Benitez 2011). In most other parts of the country, municipalities manage their own water utilities, which results in inefficiencies such as overstaffing. Due to poor management, the national government ends up subsidizing most utilities in the country, diverting funds that could instead be used for more productive purposes, thereby slowing economic growth.

To address some of these challenges, the Millennium Challenge Corporation (MCC) is funding a $41 million Water, Sanitation, and Hygiene (WASH) project. The WASH project is part of a larger $66.2 million five-year compact, which also includes a $17.3 million Land Management for Investment project that is intended to improve property rights and the investment climate. The compact began in 2012 and aims to increase economic growth and

reduce poverty in Cabo Verde. Both projects are implemented by the Millennium Challenge Account of Cabo Verde (MCA-CV). The WASH project's objective is to "establish a financially sound, transparent, and accountable institutional basis for the delivery of water and sanitation services to Cabo Verdean households and firms" through the following activities: (1) the National Institutional and Regulatory Reform (NIRR) activity which seeks to improve national policy and strengthen institutions that govern the WASH sector; (2) the Utility Reform Activity (URA) which aims to transform inefficient municipal utilities on the island of Santiago into Águas de Santiago (AdS), an autonomous corporate entity; (3) the Infrastructure Grant Facility (IGF) activity which includes the Water and Sanitation Fund (FASA) to expand and improve the quality of infrastructure in the sector and the Social Access Fund for Water and Sanitation Connection (FAS), which subsidizes household connections to water and sanitation utilities.

MCC has contracted with Mathematica Policy Research to evaluate the WASH project. The objective of this report is to describe the design for the evaluation of the WASH project as a whole and of its different activities. We plan to conduct a mixed-methods performance evaluation with the following three components:

1. A **process evaluation**, which will document how the project activities were implemented and explore the potential for the activities to have contributed to changes in key outcomes from the project logic. The process evaluation will draw from primary qualitative data collected from national and local stakeholders and households on several islands in 2017, 2018 and 2020, a review of project documents, and administrative data provided by AdS and government agencies.

2. **Pre-post analyses** of household survey data and secondary data from utilities (including AdS), which will explore changes in outcomes on Santiago in the first few years after the project activities are completed. Analysis of two rounds of panel survey data from a representative sample of Santiago households in 2018 and 2020 will reflect the medium-term effects of the NIRR and URA, and we will oversample neighborhoods served by FASA-funded infrastructure projects to measure any additional benefits. A separate panel of households will be surveyed in 2018 to track changes in outcomes among households who received subsidized connections to the piped water network on Santiago through the FAS, using baseline data from 2015 collected by MCA-CV. We will also use data from the annual WASH sector monitoring yearbook to look at changes in utility-level outcomes that are expected to be affected by the WASH project activities.

3. **Case studies** of three infrastructure projects funded by the FASA (on the islands of Santiago, Sal, and São Vicente), which will explore potential commonalities and unique aspects of projects that represent the broader portfolio. The two rounds of case studies will synthesize information from all of the data sources used in the other two components of the evaluation, including qualitative data related specifically to these three projects, to assess how FASA funding might have incentivized utilities to corporatize, how households and utilities are affected by the infrastructure, and to consider the prospects for the infrastructure to be sustainably managed.

In the chapters that follow, we provide context for the proposed evaluation and describe the planned evaluation design in further detail. In Chapter II, we describe the activities of the WASH project and the program logic and in Chapter III we review the literature. In Chapter IV, we

outline the research questions that our proposed evaluation seeks to answer, and describe the design and data sources for each of the three components of the evaluation. Chapter V discusses the administrative aspects of the evaluation.

II. OVERVIEW OF THE WASH PROJECT

In this chapter, we provide context for the planned evaluation by describing the WASH project's activities and the mechanisms through which they are expected to affect outcomes, as depicted in the updated project logic and reflected in the estimates of the project's predicted economic rate of return.

A. Overview of the project and implementation plan

Prior to the start of the WASH project, the government of Cabo Verde had already taken a number of important preliminary steps toward improving the legal and regulatory framework in the WASH sector. The WASH project is furthering this work by reforming national policy and regulatory institutions through the NIRR activity; transforming inefficient utilities into autonomous corporate entities operating on a commercial basis through the URA; and improving the quality and reach of infrastructure through the IGF activity.

These three activities were designed to be synergistic, each contributing to the objective of establishing a financially sound, transparent, and accountable institutional basis for the delivery of water and sanitation services to Cape Verdean households and firms. The policy and institutional reforms to be implemented as part of the NIRR and the progress toward corporatization with the URA were both conditions for the funding provided as part of the IGF activity. Conversely, funding provided through the IGF could also help utilities make further progress toward becoming efficient corporations. Below, we provide details on the elements, scope, and implementation status of each activity (also see Table II.1).

Table II.1. WASH project activities

Geographic scope	Implementing contractor	Timeline
National Institutional and Regulatory Reform (NIRR)		
National	National Institutions Technical Assistance contract (NITA) to AECOM	Technical assistance ended in early 2017; most reforms have been institutionalized; new policies have been developed but not yet fully implemented.
Utility Reform Activity (URA)		
Santiago island, with some support to Maio island	Assistência Técnica à Águas de Santiago (ATAS) contract to Seureca	The new muti-municipal corporatized utility began serving most of Santiago in mid-2016 and will take over service provision to Praia in mid-2017; technical assistance ends in November 2017
Infrastructure Grant Facility: Water and Sanitation Fund (FASA)		
Projects awarded on all islands other than Boa Vista and São Nicolau	Varies (construction firms)	Most tranche 1 projects (awarded in 2014) are complete but work continues on Sal and Fogo; tranche 2 projects (awarded in 2015) are all still under way but will be completed by November 2017
Infrastructure Grant Facility: Social Access Fund for Water and Sanitation Connection (FAS)		
Santiago, São Vicente, Santo Antão	CitiHabitat and Movimiento África 70 on Santiago, Associação dos Amigos da Natureza on São Vicente and Santo Antão	Household water connections and improved sanitation were completed between 2014 and 2015

1. National Institutional and Regulatory Reform (NIRR)

The NIRR activity involves expanding the functions of some of the existing WASH agencies and creating several new agencies responsible for resource allocation, strategic planning, and coordination within the WASH sector (see Box II.1). The activity aims to create a national framework for a sector which has traditionally been scattered through various government entities at the national and municipal levels. The new and altered agencies are charged with improving management of the WASH sector by (1) developing policy frameworks and revised legislation to clarify the responsibilities of each entity and to define national priorities for scarce resources, (2) instituting a system for fair and transparent tariff-setting, and (3) enhancing environmental protection, including regulating waste-water and testing water quality.

> **Box II.1. Overview of key WASH agencies**
>
> **National Agency for Water and Sanitation** (*Agência Nacional de Água e Saneamento* [ANAS]): newly-created agency responsible for policy and planning, includes Social and Gender unit; also serves as technical regulator for water quality
>
> **National Water and Sanitation Council** (*Conselho Nacional de Água e Saneamento* [CNAS]): newly-created advisory board for ANAS
>
> **Economic Regulatory Agency** (*Agência de Regulação Económica* [ARE]): existing agency newly empowered to regulate water tariffs and quality of service provision by water utilities
>
> **General Directorate of the Environment** (*Direcção Geral do Ambiente* [DGA]): existing agency's responsibilities expanded to include water and waste-water quality oversight

To support the strengthened WASH agencies, the NIRR activity includes development of several policy tools that will serve as the frameworks for sector planning, resource allocation, and investment coordination: a Strategic National Master Plan (the Master Plan), a Strategic Environmental and Social Assessment (SESA), a National Strategy on Social and Gender Aspects and National Plan on Information, Education, and Communication (IEC) for the WASH sector. Prior to the reform, national policies did address sanitation and no institution was responsible for regulating issues related to sanitation, but this critical aspect of WASH is now fully integrated. New standards for water quality and waste-water discharge, including appropriate waste-water treatment technologies and associated standards for waste-water reuse, will also be developed to support environmental protection. To support the newly empowered regulator, the NIRR activity also includes an assessment of the financial state of utilities nationally, and on Santiago particularly. The assessment aimed to identify the true cost of the existing systemic sector inefficiencies, the impacts of these costs and inefficiencies on cost of service rates, and tariff and regulatory strategies for transitioning to a financially self-sustaining system. Finally, the NIRR activity includes strengthening the capacity of national institutions to implement IEC campaigns to create a culture of paying for services and improve knowledge of recommended WASH behaviors (handwashing with soap, safe storage of water, water conservation practices, etc.).[1]

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[1] The original plan for the NIRR also included IEC to inform the planning process, solicit public input on new regulations, and explain the role of the public in tariff-setting, but during implementation the scope of the IEC campaign was re-focused.

Since the institutional and regulatory reform activities are at the national level, the entire population of Cabo Verde benefits from the NIRR activity. AECOM International Development Europe supported implementation of the NIRR activity under the National Institutions Technical Assistance (NITA) contract. To date, progress has been made in many of the WASH sector agencies.[2] ANAS has been created and is operating independently of technical assistance as of late 2016, though it is still not fully staffed. ARE has established a provisional tariff for AdS and is working on setting a new tariff for recycled waste-water that can be used for agricultural and industrial purposes. DGA has not taken advantage of the technical assistance made available through the NIRR activity but some progress has been made on establishing new standards. The SESA has been finalized and the process of developing the Master Plan is complete at the national level, but several island-level Master Plans that were not funded through the WASH project have not yet been developed. The financial assessment of utilities was completed and ANAS is expected to launch its first IEC activities in the final months of the compact.

2.   The Utility Reform Activity (URA)

The URA focuses on creating AdS, a new corporatized, multi-municipal utility (MMU) for the island of Santiago. Before the URA, households connected to the piped water network in Praia (the national capital, accounting for roughly half the population of Santiago) were served by the national power and water utility, ELECTRA, and households that did not have a household connection to the piped water network were served by the Water Distribution Agency of Praia (*Agência de Distribuição de Água* (ADA)). Each of the other eight municipalities on Santiago had its own water and sanitation department (known by the acronym SAAS (*Serviços Autónomos de Água e Saneamento*) in Portuguese). In contrast, as a corporatized MMU, AdS is intended to have financial and managerial autonomy from the government. Although it is owned by the municipalities, as a corporation AdS should have a distinct legal identity, transparent financial accounts that are segregated from other government operations, and the ability to make operational decisions independent of the government (USAID 2006). By operating on commercial principles, realizing economies of scale, and eliminating redundancies, AdS is expected to improve operational efficiency and quality of service, reduce non-revenue water[3], and increase the number of water connections relative to the previous status quo. AdS is also expected to incorporate social inclusion objectives into its operations. The URA supported the creation and strengthening of AdS by providing technical assistance to facilitate the legal process of incorporating AdS and helping the new company establish its operating procedures, including social and gender practices and IEC campaigns. The WASH project also provides AdS with information and supplies to reduce non-revenue water through improved commercial and technical management practices.

Since all of the island of Santiago will be served by AdS as a result of the URA, the activity's beneficiaries consist of the island's entire population, which was approximately 278,000 people in 2010 (MCC M&E Plan 2016). MCC expects the URA to serve as a blueprint

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[2] As the Compact comes to a close, LuxDev is launching a new project that will continue several of the activities initiated under the WASH project, including technical assistance to ANAS and support for the annual WASH sector monitoring yearbook.

[3] Non-revenue water is the difference between the volume input to the water supply system and the volume of water billed to registered customers or consumed by authorized users (AWWA 2012).

for the creation of multi-municipal corporatized utilities in other parts of the country. If there is a national-scale up of the URA during or after compact completion, the URA could benefit the population of other islands as well. Indeed, since the URA was designed, the WASH project has agreed to support technical assistance for the corporatization of the SAAS on the island of Maio (Appendix A, Table A.1 summarizes the utilities that currently serve the different islands).

Seureca supported implementation of the URA under the *Assistência Técnica à Águas de Santiago* (ATAS) contract. AdS gradually took over from the SAAS during the second half of 2016 and December 2016 was the first month in which AdS invoiced all of its customers outside Praia. It is anticipated that AdS will begin serving Praia by June 2017. The non-revenue water reduction activities have also only recently begun, with MCA-CV procuring vehicles, replacement meters, and other equipment for AdS. Because the URA fell behind schedule due to the legal and political complexities of establishing the new corporation, and also because management and operations at AdS will evolve gradually, many of the reform's effects at the utility and household level will only become apparent after the compact ends in November 2017.[4]

3. The Infrastructure Grant Facility (IGF)

The IGF funds infrastructure and capital improvements in the WASH sector. The IGF activity is intended to support the national reforms, incentivize utilities to enact corporatization reforms, and support corporatizing utilities by (1) reducing technical losses or improving quality of service through improved infrastructure, (2) improving access to water and sanitation infrastructure and generating new revenue by expanding water and sewer networks, and (3) providing important health benefits by improving the quality of water delivered. During implementation, the IGF was split into two funds (see Box II.2).

FASA. The FASA provides funding on a competitive basis to water and sanitation

> **Box II.2. IGF funds and types of grants**
>
> **Water and Sanitation Fund** (*Fundo de Agua e Saneamiento* [FASA]) provides grants to utilities for infrastructure projects:
> - network rehabilitation
> - network expansion
>
> **Social Access Fund for Water and Sanitation Connection** (*Fundo de Acceso Social* [FAS]) provides grants to non-governmental organizations to subsidize household connections to:
> - the piped water network
> - the piped water network and improved sanitation
> - improved sanitation

utilities nationwide to improve or expand their infrastructure. The FASA supports the URA by offering funding only to SAAS that are making incremental progress toward corporatization. Municipalities and corporate utilities could apply for funding to build new primary or secondary distribution lines, replace leaky pipes, or rehabilitate or upgrade treatment facilities; FASA funds could not be used to directly subsidize household connections, which was the role of the FAS. Projects were selected by MCC on the basis of the economic rate of return and other criteria, including environmental aspects and social and gender inclusion. All FASA projects include an IEC component to explain the infrastructure development to households in the project's

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[4] LuxDev plans to provide technical assistance to AdS after the Compact ends.

catchment area, encourage more households to connect to the network, and promote a culture of paying for water and sanitation services. The WASH project disbursed FASA funding in two separate tranches (see Appendix A, Table A.2, which provides a summary of all FASA projects).[5] Five million dollars were released through tranche 1 in 2014 to fund two studies and four water and sanitation infrastructure projects. In late 2015, the second tranche of FASA funding ($16 million) was contracted to nine water and sanitation infrastructure projects. Aside from one project that was canceled and two tranche 1 projects that are complete, all of the infrastructure projects are still ongoing, with expected completion dates between April and October 2017. FASA funding averaged $2.4 million per project and ranged from half a million for the island of Maio to $8 million for the island of Santiago, which also accounted for roughly half of the beneficiaries of FASA projects.

FAS. The FAS provides funding to local non-governmental organizations (NGOs) to increase access to water and sanitation infrastructure by subsidizing household connections and educating households about water, sanitation, and hygiene. The FAS project was targeted to poor and/or vulnerable households who met criteria specified in the activity's operating manual. The FAS provided three types of subsidies: domestic water connections for households that were not connected to the water supply network (type 1), water and sanitation connections for households that did not have improved sanitation and were also not connected to the water network (type 2a), and improved sanitation for households that already had a water connection (type 2b). FAS projects also conducted IEC sessions on topics including, but not limited to, demand creation for household water connections and/or sanitation, water conservation and handling at home, and use and maintenance of toilets. From October 2014 to November 2015, three NGOs implemented FAS projects on Santiago, São Vicente, and Santo Antão. Funding for the FAS included approximately $2 million from the WASH project, $400,000 from the Coca-Cola Africa Foundation, and cash and in-kind contributions from beneficiaries valued at approximately $500,000. FAS projects funded household water connections for almost 3,000 households, water connections and improved sanitation for over 600 households, and improved sanitation for almost 800 households.

B. Theory of change

The project logic (Figure II.1) illustrates how the activities support each other and translate into the short- and long-run outcomes that the project aims to affect. After a thorough review of the project's original logic as described in the evaluability assessment, the evaluation team worked with MCC and MCA-CV to (1) revise the project logic to provide more clarity on the causal pathways between the activities and the outcomes and (2) update the activities to align with how the project was actually implemented. The new version of the project logic serves as the framework for the evaluation design.

The NIRR activity will lead to important changes in how the sector functions and is regulated. Although the NIRR activity is the foundation for the URA and IGF, the latter two activities are the driving forces behind most of the changes that are anticipated at the utility and

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[5] LuxDev is currently working with ANAS to set up something like the FASA. The new entity will fundraise for resources for WASH infrastructure projects and distribute the funds it raises through a competitive process that is consistent with the Strategic National Master Plan.

household levels. The URA will address many of the challenges faced by AdS's predecessors, resulting in better performance on a variety of measures. The IGF supports the URA by offering a powerful incentive (FASA funding) for the eight SAAS on Santiago to agree to join in the corporatized AdS. In addition, both components of the IGF (FASA and FAS) will improve access to water and sanitation for households and contribute to stronger utilities (including AdS) in a number of ways:

- network improvements funded by FASA could reduce technical losses (new pipes reduce the amount of water that leaks out of the system) and commercial loses (illegal connections are identified and shut down during the process of improving existing infrastructure, so that less water is consumed but not paid for)

- the new customers who get connected to the piped water network thanks to FASA and FAS will increase utilities' revenue base

- by prioritizing connecting the last few households in neighborhoods that otherwise have high rates of connection to the piped network, the FAS could also reduce AdS's operational costs by allowing the utility to close public fountains (*chafaris*) that were previously the source of water for households that did not have a household connection

Finally, the IEC components of all three activities are intended to improve the population's knowledge about the importance of clean drinking water, proper hygiene, and sanitation and shift attitudes about the importance of paying for water and sanitation services so that the increases in access generated by the project are sustainable even after the compact ends.

Together, the outcomes of the three WASH project activities are envisioned to lead to a financially sustainable and effective AdS that provides a high level of service to customers on Santiago. Reductions in non-revenue water will reduce the costs of distributing water, and the new tariff is intended to distribute these costs more equitably across households so that the poor no longer pay more per unit of water consumed (both in terms of their time to collect water and in monetary terms).[6] As AdS gradually becomes financially sustainable, the implicit subsidy[7] provided by the government will be reduced. Improved management and efficiencies will attract new investment, as the financial and social returns will be greater. This increased investment will promote the sustainability of the processes put in motion by the WASH project.

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[6] As noted in the constraints analysis, households that are not connected to a piped water network must purchase water at an even higher price from tanker trunks or walk to collect water from *chafaris*, which also suffer from service disruptions (Government of Cabo Verde 2010). On average, households included in the baseline survey for the WASH project spent almost an hour a day fetching water from public sources or tanker trucks. The burden of fetching water is largely the responsibility of adult women and girls between the ages of 12 and 17 (EBES 2013). In remote rural areas, women may travel up to four to five kilometers when transporting water from the source to the home (Bosa 2015).

[7] Funding provided by the government through a channel that is not easily identifiable (such as budgetary support to the municipality) to cover the difference between a utility's costs and operating revenue.

Ultimately, with the reductions in the implicit subsidy, the government can reallocate those funds to productive spending, thereby stimulating the economy and contributing to poverty reduction. At the household level, the reduction in costs of water (enabling poor households to consume more water) and the improved quality of service allows households to be more productive by freeing up time and money for schooling or income-generating activities and reducing the amount of time lost to diarrheal diseases, all of which contribute directly to poverty reduction.

Whether or not the anticipated outcomes and impacts are achieved depends largely on the assumptions that are implicit in each step of the causal chain (see Table II.2). The evaluation will explore all but the last two assumptions (those related to increased government productivity and the final link to poverty reduction).

Box II.3. Heterogeneity in project context, implementation, and outcomes

Each step of the project logic could unfold differently across the nine islands, and even across municipalities on the same island, due to the diversity of the contexts and the local stakeholders involved in implementation.

For example, implementation of a key component of the NIRR activity – developing island-specific master plans – might not be completed on all islands since the project does not provide technical support or financial resources for this process.

At the municipal level, effects of the project will depend on baseline conditions, including the prior local tariff and quality of service provided by ELECTRA and the eight SAAS on Santiago.

The evaluation will explore how these variations in context and implementation might have affected the project's outcomes in different settings.

Figure II.1. WASH project logic (June 2017 version)
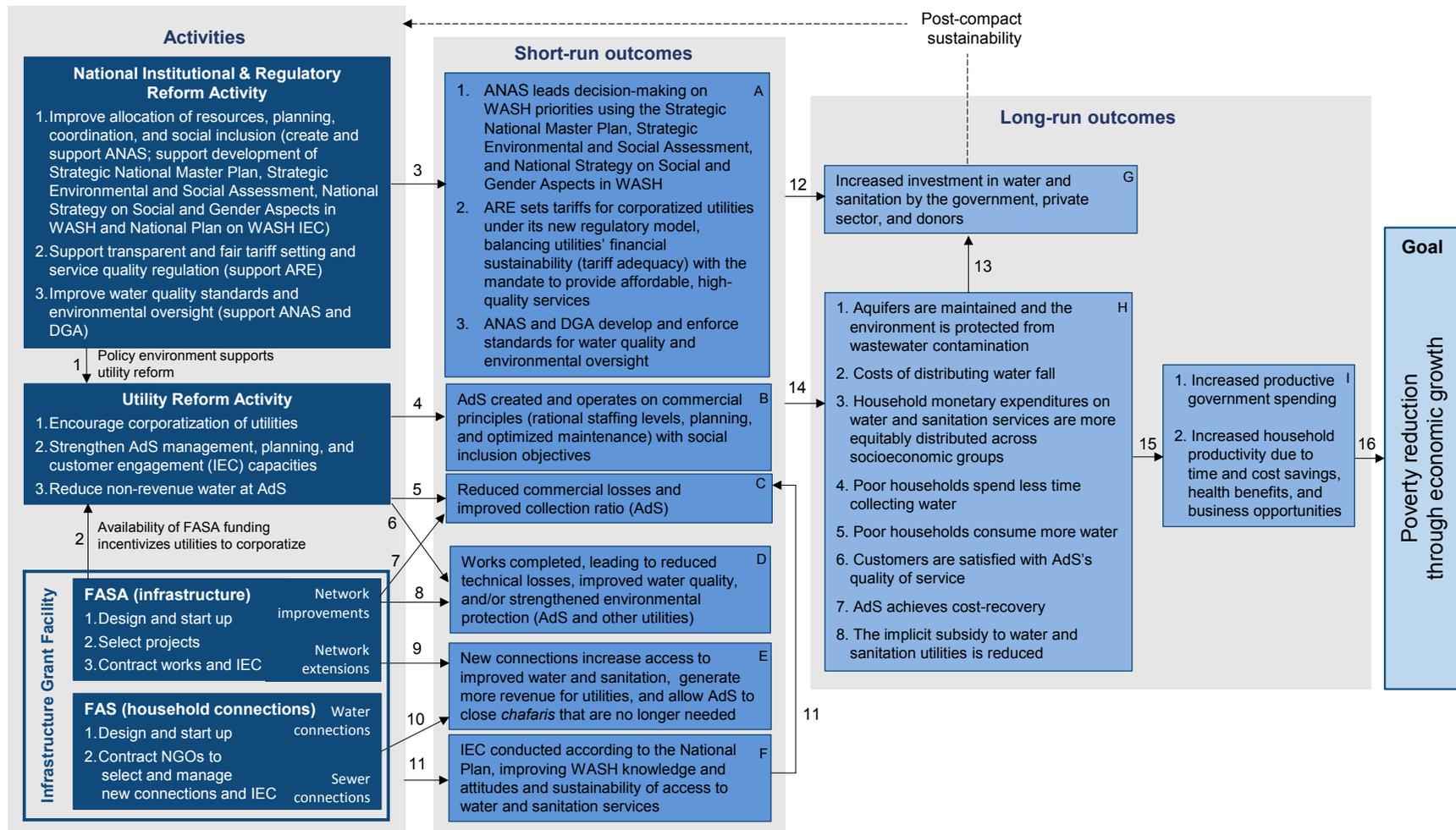
Table II.2. Assumptions underlying the WASH project logic

Causal link in the project logic	Assumption	Included in evaluation
1	NIRR creates a policy environment in which corporatized utilities can succeed	X
2	FASA funding is a meaningful incentive for SAAS to enact corporatization reforms	X
3	Responsibilities and authorities of ANAS and ARE are clearly delineated so that the two institutions can effectively complement one another ARE has the information it needs to be able to set new service quality regulations and tariffs that balance the competing objectives of financial sustainability and affordability - in particular, information from AdS about the efficiency of its operations and a government system for poverty registration so that water subsidies can be targeted to the poor	X
4	AdS is capable of operating on commercial principles without technical assistance after the compact end date - in particular, the AdS board and management are actually independent of political considerations and the government upholds its responsibilities related to retrenchment of SAAS employees not hired by AdS (passage of enabling legislation and funding for severance)	X
5-6	AdS recognizes and implements actions to reduce commercial and technical losses and to improve the collection ratio – in particular, MCA-CV provides AdS with plans and equipment to implement changes in business practices and maintenance procedures	X
7-9	FASA projects contribute to reductions in commercial losses, improved collection ratios, water quality, and/or environmental protection – in particular, the FASA selected projects with the potential to have these effects, the projects were completed according to plan, and will be sustainably managed by the corporations and SAAS that operate them	X
9-10	Households connect to FASA network extensions; these new customers and FAS beneficiaries pay their bills and stay connected to the network	X
9-10	FASA network extensions and FAS household connections are sufficient for AdS to be able to close some *chafaris*	X
11	IEC campaigns (embedded in all three activities) reach the target audiences and contain appropriate and memorable content that enables households to manage their water consumption and changes attitudes about the importance of paying for services	X
12-13	Improved policies, utility management, and customer attitudes about paying for service increase the returns to investments in the WASH sector in Cabo Verde The government continues to fund ANAS to implement the key strategies adopted under the WASH project	X
14	Improved policies, utility management, and customer attitudes are sufficient to lead to changes in these long-run outcomes	X
15	The government reallocates savings from reduced implicit subsidies into productive spending rather than other unproductive categories such as supporting ELECTRA, the port in Praia, or the national airline	
15	Increased water consumption and/or improved water quality lead to reductions in disease and/or new business opportunities that depend on water or sanitation; households reallocate time and money to income-generating activities rather than leisure	X
16	Productive government spending translates into faster GDP growth than unproductive spending	

C. Economic rate of return and beneficiary analysis

MCC uses the economic rate of return (ERR) to assess whether its projects are sound investments. The ERR is the discount rate at which the benefits of a project are exactly equal to its costs; a higher ERR implies relatively higher benefits and lower costs. Prior to the compact, MCC developed an ERR model for the WASH project based on two benefit streams: (1) faster economic growth achieved by increasing productive government spending as savings from the implicit subsidy that the government provides to water utilities are reallocated primarily as a result of the NIRR and URA activities and (2) economic benefits from each project funded by the FASA.

1. Review of the ERR model

The ERR model for the NIRR and URA projected that the government will initially save money from not having to subsidize the utilities on Santiago as AdS becomes financially sustainable, and that starting in 2018 (after the compact ends) there will be equivalent savings from the rest of the country as other SAAS also corporatize. The two most important assumptions in the calculation of the ERR from the NIRR and URA activities are (1) the value of the assumed savings reallocated to productive spending[8] and (2) the rate at which increases in productive spending translate into faster economic growth. The value of savings reallocated to productive spending is assumed to be driven by 50 percent reduction in commercial losses (from 20 to 10 percent) and a 42 percent reduction in labor costs (from 12 to 7 staff per 1,000 connections) as AdS operates with a much leaner workforce than the former SAAS. In contrast to the project logic, the ERR does not assume that the WASH project creates additional connections to the piped water or sanitation networks or leads to increased water consumption—either of which could increase utilities' revenues—nor does the ERR include any reduction in physical loss (assumed to be 30 percent), despite the efforts to reduce non-revenue water as part of the URA and IGF activities. Thus, some potential benefits from the project might not be accounted for, and as a result, the assumed value of the reduction in the implicit subsidy might be understated.

On the other hand, the ERR might have been overly optimistic, since it assumed that within three years of the compact ending, the value of corporatization of SAAS on other islands would be equal to the savings generated by creating AdS on Santiago. Since the population served by all SAAS outside of Santiago is equal to only roughly 60,000 (see Table A.1), it seems unlikely that corporatization of all other SAAS could come close to equaling the savings from corporatizing the SAAS on Santiago (which collectively served a population of almost five times as many people).

The assumed rate of increase in GDP growth due to a reallocation of government spending from non-productive categories to productive categories was based on an analysis of seven fast-growing economies[9] (Moreno-Dodson 2008) which found that reallocating 1 percent of unproductive spending (social security and welfare, recreation, and other economic services) to

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[8] The ERR assumes equal chances that either 100 percent or 70 percent of savings will be reallocated to productive spending.

[9] Korea, Singapore, Malaysia, Thailand, Indonesia, Botswana, and Mauritius.

productive spending (general public services, defense, education, health, housing, transportation, and communications) led to a 0.35 percent increase in growth of GDP per capita. However, in a subsequent paper (Bayraktar and Moreno-Dodson 2010) that compared the relationship between public spending and growth for a mix of countries with different growth patterns (mainly in Latin America),[10] the link between public spending and growth was economically and statistically strong only for the seven countries in the fast-growing group. While Cabo Verde's annual GDP per capita growth has been on par with the seven fast-growing economies since 1981, when data for Cabo Verde first became available (The World Bank Databank, World Bank website), the extent to which the results can be generalized to Cabo Verde is not clear. In the past four years, Cabo Verde's economy has not grown nearly as fast, and at the start of the compact, GDP per capita in Cabo Verde was similar only to Indonesia's among the seven fast-growing countries (both less than $4,000 in current U.S. dollars), while the other six countries were far richer (ranging from almost $6,000 in Thailand to over $54,000 in Singapore); even the two other African countries were both upper-middle-income countries according to the World Bank's categorization (Cabo Verde is lower-middle income). In any case, 0.35 percent is the average for the group of fast-growing countries and might not reflect the expected experience of any given country, even among the fast-growing group. Moreover, reallocations from unproductive to productive spending as a result of the WASH project might have been at the municipal level, rather than the national level (since the national government transfers funds to the municipalities to provide decentralized services, including water and sanitation), and it is not clear that the national conversion rate estimated by Moreno-Dodson would apply at the municipal level rather than the national level. In summary, the key assumption that Cabo Verde would experience a similar rate of growth due to a reallocation of government spending from unproductive to productive sectors seems questionable given the differences between Cabo Verde and the countries for which the relationship was estimated, and differences in the relationship between national spending and growth versus municipal spending and national growth.[11]

Given the uncertainty about what projects would be funded by the FASA when the ERR was estimated, MCC developed a strategy that relied only on assumptions about the overall ERRs of specific projects without specifying the sources of benefit streams for these projects. In particular, MCC simulated the ERR of the FASA by taking random draws (reflecting the uncertainties in the application process) from a uniform distribution of potential project-level ERRs ranging from 5 percent to 25 percent, based on information such as feasibility studies conducted by other donors.

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[10] Chile, Costa Rica, Mexico, the Philippines, Turkey, Uruguay, and Venezuela; chosen mainly for the availability of data on GDP per capita growth rates from 1960-2005.

[11] To estimate the relationship between increased productive spending and growth for Cabo Verde specifically, we would need several decades of data on the share of spending that was productive and GDP growth in subsequent years. To minimize confounding by other trends, it would also be important to control for a number of other time-varying influences on the national economy (such as the price of oil, the strength of the economy in countries that account for large shares of the tourism business in Cabo Verde, etc.). The two aforementioned studies both also used cross-sectional variation to be able to estimate this relationship. Given data limitations (GDP data has been available for Cabo Verde for 20 years less than the other countries included in those studies), it is unlikely that it would be possible to estimate the relationship between productive spending on growth, and even if it were possible to estimate, it would not be advisable to interpret this as causal.

Finally, we note that direct economic benefits from allowing businesses and households to be more productive are not included in the ERR, in contrast to the project logic which envisions that all three project activities will contribute to increased household productivity. As more households are connected to network water and spend less time collecting water, that time could be reinvested in productive activities such as additional schooling or income-generating activities; access to piped water and improved quality of service could also allow households to undertake new income-generating activities such as gardening or animal husbandry that rely on a dependable water supply. Moreover, to the extent that tourism and construction are major drivers of economic growth, and because it is anticipated that reforms related to the treatment of waste-water for irrigation and construction could make more water available to these industries at lower costs than they faced prior to the compact, this seems like another more direct route toward economic growth than through national fiscal policy.

2. Using the evaluation to inform the ERR

The ERR is based on two key assumptions that are not measurable, so we will not be able to re-calculate the ERR, although we will attempt to validate as many other aspects of the ERR as possible.[12] First, the evaluation will not be able to determine whether the government has reallocated savings on implicit subsidies to productive spending since there is no way to know what the level of productive spending would have been in the absence of the WASH project.[13] Second, the evaluation will not be able to confirm the rate at which increases in productive spending translate into faster economic growth, since we do not have enough data on the levels of productive and non-productive spending and economic growth rates to be able to model that relationship for Cabo Verde. Nonetheless, the government's implicit subsidy to AdS is a key parameter that will be assessed through the process evaluation. The ERR was based on reductions in the implicit subsidy to AdS compared to the combined implicit subsidy to its predecessor SAAS and ELECTRA. Since none of those utilities was required to be transparent about their finances, we will not be able to validate the reduction in the implicit subsidy in the ERR. Rather, the process evaluation will investigate how the implicit subsidy to AdS changes in the first three years of AdS's existence using AdS's records on its costs and revenues. This method will likely be able to capture most of the improvements in AdS's financial position relative to its predecessors, since the labor savings are known (see next paragraph) and the reductions in non-revenue water would not have been expected to be immediate anyway (although that is how they were modeled in the ERR). If we find that AdS is not able to recover its costs, then the question of whether the government would reallocate savings into productive spending and the rate at which increased productive spending would translate into faster economic growth are both moot.

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[12] Updating the ERR was not in the scope of work for the evaluation contract.

[13] We will interview the Ministry of Finance as part of the evaluation data collection (see Section IV.C.1). As part of that interview we will ask about whether the government is investing more, less, or the same amount in other non-productive spending categories (such as investments in ELECTRA, the port, or the national airline) versus productive spending categories, and the forces (political or economic) which might be driving these changes. However, even if the qualitative data are able to shed some light on whether spending patterns have shifted and why, we will not be able to conclusively attribute these changes in productive government spending to the WASH project.

Digging deeper into the components of AdS's costs and revenues, the evaluation will explore whether AdS has achieved the major reductions in labor costs and non-revenue water that were assumed in the ERR.[14] At the time the ERR was developed, MCC had to make a number of assumptions about the initial levels of these parameters, as well as the change that could be expected as a result of the project. With more information now available, the evaluation will validate the feasibility of the assumed levels as well as the changes in key parameters. For example, due to the legal process that was required to downsize staffing at AdS relative to its predecessor SAAS, it should be possible to be very specific about the labor cost savings achieved by corporatizing AdS. The evaluation will also consider other factors which could affect AdS's financial sustainability, such as the number of connections to the network, the quantity of water consumed, an non-labor costs of production, even though the ERR did not assume that the WASH project would affect these parameters. The evaluation will also investigate the savings generated by corporatization of the SAAS on Maio, which is related to the assumption that the savings from corporatizing all SAAS outside of Santiago would be equal to the savings from creating AdS. Finally, for the FASA component of the ERR, we will review each project's ERR as part of our process evaluation. MCC and MCA-CV plan to update the ERR calculations for each specific FASA project before the compact ends. We will work with MCC and MCA-CV to identify parameters in the Santiago FASA project ERRs (such as household time savings or water consumption) so that we can include questions related to these parameters in the evaluation's data collection plans.

3. Beneficiary analysis

MCC's beneficiary analysis complements the ERR model by examining the distribution of benefits among different groups of beneficiaries. The current beneficiary analysis examines the benefits by income category. It projects that the project will benefit the extremely poor and poor (defined by a daily per capita income of less than $US1.25 and $US2, respectively) by $US0.05 and $US0.18, respectively, for every dollar that MCC spends, based on the assumption that the extremely poor and poor receive 4 percent and 15 percent of the value of the project's benefits, respectively. Although the evaluation will not be able to estimate the total value of the project's benefits (because we cannot identify the value of economic growth due to increased productive government spending and because the resources for the evaluation are insufficient to estimate the value of all of the FASA projects), we will estimate the value of monetary and time savings accruing to beneficiaries in different income categories.

III. LITERATURE REVIEW

The related goals of expanding access to networked water and sanitation services, improving the quality of service provided by water and sanitation utilities, and strengthening their financial health are urgent issues for governments and donors around the world. While best practices exist for technical challenges such as reducing non-revenue water or improving utilities' bill collection ratio, there is still much debate about which ownership, management, and regulatory models are most effective. Questions related to reforms of institutions and policies are inherently difficult to

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[14] We might not be able to distinguish between commercial and technical losses as per the assumptions in the ERR, but ultimately it is only the sum of the two components (non-revenue water) that matters in terms of translating into a reduction in the implicit subsidy.

evaluate objectively since it is rarely known what would have happened in the absence of the reform. Moreover, caution must be exercised when generalizing lessons learned from one context to another, given the importance of a myriad of political, cultural, economic, and geophysical factors in determining the outcome of a particular reform. Nonetheless, to situate the evaluation of the WASH project in the broader literature, in this chapter we review the existing evidence on corporatization of water utilities, strategies to improve utilities' financial condition by reducing non-revenue water, and approaches to expand access to networked water and sanitation services. We end the chapter by identifying gaps in the literature and discussing the potential contributions of this evaluation.

A. Summary of existing evidence

1. Corporatization to improve utility performance

It is widely recognized that operations and oversight of utilities need to be independent of one another, or else there is unlikely to be sufficient incentive to identify challenges or to be proactive about solving them (Berg 2013; Baietti Kingdom and van Ginneken 2006). Different combinations of ownership, management, and regulatory authority have been tested over the years, with the popularity of some models waxing and waning. For example, since the 1990s privatization (in which a private company owns and manages the utility) has been promoted as a means of improving the financial sustainability and performance of utilities by bringing in external sources of finance and motivating utilities to provide better services (more—and more satisfied—customers are hypothesized to lead to more revenue which translates into more profit) (Araral 2009). In recent years, however, privatized utilities in many cities (for example, Accra in Ghana and Maputo in Mozambique) have reverted to government management (Lobina, Kishimoto, and Petijean 2014) as privatization has rarely succeeded in addressing the complex web of fundamental challenges that previously constrained public utilities (Baietti Kingdom and van Ginneken 2006). Indeed, eight years after ELECTRA—the largest utility in Cabo Verde—was partially privatized, the private shareholders left the company despite suffering significant financial losses because the government prevented tariff increases that were necessary for financial sustainability (Marques et al. 2013).

Corporatization is an alternative model to privatization that might be a more feasible approach to disentangling the operations and oversight of publicly-owned utilities. Under this model, the utility becomes a corporation that is still owned by the government (either national or municipal), but it has a distinct legal identity, transparent financial accounts that are segregated from other government operations, and the ability to make operational decisions independent of the government (USAID 2006). Corporatized utilities have the potential to exhibit the six characteristics of well-performing public water utilities identified by Baietti et al. (2006) through extensive case study research: (1) autonomy in practice as well as on paper, to prevent political interference by the government from undermining performance; (2) external accountability through performance standards, benchmarking, and monitoring by civil society[15]; (3) internal

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[15] Berg (2013) also emphasizes the role of citizen participation in regulating state-owned water utilities. For an extensive review on the topic, see Muller, Simpson, and van Ginneken (2008), which considers over a dozen tools to make utilities more accountable to their customers, but ultimately concludes that "despite the substantial theoretical and advocacy work that has been done on tools for accountability, we found little data on their practical benefits and performance and therefore cost-effectiveness."

accountability to motivate and reward management and staff for achieving targets; (4) use of market-oriented approaches such as outsourcing and market-testing to reduce costs; (5) customer orientation to promote satisfaction and ultimately bill-paying; and (6) a corporate culture that inspires staff and managers to excel. Baeitti et al. (2006) emphasize that although a ring-fenced government department *can* establish the recommended governance processes and operate like a corporation, and while a corporation *might not* exhibit all six of the desirable characteristics, the most promising approach for creating a well-operating utility is to create a corporation.

As noted previously, it is very difficult to evaluate the effects of corporatizing a utility, since it is impossible to know what would have happened over that same time period had the utility not been corporatized. Accordingly, the best available evidence relevant to our evaluation in Cabo Verde comes from case studies of other utilities in Africa that have corporatized, keeping in mind the importance of differences in context, the reform process, and the specifics of how each corporation is structured. Our literature review identified three relevant cases:

- **The National Water and Sewerage Corporation, Uganda**, which decentralizes responsibilities to service areas and compensates local managers in part based on achievement of minimum targets. These strategies which were implemented starting in 1998, have transformed the previously grossly inefficient utility: between 1998 and 2008 service coverage increased by 50 percent, the number of new connections each year increased by a factor of seven and the total number of metered connections increased five-fold, the number of staff per 1,000 connections fell by 80 percent, the collection rate increased by 50 percent, and the share of non-revenue water fell by almost half (Mugisha and Berg 2008; Muhairwe 2009; Berg 2013; Baietti et al. 2006; Banerjee and Morella 2011; USAID undated).

- **Johannesburg Water, South Africa**, a corporation created in 2001, which initially operated under a management contract that aimed to improve customer service, make progress toward cost recovery without large tariff increases, and empower the management of the new company. Although there were some challenges with the transition (for example, Johannesburg Water had to depend on the city for meter reading, billing, and revenue collection), the corporation benefitted greatly from the collaboration with the private provider in the company's early years (Marin et al. 2009; Smith 2006; Baietti et al. 2006; USAID undated). However, we were not able to find any updates on how Johannesburg Water has performed since 2009, which would be the best measure of the success of the corporatization process and the additional support provided by the initial management contract.

- **Office National de l'Eau et de l'Assainissement, Burkina Faso**, which was transformed into a state company with legal autonomy in 1994, and has also benefitted from a performance-based contract with an international operator, even though in practice the operator mainly served in an advisory role (Marin Fall and Ouibiga 2010; Baietti et al. 2006). Over the six years of the contract period (2001-2006), the number of household connections grew by two-thirds, the share of non-revenue water remained under 20 percent, and the number of staff per connection fell by over a third; moreover, these positive trends continued in the first two years after the contract ended (Marin et al. 2010).

2. Strategies to reduce non-revenue water

There is a wide range of reference manuals available to managers of water utilities who need suggestions about strategies to reduce non-revenue water (DAI 2010; Baghirathan and Parker 2017; Frauendorfer and Liemberger 2010; Farley et al. 2008; Farley and Liembauer 2005). These manuals cover topics such as measurement of non-revenue water and conduct of water balances; leak management and control; use of district metered areas; and addressing customer meter inaccuracy, meter reading errors, and unauthorized consumption. However, none of them include more than hypothetical or anecdotal mentions of the changes that occur at utilities that adopt these measures. We identified just two case studies in Africa that reported on the savings achieved by implementing strategies to reduce non-revenue water:

- **The Nakuru Water, Sewerage, and Sanitation Company, Kenya,** conducted research in one district meter area to document the savings achieved by conducting leak detection and repair; in-field assessments of service connections; and customer meter testing, servicing, and sealing. The company's efforts reduced the volume and percentage of non-revenue water from approximately 50 percent to approximately 20 percent within 6-9 months without any investment in network rehabilitation (Ndirangu et al. 2013).

- **The water utility JIRAMA, Madagascar**, also used two district meter areas to demonstrate that major water (and thus financial) revenues could be saved by implementing non-revenue water reduction strategies such as a pressure management system and non-visible leak location (Ramanantsoa et al. 2011).

We did not find a similar plethora of manuals related to improving utilities' collection ratios, nor did we identify any studies reporting the results of utilities' efforts to increase the collection ratio although this is likely also a major challenge for many utilities, even if they do not like to admit it. Among more than 50 utilities included in a World Bank review of water and sanitation infrastructure in Africa, the majority reported collection ratios of over 90 percent. However, alternative measures of revenue such as those based on household survey data or a comparison of reported revenue, volume produced, and the tariff schedule, suggest that no more than half of the utilities that report such high collection ratios are actually so efficient, while the rest are likely forfeiting payments from up to a third of their customers (Banerjee and Morella 2011).

3. Approaches to expand access to networked water and sanitation services

Compared to the large literature on the effect of price subsidies on water consumption by the poor, there have been relatively few studies of the effects of subsidizing household connections or other strategies to help poor households stay connected:

- **Connection subsidies.** Over ten years ago, Komives et al.'s (2005) review of the literature identified only one study on connection subsidies, and we have not found any new additions to this literature since then.[16] The sole study on water connection subsidies (Debomy et al. 2005) used administrative data to assess the performance of a subsidy program that helped

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[16] An impact evaluation of a World Bank funded program to provide subsidized social connections to low-income communities in informal settlements in Nairobi, Kenya is currently underway. The program allows low-income households to take out a joint loan for the subsidized cost of connecting a metered standpipe in their shared residential compound to the piped water network (WSP 2015).

poor households in Abidjan, Côte d'Ivoire get connected to the piped water network. Although this program (and a similar one in Senegal) aimed to serve the poor, eligibility criteria related to land tenure excluded the poorest of the poor. Nonetheless, comparing water consumption and billing information from households with subsidized connections and those with fully-paid connections, the authors conclude that the program succeeded in identifying households that used relatively little water as would be expected of poor households. However, there was some leakage of the program to households who probably could have afforded to pay for their connection based on how much water they ultimately consumed and managed to pay for. Targeting efficiency and costs of administering a connection subsidy program depend on whether the eligibility criteria are assessed at the household or neighborhood level. In the longer term, connection subsidies could undermine the financial health of utilities that are unable to target consumption subsidies to the poor and instead subsidize the first block of water consumed for all customers (as in an increasing block tariff with a "life-line" block). The potential for cross-subsidization of poor consumers by wealthier consumers could be undermined if too large a share of the utility's customers are poor households who restrict their consumption to the subsidized block.

- **Alternative billing and payment arrangements.** Although it stands to logic that more frequent billing should make paying bills easier for households with variable income and limited ability to save, we found no evidence of the extent to which such arrangements could prevent households from losing their connections. Bill pay options through mobile banking platforms are a promising approach given the rapidly expanding coverage of mobile phones, but Hope et al.'s 2011 study of mobile water payment programs in Kenya, Uganda, Tanzania, and Zambia highlight the barriers to adoption. It is possible that the situation has changed in the past six years, but we did not find any update to this early assessment of the developing technology. A more recent pilot program in an informal settlement in Nairobi, Kenya suggests the potential for information technology to transform how bills are issued and read: using mobile phones, residents can send in their own water meter readings to receive their current water bill and transfer money using their mobile money account, allowing them to make payments when money is available (WSP 2015). Pre-paid meters are another relatively new technology that prevent poor households from going far into arrears on their water bills and which have been scaled up in parts of South Africa, including the city of Johannesburg. Because the meters will temporarily shut off water to customers whose balance on the account falls to zero, there have been challenges to the legality of the meters, but in 2009 the Constitutional Court's ruling in favor of meters ended these debates (Mail and Guardian 2009).

- **Simplified legal and administrative procedures.** Price is not the only barrier to connecting to the piped network that poor households face—the paperwork required to apply for a connection can be confusing and time consuming, and once approved the construction process often requires oversight during working hours when the adults in poor households are themselves obliged to be at work. Devoto et al. (2012) tested the effects of simplifying the application process for a household connection in Tangiers, Morocco. The local utility already offered a program that allowed households to buy a connection on credit (at full cost), but only 10 percent of households in the randomly-assigned comparison group took advantage of the program. In contrast, over two-thirds of households that were randomly assigned to be informed of the program and assisted with their applications got connected.

Clearly, lack of awareness of the availability of the credit option and/or the complexity of the application process were significant barriers that prevented many households from connecting to the piped water network. Since the study only tracked outcomes for the first five months after households were connected, it does not offer any insights on the sustainability of these connections.

- **Information on managing consumption and budgeting for utility expenses**. For households that are accustomed to physically transporting all of the water they use, the luxury of being able to turn on a tap and have access to an unlimited supply of water can be difficult to manage. Without training on how water bills are calculated, poor households with low numeracy skills may have difficulty planning how much they can afford to consume. Szabó and Ujhelyi (2014) conducted a randomized evaluation of a water education campaign in low income, peri-urban townships in South Africa. Households in the treatment group received visits from education officers who explained water meters, bills, and the approximate amount of water used during various activities. Using administrative billing data, they find that the education campaign increased total payments by about 30 percent, even though it was not very successful at changing households' understanding of their bills or consumption patterns (even after the campaign, less than 12 percent of households could identify their consumption from their bill). The study's findings demonstrate the potential for psychological nudges to have at least temporary effects on consumer behaviors, even as they suggest that educating consumers may be more difficult than anticipated.

B. Gaps in the literature and contribution of the WASH evaluation

Overall, the literature on the effects of corporatizing water and sanitation utilities is nascent. Very few utilities have publicly shared their experiences with strategies to reduce non-revenue water or improve their bill collection rates, and there is very little evidence on the sustainability of subsidizing poor households' connections to the network. In addition, despite an extensive search, we did not identify any studies of infrastructure grant facilities that were used to incentivize reforms, the approach being used for the FASA grants in Cabo Verde.[17]

Our evaluation of the WASH project in Cabo Verde will contribute to addressing some of these gaps. In particular, although we do not recommend a rigorous impact evaluation of the project, given the lack of a credible comparison group for the NIRR, URA, and FASA projects (as described in greater detail in Appendix B), our planned performance evaluation will provide useful evidence of the following: (1) changes associated with the transition from government provision of water and sanitation services to a corporatized MMU, (2) strategies for helping poor households get connected and stay connected to the network, and (3) the potential for infrastructure grants to incentivize reforms. Additionally, our evaluation will combine quantitative evidence on the changes associated with the project with a comprehensive qualitative analysis to understand how and why these changes are observed. Our evaluation will not only add to the overall evidence base, but will be particularly useful in guiding Cabo Verdean policymakers and donors, who may expand utility reform to additional islands or invest

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[17] de Kemp (2009) describes the findings of a qualitative evaluation of an infrastructure investment fund for the least developed countries, but the fund did not have eligibility criteria that were used to incentivize reforms.

in a new version of the FASA, and will be responsible for the sustainability of the reforms after the end of the compact.

IV. EVALUATION DESIGN

In this chapter, we describe our proposed design for the evaluation of the WASH project. We begin by listing the evaluation questions that the evaluation seeks to address and providing a brief overview of the proposed evaluation design, which includes three components. We then describe in further detail each of these components, the data they will rely on, and how we will draw on these data to answer the evaluation questions.

A. Evaluation questions

The evaluation of the WASH project seeks to answer the following questions proposed by MCC:

1. Were the Activities/Sub-Activities implemented as designed? What were implementation challenges and successes?

2. How did the political and economic incentives of different sector actors affect the implementation, sustainability, and efficacy of the WASH project? In particular, how did these incentives affect the reform portfolio, and the effects of the WASH project on customers, utilities, and the management efficiency of the sector?

3. a) Has the FASA mechanism efficiently selected the most effective, high quality projects as measured by the effects of the FASA projects on the socioeconomic well-being of households, the finances and management of the utilities, economy value-added and business and household productivity? b) Is the FASA a sustainable institution in Cabo Verde that is and will catalyze additional financing for WASH infrastructure?

4. a) Is the new tariff for AdS pro-poor (progressive), regressive, or neutral? b) Does the new tariff structure allow for cost-recovery by AdS?

5. Is there evidence that the interventions have resulted in the outcomes outlined in the program logic?

6. Was the WASH project as a whole effective at increasing the management efficiency and sustainability of the sector as measured by non-revenue water, collection ratio, and tariff adequacy? At reducing the (implicit) subsidy to the WASH sector at the municipal and national level?

7. What has been the effect of the WASH project on access to, quality and continuity of, and total costs of (direct and indirect) water and sanitation services for households and businesses in Cabo Verde? On gender and social equality in access to and cost of water and sanitation services?

8. How do the FASA and FAS projects' effects on these outcomes compare?

B. Evaluation design overview

To answer these questions, we propose a mixed-methods performance evaluation of the WASH project that consists of three components (Table IV.1). The first component is a **process**

evaluation of all three project activities using interviews, project documents, and administrative records to document how each activity was implemented, how implementation was influenced by the context (including the incentives different actors faced and the characteristics of the individuals and institutions involved in the project), how the three activities reinforced each other, and the potential for the project's effects to be sustainable.

The second component of the evaluation is **pre-post analyses** using household survey data from Santiago and secondary administrative data sources to explore the effects of all three project activities on households and utilities. At the household level, the pre-post analyses will track changes over time in access to water and sanitation services, the quality of these services, WASH behaviors, expenses on WASH services, and outcomes related to household productivity. We will use existing baseline household survey data and primary household survey data to be collected for the evaluation to estimate the combined effects of the NIRR and URA on Santiago, using a household sample that is representative of the whole island's population. We will also estimate the additional benefits from FASA and FAS among Santiago households who live in the FASA project zones or received subsidized household connections to the piped water network through FAS by oversampling neighborhoods in FASA project areas and complementing the representative sample with a separate survey of FAS beneficiaries. In addition to the survey data, we will draw from the new WASH sector monitoring yearbook for Cabo Verde and administrative statistics provided by AdS to describe how measures such as the number of connections to the network, the collection ratio, and the volume of technical losses have changed over time.

Finally, the third component of the evaluation will be a set of **case studies of FASA projects**. Using data from the process evaluation and pre-post analyses, plus additional interviews, focus group discussions, document review, and descriptive sub-group analyses of the household survey data, we will explore the rationale, implementation, challenges, and results of three FASA projects that represent the diversity of the portfolio.

In the rest of this section, we outline our plans for data collection and relate our proposed timeline to the duration of exposure to each of the project activities. In the subsequent sections of this chapter, we describe each evaluation component in further detail, including the outcomes, data sources, and analysis approach.

Table IV.1. Evaluation questions and proposed evaluation designs

Evaluation question Data sources:	Component 1: Process evaluation Primary qualitative data, document review, secondary data from utilities	Component 2: Pre-post analyses Primary and secondary household survey data, secondary data from utilities	Component 3: FASA case studies All data sources used in components 1 and 2
1. Were the Activities/Sub-Activities implemented as designed? What were implementation challenges and successes?	X		X
2. How did the political and economic incentives of different sector actors affect the implementation, sustainability, and efficacy of the WASH project? In particular, how did these incentives affect the reform portfolio, and the effects of the WASH project on customers, utilities, and the management efficiency of the sector?	X		X
3. a) Has the FASA mechanism efficiently selected the most effective, high quality projects as measured by the effects of the FASA projects on the socioeconomic well-being of households, the finances and management of the utilities, economy value-added and business and household productivity? b) Is the FASA a sustainable institution in Cabo Verde that is and will catalyze additional financing for WASH infrastructure?	X (3a and 3b)		X (3a)
4. a) Was the tariff reform outcome pro-poor (progressive), regressive, or neutral in Santiago? b) Does the current tariff structure allow for cost-recovery by Águas de Santiago?	X	X	
5. Is there evidence that the interventions have resulted in the outcomes outlined in the program logic?	X	X	X
6. Was the WASH project as a whole effective at increasing the management efficiency and sustainability of the sector as measured by non-revenue water, collection ratio, and tariff adequacy? At reducing the [implicit] subsidy to the WASH sector at the municipal and national level?	X	X	X
7. What has been the effect of the WASH project on access to, quality and continuity of, and total costs of (direct and indirect) water and sanitation services for households and businesses in Cabo Verde? On gender and social equality in access to and cost of water and sanitation services?	X	X	X
8. How do the FASA and FAS projects' effects on these outcomes compare?	X	X	X

In the analyses for all three components of the evaluation, we will pay particular attention to potential differences in outcomes among subgroups of interest. To better understand how the project addressed concerns about gender and social inclusion, we will present results for poor and/or female-headed households versus non-poor and/or male-headed households. Because Praia is distinct from the smaller municipalities on the rest of Santiago (due to population size and the differences between ELECTRA in Praia and the SAAS in the rest of the island), we will also present results for Praia separately from the other municipalities.

1. Data sources

The evaluation will rely on several data sources for the interim analysis in 2018 and the final analysis in 2020:

- **Program documents** which we will review in 2017-2018

- **Primary qualitative data** collected in 2017-2018 and 2020

- **Household survey data from the compact baseline** – a representative household survey on Santiago conducted by the *Instituto Nacional de Estatística* (INE) in 2011 several years prior to the accomplishment of any project activities that could affect household outcomes

- **Household survey data from the FAS baseline** – a survey of roughly half the FAS beneficiaries on Santiago, funded by MCA-CV in 2015 in the months before the households received their subsidized connections

- **Household survey data from the FASA baseline** – a survey of 849 FASA beneficiaries on Santiago, funded by MCA-CV in 2015-2016 prior to the completion of the infrastructure

- **Primary household survey data** collected for the evaluation in 2018 and 2020, comprising a representative sample of Santiago households (oversampling FASA project neighborhoods) and a sample of FAS beneficiary households from the 2015 baseline

- **AdS customer data and operational records** including bills and payment histories at the individual customer level for each invoice cycle as well as technical information about the operation of the water distribution network and management of the company (analysis of customer data subject to available funds)

- **Secondary administrative data** compiled annually for the WASH sector monitoring yearbook

The process evaluation will primarily rely on the program documents, primary qualitative data, and secondary administrative data; the pre-post analyses will use the primary and secondary data from the household surveys and the secondary data from administrative sources; and the case studies will draw on all of the data sources listed above.

2. Timing of data collection and duration of exposure

The interim data collection round in 2018 will gauge the status of utility- and household-level outcomes shortly after most WASH project activities have concluded, setting a point of comparison against which medium-run effects of the combined project activities can be assessed during the final evaluation round in 2020. Specifically:

- **NIRR:** While the effects of the NIRR activity could have begun to be felt prior to 2017, in many ways the interim data collection will also fall at a crucial juncture for the reform process, since it will be only a few months after the technical assistance offered through NIRR ends, and the new and reformed institutions will still be solidifying their roles. There was no qualitative baseline, but we will ask stakeholders to describe how (if at all) the sector operates differently since the conclusion of the NIRR. The interim round will focus mainly on implementation and the initial changes stemming from the reforms, whereas the final round will be a better opportunity to gauge the sustainability and effectiveness of the reformed institutions once they have had more of a chance to mature.

- **URA:** Although the URA has been making gradual progress for several years, the creation of AdS was delayed and the process of transitioning from the SAAS and ELECTRA to AdS is still under way. Given this timeline, the interim round will actually be more like a baseline for the URA, as it would be premature to expect AdS to have been able to achieve much within the first year of its existence (other than to reduce the number of staff relative to the combined workforce of the SAAS and ELECTRA). Rather, changes in service coverage and quality, and the financial sustainability of AdS, are more likely to become apparent between the interim and final evaluation rounds.

- **FASA:** The interim round will fall one to six months after the three FASA-funded infrastructure projects are completed on Santiago. We expect that it will be too early for these projects to have affected household outcomes, but we will work with MCA-CV and the implementers to better understand when the projects' benefits could have started to manifest. Without a baseline for the FASA project areas, we will only be able to compare outcomes between the interim and final evaluation rounds, but we expect that this period will capture most of the changes in outcomes due to the FASA investments. The final round will be an opportunity to explore the sustainability of these investments and the medium-term effects of the FASA projects on the households in the project catchment areas.

- **FAS:** In contrast to the other activities, we have an appropriately timed and located baseline survey for the FAS beneficiaries on Santiago, so we can already estimate pre-post differences during the interim evaluation round. The 2015 FAS baseline was conducted just before the subsidized connections were provided and we plan to follow up with the same households during the interim data collection, two to three years after the FAS-funded connections were completed. Based on the findings of the interim evaluation round, we will work with MCC to determine whether to revisit the FAS beneficiary households in the final data collection round. In particular, although FAS households will have had their connections for two to three years by the time of the interim data collection, it may be too soon to assess the ability of FAS households to stay current on their bills. This is because the former SAAS might not have operated normally during their final year of existence and more recently AdS has still been normalizing its business operations (including frequency of meter reading and billing). By the time of the interim data collection round AdS might not have issued enough bills to have a solid case for cutting off services to delinquent households.

3.   Outcomes included in the evaluation

Our proposed evaluation will include almost all outcomes in the updated project logic (Table IV.2; lettering and numbering in the "Outcomes" column links to Figure II.1) with the following caveats:

1. There are several short- and long-run outcomes that it will not be feasible for us to measure directly.[18] Instead, we will include whatever statistics related to these outcomes that we can obtain from ANAS, ARE, DGA, AdS, and other utilities in the process evaluation. It is our understanding that most utilities in Cabo Verde (AdS included) do not even have the ability to separately identify their technical versus commercial losses. Without substantial additional resources the evaluation will not be able to provide information that utilities and regulators do not already have (similarly for water quality, environmental protection, and aquifer status).

2. We will be dependent on AdS to provide us with the necessary information for us to be able to estimate the implicit subsidy, which we can define as AdS's costs minus revenues.[19] There was not a good baseline for implicit subsidy so it will not be possible to determine how the implicit subsidy has changed since prior to the creation of AdS, though we will measure changes over the first three years post-compact.

3. On the design trip to Cabo Verde in January 2017, we determined that it is not possible to estimate changes in long-run outcome I1 ("increased productive government spending"), let alone attribute any changes to the WASH project, given the paucity of data on municipal expenditures and the government's role in supporting other state-owned enterprises such as the national airline and the port. Although we will collect both quantitative and qualitative data related to long-run outcome I2 ("increased household productivity due to cost savings, health benefits, and business opportunities"), we will not be able to comprehensively examine all aspects of household productivity. A detailed measurement of household productivity would require a much more intensive data collection effort than is warranted, considering that we are unable to rigorously attribute changes over time to the impacts of the activities (as we noted above).

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[18] From the project logic (Figure II.1): C - Reduced commercial losses and improved collection ratio; D - reduced technical losses, improved water quality, and/or strengthened environmental protection; H1 - Aquifers are maintained and the environment is protected from waste-water contamination.

[19] It has been difficult to calculate the implicit subsidy to ELECTRA since the cost of water production were not explicitly delineated from the utility's energy business. Now that AdS purchases water from ELECTRA, it should be easier to calculate AdS's costs. Depreciation of assets is another complication since technically the infrastructure is owned by the government rather than AdS, and thus will not factor into the implicit subsidy as calculated based only on AdS's costs and revenues.

Table IV.2. Evaluation questions, outcomes, indicators, and data sources

Evaluation question	Outcomes[a]	Indicators	Data sources
1. Were the Activities/Sub-Activities implemented as designed? What were implementation challenges and successes?	A1. ANAS leads decision-making on WASH priorities using the Strategic National Master Plan, Strategic Environmental and Social Assessment, and National Strategy on Social and Gender Aspects in WASH	• ANAS established • ANAS adequately funded • Strategic National Master Plan, Strategic Environmental and Social Assessment, National Strategy on Social and Gender Aspects in WASH, and National Plan on WASH IEC adopted	Key informant interviews (MCC / MCA-CV staff, national government ministries, ANAS, NITA), document review
	A2. ARE sets tariffs for corporatized utilities under its new regulatory model, balancing utilities' financial sustainability (tariff adequacy) with the mandate to provide affordable, high-quality services	• Targeting criteria for tariff subsidies developed • Tariff schedule set by ARE	Key informant interviews with MCC / MCA-CV staff, ARE, NITA), document review
	A3. ANAS and DGA develop and enforce standards for water quality and environmental oversight	ANAS and DGA conduct tests of water quality and enforce environmental regulations	Key informant interviews (MCC / MCA-CV staff, national government ministries, ANAS, NITA), document review
	B. AdS created and operates on commercial principles with social inclusion objectives	• AdS incorporated, Board members appointed, social and community unit established • AdS issuing bills to customers in all 9 municipalities • Retrenchment of former SAAS and ELECTRA staff finalized	Key informant interviews (MCC / MCA-CV staff, AdS, ATAS, ELECTRA, Santiago government and former SAAS), document review
	D. FASA works completed	Operational systems (project-specific)	Key informant interviews (MCC / MCA-CV staff, FASA implementers, FASA case study utilities), document review
	E. FAS connections completed; households connect to FASA network extensions	• Number of households connected to water or sanitation by FAS • Number of households who have connected to water or sanitation in FASA project areas since the works were completed	Key informant interviews (MCC / MCA-CV staff, FAS implementers, FASA case study utilities), document review, household survey data
	F. IEC conducted	• IEC operation manual developed and training of trainers conducted • Share of survey respondents who report hearing WASH messaging through media or interpersonal communications†	Key informant interviews (MCC / MCA-CV staff, ANAS, NITA, AdS, ATAS, FAS and FASA implementers), document review, household survey data

Evaluation question	Outcomes[a]	Indicators	Data sources
2. How did the political and economic incentives of different sector actors affect the implementation, sustainability, and efficacy of the WASH project? In particular, how did these incentives affect the reform portfolio, and the effects of the WASH project on customers, utilities, and the management efficiency of the sector?		Not applicable	All key informant interviews, document review
3. a) Has the FASA mechanism efficiently selected the most effective, high quality projects as measured by the effect of the FASA projects on the socioeconomic well-being of households, the finances and management of the utilities, economy value-added and business and household productivity?	D. FASA works completed, leading to reduced technical losses, improved water quality, and/or strengthened environmental protection E. New connections (to FASA-funded infrastructure) increase access to improved water and sanitation, generate more revenue for utilities, and allow AdS to close *chafaris* that are no longer needed	Original and updated FASA project ERRs	D: MCC and MCA-CV calculations based on original and updated FASA ERRs, key informant interviews (FASA case study utilities) E: Key informant interviews (FASA case study utilities), household survey data, document review D and E: FASA proposals, key informant interviews (MCC / MCA-CV staff, ANAS, NITA)
b) Is the FASA a sustainable institution in Cabo Verde that is and will catalyze additional financing for WASH infrastructure?	G. Increased investment in water and sanitation	Dollars committed to the next version of the FASA by government, private sector, and donors	Key informant interviews (MCC / MCA-CV staff, Ministry of Finance, ANAS, LuxDev-Luxembourg Agency for Development Cooperation), document review
4. a) Was the tariff reform outcome pro-poor (progressive), regressive, or neutral in Santiago? b) Does the current tariff structure allow for cost-recovery by AdS?	H3. Household monetary expenditures on water and sanitation services are more equitably distributed across socioeconomic groups	• Share of subsidized water (including from the network as well as other sources such as *chafaris*) consumed by non-poor† • Price of water at chafaris and purchased from tankers	Household survey, AdS billing records, document review
	H7. AdS achieves cost-recovery	AdS costs and revenues	AdS operational records, key informant interviews (ARE, AdS, ATAS)

Evaluation question	Outcomes[a]	Indicators	Data sources
5. Is there evidence that the interventions have resulted in the outcomes outlined in the program logic?	G. Increased investment in water and sanitation	Dollars committed to the next version of the FASA by government, private sector, and donors	Key informant interviews (MCC / MCA-CV staff, Ministry of Finance, ANAS, LuxDev), document review
	H1. Aquifers are maintained and the environment is protected from waste-water contamination	No indicators included in the project M&E plan	Key informant interviews (ANAS, NITA, utilities)
	(see questions 6 and 7 below)	See questions 6 and 7 below	see questions 6 and 7 below
6. Was the WASH project as a whole effective at increasing the management efficiency and sustainability of the sector as measured by non-revenue water, collection ratio, and tariff adequacy? At reducing the [implicit] subsidy to the WASH sector at the municipal and national level?	C. Reduced commercial losses and improved collection ratio D. Reduced technical losses E. Closure of *chafaris* generates more revenue for utilities H2. Cost of distributing water fall H7. AdS achieves cost recovery H8. The implicit subsidy to water and sanitation utilities is reduced	AdS-level indicators: • Volume of non-revenue water • Collection ratio • Number of connections to network (disaggregated by residential and commercial) • Number of *chafaris* in operation • Number of households relying on each *chafaris* • Ratio of staff to volume of water supplied • Operating costs (including average labor cost of production), revenues, and operating cost coverage ratio • Value of implicit subsidy	AdS operational records, AdS billing data, key informant interviews (MCC / MCA-CV staff, Ministry of Finance, ANAS, ARE, AdS, ATAS, Santiago and Maio governments and SAAS, Aguas do Maio), WASH sector monitoring yearbook, household survey (for meter accuracy contribution to non-revenue water), AdS billing
7. What has been the effect of the WASH project on access to, quality and continuity of, and total costs of (direct and indirect) water and sanitation services for households and businesses in Cabo Verde? On gender and social equality in access to and cost of water and sanitation services?	E. New connections increase access to improved water and sanitation H3. Household monetary expenditures on water and sanitation services are more equitably distributed across socioeconomic groups H4. Poor households spend less time collecting water H5. Poor households consume more water H6. Customers are satisfied with AdS's quality of service I2. Increased household productivity due to cost savings, health benefits, and business opportunities	Household-level indicators†: • Share of Santiago population with a) household connection to AdS piped water network and b) improved sanitation • Among households without a household connection to AdS piped water, the share within 250 m of a *chafaris* • Expenditures on water and sanitation (including utility bills for water and sewer services, payments for water at *chafaris* or from tankers, and payments for septic tank maintenance or emptying) • Time spent fetching water • Quantity of water consumed	Household survey, focus group discussions with households, AdS operational records, AdS billing data, WASH sector monitoring yearbook

Evaluation question	Outcomes[a]	Indicators	Data sources
		• Hours of water service per day (continuity of service) • Satisfaction with services (including supply reliability and water quality) • Correct knowledge of components of water and sanitation bills • Stated prioritization of water and sanitation bills relative to other household expenses • Knowledge, attitudes, and practices related to WASH behaviors • Diarrhea prevalence • Share of households engaging in income-generating opportunities that rely on water	
8. How do the FASA and FAS projects' effects on these outcomes compare?	E. New connections increase access to improved water and sanitation, generate new revenue for utilities F. IEC conducted, improving WASH knowledge and attitudes and sustainability of access to water and sanitation services H4. Poor households spend less time collecting water H5. Poor households consume more water H6. Customers are satisfied with AdS's quality of service H7. AdS achieves cost-recovery I2. Increased household productivity due to cost savings, health benefits, and business opportunities	• See row 7 above • Share of eligible households who did not qualify for FAS because they did not make the household contribution or had ELECTRA debt • Bill payment history among newly connected households† • Network disconnection rate among FAS beneficiaries and households that connect to network water after FASA projects are complete†	Household survey, focus group discussions with households, AdS billing records, key informant interviews (MCC / MCA-CV staff, FAS implementers), document review

[a] Letters and numbers link to the project logic (Figure II.1).

† Denotes indicators for which we will explore differences disaggregated by gender of household head, poverty status, and/or location (Praia versus non-Praia).

C. Component 1: Process evaluation

In this section, we describe the data sources and analytic approach for the first component of the performance evaluation of the WASH project—a process evaluation that will focus on implementation and early effects in the interim round of data collection (late 2017 and 2018), and on medium-run effects and sustainability in the final round (2020). The qualitative process evaluation will use data from interviews and focus group discussions; project, government, and utility documents; and project monitoring data to describe program implementation, challenges, and successes for all project activities (question 1); apply methods from political economy analysis to explore how implementation and effects might have been influenced by the national and local contexts and understand the role of the FASA in incentivizing corporatization (question 2); assess the efficacy of the FASA and FAS in terms of whether each approach led to improved coverage or quality of service for households or cost savings or new revenue for utilities (question 3); and understand the tariff-setting process and assess whether the new tariff is pro-poor (question 4). The process evaluation will also be the primary source of information about changes in institutional outcomes and several utility outcomes that are not included in the household or secondary data sources (questions 5 and 6).[20] The process evaluation will complement the pre-post analyses by enabling us to explore *how*, *why*, *where*, and for *whom* the estimated changes in outcomes did or did not occur (questions 5-8). The findings from the interim data collection round will also be used to help develop the data collection instruments for the final round. The data we collect in the process evaluation will also support and complement the case studies that we propose in Section E.

1. Data sources

Primary qualitative data. Table IV.3 summarizes the proposed respondents, data collection methods, and number of interviews or focus groups as well as the project activities, evaluation questions, and illustrative interview topics to be addressed with each respondent for the primary qualitative data collection for the process evaluation. We will develop a qualitative data collection protocol for each respondent and data collection method (interview or focus group); although the protocols will be tailored for each respondent type, they will all cover similar topics related to the research questions. We propose interviews with stakeholders who have specific content knowledge about the project activities and/or when there may be power differentials that could inhibit some people from participating in a group interview or focus group, whereas we propose focus groups when we are seeking a diversity of perspectives from larger group of people (such as households that benefitted from the FAS). At each organization we will begin by identifying the person or people who were most directly involved in implementing the project activities. The following list of respondents will allow us to document the project's implementation and outcomes within the evaluation's budget constraint by interviewing representatives of institutions that play an essential role in implementing the project's activities,

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[20] Ideally, the process evaluation would include interviews with all of the water and sanitation utilities in the country to understand how the NIRR has affected operations at the local level, but that is not feasible within the evaluation's budget constraint. Through the combination of data collected for the process evaluation and the case studies (see section IV.2), we will interview four utilities which together serve 80 percent of the population of the country.

or which were intended to benefit directly from the WASH project.[21] We plan to conduct up to 35 semi-structured interviews in the interim round and up to 14 interviews in the final round:

- **MCC and MCA-CV staff** (interim round only). We will interview key staff at MCC[22] and MCA-CV, because they were responsible for designing the project, overseeing implementation, monitoring and evaluating the project, and gender and social inclusion mainstreaming. Interviews will cover the respondents' roles, perceptions of successes and challenges, and their expectations of the effects of the project on key outcomes.

- **National government ministry stakeholders.** We will interview senior staff responsible for WASH-related decisions and activities because they can describe how (if at all) the government functions differently as a result of the policy reforms in the WASH sector. The interviews will be with senior leaders from the three ministries most closely related to the WASH project: the Ministry of Agriculture and the Environment (under which ANAS is housed), the Ministry of Finance (responsible for national spending and funds to municipalities), and the Ministry of Foreign Affairs (which negotiates with foreign donors). The interviews will gather information on changes in the roles and responsibilities of respondents and the ministries they represent, perceptions of the new institutions and policies, factors that facilitated or inhibited the institutional changes and new policies, new developments that could influence the same outcomes that the WASH project is targeting (for example, the construction of new desalination facilities or partnerships with other funders to provide technical assistance to WASH sector institutions or utilities), and changes in government spending that could be linked to the project.

- **Stakeholders involved in compact design** (interim round only). To understand the original goals for the compact and the political environment in which it was designed, we will interview key stakeholders from the compact design process, including the Government of Cabo Verde's team leader for compact design, the former minister of finance, and several representatives of the Ministry of Environment, Housing, and Spatial Planning, including the former minister; the director general of planning, budget and management; and the former team leader for technical assistance provided by LuxDev.[23] These senior leaders have a unique perspective on what the government hoped to achieve and why the project activities were chosen as the most promising approach to fulfilling the government's goals.

- **ANAS.** ANAS was created as part of the WASH project and now plays a critical role in implementing the policies developed through the NIRR, working with other WASH-related agencies whose roles and responsibilities have changed as a result of the NIRR, regulating AdS as a result of the URA, and determining whether the FASA approach of providing

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[21] The purpose of the process evaluation is to gain an understanding of if, how, and why certain aspects of the project were successful, and what changes in outcomes might have resulted from the project. While it would be ideal to collect enough focus groups to reach saturation on the diversity of WASH project beneficiaries' experiences and perspectives, that is not feasible within the budget for the evaluation. With purposive recruitment, the proposed number of focus groups should still be sufficient to complement the quantitative data with a richer picture of a range of beneficiaries' stories. In contrast, for the stakeholder interviews we are seeking technical information about how the project was implemented which does not require multiple perspectives; as such, saturation is not the goal.

[22] This might also include MCC's technical consultants supporting the WASH project.

[23] These stakeholders were suggested by MCA-CV.

grants for infrastructure projects will be sustainable. We will interview the CEO of ANAS for his comprehensive view of all of the agency's activities and interactions with other stakeholders. We will also interview the departmental directors and unit heads to gather additional detail on the specifics of the activities they oversee. The focus of the interviews will be to understand how ANAS makes decisions regarding WASH priorities using the Master Plan; how ANAS works with the ARE and DGA to create new regulations and standards to monitor the WASH sector (including utilities) using instruments developed under the compact; whether roles and responsibilities are clear among the government organizations, and especially between ANAS and ARE; whether ANAS is becoming politically and financially sustainable; the extent to which the organization can carry out its role in the absence of technical assistance; and new developments that could influence the same outcomes that the WASH project is targeting.

- **ARE.** As a result of the NIRR and URA, ARE plays a critical role in determining whether AdS (and other corporatized utilities) will be financially sustainable and able to fulfill their mandates of providing affordable services because ARE determines the tariffs these utilities can charge customers. We will interview the administrator at ARE who has been responsible for leading the tariff-setting process for water and sanitation services to understand how tariffs are set, the agency's relationships with ANAS and the utilities they regulate, and their perceptions of whether the new tariff structure for AdS is pro-poor.

- **AdS.** To a large degree, the WASH project's success depends on whether AdS is able to deliver the anticipated improvements in service quality and financial sustainability that were hypothesized to be possible through corporatization. We will interview the CEO of AdS and one or two senior staff who are responsible for operation of the network and customer relations to understand how the new utility is evolving and the extent to which it is able to operate using commercial principles and is guided by social inclusion considerations. We will also seek to gain an understanding of the financial sustainability of AdS, including the process of incorporating Praia into AdS's service area and AdS's relationship with ELECTRA. We will further probe whether and how AdS has reduced non-revenue water and made progress on its mandate to provide affordable, high-quality services. Finally, we will ask how (if at all) the national reforms have affected AdS's operations, service quality, and financial health.

- **NITA and ATAS (**technical assistance providers to national institutions—especially ANAS and ARE—and AdS, respectively; interim round only). NITA and ATAS played a large role in helping ANAS, ARE, and AdS to operationalize the policies developed under the WASH project; NITA and ATAS also have unique perspectives on the strengths and weaknesses of the institutions they supported, and the feasibility of the WASH project's logic. We will conduct interviews with the team leaders and/or project managers at both organizations to understand the facilitators and drivers of change as well as how each organization provided technical assistance and prepared the beneficiary institutions to carry out their roles and responsibilities alone.

- **ELECTRA.** As the producer of a large share of water Santiago, ELECTRA still plays a pivotal role in the WASH sector even after the creation of AdS, since the new corporatized utility is still dependent on ELECTRA for its most important input. Although ARE will set the price that ELECTRA can charge AdS for the water that AdS then distributes to customers,

ELECTRA's financial health will factor into that price, so the financial sustainability of the WASH sector will continue to be influenced by decisions made by ELECTRA's management. We will interview the CEO of ELECTRA to understand the business and financial relationship between AdS and ELECTRA, and how this influences the quality of service AdS provides and the two utilities' prospects for financial sustainability. We will also discuss ELECTRA's role in the sustainability of the FASA projects on Santiago and other islands, many of which rely on electricity as an input.

- **FASA and FAS implementers** (interim round only). We will interview representatives of the construction companies (project directors), recipient utilities (CEO or directors), and NGOs (project directors) that implemented the FASA and FAS projects to gather in-depth information on project design and implementation (including targeting of FAS subsidies); how the projects supported improved access to water, quality of service (FASA only), and reductions in non-revenue water.

- **Águas do Maio**. Águas do Maio was created as an extension of the URA, and serves as an example case of the potential for corporatization to improve service quality and financial sustainability of utilities on other islands. We will interview the CEO of Águas do Maio and one or two senior staff who are responsible for operation of the network and customer relations since they will know the most about the new corporatized utility that was created thanks to support from the WASH project. The interviews will be very similar to the interviews with AdS leadership, with the exception that we will not need to discuss the process of combining multiple SAAS (Águas do Maio serves a single municipality).

- **Maio government and SAAS**. As the first island to decide to corporatize its SAAS following the example of AdS, it is important to understand what factors influenced the Maio municipal government's decision. During the interim round, we will interview the current and former mayors of Maio municipality (who started and now oversee the corporatization process) and the former director of the Maio SAAS; in the final evaluation round we will interview the mayor of the municipality at that time. These interviews will explore the motivations to corporatize (including availability of FASA funding); the expected and perceived effects for the government, utility, and households; steps in the corporatization process; challenges encountered or anticipated and potential solutions; and contextual factors that could influence the process or effects of corporatization. Finally, we will ask how (if at all) the national reforms influenced the decision to corporatize and/or affected the Maio SAAS's operations, service quality, and financial health.

In addition to the key informant interviews, we will conduct up to 14 focus groups in the interim round and slightly fewer (up to 10) in the final round with the following WASH project stakeholders:

- **Santiago government and former SAAS** (interim round only). We will try to bring together the mayors (past and present) from each of the municipalities on Santiago to discuss the process of creating AdS, the role of FASA funding in incentivizing them to join AdS, and their perceptions of how corporatization has affected the quality of service provision and household access to and use of water on the island, and how these trends might continue to evolve. We recognize that several of the mayors who were involved in the process are no longer in their respective positions. If these mayors are unable to participate

in the focus groups, we will attempt to conduct individual interviews with each to gather their perspectives. We will also conduct separate focus groups with individuals from different seniority levels within the predecessor SAAS (some of whom now work for AdS) to understand how roles and responsibilities have changed since the creation of AdS.

- **Households** (both rounds). We will conduct ten focus groups (six on Santiago, two on São Vicente, and two on Maio) to understand the effects that changes in the water sector—including the new tariffs and the switch from the former service providers to AdS and possibly a new corporatized utility on Maio—have had on households. In all of these focus groups, we will explore issues such as choices in water sources, the cost of water from different sources, benefits of having access to the piped network, quality of service, time use, and other aspects of household productivity such as health, schooling, and income generating activities.

    We will conduct two focus groups with households on Santiago that are affected by the creation of AdS, but are not FAS beneficiaries or within the catchment area of a FASA project to understand how the general population perceives AdS and the changes in the water sector (including changes in the water tariff). Two other focus groups will gather information from FAS beneficiary households and two more focus groups will be conducted with households that live within the catchment area of a FASA-funded project to gather evidence on how the FAS and FASA projects affected access to the piped water network and/or improved sanitation, and the extent to which beneficiaries are satisfied with the quality of service they receive from AdS as a result of the subsidized connections and infrastructure projects. We will look for similarities and differences among the three types of focus groups to determine the added value of the FAS and FASA projects.

    We will also conduct focus groups with households on two other islands that have benefitted from more than just the NIRR. Specifically, we are interested in the perspectives of households on São Vicente, the only place where FASA and FAS projects were integrated (we will conduct two focus groups with joint FASA-FAS beneficiaries), and on Maio, the island which is moving most rapidly toward following the example of AdS and corporatizing their SAAS, with technical support provided under the URA (two focus groups). Whereas the corporatization process has already occurred on Santiago, on Maio we have the opportunity to capture changes in household opinions and outcomes as the SAAS on Maio is converted to a corporatized MMU between the interim and final data collection rounds.

Table IV.3. Summary of qualitative data collection for process evaluation

Respondent	Data collection method	Data collection round	Number of interviews or focus groups	Geography	Evaluation questions (see Table IV.2)	Project activities	Illustrative topics
MCC and MCA-CV staff	Interviews	Interim only	12	National	1-3, 5, 6	NIRR URA FAS FASA	• Project design, implementation, mainstreaming of gender and social issues • Successes and challenges • Influence of other organizations (such as Coca Cola Foundation and LuxDev) on how WASH project activities were implemented or will be sustained • Perceptions of effects on outcomes
National government ministries[a]	Interviews	Interim and final	3	National	1-3, 5, 6	NIRR URA FAS FASA	• Changes in roles and responsibilities due to project activities • Perceptions of new institutions and policies • Factors that facilitated or inhibited the institutional changes and new policies • New developments that could influence the same outcomes that the WASH project is targeting • Changes in government spending (particularly investments in WASH and non-productive spending such as subsidies to utilities)
Stakeholders involved in compact design[b]	Focus group	Interim	1	National	1, 2, 5	NIRR URA FAS FASA	• Rationale for the project activities • People and factors that influenced the project design • Project logic
ANAS[c]	Interviews	Interim and final	2	National	1-3, 5	NIRR FASA	• Decision making regarding WASH priorities using the Strategic Master Plan • How ANAS works with the DGA to create new regulations and standards to monitor the sector • Whether roles and responsibilities are clear among the government organizations • Whether ANAS is becoming politically and financially sustainable • The extent to which the organization can carry out its role in the absence of technical assistance (including IEC) • Successes and challenges of integrating social inclusion into sector priorities and management processes • New developments that could influence the same outcomes that the WASH project is targeting

Respondent	Data collection method	Data collection round	Number of interviews or focus groups	Geography	Evaluation questions (see Table IV.2)	Project activities	Illustrative topics
ARE	Interview	Interim and final	1	National	1-4	NIRR URA	• How tariffs are set (water and sanitation services) • ARE's relationships with ANAS and the utilities ARE regulates • Successes and challenges of operationalizing a pro-poor tariff • Perceptions of whether the new tariff structure for AdS is pro-poor
AdS	Interviews	Interim and final	2-3	Santiago	1-6	NIRR URA	• Status of and experiences with the process of creating and operating AdS • Status of and experiences with the integration of Praia network and customers • Effects of national reforms on utility operations, service quality, and financial health • Changes in non-revenue water • Ability to manage sanitation systems • Financial sustainability of AdS and relationship with ELECTRA
NITA and ATAS	Interviews	Interim only	2	Santiago	1-5	NIRR and URA, respectively	• Experience and process of providing technical assistance • Beneficiary institution's preparation to operate without technical assistance • Facilitators and drivers of change
ELECTRA	Interview	Interim and final	1	Santiago	2, 5, 6	NIRR URA FASA	• Business and financial relationship between AdS and ELECTRA • How this influences the quality of service AdS provides and the two utilities' prospects for financial sustainability • ELECTRA's role in the sustainability of the FASA projects
FASA implementers	Interviews	Interim only	3	Santiago, Sal, and São Vicente	1, 5, 7, 8	FASA	• Facilitators and barriers to implementation and sustainability • How the projects helped the utility and community, including whether households connect to new lines • Perceived effect on the utility and community

Respondent	Data collection method	Data collection round	Number of interviews or focus groups	Geography	Evaluation questions (see Table IV.2)	Project activities	Illustrative topics
FAS implementers	Interviews	Interim only	4	Santiago, São Vicente, Santo Antão	1, 5, 7, 8	FAS	• Facilitators and barriers to implementation • How beneficiaries were chosen and supported to develop a culture of bill-paying and improve their knowledge of recommended WASH behaviors • Perceived effect on households and communities
LuxDev	Interview	Interim and final	1	National	2, 3, 6	NIRR URA FASA	• Sustainability of project activities • Support provided to ANAS, AdS, and the new FASA
Santiago government and former SAAS[d]	Focus groups Interviews if needed	Interim only	3-4	Santiago	1-3, 5	NIRR URA FASA	• Motivations to corporatize (including availability of FASA funding) • Challenges in the process of creating AdS • Perceptions of how corporatization has affected the quality of service provision and household access to and use of water on the island
Águas do Maio	Interview	Interim and final	1	Maio	1-3, 5, 6, 7	URA	• Status of and experiences with the process of creating and operating Águas do Maio • Effects of national reforms on utility operations, service quality, and financial health • Changes in non-revenue water • Ability to manage sanitation systems • Financial sustainability of Águas do Maio
Maio government and SAAS	Interviews	Interim and final	2	Maio	1-3, 5-7	NIRR URA	• Effects of national reforms on utility operations, service quality, and financial health • Motivations to corporatize (including availability of FASA funding) • Expected effects for the government, utility, and households • Steps in the corporatization process • Challenges encountered or anticipated and potential solutions • Contextual factors that could influence the process or effects of corporatization

Respondent	Data collection method	Data collection round	Number of interviews or focus groups	Geography	Evaluation questions (see Table IV.2)	Project activities	Illustrative topics
Households	Focus groups	Interim and final	10	Santiago (6), São Vicente (2), Maio (2)	5-8	NIRR URA (Santiago and Maio) FAS (Santiago and São Vicente) FASA (Santiago and São Vicente)	Perceptions of: • Choices in water sources • Cost of water from different sources • Benefits of having access to the piped network • Quality of service • Time use and other aspects of household productivity such as health, schooling, and income generating activities • Changes in quality of life due to changes in water and/or sanitation conditions

[a] These Ministries include the Ministry of Agriculture and the Environment, the Ministry of Finance, and the Ministry of Foreign Affairs.

[b] Individuals involved in compact design include the Government of Cabo Verde's team leader for compact design; the former minister of finance and from the Ministry of Environment, Housing, and Spatial Planning former minister, director general of planning, budget and management, and former team leader for technical assistance provided by LuxDev.

[c] In addition to the CEO of ANAS, interviews could be conducted with the Director for Management Information Systems, the Director for Social Inclusion and Gender, the Head of the Strategic Planning Office, the Head of the Water and Sanitation unit, and the Head of the Management of Investments unit.

[d] Focus groups with SAAS would include staff working on the ground and the perspectives from new mayors as well as the mayors who participated in the creation of ADS.

AdS billing records. AdS's billing database would be a very rich resource for the evaluation, allowing us to determine whether the new tariff is pro-poor using more accurate data than the recall of water consumption that we will be able to gather through the household survey (we will record customer IDs during the survey so that poverty status can be merged with the billing database).[24] The billing data would also make it possible to:

- compare consumption and bill collection rates across branches (municipalities) and between Praia and the rest of the island as an indication of AdS's performance and progress toward providing a consistent quality of service

- compare consumption and bill collection rates between households who got connected to the piped network as a result of FAS or FASA activities and the rest of AdS's clientele

- estimate non-revenue water by comparing the total water supplied to a municipality's network (based on AdS's records of water purchase from ELECTRA or borehole production) to the volume of water billed in that municipality, assuming that AdS could also provide the data on water input into the system.

However, there are two issues that will have to be resolved before we can make use of these data for the evaluation, even if funding for analysis of the billing database becomes available. First, there is the problem that AdS's customers have not given consent for their data to be shared, either with Mathematica or in a public use data file.[25] One potential solution described in section IV.D.2 is to include the consent to access billing records in the household survey, with the institutional review board approval.[26] Second, we would have to get AdS's approval for a plan to anonymize the data to make them publicly accessible, even if we only analyzed the billing data separately from the household survey data such that there was no confidentiality concern at the household level. If MCC's requirement that the data be made publicly available leads AdS to be unwilling to share the data, we will discuss the possibility of an exemption with MCC's Disclosure Review Board so that we could analyze the data even if AdS is unwilling to make them publicly available.

Document review. Finally, the process evaluation will also include a **document review** of plans and reports related to implementation of the WASH project activities, project monitoring data, and government documents related to the project activities, such as the key policies adopted through the NIRR and new tariff schedules set by ARE. These documents and monitoring data will contribute information on the timeline of implementation, number and characteristics of

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[24] If we are unable to make use of the billing data, an alternative (but more costly) approach might be to conduct an SMS survey of AdS customers shortly after AdS issues bills, to collect data on the volume of water consumed directly from customers. This approach would not provide the accurate data on bill collection that would be included in AdS's records.

[25] The sensitivity arises from the fact that the billing data are most useful if we can merge them with the household survey data. While billing data alone would not raise concerns about confidentiality (it would be very difficult to identify a particular household from their customer ID, consumption patterns, and bill payment history), we would need consent to merge these data with the identifiable household survey data.

[26] To leave open the possibility of analyzing billing data, we could return to all FAS type 1 and type 2a beneficiaries—not only those sampled for the panel data collection—to obtain consent to access their billing records.

beneficiaries, achievement of institutional and utility outcomes, and the evolution of institutions and policies after the compact has ended. The document review could also identify topics of possible importance to explore in more detail through the qualitative data collection.

Staffing. Mathematica will hire a local data collection firm to conduct the focus groups with the SAAS and the households on Santiago. Mathematica staff will conduct the more sensitive interviews including those with the relevant Ministry stakeholders and MCC/MCA-CV. Depending on scheduling constraints, interviews with ANAS, ARE, NITA, AdS, ATAS, and ELECTRA may be conducted either by Mathematica staff, a local consultant, or the local data collection firm. The local data collection firm will be responsible for transcribing and translating all qualitative data (including from interviews that are conducted by Mathematica or Mathematica's local consultant), with quality control provided by Mathematica's local consultant (see the discussion of data quality processes below). Mathematica will be responsible for all coding and analysis.

Data quality processes. The success of the evaluation depends on the collection of high quality data, particularly the accuracy, reliability, and timeliness of the data. We will minimize the risks to quality throughout the data collection process. Close interaction with and oversight of the local firm throughout the data collection process will be essential to ensuring data quality.

The specific quality control measures that we plan to implement include the following:

- Setting interviewer recruitment and evaluation standards

- Actively participating in interviewer training sessions

- Conducting pre-testing and piloting activities to ensure the effectiveness of field protocols and instruments

- Observing fieldwork and instituting rigorous independent field oversight activities

- Providing feedback to interviewers and field managers to correct poor facilitation practices, prevent leading questions, and improve data collection

- Monitoring field data collection progress and other operational issues

- Reviewing a sample of qualitative data collection transcripts and verifying the transcripts against the recordings from the interviews and focus groups

2. Analysis approach

After transcribing and translating the recordings of the interviews and focus groups, we will begin the analysis process by reviewing all data and eliminating any that are incomplete or not useful to our analysis. We will use the following analytic methods to answer the evaluation questions using the data gathered through the process evaluation.

Thematic framing. As an initial step, we will read through the transcripts several times and obtain a holistic sense of the data. We will then develop a detailed initial coding scheme which we will apply as we systematically review data from the different respondents and documents. The coding scheme will allow us to categorize respondents' comments and document excerpts under key topics and subtopics aligned with the evaluation questions and project logic (for

example, codes might include "implementation challenges," "non-revenue water," and "cost of water"). Based on the coded data we will identify key themes across all respondents and among subgroups according to respondent characteristics (including gender, whether or not the household has a connection to the piped water network, etc.) in order to take into account similarities as well as differences in perspectives across different respondent groups. We will use qualitative data analysis software such as NVivo to manage the raw data, codes, and respondent characteristics.

Triangulation. Triangulation involves testing for consistency in results or findings across several data sources and methods of inquiry (Patton 2002). It facilitates confirmation of themes or findings and the identification of important discrepancies across qualitative data, documents, program monitoring data, and secondary data sources. It also reduces the potential for inaccuracies that arise from a largely retrospective review.

Contribution analysis. Building on the triangulation process and using the framework of the project logic, contribution analysis aims to determine the strength of the evidence on the WASH project's implementation and effects, focusing on the extent to which the project contributed to targeted outcomes anticipated in the project logic. The first step in contribution analysis involves compiling evidence on activities implemented, outputs, and outcomes and on assumptions underlying the results chain shown in the logic model. The next step focuses on critically examining the strength of the evidence supporting the achievement of outputs and outcomes and linkages, giving considerable weight to stakeholder perspectives on the program's contribution or influence, as well as evidence of the influence of other factors on outcomes (Mayne 2008). Contribution analysis complements triangulation by looking at activities and results in a broader context to identify where attribution is appropriate and robust, as well as any major shortcomings in initiative design, implementation, and achieved outcomes.

Political economy analysis. To understand how institutions are changing, the changes that occur as a result of the social inclusion aspects of the NIRR and URA, and the sustainability of the reforms, we will use frameworks from political economy analysis as a guide for instrument development and as a lens when reviewing the qualitative data. Broadly, our political economy analysis will examine (1) how power and resources were distributed and contested during implementation of the WASH project and (2) the implications of these dynamics for (a) the evolution of AdS and the government agencies involved in the NIRR, (b) the development, selection, implementation, and integration of FASA projects into existing networks, and (c) the benefits and obligations of being connected to the piped network among FAS households (Poole 2011). Our interview guides will include questions for each type of respondent about the "rules of the game" (both formal regulations and cultural norms) that govern how they interact with other actors in the WASH sector. Such interactions could include official communications between ANAS and ARE, AdS's response to a household that is delinquent on its bill, or a household's strategies to hide the fact that it is stealing water from AdS's network. A key step in political economy analysis is mapping the relationships between actors, which in the case of the WASH project would include leaders and staff at various government entities at the national and municipal levels, utility managers and staff, and consumers. As we facilitate the interviews and analyze the qualitative data, we will be looking for indications of who has power in each of these relationships and what mechanisms each actor uses to exert influence.

D. Component 2: Pre-post analyses

Although pre-post analyses cannot distinguish the effects of the WASH project from any other factors that could have influenced the outcomes over the same time period, as described in Appendix B, we have concluded that anything more rigorous than a pre-post analysis would not be feasible for this evaluation. We will use the qualitative data from the process evaluation to assess the plausibility that the WASH project activities could have contributed to the observed changes in outcomes. For example, we will consider whether other external trends such as changes in the price of fuel (which will ultimately translate into changes in the price of water in a country that relies heavily on desalination) or other projects could have also been influencing the outcomes of interest for the WASH project evaluation.

The pre-post analyses will compare changes in outcomes between the interim round (within a year of national institutions and AdS operating without technical assistance and within a few months of the completion of FASA projects) and the final evaluation round three years later, to gauge how key outcomes for households on Santiago have evolved following the NIRR activity, the URA, and the IGF activity. These analyses will focus on new household survey data collected for the evaluation because we are concerned about confounding over the relatively long period between the time that the compact baseline data were collected in 2011 and the point at which the project's activities might have started to have an effect, although we will also include comparisons relative to the 2011 baseline in the report. In addition, we will conduct separate pre-post analyses for the FAS beneficiaries on Santiago, using baseline data collected by MCA-CV in 2015 and the follow-up survey with the same households to be collected as part of the household survey planned for 2018 (we will determine whether or not to do a second follow-up survey with these households in 2020 after analyzing the interim data). The report will also present descriptive comparisons between the 2015-2016 FASA baseline and the interim and final survey rounds, although differences in the sampling approach preclude formal statistical analysis. Finally, we will do pre-post analyses of secondary data from AdS's administrative records and the annual WASH sector monitoring yearbook first produced for 2015 indicators.

The household survey on Santiago will allow us to assess whether the new water tariff for AdS's customers set by ARE is pro-poor (question 4a) and determine whether the WASH project activities have resulted in the outcomes anticipated in the project logic (questions 5 and 7), focusing on access to piped water and sewerage, quality of service provided by AdS, household decisions about water use (source choice, consumption, bill paying), and aspects of household productivity such as health status and income-generating activities. Subgroup analyses will explore differences in outcomes among poor and non-poor households (question 4), examine how the FAS and FASA projects affected household outcomes (question 8), and complement the process evaluation by separately estimating differences in outcomes for AdS customers in Praia (formerly served by ELECTRA) and those living in the rest of the island (formerly served by the SAAS). In a subset of households in the Santiago and FAS samples, we will also collect detailed data on water meter accuracy (which contributes to non-revenue water) to provide information to AdS and track whether there are changes in water meter accuracy as meters age between the interim and final data collection rounds (question 6).

1.   Household survey data

We plan to create two panel datasets: a representative sample of the population of Santiago island and a sample of FAS beneficiaries. As long as attrition is not too severe, panel datasets offer simpler interpretation and improved power relative to repeated cross-sections, by avoiding differences in the characteristics of the sample and instead reflecting only changes over time. Based on a comparison of power calculations for repeated cross-sections and panel datasets, we find that the power of our statistical tests would be very similar as long as attrition is less than 20 percent, which is feasible given the population dynamics of Cabo Verde. Technically, our samples will be panels of dwellings, rather than panels of households, since we will still collect data at a particular home even if the residents have changed—this is important particularly for the FAS beneficiary survey, since the network connection would remain at the dwelling even if the original recipients of the subsidy relocated.[27]

Because we do not have access to the personal identifiers from the 2011 compact baseline and we propose a slightly different sampling approach (see the description of the power calculations in the next section), we propose to start the household panel with a random sample drawn for the 2018 interim data collection round and return to these households for the final data collection round in 2020, rather than using the 2011 compact baseline as the beginning of the panel (see Table IV.4 for the distribution of baseline respondents across municipalities). We plan to oversample enumeration areas that are in the catchment area of the FASA projects on Santiago, but set the number of enumeration areas per municipality proportional to the municipal population size. We will use the 2011 compact baseline data for a comparison of means between the three survey rounds since both the baseline data and the panel will be representative of the population. In contrast, the FAS beneficiary panel would be based on the 2015 baseline respondents (see Table IV.4), but we propose to include only the type 1 (water connection) and type 2a (water connection and improved sanitation) in the panel, since the rationale for type 2b beneficiaries (improved sanitation only) was not as closely linked to the rest of the project logic. We will use a different sampling approach than the 2015-2016 FASA baseline so we will only be able to do descriptive comparisons with that sample, rather than formal statistical tests; hence FASA baseline does not factor into the following section on statistical power and sample size.

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[27] One hypothetical disadvantage of using a panel is that our survey will not capture water and sanitation conditions at dwellings built between the interim and final evaluation rounds. Since we do not anticipate that the housing stock would change drastically in a three year period, we do not think this is a concern. It is theoretically possible that there could be a systematic bias in outcomes such as water consumption or bill payment if we analyze the data as a panel of dwellings and it turns out that new tenants are always poorer than the previous tenants (or are always richer). In this case, we could see differences in outcomes over time that are driven by the dynamics of who lives in a given neighborhood, rather than because of the project. We will test for this slim possibility by comparing the time-invariant characteristics of survey respondents in the two data collection rounds and doing robustness checks such as dropping dwellings where the occupants have changed between rounds. Creating a panel of households would be considerably more expensive and is unlikely to lead to different conclusions as long as most households continue to occupy the dwelling where they were surveyed during the interim round.

Table IV.4. Santiago population and baseline sample sizes by municipality

Municipality	2010 population[a]	2011 compact baseline	2015 FAS baseline – type 1 beneficiaries (water connections)	2015 FAS baseline – type 2a beneficiaries (water and sewer connections)	2015-2016 FASA baseline[b]
Praia	132,317	329	245	155	310
Santa Catarina	43,297	233	281	6	69
Santa Cruz	26,609	118	3	74	174
Tarrafal	18,565	85	51	3	168
São Miguel	15,648	67			93
San Salvador do Mundo	8,677	55			29
São Domingos	13,686	54	53		
São Lourenço dos Órgãos	7,388	40			6
Ribeira Grande de Santiago	7,732	17			
Total	273,919	998	633	238	849

[a] Source: Instituto Nacional de Estatística (INE) Cabo Verde 2010.

[b] Sample sizes are for Santiago island only.

Statistical power and sample size. To determine the optimal sample size and number of clusters for the Santiago sample, we estimated the minimum detectable differences (MDDs) for tests of changes over time for two key outcomes from the project logic[28]: the percentage of households with a connection to the piped water network and continuity of service provision (hours per week) among households with a connection (Table IV.5). We use the 2011 compact baseline data as the basis for our assumed means and standard deviations for the power calculations, but we

> **Box IV.1. Sample size recommendations**
>
> Santiago sample: 100 clusters of 10 households each = 1,000 households
>
> FAS sample: half of type 1 and 2a beneficiaries surveyed in 2015 baseline = approximately 435 households

focus on choosing a sample size and number of clusters to optimize our power to detect differences between the interim and final survey rounds rather than the baseline and interim or final rounds, subject to budget constraints.[29] We focus on interim-final round differences because we are concerned about confounding in the six years since the baseline was conducted. To help contextualize the apparent differences over time, we will also discuss changes in other factors (such as the price of fuel) that could be contributing to observed changes in outcomes.

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[28] Although the project logic predicts that even households that already had a household connection to the piped network might increase their water consumption thanks to the NIRR and URA (due to better continuity of service and perhaps lower prices in the long run), we think it is overly ambitious to try to detect changes in water consumption among the whole population in the three years following the compact.

[29] To the extent that the FAS increased the share of the population with a household connection to the piped water network by approximately ten percentage points (based on MCA-CV records showing over 3,000 households received FAS-subsidized connections to the water network on Santiago, out of a population of approximately 30,000 households), the minimum detectable effect we can estimate will be slightly smaller than shown in the table. Because the means are very close to 50 percent, the gains in power from revising the mean from 52 percent to 62 percent are very small (a difference of 0.3 in the MDD).

Table IV.5. Minimum detectable differences between interim and final surveys among the Santiago sample and subsamples

	Full Santiago sample	Praia (50 percent subsample)	Non-Praia (50 percent subsample)	FASA (25 percent subsample)
Percentage of households with a connection to the piped water network	Mean=52 s.d.=50	Mean=44 s.d.=50	Mean=56 s.d.=50	Mean=10 s.d.=30
N=1,000, 50 clusters	15.6	22.2	22.2	19.4
N=1,000, 100 clusters	**11.3**	**16.0**	**16.0**	**13.9**
N=2,000, 100 clusters	10.9	15.5	15.5	13.4
N=1,500, 150 clusters	9.2	13.0	13.0	11.3
Continuity of service (hours per week), among those connected to the network	Mean=37.7 s.d.=55.6	Mean=11.6 s.d.=22.1	Mean=46.3 s.d.=60.5	n.a.
N=1,000, 50 clusters	17.9	10.3	27.7	n.a.
N=1,000, 100 clusters	**13.4**	**7.7**	**20.5**	**n.a.**
N=2,000, 100 clusters	9.8	5.7	15.0	n.a.
N=1,500, 150 clusters	9.1	5.3	13.8	

Notes: Sample size and number of clusters are per round for a pre-post comparison. Means and standard deviations (s.d.) for Santiago, Praia, and non-Praia are from the 2011 compact baseline. FASA subsample is assumed to be starting from a baseline of very little access to the piped network since FASA network extension projects will not have been complete for very long before the 2018 data collection. Power calculations are for a two-sided test with 80% power at α=0.05, R^2 within-group and between-group of 0.3, and an attrition rate of 10 percent in the follow-up round. We were not able to estimate the intraclass correlation using the 2011 compact baseline data since we did not have identifiers for the primary sampling units at the time these calculations were undertaken. The intraclass correlation is likely to be quite high since access to the piped network and continuity of service are both outcomes that largely depend on neighborhood-level infrastructure availability and service quality, so we assumed an intraclass correlation of 0.4 for both outcomes to be conservative. Sample size for continuity accounts for restricting the sample to the subset of households that had a connection to the network (52 percent in Santiago, 44 percent in Praia, and 56 percent outside of Praia; not defined for the FASA subsample since it is not useful to estimate changes in continuity among such a small number of households).

We recommend a sample size of 1,000 households for the Santiago sample (10 households in each of 100 clusters), which would allow us to detect an increase of at least 11.3 percentage points in households connected to the piped water network and 13.4 additional hours of service weekly. A sample of 1,000 households across 100 clusters also provides adequate statistical power for subgroup analyses of Praia and the rest of the island (assuming each comprises half of the total sample), and for a subgroup of FASA beneficiaries (assuming one-quarter of the total sample is drawn from FASA catchment areas). Although it might be overly optimistic to expect network coverage to increase by over ten percentage points in the three years after the compact, the MDD for FASA subsample (13.9 percentage points) seems very feasible, assuming that in these neighborhoods almost no one will have been able to connect to the new trunk lines before the 2018 data collection round is completed. Indeed, if connection rates are lower than the MDD in the FASA subsample, we could probably infer that the ERR of these FASA projects is not likely to be achieved.[30, 31] While there would be some gains in power from doubling the number

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[30] The average increase in FASA project areas will be boosted considerably by the extension of Praia's piped network to São Domingos, since more than 14 percent of households there already have a connection to the piped network, and the problem is just that the city's water supply to fill the piped network went dry (in the meantime, the city has been supplied with water trucked in by tankers).

[31] If we find that connection rates to the FASA projects are lower than anticipated in the ERR, MCC might want to update their calculations, but this would not be necessary for the evaluation. Our assessment of whether the FASA mechanism selected the most effective projects will be based on a two-step approach of comparing the original ERR

of respondents per cluster or increasing the number of clusters by 50 percent, the gains would be fairly small relative to the increase in the cost of data collection, particularly since we are already proposing to sample roughly one-third of the enumeration areas on the island. The project's Monitoring and Evaluation (M&E) plan targeted an increase from 6 hours of service per day at baseline to 13 hours per day by the end of the compact (an increase of 7 hours), but given the implementation delays, we would expect much of this increase to occur in the years after the compact ends. The MDD among the Praia subset for our proposed sample size (7.7 hours) is close to the targeted effect, despite the fact that this measure is only defined for households with a connection to the piped network (reducing sample size by almost half). Praia started with a much lower mean at baseline than the SAAS on the rest of the island offered (11.6 hours per week relative to a mean of 37.7 hours per week for the rest of the island), but because the standard deviation of service continuity was quite high outside of Praia (likely because of the diversity of the SAAS serving the rest of the island), the non-Praia MDD is much larger (20.5 hours per week) and we will only be able to detect differences that equate to almost a 50 percent increase in continuity. Despite the fact that we appear to be underpowered for continuity of service outside of Praia, we still feel that the household survey will be beneficial in many ways and that a sample size of 1000 respondents across 100 clusters is optimal, considering the relative benefit and cost of increasing the sample or number of clusters.

Statistical power for the FAS beneficiary sample is constrained by the number of respondents and clusters at baseline. Because of the weak link to the project logic, we do not recommend surveying type 2b beneficiaries (those who were already connected to the piped water network and received only subsidized sanitation).To confirm that we would have sufficient statistical power given the maximum sample size and number of clusters using only type 1 and type 2a beneficiaries, we considered three outcomes from the project logic which are particularly relevant for the FAS beneficiaries[32]: time spent collecting water, water consumption, and the rate of network disconnections (Table IV.6). Type 1 and type 2a beneficiaries did not differ significantly in how much time they spent collecting water at baseline, and thanks to the FAS subsidies, all households in both groups should be connected and spend zero time collecting water, so we analyze time savings pooling across both groups. Because we would expect different changes in water consumption as a result of getting a household connection to the piped network (type 1 beneficiaries) versus household connections to both the water and sewer networks (type 2a beneficiaries), we want to have sufficient statistical power to detect differences for each of these groups separately. Similarly, since higher water consumption translates into a larger bill, ideally we would also want sufficient statistical power to separately identify the rate of network disconnections for the two different types of beneficiaries.

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calculations and ground-truthing the assumed parameters in those ERRs based on the FASA case studies described in section IV.E.

[32] These outcomes differ from those for the Santiago-wide sample. Among the FAS sample typologies 1 and 2a, the percentage of households with a connection to the piped water network should have gone from zero (since that was the eligibility criteria) to universal thanks to the activity. Continuity of service is not defined for the FAS sample since they were not connected at baseline.

Table IV.6. Minimum detectable differences between baseline and interim surveys among FAS beneficiaries

	Santiago	Praia	Non-Praia
Type 1 beneficiaries:	**N=633, 70 clusters**	**N=245, 13 clusters**	**N=388, 57 clusters**
Type 2a beneficiaries:	**N=238, 34 clusters**	**N=155, 13 clusters**	**N=83, 21 clusters**
Types 1 and 2a beneficiaries:	**N=871, 86 clusters**	**N=400, 16 clusters**	**N=471, 70 clusters**
Time spent collecting water (minutes per household per day)	Mean=58.1 s.d.=107.2	Mean=43.1 s.d.=75.3	Mean=71.0 s.d.=126.8
All baseline respondents			
Types 1 and 2a beneficiaries	14.4	19.4	22.6
Half of baseline respondents			
Types 1 and 2a beneficiaries	20.4	28.5	32.2
Water consumption (liters per person per day)	Mean=22.9 s.d.=18.0	Mean=21.8 s.d.=17.7	Mean=23.8 s.d.=18.3
All baseline respondents			
Type 1 beneficiaries	2.9	5.5	3.6
Type 2a beneficiaries	4.6	6.2	7.5
Types 1 and 2a beneficiaries	2.5	4.6	3.3
Half of baseline respondents			
Type 1 beneficiaries	**4.1**	**8.1**	**5.1**
Type 2a beneficiaries	**6.6**	**9.3**	**10.9**
Types 1 and 2a beneficiaries	**3.6**	**6.7**	**4.6**
Network disconnections (percentage of households)	Mean=90 s.d.=30	Mean=90 s.d.=30	Mean=90 s.d.=30
All baseline respondents			
Type 1 beneficiaries	4.8	9.2	5.9
Type 2a beneficiaries	7.6	10.5	12.3
Type 1 and 2a beneficiaries	4.2	7.7	5.3
Half of baseline respondents			
Type 1 beneficiaries	**6.8**	**13.8**	**8.4**
Type 2a beneficiaries	**10.9**	**15.7**	**17.8**
Types 1 and 2a beneficiaries	**5.9**	**11.4**	**7.6**

Notes:　Sample size and number of clusters are per round for a pre-post comparison; "half of baseline respondent sample" option assumes the randomly selected subset would include half of the total clusters. Sample size, number of clusters, and means and standard deviations (s.d.) for water consumption are from the 2015 FAS baseline (the mean of network disconnections is assumed). For network disconnections, we assume that 90 percent of households were connected just after the baseline (the standard deviation that factors into the power calculations is not defined if all households were connected). Power calculations are for a two-sided test with 80% power at α=0.05, with an intraclass correlation coefficient of 0.05 (from the 2015 FAS baseline data on water consumption), R^2 within-group and between-group of 0.3, and an attrition rate of 10 percent in the follow-up round.

We recommend creating a panel based on a randomly sample of half of the 2015 baseline type 1 and type 2a FAS beneficiaries (those who got a subsidized connection to the piped water network, with or without also getting subsidized sanitation), since the power calculations suggest

this would likely be sufficient to be able to detect effect sizes that are consistent with the targets in the WASH project's M&E plan.[33] The WASH project sought to connect all FAS beneficiary households to the piped network, so we would expect that they would no longer have to spend any time collecting water. The power calculations suggest that we should be able to detect time savings that are much less than the total amount of time spent collecting water at baseline, so we should have plenty of power for this outcome. The project M&E plan calls for increasing residential network water consumption from 21.5 liters per person per day in 2012 to 34.8 liters per person per day, an increase of 13.3 liters per person per day. Based on the power calculations, even a 50 percent sample would allow us to detect smaller effects than these between the FAS baseline and the interim round, in both geographic subsets and for type 1 and type 2a beneficiaries separately. The M&E plan did not include a target for how many FAS households should stay connected to the network. However, we estimate that we will be able to detect fairly small changes in network disconnections—between about 4 and 12 percentage points for different geographic subsets and beneficiary types—assuming that disconnections are rare (if the true rate of disconnections is closer to 50 percent, we will have less power).

Sampling frame. Based on consultation with potential data collection subcontractors, we plan to use the 2010 census enumeration areas, updated for population changes, as the sampling frame for the first stage (clusters) of the Santiago sample.[34] Within each sampled cluster, we will not need a sampling frame, since we will use the random route approach to sample every Nth household based on the target sample size per cluster and the estimated population of the cluster (Harkness et al. 2010). For the FAS beneficiary sample, we will use the baseline dataset as the sampling frame, treating *bairros* (neighborhoods) as clusters.

Sampling strategy (representative sample). We will stratify by municipality to ensure that all municipalities are included in the sample (proportional to population) and within municipalities we will stratify clusters according to whether or not they are in the catchment area to benefit from a FASA project, to ensure that the representative household survey includes clusters that have and have not benefitted from FASA projects. With the appropriate weights, we will be able to obtain a representative sample for the entire island as well as for FASA project areas. Some FAS households will be drawn as part of the Santiago-wide sample, which is important for the calculation of aggregate changes in coverage of the piped water network.

Instruments. The household data collection will include three main components for both the Santiago and FAS samples—we will use the same data collection instrument for both samples. Specifically, the household survey will include the following components (see also Table IV.2):

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[33] We have assumed a two-stage sampling process for the FAS beneficiaries in which clusters are sampled first and households are only sampled within their clusters because this is likely to be logistically easier and a less expensive approach for the data collection. We will also explore the possibility of ignoring clusters and sampling households directly from the list of baseline survey respondents (types 1 and 2a only), in which case our MDDs will be less since we will not have to account for the intraclass correlation.

[34] We considered using data from the customer census currently being conducted by AdS as the sampling frame, but it is our understanding that the census has been delayed in several communities and might not be completed.

1. **A survey with the head of the household**. This will include modules on respondent and spouse characteristics; household composition and demographics; housing and assets; water collection, treatment, consumption, expenses, and satisfaction (including all four of the outcomes we used for the power calculations); sanitation infrastructure, services, expenses, and satisfaction; income generating activities; and health status.

2. **Water meter observation and accuracy test using ultrasonic meters.** Ultrasonic meters will allow us to accurately measure consumption in both evaluation rounds so that changes in consumption are not confounded by changes in meter accuracy. If meters deteriorate and under-registration of consumption worsens, then on the basis of AdS's meters we might erroneously conclude that households are not consuming more water even if they actually are (the increase in consumption might be passing through the meters without registering). Alternatively, if AdS takes action to improve meter accuracy between the interim and final evaluation rounds by replacing meters, then we might erroneously conclude that households are consuming more water even if they are actually not (what appears to be an increase might just be that less water is passing through the meter without being registered). Because consumption is such a crucial outcome for the evaluation, we do not want to rely on AdS's meters which could be inaccurate. As an additional advantage of using ultrasonic meters, we will also be able to assess the contribution of meter inaccuracy to non-revenue water by quantifying the difference between consumption registered by AdS's meters versus by the ultrasonic meter. We can then use other survey data to predict meter accuracy and help AdS prioritize meters for replacement based on observable characteristics.

   As part of the household survey, enumerators will request permission to observe the water meter in dwellings that are connected to the network. Enumerators will record characteristics that could be predictive of the meter's accuracy, including the meter type, any obvious wear and tear, meter inclination (positioning), meter age, etc., as well as the suitability of the pipes and meter placement to allow an ultrasonic meter to be installed temporarily. We propose to use 50 ultrasonic meters, each of which will be rotated through 8 different randomly-sampled households over the course of 2 months (one week per household) for a total sample size of 400 households. As shown in Table IV.7, this sample size will allow us to detect an increase of at least 8.7 liters per person across the whole island, with the ability to detect an increase of 13.3 liters per person per day in Praia as is targeted in the project M&E plan (the minimum detectable difference is slightly less on the rest of the island).[35] Enumerators will record the starting value on AdS's meter and the ultrasonic meter at the time the ultrasonic meter is installed, and will record the reading on both meters one week later when the ultrasonic meter is removed. Discrepancies between the volume of water recorded by the two meters contributes to non-revenue water. We will use the data from the water meter observations conducted during the household survey and other known characteristics of the network such as the flow rate, network pressure, altitude, location within the network (particularly at the end of branches) to predict meter accuracy.

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[35] The project M&E plan calls for increasing residential network water consumption from 21.5 liters per person per day in 2012 to 34.8 liters per person per day by the end of the compact. This was a very ambitious target (more than a 50 percent increase), so we recommend sampling enough households to be able to detect smaller increases, so as not to miss benefits of the project, even if they are not as large as were originally targeted.

Table IV.7. Minimum detectable differences between interim and endline water consumption (liters per person per day) – ultrasonic meter sample

Sample size	Santiago	Praia (50% of Santiago sample)	Non-Praia (50% of Santiago sample)
	Mean=29.6 s.d.=46.1	Mean=30.3 s.d.=49.9	Mean=29.2 s.d.=43.8
100 households	16.2	24.9	21.9
200 households	11.7	18.1	15.9
400 households	**8.7**	**13.4**	**11.7**
600 households	7.4	11.4	10.0

Notes: Sample size is per round for a pre-post comparison assuming N=100 clusters per round in Santiago (after accounting for attrition, we assume there would be data to analyze from only 90 clusters). Means and standard deviations (s.d.) for water consumption are from the 2011 compact baseline. Power calculations are for a two-sided test with 80% power at α=0.05, with an intraclass correlation coefficient of 0.05 (from the 2015 FAS baseline data on water consumption), R^2 within-group and between-group of 0.3, and an attrition rate of 10 percent in the follow-up round.

Our power to detect meter inaccuracy is also sufficient with a sample of 400 households. Assuming the true correlation between the existing meter and the ultrasonic meter is 0.8, the 95% confidence interval on our estimate for the correlation would be [0.77, 0.83]. If the correlation were actually only 0.6, the confidence interval would be a tiny bit wider ([0.56, 0.64]), but the reduced precision that would arise from a true correlation closer to 0.5 is not very important since it would be apparent that meter inaccuracy is highly problematic even if the truth were at the top end of the confidence interval.

3. **Request for consent to analyze billing and payment records from AdS** (connected households only). See section IV.C.1 for details.

The survey data will allow us to estimate water consumption per capita, describe key water- and sanitation-related outcomes at the household level, and characterize the customer experience and satisfaction with AdS (evaluation question 7; from the project logic outcomes E, F, H3-6, and I2). The household survey will also be used to identify poor households[36], which is an essential first step in determining if the tariff is pro-poor (evaluation question 4), and is also useful for subgroup analyses of other outcomes using the lens of gender and social inclusion. The water meter observations and accuracy data will give us an estimate of one component of non-revenue water (water unaccounted for in the billing process due to inaccurate meter readings, related to evaluation question 6 and outcome C in the project logic). These data will be useful to AdS which does not have an inventory of characteristics of meters it inherited from the SAAS and ELECTRA, and will serve as a baseline so that we can evaluate whether AdS makes any improvements to meters by the time of the final data collection round. Finally, the consent to

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[36] To identify poor households among our sample, we will use INE's relative and absolute poverty definitions (INE 2015 survey on household income and spending). Relative poverty is defined as household income less than 60 percent of the national median (72,325 CVE or approximately $795) and the extreme poverty line as 40 percent of the median expenses (48,216 CVE or approximately $530). Absolute poverty is based on two components: one threshold based on food consumption and another threshold based on non-food consumption. To use these two definitions of poverty, we will collect data on individual and household income following the 2015 INE survey.

obtain billing records would enable us to make use of a very rich data source (see section IV.C.1 for a description of potential analyses using this source).

Given the urgency of completing data collection and invoicing prior to the end of the compact if MCA-CV procures the survey data collection, we recommend electronic data collection to minimize the time needed for data cleaning.

Respondents within the sample unit. In the case of sampled households where no respondent is available, we will keep records of which households were skipped so that we can factor them into the weighting scheme. In the FAS sample, we will compare baseline characteristics of respondents who were absent during the interim or final survey rounds to assess whether there was differential attrition.

Staffing. Data collection will be procured by MCA-CV for the interim round and subcontracted to a local firm by Mathematica for the final round. Mathematica will work with MCA-CV to develop a terms of reference document that defines the capacities and demonstrated experience required of potential data collectors. The local data collection firm will be responsible for creating the data entry templates; translating, pilot-testing, and adapting the instruments; keeping records related to sampling; and collecting and cleaning the data. Mathematica will be responsible for creating the instruments, quality oversight, and all analysis.

Data processing. We will work with the data collection firm to determine what devices and applications will best serve the needs of this evaluation, balancing our commitment to high-quality data with the time constraints.

Data quality processes. In addition to the data quality measures described in section IV.C.2, many of which are applicable to both qualitative and quantitative approaches, for the household survey we will also implement the following measures:

- Implementing validity checks within the quantitative survey

- Providing feedback to enumerators and field managers to correct aberrant data and improve data collection

- Monitoring field data collection, sample coverage, refusals, and other operational issues

- Periodically reviewing data collection progress reports and data extracts to identify and correct systematic errors as data collection progresses

- Carefully checking the final quantitative dataset for completeness and consistency

2. Analysis approach for household survey data

For all of our survey data, we will test for statistically significant differences in outcomes between the 2018 interim and 2020 final survey for the Santiago sample and between the 2015

baseline and 2018 interim survey for the FAS sample.[37] The regression equation for the pre-post analyses is

$$Y_{i,t} = a + bPOST_t + c_i + \varepsilon_{i,t}$$

where *Y* is the outcome for individual *i* at time *t*, $POST_t$ is a binary indicator for the follow-up round, and c_i is an individual fixed effect. We will cluster the standard errors by primary sampling unit (2010 census enumeration areas) to account for the two-stage sampling process. Subgroup analyses for Praia versus the rest of the island, poor versus non-poor households, and FASA versus non-FASA areas will be conducted by restricting the sample accordingly.

We will not be able to attribute these changes to the WASH project activities without a counterfactual to track how the outcomes would have changed even in the absence of the project. Rather, our analysis will focus on assessing whether the project's targets were achieved. The process evaluation will help to shed light on the likely contribution of the project to changes in outcomes over time.

3. Secondary data

In addition to the pre-post analyses of household survey data, we will also do similar analyses using secondary data sources, including the WASH sector monitoring yearbook (RASAS) and operational records from AdS to answer evaluation question 4b (AdS cost recovery) and for many of the utility-level outcomes that fall under questions 5 and 6 (evidence of outcomes from project logic). Additional optional analyses of AdS's billing database would also enrich the analysis of tariff progressivity (question 4a) and the comparison of outcomes among FASA and FAS beneficiaries (question 8). The analysis approach for the annual monitoring data and operational data provided by AdS will be descriptive in nature, focusing on a graphical illustration of trends over time. Analyses of AdS's billing database would use a similar statistical model to the pre-post analyses of household survey data described in the previous section.

WASH sector monitoring yearbook. The WASH sector monitoring yearbook (*Relatório Anual dos Serviços de Água e Saneamento*, or RASAS) was spearheaded by the WASH project as part of the technical assistance provided to ANAS and ARE under NIRR. In light of the widespread appreciation for the process and the data it generated, MCA-CV and MCC have agreed to fund development of a RASAS database that should greatly expedite the reporting and analysis process in future years. The RASAS will be led by ANAS annually with support from a new LuxDev-funded WASH project for the next few years.

The first RASAS, compiled in 2016 but reporting data from 2015, offers some glimpses into the operation of the eight SAAS on Santiago prior to their merger into AdS, based on indicators related to access, quality of service, and financial sustainability (see the complete list of indicators we plan to analyze in Table IV.8). As indicated by the empty cells in the table, there were many problems with missing data, and MCA-CV and NITA report that there were also challenges with data quality. However, this situation is expected to improve in subsequent years

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[37] Based on the findings from the 2018 interim survey, we will confer with MCC to determine if an additional survey round among the FAS beneficiaries would be a cost-effective investment in data collection.

as management at AdS improves and all water and sanitation utilities in the country gain more experience with the indicators and processes required to collect and analyze the data. We will also compare the same set of outcomes between AdS, Agua Brava (a corporatized MMU serving the islands of Fogo and Brava, which served as a template for the creation of AdS), and the SAAS on Maio, which is currently exploring corporatization with support from the WASH project.

Table IV.8. RASAS indicators

Indicator from RASAS report	Indicator definition	Availability of 2015 data by utility											
					SANTIAGO							FOGO / BRAVA	MAIO
		ELECTRA	ADA	SAAS SD	SAAS SC	SAAS SSM	SAAS SCZ	SAAS SLO	SAAS RGS	SAAS SM	SAAS TA	AGUA BRAVA	SAAS MAIO
3.5.2. Household coverage of piped water network	Share of dwellings connected to the piped water network	X		X			X			X		X	X
3.5.3. Accessibility of *chafaris*	Share of dwellings within 250 m of a *chafaris*												
3.6.2. Household coverage of sewer network	Share of dwellings connected to the sewer network	X			X		X			X	X		X
3.6.3. Household coverage of on-site sanitation	Share of dwellings with on-site sanitation												
3.5.4. Continuity of water supply	System pressurizing time (annual average)	X			X		X				X		X
3.5.7. Water inefficiency	(Water in the system - water billed)) / water entering the system	X		X		X	X		X	X	X	X	
3.5.8. Economic accessibility of water service	Average cost of water service / average family disposable income												
5.3.1. Financial autonomy (percent)	Equity / net assets						X					X	
5.3.7. Operating profitability (percent)	Gross operating profit / turnover											X	X
5.3.9. Operating expenses per m^3 of water	Operating expenses / level of physical activity												
5.3.4. Average expenditure on staff	Operating expenses / average number of employees										X	X	
5.3.12. Average productivity per worker	Turnover / average number of employees												

Notes: Future rounds will also include testing for free and total chlorine residual and turbidity.

ADA=Water Distribution Agency of Praia, SD=São Domingos, SC=Santa Catarina, SSM=San Salvador do Mundo, SCZ=Santa Cruz, SLO=São Lourenço dos Órgãos, RGS=Ribeira Grande de Santiago, SM=São Miguel, TA=Tarrafal.

AdS operational records. We will rely on AdS to provide us with data related to non-revenue water (technical and commercial losses), their bill collection ratio, and operating costs (including staff, purchases of desalinated water from ELECTRA, other inputs to water production at AdS operated facilities, water distribution, and capital expenses). We will work with AdS, ARE and ANAS to minimize the burden on AdS by using data reported to other entities whenever possible.[38] For important statistics that are not required by ANAS or ARE for other purposes, we will provide AdS with clear definitions and instructions for how to calculate the measures we are interested in (including splitting them by AdS branch in some cases). Alternatively, if AdS is willing and MCC would prefer that Mathematica assess the quality of AdS's records and independently calculate these parameters, this additional task could be added to the evaluation through a modification to the contract.

E. Component 3: FASA case studies

As described in Chapter II, the FASA funded a diverse portfolio of projects. It is beyond the scope of this evaluation to undertake an in-depth analysis of each of them, but through a set of three illustrative case studies on Santiago, Sal, and São Vicente, we will explore commonalities and unique aspects of projects that represent the broader portfolio. We will use a mixed-methods approach, combining both descriptive quantitative data (drawn from the household survey for the case study on Santiago, RASAS, and secondary data from the utilities that will manage these three projects upon completion), information from the document review, and primary qualitative data from interviews with beneficiaries and those involved with implementation. Our analysis for this component of the evaluation will cover implementation (question 1); the political economy of the design and implementation of the FASA case study projects (question 2); the extent to which the FASA projects improved or extended the existing network (questions 3a and 6); the perceived effects on the recipient utilities, households, and the environment (questions 5-8); and the prospects for these projects to be operated sustainably by the utilities that manage them (question 3b). The case studies will also consider other potential economic benefits of the projects which are not included in the overarching WASH project logic.

1. Selection of case studies

We recommend the following three cases to reflect the diversity in the FASA portfolio. These three projects represent different types of investments that were awarded by the FASA (that is, water network expansion and sanitation infrastructure rehabilitation) and also represent projects funded under the two different funding tranches and on three different islands.

a. **Interconnection of Praia and São Domingos (Santiago, tranche 2, project 1, $3.2 million**). The main objective of the project is to supply piped water to the municipality of São Domingos and neighborhoods in the northern part of Praia, including a spur to connect the airport with the piped water network. We selected this project because it was the single largest FASA investment in dollar value and will provide network water to an entire municipality that currently relies on tanker trucks to deliver water since the borehole that formerly supplied the SAAS went dry several years ago. This project also overlaps with

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[38] As one example, as part of ATAS's contract, AdS will be pilot testing strategies to reduce non-revenue water in two communities in 2017, which could become a useful source of information about technical and commercial losses.

neighborhoods served by FAS, at least in the municipality of São Domingos. Finally, since all of São Domingos benefits from the project and the municipality will be included in the household survey, we can draw on the quantitative data as a complement to the focus groups and key informant interviews (albeit in a descriptive manner, since the sample size will be small and we will have little statistical power to detect statistically significant differences).

b. **Sal waste-water treatment plant (Sal, tranche 1, project 4, $1.4 million).** The main objective of the project is to rehabilitate an existing waste-water treatment plant so that it can provide treated waste-water for use in the agricultural and tourism sectors, but also includes expanding the sewer network in Santa Maria, an investment that directly benefits local residents and indirectly benefits the tourism sector since poorly managed waste in the neighborhoods adjacent to the hotels is a risk for the industry. We selected this project because it is one of only two sanitation projects funded by FASA[39] and has the potential to contribute large economic returns thanks to increased tourism. In particular, the rehabilitated waste-water treatment plant will play a key role in helping Sal acquire a Blue Flag rating status for sustainable beaches, which would likely attract more European tourists.[40] The project is also unique for its innovative approach to making recycled waste-water an economic commodity that could promote the intensification of several agricultural ventures in one of the most arid parts of Cabo Verde. This unconventional new line of business for Agua Ponta Preta, the corporate utility that operates the Sal waste-water treatment plant, will be an interesting opportunity to observe how ANAS, ARE, and other sector stakeholders work together to create and implement new policies that have only become necessary due to this emerging new technology. In that sense, this case study offers a window into the effects of the NIRR as well as one of the most promising FASA projects.

c. **São Vicente water network expansion (São Vicente, tranche 1, project 3, $0.4 million).** The objective of this project is to bring piped water to the High Zones of the peripheral districts of the city of Mindelo through the distribution network. If successful, the project will improve access and the quality of water for 33 percent of poor families in the High Zone and 47 percent of female headed households. The project also seeks to reduce the cost of water to the families in the High Zone. We have selected this case study because it was predicted to benefit the largest number of individuals. The project also is one of the few projects that also received FAS interventions in the community and has the potential to demonstrate combined effects from both expansion and line infrastructure improvements.[41]

2. Data collection

Table IV.9 summarizes the proposed respondents, data collection methods, and number of interviews or focus groups as well as the evaluation questions and illustrative interview topics to

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[39] A third waste-water treatment plan (in Praia) was selected but not contracted due to a shortage of funding.

[40] The Blue Flag rating is a prestigious award that signals a beach and the neighboring community is compliant with stringent environmental, educational, safety, and access criteria. If Sal were to qualify, it would be the only Blue Flag beach in West Africa, much closer to Europe than the only other sub-Saharan Blue Flag beaches in South Africa.

[41] Another example is on Santiago, where FAS subsidies helped 163 households in São Domingos connect to the piped water network and the Praia-São Domingos interconnector FASA project actually put water in the pipes (the municipality had relied entirely on water delivered by tankers since their well ran dry several years ago).

be addressed with each respondent during the primary qualitative data collection for the case studies (see Section IV.C.1 for more details on how we determined which data collection method to use with each respondent and how many interviews and focus groups to conduct). We plan to conduct key informant interviews with approximately 44 stakeholders[42] during the interim round to document how FASA projects were developed, selected, and implemented as well as gain insights into the short term effects of the projects in the months after completion. During the final data collection round for the evaluation, we plan to conduct a second interview with approximately half of these stakeholders for their input on the sustainability and longer-term effects of the projects. Finally, we plan to conduct six focus groups with households in the catchment area of the projects during each round of data collection. The list of respondents for qualitative data collection includes:

- **MCC and MCA-CV** (interim round only). We will include FASA-specific questions in interviews with all key staff at MCC and MCA-CV because they helped design the FASA, managed the FASA application process, oversaw FASA contracts, and liaised with other stakeholders who were involved with the FASA granting mechanism and/or specific projects. For staff who were more involved in other aspects of the project (and are being interviewed primarily for the process evaluation), we will include questions on linkages between the FASA case study projects and other WASH project activities. For staff who played a primary role in designing the FASA, managing the call for proposals and/or the selection of projects, or the implementation of the works projects and IEC activities, we will devote more time during the interview to gathering their input on these topics specifically focused on the three case study projects. We will also inquire about perceived effects of the FASA case study projects on the beneficiary utilities, households, local economies, and local politicians.

- **National entities** (ANAS and ATAS during interim round, ARE during both interim and final rounds). These entities are being interviewed primarily for the process evaluation, but we will include FASA-specific questions in interviews with these stakeholders to understand the linkages between each project and activities undertaken through the NIRR and URA (more details on specific topics for each agency are in Table IV.9).

- **Utilities that manage FASA projects** (AdS on Santiago, ELECTRA on São Vicente, and Águas de Ponta Preta on Sal; all during both rounds). In addition to the high-level management at AdS who we also plan to interview for the process evaluation, we will speak with AdS branch managers who are responsible for the FASA case study catchment areas in Praia and São Domingos, ELECTRA managers on São Vicente, and managers who work for Águas de Ponta Preta on Sal because these managers are the ones who have taken over operation of the infrastructure funded by the FASA. These interviews will include questions about the origins of the project and how the proposal was developed, implementation of the project including both the construction and the IEC elements, perceived effects on beneficiaries, and plans for management and maintenance of the infrastructure (to assess the potential for sustainability).

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[42] Please note that roughly two-thirds of these stakeholders will also be interviewed for the process evaluation. Whenever possible, both the project-wide topics and the FASA-specific topics will be covered during a single interview to minimize the time required of respondents.

- **FASA implementers** (interim round only). As noted in the process evaluation section, we will interview representatives of the construction companies that implemented the FASA case study projects to gather in-depth information on project design and implementation, including both the construction and IEC elements.

- **Associação dos Amigos da Natureza** (interim round only). As noted in the process evaluation section, we will interview representatives of the NGO that implemented the FAS project which was coordinated with the FASA project on São Vicente. This will allow us to understand how the two projects worked together and what the NGO perceived the effects of the joint projects to be.

- **Mayors and community leaders** (both rounds). To understand how the FASA case study projects reflected political considerations, and how local politics might be affected by the projects, we will interview the municipal mayors and a grass-roots community leader from the catchment areas of the projects. These interviews will also include the stakeholders' perceptions of the projects' successes and challenges and the effects on households.

- **Project-specific beneficiaries** (Praia airport management for the Santiago interconnection and the Chamber of Tourism and agricultural producers on Sal; both rounds). These interviews will be very project-specific (see Table IV.9 for details) in order to capture other economic benefits of the FASA case study projects.

- **Households** (focus group discussions during both rounds). We will conduct two focus groups per case study to assess the local community's familiarity with the project and their perceptions of the construction phase (interim round only) and changes in household outcomes that can be attributed to the FASA.

Table IV.9. Summary of qualitative data collection for case studies

Respondent[a]	Data collection method	Data collection round	Number of interviews or focus groups	Projects	Evaluation questions (see Table IV.2)	Illustrative topics
MCC and MCA-CV staff[a]	Interviews	Interim	12	All three	1-3, 5-8	• Linkages between FASA case studies and other WASH project activities (including the availability of FASA funding as an incentive for corporatization on Santiago) • Selection process for FASA grants (calculation of ERR, consistency with the Master Plan) • FASA project design and implementation • FASA project-specific IEC strategy and mainstreaming of gender and social issues • Coordination on FASA projects between multiple stakeholders (utilities, construction companies, government agencies, and local communities) • Successes and challenges • Perceived effects of FASA projects on utilities, households, local economy, and local politicians
ANAS[a]	Interviews	Interim	2-3	All three	1-3	• Selection process for FASA grants (consistency with the Master Plan) • Any other linkages between the case study projects and ANAS oversight or policies
ATAS[a]	Interviews	Interim	1	Santiago	2, 3, 5, 6	• Technical assistance to AdS related to FASA projects (issues identified, recommendations given, challenges experienced, and solutions implemented) • Perceived effects of FASA projects on utilities, households, local economy, and local politicians
ARE[a]	Interviews	Interim and final	1	Sal and Santiago	1-3, 6	• Tariffs for Águas de Ponta Preta services on Sal (especially recycled waste-water) • Tariffs for AdS services (including water delivered by interconnection of Praia and São Domingos, water supplied to airport)

Respondent[a]	Data collection method	Data collection round	Number of interviews or focus groups	Projects	Evaluation questions (see Table IV.2)	Illustrative topics
Utilities: **AdS**[a,b] **ELECTRA (São Vicente)** **Águas de Ponta Preta (Sal)**	Interviews	Interim and final	AdS: 4-5 ELECTRA: 1-2 Águas de Ponta Preta: 1-2	All three	1-3, 5-8	• Effects of national reforms on utility operations, service quality, and financial health (for process evaluation) • Creation of FASA project proposal (AdS might not have perspective on this since the company did not yet exist) • FASA project-specific IEC strategy and mainstreaming of gender and social issues • Coordination on FASA projects between multiple stakeholders (MCA-CV, construction companies, government agencies, and local communities; also Associação dos Amigos da Natureza on São Vicente for linkages with FAS) • Successes and challenges • Perceived effects of FASA projects on utilities, households, the environment, local economy, and local politicians • Management and maintenance plan for FASA infrastructure
FASA implementers[a]	Interviews	Interim	4	All three	1-3	• FASA project design and implementation • FASA project-specific IEC strategy and mainstreaming of gender and social issues • Coordination on FASA projects between multiple stakeholders (MCA, utilities, government agencies, and local communities) • Successes and challenges
Associação dos Amigos da Natureza[a]	Interviews	Interim	1-2	São Vicente	1-3	• Plan to co-implement FAS and FASA projects • Coordination on FASA project between multiple stakeholders (ELECTRA, MCA, construction companies, government agencies, and local communities) • IEC strategy for co-implemented FAS and FASA projects and mainstreaming of gender and social issues • Successes and challenges
Mayors and community leaders[c]	Interviews	Interim and final	2-3 per project	All three	1, 2	• Successes and challenges • Perceived effects of FASA projects on utilities, households, local economy, and local politicians
Praia airport management	Interviews	Interim and final	1	Santiago	1-3, 7	• FASA project design and implementation • Successes and challenges • Perceived effects of FASA project on airport operations • Management and maintenance plan for airport infrastructure that connects to FASA infrastructure

Respondent[a]	Data collection method	Data collection round	Number of interviews or focus groups	Projects	Evaluation questions (see Table IV.2)	Illustrative topics
Chamber of Tourism	Interviews	Interim and final	1	Sal	7	• Progress toward Blue Flag certification in all domains • Other influences in tourism sector (including global trends) • Satisfaction with operation of waste-water treatment plant and improved sewerage funded by FASA • Perceived effects of FASA project on tourism
Agricultural producers	Interviews	Interim and final	1	Sal	7	• Affordability of recycled waste-water • Satisfaction with reliability and quality of recycled waste-water • Perceived effects of FASA project on agricultural production
Households[a]	Focus groups	Interim and final	2 per project	All three	1-3, 5, 7, 8	• Familiarity with the FASA project (where the money came from, what the project entailed, messages received through IEC campaign) Perceptions of: • The construction phase (inconveniences or risks experienced) • Changes in access to piped water (on Sal, improved sanitation) due to FASA project • Quality of service provided by water and sanitation utilities • Effects of improved access on quantity of water consumed, household expenditures, time use, quality of life, household productivity, changes in the neighborhood, and other domains

[a] Respondents also included in the summary of qualitative data for the process evaluation (households on São Vicente were also described as part of the process evaluation data collection for the FAS; the household focus groups on Santiago for the case study qualitative data collection are different than those proposed for the process evaluation). In addition to the broader questions we will ask for the process evaluation data collection, we will also ask specific questions about the three FASA project case studies during these interviews.

[b] In addition to asking FASA project-specific questions of corporate management interviewed for the process evaluation, we will also interview the branch managers for Praia and São Domingos.

[c] In the interim round we will attempt to interview the person who was serving as mayor at the time the project was proposed, as well as the current mayor.

3. Analysis approach

We will provide a detailed description of each of the three FASA investments using all sources of data available to us (interviews and focus groups, project documents, administrative data from utilities, and household survey data from the 2015-2016 FASA baseline on Santiago and the two survey rounds planned as part of this evaluation) and the analysis methods described in sections IV.C.2 and IV.D.2 (especially political economy analysis). The case studies will explore a number of topics in both the interim and final round (unless otherwise noted), including:

1. the process of creating the proposal (who was involved, how the idea was chosen, what collaborations were required, etc.—interim round only)

2. facilitators and challenges to implementation (interim round) and maintenance (final round)

3. linkages between the project and the NIRR (for example, whether the project was consistent with the priorities laid out in the Master Plan and any implications of new environmental policies, tariffs, or service quality regulations for how the infrastructure will be managed)

4. the perceived impact of the investment on the utility (in terms of both finances and quality of service provision), households in the catchment area (are households aware they could be benefitting from it? for network extensions, did households connect to the new lines?), the local economy, and the political context (who reaps the political rewards—or bears the political consequences—for winning the project and managing it?)

5. the likely validity of the assumptions in the project's ERR

6. the potential for the infrastructure to be sustainably managed

Finally, drawing on all three case studies, we will look for common learnings and attempt to identify contextual factors that could explain differences between the three experiences.

F. Challenges and Limitations

Although our evaluation design offers the best possible opportunity to inform the key research questions, it also faces some limitations and challenges:

- **Absence of a counterfactual for the NIRR activity, URA, and FASA-funded infrastructure projects.** As explained previously, it will be difficult to attribute changes in outcomes to the program rather than secular trends or other developments in the WASH sector. For example, the impacts of a new WASH project funded by LuxDev[43] and/or new desalination plants for Santiago funded by JICA[44] could also be reflected in the pre-post analyses comparing outcomes in 2020 and 2018. Our contribution analysis approach will

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[43] Grant #82 from LuxDev, the Luxembourg Agency for Development Cooperation, will fund technical assistance to several of the same institutions that were supported by the WASH project and will also provide seed capital and start-up technical assistance to a new incarnation of the FASA.

[44] Discussions with the government are still underway, but the loan agreement for over $144 million to finance four new desalination plants on Santiago was signed in December 2013. The current plans call for much more capacity than is currently needed.

triangulate between the pre-post analyses and the qualitative data to assess the extent to which the WASH project likely contributed to the changes over time.

- **Inability to separately identify effects of each project activity.** As depicted in the project logic, activities complemented one another and jointly influenced the targeted outcomes, making it difficult to know exactly which activities or sub-activities were driving the effects. For example, on Santiago, all households benefit from the NIRR and URA, and some households also benefitted from FASA and/or FAS. Maio is the only other island that benefitted from the URA (as well as the NIRR, which benefitted the entire country), whereas on São Vicente, there are neighborhoods that benefitted from NIRR, FASA, and FAS (but not URA). Using the project logic as our analytical framework, the qualitative data collected through the process evaluation will be our best resource for comparing the relative contributions of different project activities to each outcome of interest, although we will also look for opportunities to exploit the timing of different activities for different geographic areas to compare outcomes in the quantitative data.

- **Limited resources to explore effects of NIRR on islands other than Santiago.** We focus on Santiago because it offers the most cost-effective learning environment due to the intensity of project activities and the fact that half the national population is on that island. There might be interesting effects of NIRR on agriculture or tourism on other islands, but the evaluation will not be able to explore the consequences of the new policies other than through the interviews with national stakeholders.

- **Limited resources to explore effects of WASH project on farms or firms.** Consistent with the project logic's focus on households, utilities, and government, our proposed evaluation does not encompass the WASH project's possible effects in the agricultural, industrial, or tourism sectors of the economy, other than through the FASA case study on Sal.

- **The baseline data are not always ideal.** Some questions from the baseline surveys were not as specific or precise as we would recommend to generate the highest-quality and most informative data. We will take a dual approach of preserving comparability with baselines but also sometimes asking more precise or detailed questions in the interim and final data collection rounds.

- **Risk of key stakeholders not being available for the process evaluation.** Former government officials and staff who were involved with the design or implementation of the WASH project may be unavailable since the evaluation is occurring several years after the project was initiated. In particular, after the 2016 election in which many seats switched party, some former municipal leaders who would have important perspectives for the process evaluation and understanding the role of the FASA in incentivizing reform might not be available or willing to be interviewed. We will attempt to locate as many respondents as possible and set up phone interviews if they are no longer in Cabo Verde.

- **Risk that AdS will not be willing or able to share operational or administrative data** such as costs, revenue, collection ratio, or volume of non-revenue water. To limit the possibility that we do not obtain the necessary information from AdS, we will try to build a strong relationship with AdS and we will undertake efforts to minimize the burden on them.

- **Risks of extrapolating conclusions from Cabo Verde to other contexts.** Cabo Verde is an unusually small country, an island archipelago highly dependent on tourism, and relatively better off in terms of economic and social indicators compared to much of the rest of Africa. Recognizing that there is a strong desire to draw lessons from the Cabo Verde WASH project for other utility reform and infrastructure projects being funded by MCC, we will be careful to consider what contextual factors might have influenced how the project activities affected the key outcomes of interest.

V. EVALUATION ADMINISTRATION AND MANAGEMENT

In this chapter, we discuss several administrative issues relevant to managing the evaluation and present a timeline of the evaluation activities.

A. Summary of institutional review board requirements and clearances

Mathematica is committed to protecting the rights and welfare of human subjects and will prepare and submit an application for approval of the research and data collection plans to an institutional review board (IRB) registered with the Office for Human Research Protections within the U.S. Department of Health and Human Services. We intend to use Health Media Lab as our IRB, based on our positive experience with it on previous MCC projects. We will submit the required documents, including a research protocol providing details of the study and data collection activity, copies of all data collection instruments, and a completed IRB questionnaire that summarizes the key elements of the research protocol and plans for protecting participants' confidentiality. The data collection instruments (both the quantitative survey and qualitative protocols) that we will prepare and share with the IRB will include consent statements approved by MCC that guarantee the confidentiality of respondents to the extent possible.

We will provide evidence of the IRB approval to MCC. IRB approval is valid for one year and we will submit annual renewals for subsequent approvals as data collection proceeds through follow-up collection processes. We expect that the annual renewals will require minimal updates to the core application materials, because we will collect similar data to track over time. If data collection instruments change substantially from those that the IRB approved, then we will reapply for review. Small changes to the instruments (such as rewording of questions, reordering of questions, or editing changes) do not require reapplication, but the finalized instruments must be submitted to the IRB for documentation. We will submit the instruments for review in both English and Portuguese.

B. Data protection

Mathematica and the local survey firm will ensure confidentiality of all respondents, including confidentiality of participating in the data collection, confidentiality of personally identifiable information, and other sensitive data. When quantitative or qualitative data are collected, the local survey firm will ensure the safe handling and transfer of electronic files, which will initially be stored on a secure server managed by the subcontractor before being transferred to Mathematica's secure server. Data files will be accessible only to project team members who clean or analyze the data. All project team members have signed a nondisclosure agreement pertaining to confidential information. Electronic data files will be shared with

Mathematica using a secure file transfer system, such as a file transfer protocol, file exchange website (FX site), or a SharePoint site. For internal control and audit purposes, if any paper forms are used, Mathematica will work with the local survey firm to identify a mechanism for storing these data for the entire duration of the project, which includes the base contract and the subsequent option contracts. All of the data collected using the evaluation budget are the property of Mathematica and will be delivered to Mathematica at the end of the contract. All files with sensitive information, including those for secondary data analyses and document review, will be stored in a designated encrypted project folder, which is secured with AES 256-bit encryption.

C. Preparing data files for access, privacy, and documentation

After producing and finalizing the interim and final evaluation reports, we will prepare corresponding deidentified data files, users' manuals, and codebooks for the household survey data, according to the most recent guidelines set forth by MCC. We will work with MCC's Disclosure Review Board and any sources of administrative data we might analyze for the evaluation to find a mutually-agreeable solution regarding the necessity and potential to create deidentified data files. Public use data files will be free of personal or geographic identifiers that would enable unassisted identification of individual respondents or their households, and we will remove or adjust variables that introduce reasonable risks of deductive disclosure of the identity of individual participants. We will also recode unique and rare data using top and bottom coding or by replacing these observations with missing values. If necessary, we will also collapse any variables that make an individual highly visible because of geographic or other factors into less easily identifiable categories.

D. Dissemination plan

The Mathematica team will produce a policy brief for the interim and final results that will include a core set of results and lessons. We will also present the final evaluation findings in person to MCC and WASH project stakeholders in Cabo Verde. Furthermore, we will participate in any other MCC-financed dissemination and training events related to the findings from the interim and final evaluation reports. To ensure that the results and lessons from the evaluation reach a wide audience, we will work with MCC to increase the visibility of the evaluation and findings targeted to the WASH sector, particularly for policymakers and practitioners. We expect the broader research community to have strong interest in the findings from the evaluation. To facilitate wider dissemination of findings and lessons, we will collaborate with MCC and other stakeholders to identify additional forums—conferences, workshops, and publications—to disseminate the results and encourage other donors and implementers to integrate the findings into their programming.

E. Evaluation team's roles and responsibilities

Our team has extensive experience and expertise in evaluation design, data collection, and analysis to meet MCC's evaluation needs. **Dr. Clair Null** oversees the project team and provides technical leadership. She is responsible for managing the evaluation team, leading the design and implementation of the evaluation, and overseeing data collection efforts, particularly for the quantitative components of the evaluation based on the household survey and secondary data sources. Dr. Null also monitors the project's budget and schedule, and she manages

communication with MCC, local partners, and other stakeholders. **Dr. Audrey Moore** works alongside Dr. Null to oversee the qualitative aspects of the evaluation, including the development of the recruitment strategy, instruments, and coding scheme, analysis, and reporting for the process evaluation and case studies. **Dr**. **Chantal Toledo** and **Dr. Abbie Turiansky** will work with Drs. Null and Moore to develop both the quantitative and qualitative data collection instruments and the sampling protocol for the household survey, and will contribute to the analyses and reporting on all three evaluation components. **Ms. Edith Felix,** the junior analyst on the team, and **Ms. Christina Phelps**, Research Assistant, will provide support for instrumentation development, data collection management, data analysis, reporting, and overall project coordination. **Dr. Evan Borkum** provides quality assurance reviews for all key deliverables for this project.

Our consultant, **Dr. Loay Hidmi**, is a civil engineer who serves as the infrastructure specialist on the team and is responsible for providing guidance on assessments of water and sanitation infrastructure and utility operations. The evaluation team is still in the process of recruiting a local evaluation coordinator who will work closely with Mathematica and local stakeholders to develop evaluation materials and oversee data collection.

F.   Evaluation timeline and reporting schedule

The evaluation activities presented in Table VI.1 below, will include an interim and final round of data collection. Mathematica will procure the data in both rounds. The interim survey and qualitative data collection will be conducted in the second quarter of 2018. In the second half of 2018, we will conduct the interim data cleaning and analysis and finalize the interim evaluation report in the first quarter of 2019, including incorporating feedback from stakeholders. The final round of data collection will begin in late 2020. We will conduct data cleaning and analysis in 2021. We expect to submit the final evaluation report, which will integrate findings from all evaluation components, by early 2022, again incorporating feedback from stakeholders after the presentation of the draft report.

Table VI.1. Evaluation timeline

Round	Data collection	Data cleaning and analysis	First draft report expected	Final draft report expected
Interim	Q2 2018	Q3 2018	Q4 2018	Q1 2019
Final	Q4 2020 – Q2 2021	Q3 2021	Q4 2021	Q1 2022

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APPENDIX A:

DETAILS ON CONTEXT AND IMPLEMENTATION

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Table A.1. Water and sanitation utilities and WASH project activities by island

Island	Utility	Ownership and management	Population served[d]	Number of FASA projects	Value of FASA projects ($)	Number of FAS households
Santo Antão	SAAS Porto Novo (distributes desalinated wáter supplied by corporate Águas de Porto Novo)	Municipal	17,431	1	$1.4 million	557
	SAAS Paúl	Municipal	6,099	1	$1.4 million	557
	SAAS Ribeira Grande	Municipal	17,017	1	$1.4 million	557
São Vicente	ELECTRA	Corporate multi-utility[c]	81,014	2	$1.3 million	757
São Nicolau	SAAS Ribeira Brava	Municipal	7,182	0	n.a.	0
	SAAS Tarrafal	Municipal	5,242	0	n.a.	0
Sal	ELECTRA	Corporate multi-utility[c]	33,747	0	n.a.	0
	Águas de Ponta Preta[a]	Corporate		1	$1.4 million	0
Boa Vista	ELECTRA	Corporate multi-utility[c]	14,451	0	n.a.	0
	Águas e Energia de Boavista[b]	Corporate		0	n.a.	0
Maio	SAAS Maio	Municipal (corporatizing)	6,980	1	$0.5 million	0
Santiago	Águas de Santiago	Corporate MMU	294,135	4	$8 million	3,029
Fogo	Água Bava	Corporate MMU	35,837	2	$2.25 million	0
Brava	Água Bava	Corporate MMU	5,698	1	$1.8 million	0

Notes: The World Bank is providing technical assistance to explore the possibility of forming a corporate multi-municipal utility (MMU) on Santo Antão, São Vicente, and São Nicolau. The WASH project is providing technical assistance for SAAS Maio to corporatize.

[a] Serves tourism and the town of Santa María; ELECTRA serves the rest of the island.

[b] Serves tourism; ELECTRA serves the rest of the island.

[c] ELECTRA provides electricity as well as water and sewerage.

[d] Source: Instituto Nacional de Estatística (INE) Cabo Verde 2015.

Table A.2. Tranche 1 and 2 projects funded by FASA

Contract number	Island	Project category	Project description	Total cost ($)	Start date	Project status[a]	Number of beneficiaries[b]
Tranche 1 (awarded 2014)							
1	Brava	Water network rehabilitation	Fluoride removal	1.8 million	Jan. 18, 2015	Ongoing	2,401 households/ 10,805 individuals
2	Fogo	Water network rehabilitation	Water network replacement from Patim to Cova Figueira (17 km)	0.95 million	April 13, 2015	Complete	833 households/ 3,749 individuals
3	São Vicente	Water network expansion	Water supply expansion in peripheral District 9 Mindelo	0.4 million	Feb. 25, 2015	Complete	7,803 households/ 35,112 individuals
4	Sal	Waste-water network extension and connection; Waste-water network and treatment rehabilitation	Operationalization of the waste-water treatment plant, improvement and expansion of Santa Maria's sewerage network	1.4 million	June 5, 2015	Ongoing, expect to complete by April 2017	4,808 households
Tranche 2 (awarded 2015)							
1	Santiago	Water network rehabilitation	Water system interconnection (Praia to São Domingos with spur to airport)	3.2 million	Nov. 26, 2015	Ongoing, expect to complete by September 2017	3,057 households/ 15,284 individuals
2	Santiago	Water network rehabilitation; Water network expansion	Lot 1: Strengthening of water supply. Lot 2: Expansion of networks	1.3 million	Jan. 8, 2016	Ongoing, expect to complete by June 2017	Lot 1: 635 households/ 3,071 individuals Lot 2: 3,848 households
3	Fogo	Water network expansion	Extension of the water network from Campanas de Baixo to Atalaia, Ribeira Ilhéu, Rotcha Fora and Mosteiros Tras to Corvo, Achada Grande and Relva.	1.3 million	Dec. 1, 2015	Ongoing, expect to complete by May 2017	10,303 individuals
4	Santo Antão	Water network rehabilitation	Lot 1: Improvements to the mobilization system and water distribution in the municipality of Paúl. Lot 2: Improvements to the mobilization system and water distribution	1.4 million	Mar. 1, 2016	Ongoing, expect to complete by September 2017	Lot 1: 1,640 households Lot 2: 28,290 individuals
5	Santiago	Waste-water network rehabilitation	Improvements to the waste-water treatment plant in Palmarejo	1.4 million	May 2, 2016	Cancelled	130,271 individuals

Contract number	Island	Project category	Project description	Total cost ($)	Start date	Project status[a]	Number of beneficiaries[b]
6	Santiago	Water network rehabilitation; Water network expansion	Lot 1: Water quality improvement and extension of the distribution network in Santa Catarina Lot 2: Improvements to the water supply subsystem and construction of new water distribution network in São Salvador do Mundo Lot 3: Expansion of water supply subsystem in São Lourenço dos Órgãos. Lot 4: Improvement of water supply subsystems in Santa Cruz	1.6 million	May 12, 2016	Ongoing, expect to complete by October 2017	Lot 1: 25,000 individuals Lot 2: 58 households Lot 3: 16 households, 58 individuals Lot 4: 15,739 individuals
7	Maio	Water network rehabilitation	Improvement and interconnection of the three subsystems of water adduction and distribution, including improvements to Ponta Preta's water production center	0.5 million	Feb. 15, 2016	Ongoing, expect to complete by June 2017	12,000 households
8	Santiago	Water network rehabilitation; Water network expansion	Extension and improvement of water supply systems in the cities of: Lot 1: São Miguel Lot 2: Tarrafal	1.9 million	May 20, 2016	Ongoing, expect to complete by August 2017	Lot 1: 2,329 individuals Lot 2: 13,300 households
9	São Vicente	Waste-water network expansion	Public sewage network extension in the suburban areas of São Vicente	0.9 million	Mar. 15, 2016	Ongoing, expect to complete by June 2017	12,000 households

Source: MCC. Table compiled by Mathematica

[a] FASA project status as of March 2017.

[b] Information from the applications of projects funded by FASA.

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APPENDIX B:

FEASIBILITY OF AN IMPACT EVALUATION

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Rationale for pre-post evaluation of NIRR, URA, and FASA

We considered whether it would be possible to conduct an impact evaluation of any aspect of the WASH project, but concluded that it was not possible to identify a valid comparison for any of the project activities. Because the NIRR is a national reform effort, it affects everyone in the country, making it impossible to distinguish the effects of the NIRR from other secular changes over time. Similarly, the URA covers the entire island of Santiago, and due to the differences between islands, it would not be appropriate to use changes over time on another island as a measure of what would have happened on Santiago in the absence of the URA.[45] Infrastructure projects such as the network extensions funded by the FASA can sometimes be rigorously evaluated using regression discontinuity designs, comparing households close to either side of the border of the project's catchment area, although with the complexity of the household decision whether or not to connect to the network additional matching would be necessary.[46] We do not recommend pursuing rigorous evaluation of any of the specific FASA projects given the evaluation's budget constraints and the relatively small contribution each project makes to the whole portfolio of WASH project activities. The proposed evaluation design will investigate the rate at which households are connecting to the network which is an important first step in determining whether the FASA network extensions are likely to have an impact.

Rationale for pre-post evaluation of FAS

Given the availability of 2015 FAS baseline data that included both beneficiary and comparison households, we originally considered implementing a comparison group design. This design would compare changes in key outcomes over time for beneficiary households to the same changes for comparison households; we would then attribute the estimates from this "difference-in-differences" analysis to the impacts of FAS. However, based on our understanding of how the comparison neighborhoods were selected and the important differences in observable characteristics between beneficiary and comparison households, we have concluded that a simple pre-post design focusing on changes over time for FAS households (without using the comparison households) is less biased than the comparison group design might be. In particular, the assumption of parallel trends needed to obtain unbiased estimates in a difference-in-difference analysis (namely that the changes in the comparison households represent what would have happened in beneficiary households in the absence of FAS) does not seem plausible in this context. Moreover, the sample size of comparison households is too small to be able to use a matching approach to try to ameliorate the concerns about differences between the two groups (see Table A.3). Below, we discuss each of these concerns.

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[45] In particular, no other island has so many SAAS that could be brought together under a single corporatized MMU.

[46] Because the network extension projects only benefit households that connect to the network, an RD design would still have to be able to identify which households outside the catchment zone would be likely to connect if they were able to - with an important behavioral component to "exposure" to the intervention, the geographic discontinuity is not sufficient to identify impacts.

Table B.1. FAS baseline sample sizes by municipality and FAS benefit type

Municipality	2015 FAS baseline – type 1 beneficiaries (water connections)	2015 FAS baseline – type 2a beneficiaries (water and sewer connections)	2015 FAS baseline – type 2b beneficiaries (sewer connections)	2015 FAS baseline – comparison
Praia	245	155	119	44
Santa Catarina	281	6	1	158
Santa Cruz	3	74	27	167
Tarrafal	51	3	26	40
São Miguel				44
San Salvador do Mundo				
San Domingos	53			90
San Lourenco dos Orgos				
Ribeira Grande de Santiago				40
Total	633	238	173	583

Source: 2015 FAS baseline survey.

1.   Concerns about the validity of the parallel trends assumption

The parallel trends assumption needed to obtain unbiased estimates in a difference-in-difference analysis does not seem plausible in this context for two reasons. First, beneficiary and comparison households were from different neighborhoods. Whereas beneficiaries were the last few unconnected households in their neighborhoods (FAS prioritized neighborhoods where there were only a few unconnected households, so that they could reach 100 percent network connection and then shut down the *chafaris*), comparison households were chosen from neighborhoods in which the majority of the population was unconnected. In particular, the comparison sample neighborhoods had at least 70 percent of the population "with a low/very low level of welfare," not more than 30 percent of households connected to the water network and not more than 30 percent with a septic tank. This suggests that there are fundamentally different contexts and unobservable neighborhood-specific factors that are likely to have a large effect on outcomes and their trends over time.

Second, comparing baseline equivalence on characteristics such as monthly expenditures, housing materials and sanitation facilities (as shown in Table A.4) reveals that FAS beneficiary and comparison households were substantially different in terms of their socioeconomic status and WASH-related outcomes at baseline. In particular, beneficiaries were socioeconomically better off (their monthly expenditures were significantly higher, they were more likely to have a house made out of tile as opposed to cement, own a TV, and have some sort of sanitation facility). In addition, those without a connection to the water network relied on different types of water sources (they were more likely to use a neighbor's piped connection or a public *chafaris*; less likely to rely on other sources such as wells and springs) and spent more on water (partly because of the differences in what type of sources they used). These substantial differences in observable characteristics that could affect outcomes and trends in outcomes suggests the potential for similar differences in unobservable characteristics for which we would not be able to control.

Table B.2. Characteristics of FAS beneficiary and comparison households in 2015 baseline

	Comparison group		Typology 1 water group			Typology 2a water and sanitation group		
	Mean	N	Mean	P-value	N	Mean	P-value	N
Female-headed household	0.67	499	0.74	0.01	633	0.66	0.67	238
Household head has at least some secondary education	0.76	345	0.76	0.92	463	0.78	0.62	194
Household head works outside the home	0.44	497	0.55	0.00	628	0.57	0.00	238
Number of household members	5.05	499	5.08	0.87	633	5.09	0.85	238
Number of rooms in the house	3.45	499	3.48	0.72	633	3.06	0.00	238
Majority of dwelling made of tile	0.08	498	0.20	0.00	633	0.16	0.00	238
Household owns television set	0.61	499	0.75	0.00	633	0.82	0.00	238
Household average monthly expenditures in the last year (CVE)	8875	470	15062	0.00	610	12745	0.00	227
Household average monthly water expenditures in the last year (CVE)	1399	272	1740	0.02	495	1463	0.69	177
Main water source is piped water	0.12	499	0.00	0.00	633	0.00	0.00	238
Main water source is neighbor's piped water	0.03	499	0.15	0.00	633	0.37	0.00	238
Main water source is chafaris	0.29	499	0.61	0.00	633	0.52	0.00	238
Main water source is tanker truck	0.08	499	0.08	0.94	633	0.03	0.03	238
Main water source is other[a]	0.47	499	0.16	0.00	633	0.08	0.00	238
Household has latrine	0.17	499	0.47	0.00	627	0.45	0.00	237
Per capita average daily water consumption (liters)	25.7	354	23.7	0.15	555	20.7	0.01	203

Source: 2015 FAS baseline survey.

[a] Public cisterns, wells, springs, irrigation channels and any other sources listed by the respondent that were not included in the survey.

2.   Inability to implement a convincing matching approach

Although we would not be able to overcome the underlying differences in neighborhoods, we considered using a matching approach to identify comparison households from the pool of available comparisons that were more similar to the FAS beneficiary households at baseline. However, this approach was not feasible for several reasons. First, there are just over half as many comparison households (583) as beneficiary households (1,044). Ideally, for matching purposes we need many more comparisons to choose from than beneficiaries, to increase the likelihood of finding high-quality comparisons. Given the small pool of comparison households, the quality of matches for some beneficiaries is likely to be poor. In addition, we might not be able to include all beneficiaries if we could not identify good matches, which would reduce the

sample size for the analysis, reducing both representativeness of the effects we would estimate and statistical power.

Second, there are three types of beneficiaries (those that received water connections, those that received sewer connections, and those that received both) and we need to analyze them separately because the effects are likely to be different depending on the type of FAS subsidy received. This reduces the beneficiary sample size for each analysis, which would further limit statistical power (statistical power for the matched comparison group design would be worse than for the simple pre-post design).

Third, it is not appropriate to match across municipalities since changes over time are likely to be dependent on which utility was serving the household at baseline. Unfortunately, comparison households are not distributed across municipalities optimally (see Table IV.1). In particular, there were only 44 comparison households in Praia relative to 519 FAS beneficiaries, so Praia almost certainly could not be included in an analysis that relies on matching. Not including Praia in our analysis would mean losing half the total sample of beneficiaries, rendering the findings less representative of all beneficiaries and reducing the statistical power for the FAS pre-post analyses.

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