

Papua New Guinea Rural WaSH Sustainability Study

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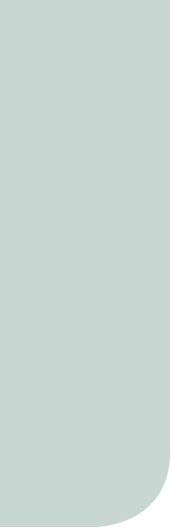
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Abbreviations

ADRA	Adventist Development and Relief Agency
CDG	Community Development Group
CFU	Coliform Fecal Units
CGC	Community Group Consultations
CLTS	Community Led Total Sanitation
DDAs	District Development Authorities
DIMS	District Information Management System
GFS	Gravity Fed (Water) Supply
ICT	Information Communication Technology
KII	Key Informant Interview
LLG	Local Level Government
MIS	Management Information System
NGO	Non-Government Organization
NWSHA	National Water, Sanitation and Hygiene Authority
ODF	Open Defecation Free
PHAST	Participatory Hygiene and Sanitation Transformation
PLWHA	People Living with HIV-AIDs
PNG	Papua New Guinea



PWD	People With Disability
RQ	Research Question
RWH	Rainwater Harvesting
SDA	Service Delivery Assessment
ToR	Terms of Reference
WaSH	Water, Sanitation and Hygiene
WMC	Water Management Committee
WSOC	Water System Observation Checklist
WSP	Water and Sanitation Program

Executive Summary

The World Bank Group's Water and Sanitation Program (WSP) provides technical assistance to support the development of government institutions and capacity building, sector policies and strategies in the water, sanitation and hygiene (WaSH) sector in Papua New Guinea (PNG). Following a Water and Sanitation Service Deliver Assessment that identified serious bottlenecks and a lack of clarity around the roles and responsibilities in the PNG WaSH sector, WSP supported the rural WaSH Policy Task Force to develop a National Water, Sanitation and Hygiene Policy which was approved in January 2015. Key strategies in the policy include:

1. Improved sector coordination and leadership
2. Increased WaSH sector funding
3. Develop and manage an effective management information system
4. Improved and consistent approaches to WaSH service delivery
5. Appropriate technology promotion
6. Enhanced private sector participation and partnerships
7. Sector capacity building and training.

To contribute towards a number of these strategies, WSP commissioned a study—the PNG Rural WaSH Sustainability Study—to gather evidence about the sustainability of rural WaSH activities in PNG. The objectives were:

1. *Identify and develop practical approaches to improve both the sustainability and equitable delivery of rural water supply and sanitation schemes in PNG; and*
2. *Make recommendation on the potential for information communication technology (ICT) monitoring systems for rural water supply.*

The study was conducted by FH Designs, a specialist WaSH consulting firm, in partnership with the Government of Papua New Guinea's WaSH Policy Task Force and four non-government organizations (NGOs) that hosted field work.

Methods

To assess the sustainability and equity of rural WaSH systems in PNG, the study developed two frameworks based upon existing global WaSH frameworks and tailored to the PNG context. The sustainability framework evaluated functionality (the current performance of WaSH systems) and system management, including maintenance. The equity framework focused on gender and social inclusion, particularly disability. Using these two frameworks the study sought to answer six research questions:

RQ1: To what extent are the water systems functional?

RQ2: To what extent are the water systems being managed?

RQ3: What factors facilitate or hinder water system management?

RQ4: To what extent are toilets and handwashing facilities being maintained and used?

RQ5: What factors facilitate or hinder households to continue using their toilets and/or handwashing facilities?

RQ6: What factors have facilitated or hindered the equitable distribution of outcomes and decision making opportunities in relation to water, sanitation and hygiene initiatives?

Twenty communities were identified for the field studies on the basis of having a functioning water system that had been used for at least four years. The communities represented a mix of WaSH programming options and technologies. Of the 20 water supply systems, 15 were gravity-fed systems and five rainwater harvesting systems. The 19 sanitation activities included examples of participatory hygiene and sanitation transformation (PHAST) and community-led total sanitation (CLTS). Fourteen involved sanitation hardware subsidies and five were non-subsidized. The communities were spread across four provinces with a different implementing agency in each:

Touching the Untouchables (TTU)	Eastern Highlands Province
Child Fund	Central Province
Adventist Development and Relief Agency (ADRA)	Morobe Province
World Vision	Madang Province

Data collection focused on investigation within communities using the following methods:

- Community group consultations
- Water supply system observations
- Water supply caretaker key informant interviews (KIIs)
- Household questionnaire survey (focused on sanitation and hygiene)

Information from this data was supplemented with observations of public sanitation and hygiene facilities and key informant interviews with implementing agencies. Community visits were carried out between September and December 2014. Each visit lasted approximately one day.

For the second study objective on sector monitoring, sustainability indicators were identified which would form the basis of a Management Information System (MIS). Interviews were also held with national-level stakeholders about the factors relevant to an MIS, including the level of institutional demand and current and potentially feasible data collection options (including use of ICT).

Study Findings on Water, Sanitation and Hygiene Sustainability

Water Supply Systems

The study found several excellent examples of communities that have been sustaining their water systems for many years. Three of the best performing communities (Avani, Yegusa and Brebrenka) had been operating their systems for more than 15 years and in Yegusa the system has been going since 1978. Clearly, while performance was mixed within the sample of communities, sustainable operation of rural water systems is possible.

Sustainability of the 20 water supply systems was assessed in terms of functionality and management. Four sub-criteria were applied for functionality—quantity, quality, access and reliability—which together described the level of service provided to water users. Management reflected the communities' efforts to carry out preventative maintenance, fix problems, and expand or improve their systems. Ratings for functionality and management were combined to give an overall sustainability rating for each system (Table i).

All except two systems (Mungkip and Gain, in Morobe, which had failed completely) were providing some water. There was, however, a range of sustainability performance. Six communities, spread over three provinces, were rated as 'high' performing and a cluster of five poorly sustained systems was identified (rated as 'sub-standard' or 'no service'), again spread over several provinces.

Table A. Water System Sustainability—Functionality, Management and Overall Rating

Community	Province	Functionality ^a				Management	Overall Rating
		Qty.	Qual.	Acc.	Rel.		
Popof	Morobe	High	High	High	High	High	High
Yegusa	Eastern Highlands	High	High	High	High	High	High
Gawam	Morobe	High	High	High	High	High	High
Ibonatou	Central	High	High	High	High	High	High
Saviya	Eastern Highlands	High	High	High	Sub-standard	High	High
Avani	Eastern Highlands	High	High	High	Sub-standard	High	High
Brebrenka	Eastern Highlands	High	Sub-standard	High	High	High	Improved
Kamasina	Madang	High	High	High	High	Sub-standard	Improved
Gufin	Morobe	High	High	High	Sub-standard	Sub-standard	Improved
Suaru	Madang	High	High	No service	Sub-standard	High	Improved
Vegos	Eastern Highlands	High	Sub-standard	High	No service	Sub-standard	Improved
Tangu*	Madang	Sub-standard	High	High	No service	Sub-standard	Improved
Seba*	Central	No service	High	High	No service	Sub-standard	Improved
Gevera*	Central	No service	High	High	No service	Sub-standard	Improved
Kokorogoro*	Central	No service	High	High	No service	Sub-standard	Improved
Yoro	Madang	High	Sub-standard	Sub-standard	No service	Sub-standard	Sub-standard
Debado*	Central	No service	High	High	No service	Sub-standard	Sub-standard
Ulingan	Madang	No service	High	No service	No service	No service	Sub-standard
Mungkip	Morobe	No service	No service	No service	No service	No service	No service
Gain	Morobe	No service	No service	No service	No service	No service	No service

* indicates rainwater harvesting systems

^a Functionality sub-criteria were quantity, quality, access and reliability, abbreviated here as 'qty', 'qual', 'acc' and 'rel' respectively. Color coding for both functionality and management is—dark green=High, light green=Improved, yellow=Sub-standard and red='No service'.

Gravity-fed systems and rainwater systems were analyzed separately for the factors that had influenced system sustainability and where relevant, the findings in communities with high and low performing gravity-fed systems were contrasted. Thematic analysis of the discussions with community members and key informants (particularly caretakers) revealed the following factors to be most important for each type of system:

Gravity-fed systems Sustainability factors	Frequency cited ^b	Rainwater harvesting systems Sustainability factors	Frequency cited ^b
Maintenance	14%	Maintenance	14%
Water Management Committee	12%	Water Management Committee	12%
Community Ownership	8.5%	External Links	11.5%
Financial Sustainability	7.5%	Ownership	9.5%
Conflict	6.5%	System Quality	8.5%

^b 'Frequency cited' indicates the number of times each factor was raised by community members during consultation meetings.

For maintenance, the critical finding was that someone—be it an individual or the management committee—needs to feel responsible for carrying out repairs. The Water Management Committee was the most important factor reported by community members for ensuring maintenance. Whilst communities often raised the importance of Water Management Committees, further analysis of the study results showed that it is not a committee in itself that is important. Combined with a sense of responsibility, maintenance personnel need to have the right skills, training and access to tools and spare parts but the sense of responsibility is fundamental to maintenance occurring.

Most Water Management Committees were not performing strongly, despite a reasonable understanding of their role. In almost all cases the committees had been established by the implementing agency at the time of the intervention. In the five communities with rainwater systems, only one committee is still active. Community members generally supported the idea of WMCs and recognized them as a factor that constrained sustainability. Indications are that WMCs are more effective when their structure is determined by the community rather than being imposed; when they have strong links to existing leadership structures, and are supported through effective training.

Community ownership was important for gravity-systems (which are community assets) but less so for rainwater systems which tend to be controlled by individuals or small groups of households. For gravity systems, **all of the communities with high performing systems were able to express a clear 'vision' for their systems** including options for how it could be improved. In many of these communities there had been investment in maintenance and, in some cases, improvements.

Communities tend to prefer flexible payment structures that collect funds as they are required rather than accumulated on a regular basis. Financial sustainability was more important for gravity-systems rather than rainwater tanks.) Unsurprisingly, willingness-to-pay was clearly influenced by the level of service provided.

Communities reported that they were generally able to manage conflict when it was directly related to the water supply but where it was about something else—and the water supply was ‘collateral damage’—it was more difficult to resolve. A reliance on external support (surprisingly) was a factor much more prominent for rainwater systems than gravity systems.

Communities with rainwater tanks indicated that they were very reliant on the implementing agency for ongoing support—sometimes to the point of dependency. For four of the five rainwater systems, the implementing agency continued to maintain regular contact with the community and was taking responsibility for almost all maintenance.

Sanitation and Hygiene

The overall performance of the sanitation and hygiene interventions were based on data collected in 177 household questionnaires, field worker observations and the community group consultations in 19 communities. Three sets of analyses were made: *coverage, service level and maintenance*. Four sub-criteria were used to assess sanitation service level: *use; quality-amenity; quality-construction; and handwashing*. Assessment of use relied on a combination of user self-reporting and visual inspection of the latrine.

Sustained use of toilets across the study sample ranged from high to poor. Of note, however, there were households in every community that were continuing to use and maintain their toilet, and some which had a history of toilet use.

Conversely with handwashing facilities, few households with a toilet also had a hand washing facility with soap and water present. The study sample included a mix of subsidy and non-subsidy approaches to sanitation promotion. For each approach, the responses varied across different communities, from good to poor results, suggesting that subsidies are not the critical element in delivering sanitation promotion.

Latrine coverage was spread evenly between three categories—seven communities were ranked high (more than 80% of households with toilets), six were medium (20-80% coverage) and six were low (less than 20%). **Most households (and communities) were found to be maintaining their latrines, with 72% reporting that they had done some maintenance** on their latrines in the past. Aside from regular cleaning, the most common type of maintenance undertaken was digging a new pit and in most cases the labor and sourcing (or recycling) of materials was carried out by the household themselves.

Eighty-five percent of households were found to be using their latrine and all except one community ranked as ‘high’ or ‘improved’. Quality-amenity was based on smell and the presence of flies and fecal matter on or around the latrine (cleanliness), as well as whether the latrine was private. Here the results were much more mixed with only one community ranking as high, and the others as improved or basic. **Most latrines (77%) throughout the sample were dry pit latrines, rated as ‘Improved’** for the *Quality-construction* meaning that they had a durable slab over the pit. Only two toilets were pour-flush. **Handwashing was the weakest of all the service level sub-criteria.** Only nine households (5%) had a hand washing facility of any sort and only one of these was provided with soap. This may not be a sustainability issue—discussions with community members suggest that initial uptake of handwashing facilities was likely to have been quite poor.

Sanitation and hygiene Sustainability Factor	Weighting
Subsidies	14.6%
Quality	14.3%
Access	13.5%
Attitudes	13.1%

Thematic analysis of the qualitative data revealed **four factors that were most important with respect to sustaining sanitation and hygiene outcomes**. Of particular note, the study found that **interventions with and without subsidies could both achieve high sanitation performance**. The experience of handwashing facilities, where subsidized materials were used as water storage containers rather than for handwashing, highlights the sustainability risks associated with providing free materials.

With respect to quality of infrastructure, **all communities had been encouraged to build VIP latrines** with durable materials. Approximately half the toilets observed, however, were simple pit toilets and having to constantly maintain or repair toilets caused some households to revert to open defecation. For access, **community members have an expectation that each household will have their own toilet**. Many survey respondents said that their household had used a toilet for a long time (since before PNG independence) suggesting that in some locations there is an existing culture of toilet use that sanitation programs can build upon. In communities with low toilet coverage, high rates of shared toilets were observed which can demotivate households to maintain their toilet. Above all other issues, **the attitudes of community members are critical**. In the seven high-performing communities households had been convinced of the value of sanitation and continued to invest in it. In the six poor-performing communities, most households who built toilets after the intervention in their community reverted back to open-defecation once their toilets became unusable.

Equity and Inclusion

The study analysis of equity and inclusion focused on gender and marginalization, including disability.

Women bear most of the responsibility for managing water in the household, as reported by all women and most men. This is in alignment with global trends in rural WaSH.

Where improvements to water supplies had been sustained, women reported that this was of great benefit to them and in communities where the *quantity or reliability* of water was inadequate, the burden fell mostly upon women, forcing them to return to unimproved sources such as creeks, (rivers) or unprotected wells and spend significant amounts of time collecting water.

Women tended to value the benefits of a household toilet more than men. Women identified the main benefits as being reduced illness, reduction in flies and smell and greater convenience. They noted that although it was men who mostly made the decision about whether to construct a toilet.

Women generally reported participating in WaSH activities but men remain the main decision makers, particularly at the community level. Changes in women's empowerment, to the extent they have occurred, appear to have been small. Some women noted that although they were expected to provide labor during WaSH construction activities they were not necessarily invited to participate in planning. Where they were involved in planning or management, **many women felt they were not being listened to or did not have decision-making power in those roles**. These findings highlight

the importance of incorporating within WaSH programming activities that trigger attitudinal change regarding cultural norms for the roles of women and men.

There was evidence in some communities of **marginalized** households suggesting that greater **attention is required on understanding and responding to issues of marginalization**. Households (singly or in groups) were in some cases not provided with good access to the community water supply. Access was poor either because there was no tapstand near their house(s) or, if there was, because social pressures prevented them from using it. In these cases, household members often had to walk long distances (20-40 minutes) to collect water. Most communities identified that there were people with disabilities in their community, with the consistent response being that their families would help them with accessing water and using a toilet.

There was no evidence that any of the WaSH programs provided targeted assistance for people with a disability. The study did not look specifically at issues for people living with HIV-AIDS.

Monitoring

The proposed National Water, Sanitation & Hygiene Authority (NWSHA) will have responsibility for the WaSH MIS. The study considered three questions regarding a WaSH Management Information System (MIS)—is there institutional demand; what data should be collected and how; and what technology could be used. A wide range of agencies are anticipated to be involved in collecting, analyzing and using data, including: Provincial, District and Local Level Government offices; Departments of Health, Education, National Planning and Monitoring; NGOs; and private sector organizations. While **it would be efficient to co-locate the WaSH MIS within an existing MIS, at present there are no feasible options to do this in PNG** and a new system will be required.

To ensure ownership of the MIS, it is important that the final indicators are developed by and agreed upon by the key stakeholders. Data to be collected will provide information for planning and measuring progress, and coordinating service provision. Proposed indicators are set out in Table 19, including factors that influence WaSH sustainability, such as WMC function, financial sustainability and maintenance.

Collecting data will present a range of challenges and require innovative thinking. NWSHA is unlikely to have its own staff who can collect data and will rely on partnerships with another government agency, service providers or civil society. The most **promising option for data collection would be LLG Coordinators working with Ward Councillors.** WaSH implementing agencies with including NGOs and churches—working with traditional leadership could be engaged in supporting roles. Using community focal points to collect MIS data is not recommended given that the substantial training and management investment that this would entail. Data collectors, at whatever level they are engaged, will need to have sufficient resources, capacity and motivation for their task.

Information Communication Technology (ICT) has strong potential to provide the platform for a WaSH MIS. While internet coverage and usage remains low in rural areas of PNG, **mobile phone coverage has expanded significantly**. Digicel reported 75% geographical coverage in 2012 and plans to expand coverage to 100% by 2014.¹ Amongst those aged 15 years or older, 67% are now estimated to own a mobile phone.²

The study affirms that an MIS combining mobile phone data collection with an interface to an internet-based system for data sharing and reporting would be feasible. Short messaging service (SMS) technology is already being used reasonably successfully both in PNG and as a basis for rural water MIS in other nations. The challenges tend to be on the behavioral/systems aspects of using the SMS technology, rather than difficulties with the technology itself and therefore use of an SMS-based system will require significant capacity development. **There is an existing suite of projects using ICT for development in PNG**, including in the health, justice and education sectors. These could provide lessons about capacity development approaches and implementation strategies. It is strongly recommended that the MIS be piloted, particularly the methods of data collection and data transmission.

Recommendations

The recommendations below are based on the analysis and are grouped separately for national government, sub-national government and for agencies directly involved in delivering services, whether government, NGOs or private sector. The recommendations are also based on the advice and feedback gathered during the Consultation Workshop in February 2015, where preliminary results of the study were presented.

National Government

1. Oversee improved quality of WaSH program delivery. The new WaSH Policy provides aims to develop an improved institutional framework for more effective service delivery. A programme management unit in Port Moresby will oversee implementation of the WASH Policy for the immediate future whilst a new National Water, Sanitation and Hygiene Authority is progressively established. The WaSH policy will be implemented through the newly established District Development Authorities (DDAs). Effective coordination and clear standards will need to be set and support provided for sector capacity building.

¹ Pers. comm. Lucy Au, 2012

² http://www.researchandmarkets.com/reports/2130998/4q11_papua_new_guinea_mobile_operator_forecast.pdf - accessed Jan 2015.

2. Build broad ownership of the new WaSH Policy and Management Information System. The proposed National Water, Sanitation and Hygiene Authority will need to take the lead in engaging key stakeholders to:
 - promote understanding and commitment to the WaSH Policy. This will promote alignment of all stakeholders to principles, strategies and targets; and
 - set-up and operationalize data collection, implementation and sustainability of any sector wide Management Information System.
3. Generate political commitment for the development and expansion of a service delivery approach. The change from a plain infrastructure investment to supporting the provision of an on-going services is a critical institutional challenge.
4. Build the budgetary justification and an understanding of life-cycle costs for water assets. The study findings clearly identified maintenance as a key determinant of sustainability and resource constraints are one of the key barriers to undertaking major repairs, rehabilitation or upgrades.
5. Develop a strategy and resource plan to underpin sustainability of the Management Information System. There appears to be no suitable existing systems yet in PNG which could incorporate the WaSH MIS. Creating the MIS will require a clear strategy and adequate funds, both for development and operation.

Sub-National Government

6. Clarify responsibility within government agencies for strengthening service delivery, particularly at the sub-national level. The roles for sub-national stakeholders require clarification, including clear policies on roles and responsibilities for different forms of maintenance.
7. Create links between community management of water supply systems and support from the Ward Development Councils, and through them to the Local Level Government. Procedures should be developed to formalise relationships between WMC with Local Level Government.
8. Develop a clear role for Local Level Governments in the WaSH Management Information Systems. Given the reach of the LLGs and the links through Ward Councillors, the District and Local Government should leverage on existing structures and processes to collecting MIS data at the LLG level. This needs further discussion and agreement among the key stakeholders.

Service Delivery Organizations

9. Developing sustainable community management systems include
 - Build community ownership and management commitment. Successful water system management can be achieved through different models but they all start with a strong community engagement process. Existing traditional leadership and faith-based organizations can represent valuable opportunities.
 - Identify clear criteria for the repairs and replacements to a water system which are the responsibility of the community and equip them to carry out these tasks.
 - Increase the professionalization of community management. Caretakers can be encouraged to continue their support by finding ways to formalize or 'professionalize' their roles.
 - Encourage communities to develop their own financial systems for sustainability of water supply systems – this usually entails collection of funds when they are needed rather than regular contributions
10. Provide post-construction training and mentoring
 - Through long-term technical assistance, either from government and/or non-government actors to build the management capacity of community members.
 - For sanitation and hygiene, ongoing activities, such as the Healthy Islands Approach, sustain interest in maintaining or improving toilets.
11. Focus on demand creation for sanitation and hygiene. There is a need for more effective triggering and community facilitation to create demand for improved toilets and handwashing behaviors.
12. Inclusive WaSH services means developing
 - WaSH activities that work to transform gender relations and that build women's influence. Approaches should be tailored to promote women's involvement and should include opportunities for women to be trained and work in technical roles.
 - Investing in understanding who is marginalized and developing strategies to address marginalized groups and individuals, including people with disabilities.

Introduction

Background

The World Bank Group's Water and Sanitation Program (WSP) provides technical assistance to support the development of government institutions and capacity building, sector policies and strategies in the water, sanitation and hygiene (WaSH) sector in Papua New Guinea (PNG). In 2011 WSP undertook a scoping study to investigate ways it could provide strategic support to the sector, which in turn led to its input to the 2011 national WaSH conference in Port Moresby. The scoping study, the conference and a follow up Service Delivery Assessment (SDA) all pointed to serious bottlenecks in the sector, largely due to the lack of a sector policy and a lack of clarity around roles and responsibilities – particularly for rural WaSH.

In 2012 the rural WaSH Policy Task Force began drafting National Water, Sanitation and Hygiene Policy which was presented to Parliament for approval in July 2014, and approved in January 2015. To address the bottlenecks in the sector and improve WaSH sustainability, the Policy describes seven strategies, including:

1. Improved sector coordination and leadership
2. Increased WaSH sector funding
3. Develop and manage an effective management information system (MIS)
4. Improved and consistent approaches to WaSH service delivery
5. Appropriate technology promotion
6. Enhanced private sector participation and partnerships
7. Sector capacity building and training.

The first of these—improved sector coordination and leadership—will be achieved through the establishment of a National Water, Sanitation and Hygiene Authority (NWSHA) that will largely be responsible for coordinating and providing oversight to the other six strategies. In 2014 WSP commissioned a study to gather evidence about the sustainability of rural WaSH programming in PNG and inform the NWSHA and other sector stakeholders. The findings of the study will support the development of the guidelines and technical documents and contribute to delivery of rural water, sanitation and hygiene services in a way that will strengthen the sustainability of rural WaSH services in PNG. The study was conducted in partnership with the WaSH Policy Task Force and non-government organizations (NGOs) that volunteered to host field work. FH Designs (an Australian-based consulting firm that specializes in rural WaSH) was contracted by the World Bank to conduct the study.

The study will complement the findings of the SDA and the new WaSH Policy by focusing on the sustainability of WaSH services at the community level. It sought to investigate the factors influencing sustainability from the perspective of community members, including women and vulnerable groups. The methodology was designed to elicit understanding of the linkages between community-level WaSH management, implementing agency programming and the enabling environment. These linkages form the foundation for the delivery of sustainable WaSH services. The findings and recommendations are intended to support implementing agencies at national and sub-national level to improve sustainability and equity of water supply and improved sanitation and hygiene.

This report presents the results of the study, including full details of the approach and conclusions. It outlines the background and study objectives, the conceptual framework, methodology and tools used, the data, analysis and the emergent findings from the field work. In addition to the focus on sustainability, the report also sets out findings for equity and inclusion and options for possible management information systems (MIS) for the sector. The results of the study were presented to rural WaSH stakeholders at a workshop in PNG in February 2015, and the resultant discussion was incorporated into this report.

The study team was led by Ms Keryn Clark as Team Leader and Community Development/ Gender/ Hygiene Specialist. Mr Paul Tyndale-Biscoe was the Senior WaSH Technical Specialist. Community visits were managed by the Field Study Coordinator, Ms Naomi Francis in conjunction with the Environmental Health and Community WaSH Specialist, Ms Gail Pigolo. Dr Matthew Bond provided input into development of the study methodology and analytical processes.

A summary of information that can be used in the Monitoring Information System (MIS) for rural water schemes is also annexed.

Objectives

Access to improved water and sanitation in rural areas of Papua New Guinea (PNG) has been declining in real terms over the past 20 years driven in part by population increase outstripping capital investment in the rural WaSH sector.³ However, to date, no study has been done to assess the functionality of existing water systems and there is currently no system for regularly measuring the ongoing use of sanitation facilities and the continuation/maintenance of open defecation free (ODF) status. It is likely, therefore, that this decline in access to improved water and sanitation facilities, as well as improved hygiene behavior, is not only due to population increase but is also due to poor sustainability of WaSH interventions.

The national WaSH policy emphasizes the importance of access to all for both water and sanitation, and this in turn was an important aspect of the study. An equity analysis was integrated into the field work to gain a greater understanding of barriers to access, as well as learning on where access for vulnerable groups has been enabled, both for individuals, households or groups of households within a community.

A number of sustainability factors were identified through the Service Delivery Assessment (SDA) process, which are mentioned in the terms of reference (ToR). This study builds on these in order to provide the sector with a deeper understanding of the social, technical, institutional, financial and environmental factors that contribute to the sustainability of water systems as well as sanitation and hygiene behaviors and facilities.

The overall objectives of the PNG Sustainability Study, as outlined in the ToR, are to:

1. Identify and develop practical approaches to improve both the sustainability and equitable delivery of rural water supply and sanitation schemes in PNG; and
2. Make recommendation on the potential for information communication technology (ICT) monitoring systems for rural water supply.

Objective 1: Practical Approaches to Improve Sustainability of Rural WaSH. The ToR details three sub-objectives under this objective:

- Identify the key drivers, common factors and challenges for increased sustainability of and equitable access to rural water supply schemes
- Identify the key drivers, common factors and challenges for increased sustainability of and equitable access to improved sanitation and hygiene initiatives; and
- Develop key recommendations for agencies implementing rural WaSH programs to improve sustainability and equity of water supply and improved sanitation and hygiene. To what extent is there evidence that supports the scaling up of these approaches?

³ GoPNG (2014) PNG Draft National Water, Sanitation & Hygiene (WaSH) Policy 2014-2030, Version: 09.05.14 Second Draft, Pg 5.

Objective 2: Recommendations for ICT Monitoring Systems. There are also three sub-objectives under this objective:

- Based on the context in PNG (including the policy environment) and global experience, identify key monitoring indicators to address the information needs for sustainable management of water systems and services.
- To improve sustainability of rural water systems, identify options for a National Management Information System (MIS) for rural water supply systems to provide timely information for the use of key stakeholders at national and sub-national (district) level.
- Based on the MIS options above, recommend appropriate field-based monitoring data collection methods and technologies. Identify options for piloting.

Study Methodology

Research Framework and Questions

This section details the study's research framework and the research questions that underpinned the study methodology. This information was presented in the study's inception report and is repeated here for completeness.

Sustainability

The ToR for the study defines a sustainable water supply as being one that is

“naturally replenished (not over-extracted), provides a reliable and adequate water supply, is accessible by all users over a prolonged period of time, and demonstrates a cost-effective and replicable use of resources”

Further, it should not lead to increased conflict or increased vulnerability, particularly for women, the poor or the marginalized. The ToR defines sustainable hygienic sanitation systems as

“those that are used by all members of the community, protect human health, minimize environmental degradation and are technically appropriate, socially acceptable and economically viable in the long term”.

To assess the sustainability of community WaSH services in the target communities, the study adopted a framework that drew upon the mapping of WaSH sustainability frameworks and tools undertaken by the IRC's Sustainable Services at Scale initiative and the 2011 WaterAid Sustainability Framework.⁴ The literature identifies consistent sustainability factors for rural WaSH, as summarized in Box 1, and which form the basis of the study's framework.

⁴ Schweitzer, R., Grayson, C. & Lockwood, WaSH., 2014, Mapping of water, sanitation, and hygiene sustainability tools, Working Paper 10, The Hague, IRC/Aguaconsult. WaterAid, 2011, Sustainability Framework.

The study's sustainability framework is included as Annex 2 and contains, for each of the sustainability components, a series of focus areas and data required to make the assessment, any relevant global references or standards against which the data can be assessed and the data collection tools required.

In developing the methodology, the study team considered how to approach the research objectives whilst making best use of the study's resources and the time available. In doing so, the team drew upon the definitions of sustainable WaSH above and considered them in terms of outcome (what is the current status of WaSH in the community) and process (what has happened within the community that has led to the current status). This led to the study's general hypothesis that sustainable WaSH systems are ones that are both *functional* and *managed*. These two concepts are broadly defined as follows:

Box 1: Sustainability Factors

- Technical
- Social/Cultural
- Management
- Institutional
- Financial
- Environmental

Functionality: This is a measure of how well the physical infrastructure meets currently agreed service level standards in terms of quantity, quality, access and reliability for water supply, and quality, access, usage and handwashing for sanitation and hygiene. It also makes reference to current community demand, based on both demographic data and user satisfaction.

Management: Management refers to the community processes that are in place that lead to effective and timely repair or maintenance of infrastructure, and sustained improved hygiene behavior. It is important to note that this encompasses more than simply the community management structure (refer Box 1), but also all the social and cultural processes that are in place that facilitate or hinder the effective management of the systems. These include conflict mitigation processes and cultural factors such as the *wantok* system.

Using functionality and management as lenses to guide the data collection and analysis, five research questions were defined for the sustainability section of the study (Box 2).

Box 2: Sustainability Research Questions

For water supplies

RQ1: To what extent are the water systems functional?

RQ2: To what extent are the water systems being managed?

RQ3: What factors facilitate or hinder water system management?

For sanitation and hygiene

RQ4: To what extent are toilets and handwashing facilities being maintained and used?

RQ5: What factors facilitate or hinder households to continue using their toilets and/or handwashing facilities?

Equity

In addition to exploring the sustainability of WaSH services in communities, the study also aimed to identify practical approaches to improve the equity of rural WaSH services in PNG. The ToR required that the study:

- Assess and gather evidence on the equitable access to rural water supply schemes and improved sanitation and hygiene initiatives;
- Develop key recommendations for agencies implementing rural WaSH programs to improve equity of water supply and improved sanitation and hygiene.

Although sustainability and gender equity are closely linked, for the purposes of this study (primarily to ensure that equity is adequately addressed and does not become overshadowed by sustainability) they were considered separately.⁵ As such, a separate equity framework and an associated research question were developed which in turn guided the development of the data collection tools and approach to the analysis.

The equity framework for the study, contained in Annex 2, is based upon current global thinking regarding equity and WaSH (*Willetts et al*) and has been tailored to the PNG context.⁶ The dimensions of equity and WaSH are diverse and the framework focuses on two main areas of equity in relation to WaSH, namely gender and social inclusion.

Gender equity within the study concentrates on direct benefits for women and girls as a result of improved WaSH facilities both at the household and institutional levels as well as any increase in the involvement of women in decision making. Given the time limitations of the study and its broad focus, it was not possible for the study to delve into strategic gender changes such as women's leadership and changed relationships and power dynamics between women and men at the household or community level.

The social inclusion component of the WaSH Equity Framework includes those living with a disability, the elderly, vulnerable members of the community and other marginalized groups. Although they are a significant group within PNG communities, the methodology did not involve specifically interviewing People Living with HIV-AIDS (PLWHA) due to confidentiality, counselling and other ethical concerns and challenges that would be difficult to address within this study framework. Research on PLWHA and WaSH in PNG has been undertaken by others, and the study draws upon relevant findings to inform recommendations and supplement information provided by community members themselves through household interviews and community consultations.⁷

⁵ Data compiled by the Australian Government's rural WaSH program in Timor-Leste (BESIK) showed a positive correlation between women's participation, WMC functionality and water system functionality. BESIK 2014 - <http://www.besiktimor.org>;

⁶ Willetts et al. (2010). Making the Invisible Visible: Gender and Pacific Water, Sanitation and Hygiene Initiatives; <https://opus.lib.uts.edu.au/research/bitstream/handle/10453/13950/2009008515.pdf?sequence=1>

⁷ WaterAid (2014) Assessing the water, sanitation and hygiene needs of people living with HIV and AIDS in Papua New Guinea - www.wateraid.org/.../assessing-the-WaSH-needs-of-people-living-with-HIV-and-AIDS-in-Papua-New-Guinea.pdf. Steve Layton and Belinda Atchison (2013) The Living with Dignity Program in Papua New Guinea, AT Projects Inc. Towards Inclusive WaSH Series, Case Study 5 - www.inclusivewash.org.au/case-studies.

The study's research question for the equity component is shown in Box 3.

Box 3: Equity Research question

RQ6: What factors have facilitated or hindered the equitable distribution of outcomes and decision making opportunities in relation to water, sanitation and hygiene initiatives?

Monitoring Sustainability

Through greater understanding of the factors that contribute to sustainability of WaSH, the study identified indicators that can be monitored to track the sustainability of rural water supply schemes. The study also drew upon existing research and evaluations of WaSH sustainability indicators and methods of collection to confirm that the indicators that were identified from the field research fully addressed monitoring for sustainability needs.⁸ All indicators identified are relevant to the PNG context and reflect data that can be reasonably made available in the PNG context. These indicators will contribute to forming the basis for a national Management Information System (MIS) for rural water supply.

The study considered options for an MIS to collect and store data relating to these key sustainability indicators. During the study's inception period, some initial work was done to explore some of the key elements of an MIS in the context of the WaSH sector in PNG. From this work, the following issues were identified for further investigation during the field work phase:

- Is there an institutional demand for sustainability data/information; if multiple institutions are involved is this demand shared across multiple institutions?
- What are the options for the collection of data; what organizational processes exist, or are required; who is involved in data collection and management; what are the implications for resourcing and management?
- What are the technology options available to enhance the monitoring system in the context of PNG?

The study drew upon experiences of using Information Communication Technology (ICT) in PNG in other sectors in order to gain a sound understanding of the potential for these technologies in the WaSH sector, as well as to explore the potential for linking a WaSH MIS to existing systems. Further details of this are contained in Section 5.3.2.

⁸ A body of work has been undertaken within the global WaSH sector to develop sustainability indicators, for example the USAID Sustainability Index and the IRC Triple S Project.

Approach and Methodology

The ToR for the study set the parameters for the data collection in terms of:

- The number of communities to be included in the study: 20 communities where interventions had taken place four or more years prior to the study.
- The main variables in terms of community types: A focus on water in all twenty; sanitation and hygiene in ten;⁹ a mix of system types, geographical spread and implementing agencies.
- General guidance as to the approach to data collection to be used: Focus group discussions, key informant interviews and observations.

The following sections outline the adopted approach to the data collection the chosen methodology and tools. Further details of these are contained in Annex 3.

Strengths-Based Approach

The study adopted a strengths-based approach to the selection of research sites, focusing on communities where water systems have been maintained over time and are largely continuing to function. In a country as large and diverse as PNG a sample of 20 communities will never be representative of all contexts. Variations in context comprise a broad range of factors including, geography, system age, sociocultural factors, size of community, technology type, funding source, implementing agency, delivery approach and community accessibility. Implying that one or two communities are representative of a particular context or approach would be misleading. The study has therefore treated the sample sites as individual case studies and sought to capture a broad range of circumstances where WaSH interventions have been successfully sustained, and have drawn lessons from these. This approach is particularly suited to developing recommendations for policy development and program delivery.

Field Site Selection

In order to identify and gain access to communities where water supplies had been constructed four or more years prior to the study, it was necessary to enlist the aid of implementing organizations who had maintained some contact with the communities. Thus the selection of communities for the field work was dictated largely by the choice of the implementing agencies who were prepared to participate in the study. With assistance from WSP, potential partner organizations delivering WaSH programs in PNG were identified and invited to express interest in collaborating with the study. In total, seven non-government organizations (NGOs) and one private sector foundation were contacted.¹⁰ Participation

⁹ The primary focus of the study was rural water. The ToR stipulated that the sanitation and hygiene component should only represent 20% of the study in terms of time and resources.

¹⁰ It should be noted that in addition to these seven, WaterAid PNG were engaged in developing the study and were undertaking complementary work in Wewak Province where WaterAid and their partners work.

involved considerable work and some expense on the part of the organization and hence was not entered into lightly. In the end four agencies—all NGOs—agreed to be involved, including:

Touching the Untouchables (TTU)	Eastern Highlands Province
Child Fund	Central Province
Adventist Development and Relief Agency (ADRA)	Morobe Province
World Vision	Madang Province

These four organizations were asked to identify, within the provinces in which they work, communities with water systems completed in 2010 or earlier and that were largely still functioning. They were also asked to include a mix of geographic locations and technologies and where possible to include some examples implemented by other agencies.¹¹ Most of the communities selected through this process were ones in which the NGOs themselves had worked. However in three communities, systems had also been installed by either government or the private sector/individuals.

For pragmatic reasons, the field work in each province was hosted by one of the NGO partners and partner staff from that agency accompanied the research team to the communities. In each province the NGOs supporting the study team invited the Provincial or District Department of Health to participate, however for various reasons government staff were unable to accompany the team in all provinces. Refer to Figure 1 for a map of the districts in which data collection took place.

Figure 1. Map of PNG Showing Sites for Field-work



¹¹ Whilst every effort was made to accommodate the criteria for a range of donor/implementing agencies, for practical reasons the team had to rely on implementing agencies to find suitable communities, assist with logistics and to facilitate contact with community leaders.

The study was conducted in 21 rural communities across the four provinces (see Table 1). Water supply systems were assessed in 20 of these communities, and in 19 the sanitation and hygiene situation was also assessed. The study sites included 15 gravity-fed water supply systems (GFS) and five rainwater harvesting (RWH) systems. In all but two communities construction of the water supply had been completed at least four years prior to the study.¹² Four of the water systems were built by the private sector or local NGOs using provincial government funds (or in one case an Australian government grant). The remaining 17 systems were built by NGOs with donor funding. There were no privately funded projects identified.

Full or partial subsidies had been offered for sanitation facilities in 14 of the communities, whilst five were non-subsidy programs. The approach to sanitation promotion including participatory hygiene and sanitation transformation (PHAST) and community-led total sanitation (CLTS).¹³ Whilst all communities had been exposed to health promotion activities as part of the WaSH intervention, handwashing facilities were only observed in five. One community, Johove in the Eastern Highlands, was added to the data collection schedule by the study partner (TTU) as an example of a highly successful sanitation program; however no water supply intervention had taken place in that community.

The four districts selected for the study represented a mix of geographical settings. Henganofi District in the Eastern Highlands is a mountainous area, with villages located in river valleys and on steep ridges. It has distinct wet and dry seasons, with monthly rainfalls varying from 300mm at the height of the rainy season down to around 50mm during the dry season. Nawaeb District in Morobe Province has similar terrain and rainfall patterns, although it is closer to the coast and so not quite as steep and inaccessible. In contrast, Bogia District in Madang Province and Rigu District in Central Province are both low lying coastal areas with villages scattered along the coast or in the low foothills just inland. Annual rainfall in Madang is around 3.2mm with most rain falling in between November and June. Rainfall in Central Province is around half that amount.

¹² In two communities in the Eastern Highlands—Saviza and Vegos—the most recently constructed water supply systems were only completed in 2012. These communities, however, also had experience of systems constructed previously.

¹³ CLTS is relatively new in PNG. However, as the criteria for selection of communities was based on when the water supply was installed, the team visited some locations where CLTS was done subsequent to the water supply intervention.

Table 1. Locations of Communities for Data Collection

Province	Partner Organization	Community and District name	Pop'n (Approx.)	WaSH focus
Eastern Highlands	Touching the Untouchables	Saviya, Henganofi	~500	Water, Sanitation & Hygiene
		Yegusa, Henganofi	~1000	Water, Sanitation & Hygiene
		Vegos, Henganofi	494	Water, Sanitation & Hygiene
		Avani, Henganofi	273	Water Supply only
		Johove, Henganofi	400	Sanitation & Hygiene only
		Brebrenka, Henganofi	1280	Water Supply only
Madang	World Vision	Tangu, Bogja	200	Water, Sanitation & Hygiene
		Yoro, Bogja	200	Water, Sanitation & Hygiene
		Kamasina, Bogja	200	Water, Sanitation & Hygiene
		Suaru, Bogja	300	Water, Sanitation & Hygiene
		Ulingan, Bogja	450	Water, Sanitation & Hygiene
Morobe	ADRA	Gawam, Nawaeb	270	Water, Sanitation & Hygiene
		Gufin, Nawaeb	150	Water, Sanitation & Hygiene
		Mungkip, Nawaeb	450	Water, Sanitation & Hygiene
		Gain, Nawaeb	2000	Water, Sanitation & Hygiene
		Popof, Nawaeb	75	Water, Sanitation & Hygiene
Central	ChildFund	Kokorogoro, Rigu	440	Water, Sanitation & Hygiene
		Seba, Rigu	180	Water, Sanitation & Hygiene
		Gevera, Rigu	110	Water, Sanitation & Hygiene
		Debado, Rigu	500	Water, Sanitation & Hygiene
		Ibonatou, Rigu	200	Water, Sanitation & Hygiene

Data Collection and Analysis

Data collection for the study centered on investigation within communities. The principal processes were:

- Community group consultations (CGCs)
- Water supply system observations
- Water supply caretaker key informant interviews (KIIs)
- Household questionnaire survey (focused on sanitation and hygiene)

Information from these processes was supplemented with observations of public sanitation and hygiene facilities and key informant interviews with implementing agencies. A review of water supply system design documentation was also envisaged but was not carried out because there was no design documentation available for any of the communities. An overview of each of these processes is set out in the following sections and illustrated in Figure 2. Further detail is provided in Annex 3.

Community visits were carried out between September and December 2014. Each visit lasted approximately one day. Observational data were recorded on pre-prepared forms, and discussions were recorded in notebooks with backup voice recording. Each day the data were transferred onto laptops and backed up in the cloud in readiness for analysis.

Quantitative data was entered into and analysed via an excel database and qualitative data were analyzed using NVivo software.¹⁴ Codes were drawn from the study's sustainability and equity frameworks, and then along with the pre-determined list of potential factors loaded into NVivo. All CGCs and KIIs were recorded in Microsoft Word documents which were uploaded into NVivo. Each comment from the CGCs and KIIs was then coded according to the frameworks, which in turn allowed the community based discussions to be analysed by factor.

The analysis of water supply sustainability looked separately at gravity fed systems (GFS) and rainwater harvesting systems (RWH), as RWHs tend to be seen as the responsibility of a small group of households whereas GFSs are seen as the responsibility of the broader community.

Data Collection Tools

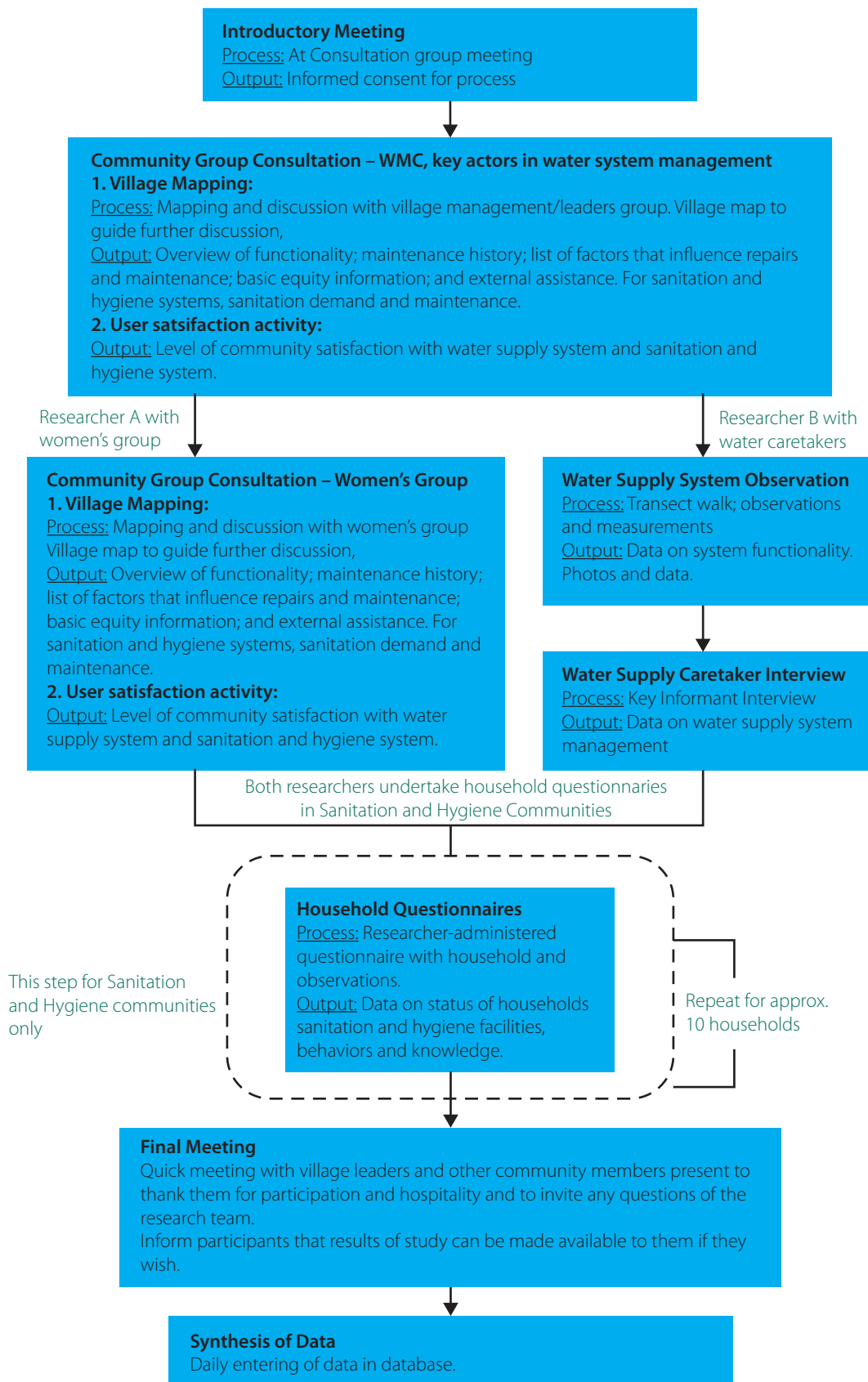
The following sections describe the tools used for data collection in the communities. Prior to the commencement of data collection, these tools were piloted in Central Province with the assistance of Child Fund, in order to check their efficacy and allow adjustments prior to the main data collection exercise. Further details of the piloting processes and adjustments that were made as a result can be obtained from the study's inception report.

Community Group Consultations

In each community two community group consultations (CGCs) were conducted. The first consultation involved those managing the water system including Water Management Committee (WMC) members, water system caretakers, health volunteers, Community Development Group (CDC) members and any others that take an active role in the management of the water system and/or sanitation and hygiene initiatives. The second group was with women users of the water system and provided an opportunity to explore women's roles and experiences. For both groups, between six and fifteen people participated. Prior to the CGC, a brief introductory meeting was conducted to introduce the study team, explain the purpose of the study and seek consent from the community members to participate in the process.

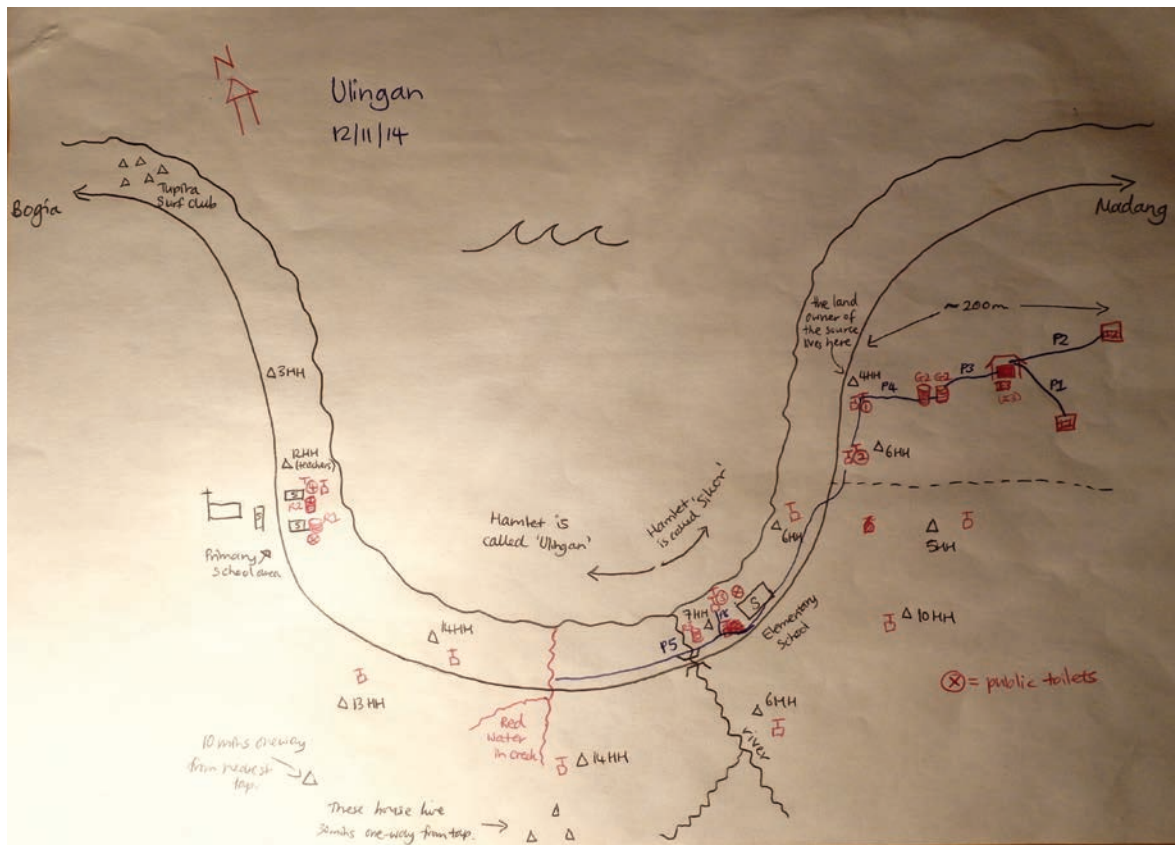
¹⁴ NVivo is propriety software that allows the thematic analysis of text-based data.

Figure 2. Field Data Collection Process



At the start of each CGC, a water system mapping exercise was completed as a way to generate discussion about the water system (see Figure 3). In the communities where sanitation and hygiene had been included in the intervention, the map also included sanitation infrastructure. During the mapping, a series of questions was asked to draw out any information about access to WaSH facilities (such as longest time required by a community member to collect water) as well as the functionality and maintenance of infrastructure, any other water sources used by community members and, for sanitation/hygiene communities, the locations of latrines and handwashing facilities.

Figure 3. Sketch Map of Ulingan, Madang Province



The maps were then used to facilitate a discussion about key factors contributing to the sustainability of the water system, and particularly what actions the community takes when problems arise. The enumerators avoided using leading questions so that the issues of most importance to the community would be expressed freely. Equity and social inclusion were included in the discussion. The final stage of discussion was a series of follow-up questions, based on the sustainability and equity frameworks, and participants were asked about any other significant sustainability factors that had not been covered previously.

At the end of the discussion, a user perception activity was done to gauge community satisfaction with the water system and/or sanitation and hygiene system. In addition to ranking their systems, participants were asked about the reasons for their rankings, the general confidence of the group in the on-going management of the system and any recommendations they may have for improvements. Each consultation lasted approximately one hour.

Following the general CGC, caretakers (mostly male) were asked to lead one researcher on a transect walk of the water supply while the other researcher repeated a CGC with a group of women.

The community consultations provided information relevant to all six research questions. Across the 21 communities, 38 consultations were held and approximately 700 people participated.

Water Supply System Observation

Water supply systems in each community were assessed using a checklist tool (Annex 3.2). This consisted of a series of measurements and observations that together allowed system functionality to be assessed. These included data on quality of water; quantity of water; and access to and reliability of the water system and were applicable to both gravity and rainwater systems. It drew upon the relevant sections from the World Health Organization Sanitary Survey as a guide for assessing sanitary risk as well as the PNG Public Health (Drinking Water) Regulation 1984 guidelines as the standard for water quality assessment.¹⁵ In addition to direct observations, a range of measurements were made including tap flow rates, tank volumes, physical water parameters and a presence/absence test for fecal coliforms. The water observations predominantly provided data to assist with answering Research Question 1 and in part Questions 2 and 6.

Water Supply Caretaker Key Informant Interview

When there was sufficient time, a Key Informant Interview (KII) was conducted with the main caretaker (or caretakers) of the water system in each community. The KII tool aimed to elicit information about the extent and operation of the water supply system and sanitation initiatives within the community including: involvement in the design and construction; management; level of service; and the inclusiveness of the WaSH initiatives. Many of these topics were also covered in the CGCs and discussions during the transect walks so these interviews served to triangulate data collected from other segments of the community.

The Caretaker KII provided data to respond to the first three research questions and Question 6, which related to equity. Ten interviews in total were conducted.

Figure 4. Measuring Source Turbidity, Ibutatou, Central Province



¹⁵ www.monitor2manage.com.au/.../Sanitary%20Inspection%20WHO.pdf

Household Questionnaire Survey

The prime focus of the household questionnaire was sanitation and hygiene infrastructure, as well as improved hygiene practices and knowledge at the household level. Information regarding defecation practices of all members of the household, including infants and children, was collected. The questions covered who built the toilet; the motivations for construction; and usage patterns of the toilet and handwashing facilities. To supplement self-reporting by respondents, the survey concluded with an observation of each household's toilet and handwashing facilities and an inspection for signs of open defecation around the house or yard. This provided data on a range of proxy indicators, particularly handwashing practice indicated by the presence of facilities with soap and water.

The questionnaire also included some questions about household access to water. Experience elsewhere has shown that people are reluctant to respond to direct questions about their sanitary habits at the beginning of an interview, but are more open once a rapport has been established by discussing the less controversial topic of water.¹⁶ These data also offered a greater understanding of the link between access to water and sanitation facilities at the household level.

In line with the study's strength-based approach, household data collection focused on those houses where latrines were still being used. This was done for pragmatic reasons¹⁷, as well as part of the deliberate strategy to direct resources towards learning about why sanitation and hygiene behaviors are sustained. This strategy, however, meant that it was not possible to determine coverage levels directly or through sampling. Rather coverage was estimated using a combination of:

- Reporting by community members
- Minimum percentage coverage (that is, the number of houses with at least one latrine as identified during the questionnaire/estimated number of households)
- The enumerator's judgement following the transect walk, CGCs and household questionnaires.

This approach was considered sufficient for the purposes of the study as national coverage levels have already been measured in other larger and more sophisticated (and focused) studies such as the 2010 Health Information System (HIS) data used in the most recent Joint Monitoring Programme (JMP) report on PNG.

Some surveying took place in conjunction with the transect walk, often involving households on the periphery of communities. The field team also varied the time of day for surveying—from early morning to evening—to maximize the pool from which households could be sampled.

Respondents from 177 households across 19 communities were interviewed. The data collected were used to respond to all research questions, particularly Questions 4, 5 and 6.

¹⁶ PhD Research currently being undertaken by Naomi Francis in Timor-Leste

¹⁷ Limited time in each community meant that the enumerators were only able to visit households who had a presence at the CGC, as they were reliant on participants of the CGC to take them to households and introduce them to the household head. Whilst it had originally been envisaged that a random sample of households would be selected to participate in the household survey, it quickly became apparent that the complicated geography and dispersed nature of the households in many communities made this approach impractical within the time available.

Other Data Collection Processes

In addition to the main data collection tools described in the preceding sections, several other processes were used to supplement the data set and provide some cross checking. These are described below.

Public Sanitation and Hygiene Observation Checklist

This tool was used at the same time as the water supply system observations were conducted and involved an assessment of the condition of toilets, water supplies and handwashing facilities in schools, health facilities and any other public buildings—where such facilities were present.

Implementing Organization Key Informant Interview

Where possible, staff from the organization that originally implemented the project were interviewed with the aim of gathering information on the approach to implementation, including on-going support for management; on-going sanitation and hygiene promotion; spare parts supply chains; and links to sanitation products. Interviews were conducted in three of the four districts, however the level of institutional knowledge was low as none of the staff involved in the original intervention were still present and able to be interviewed.

Water System Technical Design Assessment

As noted above, it was intended that original design documentation would be assessed for each system. This was aimed at understanding whether the systems were still operating as designed; whether the original designs were sound; and what modifications, if any, had been carried out. However, no documentation was made available to the study team for any of the systems visited.

Figure 5. Community Group Consultation, Avani (Left) and Vegos



Limitations

There were a number of constraints and limitations that need to be considered when interpreting the results presented in the next section. The study team has taken these into account during the analysis and development of the conclusions and recommendations. These are as follows:

Sample size. The study was limited to 21 communities, which is small in the context of rural communities in PNG, rendering statistical analysis unviable. Thus only indicative trends have been drawn from the analysis of the factors. A much larger sample size would be needed to be able to define causal links and definitive trends in the data set.

Selection of communities. The study relied on the NGO partners to identify target communities. Given the significant amount of time required from community members, the NGOs tended to choose communities with whom they had good relationships. As a result, most of the target communities were recipients of water systems built by NGOs using external donor funding, and the study was unable to compare a wider range of intervention types. There were, however, two exceptions to this. In one community rainwater tanks had been provided by Digicel, and in another the water supply system had originally been implemented by the Government prior to the more recent NGO intervention.

Lack of government involvement in data collection. Despite attempts to involve local government staff in the data collection, it proved very difficult to achieve. While the NGOs did invite Local Level Government (LLG) Councillors and Department of Health Environment Health Officers in each location, they participated in only one or two instances.

Limited number of household visits. The limited time which key community members, such as caretakers and other WMC members, could contribute to the study resulted in reducing the community process to one day, rather than one and a half days as originally planned. This proved to be sufficient for the observations and discussion groups but resulted in a reduced number of household surveys being undertaken than initially planned (177 instead of 200).

Size of the water supply systems. Some of the water supply systems visited were too large to allow an inspection of the whole system (including all tap-stands) within the available time. In these locations, approximately 10 tap-stands were selected from the community map for inspection. These tapstand were selected to maximize the geographical spread, whilst making sure to capture at least one tap per distribution branch (where there was more than one branch) and favoring taps at the end of branches. In these locations the functionality of the system was therefore assessed on the basis of the sample of components visited.

Water supply technology. The water supply systems investigated included only gravity-fed piped schemes and rainwater harvesting technology. These were the most common types of systems installed by the agencies that participated in the study. Pumped systems for groundwater abstraction are less uncommon in PNG than gravity and rainwater systems and were not investigated. Whilst the types of sustainability issues raised by the study are likely to be relevant to pumped water systems also, additional analysis for this type of technology is warranted.

Measuring access. Measuring sanitation and water access quantitatively (using for example GPS coordinates) was not feasible with the time available. Consequently, the assessment of access was based on community discussions.

Assessment of equity. Again, due to time and resource constraints, it was not possible to interview people with a disability (PWD) in a systematic way. Similarly, cultural sensitivity meant that it was not possible to interview with people living with HIV-AIDs (PLWHA) regarding challenges they face accessing WaSH facilities and services. The study therefore relied on information provided by community members during CGCs and other processes, as well as ad hoc meetings with PWD. There were no specific findings from the study concerning PLWHA, however where appropriate, the analysis drew on research by others.

WaSH Sustainability

This section presents the findings for research questions 1 to 5, concerning the sustainability of water, sanitation and hygiene interventions. The study's main focus was on water (Section 3.1) which is presently separate from sanitation and hygiene (Section and 3.2).

Water supply

The investigation of water supply took place in 20 of the study's 21 sample communities. Community group consultations, observations, transect walks, key informant interviews as well as part of the household questionnaire were used to collect data about the water supply system in each community. Of the 20 communities, five were rainwater harvesting systems (RWH) and 15 were gravity-fed systems (GFS).

The results for overall performance of the 20 water supply systems are presented in the next section. Factors contributing to the sustainability of these systems—discussed separately for GFS and RHS—are presented in the sections that follow.

Assessment of System Performance

The study collected information about water system functionality and management, in accordance with the study's sustainability framework, and then used this information to classify communities according to the overall performance of their systems. This was then used as a lens to examine the factors given by community members for why they have or have not maintained their water supplies (Section 3.1.2).

Functionality

RQ1: To what extent are the water systems functional?

The study framework defines functionality as a composite of four sub-criteria that describe the level of service provided to water users, in terms of:

- Quantity
- Quality
- Access
- Reliability

Each of these criteria was assessed for the water supply in each community and performance rated as 'high', 'improved', 'sub-standard' or 'no service'. The basis for the ratings is explained in the following discussion for each criterion and a summary of results is set out below (Table 2).

An overall performance rating for each system, that combines function and maintenance result, is provided at the conclusion of this section under the heading 'Summary of System Performance'.

Table 2. Functional Assessments by Community and Sub-Criteria

Community	Type	Quantity	Quality	Access	Reliability
Saviya	GFS	High	Improved	High	Sub-standard
Vegos	GFS	High	Sub-standard	High	No service
Avani	GFS	High	Improved	High	Sub-standard
Yegusa	GFS	High	Improved	High	High
Brebrenka	GFS	High	Sub-standard	Improved	Improved
Tangu	RWH	Sub-standard	Improved	High	No service
Yoro	GFS	Improved	Sub-standard	Sub-standard	No service
Kamasina	GFS	High	Improved	Improved	Improved
Suaru	GFS	Improved	Improved	No service	Sub-standard
Ulingan	GFS	No service	Improved	No service	No service
Gawam	GFS	High	Improved	Improved	High
Gufin	GFS	High	Improved	High	Sub-standard
Mungkip	GFS	No service	Not tested	No service	No service
Gain	GFS	No service	Not tested	No service	No service
Popof	GFS	High	Improved	High	High
Seba	RWH	No service	Improved	High	No service
Gevera	RWH	No service	Improved	High	No service
Kokorogoro	RWH	No service	Improved	High	No service
Debado	RWH	No service	Improved	Improved	No service
Ibunatou	GFS	High	Improved	Improved	Improved

Quantity

The quantity classifications spanned the range from insufficient for drinking water needs (no service) to sufficient for all domestic purposes plus other non-potable uses (such as small-scale agriculture or livestock uses). The draft National Policy defined minimum quantities of 50 liters/person/day (l/p/d) and 5 l/p/d for standpipes and RWH respectively. The framework required a slightly more granulated classification and so the study team drew upon both WaterAid’s sustainability framework (including the Malawi WaSH sustainability study¹⁸) and global standards such as Sphere¹⁹ to define four different service of varying quantities (Table 3).

It should be noted that whilst the draft National WaSH Policy allows 5 l/p/d as the minimum service level and many RWH are designed to deliver this quantity of water, the Sphere Standards stipulate 15 l/p/d as the minimum quantity required to sustain health. The minimum quantity used here is based on international standards rather than the draft policy and common practice in PNG.

The processes used to determine quantity ratings differed for RWH and GFS. For RWH rainfall data²⁰, tank size and the collection area for each tank were combined to estimate the minimum monthly quantity delivered by each tank. These quantities were combined for all tanks sampled and then divided by the proportion of tanks sampled and the population of the community to determine a minimum daily quantity per person. Results ranged from a high of 29 l/p/d in Tangu, Madang Province, to a low of just 1 l/p/d in Debado, Central Province. For all four RWH systems in Central Province the minimum daily quantity was less than 7 l/p/d, reflecting the low average rainfall in the dry season (rainfall is 75mm in July and there are three months where the rainfall is less than 100 mm).

Table 3. Water Functionality, Quantity Sub-Criterion

Service Level	Description	Quantity
High	Sufficient for drinking, personal and domestic hygiene, cooking and other activities	> 100 l/p/d
Improved	Sufficient for drinking, personal and domestic hygiene and cooking	> 30 l/p/d
Sub-standard	Sufficient for drinking and personal hygiene only	> 15 l/p/d
No service	Not sufficient water for drinking	< 15 l/p/d

Rainfall throughout the year varies significantly, so quantities provided in the wet season are likely to be five or more times greater than the estimated minimums. Given that rainwater tanks are often a household’s rather than community asset, it is also possible that individual users received greater daily quantities than the calculated average for the whole community. More detailed analysis would account for the storage volume as well the minimum rainfall, to indicate how well the systems managed the variation in rainfall. Stored volume per person (at the time of the assessment) in the five

¹⁸ WaterAid, 2013, Exploring the long-term sustainability of water, sanitation and hygiene services in Salima district, Malawi.

¹⁹ Sphere Minimum Standards in Humanitarian Response, see <http://www.sphereproject.org/>

²⁰ Rainfall data, based on the location of sites within each province, was sourced at: http://sdwebx.worldbank.org/climateportal/index.cfm?page=country_historical_climate&ThisRegion=Australia&ThisCCCode=PNG#

RWH systems averaged 30% of total storage capacity and ranged from a low of 30 liters per person in Debado to a maximum of 240 liters per person in Seba (both in Central Province). The capacity of storage is taken into account in the reliability measures discussed below.

For the gravity fed systems, system quantity was determined by summing individual tap flow rates, and calculating the theoretical volume available in an 18-hour period per person. This assumed that the flow rates across the sample was representative of all taps, that the entire population used the water supply and that there was sufficient access to taps to share the total flow between all households (which was also tested in the Access criterion). All the functioning GFS systems were rated as providing 'improved' or 'high' quantities of water. The lowest quantities were in Suaru (34 l/p/d) and Yoro (35 l/p/d) both in Madang Province. Two systems were non-functioning (Mungkip and Gain) and in Ulingan the flow rate was below the minimum level of service (<15 l/p/d).

No design data for any of the systems were available for review by the study team. This prevented a check being made of the original hydraulic designs to ensure source flow rates, with an allowance made for population growth and environmental flows, were matched to adequate storage to accommodate diurnal fluctuations in demand.

Quality

The measure of water quality drew upon two processes: a test for indications of fecal coliforms and an assessment of sanitary risk. In each location, a water sample was taken from at least one tap stand and tested for the presence/absence of fecal coliforms. Tests were carried out for all water supplies with the exception of Mungkip and Gain, Madang, where no water was available at any of the taps. For the RWH systems, water quality was tested at one tank randomly selected from within each community.

Presence/absence testing was cost-effective and appropriate to the constraints of the field work, where it would have been impractical to collect and store sample for laboratory analysis. It did not, however, quantify the degree of contamination. To complement the coliform testing, each water source was assessed using the WHO Sanitary Risk form to identify potential sources of contamination.²¹ Where there were multiple intakes and in each of the RWH communities, sanitary risk scores were averaged across all intakes/tanks. Water supplies were then rated for quality as shown in Table 4.

Table 4. Water Functionality, Quality Sub-Criterion

Quality	Coliform presence, per 100 ml		Sanitary risk score (intake/tank)
High	<1 CFU	AND	0—2
Improved	<1 CFU	AND	3—5
	>1 CFU	AND	0—5
Sub-standard	>1 CFU	AND	6—8
No service	>1 CFU	AND	≥9

²¹ www.monitor2manage.com.au/.../Sanitary%20Inspection%20WHO.pdf

In only four cases did tests of the water supplies indicate an absence of fecal coliforms (Saviya, Gawam, Kokorogoro and Ibonatou). These four also scored between three and five for the sanitary risk assessment and so were rated as 'Improved'. In another three cases (Vegos, Brebrenka and Yoro), the sanitary risk score was six and these systems were rated as 'sub-standard'.

The numerous indications of fecal contamination suggest that further testing in each location would be useful to determine the causes and degree of contamination. This is a potential area for further research.

Access

The study's functionality framework established quantitative thresholds for each of the access levels, defined from a household perspective. Access for households that did not use an improved water supply was classified as 'No service'. Classifying service for all other households required an assessment of the proximity of the water point and the number of users sharing the water point. Ideally, this would be based on an audit of all households in the communities, with associated GPS data. This was beyond the resources of the study. In the absence of accurate location data for households, the study determined the average number of households using each functioning water point. Taps that had either no flow or flow less than 0.02 liters per second were excluded as non-functioning, as were empty tanks. Information about tapstands and tanks that the study team were not able to visit was obtained from caretakers and community members. Based on the experience of the community visits, which took into account the typical spatial distribution of households within sample rural communities, the study team set thresholds for each level of service (Table 5).

In the three GFS communities where there was no or inadequate water quantity, access was rated as 'No service'. One community also had a ratio of households to functioning water points that exceeded 50 (Suaru, with 60 households). For the RWH systems, in all but one community (Debado with six households per tank) a sufficient number of tanks had been installed to provide one tank for every two or three households, thus gaining a rating of 'High'. Six of the 15 GFS systems were also rated as 'High' with the others being a mix of 'Improved' and 'Sub-standard' (Gain had 'no service').

Table 5. Water Functionality, Access Sub-Criterion

Access	Study framework definition	Approximation
High	Improved drinking water source less than 30 meters distance and with the recommended number of users	≤5 households per water point
Improved	Improved drinking water source within 30 - 500 meters and with the recommended number of users	≤10 households per water point
Sub-standard	Improved water source but more than 500 meters distance and/or more than the recommended number of users	≤50 households per water point
No service	Unimproved drinking water source	No improved source available; or >50 households per water point

These results represent an average for all households across an entire community. It is recognized, however, that the characterization of whole communities into one level of access is likely to mask significant diversity. Access for individual households is likely to vary markedly through any community, from marginalized households who may not be invited or able to use the water supply at all to those privileged households where there is a tapstand or tank located in their yard. (This issue of marginalization is explored further in Section 4, Equity and Inclusion).

Reliability

Descriptions for Reliability in the study’s original framework work well with individual water points but needed slight adaptation for applicability to whole systems, as set out in Table 6. The term ‘occasionally’ in the whole-of-system definition for ‘Sub-standard’ was defined as being out of service for less than two weeks at a time, to avoid there being a gap between ‘Sub-standard’ and ‘No service’.

Table 6. Water Functionality, Reliability Sub-criterion

Reliability	Study framework definition (single water point)	Whole-of-system definition (all water points)
High	A fully functional water point and water is available all day, every day	All water points are fully functional and water is available all day, every day
Improved	A fully functional water point and water is available every day, but not all day	All water points are fully functional and water is available every day, but not all day
Sub-standard	A partially functional water point and / or water is available almost every day, but occasionally there is no water	Some water points are functional and/or water is available in the system almost every day, but occasionally there is no water
No service	A non-functional water point and / or no water was available for two or more weeks during the past year	The system is non-functional and / or no water was available for a single period of two or more weeks during the past year

Aggregating the performance of individual water points to provide an overall score for the reliability of the whole system sets quite a high standard for systems to be classified as ‘High’ functionality—a single defective tap would render a system ‘sub-standard’. Despite this, there was a good spread of results across the 15 GFS systems in the study sample. Three high-performing systems (Yegusa, Gawam and Popof) provided water from every tap, all day, every day.²² A further three systems rated as ‘Improved’ with all water points functioning and water being available year round, albeit rationed during the daytime in the dry season. The remaining systems had a mix of poorly maintained assets or the source had dried out for more than two weeks in the past year and were thus rated as either ‘Sub-standard’ or ‘No service’.

For the RWH systems, users in all five sites reported that their tanks became empty each dry season forcing households to use alternative water sources. Each of the RWH systems was therefore rated as ‘No service’.

²² Based on the sample of tapstands visited in these communities and information from caretakers and community members.

Of the four functionality sub-criteria, Reliability provides the best level of discrimination between the levels of service for different systems. Whilst all sub-criteria are important, from a user perspective, reliability is also arguably the most significant since systems that do not provide year-round service force households to use other water sources from time to time and hence expose communities to the hazards of unimproved water supplies. Such failures also compromise the ability of households to use water-based sanitation options and practice good hygiene.

Management

RQ2: To what extent are the water systems being managed?

As described in Section 2.1.1, the study classified water supply system management by assessing the extent to which communities had taken action on maintenance issues. Following the field work, four management levels were settled upon (Table 7).²³

Table 7. Classification of Water Supply System Management

Management Level	Gravity Fed Systems	Rainwater Harvesting Systems
High	Demonstrated capacity to effectively repair or expand all system components, including intake, transmission line and storage.	Major repairs or upgrades have been made to the tank, roof, gutters or taps e.g. replaced tank, moved tank to somewhere it can collect more water, changed gutters/down pipes, extended tap, put fence around tank/tap. Clean tank, gutters and filter regularly and do first flush.
Improved	Demonstrated capacity to effectively repair or expand minor system components, such as repairs or expansion to taps and distribution lines, cleaning and preventative maintenance.	Minor work on gutters and down pipes (e.g. replaced/patched leaking section), replace mosquito nets, fix leaking taps. Regularly clean tank and gutters (and maybe first flush).
Sub-standard	Ad hoc, small-scale repairs carried out, generally with local materials and with varying success; a range of unattended maintenance issues evident.	Ad hoc repairs, home jobs with local materials on leaking taps and gutters. A range of unattended maintenance issues evident. Clean occasionally/just do filter clean.
No service	No demonstration of repairs being carried out and a range of unattended maintenance issues evident.	No demonstration of repairs being carried out and a range of unattended maintenance issues evident.

Classifications for each community were based on observation of water supply assets and discussion with caretakers and community members. Results are set out in Table 8 ('Management' column). A detailed justification for the rating given to each community is provided in Annex 2.

²³ This was a simplification of the five 'types' of management classification originally proposed (see Annex 2).

Whilst the ratings gave consideration to past activities, more recent responses (i.e. those within the last 12 months) to breakdowns or improvements were given a higher weighting than repairs reportedly carried out in the past. It should be noted that the ratings give an overall indication of management capacity within each community. Specific instances of maintenance and their implications are described in Section 3.1.2. A similar process was used for both gravity systems and rainwater systems. Categorization for rainwater systems presented an added challenge in that each tank was a mini 'system' and hence within a single community a range of management performance could exist. In these cases an 'average' rating was applied for each community.

Figure 6. Maintenance Challenges, Gufin (Left) and Yoro



Summary of System Performance

Combining both the functionality criteria and management assessments allowed an overall 'sustainability' rating to be applied to each community (Table 8). The overall ratings were determined by applying a numerical score (High = 4, Improved = 3, Sub-standard = 2, No service = 1) to each service level and averaging to get an overall score. Whilst it is recognized that this imperfectly compares complex and dynamic communities, it was done to create a filter for examining the factors identified by communities as important in the management of their systems—in particular, to compare experiences in the few, 'best' performing communities with the 'bottom' few. This is discussed in more detail in the sections that follow.

Table 8. Functionality and Management Assessments of Water Systems by Community and Sub-Criteria

Community	Functionality - Quantity	Functionality - Quality	Functionality - Access	Functionality - Reliability	Management	Overall Rating
Saviya	High	Improved	High	Sub-standard	Improved	High
Vegos	High	Sub-standard	High	No service	Sub-standard	Improved
Avani	High	Improved	High	Sub-standard	Improved	High
Yegusa	High	Improved	High	High	Improved	High
Brebrenka	High	Sub-standard	Improved	Improved	Improved	Improved
Tangu*	Sub-standard	Improved	High	No service	Sub-standard	Improved
Yoro	Improved	Sub-standard	Sub-standard	No service	Sub-standard	Sub-standard
Kamasina	High	Improved	Improved	Improved	Sub-standard	Improved
Suaru	Improved	Improved	No service	Sub-standard	Improved	Improved
Ulingan	No service	Improved	No service	No service	No service	Sub-standard
Gawam	High	Improved	Improved	High	Improved	High
Gufin	High	Improved	High	Sub-standard	Sub-standard	Improved
Mungkip	No service	Not tested	No service	No service	No service	No service
Gain	No service	Not tested	No service	No service	No service	No service
Popof	High	Improved	High	High	High	High
Seba*	No service	Improved	High	No service	Sub-standard	Improved
Gevera*	No service	Improved	High	No service	Sub-standard	Improved
Kokorogoro*	No service	Improved	High	No service	Sub-standard	Improved
Debado*	No service	Improved	Improved	No service	Sub-standard	Sub-standard
Ibonatou	High	Improved	Improved	Improved	Improved	High

*Rainwater harvesting system

Factor Analysis – Water Supply

Narrative data collected during the community consultations were analyzed using two processes:

- Comparison of high and low functioning communities (since despite the study’s strengths-based approach, a range of system performances was found as discussed above).
- Analysis of the most significant sustainability factors as identified by community members themselves. This was determined by the frequency with which different factors were raised by community members and level of detail of subsequent discussions.

The analysis involved firstly coding each comment according to the pre-determined set of factors from the study’s framework (Annex 2). This was done using Nvivo software which allowed the data to be manipulated and examined thematically. The relative importance of each factor was measured by the number of times the factor was raised and the volume of narrative recorded and coded against it (expressed as a percentage of the total narrative). Thus, a factor mentioned in every community group consultation (CGC) and discussed at length would rate more highly than one only mentioned occasionally or in response to a direct question. Community members tended to speak about issues they felt strongly about in more detail and for longer than ones that were of little importance to them, and so this process brought out the issues (or factors) rated most highly by communities. Nvivo allowed this process to be done for the entire database (the narrative documents as well as the survey data) as well as for selected sub-groupings within it.

The coding structure used for the analysis did not distinguish between positive or negative comments and so having identified a factor of interest, it was necessary to then examine each comment and draw conclusions about the factor from the entire subset. Not all factors were analyzed for each group. The highest ranked factors were examined in detail, as well as those factors known to be important for WaSH sustainability from global experience. Details of the ranking of all factors and their relative weightings are set out in Annex 2.2

Communities with gravity-fed systems (GFS) and rainwater harvesting systems (RWH) were analyzed slightly differently. For GFS the process involved examining the data for the top five ranked factors across the entire group, as well as differences in the data for the top and bottom rated communities from an overall sustainability perspective (Table 8). For RWH systems the data set was smaller and so it was not appropriate to distinguish between the top and bottom ranked communities. Instead the analysis focused on just the top ranked factors across the whole RWH group.

The following sections present the results of this analysis, with findings for GFS and RWH systems presented separately.

Gravity-Fed Systems

The five sustainability factors that were most discussed across the 15 communities with gravity-fed systems are shown in Table 9 and are discussed in turn below.

Table 9. Gravity-Fed Systems, Factors Influencing Sustainability

Factor	Frequency cited
Maintenance	14%
Water Management Committee	12%
Community Ownership	8.5%
Financial sustainability	7.5%
Conflict	6.5%

Maintenance

Maintenance was the most discussed factor across all communities, including both the top and bottom ranked communities. Maintenance includes on-going actions by, or organized by, community members to keep the water system operating well (e.g. cleaning tanks and springs, ensuring pipes are covered) and to make small or large repairs to the water system as required.

The findings on maintenance reflect the importance of community ‘ownership’ of the facilities, and the need for someone—be it an individual or the management committee—to feel responsible for carrying out repairs. Further support and training is likely to be important to underpin this, as is some sort of formal recognition of the role of the caretaker or WMC through a payment system or increased professionalization of the role.

Summary of the findings

- Overall, where caretakers have been active in maintaining their water system (including regular preventative maintenance) this has resulted in a longer lasting water system.
- Where maintenance was being undertaken, pride in the caretakers’ work was evident amongst both the caretakers and the community members:

“This is our water system...when we succeed in fixing it we are paid a small amount by the community” – Caretakers, Yegusa village

- In three of the best performing communities (Ibonatou, Vegos and Yegusa), payment was made by community members to the caretakers. The caretakers noted that small payments were seen as recognition of their efforts and stated that this was a motivating factor for them to continue to undertake maintenance.
- Most communities are not able to undertake repairs or maintenance beyond simple things such as replacing taps, fixing piping or gutters and so on. This highlights the need for access to external support for more complicated repairs that are beyond the ability of community-based technicians. A few communities had made some improvements to their systems but also had complex maintenance issues that they had not been able to repair.
- Communities with higher ranked systems also undertook basic preventative maintenance and simple repairs. In the lower ranked communities, there was limited or no evidence of any maintenance (including preventative maintenance) being undertaken.

Figure 7. Inadequate Maintenance, Kamasina



- All communities had been given training but, in communities with low performing systems, the training was described as not being appropriate nor having sufficient follow-up.
- Distribution of tool kits appeared to be inconsistent, both between NGOs and between projects by the same NGO. Whilst tool kits were given as a motivator for maintenance, not having been given a distributed tool kit did not appear to hinder communities that were motivated to undertake repairs.
- All communities understood that maintenance was important and that the community should play some role in undertaking maintenance.
- There did not appear to be any relationship between community size and performance. Both large and small sized water systems appeared in the list of high performing communities (e.g. Yegusa with 90 taps and Ibonatou with only three).
- Highly performing communities also tended to be highly motivated about maintaining their water systems.²⁴

“We must maintain the system every time there’s a need for repair to keep it functioning for a long time” – Women’s group, Gawam, Morobe Province.

- Only one community (Vegos, Eastern Highlands province) had a water system management plan, and they also had a well-maintained water system (rated ‘Improved’ for maintenance).

Water Management Committee

The Water Management Committee (WMC) provides the organizational framework for the community level management of the water system, including rules around the use of the system, mediating conflict, organizing maintenance and collecting funds for maintenance and repair. The role of the WMC was the second-most discussed factor in the communities with highly ranked water systems and the third most discussed factor in communities with low ranked water systems.

The study made a broad assessment of the functionality of the WMCs based on some key functions that WMCs should do, namely:

- Meeting regularly;
- Collecting fees;
- Coordinating repairs and upgrades;
- Reporting back to community;
- Forming the link between the community, the government and the implementing agency

The classification is shown in Table 10, and drew a distinction between WMC functionality (that is, how well the WMC was fulfilling its functions and performing as a group) and level of management as defined in the study methodology in Section 3.1.1 (how well the system was being maintained). A comparison of ratings for WMC functionality and overall management is set out in Annex 2.3.

²⁴ It is important to note that the differences in attitude may be further exacerbated by the fact that in many of the lower ranked systems the water systems were not functioning at the time of the interviews; whereas, for the higher ranked communities their water systems were largely functioning, and thus they were more likely to be positive about their water systems.

Table 10. Classification of Water Management Committee (WMC)

High	Demonstrates all or most of the key functions of a WMC, meets regularly
Medium	Demonstrated some of the key functions of a WMC, meets regularly
Low	Occasionally undertakes functions of a WMC, not meeting anymore
None	WMC no longer functioning – might exist but in name only

Overall, the study concluded that despite a reasonable understanding of their role, WMCs were not strong in the target communities. Given that the strengths-based approach for the study targeted strong communities, the situation is likely to be worse generally across other rural PNG communities. Indications are that WMC are more effective when their structure is determined by the community rather than being imposed, they have strong links to existing leadership structures, and are supported through effective training.

Summary of the findings

- While all communities with GFS systems had initially formed a WMC—and understood the WMC’s role—of these 15 communities only four WMCs were ranked with medium or high functionality. Six were assessed as low performing and five were no longer active. As the study adopted a strengths-based approach, it follows that this is likely to represent the more functional end of the management spectrum across the country and so it can be concluded that WMC sustainability is likely to be very low across PNG in general.
- A number of communities raised concerns that the WMC was not reporting to the community about what was happening in regard to their water systems (particularly around fund management). This was often noted by women. In the four locations where the WMC functionality was ranked as medium or high, the WMC noted they regularly provide information to the community.
- It was evident that the establishment of the WMCs was driven largely by the implementing agencies. One of the contributing factors to the number of low- or non-functioning WMCs (11 out of 15) may be that the traditional approach to managing community assets is not through a community management structure such as a WMC. In addition, there has been limited post-construction support for WMCs (discussed further below).
- In three of the four water systems that ranked highest in terms of overall performance, the WMC was assessed as having low functionality and one had medium functionality. However, all four of the top ranked systems for overall performance had improved management. This indicates that in some cases, even if the WMC is weak, there may be an individual(s) who takes on the role of keeping the water system operational. Thus a key measure of sustainability is the presence of one or more people who take responsibility for maintaining the water system. The high ranking communities also reported a high level of community ownership, with a corresponding sense of responsibility for the water system, even though the WMC was not functioning.
- Of the four systems that ranked the lowest for overall performance, the WMC was ranked as low for two communities and no longer functioning for the other two. This correlates with the level of management: three had no management, and one was assessed to have sub-standard management.

- The majority of WMC members were selected during the initial construction period and the study noted that there had been very limited renewal or replacement of members and that committees were often dependent on a small number of people. WMCs are primarily made up of volunteers, but in a number of communities the members collected a small payment when repairing the system. In one of the high-functioning WMCs (Suaru, Madang Province), there had been a renewal of members, due largely to recognition (in the form of payment) by the community of the amount of work required to be on the WMC. It was evident in most communities that those still active on the WMC were the natural leaders within the community.
- Eight of the fifteen communities with GFS had 40% or more female members on their WMC and one had a female chairperson (Kamasina, Madang province). While it was not possible to comment on the quality of women's participation, by international and regional standards this level of participation by women is considered high.
- Whilst some WMC members mentioned that they had received some training when the WMC was established very few had received any follow-up training relating to managing and maintaining the water system after construction. A number of WMC members mentioned that they would have liked to have received ongoing training that was specific to their role in the WMC.

“There must be training for the new WMC as well as the volunteers to look after the system.” – Caretakers, Avani village

- The lack of post construction support—including training and mentoring in maintenance or other management issues—may be a contributor to the poor sustainability of WMCs.²⁵
- In Henganofi district (Eastern Highlands Province) TTU has been using the Healthy Islands initiative, which includes regular visits to communities to strengthen the management of their water supplies, alongside other activities.²⁶ In this district, three of the five WMCs were functioning well, and in the other two communities, whilst there was no functional WMC, they had improved management due to an individual community member taking charge.
- Whilst the WMCs in the study often reported that they had established rules and regulations to guide access and use of their systems, they also stated that community members often ignore the rules. For example, in Gawam the WMC reported that some households had made unauthorized connections. Community leadership was referred to as being important to support the work and the role of the WMC and thus ensure rules were followed.
- Where the WMCs have a high or medium level of functionality, there was a higher level of pride in caring for the water system:

“This is our water system so we have to fix it” - Yegusa, Eastern Highlands.

²⁵ A 2013 study in Timor-Leste, following a Government initiative that focused on providing post-construction support to WMCs, found that since early 2010 90% of the WMCs formed were still partially functioning; a significant improvement on previous analyses which found that most WMCs became inactive within a year (*GMF Study - What is the situation of GMFs in Timor-Leste? (2013) BESIK. www.besiktimor.org*).

²⁶ The Healthy Islands Initiative is a national Ministry of Health Program which targets 10 key messages for improved environmental health, and includes water management and safe water use.

Community Ownership

Community Ownership is a measure of the extent to which communities make decisions about and drive the outcomes for their water systems, during the planning and construction phases as well as throughout the life of the water system. Understanding decision-making processes and exactly who is involved in the “ownership” is important. In this study ownership was assessed through a combination of indicators such as valuing the system, expressing satisfaction with the water system and through proxy indicators such as any investments (improvements) made in the water system. Understanding inclusiveness and who makes decisions is also important.

Summary of the findings

- All of the communities with high ranking systems were able to express a clear ‘vision’ for their systems including options for how it could be improved. In many of these communities there had been investment in maintenance and, in some cases, improvements. For example, in Yegusa (Eastern Highlands), some community members reported that they had invested in small tanks located near the tap-stands. These were estimated to cost approximately PGK300 (US\$115) per tank, with one tank per tap-stand each serving around ten households. In Popof (Morobe) the community had invested in building additional taps to have them closer to houses.
- In general, communities with higher ranking systems expressed satisfaction with their system (not surprising given that their systems were functioning):

“No matter if there is a problem, we still have the attitude to look after our water system” – Caretakers, Yegusa, Eastern Highlands.

- Conversely, in those communities where the water systems were ranked low in terms of functionality and management, there was a low level of satisfaction.
- In some places, community ownership appeared to be dynamic and changed rapidly which, in turn, affected the water system. For example in Gain (Morobe), the community initially contributed PGK10 per person for construction and a further PGK20K/person for the inauguration. However, soon after the inauguration, the land owner of the spring site felt that he had not been properly informed about the details of the water system and cut the main line rendering the system non-functional. The community response was to look at options for an alternative water source rather than trying to repair the cut pipes. This is a good illustration of ownership being a significant factor in the functionality of this water system.
- Under the EU RWSSP and World Vision programs, as an indication of ‘ownership’, communities were required to contribute 10% of the capital costs of the system before they would be supported. Of the four best-performing communities, two communities (Popof and Saviya) reported that they had provided a capital contribution and two communities (Brebrenka and Yegusa) reported that they had not. Similarly, two of the four high-ranked water systems reported that they had provided a capital contribution (Popof and Gawam) and two reported they had not (Ibunatou and Yegusa). The study thus did not find evidence to confirm the notion that the 10% capital contribution on its own is effective for building community ownership.

Financial Sustainability

Financial sustainability usually involves payments made by community members to provide funds for repairs, maintenance or improvements to the water system. This was the fourth most discussed factor for GFS overall. Notably, for the communities with low ranked water systems, payments were the tenth most discussed factor, suggesting that in poorly performing communities collecting fees is perceived as less important than elsewhere.

The study found that communities tend to prefer flexible payment structures and so it is important that programs allow for this in the way that they engage with communities and train WMCs. Willingness-to-pay was also found to be linked to the level of service provided.

Summary of the findings

- The four best-performing communities had a clear system for collecting money for repairs, primarily as a payment by each household when a repair was required.
- Contributions as needed (rather than regular contributions) appear to be more culturally acceptable, and those contributing have a greater level of confidence (trust) that funds are being used for the intended purpose. This seems to fit better with existing practices of raising funds for particular events such as weddings, deaths and community celebrations.
- Only three communities collected funds from households on a monthly basis after inauguration and all of these subsequently (after three to four years) changed to collection when repairs were needed. The motivation for this change was described as a lack of trust in how the funds were being managed; no record of how funds were being used; and, some people who worked in town did not want to contribute regularly if they were not using the water.
- Community members generally felt that when money was collected for repairs, it was being used for its intended purpose.
- Ten of the fifteen GFS communities were accustomed to collecting funds to fix a breakdown at the time of the field work, and the remaining five communities had not yet begun to collect funds. Of the nine communities that had fully or partially functioning water systems, all had collected funds to undertake maintenance.
- Contributions, ranging from PGK0.5 to PGK5 (US\$0.25 to US\$2.50) per household per month, had been collected in all four communities with high-ranking systems. In the communities with lower ranking systems, no funds had ever been collected, and there was a lack of understanding of why funds should be collected. In two communities they had initially tried a monthly collection (PGK 2/household/month) but ultimately no one wanted to contribute.
- Willingness-to-pay seemed to correlate with level of service. The communities with higher ranked systems noted that the motivation for contributing funds was the value of having water available close to their homes (as opposed to collecting from a creek or stream). In contrast, in places where the system had ceased to function, households had initially paid a monthly fee but once the water system ceased to function they stopped paying. The initial payment had not resulted in on-going repairs to the system due to a range of reasons, including poor access to spare parts, lack of technical capacity to make complex repairs and in some cases poor management of community contributions.

- In some locations, the reasons given for people ceasing to contribute were that they wanted to see if the water system worked before they contributed; and, that they felt that they had already contributed by providing labor during the construction phase so the water should be free:

“We did so much to build the system so why do we have to pay again?” – Women’s group, Yoro, Madang Province.

- Some communities expressed an understanding that not everyone can always pay and in some places there was leniency for:

“those who cannot afford to pay at that time” – Women’s group, Brebrenka, Eastern Highlands.

- In other places, the community were less lenient:

“There’s no choice – every household has to contribute” – Community leaders, Ibonatou, Central Province.

- Some communities reported having had book-keeping training by the implementing NGO, and a number reported having cash boxes in which to keep funds. However, there was no apparent correlation between training and/or a cash box and the ability of the WMC to collect and manage funds. Some communities expressed a lack of trust regarding safety of the funds:

“We usually have fights with other clans so it’s not safe to keep the money” – Women’s group, Saviya, Eastern Highlands.

“There’s still a lot of mistrust around money collection” – Key Informant Interview, Vegos, Eastern Highlands.

- Contributions are used for a variety of purposes. In some communities they are used to pay the caretakers to undertake repairs and to buy spare parts. Some communities use funds to purchase taps, whilst in others the purchase of taps and costs of repairs were the responsibility of the households using the particular tap-stand. In Popof (a small community) the contributions were being used to pay for private connections.

Conflict

Conflict is defined in this study as a disagreement or argument that has an impact on the continued functioning of the water system. The conflict may be linked directly to the water system—for example, its use, location, access issues—or the water system may be the target of conflict about an unrelated matter.

The study found that effective management of conflict is important for the ongoing sustainability of the water supply and that communities tended to be able to manage conflict when it was directly

about the water supply. Where the conflict was about something else, but targeted the water supply, it was more difficult to resolve. Ensuring that WMCs are equipped to manage conflict is an important aspect of the overall post-construction support provided to communities.

Summary of the findings

- Overall, relatively low levels of conflict relating to water systems were found. Four communities reported no conflict related to their water system and eight reported low levels of conflict. Two communities reported a high level of conflict and two a medium level.
- Reasons for conflicts included the use of water, private connections, watering gardens and use of the tap stand (for example, the water system not providing “fair” access to all; private connections; watering gardens from a tap-stand which was shared by many households). In some cases, the issue was not related to water, but the pipes were cut as a response to an unrelated issue. Two of the communities had experienced a long-standing conflict between each other which had resulted in one community being displaced for almost a decade. The conflict was primarily related to land ownership, but it had also impacted on the water system.
- Of the communities with high performing water systems, three had low levels of conflict, but one had a high level of conflict. In this case, while the conflict was multi-dimensional, it stemmed from a previous conflict around the use of the water system (both parties to the conflict using the same system). The eventual solution was to build a second water system. In the communities with poorer-performing systems, there was a mix, with one of the four (Gain, Morobe) having a high level of conflict which ultimately led to the failure of the system. Another was classified as having a medium level of conflict, which also contributed to the failure of the system. In both these cases, disgruntled community members repeatedly cut the pipes. In two other communities with low ranked systems, there were no reports of conflict.
- Minor conflicts were about access to water and its use, and this form of conflict was generally resolvable by community members. Traditional approaches—such as holding a community feast—are used to avoid or resolve conflict, and in most communities it was noted that conflicts had been resolved through discussion amongst the people involved. The ability to be able to resolve conflict is key to sustainability.
- There were two reports of conflict over land linked to the location of the water source. In one case the conflict was resolved, and in the other case it resulted in the pipes being cut and the system no longer functions. In the latter case, the community believed they had an agreement with the land owner and had made appropriate payment but problems arose after one year.
- Conflict appears to be location-specific. In the Eastern Highlands there was significantly more discussion of conflict as a factor than in the other districts. There was less discussion of conflict in Morobe and very little in Madang and Central Provinces.

Rainwater Harvesting Systems

Given the relatively small number of communities with rainwater harvesting systems (five), the analysis was confined to identifying and exploring the top factors identified across all rainwater harvesting communities, regardless of performance for sustainability (four of the five rated overall as ‘improved’ and one, Debado, as ‘sub-standard’). The five highest ranking factors that emerged are shown in Table 11, and these are discussed in turn below.

Table 11. Rainwater Harvesting, Factors Influencing Sustainability

Factor	Frequency cited
Maintenance	14%
Water Management Committee	12%
External Links	11.5%
Ownership	9.5%
System Quality	8.5%

Maintenance

As for GFS, maintenance includes on-going actions by, or organized by, community members to keep the water system operating well (e.g. cleaning tanks, gutters and roofs) and to make small or large repairs to the water system as required.

Summary of the findings

- The most common maintenance issues raised were: leaking taps; loose, warped or cracked gutters and downpipes; insufficient catchment area; leaks in the tanks; and unprotected taps and pipes.
- Attempts to repair these maintenance issues were mostly basic, using local or cheap materials.
- Most tanks were being cleaned a few times per year, usually after the dry season or when it was observed that the tank was dirty.
- There was quite a lot of evidence of neglected breakdowns. The reasons given for this included: lack of funds for spare parts; prioritizing other activities such as caring for sick family members or work; and not having the correct tools.
- In some cases where repairs had been attempted but were not successful, it was clear that the person attempting the repair was not appropriately skilled or trained. Training was conducted in most communities with RWH, but some participants said that those selected for training were not the most appropriate candidates.
- Although most communities started with a WMC, at the time of the study these groups were generally no longer functioning. Some told the team that their responsibilities had ended once the RWH was constructed. Responsibility for the maintenance of the RWH tended to be taken on by individual households for individual tanks rather than by an entire village (as discussed below about Community Ownership). This has implications for maintenance because wealth, ability and cohesiveness all vary between households and clusters and therefore resulted in large disparities in maintenance within communities.
- In most of the RWH communities, the implementing agency was very involved in the maintenance of the RWH after construction and had only recently handed over the facilities (and hence the responsibility for maintenance) to the communities.

Figure 8. Rainwater Harvesting Systems, Gevera, Seba and Kokorogoro (Left to Right)



Water Management Committee

The study found that the role of the WMC in communities with rainwater harvesting systems differed slightly to that for gravity-fed systems due to the lack of 'common' elements that require a holistic management approach. For RWH each tank is independent of the other tanks and so there is no clear impetus for individuals/households/sub-committees to work together as there is for GFS. This further supports the notion that a flexible approach to the formation of committees is more likely to lead to sustainable and effective management of systems.

Summary of the findings

- WMCs had been established in all five communities with rainwater systems, but at the time of the study only one was still active. Reasons given for this include WMC committee members having other commitments, and, in some communities, a sense that their responsibilities had ended once the tanks had been constructed.
- As with the gravity-fed systems, almost universally the WMCs were established by the implementing agency at the time of the intervention, but in several communities the collapse of the WMC coincided with the phasing out of the agency. This suggests a lack of ownership of the WMC by the community. Despite this, most participants expressed support for the idea of having a WMC.
- The structure of the WMC varied somewhat between communities with rainwater systems. Some were formed as a sub-committee of the community development committee, and others were made up of male and female representatives from each cluster of households sharing the tank. In general, there were more men than women active on the WMCs.
- WMC members were selected by community leaders rather than elected. Feelings about this were mixed. While some felt this was necessary, others thought it was undesirable:

"There's plenty of dead bodies here" – Caretaker, Central Province

- Interestingly, in one community an ex-WMC member thought that

“The whole idea with the WMC was that they could finish the project and then relax” – Caretaker, Debado, Central Province

The ‘project’ here refers to construction phase only, which would explain the lack of organized management and maintenance of established tanks in that village.

External Support

External support describes the ongoing relationships that the community has with external stakeholders such as the local Government, NGOs or the private sector to maintain their water supply system. This is recognized as an important factor for sustainability.²⁷

Generally, communities were very reliant on the implementing agency for ongoing support—sometimes to the point of dependency. It also found that links to government were tenuous at best. From the community perspective there is a need to strengthen and enhance the role of government in WaSH service delivery, and for implementing agencies to have clear exit strategies.

Summary of the findings

- As with most water supply systems, the capital investment required to build a rainwater harvesting system for a cluster of households meant that almost universally communities are dependent on an external agency. This was true of all five RWH communities visited, who also expressed the need for continued support from the implementing NGO.
- That said, in one of the study communities households had been sufficiently motivated to arrange for rudimentary rainwater tanks to be constructed and installed with minimal input from the NGO. In the other four communities, however, the implementing agency continued to maintain regular contact with the community and was taking responsibility for almost all maintenance, including procurement of spare parts and repairs.
- Where the NGO continued to play a role the WMC members (and others) noted that they felt supported. However, where the NGO was no longer active, community members indicated that the lack of ongoing support may have implications for their capacity to maintain the tanks:

“Now that ChildFund have phased out, maintenance has become a concern” – Caretaker, Debado, Central Province

²⁷ Triple S, www.watersystemsthatlast.org

- Given the relative simplicity of the technology, it is likely that this concern was not based on a lack of ability to maintain their tanks, but more a sense of dependency on the implementing agency. Some community members felt that this was not ideal and that they should be more self-sufficient:

“Now we don’t want to be spoon-fed anymore, it’s time we stood on our own two feet” – Caretaker, Seba, Central Province

- Most RWH communities reported that they had had no contact with the government regarding their water supply. The ward councillors were mentioned by some communities as being supportive, but there was a general sense that Ward Councillors themselves were not able to access support from government at District or Provincial level. The overall view was that there was more chance of receiving support from NGOs than the government:

“We cannot go to the government for help because they will never help us” – Caretaker, Kokorogoro, Central Province

“We don’t contact the government. There’s no sign of the government here.” – Caretaker, Debado, Central Province

Community Ownership

As with gravity-fed systems, ownership for rainwater harvesting systems is a measure of the extent to which beneficiaries feel and take responsibility for ongoing management and maintenance of the infrastructure. However, as discussed above, there is a fundamental difference between the two types of water supply systems in that rainwater systems were rarely perceived to be owned by the community as a whole. The location of the tanks and the number of users generally dictated who ‘owned’ the tank. Ownership is a key factor for sustainability, as there needs to be a group or individual who will take responsibility for preventative maintenance and repairs as required.

Summary of the Findings

- According to the implementing NGOs, the ‘ownership’ of RWH is transferred to communities through a formal hand-over ceremony. The study found that this process had not happened in any of the five communities visited, which partly explains the continued sense of dependency and reliance on the NGOs for maintenance and support.
- Approximately one third of the 48 tanks observed in the study were classed as ‘communal’ tanks designed to serve three or more households and connected to purpose-built rainwater catchment structures independent of any of the houses. For these ‘communal’ tanks, generally the users nominate a person to take responsibility for maintenance.
- The remainder (referred to as ‘household-owned’) were located close to one or two houses, occasionally utilising the house roof as the catchment.²⁸ Where this was observed the sense of ownership (the right to access and thus responsibility) for these rainwater systems appeared greater than for communal tanks.

²⁸ Whether a tank was ‘household-owned’ was a judgement made by the field observer based on whether it was reported that the tank was owned by anyone, whether the tank was attached to a house and how many households used the tank.

- It was not always clear whether ‘household-owned’ tanks were designed this way or were initially intended to serve more households. There were certainly some examples of tanks which were intended as communal but had since been appropriated by individual households. Usually this only occurred when a tank had been abandoned for a year or more and although the participants indicated there was some dissatisfaction among the community about this (the implementing agencies did not comment), the disgruntlement seemed irrelevant (to participants) because the tanks were otherwise unused.
- Household rather than community ownership of tanks was associated with better quality. Each tank was individually evaluated for quality as part of the water observation checklist. While there was an equal split of tanks ranked as ‘good’ and ‘poor’ quality across the sample, the majority of those ranked as ‘good quality’ were household-owned. This suggests that the level of maintenance carried out on the tanks is linked to the level of ownership, which in turn is related to the number of households using the tank.

System Quality

The design, construction and materials used were all taken into consideration as part of the assessment of system quality. None of the five communities with rainwater tanks were assessed as sustainable under the definition provided in the study terms of reference due to the unreliable nature of water supply (mainly in the dry season) and in some communities the inadequacy of the quantity.²⁹

Summary of the findings

- Overall the quality of construction was assessed as high, though in several places communities complained that construction was delayed due to late delivery of materials. Construction was generally undertaken by community members with support and technical oversight provided by the implementing agency.
- Since all the RWH run dry during the dry season, they were all assessed as having failed to supply sufficient water in accordance with the study framework, with community members regularly reverting to collecting water from unsafe sources such as creeks. This is primarily due to the adequacy of the design, with catchment and/or storage sizes too small for the number of users. Additionally, it is likely that some community members use the water in the tanks for purposes other than drinking and cooking, and so draw more water than the system was designed to supply.
- In all five rainwater harvesting communities, community participants said they would prefer an alternative water supply system. In three of the RWH communities a feasibility study had been conducted to examine the possibility of pumping spring or bore water to the community but all had proved to be unfeasible. In the other two communities there was a general understanding that there were no spring-fed or surface water sources higher than their villages and rain water harvesting was the only technically viable option readily available.

²⁹ The ToR for the study defines a sustainable water supply as being one that is “naturally replenished (not over-extracted), provides a reliable and adequate water supply, is accessible by all users over a prolonged period of time, and demonstrates a cost-effective and replicable use of resources” - WSP PNG Rural WaSH Sustainability Study ToR (2014).

Sanitation and Hygiene

The investigation of sanitation and hygiene involved a survey of 177 households across 19 of the study's 21 sample communities. (In two communities, Yegusa and Gufin, only 2 household questionnaires were completed, which should be noted when considering data aggregated by community). As well as the survey, part of the focus group discussions in each of these communities was dedicated to sanitation and hygiene in order to collect qualitative data about the factors that potentially facilitate or hinder the sustainability of improved sanitation and hygiene behavior.

With the exception of Johove, all the communities had received support for water supply in addition to sanitation and hygiene. Johove was added to the sample by TTU as an example of best-practice for their sanitation and hygiene work. Of the 19 communities included in the sanitation and hygiene component of the study, ten communities had received full subsidies as part of the implementing agency's approach, four communities received partial-subsidies and five communities received no subsidies.³⁰ The WASH sector internationally has moved away from widespread use of hardware subsidies for sanitation. The mix of subsidies evident in the communities was a chance occurrence—since communities were selected on the basis of their water supply—rather than an intentional sampling to explore the issue of subsidies. The approach used in all 19 communities included elements of both Community-Led Total Sanitation (CLTS) and Participatory Hygiene and Sanitation Transformation (PHAST) methodologies.

Overall Performance

RQ4: To what extent are toilets and handwashing facilities being maintained and used?

The overall performance of the sanitation and hygiene systems in the study site was based on data collected in the household questionnaires, field worker observations and the focus group discussions. Three sets of analyses were made:

- Coverage
- Service level
- Maintenance

Coverage

The level of coverage refers to the percentage of households that had a functioning latrine (that is, a latrine that could still be used, regardless of quality, actual use or type), irrespective of whether the household was sharing a latrine. The levels of coverage are as shown in Table 12:

³⁰ Full-subsidy approach meant that all materials (aside from bush materials) were provided to each household to construct a toilet and, in some cases, a handwashing facility also. A partial-subsidy approach meant that some materials were provided to each household but they had to contribute to purchasing moulds to make concrete slabs as well as some other materials. A non-subsidy approach meant that triggering and training but no materials were provided to the community.

Table 12. Sanitation Coverage Framework

Level	Percentage
High	>80%
Medium	20-80%
Low	<20%
No Service	0%

The level of coverage of functional latrines in each community is presented in Table 13 below.

Table 13. Latrine Coverage Levels

Province	Community	Level of Subsidy	Coverage
Eastern Highlands	Saviza	Partial	High
	Yegusa	Partial	Medium
	Vegos	Partial	High
	Johove	None	Medium
Madang	Tangu	Full	High
	Yoro	Full	Low
	Kamasina	Full	Low
	Suaru	Full	Low
	Ulingan	Full	Low
Morobe	Gawam	Partial	Low
	Gufin	None	Low
	Mungkip	None	Medium
	Gain	None	Medium
	Popof	None	High
Central	Kokorogoro	Full	High
	Seba	Full	High
	Gevera	Full	High
	Debado	Full	Medium
	Ibonatou	Full	Medium

There was no apparent correlation between the level of subsidy and coverage. There is some correlation between coverage and province/implementing agency, aside from Morobe Province. Overall, there seemed to be higher coverage in the Eastern Highlands and Central province (two provinces where the Healthy Islands approach was also used in the sample communities) and lower coverage in Madang. It is also worth noting that the sanitation and hygiene intervention had been done quite recently in the Eastern Highlands and Central provinces (around 2012 in most places) and

much earlier in Madang and Morobe provinces (mostly around 2008). However, there is too little data and too small a sample size for these to be strong correlations and other factors, such as environmental damage, could be equally significant for the level of coverage. This is discussed further in Section 3.2.2.

Service Level

As with water supply, the study adopted a framework for level of service with respect to sanitation and hygiene. The sanitation and hygiene framework has four sub-criteria: Use, Quality–Amenity, Quality–Construction and Handwashing (Table 14).³¹

Table 14. Framework for Sanitation & Hygiene Service Level

Service Level	Use	Quality - Amenity	Quality - Construction	Handwashing facility
High	All members of household use a latrine that is not shared with other households and baby feces are disposed of correctly.	Private, no fecal matter, no smell and no flies.	Latrine with floor made from durable materials (wood or concrete) and has equitable access for all. ^c	Handwashing facility with water and soap available, close to latrine.
Improved	All members of household use a latrine that is not shared but baby feces are not disposed of correctly.	Private, no fecal matter, but has smell or flies.	Latrine with floor made from durable materials (wood or concrete) but doesn't have equitable access.	Handwashing facility with water and ash available, close to latrine.
Basic	Household members use a latrine that is shared by <5 families (either their own or a neighbor's).	Private, no smell or flies, but has fecal matter.	Latrine with permeable floor, no slab and doesn't have equitable access but has a seat riser.	Handwashing facility with water but no soap or ash available, close to latrine.
Sub-standard	Household members use a latrine that is shared by >5 families or 30 people.	Private, but has fecal matter, smell and flies.	Latrine with permeable floor, no slab or seat raiser and doesn't have equitable access.	Handwashing facility with no water (irrespective of soap and ash), close to latrine.
No service	Household members usually open defecate (self-reported) or latrine looks unused.	Not private (irrespective of fecal matter, smell and flies).	No latrine, i.e. open defecation.	No handwashing facility.

^c 'Equitable' here refers to the toilet construction including features that make it accessible to people with and without disability (that is, universally accessible). The survey noted the presence of any accessibility features including bars, rails, ramps, rope from the roof to hold on to, seat raisers, larger superstructure, etc.

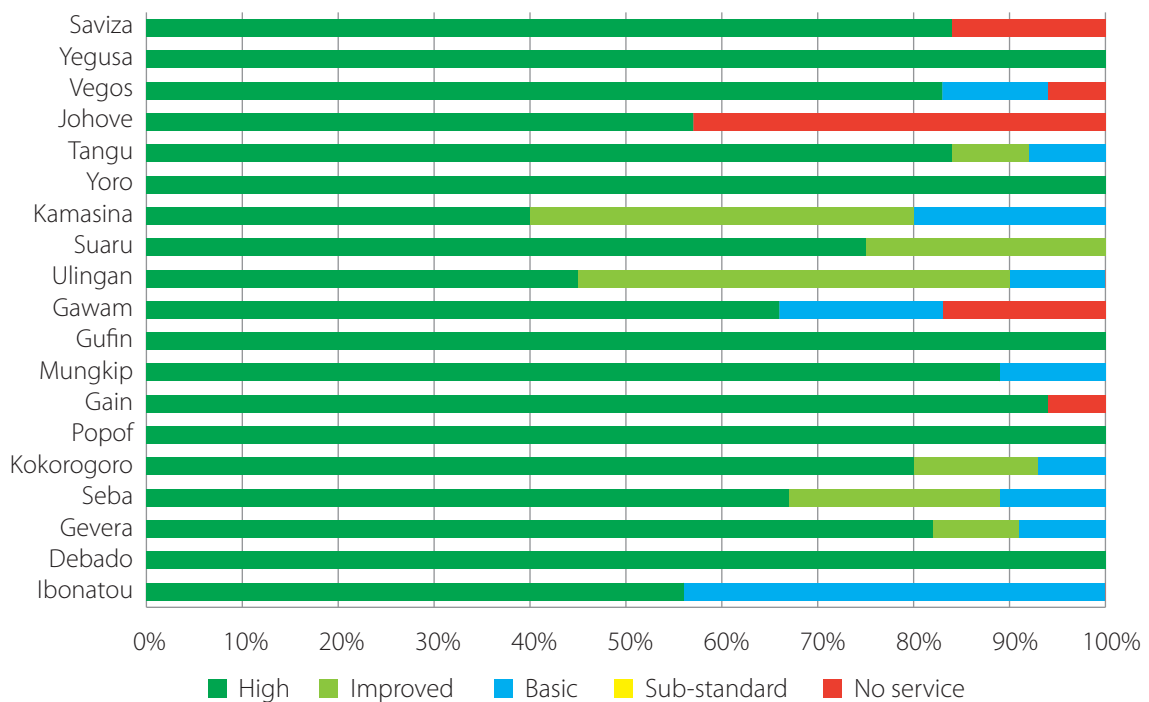
³¹ The framework was altered slightly since the Inception and Field Summary reports were prepared to allow a more consistent analysis across the sub-criteria. Quality and Access were re-labelled 'Quality—Amenity' and 'Quality—Construction', respectively, for greater clarity.

For those households sampled for the sanitation and hygiene survey, each latrine was assessed against the service level framework and the results for each sub-criteria are presented below.

Use

Most households rated ‘high’ or ‘improved’ for use, meaning that they had their own toilet, they reported using it and there were signs of it being used. This was largely consistent throughout the survey sample and across all communities (Figure 9). Across the entire sample, 85% of households were found to be using a latrine. The self-reported usage was 100% in five communities (although two of these, Yegusa and Gufin, only had two completed household questionnaires each). Only one household reported practicing open defecation despite having a functional latrine. There were another nine latrines (5%) spread across five communities that did not show signs of use (in spite of the respondent reporting that they only defecated in their household latrine), and 15 households (8%) that reported disposing infant feces in the open. It should be noted that there was a physical inspection of each latrine to check for signs of use. Disposal of infant feces was reported behavior only (that is, the survey assessed knowledge not practice).

Figure 9. Sanitation and Hygiene Service Level – Use



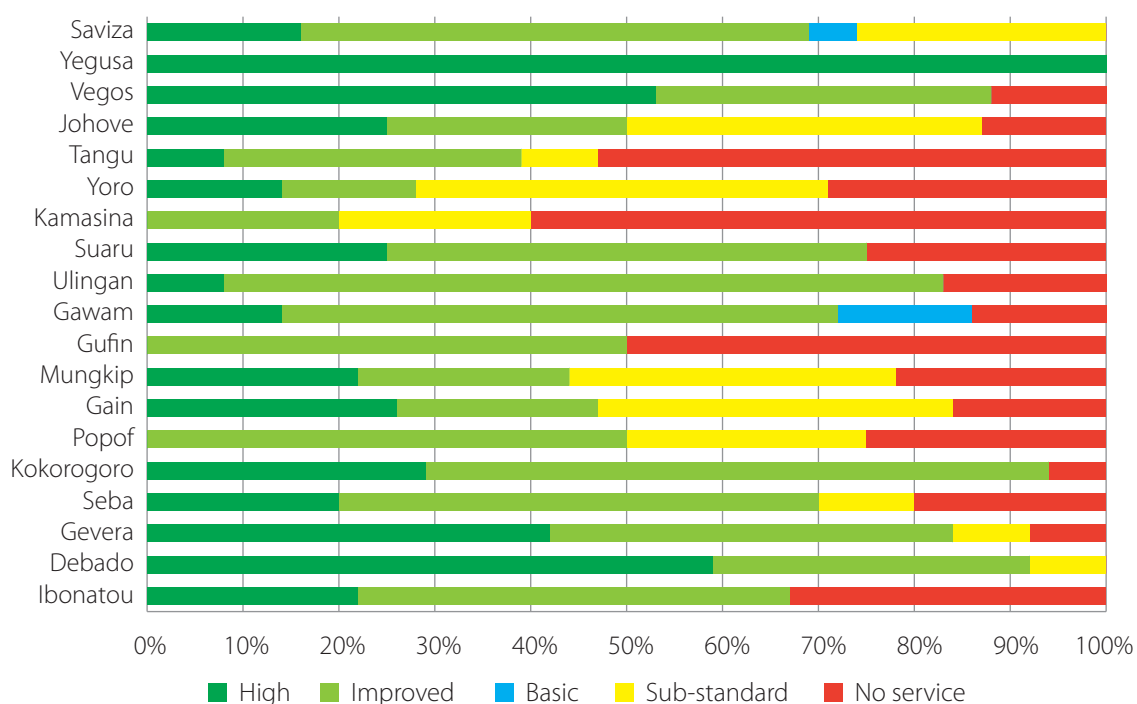
The comparatively low percentages of households which scored ‘High’ for Use in Kamasina and Ulingan were related to poor disposal of infant feces rather than open defecation by adults. The high percentage of households which scored ‘Basic’ for Use in Ibonatou is due to high rates of sharing latrines there. Finally, the high percentage of households scoring ‘No service’ for Use in Johove is because even though all households surveyed had a latrine, many of them did not show sign of use.

Johove was unique in that the households surveyed were polarized in the level of Use. It is unclear why this is, but it is certainly not related to subsidies, since these were not provided in Johove. It appears that at one point in the past sanitation and hygiene messaging was strong (probably due to training with the implementing agency) and the uptake of latrines was high but the messaging was not maintained over time and as the latrines fell into disrepair, the community were not motivated to make the necessary repairs. During the field work visit the community health volunteer who was responsible for sanitation and hygiene seemed to have little motivation and was embarrassed about the poor state of his own latrine. This may have contributed to the lack of motivation among other households in the community to maintain and use latrines.

Quality-Amenity

‘Quality-Amenity’ was based on the presence of smell, flies and fecal matter on or around the latrine (cleanliness), as well as whether the latrine was private. Results for amenity were not as impressive as those for the use of latrines and varied within and across communities (Figure 10). Approximately half of the latrines scored High or Improved and half scored Sub-standard or No service. Within amenity, privacy and cleanliness was good—82% of latrines across the entire sample were private and 75% of all latrines did not have fecal matter on or around the latrine. Performance for smell and flies was less impressive—67% of all latrines smelled and 54% had flies present. This may be explained by the general lack of effective latrine covers and ventilation pipes. Only 57% of all latrines had covers and only half of these were used properly. Half (48%) of latrines had a ventilation pipe, although only 20% of these had a screen to keep out flies.

Figure 10. Sanitation and Hygiene Service Level – Quality-Amenity

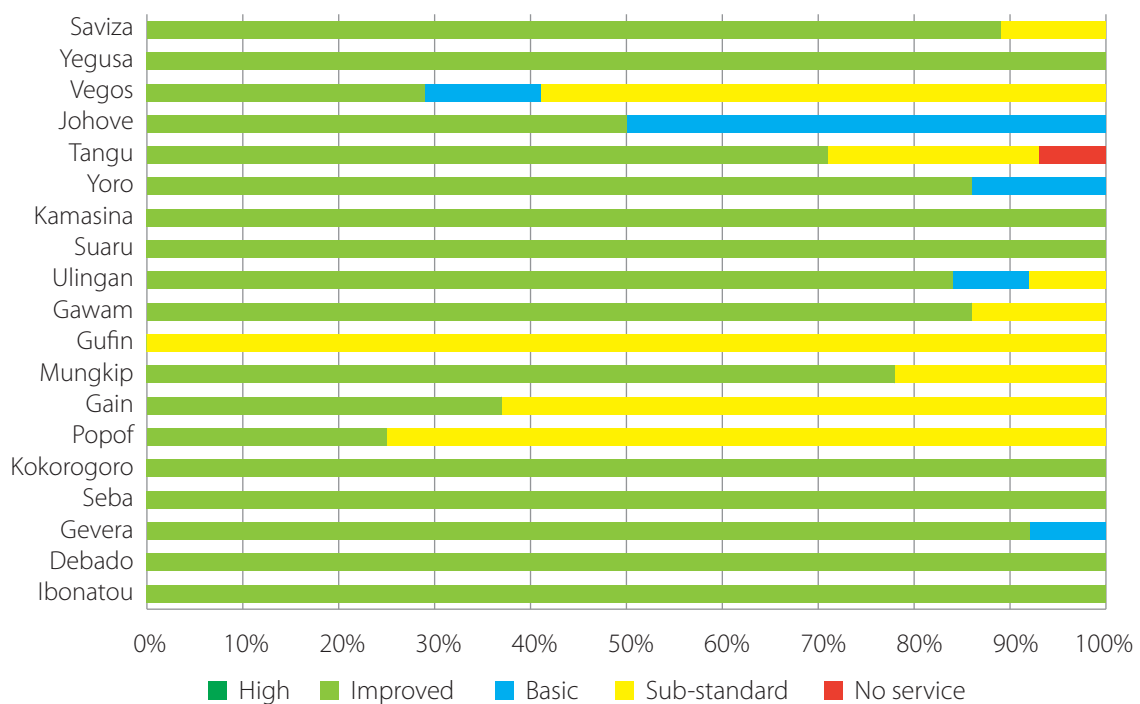


Quality-Construction

Most latrines (77%) throughout the sample were rated as ‘Improved’ for the quality of construction meaning that they had a durable slab over the pit (Figure 11). Quality-Construction in the service level framework refers only to the durability of the floor, slab and seat (if present) as well as whether the latrine is accessible to all people. Whether the superstructure provided adequate privacy was assessed under Amenity.

To be rated as ‘High’ for Quality-Construction, a latrine needed to include features that enable people with mobility impairments to use it. These features could include bars, rails, ramps, rope from the roof to hold on to, seat raisers, larger superstructure, lights, etc. None of the latrines in the sample were found with any of these features. Four communities were predominantly ‘Sub-standard’ because their latrines consisted solely of a pit with a dirt floor. Johove had the highest percentage of latrines which scored ‘Basic’ for quality of construction. This was resulted from latrines that did not have impermeable floors but were fitted with seat risers.

Figure 11. Sanitation and Hygiene Service Level – Quality-Construction



Handwashing Facilities

The presence of handwashing facilities with soap and water was universally low across the sample (Figure 12). Across the entire sample, only 5% (nine households) had a handwashing facility, and of these, only four facilities had water and one had soap. Johove (where the implementing agency has recently worked intensively) showed the best results of all the communities, with more than 50% of households surveyed having a handwashing facility. Not all of these, however, had water which raises questions about how frequently they were being used.

These results indicate that the sustainability (and most likely also the initial uptake) of handwashing facilities is generally poor across the study site. In contrast to practice, knowledge of good handwashing behavior seemed widespread. When asked 'Where do you wash your hands?', only two participants said that they do not wash their hands (Figure 13). Most participants (95%) reported that they washed their hands in a bucket or container, at a tap or shower stand, rainwater tank or in an open water source. In addition, 84% of participants said the main reason they washed their hands was for good health and to prevent disease (Figure 14).

Figure 12. Sanitation and Hygiene Service Level – Handwashing Facilities

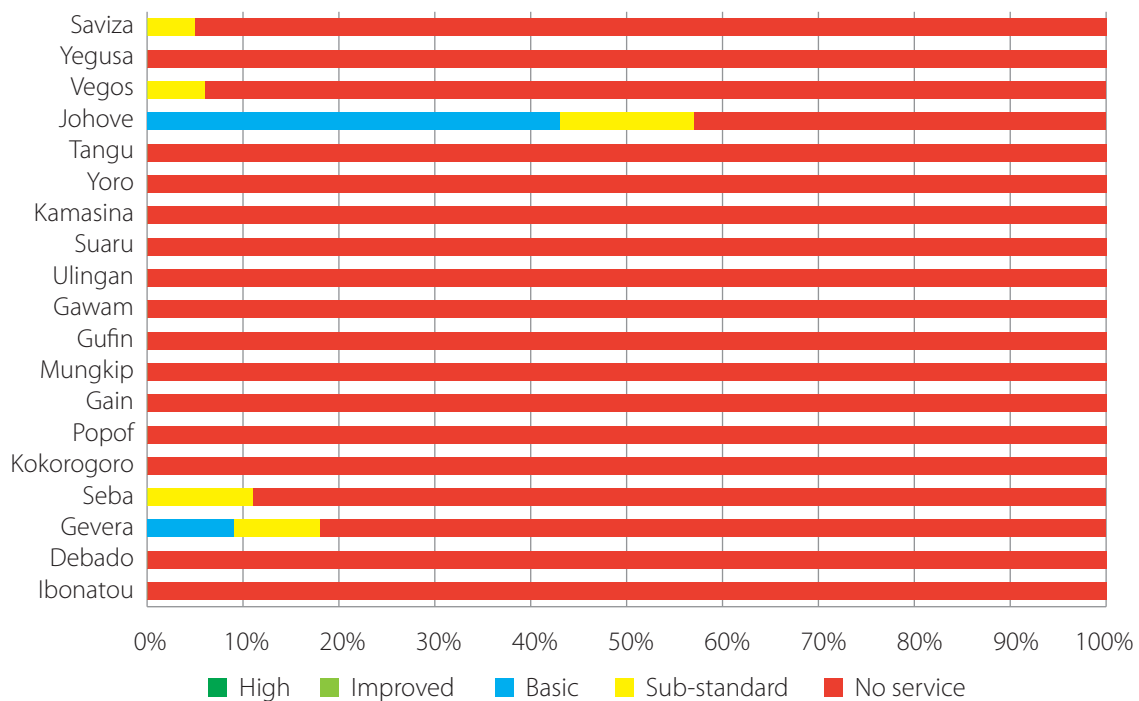


Figure 13. Main Place Where Participants Washed Their Hands (Self-Reported)

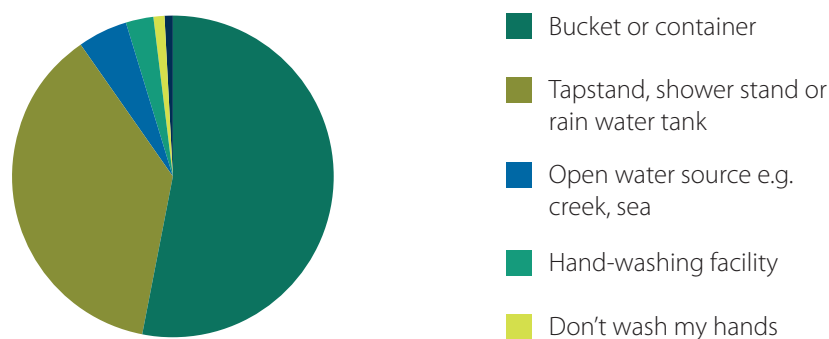
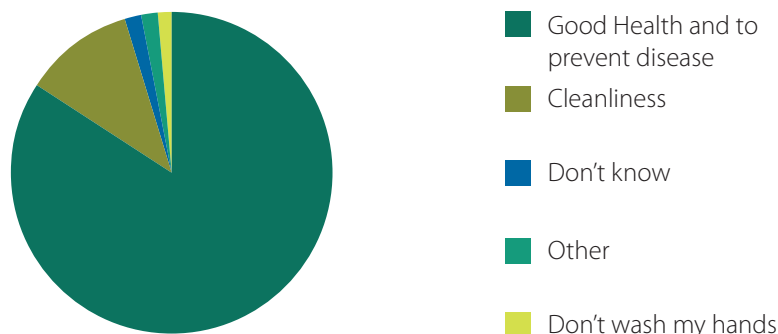


Figure 14. Main Reason for Washing Hands (Self-Reported)



Sanitation Service Level by Community

To generate an overall picture of the service levels for sanitation and hygiene in each community, the dominant performance for each sub-criteria was identified (Table 15).

Table 15. Level of Service of Sanitation and Hygiene – Community-Level Performance

Province	Community	Level of Subsidy	Use	Quality - Amenity	Quality - Construction	HWF
Eastern Highlands	Saviza	Partial	Improved	Improved	Improved	No service
	Yegusa	Partial	High	High	Improved	No service
	Vegos	Partial	High	Improved	Basic	No service
	Johove	None	Basic	Basic	Improved	Sub-standard
Madang	Tangu	Full	High	Sub-standard	Improved	No service
	Yoro	Full	High	Sub-standard	Improved	No service
	Kamasina	Full	Improved	Sub-standard	Improved	No service
	Suaru	Full	High	Improved	Improved	No service
	Ulingan	Full	Improved	Improved	Improved	No service
Morobe	Gawam	Partial	Improved	Improved	Improved	No service
	Gufin	None	High	Basic	Sub-standard	No service
	Mungkip	None	High	Basic	Improved	No service
	Gain	None	High	Basic	Basic	No service
	Popof	None	High	Basic	Basic	No service
Central	Kokorogoro	Full	High	Improved	Improved	No service
	Seba	Full	High	Basic	Improved	No service
	Gevera	Full	High	Improved	Improved	No service
	Debado	Full	High	Improved	Improved	No service
	Ibonatou	Full	Improved	Basic	Improved	No service

There were no strong correlations between performance and either the level of subsidy used or the province/implementing agency. Overall, the communities that received no subsidy performed the lowest in terms of Quality-Construction, but this was not markedly lower than the other communities. This correlation, albeit slight, is not unexpected because communities that do not receive subsidies construct their latrines out of lower or no-cost materials, which tend to be less durable.

There was also some alignment between Quality-Amenity and province/implementing agency, with generally lower performance in Madang and Morobe. Quality-Construction was also the lowest overall in Morobe. Again, this may be explained by the timing of the sanitation and hygiene intervention. The intervention took place in Madang and Morobe several years earlier than in the Eastern Highlands and Central provinces and thus, latrine quality would have deteriorated through normal wear and tear.

Maintenance

Figure 15. Well-Maintained Toilets, Vegos, Avani and Ulingan (Left to Right)



During the household survey, respondents were asked about any maintenance that had been carried out on their latrines. Communities were scored based on the percentage of latrines that had been maintained in the past (according to participant self-reporting) and grouped as shown in Table 16.

Table 16. Maintenance Assessment Levels

Level	Percentage
High	80-100%
Medium	60-79%
Basic	40-59%
Low	20-39%
No Service	0-19%

There was little correlation between province/implementing agency and maintenance performance in the Eastern Highlands or Central provinces (Table 17). Generally high levels of maintenance were found in Madang and Morobe provinces. There was no correlation observed between level of subsidy and maintenance performance.

Table 17. Percentage of Latrines Maintained in the Past – Community-Level Performance

Province	Community	Level of Subsidy	% of latrines maintained in the past
Eastern Highlands	Saviza	Partial	50%
	Yegusa	Partial	0%
	Vegos	Partial	100%
	Johove	None	25%
Madang	Tangu	Full	31%
	Yoro	Full	86%
	Kamasina	Full	80%
	Suaru	Full	100%
	Ulingan	Full	92%
Morobe	Gawam	Partial	86%
	Gufin	None	100%
	Mungkip	None	100%
	Gain	None	84%
	Popof	None	75%
Central	Kokorogoro	Full	53%
	Seba	Full	73%
	Gevera	Full	58%
	Debado	Full	67%
	Ibonatou	Full	100%

Across the whole sample, 72% of households reported that they had maintained their latrines in the past. The most common type of maintenance undertaken was digging a new pit (Figure 16). Responsibility for undertaking and sourcing materials for latrine maintenance was mostly held by the household, although in several cases, households would recycle the materials provided by NGOs in the past (see Figure 16).

Figure 16. Maintenance of Household Latrines

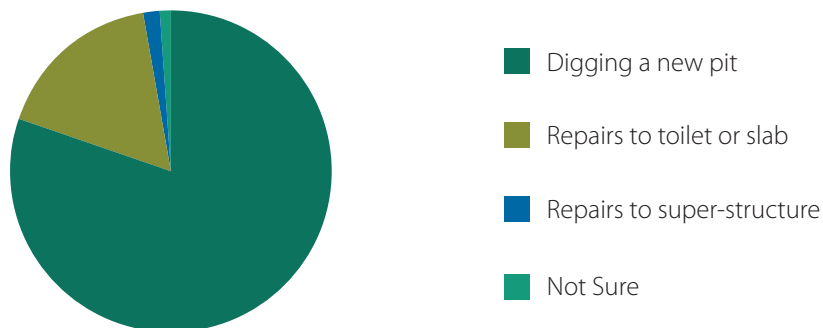


Figure 17. Who Undertook Latrine Maintenance

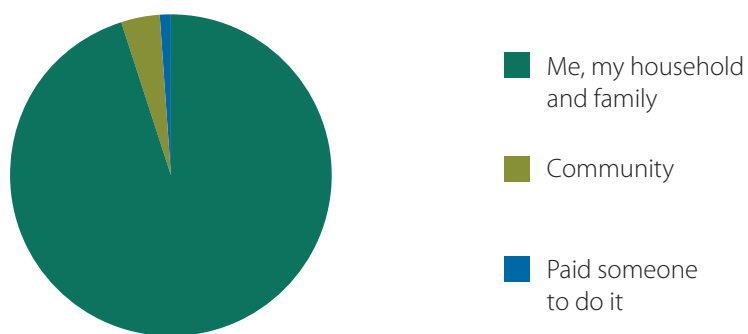
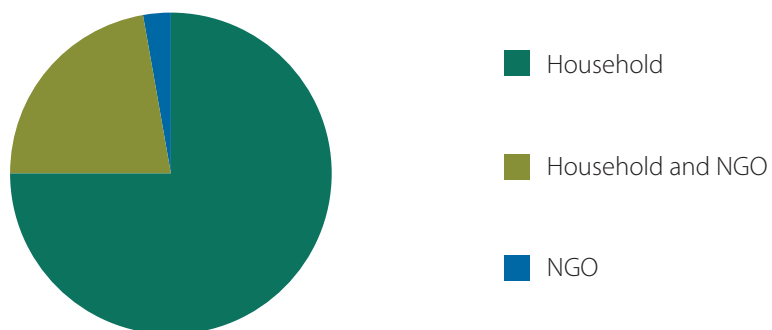


Figure 18. Materials for Latrine Maintenance



Factor Analysis—Sanitation and Hygiene

RQ5: What factors facilitate or hinder households to continue using their toilets and/or hand-washing facilities?

During the open-ended discussions about sustained use of toilets and handwashing facilities, community members identified four important sets of ideas or factors—material subsidies, quality of construction, access and attitudes ((Table 18). As with water supply, these were identified through frequency analysis of factors raised during the discussion. A table setting out the frequency with which all factors were mentioned is set out in Annex 2. Summaries of the main findings for the four priority factors are set out below.

Many of the ideas, particularly with respect to subsidies and quality, relate to maintenance. If households are going to continue using their toilets and handwashing facilities, carrying out maintenance is essential. Ongoing or one-off actions undertaken by households to keep their toilets and handwashing facilities operating include replacing/relocating toilets when pits are full, repairing broken features and regular cleaning. Discussion focused mostly on the biggest challenge—what happened when a pit filled up—rather than other repairs or regular cleaning. In a few communities the toilets were fairly new, so other issues that facilitated or hindered households to continue using their latrines or handwashing facilities were more significant than maintenance.

Table 18. Factors for Sanitation and Hygiene

Factor	Weighting
Subsidies	15%
Quality	14%
Access	14%
Attitudes	13%

As discussed above, communities were ranked according to estimated sanitation coverage (Section 3.2.1) and grouped into categories of poor-, medium- and high-performing communities. Where possible, results for each factor are considered against variations in sanitation and hygiene performance. The small sample size makes results of these comparisons indicative rather than definitive.

Subsidies

Three quarters of the sample community had received some form of subsidy and in these locations issues concerning subsidies were much discussed (including aspects of fairness and who had or had not made their own contributions). Interventions with and without subsidies both resulted in a range of sanitation performance, including some high-performing communities. In some communities all non-local materials for sanitation and hygiene infrastructure were provided to households by the implementing agency. In other communities a nominal amount had to be paid for materials which the implementing agency procured. There were also some places where no subsidy at all was provided

and clearly these represent the most cost-effective approach from a policy perspective. Participants across the study communities estimated the cost of constructing a toilet with a concrete slab to be in the range of PGK70–100 (US\$26–38).

Summary of findings

- About half of the communities received all of the necessary materials for building toilets and HWF (apart from bush materials) for free. Of these, roughly half were high-performers and half were low-performers. In some of these communities, there were tensions where some households had missed out on materials because of delivery issues (bad roads) or they had moved into the community after the intervention.
- About one-quarter of the communities received some materials for free but also had to make some contribution. In one community, each household had to contribute 10% of the cost of materials. In several other locations supported by TTU, households were required to contribute towards purchasing moulds, which were then shared by the community for making slabs. The moulds cost approximately PGK435 (US\$165) and households generally contributed about PGK5 (US\$2). Again, these communities ranged from low to medium to high performing for sustainability.
- About one-quarter of the communities received no subsidy for materials. Instead, one or two demonstration ventilated improved pit (VIP) latrines were constructed and households were expected to replicate these with their own materials. Of these, most were medium-performers. Of note, almost none of the households constructed VIP latrines.
- In about a quarter of communities, materials were provided for handwashing facilities (HWF). Sampled households were found to be using these materials as water storage containers rather than for HWF, suggesting that there was no genuine demand for these HWF. This highlights the risks for sustainability associated with providing free materials.

Quality

All communities had been encouraged to build VIP latrines with durable materials but there was high variability in quality of toilets within the sample, including in high-performing communities. Despite only visiting households that had latrines, many were of poor quality or in a poor state (not clean). The quality of sanitation and hygiene facilities contributes toward their sustainability because lower quality systems require higher levels of maintenance, are less likely to provide an improved level of service, and are generally less valued by owners and therefore potentially reduce the incentive to maintain them.

Summary of findings

- In about half of the low-performing communities, households reported their toilets broke from flooding, collapsed pits (sandy soil) and white ant damage. These households were unmotivated to repair or build new toilets and had reverted to open defecation. In one high-performing community, participants understood the importance of lining pits in unstable soil and had done so.

- A few participants expressed a desire to have a septic system. Only two such toilets were observed, one in a private household and one in a school, both under construction.
- Most of the participating households had attempted to build VIP latrines at first, some of which actually had the critical features of a VIP latrine but many that did not.³² Many latrines were referred to as VIP but the only feature that differentiated them from simple pit latrines was the presence of a vent pipe. Where toilets had to be rebuilt, most participants had reverted to simple pit toilets, especially in the poor-performing communities. This outcome was found both in communities where the implementing agency designed the toilets and helped households build them and also in communities where construction techniques were illustrated through demonstration toilets.
- In communities where materials had been provided by the implementing agency households reported planned to dig a new pit and move the slab and superstructure of the toilet when the pit filled. In five of these communities, the slab had been designed with handles to make moving the slab easier. A few households reporting having done this already. In several places, however, participants mentioned that moving the slab was too difficult and households either made a new cement slab (using their own funds) or dug a new pit and did without the slab.
- Several participants mentioned that elderly people were assisted in the maintenance of their toilets by others, usually family. Occasionally this was done for a small fee of around PGK20 (US\$7.50).
- Only one community had examples of excellent handwashing facilities (bamboo pipes, with a stopper). Only a few households, however, had these.

Figure 19. Well-Constructed Toilet, Debado



Access

Communities have an expectation that sanitation and hygiene facilities should be available at the household level. This was illustrated by most participants reporting that every household in their community had a toilet. Upon further questioning, many adjusted this to ‘most’ households have a toilet. Observation in the communities, however, showed that sharing toilets was quite common.

³² A properly designed and constructed VIP latrine will have (as a minimum): a vent pipe painted black, extending at least half a metre above the latrine roof, and fitted with a fly screen. The vent pipe should be straight to allow a shaft of light into the pit. The interior of the latrine should be dark, partially open to the prevailing wind and the pit should be open to allow airflow through the pit and out the vent pipe.

Summary of findings

- In many places the participants reported that they had pit toilets before the intervention – and that they have always had pit toilets (since colonial times). These communities had an existing culture of access to sanitation that the sanitation and hygiene interventions built upon.
- In a few communities it was quite common for single men not to have a toilet because whilst they lived in separate households, they still used their parents' toilets.
- In each of the four communities where almost everyone had reverted to open defecation, the intervention had included a full material subsidy. The original toilets constructed had been destroyed by environmental damage, such as flooding and white ants, rather than having been abandoned while still functioning.
- In most communities where there were teachers' houses (for teachers who did not come from the village), each had a toilet, being in most cases simple pit latrines. All of these toilets were constructed and maintained by other community members, presumably as part of the general community support for teachers.
- Only two or three communities had functioning HWF, and even in these communities they were only at a few households. Some of the HWF observed were innovative in their design and functioned well.

Attitudes

Attitudes towards sanitation played a big part in whether latrine use was sustained. In high-performing communities households had been convinced of the value of sanitation and continued to invest in it. In poor-performing communities, most households built toilets after the intervention but then reverted back to open-defecation once their toilets became unusable.

Summary of findings

- Across most communities, participants reported that the positive outcomes of having toilets were health benefits, fewer flies, less smell and cleaner living spaces. These outcomes underpinned positive attitudes to sanitation.
- In some communities, several households already had pit latrines prior to the sanitation and hygiene intervention and participants reported that they already preferred to use a toilet than defecating in the open. In these locations the intervention was mostly aimed at encouraging households to move from pit latrines to VIP latrines. Community members reported that they would prefer VIP latrines, or flush or septic systems where they had sufficient water.
- Lower levels of interest in sanitation resulted in households not building a toilet at all, not upgrading to a VIP latrine or not rebuilding a damaged or full toilet. Reasons given for this included: lack of materials (due to either insufficient funds, materials not getting delivered to each household or new houses that had missed out on the materials subsidy); too much labor; not a priority (especially if the toilet had been destroyed); and, in one village, the complete breakdown of the water system.
- In communities where the implementing agency's approach was based on training community leaders and relying on these leaders to carry out the intervention relatively independently, the attitude of the leaders correlated with the sanitation and hygiene performance of their community.

For example, in Saviya (a high-performing community), the community leader was active and enthusiastic, whereas in Johove (a low-performing community), the community leader had lost interest and no longer had an improved toilet in his own home.

- External support (considered as a separate factor within the sustainability framework) was closely linked to attitudes and was one of the most passionate topics of sanitation conversation during the community consultation groups. Community member felt strongly that support from external agencies, such as government or NGOs, was very important to their maintaining enthusiasm and drive for sanitation and hygiene.

Figure 20. Handwashing Facility, Avani



Equity and Inclusion

One of the goals of the National WaSH Policy is to achieve increased equity of services among rural, peri-urban and urban areas, and for disadvantaged groups. The study provided an insight into issues of equity and inclusion in rural areas. While the study's equity and inclusion framework (Annex 2) considers inequity and marginalization through multiple lenses—including sociocultural and political factors—the main focus for data collection and analysis was on gender and exclusion.

Gender Equity

Research internationally has shown that women and men have different attitudes to sanitation and hygiene and that sanitation/hygiene infrastructure affects the lives of women and girls differently to that of men and boys.³³ The sections below consider two types of gendered impacts of WaSH programming—practical and strategic gender needs. Practical needs are met by improving physical access to services, such as reducing the burden to fetch water and increasing privacy and safety for defecation and menstrual hygiene by increasing toilet coverage. Strategic gender needs are associated with changing the power balance between women and men and opening up more opportunities for an equal sharing of influence and responsibilities.

Practical Gender Needs

Women clearly stated during the community group consultations that they bear the major responsibility for WaSH at the household level. For example, in Yegusa, participants at the women's consultation reported that:

“Women are responsible for looking after the water in the home.”

³³ WSP (2010) Gender in Water and Sanitation; <http://www.inclusivewash.org.au/gender-women-and-girls>;

The study also revealed how women valued having improved access to water. The reasons provided included the health of their families, more time for other activities, getting their children to school, less of burden associated with carrying water long distances, making daily tasks easier:

"We are happy now because the tanks have really helped us and lessened the burden of carrying heavy containers, but we will be very satisfied the day we receive tanks in each household." (Women's group, Debado.)

"We are satisfied with our water supply. It is easy to get water and do household chores. Now we don't have to go long distances to get water. Instead of going to creeks in the morning, we use the tanks for a quick bath and then children can go to school early." (Women's group, Seba)

Improvements in the quality and the quantity of water are closely linked to illness, particularly of young children and infants, which in turn increases the burden on women who are generally responsible for dealing with illness within families.

"Having water has made life easy, easier to live a healthy life. With water in the house we can avoid diseases – the health center has recorded that less people from this village are coming to get treatment for being ill." (Women's group, Saviya)

Poor system performance clearly impacted upon women, forcing them to return to unimproved sources such as creeks or unprotected wells and spend significant amounts of time collecting water. These impacts were evident throughout the discussion groups in communities with poorly sustained water systems.

"Whenever no water is flowing, we have to walk up the hill to get water from the source. It's a long way and it's difficult - we need to walk back up the hill to our houses with the water. When the water is working, we have taps near our house which is much easier." (Yegusa women's group)

"We suffer from carrying water long distances. Every day we collect water two times: in the morning and in the evening." (Ulingan women's group)

Similarly, reliability of water supply has an impact for women and girls. The study found that rainwater systems were not reliable, with community members reporting that none of the rainwater systems provide water during the dry season.

"In the dry season, sometimes we go six months without water. Women and children have to look for water." (Community consultation group discussion, Kokorogoro)

"I don't want water tanks because during dry season there is no water, it collects dirt and mosquitoes breed in there. I want a water pump to be installed in a spring in the mountains so we will have water all the time." (Women's group, Debado)

Women saw the main benefits of owning a toilet as improved health, less flies, less smell and convenience. As with water-related illness, the burden of disease as a result of poor sanitation and hygiene practices falls primarily on women who are the major carers. Women noted that while they view sanitation as a greater priority than men, it is men who are the predominant decision makers regarding whether or not a toilet is built.

“Women see having a toilet as important but men don’t see it as a priority as compared with other things.” (Women’s group, Kamasina)

Increased privacy and security is often reported as a benefit for women and girls from easily accessible and improved sanitation facilities. While safety is a real concern for women and girls when there is no toilet and areas for open defecation are located far from their home, improved safety was not raised strongly during consultations with women. Likewise, convenience for menstrual hygiene management did not feature in discussions with women. This is possibly linked to discussion of menstrual hygiene and sexual violence being difficult themes to discuss openly with outsiders in a group setting.

In line with the study finding minimal evidence of handwashing with soap, hygiene and handwashing was not raised by participants during equity discussions.

Strategic Gender Needs

The study explored changes to women’s empowerment by considering women’s participation in WaSH processes. While the study did not allow for in-depth research on this topic, women—and to a lesser extent men—were able to describe the roles women and men play for WaSH. There was very little evidence that the WaSH programming undertaken in the sample communities has produced greater gender equality and helped women achieve their strategic gender needs.

There were mixed responses around women’s involvement in the planning stage for WaSH activities. Some women noted that they were not invited to be involved in planning, yet they were expected to help with construction. There were also a number of comments where women were requested to come to the planning meeting but then felt they were not being listened to.

“Men think that we don’t know anything and we might say the wrong things...they think most women are uneducated” (Women’s group, Mungkip)

In Vegos and Suaru, women noted that they initiated the funding support for the water system and had responsibilities to hold money, yet were still not given a substantive role in decision making.

In terms of construction, in all cases women were involved in activities such as collecting sand, stones, gravel, getting water, providing food and carrying pipes. It is questionable, however, whether this type of involvement for women contributes to gender equality.

Regarding the ongoing management of the water system, while the community data collection revealed generally positive findings regarding women's membership of WMCs, cases of women actually making key decisions around repairs, or undertaking repairs themselves was less evident. Eight of the 20 communities with WMC had 40% or more female members on their committee and one had a woman as the chairperson. Some groups recounted events where women undertook repairs and maintenance. More commonly, women noted that maintenance was the role of men.

Women often reported that while they were on the WMC, they did not feel they were making decisions. Women tended to have the role of treasurer, or to be involved in collecting the funds, and monitoring if the WMC rules regarding use of water were being followed.

With respect to decisions about financial contribution for repairs of water systems, generally the community leaders or the WMC (or both) make the decision about the amount each household should contribute. At the household level, some women reported having more influence. Looking after water for the home is seen as the responsibility of women (by women and men). This led to some women noting that women make the household-level decisions regarding expenditure on WaSH repairs, or that the decisions were shared by women and men.

“Within the house women are either involved in the decision or the women decide – this is because water is a need for them.” (Women's group, Yegusa)

As in many countries, strong beliefs around gendered roles relating to water and sanitation exist in PNG. It will be important when organizations aim to involve women in activities relating to WaSH—particularly for roles traditionally seen as belonging to males such as construction, maintenance, and decision making roles on the WMC—they include activities that trigger attitudinal change regarding cultural norms for the roles of women and men.

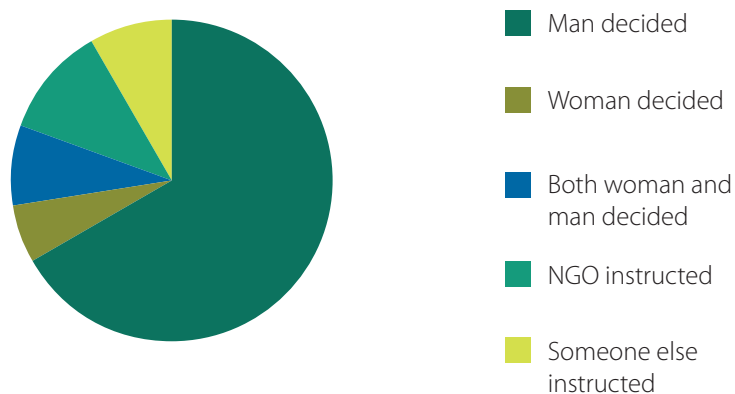
“The training about how water tanks should be constructed was only delivered to the women because the men were away. The women couldn't do anything with this knowledge because construction is a man's job.” (Women's group, Gevera)

“It's a man's job to look after the maintenance.” (Women's group, Seba)

“The men clean the tanks, women are not allowed to go inside the tanks.” (Women's group, Debado)

“The community didn't listen to me because I'm a female.” (Female treasurer, Ulingan)

Regarding sanitation, as noted above women felt that they see sanitation as a greater priority than men. This occasionally led to tensions between women and men within households because the construction of the toilet is generally considered a man's job (women assist with collecting materials such as konai grass). Despite this, the household survey revealed that men are much more likely to make decisions about whether to build a toilet than women (Figure 21), suggesting traditional gender roles continued to operate.

Figure 21. Household Decision Making Responsibilities for Toilet Construction—Who Decided

The consultations with women did provide one example of the potential for WaSH programs to work towards transformation of gender roles. In Saviya, one woman described how the training she had received as part of the sanitation and hygiene intervention had raised her profile within the community and given her the confidence to become a community leader. In contrast, and more typically, in another community (Johove) women were prevented from participating in training because it was a three-hour walk away which they were deemed unfit to undertake.

The study findings indicate that men are the major decision makers around sanitation but that women, generally, see sanitation as a greater priority than men. This highlights the importance of working with men around promotion of sanitation and also working with both women and men around decision making. This could, for example, involve linking the decision about building a toilet to household decisions around health and wellbeing and avoiding characterizing this an “infrastructure” decision. In the medium to long term, initiatives that support the greater equality of gender roles around decision making will support a shared discussion on whether to build a toilet, what type of toilet, its location and other aspects.

Social Inclusion

Marginalized Groups

Marginalization is often reflected through a family or a group of families not having a tapstand near where they live. However, there can be particular households being marginalized even if they live near a tapstand and there was evidence of this in the study. In most communities there were groups of houses, generally on the outskirts, who were not accessing water. These houses generally then collected water from unprotected wells or nearby creeks. In some cases it was reported that people would walk 20 to 40 minutes each way to get water from the closest tap. In some cases, the study

team was told that this was because these houses were situated in a remote location and that it was not viable for the gravity-fed system to provide service to them. Undoubtedly this was true in some cases but in others the water supply pipes ran past (or near) a group of houses without a tap-stand.

There was also evidence of marginalized people living within physical access to a water point but due to social issues not being able to use the water. For example, a woman who lived approximately fifty meters from a tapstand was often (but not always) prevented from using the tap, and thus would walk approximately one kilometers to collect water from a creek. Her house was in need of repair, and her assets minimal in comparison to others in the community. Thus it was likely that access to water may not have been the only aspect of marginalization she experienced. The reasons for her marginalization, however, were difficult to ascertain and highlighted that understanding social dynamics in any community requires skill, persistence and building trustful relationships. WaSH programs need to invest in understanding who is marginalized in any community and then work purposefully to help communities recognize and address issues of exclusion and promote equitable access.

While often not specifically considered a 'marginalized group', the study explored if there were particular issues relating to WaSH access for elderly people. The responses in all cases were that the family looked after elderly in the community, including helping them access water and with building their toilet. There may be a gendered dimension to this support. None of the elderly male respondents to the household survey (seven surveys) mentioned any assistance with building toilets and all said that they had decided to build their toilet for themselves. For elderly women respondents (13 surveys), seven responded that their family had helped them build their toilet. For the same elderly respondents, most said that it took less than half an hour for them to collect water (for the full return trip). One elderly woman, however, responded that it took her between 30 minutes and an hour to collect water and one elderly man that it took him over an hour to collect water.

While there are cultural mechanisms that support the elderly within PNG, it is still important that WaSH programs incorporate strategies to support the elderly. In particular, efforts are required to identify elderly people without families within the village who may require additional assistance for either water or sanitation/hygiene facilities.

Disability

Most communities identified that there were people with disabilities living in the community, with the consistent response being that family members would help them with accessing water and using a toilet. Given the limited time for field work in each community, it was difficult to locate people with disability in a sensitive way, which did not reinforce stigma or marginalization. As a consequence, only one person with a disability was interviewed directly and questions regarding access to WaSH were undertaken in community discussions.

The recently approved National WaSH Policy states that WaSH programs should actively involve people with disabilities and activities should take into account the specific requirements of people with disabilities. There was no evidence of any programs having provided this type of support for people with a disability. This suggests that disability inclusion is definitely an area that would benefit from greater emphasis within WaSH programming in PNG.

People Living with HIV-AIDS

In 2010, PNG had an estimated 32,000 people living with HIV-AIDS (PLWHA), out of an estimated population of 7 million.³⁴ This number is predicted to increase over the coming years. The study did not look specifically at issues for PLWHA, given the difficulty of addressing confidentiality and ethical issues within the timeframe available for engagement in each community. WaterAid and Anglicare PNG, however, have produced two reports on HIV-AIDS and WaSH.³⁵ Specific risks that should be addressed are:

- PLWHA and their families experience stigma relating to accessing water. In 18% of cases investigated, respondents were prevented from collecting water because of their HIV status, while another 18% reported that members of their family had been prevented from collecting water in the past.
- PLWHA have suppressed immune systems due to their illness and thus are more vulnerable to other illnesses including WaSH-related diseases, particularly diarrhea. For this reason, care around hygiene and sanitation is particularly important, as is access to improved water supply.
- Mothers who have HIV-AIDS, more often bottle feed to stop transmission of HIV to their child. These mothers need support to ensure they have clean water for the preparation of formula and to WaSH bottles and teats.

In designing WaSH programs, it is important that the needs of PLWHA are considered and that programs contribute to ending stigma.

³⁴ National AIDS Council Papua New Guinea. (2011) HIV at a glance. National AIDS Council Secretariat: Port Moresby. UNAIDS. (2012) Country Progress Report: Papua New Guinea. UNAIDS: Geneva.

³⁵ WaterAid & Anglicare (2012) Assessing the water, sanitation and hygiene needs of people living with HIV and AIDS in Papua New Guinea.

Monitoring Sustainability

The MIS component involved the following areas of investigation:

- Is there an institutional demand for sustainability data/information; if multiple institutions are involved, is this demand shared across multiple institutions?
- What data should be collected, including the key indicators for rural water supply schemes; what are the options for the collection of data?
- What are the technology options available in PNG to enhance the monitoring system?

The findings section, below, is structured around responses to these three questions. Considerations for piloting a rural WaSH MIS are set out in an additional section (Section 5.4).

The study drew on information from key informants in PNG with experience in MIS, ICT or rural WaSH, secondary sources documenting international experience in establishing WaSH MIS, and primary data collection from the field research.

Institutional Demand

Global learning has demonstrated that ownership by the key stakeholders of a Rural WaSH MIS is critical to maximize its sustainability.³⁶ Ownership is linked to agreement on resources, including funding committed to the implementation of the MIS at all levels—that is, those collecting the data, those undertaking analysis and those at a strategic level who are making decisions based on the MIS. Managing ownership is particularly important if these resources are provided across different agencies.

³⁶ Changing relationships: ICT to improve water governance (2013) – ICT Seminar, World Water Week, Stockholm. Also, Dickinson N and Bostoen K (2013) Using ICT For Monitoring Rural Water Services from Data to Action, IRC International Water and Sanitation Centre

The recently approved PNG National WaSH Policy clearly sets out the purpose of the WaSH MIS system and proposes the establishment of the National Water, Sanitation & Hygiene Authority (NWSHA). One of the principal roles of the NWSHA is 'maintaining the WaSH Monitoring Information System to help monitor and evaluate WaSH sector development and the achievement of National WaSH Policy objectives and targets.'³⁷

Strategy 3 of the National WaSH Policy outlines details of the MIS, including listing agencies that could provide data. These include Provincial, District and Local Level Government offices, Department of Health and Department of Education, NGOs, private sector organizations and other partners. It is envisaged that there will be an interim Program Management Unit (PMU) whilst the legislative framework for the NWSHA is established.³⁸ It will be essential that the PMU/NWSHA provide leadership to engage stakeholders of the MIS to:

- Ensure clear roles and responsibilities among stakeholders
- Build ownership across agencies
- Ensure information produced is available at the appropriate policy and service levels
- Develop and agree on budgets and resources required to implement the MIS

Developing and managing an MIS is resource intensive. It would be efficient to co-locate the WaSH MIS within an existing MIS or align aspects of the database (e.g. data collection) with another MIS. The study concluded that at present this would not be feasible in PNG. The Department of Implementation and Rural Development (DIRD) has started implementation of a District Information Management System (DIMS) that collects data on a range of development infrastructure including water and sanitation at the district town level. This, however, does not extend to the community level.³⁹ The Department of Health is in the process of developing some targeted MIS (e.g. disease surveillance and maternal health) but these are only being piloted and are centered on the health facility rather than at the community level. While at the time of writing there is no clear agency where the WaSH MIS could be co-located, this should be reviewed again before the WaSH MIS is developed.

The WaSH Policy allocated responsibility to the Department of National Planning and Monitoring (DNPM) for establishing the WaSH sector budgetary allocation and setting national targets for WaSH development (in consultation with the proposed NWSHA). DNPM is currently in the process of revising the PNG Medium Term Development Plan (MTDP) for 2015 – 2020 that now includes targets linked to government priorities, including a target for access to improved WASH. An MIS will then provide annual input to the MTDP report on progress towards targets and, through this, support the process for PNG investment decisions.

When developing the WaSH MIS, it will be crucial to have a strategy to ensure its sustainability. Two critical features are adequate resourcing, and a commitment to ensuring all aspects of the MIS are functioning, particularly the data collection, discussed below. The PNG Department of Health, Environmental Health Division noted that they had previously implemented a WaSH Monitoring

³⁷ Refer to Strategy 1 (7) of the PNG National WaSH Policy (2015) Government of Papua New Guinea

³⁸ Pers comm, Trevor Nott, WSP PNG Policy and Capacity Building Consultant.

³⁹ The data is managed in a database, using a written form based system for collecting and inputting data, pers comm, Diego Miranda, Adviser to DIRD. The exact indicators being collected were not available for the research team.

System until 1998. Once the donor funds for the MIS were no longer available the system lapsed.⁴⁰ The Department of Health currently implements a range of health information systems, some using an MIS-type system (described below). The experiences of these MIS should be drawn upon when designing a rural WaSH MIS.⁴¹

Options for an MIS in PNG

Three questions guided assessment of MIS options: what data should be collected; who should collect it; and how should collection take place? Responses to these questions are set out below.

Data to Collect

The MIS should draw upon existing data where possible but there is limited rural WaSH information currently being collected and no systematic processes. As noted above, DIRD has an MIS, but data on water supply is only collected for district towns. Some NGOs collect data on the water systems that they have implemented, but this is not systematically consolidated or shared. While DNPM collates data from other agencies it does not directly collect data. In summary, a new data collection system is required for a WaSH MIS.

Deciding on what data to collect largely depends on the purpose of the MIS. The PNG National WaSH Policy clearly states in Strategy 3 that the purpose of the National WaSH MIS is to:

- Identify and prioritize locations and communities in high need of WaSH interventions
- Measure progress towards the policy targets
- Coordinate maintenance, particularly in relation to rural schemes
- Provide information to assist the Department of Health in the monitoring of water quality in completed schemes
- Advocate for scheme funding and better coordinate existing funding
- Coordinate interventions between service providers
- Assist in joint training and capacity building initiatives
- Contribute to the Provincial Human Resource Plan.

The proposed MIS data, set out below, responds to these requirements of the National WaSH Policy. It also considers key factors of sustainability identified in the field research for the study and described in international literature. Important factors for water system sustainability (detailed in Section 3.1.2) cover WMC function, community ownership, tariffs, conflict, maintenance, women's engagement and the quality of the water system. For equity, both the distance to the water system and the involvement of women in decision making were identified as key indicators.

⁴⁰ Pers. comm. Environmental Health staff member, October 2014.

⁴¹ Rosewell et al. (2013). Mobile Phone-based Syndromic Surveillance System, Papua New Guinea, Emerging Infectious Diseases Vol. 19, No. 11, November 2013. Also UNICEF 2011, Information and Communication Technology (ICT) Assessment. Leveraging ICT Effectively to Strengthen HIV Prevention for Newborns and Monitoring of Maternal and Child Health in Asia-Pacific http://www.unicef.org/eapro/Unicef_Asia-Pacific_ICT_Assessment_Report_Final_19Jan2011.pdf

Suggested sustainability factors to be collected in the MIS are set out below (Table 19), along with considerations for data collection, data unit types and the level at which information should be collected.

Box 4: Water Quality Assessment

The study found that only four of the 20 community water supplies tested negative to the presence of fecal coliforms. Monitoring of water quality can be resource intensive and generally involves testing drinking water quality for a sample of households. Refer: <http://www.who.int/wsportal/wsp/en/>

Developing nations face significant challenges in measuring water quality against standards in rural communities and hence there has been a move to assess the integrity of the entire water system from source to consumer and identify and minimize hazards along the way. Refer http://www.who.int/water_sanitation_health/publication_9789241562638/en/

Table 19. Summary of Options for a National WaSH MIS

Sustainability factors	Sustainability indicators	Unit and level for data collection	Comments and data collection issues
Coverage	<ul style="list-style-type: none"> • # households in the community • % homes within 150m from an improved water point • sanitation coverage (disaggregated by latrine type) • School WaSH facilities • Health Facility WaSH facilities 	By Community and aggregated to Sub-district, District, Province, National	Provides info on progress towards national rural water supply targets, supports prioritization of locations for investment in rural water supply and provides a basis for calculating resource needs, for both investment and delivery of services. Could be collected annually (or bi-annually).
Functionality	<ul style="list-style-type: none"> • Functionality rating for improved water system(s) comprising: <ul style="list-style-type: none"> - Quantity per person per day (wet and dry seasons) - Quality (see below), - Access (see above) - Reliability: source reliable (months per year); system reliable (# of days without water in last 12 months) 	By public water system (not private water systems)	<p>Rating of functionality, e.g. fully, partially, low service level, no-service. Needs to accord with WaSH Policy.</p> <p>Differences may be necessary in data collection methods, and assessments for different types of water systems: e.g. gravity systems, rainwater or hand-pump facilities.</p>
Water quality (included in functionality measure)	<ul style="list-style-type: none"> • Water quality parameters • Date last tested • Tested by • Sanitary risks 	By public water system (not private water systems)	Testing should be against PNG water standards. Communities could also carry out their own check against the WHO sanitary risks (refer Box 4 below)

Table 19. Summary of Options for a National WaSH MIS (Continued)

Sustainability factors	Sustainability indicators	Unit and level for data collection	Comments and data collection issues
Sustainability & equity factors	<ul style="list-style-type: none"> Who manages the system (WMC, caretaker, etc?) WMC/caretaker level of function, activity. Participation level for women on WMC. Maintenance undertaken in last 12 months? Outstanding maintenance issues Extent and adequacy of funds collected? Access to external service providers and technical support % of households not accessing improved water (calculated) 	By public water system (not private water systems)	<p>Key indicators are drawn from the field research.</p> <p>Further indicators may be identified based on agreed strategies for sustainability.</p> <p>Each of these would require a clear definition of terminology and include a set of criteria and definition of that criteria for each level of assessment i.e. 'high' 'medium' 'none'.</p> <p>The method used to collect data, for example an SMS system, may require that indicators are further simplified.</p>
Service delivery providers	<ul style="list-style-type: none"> Service provider details, including where they work and expertise. 	By District (or sub-district); aggregated to Province	Register of service delivery providers. Could also link this to water investment included in district plans, progress to meeting district targets, etc.
Rural Water Capital investment	<ul style="list-style-type: none"> Water Asset Register details for assets by district/province 	By District (or sub-district); aggregated to Province	Documenting investment in water assets from Government funds, NGOs & Foundations, private sector and donors.

To gain ownership of the MIS, it is important that indicators are agreed with the key stakeholders. Sample indicators in the table above are based closely on results from the field study and relate mainly to community WaSH. Different stakeholders may request additional indicators such as WaSH coverage and functionality at health facilities and schools. When designing an MIS, there is often a desire amongst stakeholders to obtain as much information as possible. It is important, however, that collecting 'strategic data' is prioritized—that is, data that will help government identify locations in high need of WaSH interventions. The more data that an MIS aims to provide, the more complex all aspects of the MIS become, particularly the collection and transfer of data.⁴²

For each of the indicators a rubric needs to be developed with definitions for each measure. This also is best developed with key stakeholders and then field-tested to ensure a clear understanding of both the indicator and the measurement definitions.

⁴² For example using an SMS based system, the more indicators being reported on the greater risk the technology may struggle. The WaSH MIS in Timor-Leste (SIBS) collects eleven overall Indicators (each with a category selection) and works reasonably well by SMS.

Collecting data to report against these indicators will present a range of challenges and will require innovative thinking. Water quality, for example, which is included in the National WaSH Policy as a key MIS indicator, requires either access to testing equipment and can be costly. An alternative, recommended by WHO, is to undertake a Water Safety Assessment of the water system.⁴³ Results from that assessment could be monitored in lieu of water quality. Other indicators that may require innovative thinking include measuring water quantity and sufficiency of maintenance funds.

Baseline. In developing an MIS, a baseline of information is often collected during an initial round of data collection. For coverage, it would include community demographic data and access to services. Asset-based information would report on system functionality indicators and provide the basis of a Water Asset Register. This information only needs to be collected once. Basic sanitation data could also be collected during the baseline, indicating the number of households with a toilet and the presence of handwashing facilities.⁴⁴ The exact data to be collected should be agreed by key stakeholders but might include:

- Water system type, construction date and agency, and availability of design documentation
- Number of households served by water system(s)
- Main design features (e.g. for a gravity system, how many sources; condition of spring protection; months of no water; condition of pipes, tanks, etc.)
- Coverage of sanitation and handwashing facilities

Identifying codes for communities and water systems. A key aspect of any MIS is that there is a numeric identifier for each water system and for each village, along with geocodes that provide geographic location (at least to the ward level). It will be important to work with the Department for Provincial and Local Level Government Affairs to determine if there are already codes that can be used as an identifier for the village and then be adapted for use for water systems (e.g. as used by PNG National Statics Office for census data). During the design of the MIS, further investigation can be undertaken on appropriate coding and potential for linkages to other existing data sets.

Data Collection Responsibilities

Given the context in PNG—large country, limited transport infrastructure, remote communities and limited number of civil servants at local level—data collection will require innovative approaches. The National WaSH Policy sets out to establish a national system, thus data collection needs to be undertaken across all of PNG. It allocates responsibility to the proposed NWSHA for monitoring and evaluating WaSH sector development and establishing the MIS. It is not intended that the NWSHA will have a large staff at sub-national level. They would have to partner with another government agency, service providers or civil society to collect the data. This may not occur for some time, however, since at the time of writing the establishment of the NWSHA is proposed only and its establishment has not been confirmed.

⁴³ <http://www.who.int/wspportal/wsp/systassessment/en/>

⁴⁴ The study ToR specified that the MIS section should address water supply and hence that is the main focus here. It is expected that stakeholders would also agree on sanitation indicators at the same time and include sanitation and hygiene in an integrated WaSH MIS. Collecting detailed sanitation baseline information, including types of toilets and indication of use, would require significant investment.

Internationally, a particular government agency is generally responsible for the collection of MIS data. In most cases, this is via agency staff. In some cases, however, it involves others such as local service providers who provide information alongside government staff (Ghana); or enumerators who are recruited specifically to undertake data collection (Burkina Faso, Afghanistan).

Government Agencies Responsible for Rural Water Supply Services

Responsibility for a Rural WaSH MIS data collection system is closely linked to responsibility for rural water services. Given that the institutional framework for the delivery of rural water services is in a period of change, it is not possible within this study to make specific recommendations as to which organizations/department would be involved in the collection of data. Views concerning this matter, however, were shared by stakeholders during both the field research and the Consultation Workshop.

PNG's Local Level Government may be able to play a data collection role. Much of the data required is from the community level that provides a challenge, given large number of communities in PNG. PNG's 89 Districts cover approximately 287 rural Local Level Governments (LLGs). The LLG board consists of a Ward Councillor from each Ward with a system of 'bottom up' planning supported by the Ward Development Committee. Wards contribute to the LLG Plans, which in turn feed into District Plans.⁴⁵ The field study found that communities largely believed that local government was unable to assist them in either building their system, or in making major repairs or improvements to the water system.

For data collection, the key challenge will be LLG capacity and resources to engage with community focal points (WMC representatives, caretakers, community leaders) to collect data and then to transmit/send that data. There are no available data on the exact number of communities in PNG. There are approximately 6,000 rural Wards and within each Ward there are a number of communities.⁴⁶ A possibility is that at the Ward level, procedures could be established where the Ward Councillor (possibly through the Ward Development Committee) collects the data relating to the identified indicators for each water systems in different communities in that Ward. At the Consultation Workshop, participants suggested that the Ward Development Committee have a specific role in supporting water system management. A World Bank study looking at infrastructure development raises a challenge to this approach in that only 41% of respondents reported a functioning Ward Development Committee in their ward.⁴⁷

The Department of Health also plays a key role in the promotion around safe water use. Some communities mentioned the Environmental Health Officers and their role in supporting the Healthy Islands Approach, often with NGOs. The Environmental Health Officer, however, is based at the district level, which would make collecting data from the communities difficult. An alternative is for either the proposed NWSHA or another key agency in the WaSH sector to recruit a team of enumerators to

⁴⁵ Organic Law on Provincial and Local – Level Governments (1995) Section 106, Government of PNG – http://WaSH.spsnpng.com/resources/Ward_Planning_Brochure_English.pdf - accessed March 2015.

⁴⁶ The local government system in Papua New Guinea – A country profile (2013) http://WaSH.clgfpacific.org/userfiles/3/file/Papua_New%20Guinea_Local_Government_Profile_2013_CLGF.pdf - accessed Jan 15

⁴⁷ Zahid Hasnain et al (2011) How capital projects are allocated in Papua New Guinean villages: the influence of local collective action, local-level institutions, and electoral politics. The World Bank.

collect information district-by-district. This would present a number of disadvantages. In particular, the enumerators not having a relationship with the community may impact on the quality of data. It would be expensive and thus might impact on the MIS sustainability.

Community Members, Non-Government Agencies and Institutions

There is potential for community members, non-government agencies and churches to play a role in data collection. The ICT section below discusses technology options whereby community focal points (WMC Member, caretaker, community leader) could respond to a series of questions to provide data via mobile phones. This would likely require significant capacity building support (as would also be the case for a paper-based system). Alternatively, a community focal point could deliver information to a government agency, for example the LLG and Ward Councillors. This strategy could transition to community focal points providing the data directly, particularly if over time there is greater phone ownership, coverage and confidence with SMS. It is worth noting that community focal points are generally male and yet it is often women who know the most about how the community water system is actually working. It will be important to develop strategies whereby women could also act as focal points.

NGOs have and are likely to continue to play a key role in the WaSH sector and could support MIS data collection where they are present. While having sound knowledge of rural water and existing community contacts, NGOs do not generally work across a whole province, tending to focus on either districts or LLGs. There are also some districts where there are no NGOs working in WaSH and some NGOs also phase in and out of communities. Consequently, while there is a possibility of contracting NGO staff to undertake (or to support) data collection, they may not provide a sustainable option in the long term. There could be a useful role for NGOs, however, to provide initial support in piloting the MIS, particularly data collection methods. Additionally, in those districts where there is an NGO present (and willing) they could work alongside local government and community partnerships to support MIS data collection.

In the Consultation Workshop, a number of participants noted that churches play a key role in supporting services at the village level and a recommendation was made for greater engagement of the church. It is possible that a church representative could support the community focal point(s) or WMC to collect and submit the data for the MIS.

Agencies working in rural WaSH should submit data to the MIS about their own work. The Water Asset Register will be an integral part of the MIS and a system could be established whereby all agencies that build water systems—including NGOs, church-based groups, private foundations, and other government departments—register those water systems on completion of construction. This system could be internet-based and include a provision to upload system design information. The study found that implementing agencies could not readily access water system design information, which is a sustainability issue itself.

It is important to understand what will motivate MIS data collectors to collect timely and accurate information and what barriers (or enablers) they face. Lack of motivation by government staff, or by community members, could impact significantly on the MIS. Analyzing the motivators and demotivators, barriers and enablers of the various individuals and agencies in the pathway from data collection to the database is essential for sustainability. Analysis should cover both organizational and individual levels. Where those organizations that collect data have an interest in or a use for the data and/or benefit from the data being available, this generally provides a level of organizational motivation. Individual motivation is often a more challenging issue. For those in formal employment, where the task is a responsibility relating their employment, poor motivation can be addressed through performance management. Where data collectors are volunteers, such as community members or community leaders, there needs to be other motivation for collecting data. Linking data submission to improved water system support and functionality is one example. Barriers such as a lack of transport to undertake the community visits often contribute to poor motivation.⁴⁸

Data Collection Processes

Given the range of MIS data to be collected, it is recommended to phase in data collection and development of the database. The phasing would need to be agreed with the key stakeholders. A policy decision would be required as to whether it is best to focus on coverage (i.e. visit every community) or functionality (which would target those communities with a water system). It may be possible to do an approximate estimate of coverage by working with the LLGs and ward councillors to identify all the communities in an LLG, and then which ones have a public/communal water system, any private systems, and the communities that do not have access to improved water. These data on coverage would be used by the proposed WaSH Programme Management Unit/NWSHA for planning purposes. In the piloting phase this would only be undertaken in the pilot districts (or pilot LLGs) and it could then be determined, whether it is feasible to obtain this information at the LLG.

There are advantages of the MIS initially focusing on functionality and sustainability indicators and thus only collecting data from communities where there is (or has been) an improved water system. Firstly, it would minimize the creation of expectations, particularly for those communities that do not have a water system, and secondly it will reduce the village-based data collection exercise. The experience of paper-based National MIS systems (for any sector) is that they are cumbersome and resource-intensive to manage. An ICT-based MIS system offers the possibility of greater efficiency and could be implemented as part of ongoing service delivery. It is also important to note if it is to be useful, an ICT-based MIS requires robust data collection processes, adequate resources, and investment in data analysis and reporting.

The options for an ICT-based MIS are discussed in detail below. It is also recommended that the MIS be piloted (Section 5.4).

⁴⁸ Willetts, J. (2012) A service delivery approach for rural water supply in Timor-Leste: Institutional options and strategy. Prepared by Institute for Sustainable Futures, University of Technology Sydney for BESIK (Timor-Leste Rural Water Supply and Sanitation Program), March 2012

ICT Technology Options

The use of ICT tools for MIS initiatives generally requires access to the internet or mobile phone network. In PNG there has been a significant increase in the use of mobile phone ICT for development initiatives, including in the health, education and justice sectors. While these programs are in the early stages, learning has been documented and indicates that there are significant opportunities from a technical perspective in developing SMS-based monitoring systems.⁴⁹ Coverage levels, existing uses of ICT and issues for consideration when designing an ICT-based MIS are set out in the following sections.

ICT Coverage

Internet connectivity remains low in PNG with just 7% of the population having access to the internet in 2014.⁵⁰ A media study in late 2014 found that there is increasing use of the internet, but that over 70% of internet users are from urban areas, over 80% have a secondary education, over 60% are male, and 56% are aged between 18-24 years.⁵¹ These results are consistent with the field research experience for the study, where there was no internet connectivity in the 21 communities visited and thus little evidence of phones being used for purposes other than communication by voice or SMS. There are plans for one telecommunications carrier, Digicel, to improve 3G network coverage that will increase internet access across the country in coming years.

Mobile phone coverage, however, has expanded significantly in PNG with a reported geographical coverage of 75% in 2012.⁵² Both major mobile service providers have plans to further expand their networks. Digicel, for example, reported that it will extend the number of towers from 800 to 1160 to achieve 100% coverage by the end of 2014.⁵³ The field team were able to access mobile phone coverage (using two phones—one Digicel and one B-Mobile) in 20 of the 21 villages visited. Network coverage, however, was often not available throughout the whole village but only in one specific location (for example, on a hill).

As with geographical coverage, **mobile phone ownership** is quite high, with approximately 2.9 million phone users. Given a population of 4.3 million people aged 15 or over, this equates to an estimated phone ownership rate of 67%.⁵⁴ A recent study found that even though mobile phone

⁴⁹ Watson A, H. A. (2014), Utilising Mobile Phones for Development in PNG: Lessons Learnt, PNG Economic and Public Sector Program, Port Moresby, Papua New Guinea.

⁵⁰ Papua New Guinea - Telecoms, Mobile and Broadband - Market Insights and Statistics – Executive Summary (July 2014) <http://www.budde.com.au/Research/Papua-New-Guinea-Telecoms-Mobile-and-Broadband-Market-Insights-and-Statistics.html#sthash.1KszfGym.dpuf> - Accessed Feb 2015.

⁵¹ Citizen Access to Information in Papua New Guinea (2014) M&C Saatchi World Services

⁵² Pers. comm. Lucy Au, 2012

⁵³ Business Advantage PNG – interview with Gary Seddon, Digicel - <http://www.businessadvantagepng.com/digicel-plans-expansion-mobile-network-creating-television-network/> - accessed February 2015.

⁵⁴ http://www.researchandmarkets.com/reports/2130998/4q11_papua_new_guinea_mobile_operator_forecast.pdf - accessed Jan 2015. Population figures are approximate based on preliminary 2011 Census data and WHO demographic data.

ownership had increased significantly across the country, ownership by women in PNG remained low.⁵⁵ Only 4% of women in rural areas were thought to own both a phone and a SIM card and many women (39%) relied on access to someone else's phone. The study noted that women accepted use of 'missed calls' to signal for someone to call back and that majority of women subscribers were comfortable making (65%) and receiving calls (64%), with slightly lower comfort sending and receiving texts (49% and 48% respectively). Additionally, the study found low levels of confidence for other phone features for example using the clock of calculator function (16%), pay for electricity (14%) internet (4%). The main barrier to phone ownership reported by women (non-subscribers) was cost. Digicel report that the cost of phones and charges (calls and SMS) have and will continue to decline.⁵⁶ Also of note, a Saatchi study on access to the media found that male members of a household have more control over their phone than women. Of phone owners—more commonly men than women, as described above—92% of males said they controlled their phone, while only 78% of females said they controlled theirs.⁵⁷

Experiences during the field research matched findings from the literature presented above. While the study did not make an extensive assessment of mobile phone ownership and use, indications were that the most common phone is one with a screen, but which is not a smart phone. In most of the communities visited, it appeared that the phone was generally 'held' by males, and particularly those who had some work outside of the community.

A summary of behavioral aspects of mobile phone use in PNG is set out in Box 5. A notable challenge is keeping phones charged, particularly away from urban centers (the national electrification rate in 2014 was 18%).⁵⁸

In summary, mobile phone coverage and usage has expanded rapidly, but internet at the time of reporting had a far lower coverage and penetration. Given the current low rates of internet access, the following sections consider a GSM (Global System for Mobile) platform for data collection (including SMS). The interface of a mobile phone data collection with an internet-based system for shared analysis and reporting is assumed, and is not discussed in detail within this report.

⁵⁵ GSMA Connected Women (2014) Connected Women Striving and Surviving in Papua New Guinea: Exploring the Lives of Women at the Base of the Pyramid - <http://www.gsma.com/connectedwomen/striving-and-surviving-in-papua-new-guinea-exploring-the-lives-of-women-at-the-base-of-the-pyramid/> - Accessed March 2015

⁵⁶ Business Advantage PNG – interview with Gary Seddon, Digicel - <http://www.businessadvantagepng.com/digicel-plans-expansion-mobile-network-creating-television-network/> - accessed February 2015. Personal Communications, Amanda Watson, October 2014.

⁵⁷ Citizen Access to Information in Papua New Guinea (2014) M&C Saatchi World Services

⁵⁸ South Pacific Commission (SPC) - <http://www.spc.int/edd/en/document-download/viewdownload/11-reports/1480-png-si-vanuatu-energy-consolidatedreport> and <http://www.ee-pacific.net/index.php/database/country-information/papua-new-guinea> - accessed February 2015

Box 5: Learning from the 'Utilizing Mobile Phones for Development in PNG study'

1. People do own or have access to mobile phones.
2. Voice calls and text messaging (SMS) work well in the PNG context.
3. Recharging of mobile phone handset batteries remains a challenge.
4. People change their phone numbers regularly.
5. Remote training can be facilitated using phones.
6. Remote research can be facilitated using phones.
7. Stakeholder engagement is crucial.
8. Stakeholder consultation is essential.
9. Text messages need to be written so as to be clear and concise.
10. Prank calls can be received by free-call numbers.
11. Coaching can be helpful for people answering phone calls.
12. Where they are available, networked computer databases offer a user-friendly system for entering data.

Source: Watson A, H. (2014), *Utilising Mobile Phones for Development in PNG: Lessons Learnt*, PNG Economic and Public Sector Program, Port Moresby, Papua New Guinea.

Existing ICT Use in PNG

There are several examples of mobile phones being used in development activities in PNG, with some positive outcomes and learning for a WaSH MIS.⁵⁹ These initiatives involved Government Agency staff and include:

A childbirth emergency phone service: used a toll-free number to call health workers, which increased two-way communication. Relevant to WaSH maintenance advice or the reporting major breakdowns.

Village courts data collection: involved an SMS-based questionnaire with 16 questions to replace a paper-based process. An assessment of the Program in late 2013 found that *"Clerks generally found the process of responding to questions through text messaging to be easy, quick and enjoyable. The pilot project has generated much useful data that had previously been difficult to collect"*.

SMS story: key information for daily lesson plans is sent by SMS to teachers. This initiative illustrates an option for supporting rural staff through SMS, such as could be applied with water system caretakers.

⁵⁹ Examples provided are drawn from Watson A. H. A. (2014), *Utilising Mobile Phones for Development in PNG: Lessons Learnt*, PNG Economic and Public Sector Program, Port Moresby, Papua New Guinea.

Mobile phone-based syndromic surveillance system (Department of Health): piloted replacement of the existing paper-based system, with the findings that it was *'more timely (2.4 vs. 84 days), complete (70% vs. 40%), and sensitive (95% vs. 26%) than existing systems'*.⁶⁰ The assessment found that the technology was simple to use, but that sub-national ownership was weak. The system is now being scaled up, to be established in at least one site per province.⁶¹

Mobile phone-based system for surveillance of malaria cases in sentinel sites: to be implemented as a pilot by the Institute for Medical Research (IMR), Eastern Highlands and due to commence in April 2015.⁶²

A range of technology options are available in PNG for using mobile phones in data collection, including:

- **Simple or smart phones.** Some of the mobile phone/SMS-based programs require the use of a smart phone, often an android phone, others can work on simple phone with a screen (which from the field work appear to be the most common phones in rural PNG).
- **Form-based systems** (e.g. Rapid SMS, Frontline SMS). While robust and have been on the market for some time, these options require pre-programming of the phone being used. The forms in these programs can include a number of questions sent as one SMS.
- **Simple SMS-based survey form** (single answer or multiple choice). This approach can use any mobile phone with a screen, often one question at time, with a stop point if a question is not answered (e.g. SMS Track, Mobimedia, Qualtrics). The approach requires many messages to complete a survey—10 questions, for example would require 10 SMS sent out and returned (totalling 20 messages). This technology has been successfully used for health surveys and is currently being used in PNG for the Village Courts Data Collection Program (using Mobimedia) described above. It requires that the phone number of the data collector be known and the phone have a screen but no programming is required.
- **Develop a specific mobile application for PNG.** The SIASAR MIS used in Central America (Panama, Honduras and Nicaragua) is based on a purpose-built application which is then pre-programmed on Android-enabled devices.⁶³ SIASAR can also be paper-based. Data are stored on the devices memory, without an internet connection, for downloading later when the data are processed and aggregated to generate broader regional numbers and statistics. (LPPW).
- **Unstructured Supplementary Service Data (USSD).** This is a message based system where a user sends a message to an application (using a pre-determined number such as #107) – this establishes a real-time connection between the user and an application, enabling a two-way communication of information across a GSM network. This is commonly used to determine phone user account details (for example, account balances) but can also be developed for other applications. While it may not have a specific use for an MIS at the early stage, in the future it could be a useful application for reporting major breakdowns to rural water systems. This system can often use a reverse charges approach, which makes it particularly useful for a community-level reporting.

⁶⁰ Rosewell et al. (2013) Mobile Phone-based Syndromic Surveillance System, Papua New Guinea. Emerging Infectious Diseases, WaSH. cdc.gov/eid, Vol. 19, No. 11, November 2013.

⁶¹ http://www.wpro.who.int/papuanewguinea/areas/emerging_diseases_surveillance/en/ - accessed March 2015.

⁶² <http://www.swisstph.ch/en/resources/projects/project-details.html> - accessed March 2015.

⁶³ Sistema de Información de Agua Y Saneamiento Rural. Refer www.siasar.org

- **Combinations of technologies.** Different approaches above can be combined. For example, if a data collector has a phone that is pre-programmed, they could also receive a “push” message reminding them to collect the data and a reminder SMS if there are delays in submitting it.

Covering the cost of these services could be approached in a number of ways. The simplest options are users pay and reverse charging for messages (depending on the service provider). Similarly, if the phone numbers are known ahead of time (with agency owned phones, for example), phone recharge can be automatically provided to the phone (SIM). SMS costs are declining and in 2015 stood at PGK0.25 (approx. US\$0.10) per message. The largest costs, however, are generally in software development and ongoing capacity development for operating the system.

It is important to note that the information above is not exhaustive and that ICT technology is constantly evolving to meet user needs. For this reason, the range of potential technology options should be reassessed at the time the MIS is developed.

Issues for Consideration

The following technological, contextual and behavioral factors in PNG should be considered as part of the ICT assessment for the MIS:

- Using mobile phone-based survey forms, even very simple forms, will require a level of confidence in using SMS and a reasonably high level of literacy. Initial training (and most likely ongoing refresher and training) will be required. The need for training and support should not be underestimated but would also be required for a paper-based MIS.
- There is evidence that women are less likely to own a phone and a SIM (less than 4% in rural PNG in 2012). Without an effort to increase female phone ownership and use, it is likely that with an SMS-based system data collection will be primarily undertaken by men, particularly if community members are required to use their own phones.
- Watson reported that changing of phone numbers (changing SIM cards) is common in PNG. This would present challenges if the preferred option is to send a survey form to known numbers.
- Considering the section above on who should collect data, it would be a much less intensive process to introduce a mobile-based system within an organizational context (e.g. government agency, NGO) compared to one with community focal points. From experience in other countries and given the very large number of rural communities in PNG, it would be very difficult to collect data via community focal points.

In establishing an ICT-based MIS, it would be worthwhile establishing a partnership with a mobile phone service provider. Digicel has the largest coverage in PNG and also has a charitable foundation (Digicel Foundation) that funds rural water systems. These are compelling reasons to partner with Digicel. The purpose of the partnership would be to draw on the full range of options available, including reverse charge SMS, and extensive technical expertise.

It was beyond the scope of this study to estimate the costs of an ICT-based MIS. This will need to be determined as part of the MIS design. An estimate of costs, however, would include the development of the MIS system, stakeholder engagement, software development (depending on the options

followed), training, hardware including phones, regular data collection costs, data analysis and information sharing, and ICT assistance in running the MIS.

The information from an MIS is only as reliable as the data that are collected. Thus the MIS needs a system for ensuring the data are robust and strong performance management to make sure data are collected. Most ICT-based systems will provide a summary of the dates data are collected, and it is reasonably easy to determine if data for particular areas have not been collected in a timely manner.

The analysis of data collected and feeding back information from the data to key stakeholders is essential for both the immediate functionality and the longer-term sustainability of any MIS, not just an ICT-based MIS. The reporting of information from the MIS needs to be of value to the key stakeholders—for example for work-planning, more strategic decision making, reporting, allocation and justification of resources. It is likely that capacity development support will be required for the users of the information on the understanding the information produced and the various ways that it can be used. Demand for the MIS information by key stakeholders contributes significantly to the MIS being sustained, particularly if the demand is from senior officials who are making decision, and equally the information is provided to those collecting the data.

Figure 22. Future WaSH MIS Data Collectors Learning How to Test pH



ICT for Service Delivery Improvements

ICT can work in two ways to strengthen the sustainability of rural WaSH systems. Firstly, it can provide the platform for data collection and input to an MIS, providing timely and reliable data for planning and reporting. Secondly, ICT can drive improved service delivery and response by improving communication between communities and service providers, for example when complex repairs to a water system are required. The study primarily considered the first application—that is, providing the foundation for MIS data collection, as described above. Opportunities for improving service delivery are outlined briefly below.

In other countries, SMS technology is contributing towards asset management. For example, in Ghana, once a service provider system is established, a community focal point (such as a member of the WMC or the caretaker) can SMS when a water system/water point is not functioning, usually with a specific identifying reference number for the specific water point. This SMS may go via a central database to the relevant service provider, and to the District Water Utility. Once the service provider has repaired the system, they then SMS with the water point reference number to report it as repaired. This is then updated on the database with the District Water Authority.⁶⁴ In this way SMS technology has the potential to update data on breakdowns and repairs in an Asset Management component of an MIS.

A range of policies, procedures and investments would need to be put in place before a system such as this could be commenced. The central policy issue is deciding who is responsible for maintaining which aspects of a water system. If it is decided that the government can support some forms of repairs (e.g. large and more complex repairs), then budgets and systems for providing repairs need to be put in place. If governments cannot support repairs, and it is left to communities themselves to pay local service providers to undertake this work, then a different ICT system may be required. As the implementation of the National WaSH Policy commences, it will be important to review maintenance responsibilities and consider what role an ICT-based can play in increasing communication between community representatives and service providers.

Establishing Pilots

It is strongly recommended that the MIS be piloted, particularly the methods of data collection and data transmission. The purpose of the pilot would be to determine whether the approach will work in the context of PNG, the level of support required to implement the system, whether it can be scaled to national level and at the cost. Pilots must be part of a well-documented MIS strategy. Given the substantive risk associated with this type of work, a phased approach should be applied that includes stop/go points with clearly defined criteria to be satisfied before progressing to the next level of investment. The pilots would be one of those stop/go points for the overall MIS strategy.

⁶⁴ Refer to a pilot in Ghana - <http://wedc.lboro.ac.uk/resources/conference/37/Kumasi-1965.pdf>

A pilot can be either two (or more) approaches tested against each other, or it could be one approach that is assessed to determine whether it is worth proceeding at scale. Prior to piloting, a number of decisions need to be made, including the best options for data collection. If there is more than one good option, then multiple options should be piloted. Decisions also need to be made on what data will be collected, which is closely linked to who is collecting the data. The decision around the technology to use is also influenced by who is collecting the data. Adequate investment is required, including for a pilot evaluation. The monitoring and evaluation framework to accompany the pilot should be developed in unison with the development of the pilot.

It is recommended that piloting be carried out at the district or the sub-district/LLG level. To pilot at provincial level would be a large venture at the pilot phase. One option for piloting could focus on the LLG collecting the data, possibly with the Ward Councillor/WMC. The pilot could also include community data collection by mobile phone, particularly to understand the extent of support that community focal points would require. This could be undertaken in a selected number of LLGs (where all communities in that LLG would be included). The pilot would need to build in motivation for the data collection and allocate adequate resources for training.

Recommendations

The conclusions and recommendations set out below are based primarily on the data collected during the field work and subsequent analysis. Preliminary findings, however, were presented to a group of senior government and sector stakeholders at a Consultation Workshop in February 2015.⁶⁵ Some of the recommendations—particularly for national level actions—arise from the advice of those stakeholders.

National Government

- 1. Oversee improved quality of WaSH program delivery.** The new WaSH Policy aims to develop an improved institutional framework for more effective service delivery. A Programme Management Unit in Port Moresby will oversee implementation of the Policy for the immediate future whilst a new National Water, Sanitation and Hygiene Authority is being established. The WaSH policy will be implemented through the newly established DDAs in each District. This structure will need to ensure effective coordination as well as ensuring the government sets clear standards and supports sector capacity building. The National WaSH Policy supports the establishment of WaSH implementation guidelines.⁶⁶ To improve sustainability, these guidelines must cover both the social and technical aspects of water services—not just focus on infrastructure. They should guide appropriate technology choices, particularly concerning the use of rainwater tanks that provided very low levels of service in the study communities. Promoting Water Safety Planning could address concerns regarding water quality, noting that fecal contamination was indicated in 80% of water supplies tested. National government should also oversee capacity building in the Rural WaSH sector. The Consultation Workshop participants identified limited technical and management skills as significant constraint. Development of a capacity building strategy can draw on partnerships that exist within the sector, for example with NGOs and positive experience

⁶⁵ Results of that workshop were documented in a separate report; FH Designs, (2015) Papua New Guinea Rural WaSH Sustainability Study—Consultation Workshop Report.

⁶⁶ Refer Strategy 5 of the National Water Sanitation and Hygiene Policy – 2015-2030. Government of PNG (2015) p 23.

from water Utilities (Eda Ranu and PNG Water), and should reflect findings from recent studies including the Service Delivery Assessment (2013), the PNG WaSH Capacity Assessment (2012) and this study.⁶⁷

- 2. Generate political commitment for the expansion from what has largely been a focus on infrastructure to a service delivery approach.** Political commitment needs to be built at all levels of government and across various sectors. The expansion from continuing investment in infrastructure to supporting the provision of an on-going service—particularly when that service is in remote areas—is an institutional challenge. This requires leadership across a range of agencies at multiple levels. Gaining a commitment to agreed targets is one of the key steps to building the overall commitment. Recommendations around the budgetary implications are noted below. A service delivery approach that combines community management with government support should also draw on evidence of innovations that promote sustainability, for example the important role of women in managing water systems.
- 3. Build the budgetary justification and an understanding of life-cycle costs for water assets.** The study findings clearly identified maintenance as a key determinant of sustainability. Experience has shown that resource constraints are one of the key barriers to maintenance, reflecting limitations in communities' resources to undertake repairs (skills, spare parts, financing) and those of the state to assist with major repairs, rehabilitation or system upgrades. A budgetary justification could present costs over a longer period (e.g. to 2030) to demonstrate what is required to reach and maintain rural WaSH targets. This would compare the case of capital investments only (with no maintenance and services and thus greater asset replacement) to the case of regular investment in both capital and maintenance services, including complex repairs. This would address concerns raised by communities in the study that they are generally unable to get support from sub-national government for major repairs and rehabilitation.
- 4. Build ownership of the new WaSH Policy.** The proposed National Water, Sanitation and Hygiene Authority will need to take leadership in engaging key stakeholders to promote understanding and commitment to the WaSH Policy. This will promote alignment of all stakeholders to principles, strategies and targets and will be essential for the implementation and sustainability of any sector wide MIS. There is a clear requirement for a WaSH MIS system in the PNG National WaSH Policy. In developing the MIS, the proposed National Water, Sanitation and Hygiene Authority will need to take leadership in engaging key stakeholders to feel ownership, both of the data collection and the results. Reaching agreement on the WaSH targets and measures will be central to ownership. While the National Water, Sanitation and Hygiene Authority will bear responsibility for establishing disaggregated sustainability targets, this must be done in a collaborative way. Evidence from this study should be used to build support amongst stakeholders for collecting sustainability data.

⁶⁷ Mapping Human Resource Capacity Gaps in the Water Supply and Sanitation Sector. Country Briefing Note: Papua New Guinea International Water Centre (2012) - <http://www.iwa-network.org/downloads/1422744531-Briefing-Note-PNG-final.pdf>

5. **Develop a strategy and resource plan to underpin sustainability of the MIS.** There are no suitable existing MIS systems in PNG that could incorporate the WaSH MIS. Creating the MIS will require a clear strategy and adequate funds within the overall National Water, Sanitation and Hygiene Authority budget, both for development and operation. Funding allocations may also be required in other ministerial or sub-national agency budgets, particularly if they are involved in collecting data. Generating data for the MIS will amplify the demands of rural communities for government support. As part of the MIS development, it will be crucial to secure stakeholders' commitment to mobilize funds to address the issues raised through analysis of the data. This would include, for example, means to support improved operation and maintenance of rural water systems. If data collection does not lead to some change, those involved in the collection process will soon lose interest in providing information.

Sub-National Government

6. **Clarify responsibility within government agencies for strengthening service delivery, particularly the sub-national level.** While the role of the National Water, Sanitation and Hygiene Authority is documented in the National policy, the roles for sub-national stakeholders require clarification. The Consultation Workshop participants suggested that local government fund/employ a WaSH facilitator to provide an interface between the community (e.g. the WMCs, caretakers) and local government. Clear policies on who is responsible for different forms of maintenance also need to be established. Workshop participants noted that Provincial and District WaSH Forums previously existed in some provinces and districts and that these should be re-established, or established, to strengthen coordination and information sharing (such as disseminating the findings of this and other studies).
7. **Create links between community management of water supply systems and support from the Ward Development Councils, and through them to the Local Level Government (LLG).** Many of the participants at the Consultation Workshop believed that procedures should be developed whereby the work of Water Management Committees could be formally incorporated into the Ward Development Councils, resulting in strengthened engagement with the LLG.
8. **Create a clear role for LLG in the WaSH MIS.** Given the reach of the LLGs and the links through Ward Councillors, the District and Local Government, there is some advantage in an MIS data collection system that is implemented at the LLG level. This recommendation is preliminary only and needs further discussion and agreement among the key stakeholders. Mechanisms should also be explored for appropriate engagement of WaSH sector NGOs and other stakeholders in operation of the MIS (noting, however, that they are generally narrowly focused rather than being focused on a whole district or LLG).

Sustainable Service Delivery

- 9. Build community ownership and management commitment.** The study showed that successful management of the rural water system can be in various models – the ‘caretaker model’ may be as effective as the ‘water management committee’ (WMC) model (or similar community management groups). One model is unlikely to be appropriate for all communities thus it is important to build flexibility into the approach adopted. Engagement with local churches and an understanding of traditional leadership structures is an important part of building community ownership and management. A comprehensive community engagement process should be used, which explains what is involved in managing a water system, which allows communities themselves to decide the best form of management for their own circumstances. This process must not be skipped over for RWH systems. Even though these systems are technically simple, the study showed that efforts are nonetheless required to build user ownership and self-reliance for ongoing maintenance. This should be linked to the development and on-going implementation of the community-based ‘Water Sustainability Plan’, recommended in the PNG National WaSH Policy. The community engagement process should also build capacity of the community (or WMC) to plan out how they mitigate and resolve conflict.
- 10. Identify clear criteria on aspects of repairs and replacements to a water system that are the responsibility of the community and equip them for these tasks.** The study found that while basic repairs could be undertaken by communities, more complex repairs are often not within their capacity. This requires a policy decision on the types of repairs that communities are responsible for and building links, through sub-national government, with other agencies who can provide technical assistance and support. Study informants noted that poor access to simple parts are often a barrier to undertaking good quality repairs, or any repair. Implementing agencies need to facilitate links between communities and local traders so that parts required for community-level maintenance (for example, taps and washers) are available to communities. The study findings suggest that seed stocking communities with spares at the end of a project is a poor alternative to strengthening local markets and is not effective in the longer term.
- 11. Provide post-construction training and mentoring** through designated TA, either from government or non-government actors that specifically builds the management capacity of community members and management units (the Water Management Committee and/or caretakers). Sustainability requires a period of support after construction in which those responsible for operation and maintenance are mentored and further trained. The study findings support the concept of a Water Systems Warranty being trialled, which would provide support to a community for a defined period following construction of a water supply system. This might involve the implementing agency (NGO, contractor, etc.) being funded to continue to work with the community for a set period of time after construction; or holding back final payment for works until sustained operation of the system has been demonstrated.

- 12. Increase professionalization of community management.** The study found that in about a third of the communities, nominated caretaker(s) were keeping the water system functioning even though the WMC was not very active. These caretakers could be encouraged to continue their support by finding ways to formalize or ‘professionalize’ their roles, particularly linking service to payment. In three study communities this involved providing a small payment to caretakers when they undertook repairs, which the caretakers saw as a motivating factor. Promoting professionalization would also involve non-financial incentives, such as strengthening accountability to the water users, official recognition by government, and appropriate access to training and skills development, and involvement in regular data collection. Study participants also noted that positive community leadership was an enabler for successful community management. Professionalizing community management should recognize and cooperate with existing traditional and other community leaders, including Ward Councillors.
- 13. Encourage communities to develop approaches to financial sustainability for water supplies that are appropriate to their own situation.** The study found that while all communities had initially started to collect a regular payments, they had all moved to collecting funds only as they were needed for repairs. Trust was given as the primary reason for this, although providing regular amounts of money without seeing an immediate result was also raised as a concern. Traditionally, households and communities raise funds for a particular event or need, drawing on broader family (wantok) linkages. The study findings suggest that this approach to raising funds for water supply maintenance is more likely to be sustained than systems of regular contribution.
- 14. Focus on demand creation for sanitation and hygiene.** There is a need for more effective triggering to create demand for toilets, particularly improved toilets, and for improved handwashing behaviors. In some areas of PNG, approaches such as CLTS, PHAST and the Healthy Island Approach have all been used to good effect but it is clear that regular follow-up with communities is essential to promote longer term behavior change. While the study did not find a correlation between subsidy approaches and sustainability, broader sectoral experience suggests that full material subsidies are expensive and will not necessarily lead to long-term sustainability. Subsidies cannot substitute for household demand. If households value having a toilet, they will make some personal investment in sanitation and in turn be more likely to repair or replace their toilets. More demand also needs to be created for improved hygiene. The study found that handwashing facilities were not a priority in any community—just 1% of sampled households had a handwashing facility with soap. Formative research is strongly recommended for developing a contextual evidence base for PNG about what motivates hygiene behavior change, particularly handwashing with soap.
- 15. Provide post-construction training and mentoring for sanitation and hygiene.** The study found that where there were ongoing activities after sanitation interventions (for example when the initiative was linked to the Healthy Islands Approach), there had been increased interest by households in maintaining or improving their toilets. Ongoing contact with communities or community leaders can motivate continual improvement and maintenance of sanitation facilities. Building stronger links between communities and government (or other service providers) after the construction phase may improve sustainability and provide additional opportunities for hygiene behavior change activities.

- 16. Develop WaSH activities that work to transform gender relations and that strengthen women’s influence and decision making roles.** The study also found that amongst both men and women there were strong perceptions of gender roles in relation to water systems, and that this was limiting women’s involvement. Community approaches should be tailored towards strengthening the role of women and should create opportunities for women to influence activities throughout the design, construction and management phases. This should include opportunities for women to be trained and work in technical roles if they choose. The study found that approximately half of the WMCs had 40% or more female members, and that in these communities, the WMC was more likely to function well—a strong motivator to promote greater women’s involvement. As well as a gender-balanced workforce, creating these changes requires an investment in implementing staff from government and other agencies to develop their gender skills.

- 17. Invest in understanding who is marginalized and developing strategies to address marginalized groups or individuals, including people with disabilities.** The study encountered instances of marginalization both of groups of households and individual households or community members. The community engagement process for WaSH interventions should both seek to facilitate the community to recognize and address marginalization and to reduce stigma. In line with the new National WaSH Policy, this will require that people with disabilities be supported to improve their access to WaSH facilities. Developing programs that maximize access for people with disability will require that implementing agencies strategically support communities to tackle this issue. Those with a disability should be involved in monitoring whether the desired outcomes are being achieved.

