

Water and Sanitation Services for Informal Settlements in Honiara, Solomon Islands

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2 EXECUTIVE SUMMARY

The purpose of this study was to inform Solomon Islands Water Authority (Solomon Water) of potential service delivery models for the expansion of water and sanitation services in informal settlements in Honiara. Currently, a range of water service delivery models are in use by residents of settlements, comprising both formal and informal methods by which people access water for their domestic needs. As described below, many of these water access or service delivery models do not result in safe and affordable drinking and domestic water. Similarly, a range of sanitation practices are in use, most are not likely to result in safe containment of human waste.

Solomon Water, and the Solomon Islands government have both acknowledged the need to improve water and sanitation in informal settlements.

The 2012 Solomon Islands National Infrastructure Investment Plan states: “Access to improved water and sanitation sources in Solomon Islands is generally low relative to the average for PICs. Urban water systems exist in Honiara and a few provincial centres but are generally ineffectively managed and maintained. Inadequate service has led to a lack of political and community support for water regulations and charges which has further hastened the decline of services. Urban sanitation is also a major concern. There is no centralised sewerage system in Honiara and other provincial centres. The widespread use of septic tanks is a problem due to poor construction and limited resources to monitor and enforce construction and operating standards. As the town grows, the current system will be increasingly deficient and may adversely affect public health and urban amenity. Poor hygiene, lack of on-site waste treatment, and poor access to sewerage are the main issues affecting the sanitation sector, particularly in rural areas.”

Solomon Water has acknowledged this problem and adopted the following corporate objectives (identified in its 30 year Strategic Plan):

- 5-year objective: Seek SIG direction on appropriate supply options for informal settlements / peri-urban
- Areas, and Contribute to UN Sustainable Development Goals improved water supply targets
- 30-year objective: Contribute to UN Sustainable Development Goals improved water supply targets

The Strategic Plan doesn't identify specific objectives relating to sanitation in informal settlements but does identify that connection to the Solomon Water's wastewater system is unlikely to be achieved for the majority of urban users during the life of this Strategic Plan. The priority is to service those residents with unimproved (unsafe) sanitation or practicing open defecation.

Solomon Water is currently expanding and improving its water and sanitation services in Honiara, and other provincial capitals. As a part of this improvement and expansion agenda, there is the opportunity to improve the water and sanitation services available to residents of informal settlements.

This also aligns with the Greater Honiara Urban Development Strategy and Action Plan which has identified the need to improve urban services including water and sanitation (MLHS & ADB, 2018)

In recognition of the diversity of environmental, social and economic diversity amongst urban residents in Honiara's informal settlements, a range of water and sanitation service delivery models may need to be offered.

This assessment identifies the range of possible water and sanitation service models, and, with input from Solomon Water, informal settlement residents and other stakeholders, together with analytical information and lessons about service delivery models used elsewhere, makes recommendations about the water and sanitation service options best suited to informal Honiara's settlements.

2.1 APPROACH

To generate evidence about possible effective water and sanitation service delivery models for Solomon Islands urban informal settlements, the following approach was used.

1. CHARACTERIZATION OF HONIARA'S INFORMAL SETTLEMENTS

Existing data and information describing environmental, social and economic features of informal settlements was collated. The objective was to describe Honiara's settlements with regard to features such as range of location and size of settlements, land tenure, socio-economic parameters, access and use of existing urban services, vulnerability to flooding and disasters. The project aimed to provide a general description of the types of settlement characteristics that exist. In addition to describing conditions in settlements, sufficient GIS information was collated to provide further spatial identification of settlements and conditions.

2. DESK-BASED IDENTIFICATION OF POSSIBLE WATER AND SANITATION SERVICE MODELS WITH SHORTLISTING BASED ON STAKEHOLDER INPUT.

A desk review of water and sanitation options was conducted to prepare an initial list, with critical information, about the possible options. This was used to elicit feedback from Solomon Water about service options considered of interest and for further assessment.

The options included water and sanitation (wastewater) service delivery models currently provided by Solomon Water, in the case of sanitation this included options implemented by other organisations in Solomon Islands. In addition, water and sanitation options that are not currently used in Solomon Islands were included, by drawing on information and lessons from elsewhere.

A summary of technical and experience-based information describing the operational and user aspects of each of the remaining water and sanitation service options was prepared, for further consultation.

This information about operational and user aspects of the water and sanitation options was discussed during a workshop with a cross-section of Solomon Water staff from Customer relations, water operations, wastewater operations, and executive. The workshop discussions discussed the potential suitability or unsuitability of different options, particularly regarding feasibility for Solomon Water to implement. Only a small number of water service delivery options were removed at this time. Whilst it is likely that more than one service delivery model will be required to expand services to many/all informal settlements in Honiara, consideration was also given to inefficiencies associated with maintaining many different service delivery models across the city.

The shortlisted options were shared with residents of informal settlements through consultations in 5 settlements, with the assistance of local facilitators (independent consultants and recent graduates from Solomon Islands National University). Eight group discussions were conducted eliciting feedback on the attitudes about different options, including opinions on potential challenges and how these could be overcome.

Consultation insights were shared with Solomon Water staff during a second workshop, and final decisions made about the service delivery models to provide further information (Step 3).

3. DESCRIBE SERVICE DELIVERY MODELS WITH POTENTIAL APPLICABILITY TO URBAN INFORMAL SETTLEMENTS IN SOLOMON ISLANDS

A summary of operational and user information on the final shortlisted water and sanitation options, with a focus on information relevant to the context of Solomon Islands, was prepared through review of literature. This included analysis

and evaluations of models from elsewhere, as well as case study documentation, to identify critical lessons to be considered before progressing further with piloting unfamiliar models in Solomon Islands.

4. IDENTIFY WHICH WATER AND SANITATION OPTIONS SUIT DIFFERENT INFORMAL SETTLEMENT SITUATIONS

This step integrated the information from Steps 1, 2 and 3 to develop a decision-tree to guide identification of suitable water and sanitation service models for settlements based on key criteria relevant to the suitability of water and sanitation options.

Honiara's Informal settlers – a growing population with diverse characteristics

Existing definitions of 'informal settlement', such as UNHabitat's definition¹, focus on household-scale criteria, including land tenure status at the time of assessment. However, this study required a definition that could be used to identify settlements and households, at scales appropriate for planning purposes, that need improved water and sanitation services as a result of their unplanned settlement processes. As such, the **operational definition of informal settlements adopted in this study is: a spatially-defined area which has been settled over time through informal and unplanned processes, but which now comprises multiple households that may or may not have formal approval to occupy land, and, which lacks access to safe water and safe sanitation services.**

There are no recent accurate counts of people considered to be informal settlers. The 2019 census may provide data that can be used to provide an up-to-date estimate (this may require GIS analysis overlay to confirm households in settlements). The most recent estimates, based on extrapolations from the 2009 census, indicate that in Honiara, around 28,000 of Honiara's total population of around 70,000 live in around 4000 households in informal settlements¹. The Greater Honiara area, which includes peri urban areas to the east and west of the Honiara town boundary, in Guadalcanal Province, includes an additional estimated 7,000 people¹. This **total number of approximately 35,000 informal settlers in Greater Honiara** is likely an underestimate; the forthcoming census should provide more accurate population numbers.

Urban population growth in Honiara is significant, but evidence indicates it is even higher in informal settlements. Urban growth in Honiara has generally been the most rapid at the fringes of the city, e.g. Tandai and Malango wards in Guadalcanal Province grew at an average rate of 16.4% per annum across 1999–2009¹.

Urban migration from rural villagers is characterised by a strong preference to settle near kinship groups, and as a consequence the **population density in some settlements is extremely high and growth is likely to continue despite land shortage**. For example, Ontong Java / Lord Howe Settlement has a population density of 218 people per hectare².

Most settlements are not temporary, some have been settled for many decades. Most settlements inside Honiara town boundary are located on government-owned land, with a smaller number on privately-owned land. Outside the town boundary, settlements are either on privately-owned land or customary land of Guadalcanal Province customary land holders. Inside Honiara boundary, some informal settlements have been designated as '**informal settlement zones**' by the Ministry of Lands, Housing and Survey (MLHS) for administrative purposes; most of these zones are undergoing a formalisation process that will provide land tenure security. But many other settlements do not appear to be administratively recognised yet, including some on smaller land areas such as roadsides, or on land set aside for public services or utilities.

¹ UNHabitat (2016) Honiara City-Wide Informal Settlement Analysis. A report prepared for the Solomon Islands Government and Honiara City Council supported by UN-Habitat as part of the Participatory Slum Upgrading Programme.

² UNHabitat & RMIT (2016) Honiara Urban Resilience & Climate Action Plan. for Honiara City Council and the Solomon Islands Government.

Currently there is no consolidated and up-to-date map identifying informal settlements of Honiara or Greater Honiara. This study has collated and combined several disparate datasets to identify **90 potential informal settlements**, as shown in Figure 1. The focus has been on Honiara municipal area, although where possible, informal settlements known in the peri-urban areas have been included.

Most of these 90 settlements appear not to be formally recognised by MLHS yet, and some of those that are close together may represent smaller clusters of households or communities that exist within a larger contiguous settlement area. Eighty of these were identified by the CAUSE program (World Bank and Honiara City Council: Community Access and Urban Services Enhancement Project) which is engaging with poor and vulnerable populations in Honiara.

This study reviewed existing data and reports to describe some of the key characteristics that vary amongst informal settlements, focusing on those relevant to water and sanitation services. Key sources of information included UNHabitat's 2016 situation analysis of informal settlements of Honiara¹, GIS information from the CAUSE program, Solomon Water including flood-mapping prepared by EGIS, MLHS and public datasets.

The full report provides a more detailed account of characteristics that vary amongst informal settlers and settlements; the following is a brief overview:

- **Population size of individual settlements:** varies significantly; at least one (of the 90 settlements) was reported as having less than 100 residents, 15 settlements had less than residents, and 68 settlements had greater than 300 residents (there are some much larger settlements, probably with several thousand residents, though no accurate data exists).
- **Access to water:** based on case study data from 8 settlements in Greater Honiara, access to Solomon Water varied from 1-94% of households. Other sources included groundwater from springs, bores and shallow wells, rainwater tanks, and a small number relying for drinking water from bottled water and surface flows (rivers, streams)
- **Access to sanitation:** all use on-site sanitation options, with the type being highly variable across 8 case study settlements; up to 50% households have a private household toilet, though most are basic water-based pits. It is likely that none have sanitation considered 'safe' by SDG³ standards.
- **Land tenure:** 3 settlements have been formalized by MLHS, 3 were identified as too hazardous for formalization, 38 were in ISZs undergoing formalization, and the status of the remainder is unknown.
- **Social cohesion:** larger settlements are comprised of many 'communities', whereby a community represents a group of people that are socially-networked and with common characteristics, such as faith or ethnicity, and usually following some shared rules (formal, or informal norms).
- **Income:** there is no recent reliable data specific to residents of informal settlements; estimates from case studies range from \$1200-5500 SBD per month for household income. Anecdotally there appears to be significant variation amongst households within a settlement, with some households having much higher incomes than others; this affects the options for strategies to target or support low income households (a settlement is not necessarily comprised of only low income households).
- **Environmental hazards:** at least 17 settlements were identified as being in flood or landslip zones, and although there is no settlement-specific data describing the depth to groundwater, many settlements are on the coastal floodplain where groundwater is shallow (less than 3m).
- **Accessibility:** around 32 settlements had all-weather road access, though many households do not live roadside and access their houses using footpaths, sometimes through steep areas and across waterways; only a small number of pathways in settlements are easily accessible (concrete with steps).

³ SDG: Sustainable Development Goal 6: safe water and sanitation | **WATER & SANITATION SERVICES - HONIARA'S INFORMAL SETTLEMENTS** | AUGUST 2019

The need for safe and reliable water and sanitation in informal settlements

Across all informal settlements, those recognised as informal settlements and those not, residents utilize a range of water and sanitation options, and few of these provide reliable and safe water and sanitation.

The MLHS process to formalize informal settlements does not currently include provisions for installation or promotion of water or sanitation services. Although many residents of informal settlements can fairly easily arrange power services, arranging water services has been more difficult historically, and it is very difficult to arrange safe sanitation and they are not encouraged to do this during the process of acquiring an FTE or TOL.

As indicated above, access to safe water amongst informal settlers varies at household and settlement scales, with many making use of local water sources, such as springs and shallow groundwater (wells). In some settlements, bores have been installed by organisations other than Solomon Water, including when a utility water main runs close by.

Householders that rely on local water resources or carting of water in containers, and that have inadequate sanitation and irregular handwashing-with-soap practices, are at greater risk of consuming water contaminated with human pathogens.

The urban population of Solomon Islands (nationally) that has access to basic sanitation = 68% (UNICEF Urban WASH Survey 2018). At present, 15% of houses in Honiara have access to piped sewerage; 85% of houses have on-site sanitation, such as septic tanks, or pit latrines, or they have no appropriate sanitation.

Safe collection, treatment and disposal of septage sludge is not common practice.

Many people use on-site sanitation that does not safely manage human waste, or open defecation. Human waste, containing many pathogens causing illness, is contaminating water and food and environments, and causing health problems. The most common health problem caused by inadequate sanitation is diarrhoea – this causes people to not work, not go to school, and limits their opportunity to participate in society. For young children, inadequate sanitation causes lifelong problems – in the Solomon Islands 33% of children are stunted⁴; stunted children are less likely to be successful at school, and less likely to have good jobs when they are adults.

Safe sanitation means toilets and waste systems that manage human waste so that it is treated and disposed safely and it cannot contaminate water, food or environments.

Sanitation can no longer be a problem for each household to address by themselves. This is because

- If even a small number of households don't have good sanitation, the health of everyone in the community around them can be affected.
- In urban areas, most households cannot properly dispose of toilet waste safely – they need access to services.

⁴ SIG (2017) Solomon Islands Detailed National Sustainable Sanitation Plan, September 2017

In addition to the technical and operational aspects of different water service delivery models, the following key points were identified:

- 1) Recognizing that the greatest health and wellbeing benefits are delivered only through internal household water connections, the objective is to provide this level of service where-ever possible. However, it is also recognised that this highest level of service is not suited to some settlements, primarily due to the preference of residents to not commit to household connections and to be able to purchase smaller volumes of water. In these cases, the preference is to provide a service that has the flexibility to be transitioned to individual household connections as demand and willingness to pay/commit changes. An alternative service that delivers affordable safe water may increase the demand for internal household connections, thus serving as a **transitional service**.
- 2) There is a current perception that secure land tenure, such as a Fixed Term Estate agreement, or Temporary Occupancy License, is required before an application for a domestic water connection would be approved by Solomon Water. This is not a formal regulation, and consultation with Solomon Water and MLHS, has determined this need not be required. Solomon Power, the electricity provider, no longer requires an FTE or TOL before an electricity connection is installed; lessons from their process of approval can be applied to Solomon Water's processing of water connections. Relaxing the **land tenure requirements** would mean residents of most informal settlements are eligible for a household water connection. The exception would be for the small number of settlements that have been assessed by MLHS as being in highly hazardous environment. These settlements have been identified by MLHS as requiring relocation, and therefore installation of significant infrastructure such as individual household water connections would not be supported by SIG; an alternative water service delivery model must be implemented for these settlements.
- 3) There appears to be a low awareness and/or attitudes about (i) the importance of safe drinking water (ii) the safety of water provided by Solomon Water. Well-strategized communication efforts are required to influence behaviours regarding the value of water from Solomon Water in comparison to other options (e.g. bottle water, free water from unsafe local sources).
- 4) Concerns about water theft are legitimate; past estimates were higher but there is currently ~15% of non-payment of water. **Water theft** can be reduced if (i) water services reach settlements and residents are more easily able to access water (ii) there is early and effective consultation and communications about the value of Solomon Water as a safe and accessible water supply (iii) most people in a settlement adopt Solomon Water connections (iv) engineering solutions are implemented to reduce tampering and theft, and (v) monitoring of non-revenue water at the settlement-scale (or finer resolution) is used to identify possible problems.
- 5) All service delivery models apart from private household water connections that include inside taps, involve consumers carrying and storing water in containers. Local and global evidence indicates **significant risk of water quality contamination arises when water handling and storing in containers is required**, especially when local sanitation and handwashing practices are weak. Strategies to educate and change behaviours will be required to ensure water service models that include container-based transport and storage of water do not increase water quality health problems due to contamination.
- 6) Regarding **volumes of water to be supplied per person** (to assist with calculations of cost), the WHO standard is (at least) 50 l/p/d, the SIG Rural WASH standards for design requires providing (at least) 50 l/p/d. The Solomon Water strategic plan considers an aspirational average water supply of 140 l/p/d. The actual consumption for residents in settlements is likely somewhere between the range of 50 to 140L/day, and as such these values have been used to estimate affordability of water services.

- 7) Strategies used elsewhere by water utilities to provide different support specifically targeting lowest-income households (**Pro-poor strategies**) were discussed as being difficult to implement in Honiara because (i) identifying and maintaining an accurate register of low-income households is not within the current capacity of government and likely not socially or politically acceptable(ii) targeting whole settlements, as an alternative to identifying individual low-income households, could mean inequitable access by wealthier households to pro-poor allowances – this is due to the high variability of wealth within settlements, and this appears to be a widely held believe amongst locals and stakeholders. The preferred approach is to ensure the lowest tariff level is affordable by the lowest income households; this is achieved by higher rates for larger-volume users who in effect subsidise the lowest tariff level.
- 8) Even inside the town boundary where it is clear Solomon Water have a lead role in managing water supplies, coordination of water supply systems needs improving. The history of limited access for informal settlers to utility water has meant other organisations, such as civil society organisations have installed alternative (local) water supplies, such as bore pumps, usually with limited or no consultation with the water utility. However these on-site water systems are not as cost-effective especially when many settlements are located near water main pipes, and potentially not as safe (wrt water quality) nor sustainable (wrt maintenance). With Solomon Water’s intention to expand services to better service informal settlements, communication and coordination with other actors would assist in avoiding installation of alternative water systems if utility water is a feasible option.

Following desktop reviews and consultations and feedback from Solomon Water and residents of informal settlements, the **following water service delivery models were determined as having potential applicability to Honiara’s informal settlements:**

Individual private household water connections using Cash Water (pre-payment) meters	As for the existing Cash Water service delivery model, which is a pre-paid and metered water connection. Additional considerations for increasing financial accessibility through options to pay connection fees in installments or reductions to connection or monthly service fees.
Shared private water connections using Cash Water	Private household water connections, as above, registered to an identified householder, but shared with neighbouring householders through informal and self-determined arrangements. Access is usually to an outside tap, and households will carry smaller volumes of water to where it is needed. Some may use hoses to convey the water closer to each house (and potentially store in larger containers). Not formally promoted by Solomon Water, but not disallowed, and possibly further enabled (e.g. assessing tariff steps for shared connections to ensure cost-effectiveness for householders, and providing information on a range of methods for bill-splitting).
Water store (kiosk) connected to Solomon Water reticulated system	A formal water retailer located within the settlement, selling pay-per-use water by refilling containers provided by consumers (option to sell containers). Preferred by residents that don’t want to commit to ongoing water connection service fees or raise funds for connection fees. Store (locally-preferred language for a kiosk) design and operations are regulated, including the retail price of water. Options for management include owned and operated by Solomon Water, or a delegated management model; fully private water stores are not recommended (unless highly regulated).

In addition, it was recognised that **additional water accessibility** to informal residents as well as rural residents returning to villages after visiting Honiara could be provided by **installing and operating pay-per-use automated water dispersers, such as Water ATMs, at key locations**. Water ATM’s can provide larger quantities of water in containers than is currently purchasable from stores. In particular, the installation of Water ATMs at major public transport hubs could provide access to affordable and safe water in larger volumes close to transport (to reduce carrying distances).

Other service models considered but not deemed suitable for informal settlements of Honiara included:

- Public shared tap-stands
- Trucking of water to settlements (to individual or shared tanks, or to kiosks)
- On-site water source supply, treatment and distribution (e.g. local bores with storage and distribution networks).

The following characteristics of settlements were determined as critical in influencing the suitability of the different shortlisted service delivery models to different settlements, or residents within settlements.

- **Classification of settlement as hazardous by MLHS:** large investments in water infrastructure, such as for individual household water connections are discouraged by SIG. Water kiosk may be a suitable alternative
- **Water connection history:** previous experiences of high rates of non-payment of water bills, tampering or theft of water or water infrastructure and/or violence to utility personnel
- **Ability and willingness to pay for water:** low ability and/or willingness to pay for water exists in some settlements. Access to safe and affordable water from shared water connections, or from a water store, may increase value and demand of utility water.

A Water services decision tree was developed based on the above criteria, and preferred water service options (Figure 2).

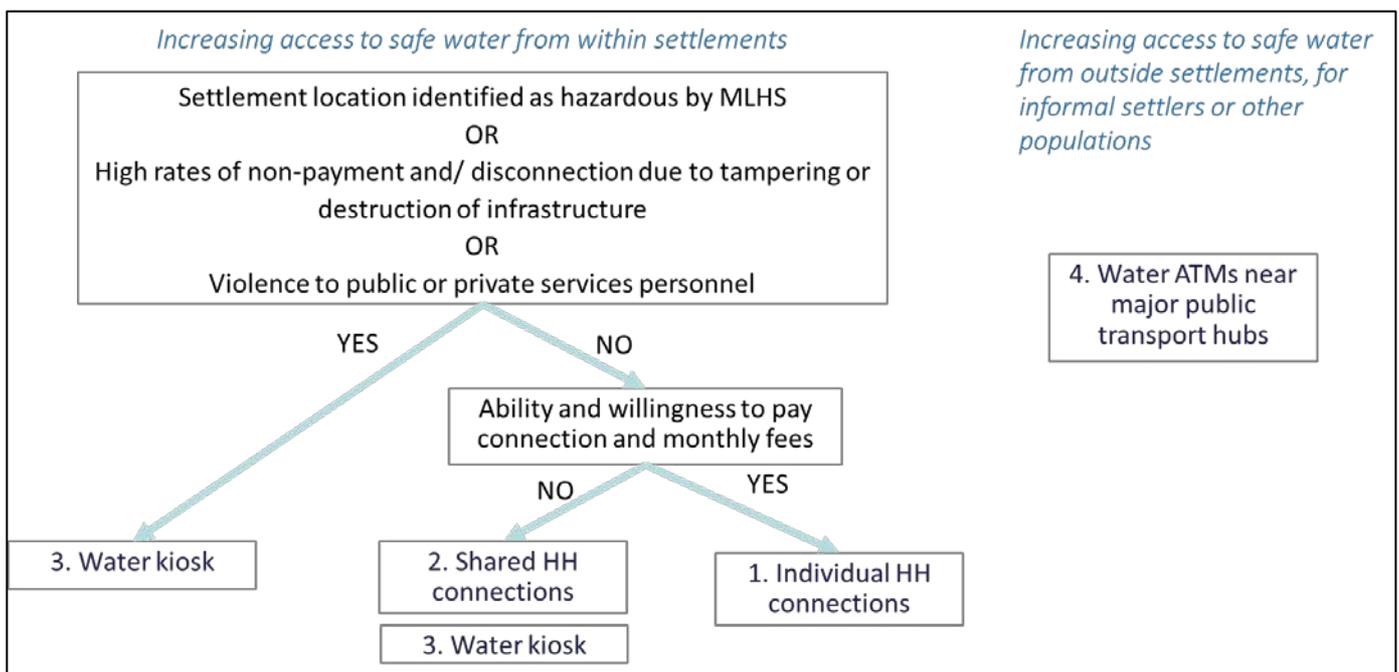


FIGURE 2: WATER SERVICES DECISION TREE FOR INFORMAL SETTLEMENTS, HONIARA.

Improvements to water services in informal settlements will need to consider drainage and wastewater services, as increasing accessibility to water will likely increase water usage.

Improving sanitation will require **three types of actions**

- **Users adopt safe sanitation behaviours** – this will require communications and behaviour change strategies to influence people’s motivation and commitment to using safe sanitation
- **Toilets that support safe sanitation practices are accessible** at households, as well as schools, offices, health clinics, markets, to safely capture human waste
- Infrastructure and service delivery models exist to collect, treat and dispose of human waste safely.

Different sanitation technologies suit different environmental (natural and man-made), social, economic situations. **Many of Honiara’s settlements are not suited to piped sewerage or septic tanks**, which are currently the most common type of sanitation in the formal residential areas of Honiara.

Based on the review of different sanitation technologies and their requirements/suitability, and the range of environmental, social and economic characteristics of and within Honiara’s settlements, the **following factors were identified as critical to influencing which types of sanitation services could potentially work in different places.**

- **Distance away from sewer line** – Honiara’s sewer network currently covers small areas – it is not possible to join every house to the sewer network, but some may be close enough that they can be connected
- **Dense settlements** – many informal settlements are dense with houses, and do not have sufficient space for proper on-site sanitation that treats and disposes of waste in the community, such as septic tanks
- **Road access to houses** – many houses inside informal settlements are not close to the road – they are too far away for septage trucks to access their septic toilets or pits to empty them
- **Groundwater** – some areas of Honiara have shallow groundwater, and in some of these areas, people use this groundwater for drinking and other household uses. Shallow groundwater can be easily contaminated by unsafe sanitation. In addition, it is difficult to construct inground pits in water-logged soil.
- **Flood vulnerability** – areas that experience river, stream or coastal flooding are not suited to many inground sanitation options, because during floods, the human waste is carried around the community in flood waters, causing ill-health
- **Water availability** – some houses don’t have access to a lot of water at their house (many are sharing water connections), and low-water using sanitation options may be required. For settlements with low availability, consideration should be given to the likelihood of improvements to water availability occurring in the near future (such as improved access to water services provided by Solomon Water).
- **Land tenure** – some settlements have been identified as being in hazardous areas and will not be formalised. These areas require sanitation that is not too expensive, or that can be moved when people move
- **Settlement or area population size and social cohesion** – the size of the population in an area and their ability to work together to maintain infrastructure affects the suitability of some community-wide sanitation system.
- A range of **socio-cultural factors** also significantly influence the suitability of types of sanitation, including affordability, ability and willingness to pay for sanitation, and widespread social norms relating to current (unsafe) sanitation practices.

A mix of sanitation services are required, to suit the range of conditions in Honiara. This is because the diversity of situations for informal settlement residents, as well as formal residents, across Honiara means there is no single sanitation service delivery option to suit the whole city’s population.

Effective sanitation requires that everyone uses it all the time, everywhere. **Even if only a few people aren’t using safe sanitation, the whole community is at risk** (any unsafe sanitation leads to the spread of pathogens throughout the environment, and then even those people that do use safe sanitation can still be exposed and suffer ill-health).

Based on a desktop assessment of different sanitation technologies, together with input from Solomon Water, and residents of informal settlements, the following sanitation options were shortlisted:

- **Flushing toilets with piped sewerage** (operated by Solomon Water) or household septic tanks (with septage collection, treatment and disposal); water-saving cisterns can improve water efficiency
- **Community simplified sewer and septic/ABR system:** Flushing toilets with community simplified (small bore, shallow) sewers and community septic/ABR tanks (operated by Solomon Water) and with offsite effluent (via solid-free sewer to existing sewerage network) and sludge disposal (via sludge removal); water-saving cisterns can improve water efficiency.
- **Pour-flush** (or water saving equivalents such as Sato-pan toilets) **with pits** (with pit emptying or burying)
- **Ventilated Improved Pit (VIP)** toilets (with pit emptying or burying)
- **Above ground-sanitation** (container-based sanitation or composting toilets).

Full reticulated sewerage was deemed unsuitable for informal settlements, due to the difficulty with installing conventional sewerage networks in unplanned housing areas, with no easements and likely difficulty to obtain and protect easements for future settlement.

Regarding sanitation in their communities, informal settlers had a **strong preference for household-based toilets, rather than public** (pay-per-use) or shared private toilets (toilets owned and shared by a small number of households).

Assessing the status of above factors influencing sanitation options for each settlement guides the identification of sanitation technologies for consideration by stakeholders, including resident informal settlers. The following Sanitation decision tree (Figure 3) combines the above factors to assist in identifying which sanitation technologies suit different situations.

The flow chart is designed to be used early in planning processes including for use by planners and programmers about which options may be suitable for consideration by stakeholders and residents. It is not a decision-making tool in-itself, and early community engagement will be critical – discussion of options and pros and cons of each. Genuine community-participation will be critical for any service delivery model to work successfully. Additionally, for sanitation technologies common to those used in rural settings, there should be alignment (where appropriate) with RWASH technical advice for households on toilet types.

Consideration should be given to whether water availability may change in settlements currently with low water availability, For example, if improved access to water services provided by Solomon Water are planned for the near-future, the options identified as suitable using the Sanitation decision-tree may be considered undesirable, particularly by consumers who may express a strong preference for water-based sanitation.

The above sanitation options do not describe full sanitation service delivery models. A full sanitation service delivery model must also describe:

- Service provision arrangements for toilet parts and construction services (where households cannot/prefer not to provide their own parts and construction)
- Provision of technical support for householder construction (where appropriate), and maintenance (where appropriate) and use
- Provision of behaviour change communication services (to ensure demand, knowledge and attitudes are supportive of adoption of sanitation services)
- Service provision arrangements for safe collection of faecal sludge and effluent from toilet systems requiring emptying
- Service provision arrangements for safe treatment and disposal of collected faecal sludge and effluent.
- Regulation and monitoring of waste management services.

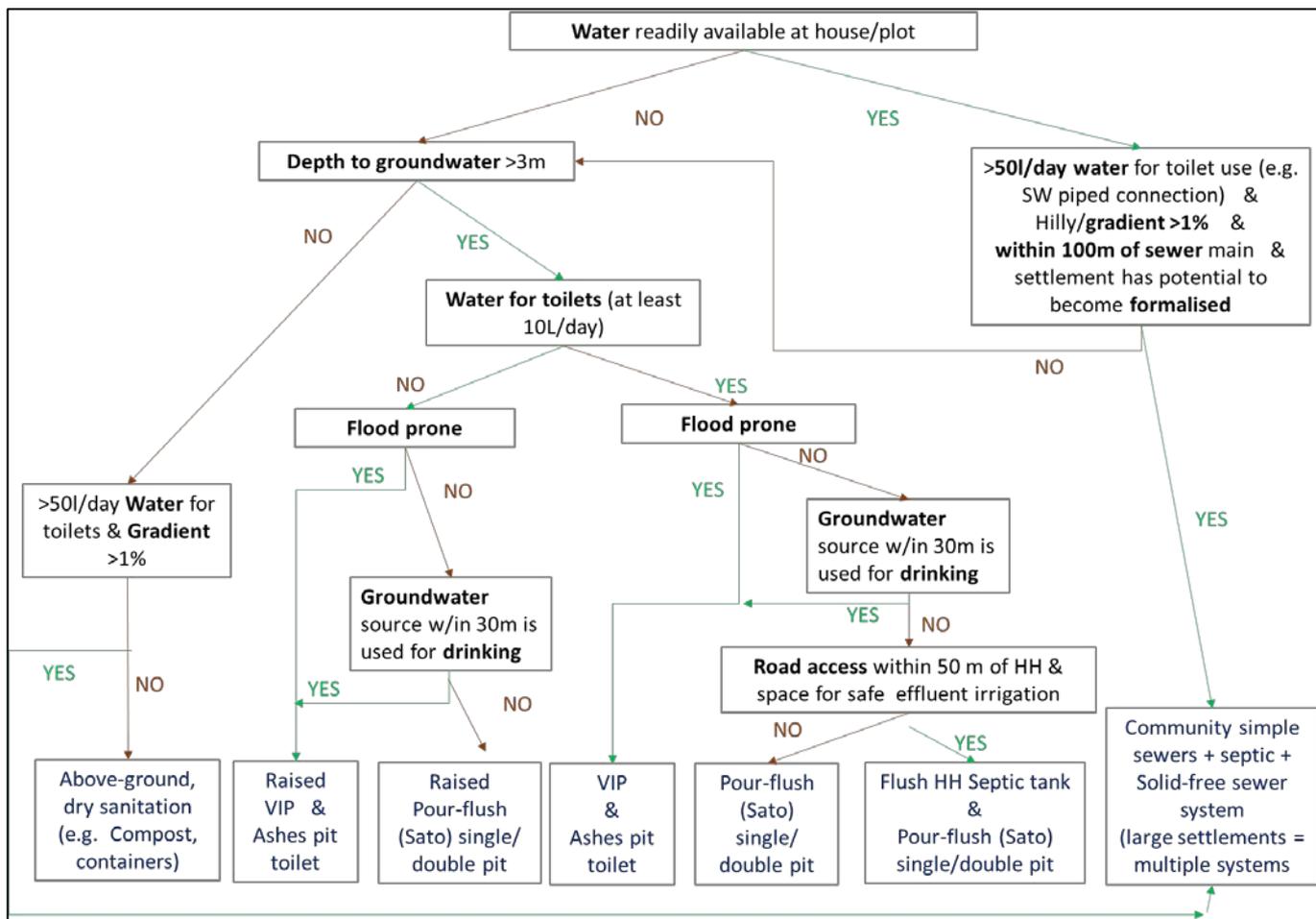


FIGURE 3: SANITATION DECISION TREE FOR INFORMAL SETTLEMENTS, HONIARA. FULL SERVICE DELIVERY MODELS NEED TO BE ASSOCIATED WITH EACH SANITATION OPTION TO ENSURE SAFE MANAGEMENT OF FAECAL SLUDGE AND EFFLUENT.

RECOMMENDATIONS

Improve provision and management of water and sanitation services to informal settlements through the following recommendations.

1. UTILIZE INFORMATION ABOUT SETTLEMENTS TO GUIDE CONSULTATIONS AND PLANNING WITH RESIDENTS AND OTHER STAKEHOLDERS ABOUT WATER AND SANITATION SERVICES:

- 1.1 **Work with MLHS, HCC, MoHMS and other organisations linked with informal settlements and urban planning, to identify and collate information and plans regarding settlements.** In particular, links should be made with those implementing The Greater Honiara Urban Development Strategy and Action Plan (GHUDSAP), to consolidate data relating to urban and peri-urban informal settlements and their development. The database (spreadsheet) developed during this study may be a useful starting point.
- 1.2 **Improve existing information about settlements**, in particular
 - a) Census 2019 data should provide updated and more detailed information about: variability of wealth within settlements; population estimates for individual settlements; growth rates of individual settlements. Once available, which may be 1-2 years, this data should be assessed for suitability and incorporated to any settlement database/information store.
 - b) MLHS data regarding land tenure status of different settlements.
- 1.3 Build on the newly collated GIS information to **update and use GIS-linked information to inform planning** of services. In particular, maintain and update as available settlement population and socio-economic data, with environmental data such as hazard mapping (coastal flooding, riverine flooding, flash flooding, landslips), and with utility asset data (water and sewerage assets).

2. IMPROVE WATER SERVICE DELIVERY TO RESIDENTS OF INFORMAL SETTLEMENTS:

- 2.1 **Provide internal household water connections where-ever possible**, to maximise health and wellbeing benefits
- 2.2 Recognise that not all residents of all settlements will be able/want to access their own private household water connections, and that a **mix of water service delivery options may be required**. Identify potential service delivery options using the water decision-tree developed in this study (Figure 2 above) to guide identification of water service delivery models to be considered during planning and consultation activities.
- 2.3 **Maintain the lowest tariff level at a rate that is affordable by the lowest income households** (this may require regular reassessment).
- 2.4 Where internal household water connections are not being provided, provide a service that has the flexibility to be transitioned to individual household connections as demand and willingness to pay/commit changes, that is, consider these services as **transitional services**. This does not apply to settlements identified by MLHS as hazardous.
- 2.5 **Accommodate a mix of water service delivery models in settlements with larger diversity of wealth and demand**. For example, consider providing both water kiosks and household water connections in settlements with lowest income households and high wealth households. Census 2019 information can be used to identify these settlements.

2.6 **Improve the awareness and attitudes about safe drinking water** in particular (i) the importance of safe drinking water (ii) the safety of water provided by Solomon Water using an evidence-based behaviour change communication strategy.

2.7 **Mitigate water theft from water pipes** by:

- a) Increasing the accessibility of household water services by planning for reticulation through settlements, and maintaining a lowest tariff rate that is affordable by low income households.
- b) early and effective consultation and communications about the value of water from Solomon Water and its cost to supply
- c) encourage uptake by majority of households
- d) utilize engineering solutions, such as resistant pipes and deeper installations, to reduce tampering and theft,
- e) monitoring of non-revenue water at the settlement-scale (or finer resolution) to identify possible problems.

2.8 Sharing of household connections amongst multiple households will not be actively promoted by Solomon Water due to difficulty of regulating on-selling and ensuring the quality of service (e.g. reliability and water quality). However, sharing of household water connections is common practice and is preferred amongst many residents of informal settlements, as a way to share the fixed costs of a connection. It is recommended that Solomon Water acknowledge this as one tactic to increase the accessibility to their water services and **improve the effectiveness of shared household connections** by

- a) reassessing the tariff (or other aspects of the cost) arrangements for these connections. This is because connections supplying water to multiple houses may use sufficient volumes to be charged a higher-use tariff – thus effectively paying more per litre than single-household connections.
- b) Making accessible information about different ways water use can be calculated (e.g. through community meetings or ‘water supply training’, which could include other aspects of demand management and water quality (containers & storage)
- c) Consider cluster metering to reduce connection costs (provided settlement residents agree to take responsibility for management of pipes and non-revenue water from the meter to the house).

2.9 **Pilot water stores (kiosks) in one or two settlements to build experience and understanding** of (i) operational requirements (ii) demand from residents of informal settlements. Specific recommendations relating to piloting of water stores:

- a) Pilot a delegated-management model and/or utility owned-and-operated model (rather than a private retailer), to ensure (i) retail price is regulated by the utility (and set at a level commensurate with affordability for likely consumers, including lowest income households and the level of service being provided); and (ii) minimum service standards are adhered to (e.g. opening hours, hygiene and maintenance of store equipment). An alternative would be to start with utility-owned-and-operated and transition to delegated management.
- b) Recognise the lower service standard that will be provided (compared with household water connections) and that this is likely a transitional service to create demand and willingness to pay by providing low cost water (this may require subsidizing the cost of the service, depending upon the potential market size).
- c) Design and locate the store considering: (i) vulnerability to vandalism (ii) personal safety of operators (ii) accessibility to residents carrying water containers (iii) hazardous locations (floods, landslips, proximity to rubbish piles) (iv) ability to maintain hygiene and to prevent contamination or supplies (e.g. through back-flows) (v) some on-site storage to mitigate short-term mains water disruptions (vi) density of stores within larger settlements to balance cost-effectiveness with accessibility.

2.10 **Pilot the installation and operation of pay-per-use automated water dispensers, such as Water ATMs, at key locations such as major public transport hubs** (large bus stops, the port).

- a) The location of the Water ATMs should consider (i) security of the ATM (ii) accessibility of the ATM with regard to hours/days it is accessible for both consumers and service operators (iii) proximity to transport departure locations to minimise carrying distances
- b) Retail cost of water should be regulated by the utility, and set at a level commensurate with affordability for likely consumers (including lowest income households) and the level of service being provided.

2.11 Recognising there will remain (for the near future) many residents that use service delivery models requiring them to carry and store water in containers (e.g. water kiosks/stores, shared HH connections), **mitigate health risks from use of water containers:**

- a) Mitigate the risk of contamination of water during handling and storing of water by consumers in containers (including drums, barrels, tanks) through education and behaviour-change strategies (which should also identify poor sanitation and hygiene (handwashing) and important factors increasing contamination of water in containers).
- b) Mitigate the health problems associated with carrying water in containers by encouraging local hardware stores to stock wheeled-water carriers or containers.
- c) Consider whether household water treatment options should be promoted (acknowledging the requirements for consistent and proper adherence to treatment procedures for these to be effective).

2.12 **Adjust the land tenure requirements and the current perceptions regarding these requirements:**

- a) adjust internal utility processes, and external communication messages regarding land tenure requirements to clarify that a Fixed Term Estate, or Temporary Occupancy License is not required for residents inside Honiara City Council boundary to apply for a private water connection.
- b) For residents living in settlements that have been assessed by MLHS as being in highly hazardous locations, individual private household water connections may not be supported, but that an alternative water service delivery model can be discussed with Solomon Water, such as a water kiosk.

2.13 **Communicate and coordinate water supply service options with all organisations active in informal settlements**, to ensure where feasible, utility water is provided, as the more cost-effective, safe and sustainable water supply system, rather than installation of on-site water supplies such as bore pumps which have minimal long-term maintenance support and may interact with Solomon Water's water supplies and network.

3. IMPROVE SANITATION SERVICE DELIVERY AND BEHAVIOURS IN INFORMAL SETTLEMENTS:

3.1 **Recognise that a mix of sanitation service options will be required to service Honiara's urban and peri-urban populations.** Achieving sanitation service provision for all people is required to ensure the health and wellbeing of all of Honiara's population, and to maximise resident's participation in society, education and economic activities.

3.2 **Identify sanitation options to suit different settlement characteristics**, such as by using the sanitation decision-tree (Figure 3) to guide identification of the range of sanitation services that may be required and their suitability to different local situations.

3.3 The required mix of sanitation services cannot be provided by any one organisation, and a mix of sanitation service providers will be required. **Coordination and cooperation** is required to ensure that all people living in Honiara can access a sanitation service that will safely manage their human waste.

- 3.4 Promote amongst key stakeholders (Solomon Water, HCC and MoH) the **critical need for a coordinated strategy to address sanitation across Honiara**. A strategy or plan for Honiara’s sanitation could include information:
- Identify which **types of sanitation services** should be made available in which parts of the city, including in identified hazardous areas, and specifying expected and acceptable service levels.
- 3.5 Identify which organisations should play a role in **supporting or delivering each sanitation service** (and whether additional capacity or capability is required)
- Confirm there are no parts of the city that can’t access a safe sanitation service.
 - Describe agreed **targets** to encourage progress on sanitation and describe how these will be **monitored**.
- 3.6 The sanitation strategy or plan should also **require coordinated communication to promote sanitation** behaviours, and to improve the motivation and commitment of people to using safe sanitation. It is important that all organisations have the same types of messages about sanitation – the best way to achieve this is for stakeholders to develop a sanitation communication strategy, with communication resources, that many organisations can use.
- 3.7 **Coordinate with MoH to improve awareness amongst residents of informal settlements about types of on-site sanitation** options suitable in different informal settlements, in particular to unfamiliar sanitation options such as VIP dry pit latrines, and container-based or composting toilets. Coordinate with MoH on the communication of acceptable sanitation technologies.
- 3.8 **Pilot the new service delivery model of “Community simplified sewer and septic/ABR system”** which combines on- and off-site collection and treatment.
- This model involves:
 - water-based (flushing) toilets with low-cost community simplified sewers (installed with assistance from residents, and oversight by Solomon Water). Water-saving cisterns can improve water efficiency, although a minimum water flow will be required to ensure functionality of the community simplified sewers.
 - connections to community septic tanks (operated by Solomon Water). Multiple septic tanks may be required depending upon the scale and topography of the settlement.
 - conveyance of effluent from septic to mains sewer using low cost solids-free sewer systems
 - septage emptying from the septic tank.
 - Significant community engagement and consultation will be required before piloting such a model. Consider partnering with organisations already with established relationships and experience engaging with informal settlements
 - Use the sanitation decision-tree to assist in identifying a pilot settlement. An additional criteria would be to select settlements in which there has previously been promotion of sanitation. An example of a settlement that meets most of these criteria is Namoliki/Gwaimaoa.
 - Ensure there is capture of the processes, strengths and weaknesses of the pilot model to provide evidence for future service model assessments.

4. IMPROVE COORDINATION AND INTEGRATION OF WATER, SANITATION AND HYGIENE IN INFORMAL SETTLEMENTS

- 4.1 **Water, sanitation and hygiene are critically linked**, both operationally and from a health perspective (e.g. the need and use of water to practice safe hygiene; the potential contamination of local water, and container-based water, through inadequate sanitation and hygiene; the increase consumption of water associated with water-based sanitation), these three areas of activity must be **planned and operationalized in a coordinated way** to

avoid ineffective communication or operations, which would prevent WASH-related health and wellbeing being achieved.

- **Engage with other WASH actors** active in Solomon Islands to ensure coordinated approaches, similarly for sanitation above. Discuss communication approaches and resources using the same messages. Synergising urban and rural WASH communications and messages would provide benefits to both urban and rural WASH outcomes – this could be achieved through expansion of the rural WASH stakeholder group to include urban WASH actors.
- **Engage with other actors active in informal settlements**, not necessarily focused on WASH, such as CAUSE and UNHabitat, to raise awareness of WASH-related approaches and activities being promoted by the government and Solomon Water.

3 PURPOSE AND APPROACH

The objective of the study was to inform Solomon Water of potential service delivery models for the expansion of water and sewerage services in informal settlements in Honiara.

Currently, a range of water service delivery models are in use by residents of settlements – not all of these result in safe and affordable drinking and domestic water. Similarly, a range of sanitation practices are in use, most not likely to result in safe containment of human waste.

Solomon Water is currently expanding and improving its water and sanitation services in Honiara, and other provincial capitals. As a part of this improvement and expansion agenda, there is the opportunity to improve the water and sanitation services used by residents of informal settlements.

In recognition of the diversity of environmental, social and economic diversity amongst urban residents in Honiara’s informal settlement, a range of water and sanitation service delivery models may need to be offered.

This assessment identifies the range of possible water and sanitation service models, and, with input from Solomon Water, informal settlement residents and other stakeholders, together with analytical information and lessons about service delivery models used elsewhere, makes recommendations about the water and sanitation service options best suited to informal Honiara’s settlements.

3.1 APPROACH

To generate evidence about possible effective water and sanitation service delivery models for Solomon Islands urban informal settlements, the following approach was used.

1. CHARACTERIZATION OF HONIARA’S INFORMAL SETTLEMENTS

Existing data and information describing environmental, social and economic features of informal settlements was collated. The objective was to describe Honiara’s settlements with regard to features such as range of location and size of settlements, land tenure, socio-economic parameters including demographic dynamics and willingness to pay for water and sanitation, housing type, access and use of existing urban services, vulnerability to flooding and disasters.

The intention was to develop descriptions about the range of situations existing across settlements, rather than describe every settlement. However, sufficient information was collated to allow a description of all settlements for some of these features, allowing a more settlement-specific description of situations.

This more specific approach was made possible due to GIS data provided by the Community Access and Urban Services Enhancement Project (CAUSE) program (a partnership between Solomon Islands government and World Bank). This program provided the GIS location of many urban communities likely to represent informal settlements, together with some basic information about population, access and services. The GIS location of settlements provided a platform for additional GIS data describing environmental features, and water and sewerage services to be overlaid, so that the specific features of each settlement could be determined.

The GIS information was supplemented by non-GIS information describing social, economic, environmental or other relevant features of specific settlements, or settlements generally. This information was collated by reviewing numerous previous studies and reports, including:

- CAUSE Social assessment Report (World Bank, 2017) – based on secondary and primary data, an identification of key social, economic and environmental factors from vulnerable urban communities in Honiara (and Gizo and Auki)

- Honiara City-Wide Informal Settlement Analysis 2016. UN Habitat with Honiara City Council and Ministry of Lands, Survey and Housing.
- Slum Situational Analysis Based on Socio-Economic Survey for UNHabitat. 2015. Ministry of Lands, Survey and Housing (Richard Pauku).
- Solomon Islands Urban Water Supply & Sanitation Sector Project - Household Survey Report. 2018. EGIS, for Solomon Water and ADB.
- Spatial Analysis of Informal Settlement Growth and Disaster Management Preparedness: A Case Study in Honiara City, Solomon Islands. 2013. Reginald Reuben – Master thesis (USP).
- Urban Development in Honiara - Harnessing Opportunities, Embracing Change. 2017. Meg Keen, Julien Barbara, Jessica Carpenter, Daniel Evans and Joseph Foukona. Australian National University.
- Informal Land Systems Within Urban Settlements in Honiara and Port Moresby. 2008. Chand, S & Yala, C, in Wawrzonek, Fitzpatrick, Levantis, O'Connor (ed.), Making Land Work, vol 1, AusAID, pp. 85-107.
- Honiara Urban Resilience & Climate Action Plan. 2016. UNHabitat and RMIT for Honiara City Council and the Solomon Islands Government.
- Solomon Islands Systematic Country Diagnostic. 2017. World Bank.
- Solomon Islands Ecosystem and Socio-Economic Resilience Analysis and Mapping (ESRAM), Volume 3: Honiara. 2018. SPREP.

The use of information from these reports, and others, is acknowledged where used in this report.

2. IDENTIFICATION OF POSSIBLE WATER AND SANITATION SERVICE MODELS

The approach to identify water and sanitation service delivery models that suit the situation of informal settlements in Honiara involved several steps:

- An initial desktop review of water and sanitation options was conducted to prepare an initial list, with critical information, about the possible options.
- An initial consultation with Solomon Water eliminated a small number of service delivery options deemed not feasible
- A summary of technical and experience-based information describing each of the remaining water and sanitation service options was prepared, for further consultation. These summaries reviewed literature describing key components of the service chain for each option, as well as technological, operational, social, economic, service standards achievable and health and wellbeing benefits.
- Workshop with Solomon Water elicited feedback to these service delivery model options and shortlist options for further consideration
- Community consultations elicited feedback to the service delivery model options, including suggestions on alternatives and ways to overcome challenges
- Workshop with Solomon Water to agree final shortlisted service delivery model options.

Additional information about the shortlisted options, relevant to considering their implementation in the context of the Solomon Islands was compiled.

3. IDENTIFYING SERVICE DELIVERY MODEL OPTIONS TO SUIT HONIARA'S INFORMAL SETTLEMENTS

The characterisations of Honiara's formal settlements (Step 1 above) was integrated with information about the shortlisted service delivery model options (Step 2) to develop a decision-support tree to identify service delivery options suited to specific conditions in informal settlements.

This was refined through a workshop with Solomon Water and their Development partners (World Bank, ADB), and for sanitation with input from other stakeholders with a key role in sanitation (Ministry Medical and Health Services, Ministry Environment, Honiara City Council, UNICEF, NGOs).

The purposes of the decision-support trees are to

- (i) identify the range of options that may be required to ensure water and sanitation services can be accessible in all informal settlement situations.
- (ii) identify possible water and/or sanitation options for specific settlements, for further consideration and consultation with key stakeholder, including settlement residents.

4 CHARACTERISATION OF INFORMAL SETTLEMENTS

DEFINITION OF INFORMAL SETTLEMENT

Informal settlement

Several definitions of informal settlements exist. One that has been used in the Solomon Islands previously, is that of UNHabitat (UNHabitat 2016a): informal settlements of Honiara comprise households with informal settlers, where a household is a group of individuals living under the same roof in an urban area, who lack one or more of the following:

- Durable housing (a permanent structure providing protection from extreme climatic conditions);
- Sufficient living area (no more than three people sharing a room);
- Access to improved water (water that is sufficient, affordable and can be obtained without extreme effort);
- Access to improved sanitation facilities (a private or public toilet shared with a reasonable number of people); and
- Secure tenure (de facto or de jure secure tenure status and protection against forced eviction).

“Informal settlements” is terminology that is locally used to indicate spatially-defined areas within which reside informal settlers, though in practice by this definition, many informal settlements have formal residents (households that do meet all of the above criteria).

The requirements of this study involve identifying informal settlements requiring improved access to water and sanitation services, and where some settlement-scale planning and community engagement will be beneficial. This means that areas relevant to this study are more defined by their history of planned/unplanned settlement, because this has a significant influence on the feasibility and accessibility of water and sanitation services, rather than the current status of individual households.

Therefore, the working definition of Informal settlement, used in this study to identify communities and households to improve water and sanitation services is an informal settlement:

- Is a spatially-defined area which has been settled over time through informal and unplanned processes, but which now comprises multiple households (which may or may not have formal approval to occupy land, durable housing, water connections, on-site sanitation, sufficient living area)
- lacks settlement-scale access to improved water and sanitation.

Informal Settlement Zone

During the mid-2000s, in association with the Solomon Islands Institutional Strengthening of Land Administration Project (SIISLAP), a number of ‘Informal Settlement Zones’ (ISZ) were created largely for management purposes – in practice, these are formally recognised informal settlements within the Honiara municipal area (UNHabitat 2016a). Most ISZ’s are undergoing a process to become formalized, providing the option for land tenure security (through a fee for a Fixed Term Estate) for residents of the formalized settlement. Not all informal settlements inside Honiara municipal area have been designated as an Informal Settlement Zone.

DESCRIBING THE INFORMAL SETTLEMENTS OF HONIARA

This study aimed to provide an overview of the range of environmental, social, economic and other situations that exist within Honiara's informal settlements.

However, sufficient information about individual settlements was collated to make a first attempt to identify all Honiara's informal settlements, and describe some of their characteristics relevant to this study. Settlement-specific data will be very useful to inform sanitation options & plan for expansion of water services, and assess water, and sewerage (or other sanitation) accessibility for informal settlers.

This more specific approach was made possible due to GIS data provided by the Community Access and Urban Services Enhancement Project (CAUSE) program (a partnership between Solomon Islands government and World Bank). This program provided the GIS location of many urban communities likely to represent informal settlements, together with some basic information about population, access and services. In addition, settlement names and locations were gleaned from previous studies and reports, as well as from MLHS map and list of informal settlement zones.

The GIS location of settlements provided a platform for additional GIS data describing environmental features, and water and sewerage services to be overlaid, so that the specific features of each settlement could be determined.

The GIS information was supplemented by non-GIS information describing social, economic, environmental or other relevant features of specific settlements, or settlements generally. This information was collated by reviewing numerous previous studies and reports – see those listed in section 3 (Purpose and Approach) and as cited throughout this section.

The recent UNHabitat (2016a) assessment of settlements of Honiara provides the most up-to-date and comprehensive overview of informal settlements and their social and economic situations and was based upon synthesis of a diverse range of primary and secondary data sources. The CAUSE (2017) report also includes valuable primary and secondary information about the social and economic situation of Honiara's informal settlements.

The following summaries focus on those aspects relevant to considering water and sanitation services for informal settlements, and other sources such as the UNHabitat (2016a) and CAUSE (2017) reports should be consulted for a broader perspective of socio-economic situations of settlements.

4.1 INCREASING URBANIZATION OF HONIARA

Honiara is the capital city of the Solomon Islands and is situated in its own province (Capital Province) located on the northern coast of Guadalcanal island, at the mouth of the Mataniko River. There are 12 administrative wards in Honiara but urbanization is creating peri-urban areas beyond the ward boundaries into the wider Guadalcanal province on all sides of the city (Figure 4, MLHS & ADB, 2018).



FIGURE 4: HONIARA TOWN BOUNDARY (GREEN) AND GREATER HONIARA AREA (ORANGE); MLHS & ADB 2018.

Compared with other areas of Solomon Islands, Honiara is experiencing rapid population growth with a greater proliferation of informal settlements, has a more diverse economy, higher incomes together with higher incidence of poverty, and higher unemployment (CAUSE, 2017).

The growth of Honiara has occurred in advance of formal and planned growth; consequently community infrastructure and services are limited. Much of the growth occurred after the tensions as people sought economic opportunity in the urban areas in response to the comparative wealth in Honiara compared to the widespread basic needs poverty in other provinces (CAUSE, 2017). The Honiara Local Area Planning Scheme of 2015 states that the rapid population growth around Honiara is not met by provision of adequate infrastructure and that there is scarcity of land for housing developments (MLHS & HCC, 2015).

The drivers of urbanization are the same as for other urban centres in the Solomon Islands: accessing employment, health and education, however there is also shorter-term movement to Honiara prompted by “seeking audiences with Members of Parliaments or their staff to access Constituency Development Funds (given most Members of Parliament live in Honiara, not in their constituencies), and dealing with natural resource development-related issues, particularly logging – in court, with government ministries or with private businesses (primarily a male pursuit)” (World Bank 2017)

The Greater Honiara Urban Development Strategy and Action Plan (GHUDSAP) was developed by the Solomon Islands Government, and outlines a series of plans in response to the rapid and unplanned urbanization of Honiara. Whilst recognizing much of the Greater Honiara Area lies in Guadalcanal Province, the plan identifies several strategies to support the vision of the city, including improving provision of basic urban services in the urban centres, and upgrading informal settlements.

4.2 INFORMALLY SETTLED AREAS OF HONIARA

Informal settlements have been present in Honiara for many years – with some settlements settled as long ago as probably the 1960s (UNHabitat, 2016). Surveys conducted in 2015 as part of UNHabitat’s Participatory Slum Upgrading Programme shows that the average length of residence by households in the Aekafo area was 18.6 years – suggesting these communities are well-established.

Reuben (2013), used GIS and aerial imagery to confirm that informal settlements have been growing in size rapidly over last 35 years, as well as expanding onto new locations, many of which are more vulnerable to natural and climate change related hazards. His study area included the area within Honiara town boundary, as well as some of the Greater Honiara Area. Figure 5 shows a ten-times growth in total area of informal settlements from 71 ha in 1984, to 721 ha in 2010 (Reuben, 2013).

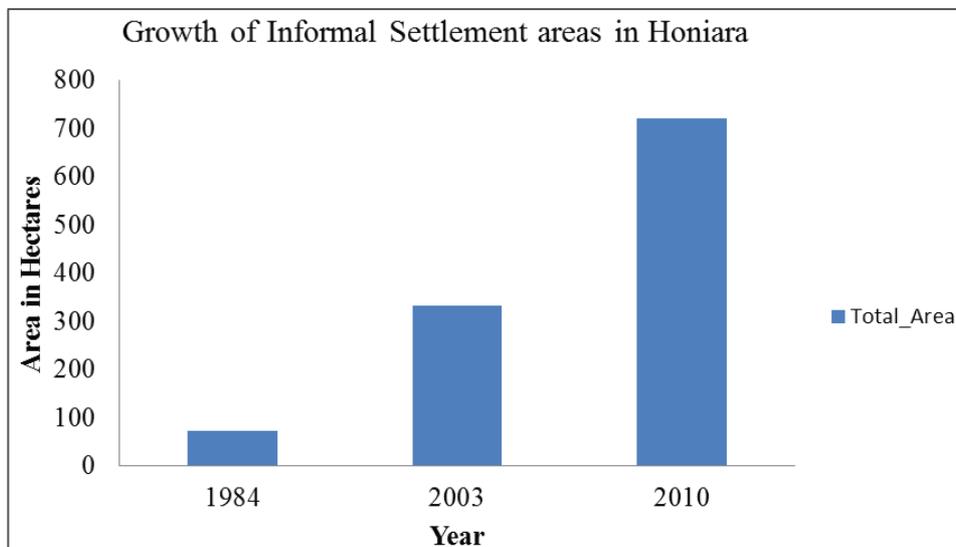


FIGURE 5: GROWTH IN INFORMAL SETTLEMENT AREAS WITHIN THE HONIARA MUNICIPAL AREA (REUBEN, 2013).

Figure 6 shows the growth of informal settlements since 1984 (Reuben, 2013). Yellow indicates the areas taken up by informal settlements in 1984 while blue and red shows the areas taken up by informal settlements in 2003 and 2010 respectively. Established informal settlements continued to expand while new ones were seen in areas previously not settled (Reuben, 2013). In 1984, informal settlements were centered on the central and western parts of the city; by the year 2000, settlements were growing in the eastern part of the city (Reuben, 2013).

UNHabitat (2016) indicates evidence that informal settlements have grown substantially since 2010.

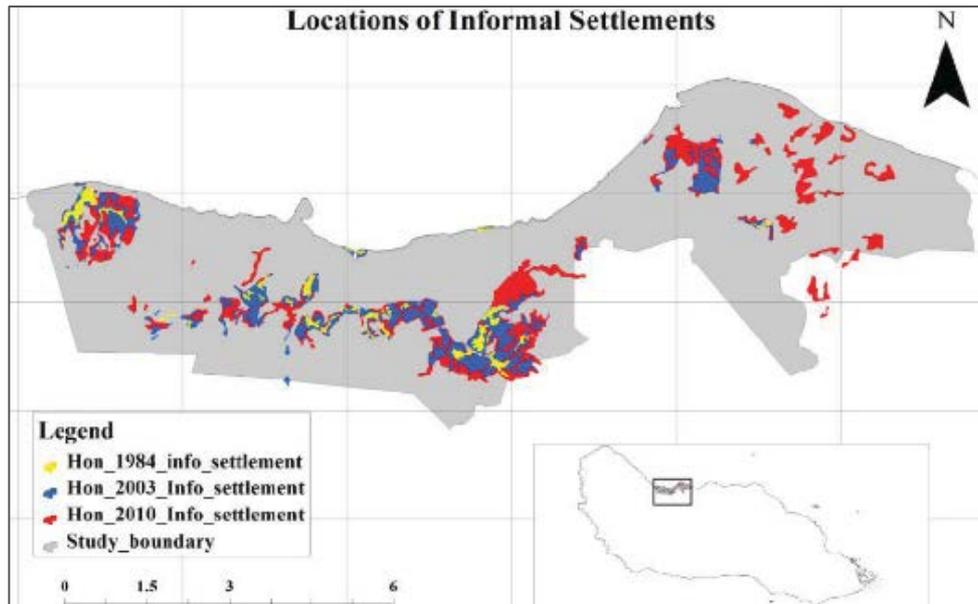


FIGURE 6. LOCATIONS AND AREA OCCUPIED BY INFORMAL SETTLEMENTS, 1984, 2003, 2010 (REUBEN, 2013).

In West Honiara, which includes White River, Tandai, upper and lower Tasahe, Rifle Range, Nggosi and Rove, by 2010, the growth of informal settlements was generally expanding inland towards steep slope areas, as well as expanding east from the existing 1984 settlements (Figure 7; Reuben, 2013).

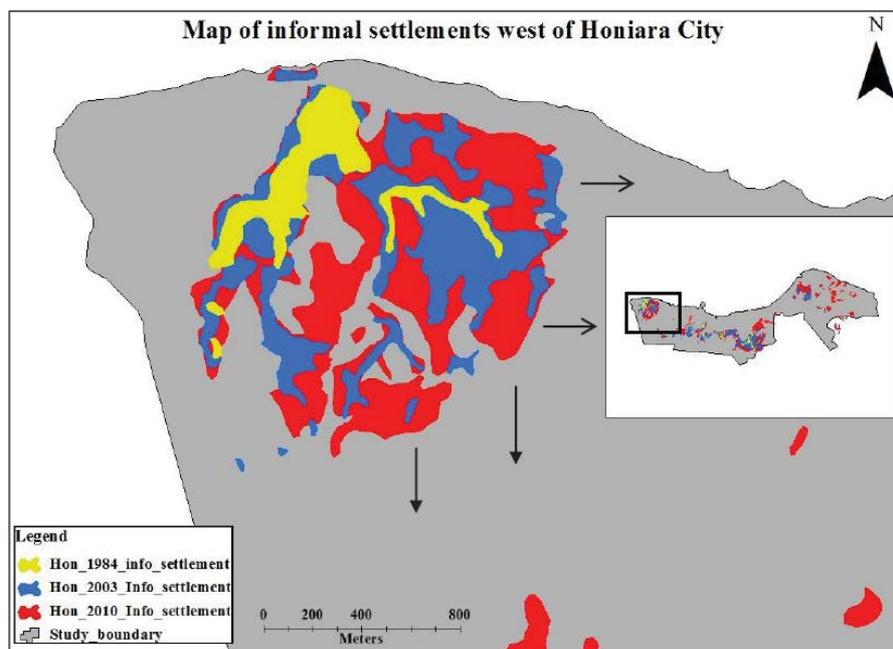


FIGURE 7. EXPANSION OF INFORMAL SETTLEMENT AREAS IN WEST HONIARA CITY, 1984 – 2010 (REUBEN, 2013).

The growth of informal settlements in Central Honiara, made up of areas from Mbumburu in the west to Panatina Ridge in the east, was similar to that observed in west Honiara; most existing settlements were growing towards steep slope areas inland (Figure 8). Lord Howe/Ontong Java settlement and Fishing Village, coastal settlements in central Honiara, were not expanding in area but increasing by the number of buildings. Many Informal settlements indicated rapid growth, including Kaibia, Kokomulevuha, Koa Hill, Aekafo, Cana Hill, Matariu, Ferakusia, Feralodoa, Fulisango, Green Valley, Mamulele, Kombito, Kofiloko, and areas surrounding Gilbert Camp.

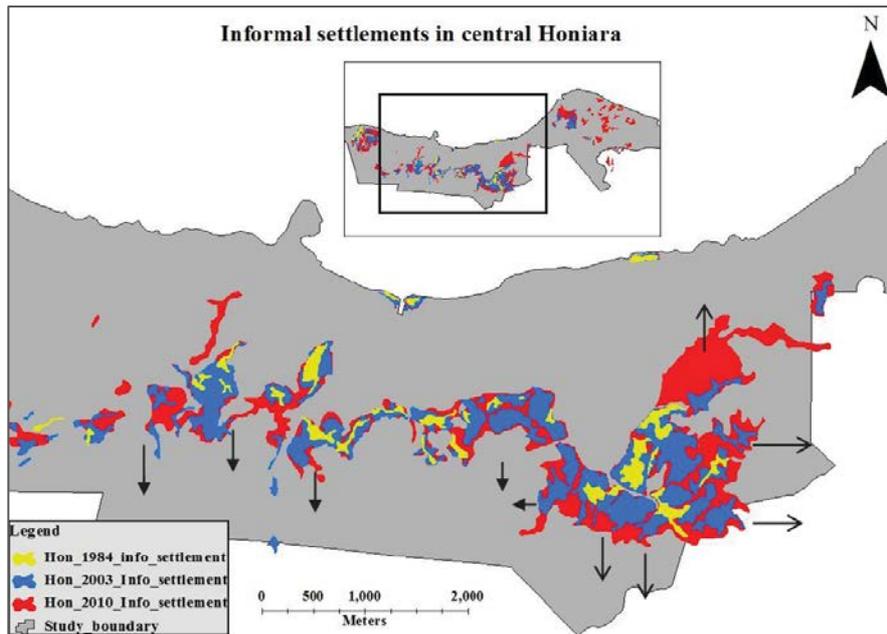


FIGURE 8. EXPANSION OF INFORMAL SETTLEMENT AREAS IN CENTRAL HONIARA CITY, 1984 – 2010 (REUBEN, 2013).

Apart from Lungga and Sun Valley informal settlements, most of the eastern parts of the Honiara City have been occupied more recently, following 2003, and there are settlements almost everywhere in this region (Figure 9). Many of these lie outside the Honiara town boundary. Informal settlements in east Honiara seem to be growing faster than in west Honiara (Reuben, 2013). In addition to existing settlements, new settlements continued to develop in other areas which has resulted in the scattered settlements shown in Figure 9. The Lungga River Delta comprises a large of east Honiara (in the Greater Honiara Area), and the growth of informal settlements expands onto the floodplain; most of these informal settlement areas are at risk of significant flooding (Reuben, 2013).

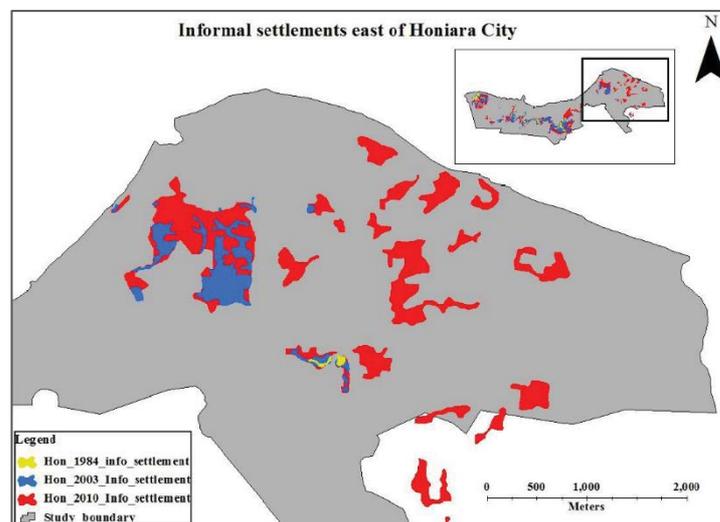


FIGURE 9. EXPANSION OF INFORMAL SETTLEMENT AREAS IN EAST HONIARA CITY, INCLUDING EXTENDING BEYOND THE TOWN BOUNDARY, 1984 – 2010 (REUBEN, 2013). INDICATION OF MUNICIPAL TOWN BOUNDARY ADDED.

Informal settlement zones (MLHS)

As describe in the definitions above, ‘Informal Settlement Zones’ (ISZ) represent some of the informal settlements within the Honiara municipal area – those that have been formally recognised and assessed by the MLHS for their eligibility to become formalized settlements (UNHabitat 2016a).

The formalization process, and how it affects land tenure are outlined in the section “Land Tenure” (below).

The most recent available map showing MLHS informal settlement zones (Figure 10), and the accompanying list, identifies 36 administratively-recognised informal settlements. However, as noted above, and is clear from comparing the map of ISZs (Figure 10) with the map showing informally settled areas from 2010 (Figure 6), there are many informal settlements in addition to those identified as informal settlement zones.

4.3 ‘INFORMAL SETTLEMENTS’ USED FOR THIS STUDY

There is no comprehensive and current list or map of informal settlements within Honiara municipal area or the Greater Honiara area.

This study has collated disparate information and lists naming informal settlements into a single list, in an attempt to provide an insight to the scale of the number of settlements.

These sources of named informal settlements includes:

- 36 ISZs (with GIS location) named by MLHS ISZs – all within Honiara town boundary (MLHS, 2015)
- 80 vulnerable urban communities (with GIS location), identified by the CAUSE Program (World Bank, HCC, 2018) (which targets households living below the Basic Needs Poverty Line) – all within Honiara town boundary
- Several individual settlements named in various studies/reports or names by local stakeholders, most within Honiara town boundary but some located outside the town boundary in Greater Honiara Area.

The process to consolidate these lists involved geographically locating each named settlement, using GIS, to identify a single list of distinct settlements.

There are no distinct boundaries identified for settlements – they have been identified by a point location representing ‘some’ households that have identified themselves as an informal settlement. Many settlements are known by multiple names, in different sources of information.

This process resulted in a **list of 92 informal settlements being identified.**

However, it is important to note that this list of 92 informal settlements has not been ground-truthed – their names have not been validated, and their boundaries are not known. Based on the closeness of some settlements, as determined through the GIS, it is likely that many settlements identified as distinct may in fact represent several contiguous ‘settlements’. These contiguous settlements have not been combined for this study – the fact that residents of these settlements have identified themselves as being distinct (such as through the CAUSE program), indicates they may in effect represent distinct communities (socially-linked groups of people). This study is interested in several community-scale water and sanitation service delivery models and as such as, the identification of distinct communities is useful.

FIGURE 10: INFORMAL SETTLEMENT ZONES (ISZs) OF HONIARA (MLHS IN UNHABITAT 2016)

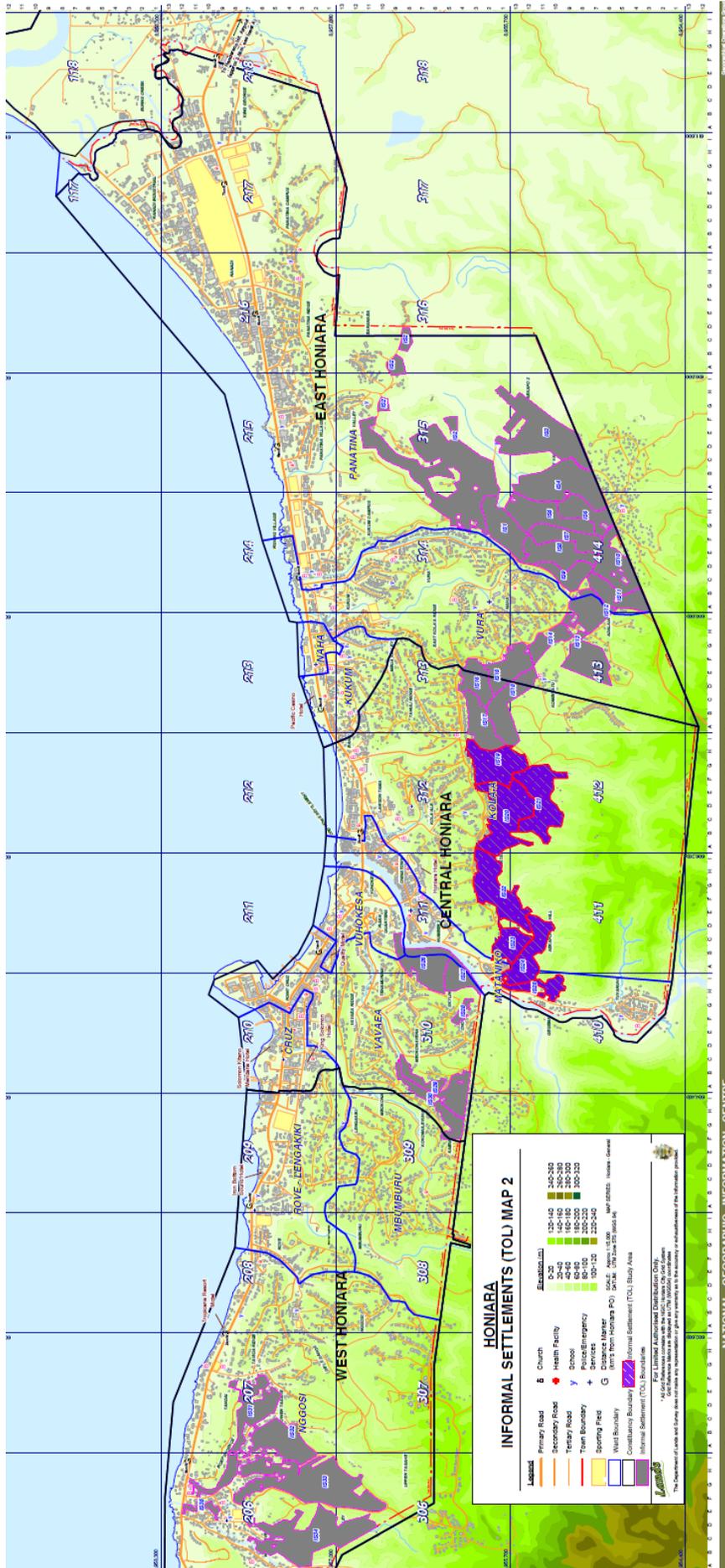


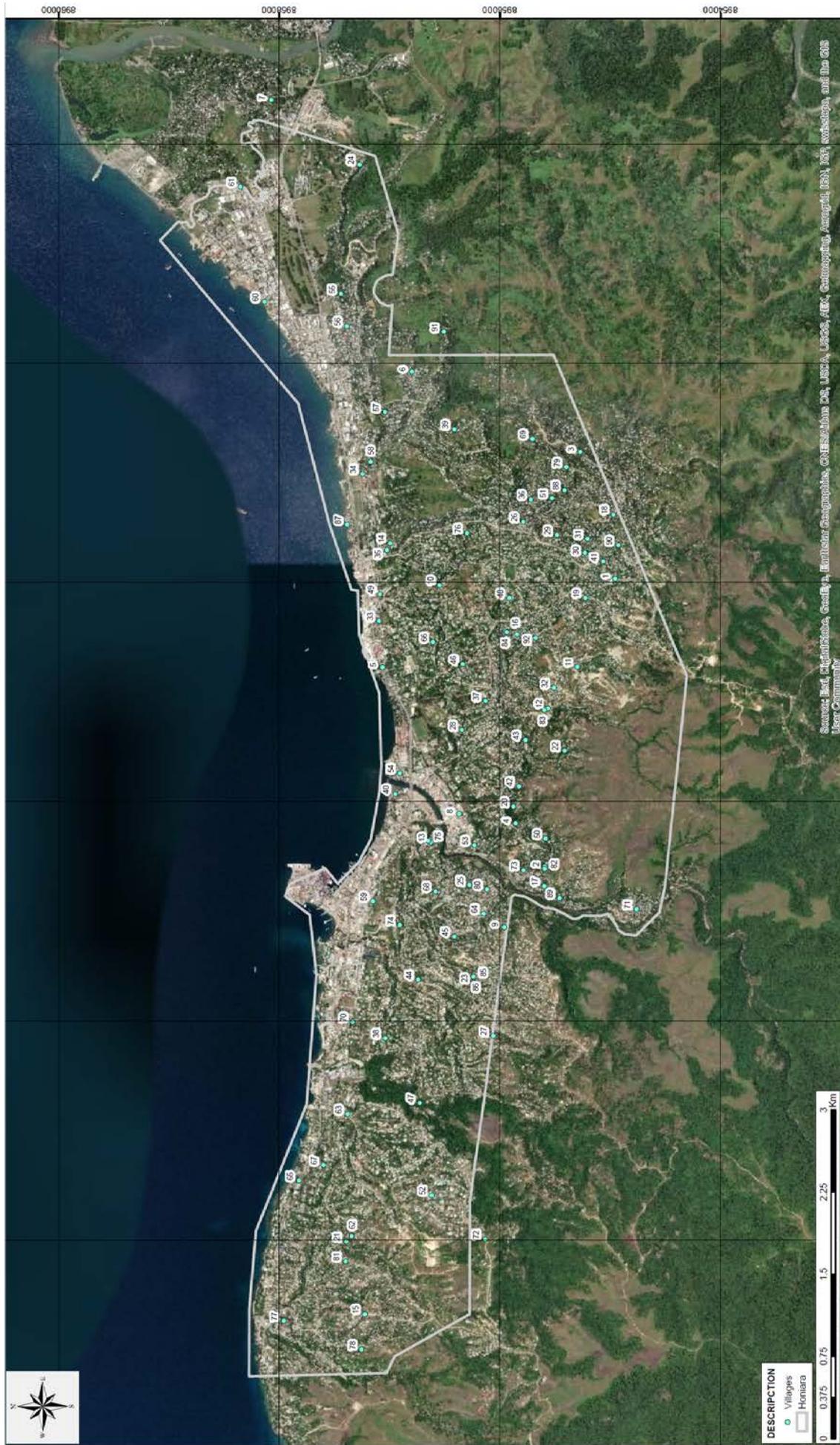
TABLE 1: LIST OF 92 INFORMAL SETTLEMENTS IDENTIFIED IN THIS STUDY, WITH OTHER KNOWN NAMES FOR SOME SETTLEMENTS (CAUSE: WORLD BANK, 208; UNH: UNHABITAT 2016;

#	Name (consolidated working name)	Ward	Community name CAUSE	MLHS (ISZ) name	MLHS ISZ no.	Other names
1	Adaliua	Vura	Adaliua	Adeliua	12	
2	Aekafo	Kola'a	Aekafo/Cana Hill	Aekafo	23 (labelled 24 on ISZ map)	Aekafo (Zone 24; UNH)
3	Aekafo 2	Panatina	Aekafo 2	Gilbert Aekafo	3	
4	Antioch	Kola'a	Antioch	Namoliki / Gaimaoa	22	
5	Bahai	Kukum	Bahai	n/a	n/a	
6	Baranaba	Panatina	Baranaba	n/a	n/a	
7	Burns Creek	Panatina	Burns Creek	n/a	n/a	
8	Chinatown	Mataniko	Chinatown	n/a	n/a	
9	Choviri	Vavaea	Choviri	none (outside IS Choviri)	n/a	
10	East Kola Ridge	Vura	East Kola Ridge	East Kola Ridge	36 (not on ISZ map)	
11	Ferakusia	Kola'a	Ferakusia		n/a	
12	Feraladoa	Kola'a	Feraladoa	Feraladoa (Talise Market side)	19	Feraladoa (Zone 19, Aefako Planning Area)
13	Fijian Quarter	Vuhokesa	Fijian Quarter	n/a	n/a	
14	Fishing Village	Naha	Fishing Village	n/a	n/a	
15	Forest Valley	Ngossi	Lower Tasahe	Forest Valley	33	
16	Fulisango	Kola'a	Fulisango	Fulisango	16	
17	Gegema	Mataniko	Gegema	Gegema	17	
18	Gilbert Camp	Panatina	Gilbert Camp	Kwaio Valley / Gilbert Camp	5 (6 on map)	
19	Green Valley	Vura	Green Valley	Green Valley area	14	
20	Gwaimaoa	Kola'a	Gwaimaoa	Namoliki / Gaimaoa	22	Gwaomaoa (Zone 22, Aefako Planning Area; UNH)
21	Independence Valley	Ngossi	Independence Valley	Independence Valley	31	
22	Jericho	Kola'a	Jericho	Jericho / Matariu	21	
23	Kaibia (West)	Vavaea	Kaibia	Kaibia (West)	30	
24	King George	Panatina	King George	n/a	n/a	
25	Koa Hill	Vavaea	Koa Hill	Koa Hill (Fiji Quarters down)	26	
26	Kofiloko	Panatina	Kofiloko	Kofiloko	1	
27	Kokomulevuha	Mbumburu	Kokomulevuha	n/a (just west of IZ30, maybe outside townboundary)	n/a	
28	Kola'ale	Kola'a	Kola'ale	n/a	n/a	
29	Kombito 1	Panatina	Kombito 1	Kombito 1	7 (CAUSE location within zone 8 on ISZ map)	
30	Kombito 2	Panatina	Kombito 2	Kombito 2	8 (CAUSE location within zone 9 on ISZ map)	

31	Kombito 3	Panatina	Kombito 3	Kombito 3, 4 & 5	9 (CAUSE location within zone 8 on ISZ map)
32	Kombivatu	Kola'a	Kombivatu	n/a	n/a
33	Kukum	Kukum	Kukum	n/a	n/a
34	Kukum Campus	Panatina	Kukum Campus	n/a	n/a
35	Kukum Community	Vura	Kukum Community	n/a	n/a
36	Lau Valley	Panatina	Lau Valley	New Valley / Kombito 1	6 (CAUSE located in zone 5 on ISZ map)
37	Lawson Tama	Kola'a	Lawson Tama	n/a	n/a
38	Lengakiki	Rove/Lengakiki	Lengakiki	n/a	n/a
39	Lio Creek	Panatina	Jackson Ridge	Lio Creek	2
40	Mamanawata	Vuhokesa	Mamanawata Settlement	n/a	n/a RenLau (SIWA)
41	Mamulele	Panatina	Mamulele	Mamulele	11
42	Matafali	Kola'a	Matafali	Ferasukia / Matavale	20
43	Matariu	Kola'a	Matariu	Jericho / Matariu	21 Matariu (Zone 20, Aefako Planning Area, UNH)
44	Mbokona	Mbumburu	Mbokona	n/a	n/a
45	Mbokonavera	Vavaea	Mbokonavera	n/a	n/a
46	Mbua Valley	Kola'a	Mbua Valley	n/a	n/a
47	Mbumburu	Mbumburu	Mbumburu	n/a	n/a
48	Naha	Naha	Naha	n/a	n/a
49	Naha Community	Vura	Naha Community	n/a	n/a
50	Namoliki	Kola'a	Namoliki	Namoliki / Gaimaoa	22 Namoliki (Zone 23, Aefako Planning Area; UNH)
51	New Valley	Panatina	New Valley	New Valley / Kombito 1	6 (labelled 5 on ISZ map)
52	Ngossi	Ngossi	Ngossi	n/a	n/a
53	Number 3	Mataniko	Number 3	n/a	n/a
54	Ontong Java / Lord Howe	Mataniko	Lord Howe Settlement	n/a	n/a
55	Panatina Campus	Panatina	Panatina Campus	n/a	n/a
56	Panatina Ridge	Panatina	Panatina Ridge	n/a	n/a
57	Panatina Valley	Panatina	Panatina Valley	n/a	n/a
58	Panatina Village	Panatina	Panatina Village	n/a	n/a
59	Point Cruz	Cruz	Point Cruz	n/a	n/a
60	Ranadi	Panatina	Ranadi	n/a	n/a
61	Ranadi Industrial	Panatina	Ranadi Industrial	n/a	n/a
62	Rifle Range	Ngossi	Rifle Range	n/a	31 (CAUSE located just outside boundary ISZ map)
63	Rove	Rove/Lengakiki	Rove	n/a	n/a
64	Skyline	Vavaea	Skyline	Choviri	28
65	Tandai	Ngossi	Tandai	n/a	n/a

66	Tanuli Ridge	Kola'a	Tanuli Ridge	n/a	n/a
67	Tavioa Ridge	Ngossi	Tavioa Ridge	n/a	n/a
68	Tehamurina	Vavaea	Tehamurina	n/a	n/a
69	Tolo	Panatina	Tolo	Gilbert Aekafo	3
70	Town Ground	Rove/Lengakiki	Town Ground	n/a	n/a
71	Tuvaruhu	Mataniko	Tuvaruhu	n/a	n/a
72	Upper Tasahe	Ngossi	Upper Tasahe	n/a	n/a
73	Vara Creek	Mataniko	Vara Creek	Vara Creek	24 (CAUSE location may be in 23 on ISZ map)
74	Vavaea Ridge	Vavaea	Vavaea Ridge	n/a	n/a
75	Vuhokesa	Vuhokesa	Vuhokesa	n/a	n/a
76	Vura	Vura	Vura	n/a	n/a
77	White River	Ngossi	White River	White River (02 bus stop)	35
78	Wind Valley	Ngossi	Wind Valley	Wind Valley	34
79	Windy Valley	Panatina	Windy Valley	Gilbert Aekafo	3
80	Koa Hill (US Memorial down)	Vavaea	Koa Hill	Koa Hill (US Memorial down)	27
81	Banana Valley		n/a	Banana Valley	32
82	Cana Hill		Aekafo/Cana Hill	Aekafo	23 (labelled 24 on ISZ map) Cana Hill (Zone 25, UNH)
83	Feraladoa (Pakoe Lodge side)	Kola'a	n/a	Feraladoa (Pakoe Lodge side)	18 Feraladoa (Zone 19, Aefako Planning Area; UNH)
84	Green Valley (SIWA)		Green Valley	Green Valley (SIWA area)	13
85	Kaibia (East)		Kaibia	Kaibia (East)	29
86	Kaibia Heights		Kaibia	Kaibia Heights	listed but not numbered (ref to zones 29/30)
87	Kukum Fishing Village		n/a	n/a	n/a Kukum Fishing Village, UNH
88	Kwaio Valley		n/a	Kwaio Valley	4
89	Marble Street		n/a	Marble Street	25
90	Master Liu		n/a	Master Liu	10
91	Ohiola	GCNL province	n/a	n/a	n/a
92	Zion		n/a	Zion	15

FIGURE 11. LOCATION OF 92 INFORMAL SETTLEMENTS, WITHIN HONIARA TOWN BOUNDARY, AND SOME IN GREATER HONIARA



4.4 HONIARA INFORMAL SETTLER POPULATION ESTIMATES

The total urban population of Honiara is well-described in UNHabitat (2016); an extract is included here.

The 2009 Census showed that Solomon Islands had an urban population of 102,030 – representing 19.7% of the total national population. The Greater Honiara area (comprised of the 12 wards within the Honiara town boundary and the contiguous wards of Tandai and Malango in Guadalcanal Province) represented close to 80% of the total urban population in 2009. Across 1999–2009 annual urban growth was high at 4% per annum (compared to national population growth of 2.3% per annum) – representing a doubling time of 15 years.

From a population of less than 20,000 at Independence in 1978 Honiara has grown rapidly – particularly since the country’s recovery from the ethnic conflict period in the late 1990s/early 2000s. Honiara’s municipal population was estimated to be about 87,000 in 2015 – and with the peri-urban populations of Tandai and Malango wards added the **urban population of the Greater Honiara area is now likely to be over 100,000 people.**

The informal settler population is not accurately represented in the existing population data, but the following estimates were found (UNHabitat 2016):

2015 population estimates: 3567 household in the identified Informal Settlement Zones without FTE land tenure, ~400 households with FTE, and ~400 HH outside ISZs This gives an estimate of 4,370 households, or (assuming ~ 7 people per household) around 30,000 people. **This represents around 30% of Honiara’s population.**

This quote by Evans (2016) in UNHabitat describes the difficulty in determining an accurate number of informal settlers:

“[d]etermining the number of people residing within settlements – both within Honiara and outside – as well as their ethnic composition is now a highly problematic task. This is due to the definitional problem[s]..., the fluidity of the population, the rapid growth of these areas, and poor and irregular data collection. Population figures that have been suggested are not based on any discernible methodology with dated figures being recycled.” (Evans, 2016 in UNHabitat 2016)

The population size of individual settlements is not known, but is observed to vary significantly. Combining the CAUSE (2017) survey of self-reported settlement populations with mentions of population estimates of specific settlements in various sources, Table 2 provides an estimate of the population size of the 92 settlements included in this study.

TABLE 2: ESTIMATED POPULATION SIZE OF THE 92 SETTLEMENTS OF THIS STUDY

Estimated population size range	No. settlements
Less than 100 (<15 households)	1
100-299 (15-42 households)	12
300 and greater (>42 households)	68
Unknown	11

A more detailed and accurate indication of the size of individual settlements would prove helpful for planning purposes. Analysis of the 2019 Census data, using GIS of informal settlements, could provide such data.

Urban migration is continuing and because of the strong pull for new arrivals to settle near their kinship groups, some settlements are likely to experience continued growth, despite very high density. New urban arrivals typically rely on kin for housing and subsistence (CAUSE, 2017), while they are temporarily in Honiara before returning the rural homes, or

temporarily until they establish their own residence. Typically new residences are located close to those of kin, where wantok systems can more easily continue to provide a social safety net (CAUSE, 2017). However the lack of regulation on land use activities and placement of structures leads to disorganized development and in some cases serious conflicts within settlements (CAUSE, 2017).

Settlement size is important not only to estimate demand and market size for services, and cost-effectiveness of different options, but also because it is probably correlated with ethnic and religious diversity (with larger settlements comprising more diversity). Higher social and cultural diversity may indicate that social cohesion is stronger at the level of these social groups rather than the whole settlement; this should inform engagement strategies with larger settlements.

Household size

The CAUSE (2017) reported an average household size of 6.5 for households it surveyed in Honiara.

The EGIS survey of informal settlements in Honiara reported a range of household sizes from 5.6 to 9.2, with an average of 7.7 (Table 3).

TABLE 3: HOUSEHOLD SIZE OF SOME INFORMAL SETTLEMENTS (EGIS, 2018).

Settlement	Av No Persons per HH
Burns Creek	9.2
Ohiola	5.6
Lau Valley	6.5
Fulisango	6.6
RenLau	6.7
Lord Howe Settlement	8.6
Average Across Survey Area	7.7

4.5 ENGAGING WITH INFORMAL SETTLEMENTS - COMMUNITIES AND LEADERSHIP

The processes of community engagement usually entail seeking discussions and sometime collective action amongst a group of ‘connected’ people. This purpose is more achievable when the ‘community’ has existing social cohesion. Social is usually taken to mean the willingness of members of a society to cooperate with each other in order to survive and prosper, and is beneficial to a wide variety of social outcomes such as health and economic prosperity.

A community is a group of people (often in the same location), socially-networked and connected via a common characteristic (such as those listed below) with commonalities, usually following some shared rules (formal, informal). Communities are not necessarily, and often rarely, defined only by their sharing a geographic location.

In Solomon Islands, formal leadership is often associated with communities, or social groupings, including:

- Kinship and ethnic networks (within and between settlements)
- Faith-based / church groups
- Formal government: Ward Committees

It is therefore important to recognise that a settlement, particularly larger settlements, are not comprised of a single, socially-cohesive community. Community engagement is therefore likely to be more effective at the level of communities within a settlement, and potentially amongst several types of communities within a settlement.

The CAUSE (2017) Situation analysis of informal settlements describes that: “the social fabric of communities can be complex and loyalties can change depending on the context and situation”. Their consultations with ‘communities’ indicated a preference that there be active and appropriate community liaison officers to ensure that proper consultation occurs.

All of the above types of communities have been utilised effectively for community engagement within settlements in Honiara, e.g. development projects (WASH - Live and Learn & World Vision), rehousing during disaster response (e.g. April 2014 floods; UNHabitat 2016).

4.6 WATER SUPPLIES

Access and sources used

In 2018 UNICEF commissioned a survey to identify broadscale access to WASH in the urban areas of Solomon Islands (UNICEF and UNC, 2018), however at this stage it is difficult to extract access data specifically for informal settlers.

An indication of the current types of water supplies being used by informal settlers in Honiara, and the proportion of populations using them, exist in a small number of case study surveys (Tables 4 and 5). Better estimates of connections to Solomon Water could be determined using GIS, overlaying informal settlement areas with the geographically-located connection data.

Use of Solomon Water varies widely between individual settlements – this is more likely to reflect current perceptions on eligibility for connections and difficulty in accessing connections, rather than indicating a low demand for connections.

These surveys indicate a large range of sources beyond Solomon Water. Local water resources, such as springs and shallow groundwater are heavily used in some settlements. Given the low rates of access to safe sanitation, there is significant risk of these sources being contaminated with faecal-oral pathogens, causing chronic and acute illnesses.

TABLE 4: ESTIMATES OF WATER SERVICES BEING USED IN SOME INFORMAL SETTLEMENTS OF HONIARA (LIVE AND LEARN, 2015).

Primary Drinking water source	C1 (Henderson)	C2 (Namoliki)
Access to piped water (HH, neighbour or shared)	6%	25%
Local groundwater (Springs, bores, wells)	63%	71%
RW tanks, containers, drums		2%
Tanker truck/cart	10%	1%
Bottles	10%	0%
Surface sources	1%	0%

TABLE 5: ESTIMATES OF WATER SERVICES BEING USED IN SOME INFORMAL SETTLEMENTS OF HONIARA (EGIS, 2018)

Table 5: Overview of Primary Water Sources in Surveyed Areas of Honiara

	Burns Creek	Fulisango	Ohiola	Ren Lau	Lord Howe	Lau Valley
No HH Respondents	113	69	16	59	53	64
Source of Primary Water Supply (% of HHs Surveyed)						
SW Piped Water Supply	1%	83%	88%	80%	94%	80%
Public Tank or Tap	6%	10%	6%	2%	4%	-
Neighbor	-	1%	-	-	-	-
Private Bore Hole	85%	6%	6%	12%	2%	5%
River	-	-	-	2%	-	-
Spring	2%	-	-	-	-	0%
Rainwater	2%	-	-	5%	-	13%
Water Vendor	-	-	-	-	-	-
Other	4%	-	-	-	-	3%

Water quality

Only one report of a small number of tests of microbiological quality of drinking water sources used in these settlements is known (Table 6), and indicate that many of the local resources used for drinking contained unsafe levels of E.Coli.

TABLE 6: E. COLI LEVELS OF WATER SOURCES FROM TWO INFORMAL SETTLEMENTS (UNPUBLISHED, SOUTER, IWC). TNTC: TOO NUMEROUS TO COUNT

Settlement	Source type & access	Thermotolerant Coliforms (CFU / 100ml)	Year tested
Henderson	Groundwater (~6m), via Hand bore pump	TNTC	2017
	Shallow groundwater, via well (manual)	TNTC	2017
	Shallow groundwater, via well (manual)	TNTC	2017
	Groundwater, via Hand bore pump, depth unknown	0	2018
	Shallow groundwater, via well (manual)	158	2018
	Shallow groundwater, via well (manual)	TNTC	2018
Namoliki	Spring, via sealed and protected Spring box with pipe	500	2017
	Spring, via Spring box with pipe	TNTC	2017
	Spring, via open channel	1450	2017
	Surface spring (uphill)	28.5	2018
	Surface spring (uphill)	0	2018
	Surface spring (bottom of hill)	68	2018
	Surface Spring	160	2019
	Spring Box	70	2019
	Spring	12	2019
	Spring Box	0	2019
	Spring	15	2019
	Spring (bottom of the hill)	270	2019

Shared HH connections in informal settlements in Honiara

The sharing of private household water connections is an existing widespread practice in informal settlements in Honiara, as well as elsewhere in Melanesia. From two to ten or more households (often in a kin-related hamlet) can share a single connection – this is not public tapstand but a connection registered to a single household, who has elected to share their connection. This is usually shared/accessed via an outside tap.

The financial arrangements for shared taps varies between households:

- Connection fee shared or paid by connection-owner
- Monthly service fee shared or paid by connection-owner
- Usage fees per connection can be higher than non-sharing connections, because total water volume used can be high enough to elevate to second or third tier or pricing structures

Tension and conflicts between sharers is a common occurrence (globally, and Honiara), usually in relation to perceived fairness of payment calculations, or non-payment. The consequences of not paying an expected contribution to a water bill also varies, including disconnection by the utility (no service for several households), some households being excluded by the connection owner, or the paying households left to “subsidise” the non-paying (when both can be low income households, and greater further inequalities in access).

4.7 SANITATION PRACTICES

As for water, there are no city-wide estimates of access to, or use of different types of sanitation options; case studies can provide an insight to sanitation situations.

All settlements are reliant upon onsite sanitation, with very low probability that these have safe faecal sludge/waste management (Table 7, Figure 12). Rates of open defecation vary significantly between settlements, but is high in at least some settlements, including some in dense urban settings utilizing local shallow groundwater for drinking.

TABLE 7: SANITATION ACCESS IN TWO INFORMAL SETTLEMENTS OF HONIARA (UNPUBLISHED LIVE AND LEARN, 2015),

Sanitation and Hygiene (% HH)		
	Henderson	Namoliki
Population	3800	1200
Basic sanitation (%HH)	17%	16%
Safe sanitation?	3%	14%
Households have no toilet (sharing or OD)	49%	20%
Sharing their toilet (%HH)	22%	19%
HW location with soap	42%	22%

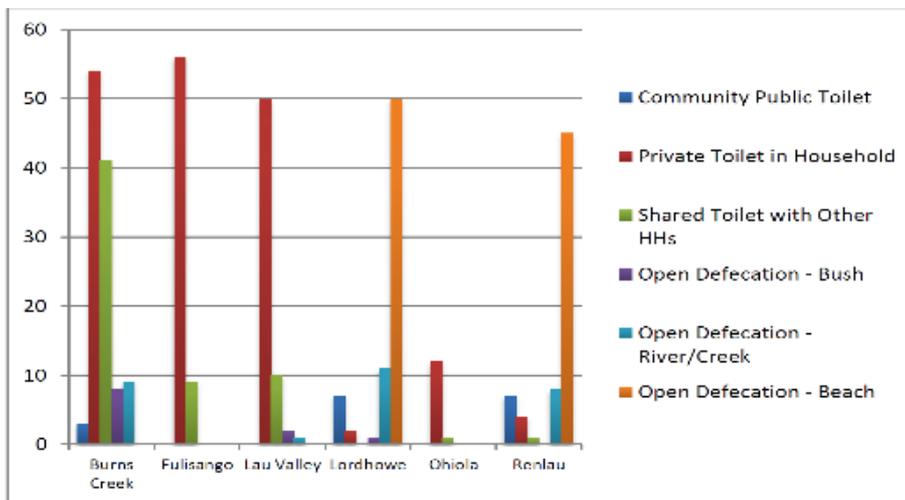


FIGURE 12: SANITATION PRACTICES OF RESIDENTS OF SIX INFORMAL SETTLEMENTS IN HONIARA (EGIS, 2018).

4.8 LAND TENURE

Most settlements inside Honiara City council area are on public land, with a small number on private land; in the Greater Honiara Area in Guadalcanal Province, most settlements are likely to be on customary land.

UNHabitat (2016) reported that the Solomon Islands Government (SIG) through the Ministry of Lands, Housing and Survey (MLHS) “has been slowly upgrading informal settlement zones through subdivision planning and offers of Fixed Term Estate (FTE) to current informal settlers. This work remains ongoing, and plans are in place for the majority of informal settlement zones within Honiara city. Importantly, upgrading is already underway, and SIG has effectively accepted the permanence of many current informal settlement areas. Evictions from informal settlement areas are not occurring.”

The formalisation process results in the MLHS providing permission for residents of the specified settlement to apply for a FTE – typically these apply to individual households, but in a small number of cases FTE’s cover a whole settlement and the grantee (applicant of the FTE) allows others to reside.

The formalisation process involves land surveying, allocating plots and offering FTEs usually of ~75 years and requiring a fee payment. The rate of uptake of FTE offers amongst residents of those settlements approved for formalisation appears to be variable, and may be limited by the fees and application process.

There is an interim measure available to residents who are awaiting for MLHS to determine whether their settlement is to be formalized – this is the of Temporary Occupancy Licenses to individual HH.

Keen et al. (2017) reported that many residents are unsure of their land tenure status.

Of the 92 settlements identified in this study, using GIS locations of settlements with MLHS map of informal settlement zones (2015) it was determined that the land tenure of most of them is unclear (Table 8, Figure 13).

TABLE 8: STATUS OF LAND TENURE OF THE 92 SETTLEMENTS OF THIS STUDY.

Settlement Land status	Total
Formalised	3
No formalisation to occur (MLHS)	3
No ISZ status	47
SIWA FTE	1
Undergoing formalisation	38
Total	92

Regarding housing tenure, the EGIS household survey (2018) of informal settlers indicated that most own their homes, with less than <10% renting; however only ~35% had houses constructed with permanent housing materials (EGIS, 2018).



FIGURE 13: LOCATION OF 92 INFORMAL SETTLEMENTS IDENTIFIED IN THIS STUDY (BLUE MARKERS), WITH MLHSH INFORMAL SETTLEMENT ZONES (GREEN SHADED AREAS)

4.9 SOCIO-ECONOMIC SITUATIONS

Household income data is only accessible for a small number of settlements, and from varying points in time (The 2019 Census may be able to provide more accurate data for informal settlers).

A Solomon Island-specific “basic needs poverty line” is specified as the minimum expenditures needed to obtain basic food and non-food goods taking into account prevailing consumption patterns in the country (SIG, 2012). The cost of basic needs is calculated separately for food and non-food goods. The cost of non-food basic needs is taken as the average non-food expenditure of those households whose spending on food is just equal to the food poverty line (calculated as the minimum amount of money required to secure a daily energy intake of 2200 calories per day given prevailing dietary patterns of the poorer groups in Solomon Islands). This cost of basic non-food goods also varies by location. All households whose expenditures fall below the basic needs poverty line are deemed to be poor. Honiara had an overall rate of poverty of 15% of the population (living below the poverty line) (SIG,

The basic needs poverty line for Honiara (2012), for food and non-food, was an annual income of approximately ~\$10,000 SBD adult; (or \$833/month) (SIG, 2012).

The range of estimates for households’ incomes are summarised here.

EGIS HHS (2018) (Table 9)

- Av. Monthly income: \$4100-5500/HH/month
- Av. Monthly expenses: \$3000-\$3,800
- 20-50% households below the Poverty line

Aekafo study area (2015 PSUP, in UNHabitat 2016)

- Average income: \$1294/month/HH; 80% HH with permanent income

Maebuta & Maebuta (2009): 4 settlements (White River, Lunga, Mamanawata, Kabia)

- 31% respondents’ main income was from full time job: average wage ~\$750/month
- 20% of respondents’ main income was from casual jobs

- 36% of respondents’ main income was from informal activities_(e.g. selling betel-nuts and cigarettes): average income: \$50/day = \$1500/month/HH

TABLE 9: AVERAGE DISPOSAL INCOME AND POTENTIAL TARIFFS FOR HOUSEHOLDS SURVEYED (EGIS, 2018)

Community	Average HH Income (SBD/month)	Average HH Expenses (SBD/month)	Average Disposable Income
Honiara			
Burns Creek	4,355	3,056	1,299
Fulisango	5,524	3,200	2,324
Lau Valley	4,956	3,877	1,079
Lordhowe	4,152	3,848	304
Ohiola	4,216	3,515	701
Renlau	4,936	3,277	1,659

4.10 WILLINGNESS TO PAY FOR WATER

The EGIS (2018) surveyed asked respondents about the amount of money they are willing to pay for water provided by Solomon Water. The results are highly variable between settlements. The lowest reported willingness to pay was reported for Burns Creek (Figure 14).

The ability to pay is further assessed in Chapter 5 (water service delivery models), but to provide a basic comparison, the monthly cost to provide 137L/person/day to a household of 8 members is approximately \$300 SBD (excluding the connection fee). **The percentage of households reporting they would be willing to pay more than \$250 SBD/ month varied from 20-55% households surveyed (Figure 14).**

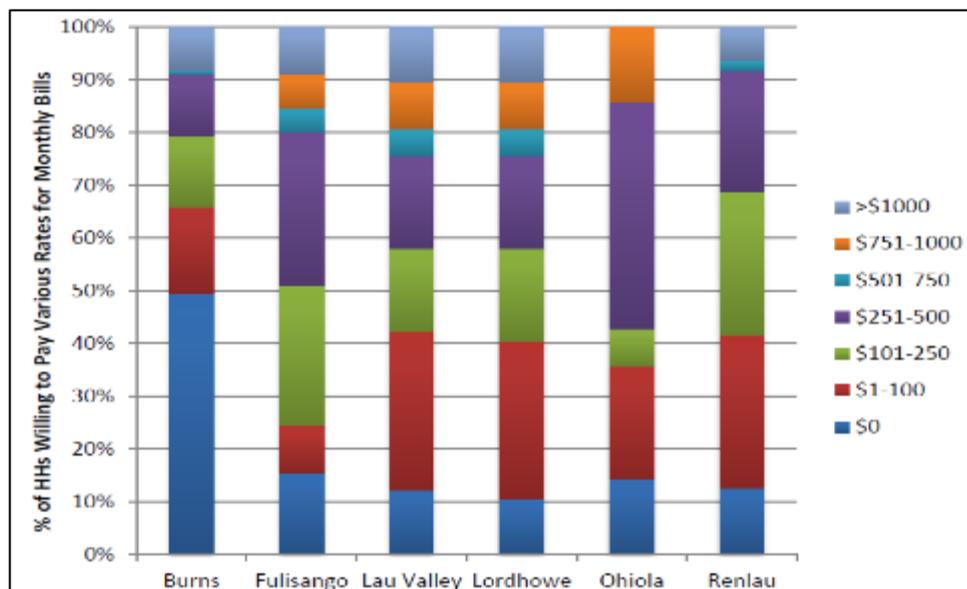


FIGURE 14: PERCENTAGE OF SURVEYED HOUSEHOLDS IN HONIARA’S INFORMAL SETTLEMENTS WILING TO PAY SPECIFIED MONTHLY FEES FOR WATER SUPPLY (EGIS, 2018).

An alternative indicator of the willingness to pay for new services is the amount that people currently pay for water (Heymans et al., 2014).

Approximately 45% of surveyed households (Across all 6 settlements surveyed) buy bottled water, with approximately 30% spending >\$300/month. This provides some validation to the reported willingness to pay amounts above (20-55% households willing to pay >\$250 SBD/ month).

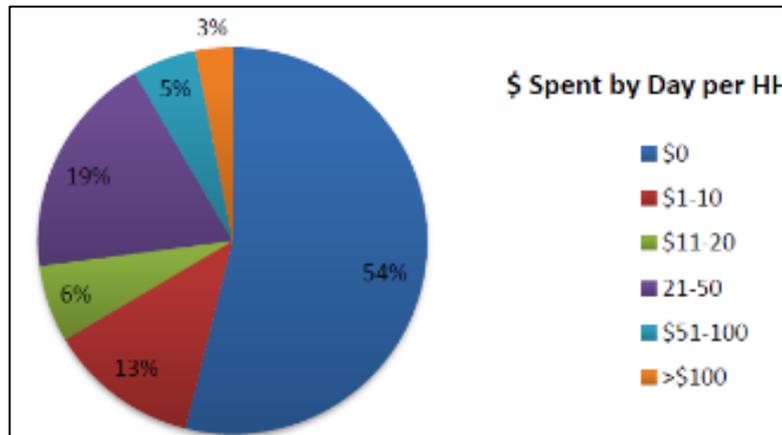


FIGURE 14: DAILY AMOUNT SPENT ON BOTTLED WATER PER HOUSEHOLD SURVEYED (EGIS, 2018).

4.11 ENVIRONMENTAL CONDITIONS

Environmental hazards

Generally, informal settlements occupy lands more prone to hazards (Reuben, 2013), and their growth is continuing. Reuben (2013) noted that:

- the area taken up by informal settlements on floodplains increased from 5 ha in 1984 to 131 ha in 2010, and the number of houses increased from 36 houses in 1984 to 834 houses in 2010
- the number of houses built on low-lying areas increased from 113 houses in 1984 to 1278 houses in 2010.
- the growth of informal settlements onto weak sediments (recently deposited sediments) areas also increased from 67 ha in 1984 to 806 ha in 2010, and the number of houses has increased from 427 houses in 1984 to 3462 houses in 2010.

This study aimed to provide a description of the range of environment conditions that exist in informal settlements, for those environmental variables that significantly influence water and sanitation services and options. (relating to water and sanitation service provision). These environmental conditions include:

- Vulnerability to flooding, which can damage water and sanitation infrastructure, as well as spread apthogens from on-site sanitation options that are not flood-resistant. Flooding can occur as riverine flooding (usually on river flood plains), coastal flooding (usually as storm surges into coastal settlements/areas)
- Vulnerability to landslips, which can cause similar effects to flooding

The number of the 92 settlements of this study that are vulnerable to these environmental hazards was estimated by overlaying their location with various environmental hazards maps. An example is shown in Figure 15, and the results are summarised in Table 10. These results are likely to significantly underestimate the number of settlements vulnerable to

these environmental hazards – the analysis was limited to the lack of accurate data for both environmental hazards and settlement boundaries.

TABLE 10: NUMBER OF INFORMAL SETTLEMENTS IDENTIFIED IN THIS STUDY THAT APPEAR TO BE LOCATED IN AREAS PRONE TO NATURAL ENVIRONMENTAL HAZARDS. NOTE THAT THE VULNERABILITY OF MANY SETTLEMENTS COULD NOT BE DETERMINED WITH THE DATA AVAILABLE.

Type of vulnerability	No. settlements
Riverine	8
Riverine, Coastal	3
Flat low-lying land	18
Flat low lying, Coastal	2
Landslip	1
<i>Uncertain</i>	60
Total	92

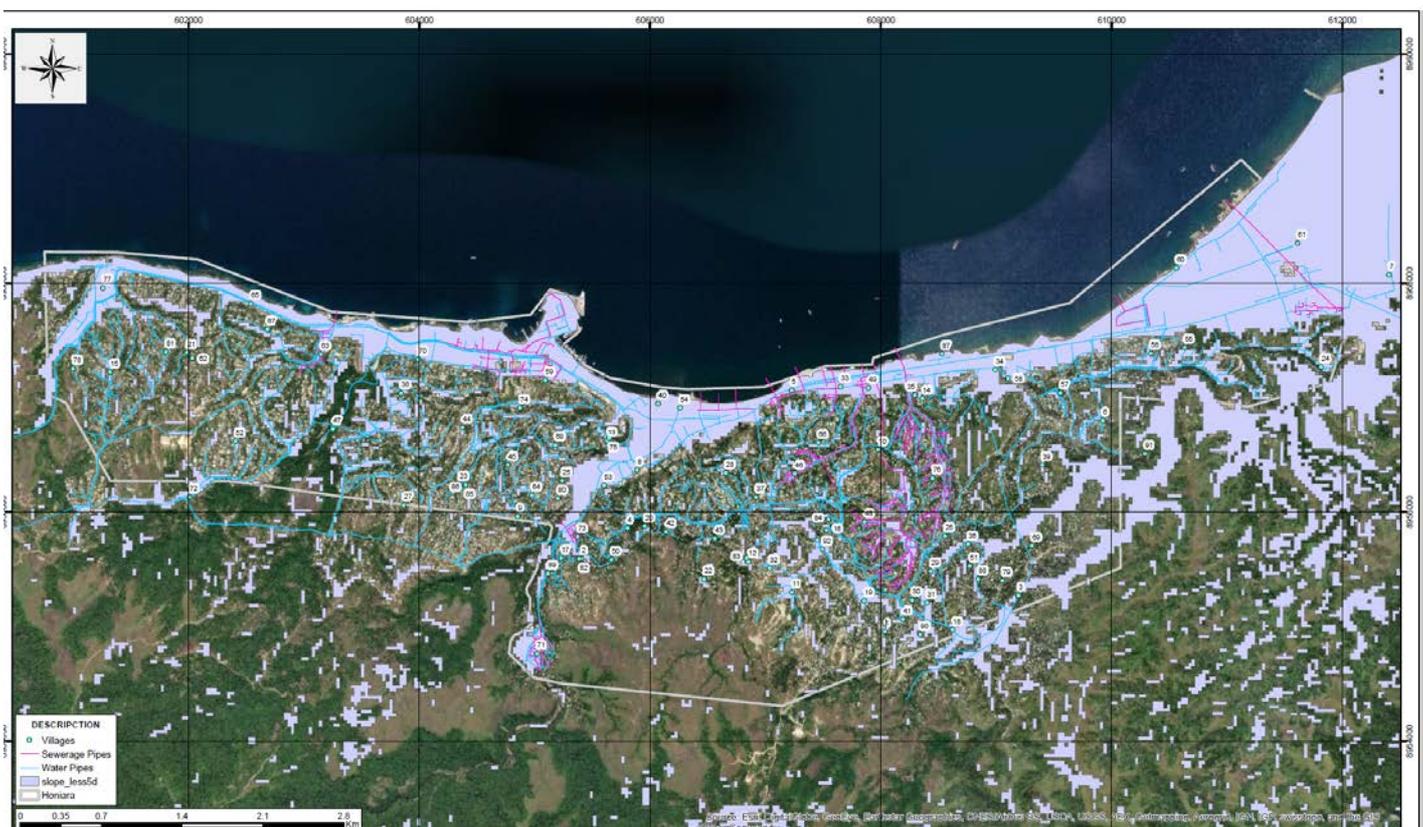


FIGURE 15: LOCATION OF SETTLEMENTS OVER-LAIN WITH LOW-LYING LAND (LESS THAN 5 DEGREES SLOPE – SOURCE SOLOMON WATER AND EGIS)

Groundwater

The average depth to groundwater in Honiara is not precisely known, but it is expected to vary across the topography. An assessment by JICA (2005) indicated groundwater was typically as shallow as 3 meters below the surface.

Shallow groundwater such as this presents two possible problems with regard to water and sanitation services:

- Difficulty with constructing and operating in-ground sanitation such as pit latrines
- Increasing the potential for contamination of local water resources from almost all onsite sanitation options

This study did not identify any settlement-specific data on depth to groundwater. The use of shallow groundwater sources as drinking water supplies was reported above and indicates the presence of shallow groundwater – as well as its use as a drinking source. The water quality test results reported earlier (Table 6) indicate that some shallow groundwater sources are not safe for drinking; this is likely to be related to their shallowness and vulnerability to contamination by unsafe sanitation.

4.12 ACCESS (ROAD, PEDESTRIAN)

The nature of accessibility to settlements, and houses within settlements has a significant impact on the feasibility of different water and sanitation options. In particular sanitation, as many options require storage of faecal waste at the household for later disposal onsite in safe areas (which are very limited in many settlements), or disposal offsite via transport.

As indicated by Rueben (2013), many settlements are located in top of ridgelines or on steep slopes. The CAUSE situation analysis summarised accessibility (Table 12)

TABLE 12: ACCESSIBILITY ROAD, PEDESTRIAN – OF SETTLEMENTS (DATA SOURCES FROM CAUSE, 2017).

Means of Access	No. settlements
All weather road	32
Rough road	43
Footpath	5
Unknown	12

4.13 DISTANCE TO SEWER AND WATER MAINS

The cost and feasibility of reticulated water and sewerage is influenced by the distance to the nearest (existing) mains, and the elevation of the settlement.

Integrating the location of informal settlements with the location of Solomon Water’s assets has provided useful insights to the distance of settlements to the nearest water and sewer mains (Figure 16). These distances are summarised in Table 13.



FIGURE 16: INTEGRATION OF SEWER AND WATER MAINS ASSETS, WITH LOCATION OF 92 INFORMAL SETTLEMENTS.

TABLE 13: SUMMARY OF DISTANCES OF SETTLEMENTS TO WATER MAINS AND SEWER MAINS.

Distance from sewer main	No. settlements
0-50 m	10
50-100 m	4
100-500 m	38
500-1000 m	32
>1000 m	8
Distance from water main	No. settlements
0-15 m	35
15-50 m	36
50-100 m	12
100-500 m	9

5 SERVICE DELIVERY OPTIONS

5.1 SHORTLISTING WATER AND SANITATION SERVICE DELIVERY OPTIONS

Appendices 9.1 and 9.2 shows the full list water and sanitation service delivery models (respectively) that were considered for suitability to informal settlements in Honiara.

Following initial consultations with Solomon Water this list was shortened, with a small number of service delivery or technology options excluded because of obvious lack of suitability or feasibility. The options that remained, and were progressed for further assessment (desktop and consultative) were as follows

Water Service Delivery Models

- Household and shared household connection
 - Household / Piped water
 - Share household / Piped water
- Water kiosks
 - Piped
 - Trucked
 - Borehole
- Water ATMs and Token taps
 - Piped
 - Trucked
 - Borehole

Sanitation Service Delivery Models

- Simplified sewer pipes (to mains sewers)
- Simplified sewer pipes to Packaged wastewater treatment
- Septic/ABR systems (household, or shared, including Simplified sewer pipes to community septic, with optional solids-free piping of effluent to sewer mains)
- Pour flush latrines (household, shared)
- Ventilated improved pit (VIP) latrines (household, shared)
- Composting toilets (household, shared)
- Biogas system (household, shared)

A review of the key features of the remaining options was undertaken, describing different aspects of the water or sanitation service chain for each service delivery option. The type of information reviewed included:

- Technologies (infrastructure and hardware)
- Environmental and physical considerations
- Key Operational tasks
- Key Maintenance tasks
- Service providers, and roles of other actors including consumers and community
- Cost rating
- Regulatory considerations
- Social considerations
- Service standards achievable
- Health and wellbeing considerations

A range of resources were drawn on to generate these summaries of water and sanitation service options.

For water service delivery models, a large number of case study reports were drawn from, however three key resources included:

- WSUP 2014. "The Urban Water Supply Guide Service delivery options for low-income communities"
- World Bank 2014. "Limits and Possibilities of Prepaid Water in Urban Africa: Lessons from the Field". Chris Heymans, Kathy Eales and Richard Franceys
- World Bank. 2017. "Sustainability Assessment of Rural Water Service Delivery Models: Findings of a Multi-Country Review." World Bank, Washington, DC.

In the case of sanitation, the key resource used was:

- Tilley, E., Ulrich, L., Lüthi, C., Reymond, Ph. and Zurbrügg, C., 2014. “Compendium of Sanitation Systems and Technologies”. 2nd Revised Edition. Swiss Federal Institute of Aquatic Science and Technology (Eawag).

This review formed the basis of consultations with Solomon Water, and with informal settlers. This process was designed to further shortlist appropriate options for further review and consideration by Solomon Water and as the basis for consultations with informal settlers.

Feedback gained during these consultations is included in Appendix 9.3 (Solomon Water, and Appendix 9.4 (informal settlers).

Consultations with informal settlers

Eleven focus Group Discussions were completed (5 with men only, 5 with women only, 1 with men and women) across 6 different locations in 5 different settlements. The six locations were:

- Burns Creek (riverside) – no SW connections
- Burns creek (middle)– no SW connections
- Fulisango – most/all have SW connections
- Ohiola most/all have SW connections
- RenLau some/most have SW connections
- Namoliki – some/few SW connections

The notes from each group discussion are included in appendix 9.4. Any differences between groups are noted.

CURRENT EXPERIENCES ACCESSING WATER (How do people get water to use for drinking? What do they think about it?)

Settlements with no SW connections (1)

- Shallow hand dug wells (not boiled – concern about safety was raised)
- River for swimming and washing
- Buy bottled water
- Not happy with this situation, but don’t feel have other options

Settlements with some/few SW connections (2)

- SW – some “shared” taps (can be a single owner and payer but others use)
- Many use spring water, some use an old bore, few tanks (some think SW causes diarrhea) but also concerned about safety of spring water

Settlements with widespread SW connections: (2)

- drinking from SW connections (CashWater) – typically 1 HH connection is shared amongst few HH or shared tapstands
- Some rain tanks (for drinking)
- Some with wells – used for everything when SW disrupted
- Creeks for washing, swimming, and toilets
- Seawater for bathing in some coastal settlements

Attitudes about SW connection by those that have them

- Happy to have “proper” water

- Overcrowding at shared tap stands e.g. some have to collect water at 9 pm to 12 midnight when the tap is free
- Large bills, from shared connections can be difficult to manage – difficulty splitting amongst users, difficulty raising large sums, accumulating interest on bills increases payment required

DISCUSSION ON OTHER WAYS SOLOMON WATER COULD USE TO GIVE ACCESS TO WATER FOR PEOPLE IN SETTLEMENTS.

This section aimed to discuss four alternatives to water access provision: **(1) water kiosks, (2) automated taps / water ATMs, (3) private household connection** and **(4) shared household connection**. Community members were asked if they thought these alternatives (i) were a good thing, if they saw any (ii) problems with such alternatives, and (iii) how to make these alternatives work. In the case of water kiosks, an additional discussion point was put forward to community participants: who do you think should run the water kiosk? SIWA? or someone from the community? A business operator?

In addition to the open discussion, some FGDs conducted a voting activity, during which individual residents present during the discussion voted for their preferred water service delivery modelled. These results are summarized in the graph below.

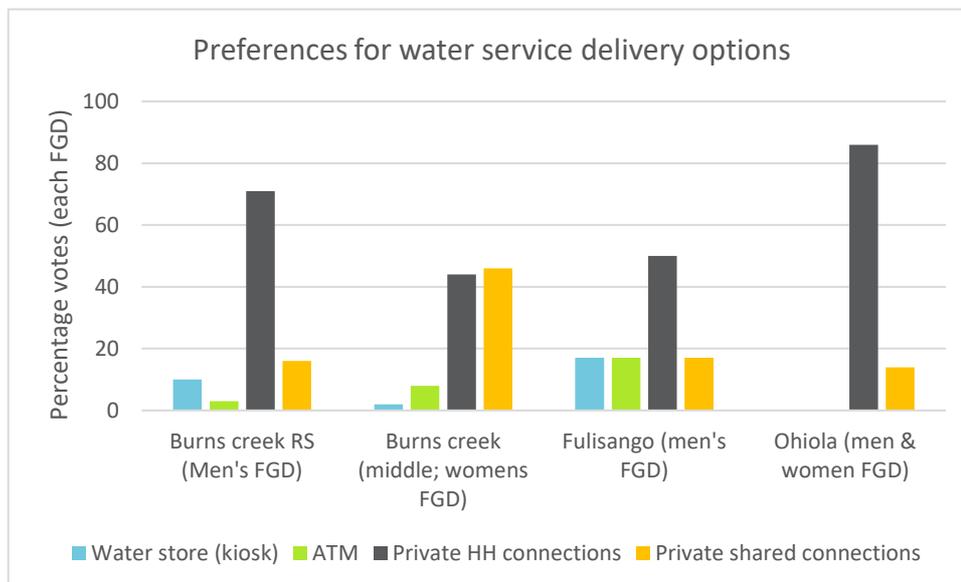


FIGURE 17: PREFERENCES OF RESIDENTS OF INFORMAL SETTLEMENTS FOR 4 DIFFERENT WATER SERVICE DELIVERY OPTIONS (DETERMINED THROUGH INDIVIDUAL VOTING).

GROUP DISCUSSION SUMMARIES

WATER KIOSKS/STORES:

- In settlements with no SW connections residents responded water stores would be beneficial (though not as preferred as HH connections). In settlements with many SW connections, some settlements had the attitude water stores would be useful for those without HH connections and could work, while other settlements had the view they would not be successful.
- There were different perspectives on whether the store should be operated and o/or owned by a resident of the settlement, or by Solomon Water (and these opinions were not aligned with existing access to SW connections, or gender, or other settlement characteristics).

- Note, some residents have interpreted this option as to be similar to buying 1L bottles of water, perhaps due to the lack of familiarity with large water containers seems.

The positive attitudes about water stores/kiosks included:

- It will help those who have no water access
- Opportunity for local employment/business
- People can buy water at any time when is needed
- Each person/family can spend only as much as they want on water
- People will be more cautious in their water use (because of cost)
- Reduce frustration when water is cut-off at HH connections (can go to store for water)
- Doesn't require technology such as ATM cards or tokens
- Freshness of non-bottled water
- Accessible by children
- Avoids the disputes between family and friends relating to sharing bills or unequal water use (for shared connections)
- Some like water store because users will be cautious about that water since water is life and it cost them money.

A range of challenges or concerns were raised by residents, including:

- security of the store and personnel (due to "lack of respect" for operators and infrastructure, and "drunken youths, men and public")
- carrying water is hard work and can be especially difficult for some people
- can't access water when store is closed (e.g. Sundays, at night)
- price should not be high compared with bottled water sold in the shops (current assumption of residents is that it would be as high or higher than \$5/L bottle), and some believe it must be cheaper than a Cash Water connection
- Operators need to be carefully selected
- Good community engagement was requested prior to installing such a store, to ensure everyone understands how the store will operate - there was concern about the ability of some residents in some settlements to properly interpret and understand information and a need to ensure good communication and engagement about such a new concept

WATER ATMS

- limited support generally across settlements.
- The concerns and challenges raised included:
 - risk of damage to infrastructure, and suggestion to overcome this would require an operator to be present to protect it (note: this would then essentially be a store model)
 - unfamiliarity and lack of comfort with technology and concerns about it's lack of appropriateness for Solomon Islands
 - burden of carrying of water longer distances, and difficult to carry enough water for all household members and needs
 - concern about reliability

SHARED PRIVATE CONNECTION

- There was general support for this approach, and one settlement preferred it (women's FGD, Burn's creek, where there are currently no SW connections)
- Some of the positive attitudes included:
 - Sharing of maintenance tasks and water bills.
 - It establishes friendship among community members who use shared pipes.

- It teaches community members to be responsible for what the community owns.
- Some concerns and challenges raised included:
 - Arguments and dispute can happen amongst those sharing a connection.
 - Anyone can access to collect water when no one is around.
- Recommendation from residents that the sharing be between family members or small numbers of nearby houses, so there are not too many people with little social cohesion
- Advice and consultations about managing water use and bills was requested

PRIVATE HH CONNECTIONS

- in most settlement consultations, this was the preferred water service delivery model.
- Many positive attitudes were raised, including:
 - Water will cost less (than other options)
 - Householders can control the use of the water and therefore bills “If you use the water wisely your bill will be less, but if you mismanage your water you will meet the high water bill”
 - Privacy in using water could be achieved
 - living in a settlement “life is not easy” but private taps would make life easier
 - allows individuals to make their own decisions about whether to have a connection or not (rather than requiring community collective decisions)
 - no crowding or waiting at shared taps
- Some concerns, challenges raised:
 - Affordability and ability to pay bills (some may continue to prefer stream/spring water)
 - natural disasters damaging infrastructure
 - Good consultation should address land access issues, because there is a strong demand for water and residents would like a piped water solution

Generally – some settlements have no opinions on how other settlements access water how they could address problems – it is the responsibility of each settlement. Others do have opinions on settlements close by – holding the view they are ready for connections (no damage to infrastructure likely to occur)

SANITATION

WHAT DO YOU THINK ABOUT TOILETS THAT USE WATER COMPARED TO TOILETS THAT DON'T USE WATER?

Generally, most residents of all settlements believed that toilets that use water are better than those that don't, though some disadvantages of water-based toilets, and some advantages of dry-based toilets, were raised.

There was little familiarity with VIP toilets, but once explained, significant interest.

ATTITUDES ABOUT WATER-BASED TOILETS

Positive points raised:

- Easier to keep clean and hygienic
- Smell better
- Comfortable to use
- Not yucky to use
- Safe for kids
- Private
- No flies

Negative points raised:

- Water is expensive
- Water based can be harmful, at times it can cause the linkage to water streams and affects kids playing around the streams
- Difficult to construct on-site water-based toilets (e.g. septic) when water table is shallow

- Household (rather than shared) responsibility to maintain
- Easy to remove waste when septic is full just hire trucks to pump the waste out
- Good for the environment

ATTITUDES ABOUT DRY-BASED TOILETS (GENERALLY)

Positive points raised:

- Less expensive to construct
- Require less cleaning up
- Some residents responded there is nothing good about them
- Can construct with local materials
- No expense to pay for water
- Better for some locations (e.g. Burns creek)

Negative points raised:

- Attracts flies
- unhealthy
- smelly
- Unsafe for kids and animals

ATTITUDES ABOUT VIP TOILETS

- Low familiarity with these toilets – most comments were in response to description of VIPs by facilitators

Positive points raised:

- Less expensive to construct
- No water bill
- reduce the bad smell in the environment

Negative points raised:

- though in some settlements some where concerned about the smells and difficulty to manage these)

WHAT DO YOU THINK ABOUT SHARING TOILETS WITH SOME OTHER HOUSES NEAR TO YOURS?

In some settlements, many households already have their own “toilet”, and in these sharing was no viewed as necessary or beneficial.

In settlements where there are few toilets, many concerns were raised:

- More easy to spread diseases
- Lack of privacy while using and when entering/leaving
- only the owner of the toilet will do proper cleaning and maintenance
- cultural norms about sharing with other genders or other family/non-family members (and associated concerns about accidentally causing problems requiring compensation), and other norms about cleaning other people’s messes
- misunderstanding between shared members
- ownership concerns
- may need to wait to use the toilet if too more than a few households are sharing
- Careless attitude by other users may result in disputes
- Generally considered not to be better than using the beach

WHAT ABOUT PUBLIC TOILETS THAT YOU PAY TO USE? *Could these work if designed appropriately, maybe separate men and women’s buildings? Who would keep these clean?)*

All settlement residents agreed the concept of Public Toilets is good for Honiara, but all believed this would not be a feasible solution within the settlements, because:

- they would need to be maintained by someone, as a business. But most people would not pay to use the toilet when they can use the bush, beach or river for free
- there would be some in the settlement that would not be supportive of the facility with the risk they would vandalize it or cause difficulty for users (making it not attractive to use).

When encouraged to offer suggestions on how Public Toilets could work, some settlements indicated pay-per-use public toilets could possibly work if:

- They were well designed to avoid any confusions or inappropriate encounters between men and women, and to ensure safety and privacy of women at all times (possibly separate men and women’s buildings)
- In two settlements, the opinion was the toilets must be run by community members as a business – either a specific household, or some youths assigned to operate it as a Business – with men operating the men’s toilet and women operating the women’s toilet. And some assistance from Honiara City Council or other agency to operate and maintain it.

The challenges of vandalism, harassment of users and unwillingness to pay would remain.

WHAT DO YOU THINK SHOULD HAPPEN WITH THE WASTE FROM THE TOILETS IN THE SETTLEMENT? (If taken away, who to do that and how?)

Generally, there was little interest by resident to discuss waste management options. The interest in sanitation was focused on the latrine itself (the location of defecation) rather than much concern about safe sludge management. Some settlement FGDs were unwilling to discuss toilet waste management, particularly when their priority was to improve water access.

Those that were willing to discuss waste management, responded:

- Emptying of septic tanks can be undertaken by HCC or private contractors (residents in two different settlements raised concerns about whether this waste is properly disposed to protect human health)
- Some commented when tanks/pits are full, another is built to take more waste, or existing pit/tank is emptying by buckets to surrounding ground
- Some commented it should be the responsibility of Solomon Water to remove waste, because they provide water.
- Alternative options, such as reusing the waste were not raised.

WHAT DO YOU THINK ABOUT COMPOST TOILETS?

- Most residents were not familiar with compost toilets; those settlements that offered responses based these upon descriptions given by facilitators or other residents that had familiarity
- Some settlements expressed some interest because they are “cheap to build” and, and produces fertilizer, though others responded the fertilizer could not be used on food crops (or people would not buy/eat them)
- Settlements with high density housing responded composting toilets wouldn’t be suitable

HAS ANYONE ANY EXPERIENCE/KNOW ABOUT SUP SUP BIOGAS TOILETS? (What do you think about these? Do you think these could be the way to deal with the waste from toilets?)

Only very few residents had any knowledge of biogas toilets. All expressed interest in the idea and requested more information and training.

5.2 CONSIDERATIONS FOR OPERATIONALISING THE SHORTLISTED SERVICE DELIVERY OPTIONS IN HONIARA

Based on the assessments and consultations described above, the following service delivery model options were prioritized as though having the most applicability to Honiara’s informal settlements (Table 14 and 15)

TABLE 14: PRIORITIZED WATER SERVICE DELIVERY MODELS FOR HONIARA’S INFORMAL SETTLEMENTS

Individual private household water connections using Cash Water (pre-payment) meters	As for the existing Cash Water service delivery model, which is a pre-paid and metered water connection. Additional considerations for increasing financial accessibility through options to pay connection fees in installments or reductions to connection or monthly service fees.
Shared private water connections using Cash Water	Private household water connections, as above, registered to an identified householder, but shared with neighbouring householders through informal and self-determined arrangements. Access is usually to an outside tap, and households will carry smaller volumes of water to where it is needed. Some may use hoses to convey the water closer to each house (and potentially store in larger containers). Not formally promoted by Solomon Water, but not disallowed, and possibly further enabled (e.g. assessing tariff steps for shared connections to ensure cost-effectiveness for householders, and providing information on a range of methods for bill-splitting).
Water store (kiosk) connected to utility reticulated water system	A formal water retailer located within the settlement, selling pay-per-use water by refilling containers provided by consumers (option to sell containers). Preferred by residents that don’t want to commit to ongoing water connection service fees or raise funds for connection fees. Store (locally-preferred language for a kiosk) design and operations are regulated, including the retail price of water. Options for management include owned and operated by Solomon Water, or a delegated management model; fully private water stores are not recommended (unless highly regulated).

In addition, **Water ATMs** located where large numbers of commuters (buses, boats) depart from Honiara’s central market/business area may prove well-suited to providing an access point to safe water for any resident of the Solomon Islands currently doesn’t have reliable, affordable access to safe drinking water. This may include residents of informal settlements currently without utility water connections, as well as people returning or visiting rural villages.

TABLE 15: PRIORITIZED SANITATION OPTIONS FOR HONIARA’S INFORMAL SETTLEMENTS (NOTE: NOT ALL OPTIONS ARE SUITABLE TO ALL INFORMAL SETTLEMENT SITUATIONS)

Flushing toilets with piped sewerage or household septic tanks	(operated by Solomon Water) or household septic tanks (with septage collection, treatment and disposal); water-saving cisterns can improve water efficiency. Only applicable for conventional reticulated sewerage is physically possible and planned.
Community simplified sewer and septic/ABR system	Flushing toilets with community simplified (small bore, shallow) sewers and community septic tanks or ABR systems (operated by Solomon Water), from which effluent is connected via solid-free pipes to the conventional sewerage network, and sludge is removed as needed from the septic/ABR. Water-saving cisterns can improve water efficiency.
Pour-flush to pits with pit emptying service or burying	Water-based sanitation, with pour-flush slabs or raisers, including water saving equivalents such as Sato-pan toilets.
Ventilated Improved Pit (VIP) with pit emptying service or burying	Improved dry-based sanitation
Above ground-sanitation	Container-based sanitation or composting toilets

5.3 PRIORITY WATER SERVICE DELIVERY OPTIONS

Individual private household water connections using Cash Water (pre-payment) meters

Overview of this service delivery model

Name of service delivery model		Household / Piped water connection (private – not shared; prepaid connection)			
Service Delivery Chain <i>(note: this model does not require settlement access points separately from household access points)</i>		Water production	Means of water conveyance to settlement	Water conveyance to households	Water use and storage at household
Technical aspects	Technology	As for existing water production system	<ul style="list-style-type: none"> • Piped from source to individual households (for either individual or shared taps) • May require local storage tanks, to enable a gravity-fed system 	<ul style="list-style-type: none"> • Water reticulation from settlement mains to HH connections • Depth of burial of pipes may be less than usual → avoid heavy traffic areas 	<ul style="list-style-type: none"> • Storage only required if service is not 24/7 • Usually in containers or small tanks
	Environmental and physical considerations	As for existing water production system	<ul style="list-style-type: none"> • Space availability is required to lay out and protect pipes from the connection to existing water mains. • Topography will affect pressure requirements during conveyance. • Capacity of existing water mains might need to be increased to accommodate extra demand. • Energy may be required for the operation of the conveyance system (e.g. water pumps) 	<ul style="list-style-type: none"> • Space availability is required to lay out and protect pipes from the connection to existing water mains 	<ul style="list-style-type: none"> • Minimal
	Key operational tasks	As for existing water production system	<ul style="list-style-type: none"> • Monitoring of Water pipe pressure • Water quality • Depending on the complexity of the system, the operation of Water pumps and/or storage tanks, Valves 		<ul style="list-style-type: none"> • Manage storage of water (capture water when available, store in hygienic conditions)
	Key maintenance tasks	As for existing water production system	<ul style="list-style-type: none"> • As for existing water reticulation system 		<ul style="list-style-type: none"> • Repair or replace water access point (i.e. taps) • Maintain temporary water storage if required

Service Delivery Chain		Water production	Means of water conveyance to settlement	Water conveyance to households	Water use and storage at household
Actors and their potential roles	Water utility	As for existing water production system	<ul style="list-style-type: none"> As for existing water production system Promote accurate cost information to communities (recent HH survey residents estimated costs of \$24 - \$5000 per month) 	<ul style="list-style-type: none"> Provide technical advice on water pipe maintenance (direct to householders or via other actors, such as NGOs, HCC, government) 	<ul style="list-style-type: none"> Promote water conservation at household scale
	Consumers	As for existing water production system	<ul style="list-style-type: none"> As for existing water reticulation system 	<ul style="list-style-type: none"> Maintain pipework from mains to HH connection 	<ul style="list-style-type: none"> Pay for water (connection and use fees) Store water safely if required. Report problems in the water reticulation system utility Use water efficiently.
	Community	As for existing water production system	<ul style="list-style-type: none"> Community mobilisation for uptake of HH connection, including promoting payment of connection and use fees Community cooperation to protect reticulation system 	<ul style="list-style-type: none"> Not vandalise others' connections Fund-raising to support reticulation from mains to individual households 	<ul style="list-style-type: none"> promote improved water management practices at the household level, including water conservation
	Other actors	<ul style="list-style-type: none"> Regulators: As for existing water production system NGOs and HCC promote protection and maintenance of water sources used for the production of water 	<ul style="list-style-type: none"> Regulators: As for existing water reticulation system. NGOs: potential communication conduit to settlements (for Solomon Water), especially regarding accurate costs and initial engagement on community decision to support Sol Water connections 	<ul style="list-style-type: none"> NGOs and Donors financial support for connection fees E.g. NGOs have been funded by donors using output-based models to subsidise cost of water connections (based on achievement of other development outcomes such as installation of safe toilets, handwashing facilities with soap etc) 	

Service Delivery Chain <i>(note: this model does not require settlement access points separately from household access points)</i>		Water production	Means of water conveyance to settlement	Water conveyance to households	Water use and storage at household
Costs	O&M costs (relative to alternative water service chain options)	<ul style="list-style-type: none"> If additional water production is required. Cost score: 3 (compared with onsite production) 	Maintenance of expanded reticulation system Cost score: 2	Cost of water is minimal (to be confirmed: ~70 SBD/month for household of 8, using 50L/p/day) Cost score: 1	
	Capital costs (cost score is relative cost per consumer)	<ul style="list-style-type: none"> Only if increased production is required. Cost score: 2 	<ul style="list-style-type: none"> Additional water mains and pipework into settlements needed. Possible pumps and onsite storage Cost score: 3	<ul style="list-style-type: none"> Connection fee, and reticulation to water main Cost score: connection fee?	If required Cost score: 1
Regulatory considerations		<ul style="list-style-type: none"> As for existing water production system 	<ul style="list-style-type: none"> Regulations currently do not prevent utilities or other water providers from extending their systems into informal settlements. Potential significant financial investment required; may be better suited to settlements with planned settlement formalisation process underway (MLHS list classification). 	<ul style="list-style-type: none"> Land tenure status – current perception that TOL is required before application for water connection. TOL difficult to obtain. And recent indications are that utility can provide connections if they assess appropriate. 	
Social considerations			<ul style="list-style-type: none"> Likely to be most successful if communities (subcommittees within settlements) agree to support access to the service Solomon Water is offering. Broader uptake of the service will mean less likely vandalism (i.e. more people with connections, less theft) Ownership status (e.g. customary ownership, private ownership) of the land where pipes are to be implemented needs to be considered. Community cooperation to mitigate vandalism of reticulation systems 	<ul style="list-style-type: none"> Willingness to pay for water. Recent HH survey indicated willingness to pay at most settlements: 80% respondents willing to pay \$100/month. Willingness to pay for connection fee is low (HH survey: 57% unwilling to pay anything). Agreement for pipes to traverse/run adjacent to other HH plots Community cooperation to mitigate vandalism of reticulation systems 	
Service standards (at point of use, inside households)	Water quantity	<ul style="list-style-type: none"> Best option for sufficient quantities to support health and wellbeing And to support improved sanitation options (however see quality) 			
	Water quality	<ul style="list-style-type: none"> Best option for sufficient quantities to support health and wellbeing High quality not required for water-based sanitation – which would increase use and cost to consumers (and to utility) significantly. 			
	Service reliability	<ul style="list-style-type: none"> Potential for 24/7 water service Water production capacity could limit reliability Reticulation systems may have constraints to maintain service delivery (e.g. affected by topography of the settlement) 			
	Accessibility	<ul style="list-style-type: none"> Very high (Best option and can be controlled by consumer in the house) 			
	Affordability	<ul style="list-style-type: none"> Water use fees are affordable Willingness to pay for connection fee is low amongst informal settlements (cost of connection fee?) 			
Health/wellbeing considerations		<ul style="list-style-type: none"> A household connection provides the greatest health and wellbeing benefits of all water service options (due to more water available for hygiene, usually better water quality, no manual conveyance) 			
Other		<ul style="list-style-type: none"> Might require significant communication campaign relating to accurate use costs, and benefits (health and psycho-social) of safe drinking water Connection fees may be a barrier, unless alternative payment options are considered (e.g. post-payment in installments; subsidized connections (from other SW revenue or development partner/donor programs). 			

Affordability

Costs

The following estimates of affordability are based on the following Cash Water water tariffs (current at the time of this study)

Existing Tariffs (water)	per kL (SBD)
0-15kL / month	\$5.89
16-30k/month	\$8.87
>30kL/month	\$10.36
PLUS MONTHLY SERVICE FEE	\$50.60

Water consumption

the volume of water consumed per person and household affects the total cost of water. Currently, estimates of average water consumption for residents of Honiara is around 160l/p/day. The Solomon Water Strategic Plan identifies a target of achieving 137l/p/day. WHO minimum requirement for water supply is 50l/p/day. The SIG National Policy for rural WASH identifies also a supply of 50l/p/day to be used for designing capacity of water systems. The number of residents in a house will affect the per person consumption – a household with a larger number of people will likely consume less than a house with fewer people, due to set amount being used for standard needs regardless of household size (such as cleaning the house).

The actual water consumption by informal settlers, from a continuous supply to the house, in Honiara is difficult to predict, but likely to be in the range of 50-137l/p/day. The total monthly bill is not very price-sensitive to the metered water usage charges for this range of volumes, and as such water use in this range does not have a large effect on affordability.

Monthly incomes

In addition, the data describing monthly income of households in informal settlements is highly variable, and potentially not very accurate. The scenarios below use the EGIS household survey data (EGIS, 201For each scenario below, the median income for a settlement is applied, as well as a scenario using the 20% percentile (representing the lower income households in the settlement).

Estimates of affordability

Because of these uncertainties in water consumed and actual household income, the following estimates of affordability are indicative only.

Monthly cost of private CashWater household water connections supplying 137l/p/day to a household of 8 people.

Total water consumption per household per month = 32880L (8 people / household; 137l/p/day)		
Monthly cost (applying current water tariffs) \$301.84, excluding the connection fee.		
Settlement	Water cost as a % of HH income (for HH on the 20 th percentile of incomes)	Water cost as a % of HH income (for HH on the median income)
Burns Creek	22%	12%
Fulisango	22%	7%
Lord Howe	56%	8%
Lau Valley	28%	8%
Ohiola	12%	8%
Renlau	25%	11%

If the global target of affordability of water is applied (water costs being not more than 5% of total household income), then this amount of consumption and costs would not be considered affordable in any of these settlements, for at least half of the residents of informal settlements (those earning less than the median income).

Volume that is affordable at current prices (single HH connection, 8 people/HH)

The following table estimates the volume of water that could be supplied to maintain the cost of water at or less than 5% of household income.

Household: 8 people		
Settlement	Vol water supplied for 5% HH income for HH earning 20 percentile income	Vol water supplied for 5% HH income for HH earning median income
Burns Creek	14	58
Fulisango	14	102
Lord Howe	-16	82
Lau Valley	3	82
Ohiola	55	91
Renlau	7	62

For lower income households, earning less than the 20th percentile of incomes in their settlement, none could likely afford to buy a sufficient volume of water to meet domestic water needs. Households earning at least the median incomes in some settlements (e.g. Fulisango, Ohiola) may afford sufficient water for domestic water needs.

Affordability of water services – key lessons and strategies used elsewhere to increase accessibility by low income households

As identified by WSUP (2014), the following are key features of low income populations accessing water services:

- low-income consumers can pay commercially viable rates, and serving low-income communities is good business for utilities.
- but some capital investment by governments and development partners is generally necessary to cover full lifecycle costs of water services provision; and
- providing services to the very poor will often require some form of cross-subsidy from other consumers.
- Increasing access for lower income households is achieved through different strategies in different places

Water utilities can offer a different (lower) service option that costs the consumer less, to low income households, to increase the accessibility of people currently without household water utility connections.

1. Prepaid – more easy to link consumption with cost and manage payments in smaller, regular amounts (e.g. Solomon Water Cash Water)
2. Purchase of smaller volumes, regularly to better align with cash flows in low income households (*What is the smallest volume via HH cxn that can be cost-effectively administered?*)
3. Lower (subsidized) connection fee
4. Post-payment of connection fee in instalments (Cash Water allows for this)
5. Lower monthly service fees for low income households
6. Volume-limited free water designated to low-income household , or
7. Lower cost for lowest use tariff (e.g. lifeline tariff) – but usually benefits all customers, doesn't target low income HH
8. Non-payment penalties do not lead to cutting off all water, but result in limited flow water
9. Enable shared connections (refer next section)

Many of these strategies would require being able to **identify low income households**. The feasibility to identify low income households in Honiara is not high. Possible strategies to achieve this include:

1. Eligibility for Individual households:

- Census data: but not very regular/current
- Voluntary assessment of income status (by government?)
- Costly to conduct household-scale assessments
- Very difficult to maintain, and likely to be highly variable at different times of the year due to seasonal employment and seasonal migrations between urban and rural areas.

2. Eligibility for all households within a settlement or community-within-settlement

- Settlement-scale criteria
 - Average (or other measure) of settlement incomes – however there is high income level diversity and the settlement 'average' will still exclude the poorest of the poor; expensive to determine and maintain
 - Location – based on list of recognised (not only formalising) Informal settlements (which could be administered by MLHS).
- Proof HH belongs to an approved settlement:
 - Difficult to define boundaries
 - Proof of residence (such as used by Solomon Power – letters from neighbours)

The cost of ascertaining income classifications for individual households would be very high, with limited effectiveness. Targeting low income households using their location in an agreed list of lower-income settlements, or all informal settlements, had better potential to cost-effectively target lower income households. alternative has potential

A third alternative is to follow Solomon Power's example, and provide subsidies or lower cost options to everyone in Honiara who doesn't yet have a connection.

Lessons from the power utility in Honiara - Solomon Power

Consultation with Solomon Power identified that although power and water are quite different resources, some lessons about providing services to lower income households can be learned from the power sector.

Engagement with customers in informal settlements:

- Household scale but also community-scale engagement
- Expansion into new settlements is often in response to request from community (letter, evidence of community interest and demand)
- Community-engagement first – community meetings, discuss access requirements.
- Discuss location of easements (and removal of trees, structures etc) – sign MOU. Difficulties with easements usually only prior/during construction – not later (different to water services) → negotiate & renegotiate during construction
- Feasibility assessment (number connections, easements)
- Illegal connections and meter-bypassing – does happen. Audit team regularly monitoring – disconnect 'shared' connections (safety risks)
- No problems with damage to infrastructure
- CashPower well-accepted - despite few payment locations (don't interfere with informally-arranged payment practices. Tariff changes monthly.

Output-Based Aid (OBA) program

Initial objective: Target low income households

Revised objective (to achieve initial objective): increase number of connections (to improve cost-benefit of current system)

This strategy improved access to power for everyone, but it was deemed suitable at this time because many middle-higher income houses already had connections, so this strategy is probably benefiting mostly lower income households, and without the administrative burden of needing to confirm they are low income.

To increase number of connections:

- Relaxed land tenure & permission requirements – essentially none required now (to qualify for a connection – minimal housing standard to ensure safety (leaf house can be ok), acceptance from neighbours/community (letters)
- Don't try to identify low income HH – anyone can apply for an OBA connection. OBA connection:
- Very reduced connection fee (\$200 SBD) 2 powerpoints, 3 lights, wiring – can be paid in instalments with future Cash Power payments
- For first year: limited power (3 amps). Ampage limits removed
- Focus on number of connections, use OBA to get connections installed

Implications of extending Cash Water to Honiara's informal settlements

Extending this service to informal settlements would require **expansion and some modifications of existing Cash Water service** (it is not exactly the same service as the existing Cash Water service):

1. Use of existing prepaid systems: specific administration, infrastructural, operational, communication etc systems have already been developed) [*confirm accessibility to payment system – mobile phone ownership is variable*]
2. Different customer engagement → community and settlement-scale engagement to minimise tampering/ infrastructure damage
3. Extend reticulation system: expanded supply and treatment capacity is already planned. In addition: may need to consider modified reticulation systems because: absence of easements, tamper-minimisation
4. Review (revise) connection processes and requirements: SW can determine the requirements for eligibility for connections. Currently: proof of permission from land owner – Government – permission give if TOL or FTE on the plot.
5. Consider strategies for low income households

Possible modifications to conventional reticulation system design

- Tamper minimization strategies:
 - More resilient piping, and depth of mains
 - HH meters at mains.
- Lack of easements & tamper minimisation → Meter clusters are situated on adjoining recognised roads or public lands, and households lay their own pipes to connect their homes to the more distant meters (Example: Fiji)
 - householder takes responsibility for the final few metres of pipe → utility charges lower connection fee as it has avoided part of the network extension cost
 - Water conveyed through pipes into houses
 - cost-effective way for utilities to extend piped access to the utility network
 - NRW responsibility of individual connection-owners
 - Limits opportunity for cost-effectiveness from shared piping (with individual HH meters)

Shared private water connections using Cash Water

Overview of this service delivery model

Name of service delivery model		Shared household, Cash Water connection				
Service Delivery Chain		Water production	Means of water conveyance to settlement	Settlement access point (one household)	Water conveyance to households	Water use and storage at household
Technical aspects	Technology	As per current utility water production	<ul style="list-style-type: none"> Piped from source to individual household tap, via local settlement 'water main' May require local storage tanks, to enable a gravity-fed system 	<ul style="list-style-type: none"> Usually outside house Storage only required if service is not 24/7 Usually in containers or small tanks 	<ul style="list-style-type: none"> water containers to transport water to households. Containers can include wheeled containers to carry larger volumes and minimise health impacts of carrying. Non-wheeled containers are carried manually, or in wheelbarrows. Distance is usually shorter than from a public kiosk, ATM, tapstand 	<ul style="list-style-type: none"> Containers Household water treatment technologies (HWT) could be promoted or provided to reduce risk of consuming contaminated water.
	Environmental & physical factors	As per current utility water production	<ul style="list-style-type: none"> Space availability is required to lay out and protect pipes from the connection to existing water mains. Topography will affect pressure requirements during conveyance. Capacity of existing water mains might need to be increased to accommodate extra demand. Energy may be required for the operation of the conveyance system (e.g. water pumps) 			<ul style="list-style-type: none"> Minimal
	Key operational tasks	As per current utility water production	<ul style="list-style-type: none"> Monitoring of Water pipe pressure Water quality Depending on the complexity of the system, the operation of Water pumps and/or storage tanks, Valves 	<ul style="list-style-type: none"> Manage storage of water (capture water when available, store in hygienic conditions) 		<ul style="list-style-type: none"> Use water from containers as required. Protect water container to avoid water wastage, theft, contamination, etc. Use of HWT, such as boiling, sand filters, if contamination is possible)

	Key maintenance tasks	As per current utility water production	<ul style="list-style-type: none"> As for existing water reticulation system for water mains Householders: to maintain local water connection from mains to HH 	<ul style="list-style-type: none"> Repair or replace water access point (i.e. taps) Maintain temporary water storage if required 	<ul style="list-style-type: none"> Clean conveyance containers 	<ul style="list-style-type: none"> Clean storage containers Repair or replace damaged containers. Maintain and repair HWT (if available) Sanitize / disinfect area where water is stored.
Actors and their potential roles	Water utility	As per current utility water production	<ul style="list-style-type: none"> As for existing water production system Promote accurate cost information to communities (recent HH survey residents estimated costs of \$24 - \$5000 per month) Provide technical advice on water pipe maintenance (direct to householders or via other actors, such as NGOs, HCC, government) 	<ul style="list-style-type: none"> Provide technical advice on water pipe maintenance (direct to householders or via other actors, such as NGOs, HCC, government) 		<ul style="list-style-type: none"> Promote water conservation at household scale
	Consumers	As per current utility water production	<ul style="list-style-type: none"> As for existing water reticulation system 	<ul style="list-style-type: none"> Maintain pipework from mains to HH connection Pay for water (connection and use fees) Store water safely if required. Report problems in the water reticulation system utility 	<ul style="list-style-type: none"> Maintain hygienic conveyance containers 	<ul style="list-style-type: none"> Use water efficiently. Maintain hygienic and sufficient water storage
	Community	As per current utility water production	<ul style="list-style-type: none"> Community mobilisation for uptake of HH connection, including promoting payment of connection and use fees Community cooperation to protect reticulation system 	<ul style="list-style-type: none"> Not vandalise others' connections Fund-raising to support reticulation from mains to individual households 	<ul style="list-style-type: none"> Maintain plots and pathways to carry water 	<ul style="list-style-type: none"> promote improved water management practices at the household level, including water conservation
	Other actors	<ul style="list-style-type: none"> Regulators: As for existing water production system NGOs and HCC promote protection and maintenance of water sources used for the 	<ul style="list-style-type: none"> Regulators: As for existing water reticulation system. NGOs: potential communication conduit to settlements (for Solomon Water), especially regarding accurate costs and initial engagement on community decision to 	<ul style="list-style-type: none"> NGOs and Donors financial support for connection fees E.g. NGOs have been funded by donors using output-based models to subsidise cost of water connections (based on achievement of other development outcomes such as installation of safe toilets, handwashing facilities with soap etc) 		

		production of water	support Sol Water connections			
Costs	O&M costs (relative to alternative water service chain options)	If additional water production is required. Cost score: 3 (compared with onsite production)	Maintenance of expanded reticulation system Cost score: 2	Cost of water is minimal (to be confirmed: ~\$35 SBD/month for household of 8, using 25L/p/day) Cost score: 1	Container hygiene Cost score: 1	Container hygiene Cost score: 1
	Capital costs (cost score is relative cost per consumer)	<ul style="list-style-type: none"> Only if increased production is required. Cost score: 2	<ul style="list-style-type: none"> Additional water mains and pipework into settlements needed. Possible pumps and onsite storage Cost score: 3	<ul style="list-style-type: none"> Connection fee, and reticulation to water main (?) Cost score: connection fee?	<ul style="list-style-type: none"> Capital cost will depend on whether consumers use their own containers, containers from a swap-and-go model, or improved technologies such as roller-based containers. Cost score: 0 - 1	<ul style="list-style-type: none"> Minimal necessary, as per each household preferences, unless HWT are implemented. Cost score (no HWT): 1 Cost score (with HWT): 3
Regulatory considerations	<ul style="list-style-type: none"> As for existing water production system 	<ul style="list-style-type: none"> Regulations need to allow for utilities or other water providers to extend their systems into informal settlements. Potential reasonably significant financial investment required for insecure land tenure. Better suited to settlements with planned settlement formalisation process underway (MLHS list classification). 	<ul style="list-style-type: none"> Land tenure status – current requirement for TOL, but these have been difficult to obtain. Alternative regulatory options need to be explored – with MLHS? Perhaps based on zoning status of settlement rather than individual households' status 	<ul style="list-style-type: none"> It is likely that women and children will own the role of collecting water from shared taps and transporting it to households. 		
Social considerations		<ul style="list-style-type: none"> Likely to be most successful if communities (subcommittees within settlements) agree to support access to the service Sol Water is offering. Broader uptake of the service will mean less likely vandalism (i.e. more people with connections, less theft) Ownership status (e.g. customary ownership, private ownership) of the land where pipes 	<ul style="list-style-type: none"> Small groups of households near to each other are likely to be from same Wantok, and willing to share and support each other to use water. See affordability estimates below Connection fee to be shared. As for piped HH connections: <ul style="list-style-type: none"> Recent HH survey indicated willingness to pay at most settlements: 80% respondents willing to pay \$100/month. HH survey also indicated \$70/month would be less than at least half households spend buying bottled water Willingness to pay for connection fee is low (HH survey: 57% unwilling to pay anything). Agreement for pipes to traverse/run adjacent to other HH plots Community cooperation to mitigate vandalism of reticulation systems 			

		<p>are to be implemented needs to be considered.</p> <ul style="list-style-type: none"> Community cooperation to mitigate vandalism of reticulation systems 	
Service standards (at point of use, inside households)	Water quantity	<ul style="list-style-type: none"> Second-best option for sufficient quantities to support health and wellbeing And to support improved sanitation options (however see quality) 	
	Water quality	<ul style="list-style-type: none"> Second- option for sufficient quantities to support health and wellbeing Can be compromised by poor container hygiene i.e. unsafe sanitation combined with inadequate personal hygiene (e.g. hand washing with soap) leads to contamination of drinking water containers with pathogens. HWT would further reduce these risks. High quality water not required for water-based sanitation – which would increase use and cost to consumers (and to utility) significantly. 	
	Service reliability	<ul style="list-style-type: none"> Potential for 24/7 water service Water production capacity could limit reliability Reticulation systems may have constraints to maintain service delivery (e.g. affected by topography of the settlement) 	
	Accessibility	<ul style="list-style-type: none"> Very high (Best option and can be controlled by consumer in the house) 	
	Affordability	<ul style="list-style-type: none"> Water use fees are affordable, especially if ~20 of fewer people sharing (~2.5 HH). Cost higher for say 5 HH, but still affordable Willingness to pay for connection fee is low amongst informal settlements (cost of connection fee?) Usage likely to be higher than current, but still affordable (even if used for sanitation) 	
Health/wellbeing considerations	<ul style="list-style-type: none"> A household connection provides the greatest health and wellbeing benefits of all water service options (due to more water available for hygiene, usually better water quality, no manual conveyance) 		
Other	<ul style="list-style-type: none"> Might require significant communication campaign relating to accurate use costs, and benefits (health and psycho-social) of safe drinking water Connection fees may be a barrier, unless can be supported by donor programs 		

Affordability

The following is an estimate of the cost of sharing a Cash Water connection between 5 households.

Shared connection

Total Litres for 100l/day , for 5 houses x 8 people, per month	120000L
Monthly cost (5 houses) excluding connection fee	\$1,204
Monthly cost per HH	\$241

Single (individual household) connection

Total Litres for 100l/p/day , for one house of 8	24000l
Monthly cost per HH	\$219

The shared connection is higher than an individual connection, for the equivalent amount of water supplied. This is because the tiered structure of water tariffs means connections that use larger volumes of water are charged a higher rate per volume – to discourage very high water use. However, for shared water connections, where each household is not necessarily using high volumes, the total use for the connection is high enough that higher rates per volume would be paid. **Shared connections are currently only cheaper than individual connections if usage is less than 51L/person/day.**

Improving the inclusiveness and affordability of shared water connections

Sharing of water connections is not a formally-approved water service model by Solomon Water – this is primarily because of the difficulties in ensuring service standards beyond the end of the shared tap, and dealing with issues of accountability for the connection.

However, this is a very common method of connecting to the utility's service in Honiara and is currently how many residents do access water – it is an active service delivery model even though not necessarily promoted or encouraged by the utility. The registered connection holder is responsible for the connection and determining the 'rules' that it will use to ensure payment of bills and operation and security of the connection. The utility does not interfere with these arrangements, allowing socially and culturally-determined arrangements to exist. This aligns with the recommendations of Barrington et al., (2017) to allow multiple marketing-based systems to exist to maximize the inclusiveness of a WASH service.

Without making this option a promoted service delivery option, some minor adjustments could be made improve overall inclusiveness and equity relating to water access:

- Offer different tariff structure for those HH connections within informal settlements that are verified as shared, with an agreement not to profit (to balance allowing sharing but not allowing on-selling for profit), or
- Offer different tariff structure for those living in informal settlements (this would need to link to improved administration of recognised informal settlements) – such as volume-limited free water allocation (requires HH meters), and
- Make accessible information about different ways water use can be calculated (e.g. through community meetings or 'water supply training', which could include other aspects of demand management and water quality (containers & storage), and
- Consider cluster metering to reduce connection costs.

Water kiosks (connected to utility reticulated water systems)

Key features

- Formalised **reselling/onward distribution** of utility water (or other water) by small-scale vendors for domestic use, **at a small shop (kiosk)**, fitted with water tap.
- Common in urban areas, **where water scarcity / lack of infrastructure** limit access to drinking water at households. Can also be a useful **transitional service** – for communities/consumers uncertain about the value of utility water; kiosks allow consumers to gain firsthand experience with the quality and benefits of the water supplied, thus potentially increasing demand and commitment to household water connections.
- Consumers use **containers** to transport the water to the household (often done by women/children)
- Price (per litre) charged usually not more, **often is less** (e.g. half) **that of usage tariff-equivalents** – recognizing the lower service being paid for (Heymans et al., 2014)
- Many utilities recognise prepaid vending is their best option for providing more equitable services in low-income areas, but acknowledge that **kiosk income will not meet their own costs and cross-subsidies are in place** (Heymans, et al., 2014).



FIGURE 18: EXAMPLES OF WATER KIOSKS (IMAGE SOURCES: LEFT: JOANNEBEALE.WORDPRESS.COM/2013/07/15/NAKURU-KENYA/; RIGHT: WWW.WORLDWATERWEEK.ORG/EVENT/8526-INCLUDING-ALL-PARTICIPATORY-APPROACHES-IN-WATER-GOVERNANCE-AND-PROGRAMMES).

Some of the main benefits

For households

- Possible transitional service delivery option for households not certain about committing to household water connections and the associated costs, but interested in accessing safer, more reliable and more cost-effective water services than currently available.
- Can increase financial inclusiveness (support lower income households to access safe water services) by being prepaid and allowing for smaller volumes of water to be purchased. This allows for smaller and more regular payments, which can be more responsive to household cash flows, and potentially reduced costs (IF the cost is lower than water via household connections, and is regulated)
- Potential livelihood opportunity for small number of residents (depending upon the business model adopted).

For utilities

- Supports transition to household connections – creates demand and norm for paying for water services
- Excellent communication channel – for utilities with existing and potential customers, and community broadly
- More easily expandable water service (compared with HH connections)

- Infrastructure can be reused after transition to HH connections: reticulation infrastructure can be used & added to for HH connections; Kiosk can be relocated or repurposed (sold as shop).

Society:

- Opportunity for broader health promotion – communication channel, but also products (health & hygiene products) and services (e.g. container sanitisation).

Some of the main disadvantages and challenges

- Water is only accessible when the kiosk is manned.
- Use of containers present significant risk to water quality, and present a physical challenge to consumers by having to carry water to home.
- Need consumer protection to ensure service standards are maintained (e.g. quality of water) and to regulate pricing to minimise inequalities and marginalization.
- Most customers are positive about prepayment (Heymans, et al., 2014, p20) but commonly identified three requirements for improvement:
 - Need to improved technical performance and reliability of service provided (including rapid response to payments, and to faults)
 - Need for more convenient vending (locations for purchase)
 - Better safeguards against inconvenience (difficult to access top-ups) and hardship (emergency water rations) --< HH cash flows
- Water use is typically lower than for HH connections (Heymans et al., 2014), which is reflect in reduced health and wellbeing benefits (Evans et al., 2013), often because personal and domestic hygiene are reduced.

Overview of this model

		Water kiosk / Piped				
Service Delivery Chain		Water production	Means of water conveyance to settlement	Settlement access point	Water conveyance to households	Water storage at household
Technical aspects	Technology	<ul style="list-style-type: none"> As per current utility water production 	<ul style="list-style-type: none"> Piped from source to kiosks 	<ul style="list-style-type: none"> At kiosk, which is accessible to the public. Water is provided through a water tap controlled by the kiosk's operator. Multiple kiosks might be needed depending on settlement size, density and topography. 	<ul style="list-style-type: none"> Normally, consumers use water containers to transport water to households. Containers can include wheeled containers to carry larger volumes and minimise health impacts of carrying. Non-wheeled containers are carried manually, or in wheelbarrows. Containers could be provided to consumers using a swap-and-go model, where the kiosk operator decontaminates the containers. This reduces risk of water contamination at both access point and household use point. In some cases, water is transported by a middle man using a vehicle or carrier for several containers 	<ul style="list-style-type: none"> Containers (either provided by kiosk or household containers) Household water treatment technologies (HWT) could be promoted or provided to reduce risk of consuming contaminated water.
	Environmental and physical considerations	<ul style="list-style-type: none"> Depending on utilities current and planned systems. 	<ul style="list-style-type: none"> Space availability is required to lay out and protect the connection from existing water mains. Topography will affect pressure requirements during conveyance. Capacity of existing water mains might need to be increased to accommodate extra demand. Energy is likely to be 	<ul style="list-style-type: none"> The kiosks need to be protected and secured to avoid water theft or damage. Location of kiosks needs to consider both accessibility by users and distance to water main.* More flexibility with locations than trucking water to kiosks (which is limited by road access) Adequate drainage around kiosk might be required, including flood protection. *Note: To meet service standards under SDG 6.1 for basic services, the maximum time required to collect and transport water to household is 30 minutes in total. 	<ul style="list-style-type: none"> Kiosk needs to be strategically located to reduce conveyance distance to household (i.e. allowing for no more than a 30-minute round-trip for consumers) A flat topography is ideal for conveyance. For example, a flat terrain supports the use of roller-based containers. Difficult topography will limit accessibility, especially for people with disabilities (e.g. elderly, pregnant women, etc.) 	<ul style="list-style-type: none"> Minimal.

			required for the operation of the conveyance system (e.g. water pumps)	(https://unstats.un.org/sdgs/report/2017/goal-06/)		
	Key operational tasks	<ul style="list-style-type: none"> Depending on utilities current and planned systems. 	<p>Monitoring of:</p> <ul style="list-style-type: none"> Water pipe pressure Water quality <p>Depending on the complexity of the system, the operation of:</p> <ul style="list-style-type: none"> Water pumps Valves 	<ul style="list-style-type: none"> Water access point operation (i.e. fetch water to consumers) Kiosk management <ul style="list-style-type: none"> Customer service (e.g. take payments from consumers) Book keeping Report to kiosk owner, water utility, etc, as per ownership/management contractual arrangements. Ensure kiosk is secure Maintaining premises clean Recommended: clean containers for consumers (e.g. on a swap-and-go model) 	<ul style="list-style-type: none"> Transport water containers In some instances, conveyance is done by a middle man, and may involve the use of a vehicle or carrier for several containers. Some additional tasks may include charging consumers for the conveyance service. 	<ul style="list-style-type: none"> Use water from containers as required. Protect water container to avoid water wastage, theft, contamination, etc. Use of HWT, such as boiling, sand filters, if contamination is possible.
	Key maintenance tasks	<ul style="list-style-type: none"> Depending on utilities current and planned systems. 	<ul style="list-style-type: none"> Regular assessment of conveyance system condition (i.e. pipes, pumps, valves, structural integrity, etc.) Repair or replace deteriorated or damaged system components. 	<ul style="list-style-type: none"> Repair or replace water access point (i.e. tap). Sanitize / disinfect kiosk infrastructure and immediate surroundings to reduce risk of water contamination. Maintain and repair kiosk structure as required. Replacement of unusable containers (if using a swap-on-go model). Spot checks of water quality 	<ul style="list-style-type: none"> Maintenance of roads, walking trails, staircases, etc. used by consumers to transport water across the settlement to their households. 	<ul style="list-style-type: none"> Clean unused containers Repair or replace damaged containers. Maintain and repair HWT (if available) Sanitize / disinfect area where water is stored.
Actors and their potential roles	Water utility	<ul style="list-style-type: none"> O&M of utility's water production infrastructure. Maintain or enforce levels of service as per current regulation and kiosks system contractual/management arrangement. Community engagement 	<ul style="list-style-type: none"> Implementation and O&M of utility's water pipes and systems conveying water to the kiosk. Maintain level of service as per current regulation and kiosks system contractual arrangement. 	<p>Depending on the ownership / management contractual arrangements, the utility may:</p> <ul style="list-style-type: none"> Introduce the necessary measures, guidelines, procedures and sanctions to assure the proper functioning of the water kiosks. Set water tariff Monitor water kiosk operation. Collect from kiosk operator the money paid by customers. Contract kiosk operators (e.g. community members or private 	<ul style="list-style-type: none"> No role, unless involved in initiatives to build consumers capacity to better transport water to households (e.g. use of improved technologies such as roller-based containers), or reduce risks associated with the transportation of water (e.g. safety for women and children, water pollution risks, etc.) 	<ul style="list-style-type: none"> Promote water conservation at household scale Potentially promote water treatment (via kiosk operators, HCC, Government, or NGOs, or directly) .

			<p>sector), or operate the kiosk using own staff.</p> <ul style="list-style-type: none"> • Remunerate kiosk operators. <p>Note: It is recommended that utility at least builds the kiosks. Utility-operated or leased models are preferred.</p>		
Consumers	<ul style="list-style-type: none"> • If community engagement mechanisms exist, consumers can influence utility' water production management and planning decisions. 	<ul style="list-style-type: none"> • Oversee the implementation of piped connection. • Report problems with the connection (e.g. breakages) to connections' operator (e.g. utility or water provider). 	<ul style="list-style-type: none"> • Pay for the provision of water at kiosk, in alignment with set tariffs and requirements from kiosk operator (e.g. credit protocols). • Adequately use and maintain water containers to reduce risk of water contamination at water access point. • Report problems in the water access point to system operators, including customer service issues. 	<ul style="list-style-type: none"> • The transportation of water, unless this is done by a third party (e.g. water delivery service to households). • 	<ul style="list-style-type: none"> • Store water as best as possible to avoid water losses, pollution, theft, etc. • Perform O&M tasks as indicated on relevant section above. • Use water as efficiently as possible.
Community	<ul style="list-style-type: none"> • As above for consumers 	As above for consumers	<p>Depending on the ownership / management contractual arrangements, the community may:</p> <ul style="list-style-type: none"> • Perform O&M tasks, either as owners of a kiosk, or as contractors for the system's owner (e.g. the utility). • Broader community may be involved in deciding who is recruited to operate the kiosk • Make additional profits from using the kiosk a shop to sell other goods. <p>Community-based organisations may have a role in:</p> <ul style="list-style-type: none"> • Support the effective implementation of kiosks (e.g. select kiosk locations) • Supporting campaigns to improve water use practices at kiosks, prevent vandalism, etc. 	<ul style="list-style-type: none"> • Community groups may have a role in facilitating favourable conditions for consumers transporting water from kiosks to households (e.g. street security, maintenance of walking tracks, etc.), as well as participating in campaigns to raise awareness and build capacity of community members. • May also provide assistance to those unable to carry their own water (informal arrangements) 	<ul style="list-style-type: none"> • Community groups may be involved in promoting improved water management practices at the household level, including the adoption of HWT.
Other actors	<ul style="list-style-type: none"> • Regulators: oversee utilities' or other water providers' compliance with 	<ul style="list-style-type: none"> • Regulators: oversee utilities' or other water providers' compliance 	<p>NGOs: can have the capacity to support community and water providers (e.g. utility) in:</p> <ul style="list-style-type: none"> • Deciding best locations to implement kiosks. 	<ul style="list-style-type: none"> • Government, NGOs and/or private sector can promote the update of improved water carrying 	<ul style="list-style-type: none"> • Government, NGOs and/or private sector can promote the uptake of HWT.

		<p>established levels of service.</p> <ul style="list-style-type: none"> • NGOs: support utility, government, community, etc in the protection and maintenance of water sources used for the production of water. • Private sector: may provide support services water utilities / water providers, as necessary. 	<p>with established levels of service.</p> <ul style="list-style-type: none"> • NGOs: support utility, government, community, etc. in the O&M, protection, etc of piped connection to water access point. • Private sector: may provide support services water utilities / water providers, as necessary. 	<ul style="list-style-type: none"> • Providing capacity building to manage and use the kiosks. • Supporting campaigns to improve water use practices at kiosks, prevent vandalism, etc. <p>Regulators:</p> <ul style="list-style-type: none"> • may oversee the management and O&M of kiosks, in alignment to relevant regulations (e.g. tariff setting). <p>Private sector:</p> <ul style="list-style-type: none"> • May own, or be contracted to operate kiosks. • Water vendors: may obtain water from the kiosk and resell it to consumers e.g. delivering the water to households in containers, possibly using a vehicle. 	<p>technologies and practices.</p> <p>Private sector:</p> <ul style="list-style-type: none"> • Water vendors: may obtain water from the kiosk and resell it to consumers e.g. delivering the water to households in containers, possibly using a vehicle. • Importers/manufacturers/Suppliers of water containers 	<ul style="list-style-type: none"> • Suppliers of HHWT and HHWT construction training (e.g. Youth With a Mission, Honiara)
Costs	O&M costs (relative to alternative water service chain options)	<ul style="list-style-type: none"> • If additional water production is required. <p>Cost score: 3 (depending upon scale of water production)</p>	Cost score: 2 (compared with trucks, and onsite production)	<p>Manual operations cost greater than manless-ATM</p> <p>Cost score: 4</p>	Cost score: 1	Cost score: 1
	Capital costs (cost score is relative cost per consumer)	<ul style="list-style-type: none"> • Only if increased production is required. <p>Cost score: 2</p>	<ul style="list-style-type: none"> • Additional water mains potentially needed. • Reticulation to kiosks will require piping, and possible pumps and storages. <p>Cost score: 3</p>	<ul style="list-style-type: none"> • Kiosk and all associated equipment (depending operating model e.g. who sets up the kiosk) <p>Cost score: 3</p>	<ul style="list-style-type: none"> • Capital cost will depend on whether consumers use their own containers, containers from a swap-and-go model, or improved technologies such as roller-based containers. <p>Cost score: 0 - 1</p>	<ul style="list-style-type: none"> • Minimal necessary, as per each household preferences, unless HWT are implemented. <p>Cost score (no HWT): 1 Cost score (with HWT): 3</p>
	Regulatory and financing considerations	<ul style="list-style-type: none"> • Service delivery standards need to be in place and enforced. 	<ul style="list-style-type: none"> • Regulations need to allow for utilities or other water providers to extend their systems into informal settlements. • Financing mechanisms that support utilities and other service 	<ul style="list-style-type: none"> • Depending on ownership / management contractual arrangements, regulations may have a role in ensuring the kiosk and the water access point are operated and maintained adequately. • A fit-for-context tariff system needs to be developed. This may involve the use of increasing block rates to 		<ul style="list-style-type: none"> • If consumers use HWT, there may be a role for regulatory instruments that ensure quality standards of the treatment technologies made available to consumers.

		<p>providers to extend their systems may be necessary (e.g. a fund management instrument that channels donor resources to finance capital expenditures)</p> <ul style="list-style-type: none"> • Potential reasonably significant financial investment required for insecure land tenure. Better suited to settlements with planned settlement formalisation process underway (MLHS list classification). 	<p>ensure service provision targets the poor (through subsidisation), while supporting utilities / water providers in covering O&M costs of extending service provision.</p> <ul style="list-style-type: none"> • Financing mechanisms that support utilities to implement kiosks should be considered (e.g. a fund management instrument that channels donor resources to finance capital expenditures, and well as supporting sustainable management systems). • It is common that water vendors, who resell water (e.g. obtained from a kiosk), will operate outside or at the margins of legal frameworks. However, they are usually tolerated by utilities. 		
Social considerations	<ul style="list-style-type: none"> • Utilities, service providers, regulators, etc, to consider how communities' value water resources. This should inform water resources management and planning. 	<ul style="list-style-type: none"> • Ownership status (e.g. customary ownership, private ownership) of the land where pipes are to be implemented needs to be considered. 	<ul style="list-style-type: none"> • Service affordability (for low income consumers) should be a priority. • In communities with strong cultural diversity, conflict between different cultural groups may happen at the water access point. • Cultural perspectives on the value of water may make difficult the implementation of a tariff system to cover cost of access point O&M costs. • The location of kiosks needs to take into consideration the distribution of different cultural groups, as well as the distribution of disadvantaged people in the settlement. 	<ul style="list-style-type: none"> • It is likely that women and children will own the role of collecting water from kiosks and transporting it to households. 	<ul style="list-style-type: none"> • Understanding water use practices of consumers is necessary to ensure service delivery model is adequately designed and implemented
Service standards (at point of	Water quantity	Consumers can only access small volumes, limited by container size and capacity to carry them and store (i.e. 20lt containers, carried 2-3 times a day on 30-minute round-trips).			
	Water quality	<ul style="list-style-type: none"> • Often compromised by poor container hygiene i.e. unsafe sanitation combined with inadequate personal hygiene (e.g. hand washing with soap) leads to contamination of drinking water containers with pathogens. • A container decontamination service will reduce these risks. • HWT would further reduce these risks. 			
	Service reliability	<ul style="list-style-type: none"> • Water production capacity could limit reliability • Reticulation systems may have constraints to maintain service delivery (e.g. affected by topography of the settlement) 			

	<ul style="list-style-type: none"> • Kiosk is only accessible when manned by vendor (i.e. only available during work hours).
Accessibility	<ul style="list-style-type: none"> • Already reduced due to lack of access at households. • Affected by topography, and the spatial distribution of kiosks and households. • Further accessibility challenges for people with disabilities and older people.
Affordability	<ul style="list-style-type: none"> • If water tariffs at kiosks are regulated, affordability can be good. This is because people can purchase small water volumes as needed. • Consumers are unlikely to be able to pay for capital costs of new infrastructure (kiosk)
Health/ wellbeing considerations	<ul style="list-style-type: none"> • The lack of a household connection means health benefits are reduced (due to lower volumes for hygiene, compromised water quality, health and wellbeing impacts of transporting, which include opportunity costs for time and energy spent) • Usually, it is the women and the children who transport the water, impacting on their capacity to perform other activities (e.g. engage in economic activities, attend school, etc). • In models where community members operate the kiosk, there are opportunities to use the kiosk facilities for further economic activities (e.g. selling of other goods).

Kiosks – business model options

Three main business model options exist, though there are many variations possible.

1. Utility-operated and staffed

- Utility – full control and full responsibility over products and services, operations (SOPs), and all costs including operator costs
- Operator – limited responsibility – through staff performance management processes.
- Salaried position (not revenue-linked)
- Customers – requires trust of utility and staff
- Settlement residents – no added employment opportunity

2. Delegated management model (operator contractor OR franchise)

- Utility – some control and some responsibility over products and services, operation, through contractual arrangement (which can include performance requirements), franchised systems and service monitoring
- Franchisee: – profit generation required.
- Full responsibility for operational and business performance inc NRW, bad debts etc)
- Shared responsibility for maintenance
- Contracted operator – commission + extra sales; no maintenance, responsible NRW, required to meet service and performance standards.
- Customers – requires trust of operator.
- Settlement residents – potential to be contractor, franchisee, own, or be employed by owner/franchisee
- e.g. HCC lease Public toilet business (library)

3. Private water retailer

- Utility – limited control over products through contract to provide bulk water
- Owner & operator – profit required.
- Full responsibility for operational performance.
- Shared responsibility for maintenance

Factors influencing choice of kiosk business model

- Most appropriate model may not be the same for every settlement. Especially during piloting phase. Some settlements expressed preference for utility-operated, some for local business opportunity.
- Consider balance between water supply as a public health service, and water as a commodity
- Ability to control quality of service, and therefore influence reputation amongst a new market/population (absence of a strong positive relationship which improves tolerance for poor service)
- Responsibility for NRW from street mains to kiosk.
- Whether additional pro-poor strategies to be employed – free water allocation per HH probably more difficult to manage for non-utility owned kiosks

In Heyman et al (2014), the benefits to utilities and benefits to customers of different models are compared (utility-owned & operated; Community operated; utility-contracted private operator; private operator; free-water allocation v Lifeline tariff), with the conclusion that **utility-contracted operator, with free-water allocation, produces the best financial outcomes for the most stakeholders.**

Community or private operator: Often assumed that community associations will be motivated to provide a better level of service to the wider community, whereas a private operator is likely to have stronger capacity and business processes (WSUP, 2014)

Comparative financial analysis from Africa (Ghana, WSUP, 2014) this option had capacity to generate revenue for the utility, but often at the expense of the low-income consumer. *“The utility must remember that this option means it has not fulfilled its responsibility to deliver water directly to urban consumers (it is offering a reduced service) and the reduction in the utility’s distribution costs should therefore be reflected in reduced bulk water charges to the kiosk. This rarely happens in practice with the vendor/intermediary costs typically paid by the consumer, leading to the poorest consumers paying much more per volume used than higher-income consumers with individual household connections. We note that where there is a replacement of vendors by pre-paid meters, these even higher costs are absorbed within the overall costs of the utility – the same principle should be applied with the staffed standpost [kiosk] option (pg 19. WSUP, 2014).*

Considerations relating to implementing kiosks in Honiara’s informal settlements

The following are additional factors to be considered when assessing the suitability of different kiosk business models to Honiara and Solomon Water.

Solomon Water-operated and staffed kiosks

- Is preferred by residents of some informal settlements (Honiara)
- Operator is an employee of Solomon Water
 - Easier to develop and enforce Standard Operating Procedures
- Need to consider performance expectations of these staff
 - Non-revenue water from street mains to kiosk?
 - Maintenance of kiosk equipment
 - influence the amount of social-standing in settlement needed by the staff member, and risk to staff safety in enforcement
- Payment systems – linked with Cash Water model/infrastructure?
- Standardised communication & marketing materials including prices – cost-effective and consistent

Solomon Water – outsourcing models (Delegated, or fully privatised)

- Preferred by some settlements (opportunity for livelihoods)
- National performance standards are recommended (when multiple vendors) – for SI, start with Honiara-wide standards for all vendors/contractors. Performance criteria could include:
 - Operating hours; Hygiene (of facilities and water distribution equipment → water quality standards); Non-revenue water targets (street mains to kiosk loses);
- Regulations on product & services offered:
 - Price of water; Water that can be sold; Approval of additional P&S e.g. containers, container sanitisation facility/service, household water treatment
- Standardised payment systems – accounts-system is possible for delegated model, Privatised – no control
- (Some) Standardised communication & marketing materials – delegated models yes, privatised – reduced
- Supply chain considerations:
 - Repair/replacement of essential kiosk facilities
- When price is regulated, allowing kiosks to provide other products and services can improve livelihood options (e.g. selling approved complementary products and services).

CASE STUDY – Zambia: Utility-owned, delegated management model of water kiosks
(GIZ, 2009)

- Utilities own kiosks and related infrastructure → fully responsible for operations and maintenance
- Day-to-day operation – a **contractor** to the utility (often resident, female)
 - Paid commission (30-40% sales) + profits from selling other approved products (restricted by utility – for hygiene and water safety reasons)
 - Receive cash for water from customers. Pay utility monthly water bill based on meter. Utility pays commission. If non-payment of bill w/in 3 days, operator replaced.
- **Utility**– ‘informal settlements unit’ manages kiosks and their operations, including:
 - setting retail price
 - managing kiosk operators
 - revenue and commission payments
 - training and support
 - specifying and monitoring performance (e.g. operating hours, kiosk operations tasks)
 - customer complaints
 - maintenance of kiosks and infrastructure.

→ Need to visit every kiosk weekly/fortnightly
- Community engaged prior to kiosk establishment
 - Promotion of utility water service (social marketing to influence demand and willingness to pay)
 - Identify kiosk zones (ensure sufficient revenue per kiosk, but also consider accessibility and ‘communities’)
 - Kiosk locations within zone
- Financing – some from government and donors – Access to water is a key strategy of the governments plan to overcome poverty → eligible for pro-poor activities such as kiosks

Impacts: Customer satisfaction higher (than other water source options); consumption of safe water has increased (~20l/p/day)

Some (difficult) challenges observed:

- Maintaining hygienic conditions at kiosks → some customers not willing to pay
- Maintaining livelihood through delegated model (to maintain operators) – microfinance support to purchase supplies, supply-chain facilitation



Siting & facilities in informal settlements in Honiara

Kiosks are most likely to be:

- cost-effective in larger settlements
- socially acceptable and secure in settlement with distinct communities (which can host kiosks), in which case multiple kiosks may be appropriate to acknowledge the social and cultural diversity of communities within settlements
- more attractive where there is a lack of interest in household water connections and existing connections rates are low.

The specific location of should be influenced by (at least):

- customer accessibility (SDG6.1 Basic water service requires <30 mins round trip to collect, but also need to consider topography and carting, and convenience. Householders with low and/or difficult accessibility will likely not see the cost-benefits to shift to this water service (from their existing water supplies, even iuf the latter are unsafe for drinking). Accessibility can be assisted by consideration of container designs (see below).
- suitability of location - often the remaining available land spaces are less accessible, more vulnerable to environmental hazards (floods, land slips etc), or presently used for rubbish dumping/accumulation.

The specific locations and numbers of kiosks will also need to be considered in light of the selected business model:

- If Utility-owned, competition is not of concern (though cost-effectiveness to be considered)
- If delegated or privatised, need to consider business impacts of multiple kiosks located nearby (controllable delegated model; less so privatised model).

The design of facilities should allow for:

- Protection from vandalism when attended and unattended
- Operator security
- Hygienic service (drainage, container hygiene and backflow)
- Hose fill-up option – to fill up nearby larger (immobile) containers, such as larger storage drums or tanks at nearby households.

Reticulation design considerations, in addition to the standard factors for design of reticulated systems should also consider:

- Increased resistance to tampering (e.g. resilient materials, deeper installation of pipes underground)
- future expansion of the system for households ready for their own connections.

Containers and carrying water to households:

Carrying water:

- the burden of carrying water from the kiosks to the place of use (usually at home) can be significant. This burden typically borne most by women who are responsible for most domestic cleaning, cooking and childcare responsibilities requiring water, and by children.

- This burden can be improved by attention to accessibility of kiosks (as noted above in siting), as well as improvement of pathways to/from kiosks, especially grading to allow for wheeled containers (see example below, Figure 19) or wagons/bicycles/trailers to carry containers and improve the safety of carrying containers on paths.
- Some consumers or households may not be able to collect their own water, for example older residents or those with disabilities and they will be reliant on others to carry water for them. Some water kiosk operators could consider optional service delivery.

Container hygiene

- Containers require adequate and regular cleaning. Poor container hygiene is a common cause of water pollution. This is more likely in populations with unsafe sanitation and inadequate hand hygiene practices – providing a pathway for faecal-oral pathogens to enter drinking water supplies.
- This could be mitigated through multiple strategies to promote both container hygiene and household water treatment.



FIGURE 19: EXAMPLES OF WATER CONTAINERS AND THEIR PRICE EQUIVALENT IN SOLOMON DOLLARS

Piloting water kiosks (water stores) in Honiara

The settlement consultations indicated a strong preference for kiosks to be referred to as water stores by residents, as this was more meaningful in the local context.

In addition to the typology (suitability of different options for settlements, considering ability & willingness to pay, history of connections/disconnection, & violence against staff/infrastructure), general considerations for pilots (testing and improving the water kiosk model) include identifying settlements in which

- There is limited existing demand for household water connections but an interest in safe water (preference or acceptance of kiosk as feasible solution; limited alternative affordable and safe sources) although communication on the benefits and value of utility (safe) water will be important
- ‘community’ engagement is feasible, with recognised entry points and some social structures with whom to engage, as it will be necessary to create awareness, seek interest and support, discussion operations, negotiate easements.

Automated (e.g. Water ATM, token-taps) in central public places

Automated water dispensers could increase accessibility to Solomon Water's water by improving access to safe water to those in unserved urban or rural areas, if located near to central transport hubs (via which containers of water could be transported). It is not uncommon to see very large numbers of small plastic bottles of water being loaded to buses and boats for transport to homes outside Honiara.

Water ATMs operate similarly to kiosk, the only important difference being that they are not manned. They comprise an **automatic water dispenser with an on-site payment mechanism**, such as an **ATM** or a **token-based system**. Consumers pay using **cash or tokens**. More sophisticated systems use **smart cards** topped-up at a designated establishment or **via mobile phone**.



FIGURE 20: EXAMPLES OF AUTOMATED WATER DISPENSERS

Operational features

Most of the operational, social, environmental and other factors summarized above for water kiosks apply to automated water dispensers. Some additional/alternative factors include:

- **Essential operational and maintenance:** protecting and maintaining access point functionality and hygiene is critical and requires regularly attention (visits by maintenance contractor). The complexity of the payment technology will also influence maintenance requirements and roles and responsibilities.
- **Regulatory:** Water tariff and ownership/management regulation is critical to ensure affordability of the service.
- **Locations:** close to major public transport hubs, but needs to be securable (which will likely reduce accessibility). Possible options for Honiara include:
 - Inside existing stores
 - Inside secure compounds e.g. public (pay-per-use) toilets, government buildings/compounds/

5.4 PRIORITY SANITATION OPTIONS

Objective of sanitation: safe containment, treatment and disposal of human waste, in order to reduce the spread of pathogens and improve human health (diarrhoea, childhood stunting; worms, typhoid, etc), as well improving aspects of wellbeing including security, privacy and convenience.

The 'Best' options are very influenced by local situation. Therefore a city that has **safe sanitation everywhere most likely has a mix of sanitation options**: different service delivery models, different organisations with different roles, supporting/ operating different types of sanitation).

This report includes sanitation service delivery options that are not necessarily to be implemented by Solomon Water (but all could have possible roles). The complete service delivery models are less clear because they will involve actors not directly involved in the consultations of this study.

A process to develop **city-wide sanitation plan or strategy** would be best to ensure there is (consistency in approaches promoted (ii) no gaps – everyone has access to a sanitation option (iii) sanitation services are complementary and synergies utilised (iv) responsibility can be assigned to different actors.

In addition, those that are considered to be the 'Best' options now, will likely be different if/when access to water is improved because:

- readily available water supply (e.g. piped to house) will increase the demand and opportunity for water-based sanitation (unwillingness to adopt water-less sanitation)
- less reliance on local sources from drinking will lower risks from sanitation options that potentially cause groundwater contamination.

Requirements common to all sanitation options

- Superstructure (toilet house) – can be locally designed, constructed and maintained – few sanitation options with specific superstructure requirements
 - Need to promote sanitation (and promote hygiene – consider that handwashing with soap, safe menstrual hygiene will be promoted alongside toilet use → water use, technologies/design, use/misuse of toilet technologies e.g. clogging)
- stakeholder cooperation will lead to more effective promotion of sanitation → encourage city-wide (or national urban) communication materials

Costs, Affordability and Willingness to pay for sanitation

Existing wastewater (sewerage) fees

The fees associated with Solomon Water's domestic waste water service are:

Wastewater tariffs	per kL (based upon water consumption)	
0-15kL / month		\$3.06
16-30k/month		\$4.62
>30kL/month		\$5.40

In addition, the consumer will need to pay for additional water used in the sanitation system (depending upon the type of sanitation adopted). For a system that requires 50l/day total water (such as the simplified sewer system), this equates to approximately an additional \$9 SBD on top of an existing water connection usage and monthly fees.

Costs

Daudy (2018) compared the lifecycle costs of full sanitation chain systems in developing cities of Africa and Asia, examining the cost ratios between different sanitation systems. **That study concluded that conventional sewer systems are in most cases the most expensive sanitation options, followed, in order of cost, by sanitation systems comprising septic tanks, ventilated, improved pit latrines (VIP), urine diversion dry toilets and pour-flush pit latrines.**

The cost of **simplified sewer systems was found to be lower than both conventional sewer systems and septic tank-based systems**, but lack of data prevented further comparisons with other types of sanitation solutions (Daudy, 2018).

Manga et al (2019) compared the costs of two on-site options (VIPs and Urine-diverting toilets) with three versions of simplified sewerage:

- System discharging in the existing conventional trunk sewer with treatment
- Pump-based Simplified sewers with treatment plant
- Gravity-based Simplified sewers with treatment.

The Manga et al (2019) study determined that on-site options were only more economical when population densities were low (in their case study, below 112 people/hectare). At higher densities (above 172 people/hectare), simplified sewerage was cheaper than VIPs. At 'medium' densities, situational factors determined which was cheaper. This is because at high population densities, off-site sanitation systems achieve economies of scale that are not achievable with the onsite (per household) options. For Honiara, variable population densities have been reported, from 50 to 200 people per hectare (see Section 2 for details).

Willingness of informal settlers to invest

Willingness to invest in sanitation, can be indicated by the existing investment in sanitation.

- Existing investment in types of sanitation – low (few proper septic tanks)
- Consultations with residents of informal settlements indicated that these consumers are focused on the user interface (defecating experience) – the toilet house, the riser, etc), rather than considering the whole sanitation service chain, and as a consequence less interested in investing in those parts not related to the direct user experience. However, to date, there has been minimal promotion of sanitation beyond the interface and basics pits, and for residents without water this is their priority investment (water).

As for water, capital investments required of informal settlers will likely be a financial barrier – the forms of simple, low cost sanitation options adopted in rural settings will not be appropriate in all informal settlement situations.

An Output-based aid program, if secured, could present an opportunity to subsidise capital/connection costs for informal settlers.

Note: The SIG rural WASH Policy states that there should be no subsidies for domestic rural sanitation. Adoption of, and communication regarding subsidies provided for urban sanitation will require careful consideration so as not to create confusion and apparent inequalities between urban and rural populations.

Types of sanitation for Honiara’s informal settlements

As indicated above, based on the assessments of technology options, service requirements and consultations with Solomon Water and informal settlements, a shortlist of sanitation options was identified (refer below). However, it is recommended a sanitation strategy or plan for Honiara be developed by the range of agencies and actors with a, existing or potential role in the city’s sanitation, to more fully examine the feasibility and capacity for these options.

Priority sanitation options for Honiara:

Flushing toilets with piped sewerage or household septic tanks	(operated by Solomon Water) or household septic tanks (with septage collection, treatment and disposal); water-saving cisterns can improve water efficiency. Only applicable for conventional reticulated sewerage is physically possible and planned.
Community simplified sewer and septic/ABR system	Flushing toilets with community simplified (small bore, shallow) sewers and community septic tanks or ABR systems (operated by Solomon Water), from which effluent is connected via solid-free pipes to the conventional sewerage network, and sludge is removed as needed from the septic/ABR. Water-saving cisterns can improve water efficiency.
Pour-flush to pits with pit emptying service or burying	Water-based sanitation, with pour-flush slabs or raisers, including water saving equivalents such as Sato-pan toilets.
Ventilated Improved Pit (VIP) with pit emptying service or burying	Improved dry-based sanitation
Above ground-sanitation	Container-based sanitation or composting toilets

Community simplified sewers, community septic/ABR, with offsite effluent and sludge disposal

Figure 21 below gives a conceptual diagram of this system. It is not commonly in use, and little information exists about this as a whole system. This is primarily because:

- in most urban informal settlements where simplified sewers are considered appropriate, there is a sufficient conventional sewerage network nearby to receive the waste from the simplified sewer system. below represents
- in other cases, there is some initial treatment (and sometimes disposal) or either effluent or sludge at the household level (rather than centralisation of all household toilet waste, for offsite treatment and disposal).

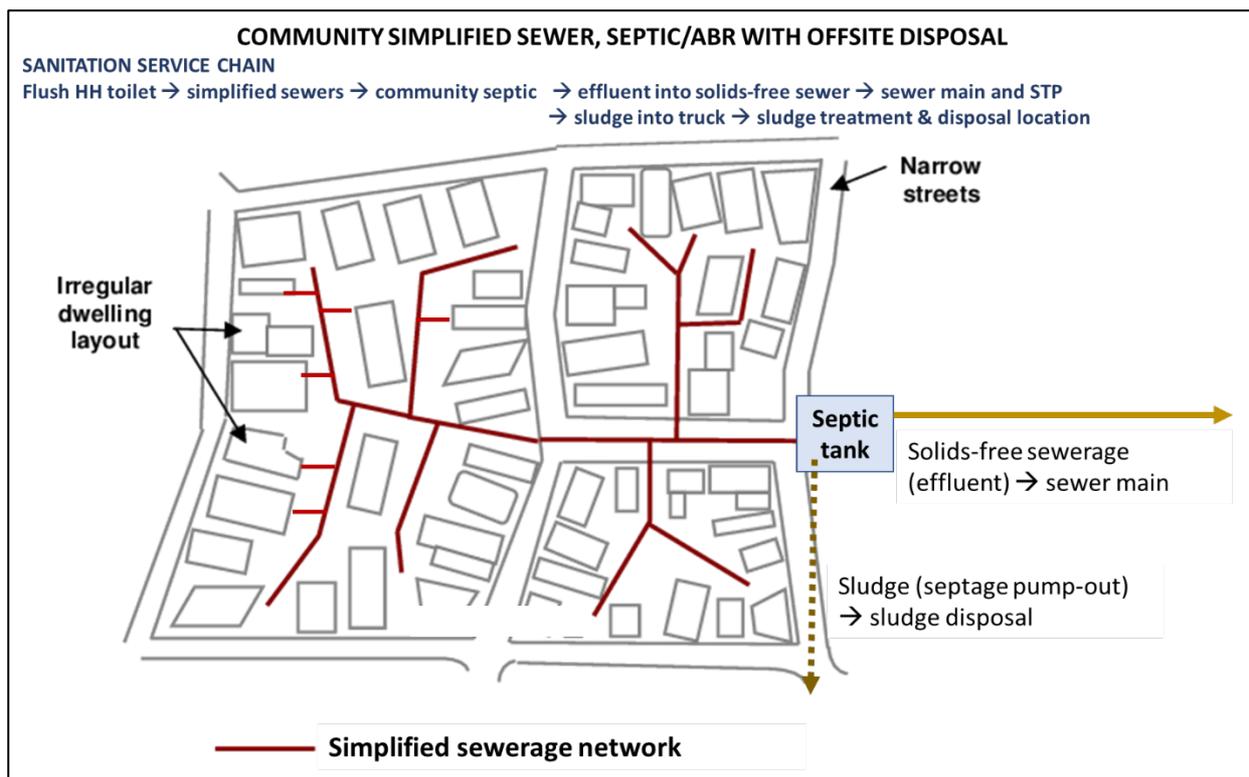


FIGURE 21: CONCEPTUAL DIAGRAM OF A COMMUNITY SIMPLIFIED SEWER AND SEPTIC/ABR SYSTEM FOR INFORMAL SETTLEMENTS IN HONIARA, WITH OFFSITE SLUDGE AND EFFLUENT DISPOSAL

Overview of service delivery model

Name						
Community Simplified sewer, Septic (or variation: Anaerobic Baffled Reactor (ABR), Anaerobic Filter (AF), Aerobic treatment system (ATS)), offsite effluent and sludge disposal						
Service Delivery Chain	Access (site of use)	User interface	Waste storage (none at the household)	Transport (onsite)	Treatment & disposal technology	Further transport, treatment or disposal
TECHNICAL ASPECTS						
Technology	<p>Access via</p> <ul style="list-style-type: none"> shared private household toilets individual household toilets <p>All options supported simultaneously</p> <ul style="list-style-type: none"> Superstructure (housing) can be built with local materials 	<ul style="list-style-type: none"> Sitting or squatting slabs with pour flush or cistern flush design – with a water seal. Ready supply of water (containers for pour flush, or piped to cistern) System needs greywater to operate effectively (handwashing and showers, kitchens etc) <p>As for all toilets: Also required:</p> <ul style="list-style-type: none"> handwashing with soap facility (need water access) bins for menstrual hygiene management and infant faeces management 	<ul style="list-style-type: none"> a sewerage network that is constructed using smaller diameter pipes laid at a shallower depth and at a flatter gradient than Conventional Sewers. allows for a more flexible design at lower costs. installed where they are not subjected to heavy traffic loads, → can be laid at a shallow depth, little excavation is required PVC recommended, minimum 100 mm gradient of 0.5% is usually sufficient each junction or change in direction, simple inspection chambers (or cleanouts) are sufficient. Inspection boxes are also used at each house connection Protect from stormwater inflows as much as possible 		<p>Treatment tank options (on-site) to provide initial treatment to effluent and sludge. All options involve effluent transported via solid-free sewer to conventional sewerage network, and desludging of the tank options.</p> <p>Septic:</p> <ul style="list-style-type: none"> watertight chamber made of concrete, fibreglass, PVC or plastic. With at least two chambers (separated by a baffle). Accessibility to all chambers (through access ports) is necessary for maintenance. should be vented for controlled release of odorous and potentially harmful gases. Treatment: in chamber: Settling and anaerobic processes reduce solids and organics, but the treatment is only moderate (no treatment of pathogens, unless chlorine dosing before discharge of effluent) <p>Variation: ABR:</p> <ul style="list-style-type: none"> is an improved with 3-6 baffles under which the wastewater is forced to flow. Larger capacity – suited to multiple toilets (needs more regular flow of waste) and can take greywater <p>Variation: AF</p> <ul style="list-style-type: none"> Similar ABR but with Biological filters (biofilm on gravel/rocks) incorporated to multiple chambers to improve treatment Requires pre-settlement tank Often combined with subsequent Aerobic treatment system (requiring constant pump aeration) <p>ABR & AF treatment:</p> <ul style="list-style-type: none"> Similar process to septic but more effective at reducing BOD (but similarly ineffective for pathogens) <p>AF:</p> <ul style="list-style-type: none"> Pathogens and nutrients not treated so effluent requires further treatment / careful disposal 	<p>Effluent: transported via solid-free (small bore, low gravity, or pumped) pipes to conventional sewerage network.</p> <p>Sludge:</p> <ul style="list-style-type: none"> Sludge emptying and safe disposal (treatment) required every 2-5 years ABR: 1-3 years) Requires trucks or motorised carts to de-sludge tanks Sludge disposal and treatment facility offsite

<p>Environmental and physical factors</p>	<p>As for all sanitation</p> <ul style="list-style-type: none"> Minimal and flexible physical accessibility during night – prefer location in/adjacent to house for safety need access to a water supply suitable for, handwashing, cleaning and toilet flushing. 	<ul style="list-style-type: none"> Water supply required for toilet flushing. Enough water needed to enable adequate flow of effluent through treatment processes 	<ul style="list-style-type: none"> Requires reasonably high-water use Pipes are usually laid within the property boundaries, through back or front yards, rather than beneath the central road, allowing for fewer and shorter pipes Topography may impact capacity to transport wastewater to sewer mains (e.g. pressure in pipes). Leakages pose a risk of wastewater exfiltration and groundwater infiltration and are difficult to identify 	<p>Septic (ABR or AF)</p> <ul style="list-style-type: none"> Soak Pit or Leach Field require significant land area – not suited to many informal settlements. Preference to transport offsite On-site treatment & disposal not suited to shallow groundwater (especially if accessed for human use nearby) Need truck access (for desludging) 	<ul style="list-style-type: none"> safe sludge treatment/ disposal location required
<p>Key operational tasks</p>	<p>As for all sanitation</p> <ul style="list-style-type: none"> Adequate toilet use practices (e.g. flushing, cleaning, etc.) Promotion of sanitation use is generally required 	<ul style="list-style-type: none"> Flush toilets when required - Ensure water availability for flushing. Ensure sufficient wastewater (grey or black) is entering system Need care by users: e.g. harsh chemicals entering tank will decrease treatment significantly (and create odours), Clogging is frequent when bulky cleansing materials are used Pour flush: Must use bucket/container of water to flush and maintain water seal 	<ul style="list-style-type: none"> ABR: start-up time can be several months (unless inoculated) 		
<p>Key maintenance tasks</p>	<p>As for all other toilet types</p> <ul style="list-style-type: none"> Hygienic facilities (at least daily cleaning depending on level for use, maybe several times per day) handwashing facility bins promotional materials (notices etc) Super structure (building/housing maintenance) 	<p>As for other toilets</p> <ul style="list-style-type: none"> Maintain user materials: anal cleansing materials Repairs to toilet interface (cracks etc) and functional lid 	<ul style="list-style-type: none"> Inspect household connections and junctions Requires repairs and removals of blockages more frequently than a Conventional Gravity Sewer 	<ul style="list-style-type: none"> Accumulated sludge and scum must be periodically removed (septic: 2-5 years; ABR: 1-3 years) check tank is water tight and repair cracks (typically not regularly undertaken by consumer, leading to leakage of untreated effluent) Check pipework associated into and from tank – clogs must be removed, pipes repaired). 	<ul style="list-style-type: none"> Sludge need to be safely disposed (it is not fully treated – high pathogenic load)

Actors and their potential roles					
Service providers	<ul style="list-style-type: none"> As for all sanitation: Sanitation promotion is required – city-wide (or country-wide urban) communication materials need to be developed; can be implemented by HCC, NGOs and SW1 Superstructure construction (optional) 	<ul style="list-style-type: none"> Sale of risers & slabs 	<p>Construction:</p> <ul style="list-style-type: none"> Supply of piped network materials Local manufacturers of septic tanks (plastic and concrete) Requires expert design and construction skills. Installation of simplified sewer pipes potentially by communities – with design and supervision by plumbers / utility expertise. <p>Operation and maintenance</p> <ul style="list-style-type: none"> Solomon Water O&M responsibility of communal treatment systems (either from communal tank, or including simplified sewer depending on model adopted). Possibility for training and engagement of local residents for minor maintenance inspections ABR, AF (with or without aerobic treatment system) requires expert maintenance All require regular desludging by a licenced service provider 		<ul style="list-style-type: none"> Sludge removal services required (trucks and smaller motorised carts for improved access) Sludge treatment & disposal facilities/services
Consumer roles	<ul style="list-style-type: none"> Superstructure construction (optional) Connection and/or service fee may be required 		<ul style="list-style-type: none"> Potential involvement in installation of simplified sewer pipes Required to pay service fee 		
Costs					
O&M costs	<ul style="list-style-type: none"> Minimal (mostly local materials can be used for super structure) <p>Cost score: 1</p>	<ul style="list-style-type: none"> Minimal costs to repair (consumer able to cover) <p>Cost score: 1</p>	<ul style="list-style-type: none"> Most significant cost to consumer is associated water usage fees, and likely sewerage fee <p>Cost score: 2</p>	<ul style="list-style-type: none"> No Electricity (except if Aerobic Treatment System added), but several maintenance tasks – some may require expert assistance (e.g. desludging) <p>Desludging of tanks</p> <p>Cost score: 3</p>	<ul style="list-style-type: none"> Cost to operate desludging services, and treatment & disposal locations <p>Cost score: 4</p>
Capital costs (relative indication)	<p>As for all sanitation</p> <ul style="list-style-type: none"> Low (but variable) capital costs depending on materials Pour flush slabs and raisers available from HSS for purchase: \$100 squat slab with water seal; \$500 raised seat with water seal <p>Cost score: 1</p>	<ul style="list-style-type: none"> HCC sells low cost options <p>Cost score: 1</p>	<ul style="list-style-type: none"> Simplified sewer network – low installation costs (community labour an option), cheaper pipe materials than conventional sewerage System can be easily expanded as population size varies <p>Cost score: 2</p>	<p>Community Septic/ABR/other tanks</p> <ul style="list-style-type: none"> Cost-efficiencies for larger capacity systems, but need to consider number of connections that can cooperate to operate properly and undertake minor maintenance (if needed) <p>Cost score: 3</p>	<p>Potential expansion of sludge treatment capabilities</p> <p>Cost score: 4</p>
Regulatory considerations	<p>As for all sanitation</p> <ul style="list-style-type: none"> Superstructure: building regulations Limitations on building on steep slopes 		<ul style="list-style-type: none"> Land ownership for pipe access 	<ul style="list-style-type: none"> Regulation of sludge disposal and effluent disposal 	
Social considerations	<ul style="list-style-type: none"> cooperation on use of simplified sewer pipes is required, especially to prevent and manage blockages (As for all sanitation): Community mobilisation requirements: sanitation promotion at settlement scale Need separate male and female toilet houses, with discrete entrance doors, for public toilet and possibly for private shared toilets 				

Service standards (consumer perspective)	FSM safety	<ul style="list-style-type: none"> • Good if no pipe leakage
	Affordability	<ul style="list-style-type: none"> • Settlement residents could possibly contribute/cover simplified sewer pipework costs • Service fee likely to be required (~\$30-50/month (if equivalent to sewerage) plus water use fees (\$10-50/month)
	Accessibility	<ul style="list-style-type: none"> • Can be good if close to house and not difficult physical terrain to access at night and by children and people with disability • Design of user interface will need to consider people with disability and children (e.g. squatting difficult for many – raised seat preferred,
	SDG Sanitation service level	<ul style="list-style-type: none"> • Safely managed (highest) (potentially with some private sharing)
Health/wellbeing considerations	<ul style="list-style-type: none"> • Health (reduced spread of pathogens) gains only if all in settlement use safe sanitation (→ settlement-scale mobilisation required) • Well-constructed facilities offer privacy and safety for women • In-house facilities offer BEST wellbeing outcomes for all (e.g. privacy and safety for women) • Health significantly improved if handwashing facilities available (and HWWS promoted) • No mosquito breeding compared with dry sanitation 	
Other	<ul style="list-style-type: none"> • Especially appropriate for dense urban areas where space for onsite technologies is limited. They should be considered as an option where there is a sufficient population density (about 150 people per hectare) and a reliable water supply that can be used for sanitation (at least 50 L/person/day). • Requires water use (not suited to households carting water unless an alternative source is available at the house) • Significant investment by consumer so better suited to settlements planned for formalisation 	

Simplified sewers

Extracted from Manga et al. (2019):

“Simplified sewerage is a low-cost off-site sanitation technology designed mainly for collecting, and conveying all forms of unsettled wastewaters from household environment. It is basically a conventional sewerage system stripped down to its hydraulic design basics, so as to allow for the use of smaller-diameter pipes, shallower depths, flatter gradients and reduced manholes while maintaining sound physical design principles (Tilley et al., 2014; Mara, 1996; Sinnatamby, 1983; Türker, 2011).”

“Simplified sewerage layout is very flexible in that it can be implemented in unplanned areas with less destruction and restoration costs since it uses both back yard and in-street layout versions in private land, unlike conventional sewerage where in most cases sewers are laid in the centre of the roads. The system also **allows in some cases for community participation in the implementation, operation and maintenance** of the system.” “However, it's important to note that although many studies report community participation as one of the key features associated with successful simplified sewerage system, in practice is not really the case as some communities do not actually enjoy participating in sanitation say performing simple operation and maintenance tasks such as unblocking sewers (Tilley et al., 2014). Therefore, in such situations, operation and maintenance works of the system may be delegated to small engineering companies or specialised group of persons trained in appropriate operation and maintenance procedures so as to identify problems early enough prior to them becoming severe hence reducing on the costly repairs (Sinnatamby et al., 1986; Tilley et al., 2014).”

“All such system characteristics and modifications to the design features lead to reduced capital costs of the system, which enables the sanitation service providers to achieve a greater coverage of sanitation services to its citizens with the existing or available financial resources (Paterson et al., 2007).”

Lessons from semi-decentralised sewerage in other places

- especially appropriate for dense urban areas where space for onsite technologies is limited. They should be considered as an option where there is a sufficient population density (about 150 people per hectare) and a reliable water supply (at least 50 L/person/day) (Tilley et al., 2014)
- Sewers laid within property boundaries, allows for higher connection rates, fewer and shorter pipes, less excavation (pipes not subject to heavy traffic loads), but requires careful negotiation between stakeholders
- Cost: typically 20 and 50% less expensive (capital) than conventional sewerage (Tilley et al., 2014) (also found to be cheaper than septic tank-based systems, when consider whole service chain (Daudy, 2018)
- Sewerage becomes more sustainable and cost-effective when the local public sector or utility accepts co-management responsibility for monitoring facilities, ensuring repairs and maintenance, as well as ongoing technical support and sanitation promotion (Eales et al. 2012).
- Potentially, households responsible for the maintenance of the simplified sewer part of the system. However, in practice this may not be feasible because users may not detect problems before they become severe and costly to repair. Alternatively, a private contractor or users committee can be hired to do the maintenance. (Tilley et al., 2014)

Technical aspects of simplified sewers

Expert design is required because of the complexity of these systems. Mara et al. (2001) developed detailed guidelines for technical specifications. Some of the key technical aspects include:

- Similar in concept to conventional gravity sewerage networks (operate using same principles, but designed differently)
- Systems that connect direct to sewer usually require HH settling tanks and interceptor tanks (to settle additional solids) - but not in this case where communal septic is used (needs the solids), but maybe access to inspect/clear blockages
- minimum peak flow should be 1.5 L/s and a minimum sewer diameter of 100 mm is required. A gradient of 0.5% is usually sufficient e.g. a 100 mm sewer laid at a gradient of 1 m in 200 m will serve around 2,800 users with a wastewater flow of 50 L/person/day → connect greywater from houses
- PVC pipes are recommended. The depth at which they should be laid depends mainly on the amount of traffic. Below sidewalks, covers of 40 to 65 cm are typical.

Often have multiple sub-systems connecting to a single large septic/sewerage system. Regarding the size of subsystems – capacity of 100mm pipes is the main limitation, but capacity is quite high (~200 HH)(Mara et al., 2001). This is bigger than many settlements in Honiara,

Regarding maintenance (Mara et al., 2001)

- If this is the responsibility of households sharing a subsystem, training will be required to ensure safety handling faecal waste
- Occasional flushing of the pipes is recommended to insure against blockages (recommend scheduled flushing by community – flushing ‘day-of-the-week’). Blockages can usually be removed by forcing a rigid wire through the pipe.
- Extra unplanned connections may lead to blockages of pipes. Additional connections need to be managed through community engagement, and training.

Good community engagement is essential

Several aspects of this system will require effective and regular engagement between the operator (Solomon Water) and the residents. These include:

- Location/boundaries/households within subsystems
- Location of pipes
- Space for pipes (move temporarily or permanently existing structures if needed)
- Pipe laying capacity (and for pipes O&M): potential to involve community members. Possible short-term employment for youth (connect with CAUSE rapid employment program?). Volunteer/HH contribution also possible (but potential for reluctance to pay for sewerage services later)
- Ongoing management of simple sewer system – engagement (training regarding the health risks associated with removing blockages)

Communal Septic (or ABR)

Some key factors relating to their use in Honiara (in addition to the overview table above)

- There is currently high user acceptance for septic tanks (mostly at the household scale, but this indicates an acceptance of this technology)
- These tanks can be installed underground (with accessibility to all chambers)- limited land area required, but required truck access
- Effective all climates, but minimal removal nutrients and pathogens (effluent and sludge remain unsafe) (removes solids and lowers BOD)
- Design needs to carefully consider capacity and plan for increased capacity with likely continued growth and increasing density of urban settlements
- construction can be achieved with local resources

Solids-free sewers

These comprise a network of small-diameter pipes that transports pre-treated and solids-free wastewater (such as septic tank effluent) (Tilley et al., 2014). If well designed and maintained, there is little risk of clogging, thus there is no need of self-cleansing velocity. Critical design and maintenance considerations include (Tilley et al., 2014)

- recommended pipe diameter is 75 to 100 mm
- Shallow depths (at least 300mm)
- Small or even inflective gradients
- Fewer inspection points
- Can follow topography more closely

For operations, these sewers require a constant supply of water, although less water is needed compared to conventional sewers.

CASE STUDY: Hatdady Tai settlement, Low-income, unplanned urban village in centre of Vientiane, Laos

(Luethi et al., 2009)

Settlement characteristics:

- 275 residents, av. HH size: 4.9p
- Diverse socio-economic and socio-cultural
- Land tenure: informal settlers. Formalisation process underway (2/3 formally recognized plots)
- 1.4 hectares, flat terrain, shallow groundwater (0.5-1.0m below ground level), regular flooding, limited road access (no trucks)

Water and sanitation:

- HH connections to utility water service
- High toilet ownership: 85% pour-flush pits, 10% septic tanks discharge/overflow/effluent to open ground & natural open drainage. No sludge emptying (no access by trucks). Manually emptying (hole in pit → drainage to open ground/drainage channels)
- Cultural barriers to reuse
- No solid waste management
- Community engagement: occurred in response to request for assistance.
- wastewater systems constructed:
 - 32 Households with simple sewers (265m) to 3 community septic tanks
 - Simple sewers depth 20-30cm, PVC: 100-150mm

Budget:

- \$70,000US (inc. Training, stormwater drainage, solid waste management). Total planning & implementation: \$263US/beneficiary (275 residents).
- Residents made financial contribution via village committees (some used microfinance) to improve their HH sanitation infrastructure [required early negotiation and agreement] and non-financial (feeding workers etc)

O&M costs minimal
– residents pay monthly fee (\$0.5/person/month)



Figure 9: Wastewater collection and treatment system No. 1.

The sewer network connects 23 households to a community wastewater treatment system located on private ground. The treatment system can be accessed via a gravel road.

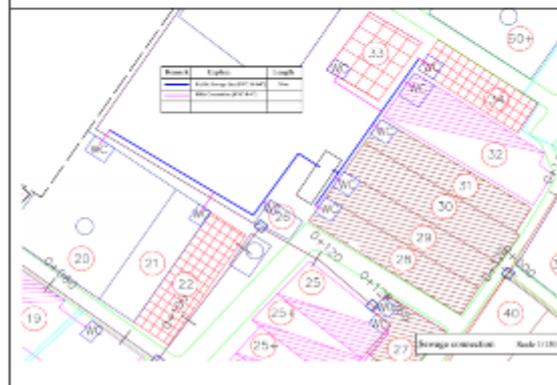


Figure 10: Wastewater collection and treatment system No. 2.

The sewer network connects 12 households in the North-east of the village to a community treatment system located on private ground. Access will need to be established (removal of fence, access path)

Piloting the Community simple sewer, septic/ABR and offsite disposal system

Given there appear to be very few case studies describing the use of these systems including the advantages, disadvantages success factors and challenges, it is recommended the a pilot of this system be undertaken. This would provide critical evidence to assess the feasibility of this system. Not only for the urban settings of the Solomon Islands, but also for other urban centres of Pacific Island Countries, and globally.

Regarding selection of possible settlements (or communities within) to pilot this system, the following criteria are useful to elect a pilot settlement:

- No or limited other safe options for sanitation as these represent settlements with critical need for such a system (the decision tree for sanitation options can assist with identifying such settlements) A settlements that will require this (because very limited/no other safe options).
- Within 100m sewer (~ 14 of the identified settlements)
- With existing or increasing Solomon Water household or shared household water connections
- Not identified as a settlement that is not to be formalised
- Has had some past engagement on sanitation so that there is already some existing demand and/or awareness of sanitation. Very few settlements meet this criterion e.g. Namoliki, Henderson & Burns Creek, however, no settlements meet all of the above criteria)

Best options for pilot settlements:

- Kofiloko: being formalised, close to sewer and existing water connections) but no known prior engagement on sanitation
- Namoliki: being formalised, has existing community interests in a sanitation (sanitation enterprise constructing pour-flush toilets) providing an existing entry point, but is 100-500m from sewer.

On-site sanitation options

A range of on-site sanitation options have the potential to suit some informal settlements (or parts of these).

The shortlisted on-sanitation options include:

DRY-BASED SANITATION		WATER-BASED SANITATION	
Above-ground, dry sanitation (e.g. Compost, containers)	VIP & Ashes pit toilet (inc raised options)	Pour-flush (Sato) single/double pit (inc raised version)	Flush HH Septic tank & Pour-flush (Sato) single/double pit

Although there is a preference for water-based sanitation, the promotion of dry-based sanitation options should be encouraged as a more water conservative option for those who choose it (which may also relate to lower costs to operate), and to give more consumer choice.

Appendix 9.5 includes the sanitation technology overviews for each of these options. Comprehensive service delivery models cannot yet be defined without further engagement of possible service delivery organisations, and assessment of capacity.

Regarding service delivery models, some additional considerations include:

- Supply chains:
 - Parts: some on-site manufacturing/construction possible (reduced cost, potential livelihood opportunities, some parts more effectively purchased from hardware)
 - Installations: simple carpentry and plumbing skills – locals can install (design specifications from RWASH)
- Demand creation:
 - in the rural populations, this is to be achieved using the CLTS approach as outlined in the National RWASH policy. This approach, which includes a no-subsidy policy, may be less appropriate in urban spaces and alternative options need to be considered.
 - There is also a need to consider creating demand for ‘beyond-the-user-interface’, as currently there appears limited interest in understanding and investing in effective faecal sludge management
- Community-based enterprises that simultaneously address supply and demand have been attempted in Honiara’s informal settlements with limited success (Live and Learn’s program in a small number of settlements 2013-2018): significant challenges were encountered in creating and mobilizing action of community-owned enterprises (likely due to a lack of social cohesion), however privately (e.g. family-owned) enterprises may prove more successful.

6 ALIGNMENT OF SERVICE DELIVERY OPTIONS WITH KEY CHARACTERISTICS OF HONIARA'S INFORMAL SETTLEMENTS

6.1 KEY CHARACTERISTICS INFLUENCING SERVICE DELIVERY OPTIONS

Based on characterisations of the informal settlements described in chapter 4, and the requirements and features of the different water and sanitation service delivery models described in chapter 5, the following are the key settlement characteristics that influence which of the service delivery options are best suited.

For water, the following characteristics of settlements were determined as critical in influencing the suitability of the different shortlisted service delivery models to different settlements, or residents within settlements.

- **Classification of settlement as hazardous by MLHS:** large investments in water infrastructure, such as for individual household water connections are discouraged by SIG. Water kiosk may be a suitable alternative
- **Water connection history:** previous experiences of high rates of non-payment of water bills, tampering or theft of water or water infrastructure and/or violence to utility personnel
- **Ability and willingness to pay for water:** low ability and/or willingness to pay for water exists in some settlements. Access to safe and affordable water from shared water connections, or from a water store, may increase value and demand of utility water.

For sanitation, the critical characteristics of settlements (or communities within settlements) that influence the suitability of the prioritised sanitation options are

- **Distance away from sewer line** – Honiara's sewer network currently covers small areas – it is not possible to join every house to the sewer network, but some may be close enough that they can be connected
- **Dense settlements** – many informal settlements are dense with houses, and do not have sufficient space for proper on-site sanitation that treats and disposes of waste in the community, such as septic tanks
- **Road access to houses** – many houses inside informal settlements are not close to the road – they are too far away for septage trucks to access their septic toilets or pits to empty them
- **Groundwater** – some areas of Honiara have shallow groundwater, and in some of these areas, people use this groundwater for drinking and other household uses. Shallow groundwater can be easily contaminated by unsafe sanitation. In addition, it is difficult to construct inground pits in water-logged soil.
- **Flood vulnerability** – areas that experience river, stream or coastal flooding are not suited to many inground sanitation options, because during floods, the human waste is carried around the community in flood waters, causing ill-health
- **Water availability** – some houses don't have access to a lot of water at their house (many are sharing water connections), and low-water using sanitation options may be required. For settlements with low availability, consideration should be given to the likelihood of improvements to water availability occurring in the near future (such as improved access to water services provided by Solomon Water).
- **Land tenure** – some settlements have been identified as being in hazardous areas and will not be formalised. These areas require sanitation that is not too expensive, or that can be moved when people move
- **Settlement or area population size and social cohesion** – the size of the population in an area and their ability to work together to maintain infrastructure affects the suitability of some community-wide sanitation system.
- A range of **socio-cultural factors** also significantly influence the suitability of types of sanitation, including affordability, ability and willingness to pay for sanitation, and widespread social norms relating to current (unsafe) sanitation practices.

6.2 DECISION-SUPPORT TREES FOR WATER AND SANITATION SERVICE DELIVERY OPTIONS – INKED TO HONIARA SETTLEMENT CHARACTERISTICS

These decision trees have been developed to link the critical settlement (or community) characteristics with appropriate service delivery options. They have been designed for use by planners and programmers, to determine which options may be suitable to promote or further investigate.

These decision trees have not been designed with use in community consultations. However early community engagement will be critical; discussion of options and pros and cons of each will be important to ensuring consumer interest and participation. Genuine community-participation will be critical for any service delivery model to work successfully.

Water service delivery decision tree - to support planning for Honiara’s informal settlements

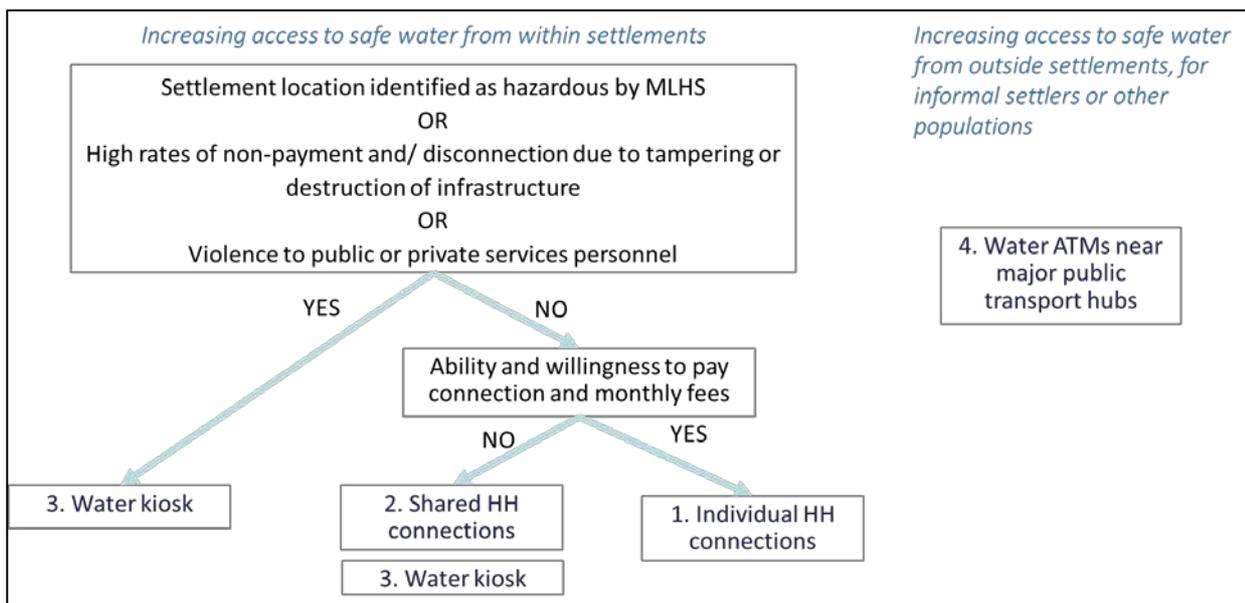


FIGURE 22: WATER SERVICES DECISION TREE FOR INFORMAL SETTLEMENTS, HONIARA.

Improvements to water services in informal settlements will need to consider drainage and wastewater services, as increasing accessibility to water will likely increase water usage.

Sanitation service delivery - decision tree to support planning for Honiara's informal settlements

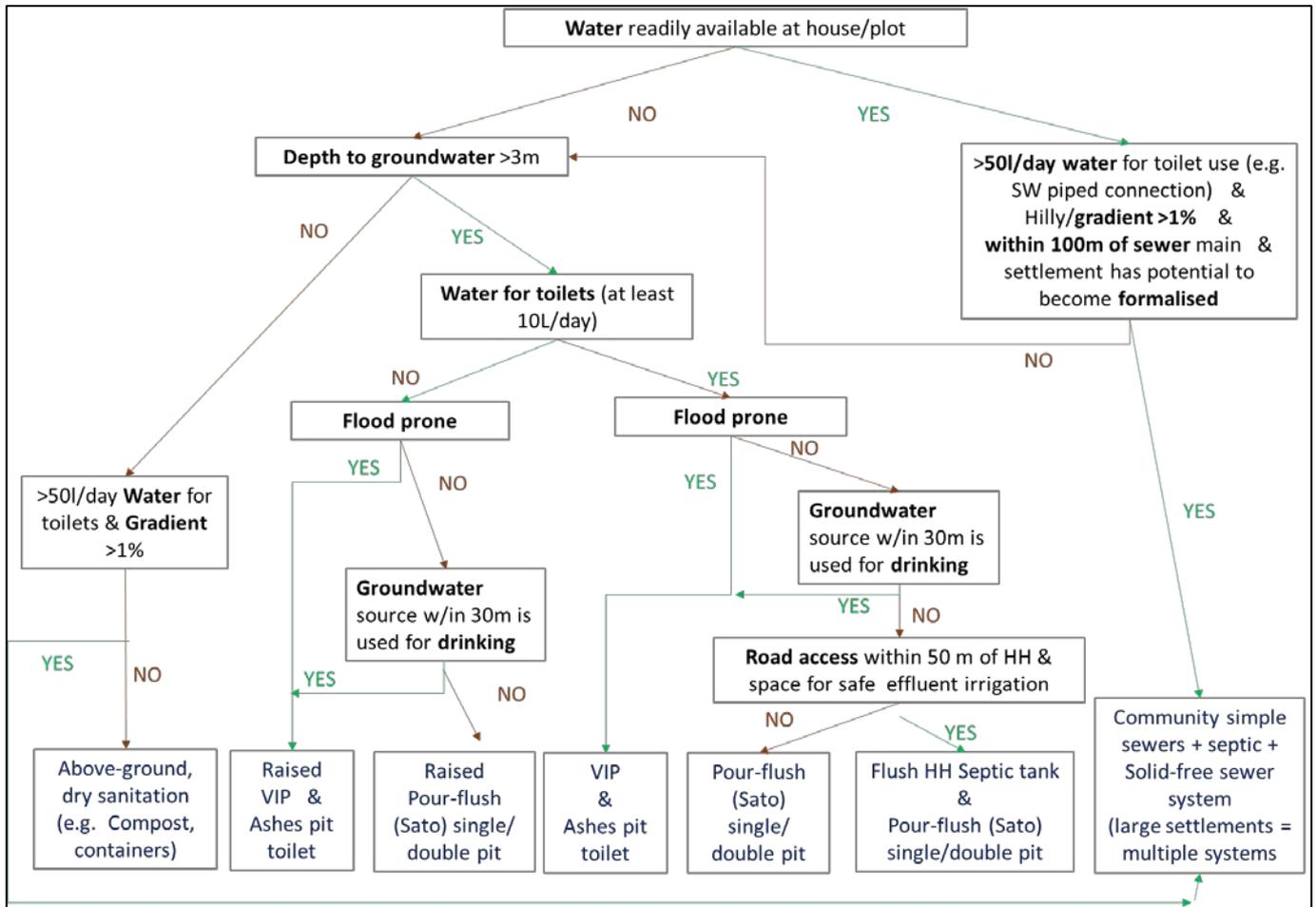


FIGURE 23: SANITATION SERVICES DECISION TREE FOR INFORMAL SETTLEMENTS, HONIARA.

7 RECOMMENDATIONS FOR WAYS FORWARD

Improve provision and management of water and sanitation services to informal settlements through the following recommendations.

1. UTILIZE INFORMATION ABOUT SETTLEMENTS TO GUIDE CONSULTATIONS AND PLANNING WITH RESIDENTS AND OTHER STAKEHOLDERS ABOUT WATER AND SANITATION SERVICES:

- 1.1 **Work with MLHS, HCC, MoHMS and other organisations linked with informal settlements and urban planning, to identify and collate information and plans regarding settlements.** In particular, links should be made with those implementing The Greater Honiara Urban Development Strategy and Action Plan (GHUDSAP), to consolidate data relating to urban and peri-urban informal settlements and their development. The database (spreadsheet) developed during this study may be a useful starting point.
- 1.2 **Improve existing information about settlements**, in particular
 - c) Census 2019 data should provide updated and more detailed information about: variability of wealth within settlements; population estimates for individual settlements; growth rates of individual settlements. Once available, which may be 1-2 years, this data should be assessed for suitability and incorporated to any settlement database/information store.
 - d) MLHS data regarding land tenure status of different settlements.
- 1.3 Build on the newly collated GIS information to **update and use GIS-linked information to inform planning** of services. In particular, maintain and update as available settlement population and socio-economic data, with environmental data such as hazard mapping (coastal flooding, riverine flooding, flash flooding, landslips), and with utility asset data (water and sewerage assets).

2. IMPROVE WATER SERVICE DELIVERY TO RESIDENTS OF INFORMAL SETTLEMENTS:

- 2.1 **Provide internal household water connections where-ever possible**, to maximise health and wellbeing benefits
- 2.2 Recognise that not all residents of all settlements will be able/want to access their own private household water connections, and that a **mix of water service delivery options may be required**. Identify potential service delivery options using the water decision-tree developed in this study (Figure 2 above) to guide identification of water service delivery models to be considered during planning and consultation activities.
- 2.3 **Maintain the lowest tariff level at a rate that is affordable by the lowest income households** (this may require regular reassessment).
- 2.4 Where internal household water connections are not being provided, provide a service that has the flexibility to be transitioned to individual household connections as demand and willingness to pay/commit changes, that is, consider these services as **transitional services**. This does not apply to settlements identified by MLHS as hazardous.
- 2.5 **Accommodate a mix of water service delivery models in settlements with larger diversity of wealth and demand**. For example, consider providing both water kiosks and household water connections in settlements with lowest income households and high wealth households. Census 2019 information can be used to identify these settlements.

2.6 **Improve the awareness and attitudes about safe drinking water** in particular (i) the importance of safe drinking water (ii) the safety of water provided by Solomon Water using an evidence-based behaviour change communication strategy.

2.7 **Mitigate water theft from water pipes** by:

- f) Increasing the accessibility of household water services by planning for reticulation through settlements, and maintaining a lowest tariff rate that is affordable by low income households.
- g) early and effective consultation and communications about the value of water from Solomon Water and its cost to supply
- h) encourage uptake by majority of households
- i) utilize engineering solutions, such as resistant pipes and deeper installations, to reduce tampering and theft,
- j) monitoring of non-revenue water at the settlement-scale (or finer resolution) to identify possible problems.

2.8 Sharing of household connections amongst multiple households will not be actively promoted by Solomon Water due to difficulty of regulating on-selling and ensuring the quality of service (e.g. reliability and water quality). However, sharing of household water connections is common practice and is preferred amongst many residents of informal settlements, as a way to share the fixed costs of a connection. It is recommended that Solomon Water acknowledge this as one tactic to increase the accessibility to their water services and **improve the effectiveness of shared household connections** by

- d) reassessing the tariff (or other aspects of the cost) arrangements for these connections. This is because connections supplying water to multiple houses may use sufficient volumes to be charged a higher-use tariff – thus effectively paying more per litre than single-household connections.
- e) Making accessible information about different ways water use can be calculated (e.g. through community meetings or ‘water supply training’, which could include other aspects of demand management and water quality (containers & storage)
- f) Consider cluster metering to reduce connection costs (provided settlement residents agree to take responsibility for management of pipes and non-revenue water from the meter to the house).

2.9 **Pilot water stores (kiosks) in one or two settlements to build experience and understanding** of (i) operational requirements (ii) demand from residents of informal settlements. Specific recommendations relating to piloting of water stores:

- d) Pilot a delegated-management model and/or utility owned-and-operated model (rather than a private retailer), to ensure (i) retail price is regulated by the utility (and set at a level commensurate with affordability for likely consumers, including lowest income households and the level of service being provided); and (ii) minimum service standards are adhered to (e.g. opening hours, hygiene and maintenance of store equipment). An alternative would be to start with utility-owned-and-operated and transition to delegated management.
- e) Recognise the lower service standard that will be provided (compared with household water connections) and that this is likely a transitional service to create demand and willingness to pay by providing low cost water (this may require subsidizing the cost of the service, depending upon the potential market size).
- f) Design and locate the store considering: (i) vulnerability to vandalism (ii) personal safety of operators (ii) accessibility to residents carrying water containers (iii) hazardous locations (floods, landslips, proximity to rubbish piles) (iv) ability to maintain hygiene and to prevent contamination or supplies (e.g. through back-flows) (v) some on-site storage to mitigate short-term mains water disruptions (vi) density of stores within larger settlements to balance cost-effectiveness with accessibility.

2.10 Pilot the installation and operation of pay-per-use automated water dispensers, such as Water ATMs, at key locations such as major public transport hubs (large bus stops, the port).

- c) The location of the Water ATMs should consider (i) security of the ATM (ii) accessibility of the ATM with regard to hours/days it is accessible for both consumers and service operators (iii) proximity to transport departure locations to minimise carrying distances
- d) Retail cost of water should be regulated by the utility, and set at a level commensurate with affordability for likely consumers (including lowest income households) and the level of service being provided.

2.11 Recognising there will remain (for the near future) many residents that use service delivery models requiring them to carry and store water in containers (e.g. water kiosks/stores, shared HH connections), mitigate health risks from use of water containers:

- d) Mitigate the risk of contamination of water during handling and storing of water by consumers in containers (including drums, barrels, tanks) through education and behaviour-change strategies (which should also identify poor sanitation and hygiene (handwashing) and important factors increasing contamination of water in containers).
- e) Mitigate the health problems associated with carrying water in containers by encouraging local hardware stores to stock wheeled-water carriers or containers.
- f) Consider whether household water treatment options should be promoted (acknowledging the requirements for consistent and proper adherence to treatment procedures for these to be effective).

2.12 Adjust the land tenure requirements and the current perceptions regarding these requirements:

- c) adjust internal utility processes, and external communication messages regarding land tenure requirements to clarify that a Fixed Term Estate, or Temporary Occupancy License is not required for residents inside Honiara City Council boundary to apply for a private water connection.
- d) For residents living in settlements that have been assessed by MLHS as being in highly hazardous locations, individual private household water connections may not be supported, but that an alternative water service delivery model can be discussed with Solomon Water, such as a water kiosk.

2.13 Communicate and coordinate water supply service options with all organisations active in informal settlements, to ensure where feasible, utility water is provided, as the more cost-effective, safe and sustainable water supply system, rather than installation of on-site water supplies such as bore pumps which have minimal long-term maintenance support and may interact with Solomon Water's water supplies and network.

3. IMPROVE SANITATION SERVICE DELIVERY AND BEHAVIOURS IN INFORMAL SETTLEMENTS:

3.1 Recognise that a mix of sanitation service options will be required to service Honiara's urban and peri-urban populations. Achieving sanitation service provision for all people is required to ensure the health and wellbeing of all of Honiara's population, and to maximise resident's participation in society, education and economic activities.

3.2 Identify sanitation options to suit different settlement characteristics, such as by using the sanitation decision-tree (Figure 3) to guide identification of the range of sanitation services that may be required and their suitability to different local situations.

3.3 The required mix of sanitation services cannot be provided by any one organisation, and a mix of sanitation service providers will be required. Coordination and cooperation is required to ensure that all people living in Honiara can access a sanitation service that will safely manage their human waste.

- 3.4 Promote amongst key stakeholders (Solomon Water, HCC and MoH) the **critical need for a coordinated strategy to address sanitation across Honiara**. A strategy or plan for Honiara’s sanitation could include information:
- Identify which **types of sanitation services** should be made available in which parts of the city, including in identified hazardous areas, and specifying expected and acceptable service levels.
- 3.5 Identify which organisations should play a role in **supporting or delivering each sanitation service** (and whether additional capacity or capability is required)
- Confirm there are no parts of the city that can’t access a safe sanitation service.
 - Describe agreed **targets** to encourage progress on sanitation and describe how these will be **monitored**.
- 3.6 The sanitation strategy or plan should also **require coordinated communication to promote sanitation** behaviours, and to improve the motivation and commitment of people to using safe sanitation. It is important that all organisations have the same types of messages about sanitation – the best way to achieve this is for stakeholders to develop a sanitation communication strategy, with communication resources, that many organisations can use.
- 3.7 **Coordinate with MoH to improve awareness amongst residents of informal settlements about types of on-site sanitation** options suitable in different informal settlements, in particular to unfamiliar sanitation options such as VIP dry pit latrines, and container-based or composting toilets. Coordinate with MoH on the communication of acceptable sanitation technologies.
- 3.8 **Pilot the new service delivery model of “Community simplified sewer and septic/ABR system”** which combines on- and off-site collection and treatment.
- This model involves:
 - water-based (flushing) toilets with low-cost community simplified sewers (installed with assistance from residents, and oversight by Solomon Water). Water-saving cisterns can improve water efficiency, although a minimum water flow will be required to ensure functionality of the community simplified sewers.
 - connections to community septic tanks (operated by Solomon Water). Multiple septic tanks may be required depending upon the scale and topography of the settlement.
 - conveyance of effluent from septic to mains sewer using low cost solids-free sewer systems
 - septage emptying from the septic tank.
 - Significant community engagement and consultation will be required before piloting such a model. Consider partnering with organisations already with established relationships and experience engaging with informal settlements
 - Use the sanitation decision-tree to assist in identifying a pilot settlement. An additional criteria would be to select settlements in which there has previously been promotion of sanitation. An example of a settlement that meets most of these criteria is Namoliki/Gwaimaoa.
 - Ensure there is capture of the processes, strengths and weaknesses of the pilot model to provide evidence for future service model assessments.

4. IMPROVE COORDINATION AND INTEGRATION OF WATER, SANITATION AND HYGIENE IN INFORMAL SETTLEMENTS

- 4.1 **Water, sanitation and hygiene are critically linked**, both operationally and from a health perspective (e.g. the need and use of water to practice safe hygiene; the potential contamination of local water, and container-based water, through inadequate sanitation and hygiene; the increase consumption of water associated with water-based sanitation), these three areas of activity must be **planned and operationalized in a coordinated way** to

avoid ineffective communication or operations, which would prevent WASH-related health and wellbeing being achieved.

- **Engage with other WASH actors** active in Solomon Islands to ensure coordinated approaches, similarly for sanitation above. Discuss communication approaches and resources using the same messages. Synergising urban and rural WASH communications and messages would provide benefits to both urban and rural WASH outcomes – this could be achieved through expansion of the rural WASH stakeholder group to include urban WASH actors.
- **Engage with other actors active in informal settlements**, not necessarily focused on WASH, such as CAUSE and UNHabitat, to raise awareness of WASH-related approaches and activities being promoted by the government and Solomon Water.

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9 APPENDICES

9.1 WATER SERVICE DELIVERY MODELS CONSIDERED

System shortname	Code	Means of water conveyance to settlement	Settlement access point	Water conveyance to households	water storage at household	Ongoing service providers roles' in this type of sanitation (i.e. apart from any role in installation)
Piped water - Households	PH1	piped water to households	direct to HH	direct to HH	na	SW responsibilities as for existing services
	PH2	piped water to households - with on-selling allowed	neighbour's HH	water containers to households - carried by customers	containers	SW responsibilities to connection; HH connection owner to determine access, conveyance, price etc
Kiosk (pipied)	PK	pipied to kiosk	Kiosk accessible by public	water containers to households - carried by customers	containers	Recommended SW roles: <ul style="list-style-type: none"> - produce and convey water to kiosk/vendor - set and monitor water service standards - regulate retail water prices Other roles to be determined: (SW or outsource or technical support to local operator) relating to <ul style="list-style-type: none"> - ownership of water supply infrastructure to kiosk - ownership of kiosk business (own & operate, lease or sell to individual or commuinity group/business) - responsibility for maintenance - supply and/or ownership of business service equipment e.g. containers, cleaning agents, water carts (own & operate, lease, sell)
Delivery vendor (pipied)	PV	Piped to local vendor access point	Vendor's access tap (private not public)	delivery via small water carts to households (to containers or small tanks)	containers	as for PK above
ATM or token-coin-tapstands (Piped)	PAT	pipied to ATM/token-tap stands	Public ATM or tapstand (token/coin operated)	water containers to households - carried by customers	containers	SW or third-party to own and maintain infrastructure For third-party operated/owned ATMs/Taps: SW to: <ul style="list-style-type: none"> - fix retail water prices - set service standards and monitor Option to supply containers to local stores for sale, community groups, of delivery vendors etc
Private shared taps	PPR	pipied to shared tap stands - groups of households	shared (private) tap stands	water containers to households - carried by customers	containers	SW own and maintain infrastructure
Public taps	PPU	pipied to public tap stands	Public tapstand	water containers to households - carried by customers	containers	SW own and maintain infrastructure
Trucks to vendors/ATM	TK	water trucks to kiosks/atms	Kiosk or ATM storage tanks	Customer containers to households; or local vendor delivery	containers	SW roles: <ul style="list-style-type: none"> - produce water for trucks - delivery service: owned & operated by utility, or leased or fee-for-service to third party (with appropriate service standards) - Kiosk & ATM - as for above (PV, PK, PAT)
Trucks to HH (pipied+rain)	TH	HH rainwater capture, supplemented by water trucks conveying utility water to households	direct to HH	direct to HH	large tanks; containers	SW roles: <ul style="list-style-type: none"> - produce water for trucks - delivery service: owned & operated by utility, or leased or fee-for-

						service to third party (with appropriate service standards) HH to install and maintain RW Tanks Consider a program to subsidise tank system purchasing for low-income HH?
Groundwater	B (and variations within)	local boreholes to token-coin-tapstands / kiosks / atms / shared private tapstands / public tapstands	As for respective options above (piped): PK, PV, PAT, PPR, PPU	As for respective options above (piped): PK, PV, PAT, PPR, PPU	containers	SW roles: - ownership and maintenance of infrastructure (water extraction) additional roles as per PK, PV, PAT, PPR above
Rainwater	RW (and variations within)	local large-scale rainwater tanks to token-coin-tapstands / kiosks / atms / shared private tapstands / public tapstands	As for respective options above (piped): PK, PV, PAT, PPR, PPU	As for respective options above (piped): PK, PV, PAT, PPR, PPU	containers	SW roles: - ownership and maintenance of infrastructure (rainwater harvesting system) additional roles as per PK, PV, PAT, PPR above

9.2 SANITATION SERVICE DELIVERY MODELS CONSIDERED

Key information based on a range of sources, in particular:

System short name	Code	Access (point of use)	User interface	Waste collection / storage	Treatment & disposal technology	Ongoing service providers roles' in this type of sanitation	Existing use in Solomon Islands, or Pacific Island countries	Advantages	Disadvantages
Water-based technologies Note: There is (likely) a strong local preferences for water-based sanitation, which will likely increase when water access is improved									
Household Piped sewerage	HPS	public toilets; shared private household toilets; individual household toilets (inside house possible)	piped-to-flush cistern - Low flush models are available	connect to conventional piped sewerage network	wastewater treatment plant by service provider	maintenance of all pipework (or mains pipework); O&M of treatment and disposal	SI	The water seal effectively prevents odours The excreta of one user are flushed away before the next user arrives Suitable for all types of users (sitters, squatters, wipers and washers) Low capital costs; operating costs depend on the price of water Ultra-low-flow flushing toilets, and pour-flush toilets reduce water consumption and costs to the consumer Easy to use and clean	Requires a constant source of water (can be recycled water and/or local non-drinking water source) Requires materials and skills for production that are not available everywhere Coarse dry cleansing materials may clog the water seal Some ultra-low-flow models may require flushing more than once to adequately clean the toilet bowl
Household Piped sewerage (vacuum)	HPF	public toilets; shared private household toilets; individual household toilets (inside	Vacuum-flush	sewerage; although high organic load so best used with separate greywater and blackwater treatment	wastewater treatment plant by service provider	maintenance of all pipework (or mains pipework); O&M of treatment and disposal	none known in SI or PICs	Large water savings - Low water use (0.5 to 1.5 litres per flush)) No deposits in the toilet, reduced use of detergents Very hygienic Flexible and convenient No deposits in the pipes Odour-free	Relatively high investment cost Depended on electric power supply Coarse materials can lead to blockage of collection system House service connection and vacuum station have to be maintained Need for a vacuum station (house-or community based)

		house possible)		(aerobic digestion treatment for biogas production - see below)				Facilitates reuse of urine and faeces Applicable in many different constructions	Requires space for connection Bulky material (i.e. sanitary napkins) can lead to clogging
Household Piped Simplified sewerage	HPC	public toilets; shared private household toilets; individual household toilets - (inside house possible)	piped-to-flush cistern - Low flush models are available	Simplified sewerage (smaller diameter pipes laid at a shallower depth and at a flatter gradient than conventional sewers)	wastewater treatment plant by service provider or community septic tank	maintenance of all pipework (or mains pipework); O&M of treatment and disposal	not SI, not PIC (to be confirmed)	Can be built and repaired with locally available materials Construction can provide short-term employment to local labourers Can be laid at a shallower depth and flatter gradient than conventional sewers Lower capital costs than conventional sewers; low operating costs Can be extended as a community grows Greywater can be managed concurrently Does not require onsite primary treatment units	Requires enough water for flushing Multiple users: limited responsibility for operator misuse Need significant additional investment in treatment facilities Requires repairs and removals of blockages more frequently than a conventional gravity sewer Requires expert design and construction The interceptor tanks can overflow when they have not been desludged in time Leakages pose a risk of wastewater exfiltration and groundwater infiltration and are difficult to identify Effluent and sludge (from interceptors) requires secondary treatment and/or appropriate discharge The need to desludge the interceptor tank regularly requires the involvement of a well-organised sewerage department
Packaged Wastewater Treatment Plant	HPW	public toilets; shared private household toilets; individual household toilets (inside house possible)	piped-to-flush cistern; pour-flush	Packaged Wastewater Treatment Plant - potentially via Simplified pipes	onsite treatment and disposal, or piped to disposal site, managed by service provider	maintenance of onsite treatment plant, and pipes to plant (?)	SI (industrial/commercial); PICs (e.g. Fiji)	Locally-based treatment and discharge (minimal reticulation requirements)	Requires electricity Skilled maintenance required Multiple users: limited responsibility for operator misuse Suitable discharge location nearby required Significant capital costs
Communal Septic tanks	CS	public toilets; shared private household toilets; individual household toilets (inside house possible)	piped-to-flush cistern; pour flush	communal-scale septic tank (various specific septic technologies, using aerobic and/or anaerobic digestion)	onsite treatment and disposal of wastewater range of technologies available (anaerobic, baffled anaerobic,	maintenance inspections and servicing; septage pumpout and disposal	SI (Honiara - see map in PRIF sanitation review)	Simple and robust technology No electrical energy is required Low operating costs Long service life Small land area required (can be built underground) Can be designed for flood-prone areas	Not suited to areas with shallow groundwater Low reduction in pathogens, solids and organics - depending upon treatment technology Regular desludging must be ensured Effluent and sludge require further treatment and/or appropriate discharge multiple users: limited responsibility

					septic tanks, managed by 'community' or service provider offsite disposal of septage required				for operator misuse Land for irrigation of wastewater Land for disposal and further treatment of sludge - if offsite, then transport required
HH Septic tanks	HS	individual household toilets (inside house possible)	piped-to-flush cistern; pour flush	household-scale septic tank (various specific technologies, using aerobic and/or anaerobic digestion)	onsite treatment and disposal of wastewater range of technologies available (anaerobic, baffled anaerobic, septic tanks, managed by 'household' or service provider offsite disposal of septage required	maintenance inspections and servicing; septage pumpout and disposal	common in SI (though many are not proper Septics - not sealed storage & treatment)	Simple and robust technology No electrical energy is required Low operating costs Long service life Small land area required (can be built underground) Can be designed for flood-prone areas	Not suited to areas with shallow groundwater Low reduction in pathogens, solids and organics - depending upon treatment technology Regular desludging must be ensured Effluent and sludge require further treatment and/or appropriate discharge multiple users: limited responsibility for operator misuse Land for irrigation of wastewater Land for disposal and further treatment of sludge - if offsite, then transport required
HH pour-flush with pits	PP	individual household toilets - outside house only	pour-flush	twin-pits, used alternately to full-point	onsite - minimal: slow leaching into ground	none	use unknown?	Because double pits are used alternately, their life is virtually unlimited Excavation of humus is easier than faecal sludge Potential for use of stored faecal material as soil conditioner Flies and odours are significantly reduced (compared to pits without a water seal) Can be built and repaired with locally available materials Low (but variable) capital costs depending on materials; no or low operating costs if self-emptied Small land area required	Not suitable for flood-prone areas or where rocky soil or shallow groundwater Manual removal of pit humus is required Clogging is frequent when bulky cleansing materials are used Higher risk of groundwater contamination due to more leachate than with waterless systems - not suited areas with shallow groundwater
Dry-based technologies	Note: User desirability of dry-based sanitation, when water is accessible, is low. Attitudinal/behaviour change communication campaigns may be required (e.g. emphasizing water-cost-savings benefits)								
Container-based sanitation	CBS	individual household toilets - outside or exterior wall of house	sitting riser	small container (above ground, under toilet seat) for weekly storage; larger storage within	offsite treatment and disposal - which could include composting requires	regular (e.g. weekly, biweekly) collection of containers, storage	not known in SI Vanuatu (for People with Disabilities);	Low-cost (monthly user fees, lease of 'toilet') Minimal space requirements at household or within settlement Odours less likely than coposting due to regular emptying Suitable for flood-prone areas	user acceptability; low cultural acceptability for managing waste/compost would require outsourced servicing User training required to manage odours

				settlement prior to sludge collection may be required	transport of sludge offsite by trucks Or, transfer to onsite (settlement) shared treatment location	treatment and disposal by service provider	Humanitarian situations)		Manual removal of waste by service provider (requires training, OH&S equipment, and overcoming cultural taboos)
Composting sanitation - shared	CS1	public toilets; shared private household toilets	sitting or squatting riser	composting (sealed)	onsite treatment, onsite/offsite disposal of sludge, managed by service provider	technical support may be required by users collection of compost by service provider (possible onselling for agricultural use)	? Public toilet (pay per use) near library	Suitable for flood-prone areas Significant reduction in pathogens Compost can be used as a soil conditioner No real problems with flies or odours if used and maintained correctly (i.e., kept dry) Organic solid waste can be managed concurrently Long service life Low operating costs if self-emptied	Can be expensive (capital) User acceptability; Low cultural acceptability for managing waste/compost would require outsourced servicing Requires well-trained user or service personnel for monitoring and maintenance Compost might require further treatment before use Leachate requires treatment and/or appropriate discharge Requires expert design and construction May require some specialized parts and electricity Requires constant source of organics Manual removal of compost is required
Composting sanitation - household	CS1	individual household toilets (outside house)	sitting or squatting riser	composting (sealed)	onsite treatment and disposal of sludge, managed by household	technical support may be required by users collection of compost by service provider (possible onselling for agricultural use)	Rare in SI Trials in other PICS	Suitable for flood-prone areas Significant reduction in pathogens Compost can be used as a soil conditioner No real problems with flies or odours if used and maintained correctly (i.e., kept dry) Organic solid waste can be managed concurrently Long service life Low operating costs if self-emptied	Can be expensive (capital) User acceptability Low cultural acceptability for managing waste/compost would require outsourced servicing Requires well-trained user or service personnel for monitoring and maintenance Compost might require further treatment before use Leachate requires treatment and/or appropriate discharge Requires expert design and construction May require some specialized parts and electricity Requires constant source of organics Manual removal of compost is required

Biogas system	BS	individual household toilets; shared private households; public toilets	vacuum flush piped to digester	Pipe from house to Biogas digester (1,000 L for a single family up to 100,000 L for institutional or public toilet): brick-constructed domes or prefabricated tanks, installed above or below ground	onsite treatment and production of biogas (best used locally to avoid transport); digestate (partially treated) needs to be manually removed and required further treatment	technical support and maintenance - though not regularly required	? Trials in other PICS	Suitable for flood-prone areas Generation of renewable energy Small land area required (most of the structure can be built underground) No electrical energy required Conservation of nutrients Long service life Low to moderate capital costs; low operating costs	Requires expert design and skilled construction Incomplete pathogen removal, the digestate might require further treatment Limited gas production below 15°C Biogas production not high unless significant inputs of high organic materials (e.g. animal manure, organic market or household waste)
Dry pits (VIP and similar variations)	VIP	public toilets; shared private household toilets; individual household toilets	sitting or squatting riser, concrete/plastic slab for hygiene	Ventilated Improved Pit (VIP) - single or double pit	onsite treatment and disposal	none (beyond spare parts)	common in SI	Not suitable for flood-prone areas or with shallow groundwater, or rocky ground Can be built and repaired with locally available materials Low (but variable) capital costs depending on materials and pit depth Small land area required Double Longer life than single VIP (indefinite if maintained properly) Excavation of humus is easier than faecal sludge Significant reduction in pathogens Potential for use of stored faecal material as soil conditioner Flies and odours are significantly reduced (compared to non-ventilated pits) Can be built and repaired with locally available materials	Manual removal of humus is required Possible contamination of groundwater Higher capital costs than Single VIP; but reduced operating costs if self-emptied
Dry Pits (unimproved pits)	DP	Don't meet basic sanitation standards - not recommended							

9.3 CONSULTATIONS ON SERVICE DELIVERY MODELS: WORKSHOP WITH SOLOMON WATER

Date of workshop: 26 Feb, 2019

Location: SW (Mataniko office)

Participants: IWC (Regina Souter, Pablo Orams Whiting), ~10 SW staff from multiple divisions and executive

Copy of presented materials is attached as PDF, and was designed to accompany the *Draft assessment of water and sanitation service options report*.

1. GENERAL COMMENTS & ACTIONS ARISING DURING THE WORKSHOP

- SW needs greater clarity regarding existing policies and legislations relating to services that can be provided for different status of land tenure. *[Subsequent consultation with MLHS confirmed the government does not have formal rules about what services can/cannot be installed depending upon land tenure status, and that SW is entitled to make its own policies regarding requirements to be met to qualify for water connections].*
- It is recommended to engage with Solomon Energy to identify lessons and challenges, and identify any synergies regarding providing services into informal settlements [Consultation planned 30 April]
- Recognise there is significant variability in total incomes and disposable incomes between residents within and between settlements. Previous SW survey (by AECOM) estimated these incomes for 6 settlements, illustrating the range (summarised in settlements characterisation chapter of this report). Thus, water and sanitation service delivery options should not exclude those options similar to existing services offered to formal settlements in Honiara, as some residents will be able to afford these services. However consideration will need to be given to how affordability for lower income households can be achieved.

WATER SERVICES

General comments:

- Well-strategized communication efforts are required to raise awareness about benefits of SW (safe) water over other options (e.g. bottle water, free unsafe sources, etc).
- It is believed that issues of water theft will be reduced if water services reach settlements, together with good communications about the value of SW water, engineering solutions and adequate monitoring.
- SW strategic plan considers an aspirational average water use of 140 l/p/d. Note that WHO standard is 50 l/p/d. Rural WASH standards for design in Solomons is also 50 l/p/d.

Feedback on specific water service options

2.1. HH private water connection

- Cost of connection in formal circumstances includes:
 - o Service fee (fixed cost) = \$52/month
 - o Water fee (volumetric)
 - o Connection fee (one-off) = \$1300
 - o There is an additional cost, covered by user, to implement piping to meter outside the house.

What is the smallest unit (volume) of water that can be purchased using CashWater?

- Strong consideration to affordability and willingness to pay is required. The challenge is the income-level diversity/variation within communities.
- Water theft is a prevalent issue. Motivations for theft are diverse (lack of access, cost, stealing for selling, etc)

- Theft (across the system) makes up for 25% of total NRW (=65%), but this is less than was previously thought.
- There can be safety risks for SW staff working on informal settlements.
- Illegal connection may cause backflow contamination of water supply.
- After lengthy discussion it was determined water theft can be minimised by (i) high rates of HH connections through an easier process to gain a connection and (ii) more resilient piping with deeper installation where necessary.
- In settlements where rates of non-payment or theft have proven to be high, a transitional approach may be better suited, by starting with a water kiosk

2.2. HH shared connection

- It is not allowed, but tolerated, and common practice.
- Payment of usage is an issue. Some pay (sharing cost with neighbours), many find this difficult especially for post-paid options).
- Some connection owners will earn money from charging neighbours for access, however this doesn't ensure owner paying SW for connection.
- Main benefit of this model is the sharing of water tariffs, although the higher consumption (due to more houses) may result on a higher tariff tier.
- Is used with CashWater

2.3. Kiosk (piped)

- People pay in advance, similar to CashWater Some thought is required to know how CashWater aligns to this model – has advantage of no monthly service fee. But need to check pricing structure is not too different
- Price needs to be regulated by SW to ensure equity in water costs
- Kiosks may be adequate for some, but not all settlements.
- Kiosk may be implemented at the edge of settlements, avoiding the need to running pipes through the settlement. May be adequate where population density is enough to make it viable.
- Kiosks can serve as precursor/"tasters" of water service provision in areas of expansion (e.g. a mobile kiosk moved as the grid expands, developing a norm for paying for safe water.
- Kiosks may offer better value to community than automatic dispenser, as it could offer a business opportunity.
- Proposed additional service to this model: From the access point (e.g. kiosk), water can be pumped to a household tank via hose allowing people to purchase larger volumes (e.g. to fill small tanks). This would require SW to visit with larger distribution hose to reach nearby HH tanks
- The management model needs to be discussed. It is not clear how far SW would go in the implementation and operation of the system. Community involvement in the management needs to be explored, and might vary depending on each settlement. Currently, there are community run business (canteens, shops), and kiosks could leverage from this. In appointing/recruiting kiosk operators, SW could reach out to strong community groups (e.g. churches). SW keen to hear from settlements on their views (refer to settlement consultations for summary perspectives)
- The business model/strategy needs to be well thought through to ensure sustainability of service (e.g. having the profit of kiosk being reinvested in the community).
- A potential model to ensure sustainability of a kiosk scheme is to ensure service provision if community complies with a no-water-theft commitment, policed by implementing water meters at source and at kiosk and monitoring NRW levels.
- Communication on benefits of choosing kiosk water over informal cheaper/free options needs strong consideration (e.g. value of having a safe water source).

- SW confident previous challenges associated with tampering and breakage of pipes could be overcome by piping technology and installation methods (e.g. more resilient piping material and buried deeper to minimise possibility of tampering).

2.4. Automatic water dispensers (piped)

- Not considered a preferred option by SW for use within settlements due to risks such as vandalism, money/tokens theft (tokens could be safer), energy requirements, impact of power failures, low reliability of technology/broadband, etc.
- A more feasible option would be to have the device inside a shop. This would require a clear agreement on who is responsible for /owns the system.
- Would be more useful in critical congregation areas within the city (e.g. port, market)
- While kiosk may require more community cohesion to ensure sustainability of system (e.g. for adequate operation, use, etc), automatic dispensers may be easier to implement.
- Strong communication/awareness campaign would be required (e.g. to ensure community knows how to use the system).

2.5. Trucked water (to kiosk/automatic dispenser)

- Trucks are currently providing water services, and it is poorly regulated (although these are private operators, service is of low quality, they steal water from SW and sell at higher prices).
- Main challenge is the quality of roads, cost of service, water safety, and the distance to the refill point.
- Not a preferred option, but there might be a role for truck conveyance in circumstance where piping is not feasible (long distances, etc).
- This is considered not likely to be necessary anywhere within the town boundary.

2.6. Borehole supply (to kiosk/automatic dispenser)

- Maintenance costs of boreholes is high
- Willingness to pay for local/on-site water could be an issue (survey data from AECOM indicated no willingness to pay for local water resources).
- It is difficult to ensure the quality of water, giving intensive O&M tasks. Only feasible on big scale systems. It is an operational risk for SW.
- There could be naturally occurring arsenic, but need to be confirmed.
- Water hardness is an issue.
- Artesian bores could be an option, given their high-water volume potential, and location within communities.
- More suited for remote locations, or where no other options can be feasibly implemented – decided to be not necessary within town boundary

Summary of discussion about water service delivery options feasible for Honiara settlements

- First preference is piped water connections to households or shared households
 - o SW will need to review its policies/practices on requirements residents must meet in order to qualify
 - o Community engagement will be important, as this approach will likely be most effective if many in the settlement take up connections (minimising the number of people without connections will likely reduce water theft/tampering)
- Where difficult (now) to run mains water pipe to each household/group of houses: Piped water to kiosks.
 - o Operation of kiosks as a business, prices regulated by SW
 - o engagement of operators to be determined in discussion with the settlement.
 - o May need to consider theft-proof water pipes to kiosks as well as community engagement on protecting water pipes

- o Containers.
- o Cash management?
- o Retail cost – need to think about how align with tariff system (domestic v commercial and other)
- o Business model (service fees, tariff rates, retail/on-charge, other products; contract v inhouse)
- ATM / t-taps – possibly problems with security and vandalism but potentially of value near to major public transport terminals (if associated with existing shops for security)
- Trucks and bores – not a better option than main pipes (for locations within town boundary)

SANITATION

- For all onsite options – need clarity on SW role. Applying current governance arrangements it would be aligned to catchment management rather than provision of service.
- There is a need to liaise with the Ministry of Health and Honiara city Council, and other local actors. The challenge is bigger than what SW can do and is responsible for.
- Open defecation is a prevalent issue.
- The existing cultural norms around defecating and management of human waste influences the feasibility of some onsite options (e.g. compost)
- All solutions will require greater capacity in Honiara for waste treatment and disposal – either water-based sewerage/effluent treatment and/or septage collection, treatment and disposal.

Feedback on specific sanitation options

3.1 Public toilets (versus individual household or shared household toilets)

- Cultural behaviours around sharing of toilet facilities is an important consideration
- Public toilets in public spaces seem to work, but inside communities it would be difficult, given close relationships across community, as well as expectation to pay within community
- Cultural norms around who can see who going to bathroom present challenges when implementing public toilets in community spaces
- Operation & Maintenance, especially maintaining hygiene, likely to be a significant challenge as running public toilets on fee-for-use arrangement within a community is likely to be problematic, and therefore limited funds will be available.
- It would be a new concept in the context of communities

Technology options for collection, treatment and disposal of waste

3.2 Simplified (simple sewer) pipes (to either onsite or offsite treatment options)

- Will be associated with higher water usage (and therefore household costs)
- Likely to have challenges in terms of system pressure due to increased/uncontrolled discharge from houses.
- There could be challenges around users connecting other inputs into the Simplified network (stormwater, etc.), and put pressure on system downstream. And this would be difficult to regulate.
- Simplified + community septic + EDS (effluent disposal system)
- For some settlements, where onsite options are limited in practicalities/feasibility, and the terrain is suitable, it may be possible to combine Simplified pipe systems to shared septic tanks – that are managed by SWater and where the effluent is transported offsite for treatment (e.g. solid-free sewer pipes to connect to existing sewerage infrastructure), and septage is pumped and treated offsite

3.3 PWWTP (as an onsite or near site treatment option)

- O&M requirements likely to be intensive given previous experience of SW staff
- There are experiences in using PWWTPs in resorts, but they are not very effective due to O&M.

- Biological systems can be more sensitive to the type of waste that goes in, and there is a risk of people putting in waste that shouldn't go in (e.g. chemicals, paint, etc)
- Chemical and Physical systems – often operational and maintenance challenges
- Sludge disposal practicalities need to be considered (distance, conveyance, treatment, disposal.)

3.4 Pour flush (single and double pits)

- Has potential, though uses water. And wont suit all settlement situations. Is the preferred option of settlement residents now, so limited behaviour change required.
- Challenge is treatment and disposal as these are often used in unsafe situations at present (where local environments, and water sources are likely contaminated)

3.5 VIP latrine

- Not widely known.
- If pit is to be emptied rather than buried and new pit dug, management of sludge would be a challenge due to topography, access, disposal options.

3.6 Composting toilets

- Investment can be substantial
- Community is unlikely to use the resulting waste on food crops as there is a strong stigma around human waste. Potentially could be encouraged to use on flowers and non-edible gardens.
- Leachate needs to be safely managed
- Some discussion about possible challenges of men handling women's waste and vice-versa – seek settlement views on this.
- Space requirements for storing composting waste is an important considerations.
- A potential model could involve a desludging service by a third party operator.

3.7 Biogas (with pour-flush)

- Digestors are being constructed by some local groups, but it is not common knowledge.
- Expensive and site visit (Burns creek) confirmed tend to be used mostly for animal waste not human waste due to cultural norms
- Maybe has potential in school environments but recommended not to pursue for settlements.

3.8 Septic tank

- HH-scale septic tanks problematic O&M and very rarely conducted properly.
- effluent is not safe
- Sludge removal – need truck/cart access septage for safe removal – very difficult in the hilly areas where no roads

Summary of sanitation discussions

- For some settlements, with steep terrain, dense housing and limited road access, there are very few suitable on-site options in which the whole sanitation service chain can be safely achieved.
- Where these settlements are close to existing sewerage networks, may be its possible to explore simple Simplified sewers to community septic tanks managed by SW, and where the effluent is transport offsite via an EDS (solid-free sewer) connected to existing sewerage network, and septage is pumped and transported offsite for treatment and disposal.
- For flatter settlements, where access is often easier/more feasible, groundwater is often very shallow, making in-ground options problematic (e.g. pit latrines). Above ground options, such as composting, biogas or above ground pits could be feasible though leachate will be unsafe and need disposal consideration. Biogas and composting options would need to address cultural barriers regarding use of human waste (such as not using waste products for consumption-related activities).

RESULTS OF SERVICE DELIVERY MODEL VOTING EXERCISE

All workshop participants were given 3 green and 3 pink dots to cast votes independently. Green dots were used to indicate that option has potential and should be further assessed; Pink dots indicated option has limited/no potential and should not be further assessed).

Regarding water service delivery models, workshop participants preferred the piped household connections (57% of preference votes), in particular private house connections (36%). Neither private or shared household connections received non-preference votes. Water kiosks sourced by piped water came second in preference (32%), while bore and truck sourced kiosk were not seen as feasible (47% of non-preference votes). Automated water dispensers (water ATMs / token taps) receive little support overall (only 11% of preference votes, 53% of non-preference votes), with a slight preference for these models to be sourced by piped and bore water sources.

On the sanitation service delivery models, septic tanks were the most preferred option (27%). Pour flush technologies came second in preference (23%), although with 5% of non-preference votes on its double pit setup. Simplified pipes also received an overall preference of 23%, in particular if connected to decentralized packaged treatment plants (18%). However, the same level of non-preference was given to the later (18%). VIP latrines received 14% of preference votes, while the remaining options (biogas, fossa alterna and composting toilets) were received the least preference.



9.4 CONSULTATIONS ON SERVICE DELIVERY MODELS: INFORMAL SETTLERS

Where possible, community consultations have been done separately with men and women groups with the aim of understanding gender-specific perspectives on the discussed issues.

In some of the main questions / discussion topics, sub-questions have been used to prompt conversations and gain more clarity on the discussed issues. When possible, results have been categorized under these sub-questions.

Water

CURRENT EXPERIENCE ACCESSING WATER? (HOW DO PEOPLE GET WATER TO USE FOR DRINKING? WHAT DO THEY THINK ABOUT IT?)

Settlement	Men	Women
Burns Creek (Riverside)	<ul style="list-style-type: none"> - No water access is available [from Solomon Water] <p>How do people get water to use for drinking?</p> <ul style="list-style-type: none"> - Water collected from the dug-up wells - About three dug-up Wells in the entire settlement and people shared from that. - They said that they can buy bottled water from the shops or market hats only if they had enough money. - The safety of their drinking well is not safe given their environment live its surroundings. <p>What do they think about it?</p> <ul style="list-style-type: none"> - The response was we don't have many options to meet the cost of bottles of water. These are sold in the shops but that depends on the availability of cash flow. - They also knew the risk related to water collected from the well, one even mentioned that diarrhoea is very common here maybe it's from water from the well, he said. 	<ul style="list-style-type: none"> - There is no accessing water from Solomon water <p>How do people get water to use for drinking?</p> <ul style="list-style-type: none"> - People got their drinking water from well. - There was only one well owned by a family that was shared by the whole riverside community. - The well was covered properly. - The water was fetched directly from and well and used as a drinking water they didn't boil it. - Only a few people in the community both water from nearby community/block which was cost them \$5 per mineral water bottle. (1.5 Liter) <p>What do they think about it?</p> <ul style="list-style-type: none"> - They knew that the well was bad for drinking because if the smell but they didn't have other choices.
Fulisango (Mad Land)	<ul style="list-style-type: none"> - Accessing from Solomon Water through using of Meter Water and Cash Water - 1x question was raised and asking why Solomon Water continued to cut and even worst the quality of it its always turn brown/dirty. <p>How do people get water to use for drinking?</p> <ul style="list-style-type: none"> - Almost everyone access water from Solomon Water and some household used water tanks - One community leader explained, here few households shared to pay for one pipe connection then they had to contribute on a monthly basis to meet water bills. 	<ul style="list-style-type: none"> - Few houses already have Solomon water connection. - Many families live in one house and no discussion between the families - Financial problem <p>How do people get water to use for drinking?</p> <ul style="list-style-type: none"> - Most people in the community got there drinking water from Solomon Water and rain. <p>What do they think about it?</p>

	<p>What do they think about it?</p> <ul style="list-style-type: none"> - Currently they happy with what they had now but they really want Solomon Water to improve on their services such as quality of the water and stop cutting-off water unnecessary. - Few men also add on the same line that they want to see if Solomon Water can reduce or improve its rating system of bills because they have faced a similar problem with Meter Water (Connection) that their bills continue to increase every month even when they already paid for. • 	<ul style="list-style-type: none"> - One woman that got her drinking water from rainwater said that she prefers rainwater because it is fresh and didn't have the chlorine smell on it. But for Solomon water, she said the most time it has the chlorine smell with the white colour water. - Those who used Solomon water as their source of drinking water said although, they have a kind of smell they don't have any other choice.
<p>Ohiola</p>	<ul style="list-style-type: none"> • There is an existing SIWA pipeline running in the settlement. <p>How do people get water to use for drinking?</p> <ul style="list-style-type: none"> - Most people access drinking water through SIWA connection. - Total of 16 houses. 8 House shared connections and 2 storage distributing to the settlement. Everyone gives fair to contribute to pay the bill. - Even today only one end of the settlement has water one side of the settlement water is disconnected. - For washing and swimming sometimes we use well or tank if there is rain. - Sometimes the creek is used for washing and toilets. <p>What do they think about it?</p> <ul style="list-style-type: none"> - Not fair for all household because some pay high while only use less water - Some water pressure was not strong to reach all house - Paying bill can be problematic - Last time we have \$5000 outstanding bill with SIWA and they disconnect the water - When bills are not paid in time, interest will be added to the bill and it keeps accumulating. It is not good that way. 	
<p>Burns Creek (Site 2)</p>	<p>How do people get water to use for drinking?</p> <ul style="list-style-type: none"> - Most people access drinking water only through the water well. Some water tank - For washing and swimming, most use the river. <p>What do they think about it?</p> <ul style="list-style-type: none"> - We think it is not good for us but there is no other alternative to get water. 	
<p>Namoliki</p>	<p>How do people get water to use for drinking?</p> <ul style="list-style-type: none"> - Spring water - Some have access to SIWA water - They also access to a borehole water source - Few people purchase water from nearby shops (mineral water). Only some can afford this. <p>What do they think about it?</p> <ul style="list-style-type: none"> - They said they are satisfied with those water sources they already have. They used the spring water for wash and bath. For drinking water, they mainly use borehole. They don't trust SIWA water, it can cause diarrhoea. The borehole is constructed by city council 40 years ago and it is safe and cheap. 	<p>How do people get water to use for drinking?</p> <ul style="list-style-type: none"> - Some household access water from SIWA - Few stand-pipes were also there piped by SIWA - Others collect water from the stream. Used it for washing. - Use water from rain stored in the tank - Few people said that only if they had enough money they will buy water from shops used for drinking. - Spring water was also used there. <p>What do they think about it?</p> <ul style="list-style-type: none"> - The response was we don't have many options of course bottles of water are sold in the shops but that depends on the availability of cash flow. - They suggest that SIWA should just improve the stream - During the rainy season, flooding occurs to the stream, it can be contaminated.

	<ul style="list-style-type: none"> - They suggest the SIWA should just improve the stream. - During flooding, it can be contaminated - The water source(borehole) can be overcrowded(water is daily used) - An elder suggests that SIWA should put tanks at the hilltop to provide water to all households. The water is supplied from the borehole. This will prevent them from buying expensive water bills from SIWA. 	<ul style="list-style-type: none"> - Sometimes the SIWA water source can be overcrowded and at times it is hard to get water when SIWA supply is cut off. - They also knew the risk related to water collected from the stream, one even mentioned that diarrhoea is very common here maybe it's from water from the well, he said. - SIWA supply is too expensive and can't afford to pay the bills. - Others comment that their drinking water is not safe at times.
<p>Renlau</p>	<ul style="list-style-type: none"> - Well water - Tank water(rain) - Sea water - Mataniko water - SIWA water. <p>How do people get water to use for drinking?</p> <ul style="list-style-type: none"> - One woman explain that all household used SIWA water and rainwater for drinking, - They used the well water and Mataniko River for washing and swimming. Sometimes they also drink from well water. Seawater is used for swimming, - Seafont (beach) they used for toilet - One community leader explained, here few households shared to pay for one pipe connection then they had to contribute on a monthly basis to meet water bills. (SIWA) <p>What do they think about it?</p> <p>So far they are happy that they have proper drinking water which was funded by Honiara city council (six standpipes) (SIWA). However, listed are some of their concerns.</p> <ul style="list-style-type: none"> - The flow of the water is not good - Water taps are far distant from some households - Overcrowded (some have to collect water at 9 pm to 12 midnight when the tap is free) - They contribute at \$20 per households, others don't contribute. This is not fair. - It can cause augments between community members. - They complain about high bills they used to charge them without even explaining how they calculate the charges. 	<ul style="list-style-type: none"> - They access to water from the well, rain, sea, Matanikio river and SIWA. - The flow of the water is not good - Water taps are far distant from some households - Overcrowded (some have to collect water at 9 pm to 12 midnight when the tap is free) - They contribute at \$20 per households, others don't contribute. This is not fair. - It can cause augments between community members. - They complain about high bills they used to charge them without even explaining how they calculate the charges. <p>How do people get water to use for drinking?</p> <ul style="list-style-type: none"> - They mainly get drinking water from SIWA and rainwater <p>What do they think about it?</p> <ul style="list-style-type: none"> - They said that rainwater is good because it is cheap, fresh and thus not have the chlorine smell in it. - Others comment that even if it has the chlorine smell on it, this is much safer for them to drink - They want more standpipes to be constructed because they are now becoming overpopulated.

WHAT DO YOU THINK ABOUT SIWA CONNECTIONS TO THE INDIVIDUAL HOUSEHOLD? (WHAT DIFFICULTIES WOULD THERE BE FOR SIWA IF WANTED TO PUT PIPES THROUGH THE COMMUNITY? WHAT ABOUT THE OTHER COMMUNITIES? HOW COULD THESE PROBLEMS BE SOLVED?)

Settlement	Men	Women
Burns Creek (Riverside)	<p>Connecting water to our houses is what we are longing for we've tried many times even seeking parliamentarians for financial assistance, but nothing happens, so yes it is a great idea and reduces of the life stresses here.</p> <p>What difficulties would there be for SIWA if wanted to put pipes through the community?</p> <p>The vulnerability of the area is the concern because due to river flooding and waterlogs.</p> <p>Water is life so I think connecting pipes through community would not be a problem, said chief (Peter) only fear I've got in mind is illegal connecting pipes.</p> <p>The land is not an issue here because needs water.</p> <p>What about in other communities?</p> <p>The reply to this is, Burns Creek community has similar issues but water would be their priority to address or solve.</p> <p>How could these problems be solved?</p> <p>To solve the issue of waterlogging and river flooding drains for pipe connections must be well constructed to withstand those types of situations. Thus, for the better community then consultation with.</p>	<p>They thought water connection is from Solomon Water is a good idea but they're afraid of the charge that will be allocated for them.</p> <p>What difficulties would there be for SIWA if wanted to put pipes through the community?</p> <p>Land dispute (people might not be allowed the water pipes to pass their area.</p> <p>Some people will not agree and some might agree about the arrangement.</p> <p>What about in other communities?</p> <p>They not really sure about other communities but the main problem that a lot of people will face is the land dispute.</p> <p>How could these problems be solved?</p> <p>The community should be meet together and come up with one agreement, and let the whole community aware of the issue before carrying out the activity.</p> <p>They thought if Solomon water put water pipe to the community there should be a water tap for each block.</p>
Fulisango (Mad Land)	<p>So far so well said by the community chief and he also adds on by saying that Solomon Water and other responsible authorities should work together solve water issue in Honiara.</p> <p>To have water connected to your home/house is what we want the most currently almost every household have already connected their homes with water with the help or assistance for Solomon Water.</p> <p>Most participants complained about unreliable and very expensive services provided by Solomon Water and they think water should be cheap to all residents of Honiara city as well as for the whole nation.</p> <p>What difficulties would there be for SIWA if wanted to put pipes through the community?</p>	<p>Almost all the participant want SIWA connection to individual households.</p> <p>What difficulties would there be for SIWA if wanted to put pipes through the community?</p> <p>The water pipe already been in the community and only a few households don't have it. The main problem is the financial problem.</p> <p>There is no other problem but some woman complained about how some household connects their water pipe. They said the Solomon water should connect the new pipes from the main connection not connected from the middle because it causes low water pressure in some houses.</p>

	<p>Piping access is an issue because it has to run through different area or land before reaching your area/households.</p> <p>Financial difficulties are the main problem because some families can afford and some are don't.</p> <p>About 3xpersons have mentioned that a good consultation with landowners or area owners is needed to be done first.</p> <p>What about in other communities?</p> <p>Have no clue or how they had connected their water.</p> <p>How could these problems be solved?</p> <p>Solomon Water should improve their existing piping system because some households have connected their pipe without consultation or permission from Solomon Water.</p> <p>Solomon Water should at least reduce the rate of water bill per month</p> <p>Introduce more Cash Water than Meter Water.</p>	<p>Also, some people paid for high cost and those who connected from others paid at lower cost.</p> <p>What about in other communities?</p> <p>They aren't really sure about other communities.</p> <p>How could these problems be solved?</p> <p>Solomon water should connect all the water pipes from the main connection.</p> <p>Some people not really sure about the charge of water therefore, Solomon water should have awareness talk so that they informed the people in the community about the water bill and the other charges.</p> <p>Because of the higher bill but they don't know how they calculating the charges they used cash water meter.</p>
<p>Ohiola</p>	<p>What difficulties would there be for SIWA if wanted to put pipes through the community?</p> <p>I want a SHARED SIWA connection between houses we can work together to pay the bill for water.</p> <p>There is an existing connection to the settlement</p> <p>SIWA help do the connection but the pipes belong to the community.</p> <p>The pipes were funded by MP for East Honiara after we have water problem for so long so he helps provide the pipes for the water connection now currently used.</p> <p>I think water is for the good of family and community to benefit no one will spoil so we will work together to help protect it. And we do not want anyone else to take from out connection because it will reduce water pressure to the settlement.</p> <p>If SIWA set up water connections individual houses we would be very happy.</p> <p>In this settlement, I think it is safe now for SIWA to make water connections because we are working together for individual connections to households.</p> <p>What about in other communities?</p> <p>Other communities April Valley and Lau valley also need water they will help to protect the water connections.</p> <p>It is for the benefit of all the community so I think no one will damage the facilities. If anyone damages the pipe he must be punished.</p> <p>There is no existing connection to those settlements and communities.</p> <p>How could these problems be solved?</p> <p>Community help collect to pay the pipes once a member of the community destroys it</p> <p>Someone who destroys the pipe or causes the problem must be punished or move away from the community</p> <p>People will work together to allow SIWA connections to individual houses</p> <p>Protect other SIWA facilities</p>	
<p>Burns Creek (Site 2)</p>	<p>What difficulties would there be for SIWA if wanted to put pipes through the community?</p>	<p>What difficulties would there be for SIWA if wanted to put pipes through the community?</p> <p>One woman mentioned that it would be easy and hard at the same time. Easy in the sense that the water would be accessible for them to use at their disposal but also hard</p>

	<p>I want a SHARED SIWA connection between houses we can work together to pay the bill for water.</p> <p>Before the young people are too crazy so they will destroy the water, but now the people are behaving and we are in need of water and suffering so we can't spoil it.</p> <p>I think water is for the good of family and community to benefit no one will spoil so we will work together to help protect it.</p> <p>If SIWA set up water connections we would be very happy.</p> <p>In this settlement, I think it is safe now for SIWA to make water connections because we are in great need of water and work together.</p> <p>What about in other communities?</p> <p>Other communities also need water they will help to protect the water connections.</p> <p>It is for the benefit of all the community so I think no one will damage the facilities.</p> <p>How could these problems be solved?</p> <p>Community help collect to pay the pipes once a member of the community destroys it</p> <p>Someone who destroys the pipe or causes the problem must pay for or we will arrange for police to arrest him.</p> <p>People will work together to allow SIWA connections to pass through their areas to reach most parts of the settlements.</p>	<p>because of the paper works needed and not forgetting will be expensive to pay for the connection and the user fee. It is seen likely to be so, but overall, they don't know and never tried it out all because there is no one from the community or the authority to go ahead in setting up the idea for implementation. No leadership role carried out (personally; responsible authority need to consult with the chiefs, church leaders or elders in the role and option there is to help the community in development access). Even the Minister of the Parliament (MP) does not see fit to help out in any way</p> <p>In the settlement settings like that of Burnscreek where most of the dwellers are ill-literate, they tend to hesitate in thinking of going into such development of connection because they (the women's) wouldn't know what the authority(s) will be asking for when questioned. No knowledge of when it comes to meter reading, registration or questioning.</p> <p>What about in other communities?</p> <p>What about the other community like that of Sand valley? Do they have the same problems or difficulties in gathering drinking water? They replied; 'they wouldn't know if SIWA have done piping to each house'. But would have faced the same problem like those in burns creek. Many women at burns creek area do not have some form of work and live off their daily lives through subsistence farming only.</p> <p>How could these problems be solved?</p> <p>A woman raised up the idea of shared connection between household which directed the discussion to Question 3 on water.</p>
<p>Namoliki</p>	<p>This idea is 100 per cent supported by all community members. They question us about the charges SIWA will put if this is going to happen.</p> <p>What difficulties would there be for SIWA if wanted to put pipes through the community?</p> <p>They suggest that SIWA will not help out. They just go for the spring water and borehole.</p> <p>An elder said that if the pipe is to be connected through their community, it should be along the access road. He explains that this will not be a problem since water is life.</p> <p>What about in other communities?</p> <p>Water pressure is the main issue for those communities who are living up the hills.</p> <p>Others said that if the other communities live as we live then they should also experience the same as we did.</p> <p>One main problem that they will face land disputes.</p> <p>How could these problems be solved?</p>	<p>All agree that SIWA should connect water to individual houses. It is what they are longing for. The question about the bill. Will, it not too expensive?</p> <p>What difficulties would there be for SIWA if wanted to put pipes through the community?</p> <p>Settlers who live there have no right ownership of the land so pipes can't go pass others boundary.</p> <p>Flooding is also an issue.</p> <p>Geographical location of that area. Needs more pressure to be able to supply water to all household since most houses are built up the hills.</p> <p>Drunkards will damage the taps or pipes.</p> <p>Others said that it will be too expensive for SIWA to connect the pipes.</p> <p>What about in other communities?</p> <p>The reply to this is if other communities are living in the same geographical location as we, they will also face the same difficulties. However, they said water would be their priority to address.</p> <p>How could these problems be solved?</p>

	<p>The community should be meet together and come up with one agreement, and let the whole community awareness of the issue before carrying out the activity.</p> <p>An elder suggests that SIWA should put tanks at the hilltop to provide water to all households. The water is supplied from the borehole. This will prevent them from buying expensive water bills from SIWA</p>	<p>They suggest tanks should be provided uphill so that it will be able to supply to all households who collect water from the spring or SIWA.</p> <p>One woman recommend that it will be better if pipes are connected to all households</p> <p>Chiefs and elders to of the community to give heavy penalties with those who cause the damage.</p> <p>One woman strongly suggests that if he/she purchases her own pipe, she does not allow anyone else to connect to the pipe for his or her household since it cost her to connect the pipes.</p>
<p>Renlau</p>	<p>They all agree that connecting pipes is the best idea. However, they have some concerns that SIWA should consider. They are listed below,</p> <p>Water and other responsible authorities should work together to solve the water issue in their community.</p> <p>They think that SIWA might afraid that the owners will not pay the bills if pipes are constructed.</p> <p>Pipes should be piped to houses that only owned by landlords.</p> <p>SIWA should also understand than Renlau is a customary land said by one old woman.</p> <p>They ask about how the bills will cost them if this is so. They said that it will be too expensive for them.</p> <p>Sometimes they said that the service can be unreliable.</p> <p>What difficulties would there be for SIWA if wanted to put pipes through the community?</p> <p>The land issue is a common obstacle in connecting pipes through our community. They said that the only access for SIWA connection to reach them is to go through the WORKS area.</p> <p>Difficulties in where the pipes will run through since the houses are not distant from each other.</p> <p>Others comment that proper consultation should take place before the actual job is carried out.</p> <p>What about in other communities?</p> <p>It depends entirely on their geographical location.</p> <p>How could these problems be solved?</p> <p>Proper consultation as to who is the right ownership where the pipe is to be connected. Mutual understanding should be done between SIWA and landowners.</p>	<p>Connecting SIWA connection to all houses is the best option they all prefer.</p> <p>What difficulties would there be for SIWA if wanted to put pipes through the community?</p> <p>The problem with finance</p> <p>Houses are closed together, pipes cannot pass through</p> <p>Careless attitude of drunkards</p> <p>This needs proper consultation.</p> <p>The expensive charge that SIWA used to do without explaining to customers how the charges are calculated.</p> <p>What about in other communities?</p> <p>They are not really familiar with other communities.</p> <p>How could these problems be solved?</p> <p>Some people not really sure about the charge of water therefore, Solomon water should have awareness talk so that they informed the people in the community about the water bill and the other charges.</p> <p>Because of the higher bill but they don't know how they calculating the charges they used cash water meter.</p>

	<p>Houses, when built, should be planned properly so that it will be easy for the pipes to go through.</p> <p>Cash water is most preferred.</p>	
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DISCUSSION ON OTHER WAYS WATER AUTHORITIES USE TO GIVE ACCESS TO WATER FOR PEOPLE IN SETTLEMENTS.

This section aimed to discuss four alternatives to water access provision: **(1) water kiosks, (2) automated taps / water ATMs, (3) private household connection and (4) shared household connection.** Community members were asked if they thought these alternatives (i) were a good thing, if they saw any (ii) problems with such alternatives, and (iii) how to make these alternatives work. In the case of water kiosks, an additional discussion point was put forward to community participants: who do you think should run the water kiosk? SIWA? or someone from the community? A business operator?

When feasible, a simple voting process was used to measure preference of community participants over the four discussed alternatives. When available, results of the voting have been provided as percentages.

Settlement	Men	Women
Burns Creek (Riverside)	<p>Water Kiosk (voting results: 10% preference)</p> <p>Is this alternative good thing? Water Store is a great idea most like this some even mentioned that it's a good business idea for an individual to run. They also said that the Water Store can be seen as a way to create income.</p> <p>Problems with such alternative? Nature often the area is a threat if this can be implemented. Attitude problems, no respect Wantok system will be the downfall of this.</p> <p>How to make this alternative work? This can be work if they run someone in the community as its own. They also said to avoid break-in or robbing it, it needs to be safeguarded which then it create jobs for community dwellers.</p> <p>Who should run the water kiosk? No response</p>	<p>Water Kiosk</p> <p>Is this alternative good thing? They thought there will be no good thing about water kiosk for their community</p> <p>Problems with such alternative? Attitude problem. People will not respect whoever owns the water store.</p> <p>How to make this alternative work? These can't work in their small community they said.</p> <p>Who should run the water kiosk? No response</p>
	<p>Automated taps / water ATMs (voting results: 3% preference)</p> <p>Is this alternative good thing? For us, in the community or settlement levels Water ATM is not really suits but maybe it fits for other community with a good background. The reason not everyone here can make a dollar a day.</p> <p>Problems with such alternative? A most common problem here is stealing due to the diversity of people live here it quite hard to control or manage so for those kinds of facilities to be installed here is risk associated to this is high, this was said by the chief.</p>	<p>Automated taps / water ATMs</p> <p>Is this alternative good thing? No response</p> <p>Problems with such alternative? These are the same as the water store they said it won't work in their community because of an attitude problem. It is easy for criminals are known as beluga to spoil it.</p> <p>How to make this alternative work? No response</p>

	<p>How to make this alternative work? The only way these facilities can work here is to build a well secure house. Community awareness is also needed before any further development into this kinds facilities, someone has mentioned that level understanding is very low which is good if government or NGOs to aware about before going into such activities basic training should be provided.</p>	
	<p>Private household connection (voting results: 71% preference)</p> <p>Is this alternative good thing? Almost everyone goes for private tap, they said that this is the only solution because it allows each household to look after and easy to manage. They said that water bills can be low because each house can control how they had used it.</p> <p>Problems with such alternative? The problem that may relate to this is paying off monthly water bills because here not every one of us gets permanent jobs. Natural disaster also a problem to consider because of our location.</p> <p>How to make this alternative work? Conduct proper consultation with landowners that water pipe connections run through their homes/areas this avoids any disagreements or hiccup. They said that water is our main issue here so we don't see any big problem might affect this, only proper consultation is needed.</p>	<p>Private household connection</p> <p>No discussion</p>
	<p>Shared household connection (voting results: 16% preference)</p> <p>Is this alternative good thing? The idea of sharing water amongst several households is a good idea because they will take up full responsibility for whatever requirements it requires, for instance, water bills, repair of any damages and etc.</p> <p>Problems with such alternative? An argument between users/household members this is common everywhere that sometimes people turn blind eye to perform their responsibilities, especially when sharing responsibilities amongst themselves.</p> <p>How to make this alternative work? It is best for shared water is amongst close relatives or family members. one person from the group suggested that to avoid any disagreement between community members then, the facility (shared water) should be run and look after by one person and he/she will take full responsibility for collecting water fees, security purposes and also to do the repair.</p>	<p>Shared household connection</p> <p>No discussion</p>
Fulisango (Mad Land)	Water Kiosk (voting results: 17% preference)	Water Kiosk

	<p>Is this alternative a good thing? The idea of Water Store is a good idea given that water access is limited most of the participants in favour of this idea. People can go and buy water at any time when is needed. Reduce frustration when water is cut-off. Few participants have said that this idea can bring job opportunities to our community</p> <p>Problems with such alternative? The security of it is an issue; the chief highlighted that community itself but faces issues related to stealing and drunken youths, men and public. Management also an issue if the price is high compared to bottled water sold in the shops nowadays.</p> <p>How to make this alternative work? To install or construct water store inside the community first thing to identify who will run or own the store or it is own by Solomon Water or private entrepreneur, this can allow the public to know.</p> <p>Who should run the water kiosk? No response</p>	<p>Is this alternative a good thing? They thought it is a business where people could earn money from. It will help those who have no water access. People would pay at a certain amount they want to spend.</p> <p>Problems with such alternative? If the shop closed especially on Sunday, and in the night people want water they won't get the water.</p> <p>How to make this alternative work? They don't want Solomon water staffs to run the water store, it should be a local from the settlement but it must have a license from the city council like the other shops and have an agreement with the Solomon water.</p> <p>Who should run the water kiosk? No response</p>
	<p>Automated taps / water ATMs (voting results: 17% preference)</p> <p>Is this alternative a good thing? Water ATM good because one can access it at any time</p> <p>Problems with such alternative? The security concern is the most common in whatever community around Honiara highlighted by the chief. Land/Space to install such facilities is another issue. Public response to those of facilities is another issue.</p> <p>How to make this alternative work? This only works if it is run or owns by a private businessman or if Solomon Water then they should considering employ someone to take care of it.</p>	<p>Automated taps / water ATMs</p> <p>Is this alternative good thing? Automate tap is good people will get whatever amount of water that fits their pocket</p> <p>Problems with such alternative? How people will respect the machine is the other problem. Also for big families, it will not adequate to give them all.</p> <p>How to make this alternative work? No response</p>
	<p>Private household connection (voting results: 50% preference)</p> <p>Is this alternative good thing? Private tap is the best solution because it manages by individuals or each household. They said living in a community like is not easy so therefore they prefer private taps.</p> <p>Problems with such alternative? Financial difficulties are the core problem, some families can afford while others can't.</p> <p>How to make this alternative work? If this kind of project is funded by the government or NGOs then it would be best because an individual can apply for themselves.</p>	<p>Private household connection</p> <p>No responses</p>

	<p>Shared household connection (voting results: 17% preference)</p> <p>Is this alternative good thing? They thought that shared water is good and at the same time it has its disadvantages.</p> <p>Problems with such alternative? People are not taking responsibilities seriously while others do. Arguments and dispute can happen amongst families. Anyone can access to collect water when no one is around.</p> <p>How to make this alternative work? The agreement should be a sign between landlords and tenants. Everyone should take ownership rather than a few or one household. Consultation with community dwellers is needed and further information on water management should be provided this was recommended by the chief of the community.</p>	<p>Shared household connection</p> <p>No discussion</p>
Ohiola	<p>Water Kiosk (voting results: 0% preference)</p> <p>This way will not work well in the settlements. What we want is for SIWA to put a big tank here to supply water to the settlements or households. Water kiosk will not work well in the settlement since there is an existing SIWA connection Hard work carrying water every day Most people are not earning to buy water every day</p>	
	<p>Automated taps / water ATMs (voting results: 0% preference)</p> <p>This way was not good for the settlements. People do not get used to the machine and it was a new technology will take long for people to know how to use and adapt to it. Even ATM first time to be seen in the Solomon Islands. Will this work in the Solomon Islands? And how reliable will it be? Can be good for other parts of the world not for the Solomon Islands at the moment.</p>	
	<p>Private household connection (voting results: 86% preference)</p> <p>Is this alternative good thing? Private SIWA household connection is best for the people of Ohuioala settlement as preferred by the majority. There is privacy and you can control water and pay for your water bill. If you use the water wisely your bill will be less, but if you mismanage your water you will meet the high water bill.</p>	
	<p>Shared household connection (voting results: 14% preference)</p> <p>No discussion</p>	
Burns Creek (Site 2)	<p>Water Kiosk</p> <p>Is this alternative good thing? No response</p> <p>Problems with such alternative? This way will not work well in the settlements. Previous when SIWA brings water to the front settlement they youths destroy it because those at the front use water it will not reach the settlements at the end.</p>	<p>Water Kiosk voting results: 2% preference</p> <p>No discussion</p>

	<p>What we want is for SIWA to put a big tank here to supply water to the settlements. And then we pay the bill to SIWA.</p> <p>Water kiosk will not work well in the settlement because they can go and buy \$5 bottle of water in Chinese shops which can cheap for them.</p> <p>Hard work carrying water containers every day over a long distance.</p> <p>How to make this alternative work? No response</p> <p>Who should run the water kiosk? No response</p>	
	<p>Automated taps / water ATMs</p> <p>Is this alternative good thing? No response</p> <p>Problems with such alternative? This way was not good for the settlements. People do not get used to the machine and it was a new technology will take long for people to know how to use and adapt to it.</p> <p>Even ATM machine which is much heavier people removed it; this could be easily done with this water ATM</p> <p>How to make this alternative work? No response</p>	<p>Automated taps / water ATMs voting results: 8% preference</p> <p>No discussion</p>
	<p>Private household connection</p> <p>Is this alternative good thing? Private SIWA household connection is best for the people of Burns Creek settlement.</p> <p>There is privacy and you can control water and pay for your water bill.</p> <p>If you use the water wisely your bill will be less, but if you mismanage your water you will meet the high water bill.</p>	<p>Private household connection voting results: 44% preference</p> <p>No discussion</p>
	<p>Shared household connection</p> <p>No discussion</p>	<p>Shared household connection voting results: 46% preference</p> <p>No discussion</p>
Namoliki	<p>Water Kiosk</p> <p>Is this alternative good thing? Young men prefer water store is best since in communities not all people have access to ATM cards.</p> <p>They proposed that the water store should be run by SIWA employers to avoid conflict among themselves or wantok business during cash shortage.</p> <p>Others said that this is a business opportunity and anyone to run this should have a business license and privately owned.</p> <p>Problems with such alternative? Attitude problem. People will not respect whoever owns the water store. Water is life and if they have no money, they will have to steal from the water shop.</p>	<p>Water Kiosk</p> <p>Is this alternative good thing? Water Store is a great idea most like this some even mentioned that it's a good business idea for an individual to run.</p> <p>They agree with it but it must be at a cheap rate</p> <p>Accessibility to kids</p> <p>They also said that the Water Store can be seen as a way to create income.</p> <p>It will help us to use water wisely since it cost them money.</p> <p>Problems with such alternative? Nature of the area is a threat if this can be implemented. It will only work if cash flow there is effective and cooperation among community members is well implied.</p> <p>Attitude problems, no respect</p> <p>Wantok system will be the downfall of this.</p>

	<p>It can bring conflicts between customers and the shop owner.</p> <p>How to make this alternative work? These can't work in their small community they said. Water should be sold at a cheaper price.</p> <p>Who should run the water kiosk? No response</p>	<p>How to make this alternative work? This can be work if they run someone in the community as it's owned. They also said to avoid break-in or robbing it, it needs to safeguarded which then it create jobs for community dwellers. The owner of the water store should always be loyal to customers Community leaders should do awareness on how to safeguard the water store.</p> <p>Who should run the water kiosk? No response</p>
	<p>Automated taps / water ATMs</p> <p>Is this alternative good thing? Chief says that swipe card is best so that each can only purchase enough to sustain them. It also helps to maintain freshness other than those ones stored at the shops.</p> <p>Problems with such alternative? It is not safe unless it is guided properly. Drunkards and stealers can destroy this when they are not happy with something else. Most questioned about how to register the ATM card.</p> <p>How to make this alternative work? No response</p>	<p>Automated taps / water ATMs</p> <p>Is this alternative good thing? For us, in the community or settlement levels Water ATM is not really suits but maybe it fits for other community with a good background. The reason not everyone here can make a dollar a day. Easy for kids to use Cost wise. Just take enough to use</p> <p>Problems with such alternative? A most common problem here is stealing due to the diversity of people live here it quite hard to control or manage so for those kinds of facilities to be installed here is risk associated to this is high, this was said by the chief. It might be too expensive for them It can be damaged by drunkards Most of them have no idea in this system and they did not bank at any bank. They prefer water store.</p> <p>How to make this alternative work? The only way these facilities can work here is to build a well secure house. Community awareness is also needed before any further development into this kinds facilities, someone has mentioned that level understanding is very low which is good if government or NGOs to aware about before going into such activities basic training should be provided.</p>
	<p>Private household connection</p> <p>No discussion</p>	<p>Private household connection</p> <p>Is this alternative good thing? Almost everyone goes for private tap, they said that this is the only solution because it allows each household to look after and easy to manage. Not overcrowded They said that water bills can be low because each house can control how they had used it. The owner is fully responsible for any damage without any compliance.</p> <p>Problems with such alternative? The problem that may relate to this is paying off monthly water bills because here not every one of us gets permanent jobs. Some say that this will too expensive for them. They just prefer the stream water. Natural disaster also a problem to consider because of our location.</p> <p>How to make this alternative work?</p>

		<p>Rules and regulation in the community must be strongly implemented.</p> <p>Some suggest that leader in the communities should be the leading hands to work forward.</p> <p>It can work well if all household has one mindset.</p>
	<p>Shared household connection</p> <p>No discussion</p>	<p>Shared household connection</p> <p>Is this alternative good thing? Shared water has the advantage in terms of maintenance, water bills and etc. community members has the full responsibility to account for any issue arise concerning what may become a problem to their water. It establishes friendship among community members who use shared pipes. It teaches community members to be responsible for what the community owns.</p> <p>Problems with such alternative? The concern raised by most women saying that they did not agree with shared water. It can cause arguments among themselves when it comes to usage, bills payments, maintenance and etc.</p> <p>How to make this alternative work? Each family should have their own SIWA connection so that he/she took full responsibility for whatever occurs.</p>
Renlau	<p>Water Kiosk They all agree with the idea of running a water store because they said that it cost less.</p> <p>Is this alternative good thing? Its family can concern for its own use. Some like water store because users will be cautious about that water since water is life and it cost them money. It only good when sold cheaper compared to cash water. It provides employment for the unemployed. When water is cut off, you can just go to the shops. It also avoids an argument between community members.</p> <p>Problems with such alternative? Some suggest that if it owns by the community it will cause arguments. If it is owned by any individual proper manages and avoid Nature of the area is a threat if this can be implemented. It will only work if cash flow there is effective and cooperation among community members is well implied. Attitude problems, no respect Wantok system will be the downfall of this. Robbery will be an issue.</p> <p>How to make this alternative work? Community to have good leaders to shared idea amongst them so that it works. Avoid the wantok system Tired security</p>	<p>Water Kiosk</p> <p>Is this alternative good thing? Generate income in the community setting Cheaper for peoples that they don't have enough money to meet the Solomon water bills. Accessibility for kids to use. Less time spent when using of it. It will useful for them when disaster strikes</p> <p>Problems with such alternative? This important service should be provided for 24 hours and 7 days a week all throughout the years. (Water is life). If shop is closed. It will affect he customers.</p> <p>How to make this alternative work? If anyone has to run this service, they must be always reliable. Water should be sold at a cheaper rate It should be privately owned and has a business license Security to safeguard the shops.</p>

	<p>Proper consultation should be done as of who should run the business. (SIWA, private or community owned) Elders should teach the community to be responsible and have respect for others. Heavy penalties should give to those who break or don't follow the rules.</p> <p>Who should run the water kiosk? No response</p>	<p>Who should run the water kiosk? Automate tap is good people will get whatever amount of water that fits their pocket but how people will respect the machine is the other problem. Also for big families, it will not adequate to give them all.</p>
	<p>Automated taps / water ATMs</p> <p>Is this alternative good thing? Some agree of it because of it easy to manage by each family. Easy for kids to use Anyone can access water at any time they wish. Water is fully utilized since it cost them money. Educate us to use water wisely.</p> <p>Problems with such alternative? Not all community members can cater to have ATM cards. They also say that most community members are not educated so they question us how this will work. When explained they say that it needs proper training. If this has to be installed, it needs careful management (security). Attitude is also an issue. It will cost SIWA to install such facilities If ATM card is lost they will become stranded.</p> <p>How to make this alternative work? Generally, they said that this will not best for them.</p>	<p>Automated taps / water ATMs</p> <p>Is this alternative good thing? Automate tap is good people will get whatever amount of water that fits their pocket but</p> <p>Problems with such alternative? how people will respect the machine is the other problem. Also for big families, it will not adequate to give them all.</p> <p>How to make this alternative work? No response</p>
	<p>Private household connection</p> <p>Is this alternative good thing? Private tap is the best solution because it manages by individuals or each household. It will not be overcrowded. It will avoid arguments since it is privately owned. It will cost them less It is easy to clean up the mess. Each household is satisfied with what bills they charge them for.</p> <p>Problems with such alternative? If a fault occurs, it will cost them to repair the damage. The main problem is with finance incurred to install such facilities. Cliticization can occur if the owner put a restriction of not allowing anyone to use his/her tap.</p> <p>How to make this alternative work? SIWA must provide each household with a private tap.</p>	<p>Private household connection</p> <p>No discussion</p>
	<p>Shared household connection</p>	<p>Shared household connection</p>

	<p>Is this alternative good thing? Cost less (water bills) It provides friendship between households. Shared connection tap will enable each household with full responsibility. (this is not always the case) SIWA connection shared is easy to delegating of work done between households.</p> <p>Problems with such alternative? Full responsibility for delegating work sometimes is not done accurately. Feeling unreliable is the most problems with the shared connection of water. Anyone can access to collect water when no one is around. Water bills are the main issue. Overcrowded and time-consuming are the big problems with the households. Families always face arguments between themselves</p> <p>How to make this alternative work? The agreement should be a sign between landlords and tenants. They should all agree with one idea. Everyone should take ownership rather than a few or one household. Consultation with community dwellers is needed and further information on water management should be provided this was recommended by an elder of the community.</p>	<p>No discussion</p>
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Sanitation

WHAT DO YOU THINK ABOUT TOILETS THAT USE WATER COMPARED TO TOILETS THAT DON'T USE WATER? (What is good about the water use-based toilets? What is good about the dry toilets? What about the VIP toilets?)

Settlement	Men	Women
Burns Creek (Riverside)	<p>2x participants within the discussion group said here we don't use those facilities but generally we think that toilets that use water is better than ones that don't use water</p> <p>What is good about the water use-based toilets? Clean and better smell Comfortable when using</p> <p>What is good about the dry toilets? Less expensive Require less cleaning up</p> <p>What about the VIP toilets? Good settings with less expense and reduce the bad smell in the environment</p>	<p>A toilet that uses water is better compared to toilets that don't use water.</p> <p>What is good about the water use-based toilets? Clean Not smelly</p> <p>What is good about the dry toilets? They thought that there is no good thing about dry toilets because it is smelly where you can smell it from far a distance.</p> <p>What about the VIP toilets? Less smell with no water bill</p>
Fulisango (Mad Land)	<p>Use a water toilet is expensive, unlike toilets that don't water.</p> <p>What is good about the water use-based toilets? Clean and hygiene, comfortable when used. No smell Clean environment with fresh air</p>	<p>Most of them prefer water based toilet.</p> <p>What is good about the water use-based toilets? The water-based toilet is clean. Not Smell It is not yucky to use</p> <p>What is good about the dry toilets?</p>

	<p>What is good about the dry toilets? Less expensive to construct No water bills What about the VIP toilets? They said that it's cheap to build but it requires good management. Some said the smell will pollute the air.</p>	<p>No water bill but it not good for urban areas because it is smelly</p> <p>What about the VIP toilets? They don't really understand this type of toilet but by listening to the explanation they said no water charges, Not smelly</p>
Ohiola	<p>What is good about the water use-based toilets? Good to use water-based toilets because it is clean and free from flies. Privacy in the use of the toilet. Household responsible for cleaning the family toilet Less smell than dry pit toilets Hygienic and safe for kids What is good about the dry toilets? Cheap to create Can create with local materials No expense to pay for water Disadvantages: Attracts flies Bad unhealthy smell The danger for kids and animals The dry pit is not good. What about the VIP toilets? They have no Idea about VIP toilets. They have never seen one before. New thing for them. Don't even know how it works.</p>	
Burns Creek (Site 2)	<p>What is good about the water use-based toilets? Good to use water-based toilets because it is clean and free from flies. Privacy in the use of the toilet. Household responsible for cleaning the family toilet Easy to remove waste when septic is full just hire trucks to pump the waste out. Safer than dry pit from animals like chickens, and dogs etc... Less smell than dry pit toilets What is good about the dry toilets? Cheap to create Can create with local materials No expense to pay for water Disadvantages: Attracts flies Bad unhealthy smell The danger for kids and animals The dry pit is not good. What about the VIP toilets? They have no Idea about VIP toilets. They have never seen one before.</p>	<p>The current sanitation used is the one over the creek. They simply build a bridge like platform over the creek which leads to the small room.</p> <p>One women said that, 'it really depend on whether they live near the river or live inland whereby, those living inland use properly built sanitation house than those using the sanitation over the creek.</p> <p>What is good about the water use-based toilets? They mainly prefer the toilets using water flush or pour flash but one of the women added by saying that, 'their means of income does not carter to purchase the needy materials to build a preferable toilet, but rather she added by saying that it is rather easier to build a simpler sanitations system.</p> <p>What is good about the dry toilets? As above What about the VIP toilets? No response</p>
Namoliki	<p>A toilet that used water is better compared to toilets that don't use water. What is good about the water use-based toilets? Clean Not smelly Water based can be harmful, at times it can cause the linkage to water streams and affects kids playing around the streams. What is good about the dry toilets? They thought that there is no good thing about dry toilets because it is smelly where you can smell it from far a distance. They did not agree with dry toilets even if it is less expensive and not too much labour required. What about the VIP toilets?</p>	<p>They prefer water-based toilets to avoid the filthy smell. Water can dissolve the waste unlike non water based according to their geographical location. Their houses are closed together. Population growth is also a major concern. What is good about the water use-based toilets? It is clean, safe and smells at least better than dry toilets It feels Comfortable when using It avoids diarriaoh all over the place</p> <p>What is good about the dry toilets? Less expensive Require less cleaning up</p> <p>What about the VIP toilets?</p>

	Less smell with no water bill	Good settings with less expense and reduce the bad smell in the environment
Renlau	<p>All prefer water-based toilet.</p> <p>The problem is you can't dig septic because the water table is just about 3 feet below ground level. Therefore they are eager to understand how dry toilets work. They are really interested in this type of toilet. One participant suggested that big tanks should be used instead of rubbish bins</p> <p>What is good about the water-based toilets?</p> <p>They prefer water base toilets. Because of the following reasons,</p> <p>It is clean, safe and smells at least better than dry toilets</p> <p>It feels Comfortable when using</p> <p>It avoids diarrhoea all over the place</p> <p>It is good for the environment</p> <p>What is good about the dry toilets?</p> <p>Less expensive to construct</p> <p>No water bills</p> <p>Use water toilet is expensive, unlike toilets that don't use water.</p> <p>They like the dry toilets but more training should be done to give them broad ideas on how the system works</p> <p>They said that dried toilets are best for their location.</p> <p>What about the VIP toilets?</p> <p>In accordance with their location. They did not agree with the VIP toilets.</p>	<p>Compared to the two toilets they all agree for the water based one.</p> <p>They said that the water base is more comfortable than the dry toilet.</p> <p>Why some people prefer water base toilet is because the standard of living is the most contributing factors in our areas. So that people always go for it.</p> <p>What is good about the water-based toilets?</p> <p>Easy to clean it up the mess</p> <p>Smell at least good, compared to the dry toilet.</p> <p>Provides hygiene for the communities surrounding.</p> <p>What is good about the dry toilets?</p> <p>They said it is very cheap for the Grasse root peoples.</p> <p>No water bills costs.</p> <p>Cheap materials used.</p> <p>What about the VIP toilets?</p> <p>They agree with it but due to limited space, and careless attitude, they conclude that this is not the best option for them.</p> <p>Others did not understand what VIP toilets are.</p> <p>The water level is just about 3 feet above ground level so it will be difficult to construct the septic.</p>

SHARING TOILETS

WHAT DO YOU THINK ABOUT SHARING TOILETS WITH SOME OTHER HOUSES NEAR TO YOURS?

Settlement	Men	Women
Burns Creek (Riverside)	There are many factors concerning shared toilets they said; cultural norms, misunderstanding between shared members, ownership concerns. Careless attitude by other users may result in disputes.	The ladies thought that it is not a good idea to share a toilet. This is because they thought only the owner of the toilet will do everything like the washing of the toilet; the people will just use and live their waste there and go.
Fulisango (Mad Land)	Almost every household already have private toilets so for sharing toilet is not what they are looking for. They said sharing toilets have many disadvantages especially in the community like this where very diverse.	Nobody wants shared toilets. They said community like them sharing toilet is not good because some people will have no care attitude where they will leave their waste and go. Only the person who owns the toilet will do cleaning up and other stuff like water bills, and detergents and so forth.
Ohiola	Toilets can be shared but it is not good like a private toilet. In case a woman is using the toilet and a man comes in might spark arguments and might end up in compensation No one is responsible for cleaning the toilet Others are not free to use the shared toilet Easily spread diseases	
Burns Creek (Site 2)	Toilets can be shared but it is not good like a private toilet. In case a woman is using the toilet and a man comes in might spark arguments and might end up in compensation No one is responsible for cleaning the toilet Others are not free to use the shared toilet Easily spread diseases	The women agreed that sharing toilets by other houses is time consuming in reference to waiting in line for long hours or so. In an instance, if there were 5 houses sharing the same toilets for male and female respectively and there are more than 5 family members living in the house, there will be problems faced if there is a long queue awaits their turn of use. Therefore, they (the women)

		said it would rather be much easier and convenient if each house has its own private toilet system. The other issue is that, when it comes to cleaning the shared toilets only one or two house members would do all the cleaning all the time when some houses would ignore their duties if set.
Namoliki	One man comment that his wife is only responsible to clean up the mess of his own family. It's against their norms to clean other relatives mess.	Not good also during when emergency purposes. They comment saying it is very dangerous (not good). Men at times can peep through the windows. Each household should have each toilet(looking at household size, who to clean up the mess, cultural norms and beliefs, ownership concerns, conflict between family members)
Renlau	They did not experience shared toilets because all of their lifetime they use the seafront as their waste venue. It is not good at sharing of toilets because it costs if others do not feel responsible to clean it and maintained it. They said that shared toilets are not good for them by their own views.	Nobody wants shared toilets. They said community like them sharing toilet is not good because some people will have no care attitude where they will leave their waste and go. Only the person who owns the toilet will do cleaning up and other stuff like water bills, and detergents and so forth Meanwhile, they use the seafront to dispose of their waste.

WHAT ABOUT PUBLIC TOILETS THAT YOU PAY TO USE? COULD THESE WORK IF DESIGNED APPROPRIATELY, MAYBE SEPARATE MEN AND WOMEN'S BUILDINGS? WHO WOULD KEEP THESE CLEAN?)

Settlement	Men	Women
Burns Creek (Riverside)	In community settings like this public toilet is not a good option. However, 1x participant explains that if it's going to build then someone has to employ to take care of it. Could these work if designed appropriately, maybe separate men and women's buildings? They said that it may work but their concern is how long it will be last. Who would keep these clean? One participant said it should give to one household so look after manage it as a business.	They thought in their community public toilet won't work. Could these work if designed appropriately, maybe separate men and women's buildings? They thought for the public like in the city it will work but for their community, almost everybody used the river, therefore, they don't need it. Who would keep these clean? No response
Fulisango (Mad Land)	To have a public in the community is a very idea but it needs someone to manage it either that person owns that toilet or employ under any NGOs who responsible for it. As a youth leader, he said that this is a good idea to create so youths can involve in. Could these work if designed appropriately, maybe separate men and women's buildings? Definitely, it will work but it needs to be well managed and look after. In community settings, those kinds of facilities should well set-up to avoid any misunderstanding also considering factors involves women or girls involvement.	They thought it is a good idea to have public toilets. It is a business for the community. Could these work if designed appropriately, maybe separate men and women's buildings? Yes, they said it should be designed separated men and female, so those women don't listen to the men and so as men. Privacy concern Security purposes or safety for women. (Avoid men peeping to a woman) Who would keep these clean?

	<p>Who would keep these clean?</p> <p>That kind of set-up should run by someone as a business so he/she can manage it.</p>	<p>They thought that men should keep their own and female kept their own toilets. (Cleaning the toilet)</p>
Ohiola	<p>A public toilet like that can work but not reliable. This is because most of the people in these settlements are not employed and paying for using the toilet every day would be a problem for them.</p> <p>Most will turn to use the bush or river as their toilet</p> <p>Could these work if designed appropriately, maybe separate men and women's buildings? No response</p> <p>Who would keep these clean? No response</p>	
Burns Creek (Site 2)	<p>A public toilet like that can work but not reliable. This is because most of the people in these settlements are not employed and paying for using the toilet every day would be a problem for them.</p> <p>Most will turn to use the bush or river as their toilet</p> <p>Chief Peter Usi said if there is access to water, he can build a cheap toilet that uses two drums. Said this was an Indian design and he had built one before and it worked. The design he gave is handed to Regina.</p> <p>Could these work if designed appropriately, maybe separate men and women's buildings? No response</p> <p>Who would keep these clean? No response</p>	<p>in an area or settlement like that of burns creek it wouldn't be applicable to run or establish a public toilet, because some of them men and women have attitude problem.</p> <p>This attitude problem may include; vandalism, loitering, leaving faeces near the building especially when it is closed, not using it wisely because of the thinking that the public toilet does not belongs to them and so on.</p> <p>Overall, they see that setting up a public toilet at burns creek area isn't going to work for them and would rather not think of going to that agenda.</p> <p>Could these work if designed appropriately, maybe separate men and women's buildings? No response</p> <p>Who would keep these clean?</p> <p>The other question asked by the women is, who is going to look after the facilities by cleaning it and providing tissues? Is it going to be the Honiara City Council, the Solomon Islands Water Authority or a joint partnership by someone living in the area?</p>
Namoliki	<p>They did not agree with the idea of a private toilet to pay even if the focus group leader tries to convince them.</p> <p>Could these work if designed appropriately, maybe separate men and women's buildings?</p> <p>They though for the public like in the city it will work but for their community, almost everybody has their own toilet, some use shared toilet.</p> <p>Who would keep these clean?</p> <p>No one they think off that's why they did not agree with it.</p>	<p>They all did not agree with the public toilet. (Careless attitude, Low-income earners) However, one woman stressed out that it is only good to use during special occasions like church activities. Someone has to be employed to take care of this.</p> <p>Could these work if designed appropriately, maybe separate men and women's buildings?</p> <p>They all agree that if it is to be built, it has to be separated, whilst, this will not last.</p> <p>Who would keep these clean?</p> <p>They suggest that public toilet has to be owned by the community as their source of income. They have to set up a committee to look after the toilet as their business. The caretaker should be employed for this.</p>
Renlau	<p>They said that this is a very good idea but it will not work for them. Most of them are low-income earners. Their daily earnings are just enough to buy food.</p> <p>Attitude is also an issue.</p> <p>Could these work if designed appropriately, maybe separate men and women's buildings?</p>	<p>They thought it is a good idea to have public toilets.</p> <p>It is a business for the community.</p> <p>They did not agree with the public toilet since some families have large numbers and can't afford to pay them all for every day.</p> <p>Most did not agree with this.</p>

	<p>Yes they think so, it only needs to be carefully managed</p> <p>Who would keep these clean?</p> <p>In such cases, it has to be managed by any private firm, not the community. If it is owned by the community, community leaders must have to always teach community members on how to be responsible for such properties.</p>	<p>Could these work if designed appropriately, maybe separate men and women's buildings?</p> <p>Yes, they said it should be designed separated men and female, so those women don't listen to the men and so as men.</p> <p>Privacy concern</p> <p>Security purposes or safety for women. (Avoid men peeping to a woman)</p> <p>Who would keep these clean?</p> <p>They thought that men should keep their own and female kept their own toilets. (Cleaning the toilet)</p>
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WHAT DO YOU THINK SHOULD HAPPEN WITH THE WASTE FROM THE TOILETS IN THE SETTLEMENT? (If taken away, who to do that and how?)

Settlement	Men	Women
Burns Creek (Riverside)	<p>Here we don't have toilets so to manage waste is not our concern right now.</p> <p>Some said if given a chance to have those facilities then yes that question is necessary to us.</p> <p>If taken away, who to do that and how?</p> <p>Currently, Honiara City council do that but have to pay for it.</p>	<p>There is only one woman who owns the toilet in the community said; when the septic is full the waste was taken away.</p> <p>If taken away, who to do that and how?</p> <p>They paid the city council to come and empty the septic.</p>
Fulisango (Mad Land)	<p>Most household here have a toilet so when it comes with the waste they usually call Honiara City Council to do that.</p> <p>So far waste in the community remains an issue but others who use proper toilets they don't have a problem.</p> <p>If taken away, who to do that and how?</p> <p>Honiara city council and other private companies were paid to do that.</p>	<p>Few women who have proper toilets said the waste should be taken away.</p> <p>One woman said her husband build another septic tank beside the old one so that when it full it will transfer to the other septic tank.</p> <p>If taken away, who to do that and how?</p> <p>They pay the private and the city council trucks to come and did the pumping of the septic tanks.</p> <p>A concerned woman asks and worried, she wants to know if the wastes that were taken away Were thrown at the right place or otherwise It just dumps anywhere which will affect our health.</p>
Ohiola	<p>They did not really care about the waste from the toilets.</p> <p>This part they don't freely discuss so we move on</p> <p>If taken away, who to do that and how?</p> <p>If it is possible to waste disposal trucks can remove the waste if they want.</p>	
Burns Creek (Site 2)	<p>They did not really care about the waste from the toilets.</p> <p>There are no other ideas on ways to do with waste, unlike chicken manure where you can reuse in gardens as organic for plant growth.</p> <p>If taken away, who to do that and how?</p> <p>If it is possible to waste disposal trucks can remove the waste if they want.</p>	<p>Questions 4, 5 & 6 (remaining question on sanitation and waste) where not discussed by the women's group because they would rather not think more on how and what would happen to the waste. They joked about it and said that if anybody wants it then they can come and take it away for other use.</p>
Namoliki	<p>There is only one man who owns the toilet in the community said; when the septic is full the waste was taken away due to the accessibility of road.</p> <p>Others who lived up the hills just don't care about what happens to the waste in the toilets.</p> <p>If taken away, who to do that and how?</p> <p>They paid the city council to come and empty the septic.</p>	<p>They just don't care about where the waste goes out.</p> <p>This is due to poor road access. They said that SIWA should be responsible that since they are responsible for water.</p> <p>If taken away, who to do that and how?</p> <p>Honiara city council should be responsible for this.</p> <p>One woman said that during heavy rain when septic is filled, she just use buckets to draw water from the septic and splash it to the drains and run off to the streams.</p>

Renlau	<p>This is a good question but for our case, at the moment we just dispose of them at the sea(out of sight out of mind)</p> <p>Only one woman have septic and say that if it is full, she use to call the town council team to get rid of this waste. The question she asks is where did town council dispose of this waste?</p> <p>If taken away, who to do that and how?</p> <p>Honiara city council and other private companies were paid to do that.</p>	<p>Few men who have proper toilets said the waste should be taken away by the Honiara city council or any relevant firm...</p> <p>One man build another septic tank beside the old one so that when it full it will transfer to the other septic tank.</p> <p>One participant prefers that all waste from the different toilets should pipe to the main sewage lines that were established by SIWA long ago since septic tanks are hard to construct in those areas because of sea level rise and high water table.</p> <p>If taken away, who to do that and how?</p> <p>They pay the private and the city council trucks to come and did the pumping of the septic tanks.</p> <p>A concern raised does the waste taken disposed of in the right place or they used it for other purposes.</p>
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WHAT DO YOU THINK ABOUT COMPOST TOILETS?

Settlement	Men	Women
Burns Creek (Riverside)	<p>Some heard about but never seen one.</p> <p>From the explanation made during the discussion they just learn its usefulness and turn to like it because it is very cheap and fits their situation.</p>	<p>They don't really understand this type of toilet.</p> <p>They think it will useful for fertilizer if they really understand how it works.</p>
Fulisango (Mad Land)	<p>The compost toilet is not fit for us here because most houses were built very close to each other.</p> <p>A teacher who also attends said compost good because it is cheap to build and plus one can use it manure for other purposes.</p> <p>It great they said but it does not really suit where we lived.</p>	<p>They don't really familiar with this kind of toilet.</p> <p>They don't think it can be done in their community.</p>
Ohiola	They have no idea about compost toilets and no discussion	
Burns Creek (Site 2)	They have no idea about compost toilets and no discussion	They have no idea about compost toilets and no discussion
Namoliki	<p>They don't really understand this type of toilet.</p> <p>One elder agrees because it's cheap to construct and can be used as fertilizer, on the other hand, it is not really good for the environment due to high population density and closeness of the houses. In overall, it is not good by looking at their geographical location.</p> <p>They think it will useful for fertilizer if they really understand how it works.</p> <p>Majority of them don't want to comment on this question. They no agree with this.</p>	<p>Most women have no idea about compost toilet and when explained to them they did not agree with it. It will cost them to pay sawdust and truck hire. (expensive)</p> <p>They said that if the waste is to be used as compost for vegetables and sold at the market, people will not buy them if they knew it was planted with waste compost.</p> <p>They totally not agree with this idea.</p>
Renlau	<p>They declared that compost toilet will no work well for them because of their setting. Houses were built closely together and limited space where they can do gardening. They think that if they sold the compost toilet, there will not any buyer for this because of cultural norms.</p> <p>One person even highlight the importance of compost toilet but still, they did not agree with this, they said that what they have so far is good for them. They said that this is good but it will not work well for them.</p>	<p>They don't really familiar with this kind of toilet.</p> <p>They agree with this type of toilet because it will suit their location. (water table is close to ground level and sea level rise experienced)</p> <p>All they need is good training and expert engineers to construct it for them.</p> <p>One elder prefers to use the tank instead of using rubbish bin which will easily be filled if they are too many in the family.</p> <p>They agree with the compost toilet. They said that all they have to do is careful management.</p> <p>Each should have a concern for his/her own health.</p>

HAS ANYONE ANY EXPERIENCE/KNOW ABOUT SUP SUP BIOGAS TOILETS? (What do you think about these? Do you think these could be the way to deal with the waste from toilets?)

Settlement	Men	Women
Burns Creek (Riverside)	<p>Never heard about it but it was interesting to learn about if awareness or training can be provided for this particular one of participant said.</p> <p>What do you think about these?</p> <p>Sound interesting because it control waste and it can be used again.</p> <p>Do you think these could be the way to deal with the waste from toilets?</p> <p>They agreed that it is, also they ask if possible that training can be provided, they even said that they want to learn about it.</p>	<p>No one knows or heard about the supsup biogas.</p> <p>What do you think about these?</p> <p>No response</p> <p>Do you think these could be the way to deal with the waste from toilets?</p> <p>They didn't understand about the sup biogas but they did mention if someone does some awareness or give them more information about it and it could be work.</p>
Fulisango (Mad Land)	<p>No, it sounds new to us.</p> <p>One participant said that he might have seen the Biogas system at Taiwanese Technical Farm</p> <p>What do you think about these?</p> <p>Really we can't make any comment on this because it is new to us.</p> <p>Do you think these could be the way to deal with the waste from toilets?</p> <p>Form the discussion some suggested that if free training on how to construct and its uses then it would be must more interesting.</p>	<p>No response</p> <p>What do you think about these?</p> <p>Really we don't know how its system is functioning.</p> <p>One lady even asks if possible Solomon Water can offer training on this.</p> <p>Do you think these could be the way to deal with the waste from toilets?</p> <p>No one has any idea about sup biogas but they were interested to know about it.</p> <p>One lady said the sup biogas could be a good way to remove the waste and at the same time using the gas for the cook.</p>
Ohioia	<p>They also have no ideas on sup-sup Biogas toilets. Just new to them</p>	
Burns Creek (Site 2)	<p>They also have no ideas on sup-sup Biogas toilets.</p> <p>What do you think about these?</p> <p>If it is possible that could be good to use biogas to make use of the waste from the toilets. But we have never seen one before so we can't talk about.</p>	<p>Not familiar and no opinion</p>
Namoliki	<p>Only one man heard about the supsup biogas. The majority has no idea.</p> <p>What do you think about these?</p> <p>They said that this is a good idea but it sounds difficult. All they need is proper training.</p> <p>Do you think these could be the way to deal with the waste from toilets?</p> <p>They didn't understand about the sup biogas but they did mention if someone does some awareness or give them more information about it and it could be work.</p>	<p>One woman has some idea about that. Others suggest that awareness and training should be implemented. They are surprised to know that the Boral gas is made from such waste. It sounds are interesting to them.</p> <p>What do you think about these?</p> <p>Interesting to know that that the gas that was used for cooking is extracted from waste.</p> <p>However, this sounds difficult due to its expensiveness to implement.</p> <p>Do you think these could be the way to deal with the waste from toilets?</p> <p>They agreed that it is, also they ask if possible that training can be provided, they even said that they won't learn about it.</p>
Renlau	<p>Only one participant said that he has seen the Biogas system at Taiwanese Technical Farm</p> <p>All of them are not familiar with this system.</p> <p>What do you think about these?</p> <p>They had not much to say about this system because of it sounds new to them. They need experts to clarify this with more training. They all think that this is a good idea.</p>	<p>What do you think about these?</p> <p>Really we don't know how its system is functioning.</p> <p>One man even ask if possible Solomon Water can offer training on this.</p> <p>Do you think these could be the way to deal with the waste from toilets?</p> <p>No one has any idea about sup biogas but they were interested to know about it.</p>

	<p>Do you think these could be the way to deal with the waste from toilets? Off course yes, they need experts (engineers) to help them out</p>	<p>One man said the sup biogas could be a good way to remove the waste and at the same time using the gas for the cooking</p>
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9.5 ON-SITE SANITATION OPTIONS

SEPTIC SYSTEM

Name of service delivery model		SEPTIC SYSTEM (variations: Anaerobic Baffled Reactor (ABR), Anaerobic Filter (AF), Aerobic treatment system (ATS))					
Service Delivery Chain		Access (site of use)	User interface (CAPTURE of waste)	Waste storage	Transport	Treatment & disposal technology	Further transport, treatment or disposal
Technical aspects	Technology	<p>Access via</p> <ul style="list-style-type: none"> public toilets; shared private household toilets; or individual household toilets (inside house or outside) <ul style="list-style-type: none"> Superstructure (housing) can be built with local materials <ul style="list-style-type: none"> Drainage from handwashing facility required (e.g. garden bed) 	<ul style="list-style-type: none"> sitting or squatting slab with pour flush or cistern flush design – with a water seal. Ready supply of water (containers for pour flush, or piped to cistern) <p>Also required:</p> <ul style="list-style-type: none"> handwashing with soap facility (need water access) bins for menstrual hygiene management and infant faeces management 	<p>Septic:</p> <ul style="list-style-type: none"> watertight chamber made of concrete, fibreglass, PVC or plastic. With at least two chambers (separated by a baffle). Accessibility to all chambers (through access ports) is necessary for maintenance. should be vented for controlled release of odorous and potentially harmful gases. <p>Variation: Aquaprivy</p> <ul style="list-style-type: none"> simple storage and settling tank that is located directly below the toilet so that the excreta fall into it (low treatment efficiency). <p>Variation: ABR:</p> <ul style="list-style-type: none"> is an improved with 3-6 baffles under which the wastewater is forced to flow. Larger capacity – suited to multiple toilets (needs more regular flow of waste) and can take greywater <p>Variation: AF</p> <ul style="list-style-type: none"> Similar ABR but with Biological filters (biofilm on gravel/rocks) incorporated to multiple chambers to improve treatment Requires pre-settlement tank Often combined with subsequent Aerobic treatment system (requiring constant pump aeration) 	<ul style="list-style-type: none"> Optional transport of effluent (e.g. through simplified sewer system) if on site soak pit/leach field not feasible 	<p>Septic:</p> <ul style="list-style-type: none"> in chamber: Settling and anaerobic processes reduce solids and organics, but the treatment is only moderate (no treatment of pathogens, unless chlorine dosing before discharge of effluent) The effluent of the septic tank must be dispersed by using a Soak Pit or Leach Field Sludge needs to be emptied (removed for treatment) Suited to 1 or small number houses, or for more toilets/public toilet – add chambers <p>ABR & AF:</p> <ul style="list-style-type: none"> Similar process to septic but more effective at reducing BOD (but similarly ineffective for pathogens) <p>AF:</p> <ul style="list-style-type: none"> Pathogens and nutrients not treated so effluent requires further treatment / careful disposal 	<ul style="list-style-type: none"> Sludge emptying and safe disposal (treatment) required every 2-5 years ABR: 1-3 years) Requires trucks or motorised carts to de-sludge tanks

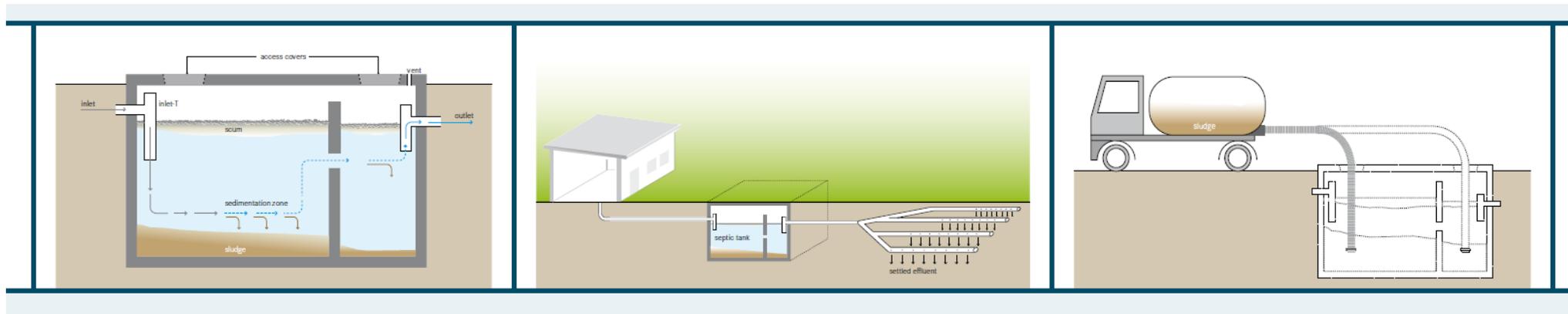
Environmental and physical considerations	<ul style="list-style-type: none"> physical accessibility during night – prefer location in/adjacent to house for safety need access to a water supply suitable for handwashing and cleaning and toilet flushing (not necessarily potable) 				Septic (ABR or AF) <ul style="list-style-type: none"> Soak Pit or Leach Field require significant land area – or ability to transport offsite On-site treatment & disposal not suited to shallow groundwater (especially if accessed for human use nearby) Need truck access (for desludging) 	<ul style="list-style-type: none"> safe sludge treatment/ disposal location required
Key operational tasks	<ul style="list-style-type: none"> Need to be used with care by users: e.g. harsh chemicals entering tank will decrease treatment significantly (and create odours), Clogging is frequent when bulky cleansing materials are used Pour flush: Must use bucket/container of water to flush and maintain water seal Promotion of sanitation use generally is required (see service providers – community mobilisation) ABR: start-up time can be several months (unless inoculated) 					
Key maintenance tasks	As for all sanitation: <ul style="list-style-type: none"> Hygienic facilities (at least daily cleaning depending on level of use, maybe several times per day) Supplies: anal cleansing materials handwashing facility bins promotional materials (notices etc) Super structure (building/housing maintenance) 	<ul style="list-style-type: none"> Repairs to toilet interface (cracks etc) and functional lid 	<ul style="list-style-type: none"> Accumulated sludge and scum must be periodically removed (septic: 2-5 years; ABR: 1-3 years) check tank is water tight and repair cracks (typically not regularly undertaken by consumer, leading to leakage of untreated effluent) Check pipework associated into tank and from tank through leach field or soak pit – clogs must be removed, pipes repaired). 		Sludge need to be safely disposed (it is not fully treated – high pathogenic load)	

Actors and their potential roles	Service providers	<p>As for VIPs:</p> <ul style="list-style-type: none"> Sanitation promotion is required – city-wide (or country-wide urban) communication materials need to be developed; can be implemented by HCC, NGOs and SW Construction of superstructure (optional) 	<ul style="list-style-type: none"> Requires expert design and construction skills. Possibility for home-built with design assistance and plumbing assistance. Local manufacturers of septic tanks (plastic and concrete) ABR, AF (with or without aerobic treatment system) requires expert maintenance All require regular desludging by a licenced service provider Possible Sol Water roles: technical training to NGOs, HCC or other actors engaging with settlements 				<ul style="list-style-type: none"> Sludge removal services required (trucks and smaller motorised carts for improved access) Sludge treatment & disposal facilities/services
	Consumer roles	<ul style="list-style-type: none"> Public toilets: pay-per-use Construction of superstructure (optional) 	<ul style="list-style-type: none"> Pay for maintenance inspections Manage soak pit / leach field Arrange desludging 				
Costs	O&M costs	<p>Minimal (mostly local materials can be used for super structure)</p> <p>Cost score: 1</p>	<p>Minimal costs to repair</p> <p>Cost of water to operate</p> <p>Cost score: 2</p>	<p>No Electricity (except if Aerobic Treatment System added), but several maintenance tasks – some may require expert assistance (e.g. desludging)</p> <p>Cost score: 3</p>		<p>Desludging of tanks</p> <p>Cost score: 3</p>	<p>Cost to operate desludging services, and treatment & disposal locations</p> <p>Cost score: 4</p>
	Capital costs (relative indication)	<ul style="list-style-type: none"> Low (but variable) capital costs depending on materials for super structure Pour flush slabs and raisers available from HSS for purchase: \$100 squat slab with water seal; \$500 raised seat with water seal <p>Cost score: 1</p>		<ul style="list-style-type: none"> Plastic tanks cheaper, and easier to move and install than concrete, if access can be gained. Concrete requires ability to transport concrete rings for tank or construct onsite. <p>Cost score: basic septic: 2.5</p>			<p>Potential expansion of sludge treatment capabilities</p> <p>Cost score: 4</p>
Regulatory considerations	<p>Same as for all sanitation</p> <ul style="list-style-type: none"> Superstructure: building regulations Limitations on building on steep slopes 	<ul style="list-style-type: none"> HCC: septic tanks regulated by HCC 					

Social considerations	<ul style="list-style-type: none"> • Shared private septic (multiple households) tanks will require cooperation on operation and maintenance • more desirable than dry-based sanitation • Community mobilisation requirements: sanitation promotion at settlement scale • Need separate male and female toilet houses, with discrete entrance doors, for public toilet and possibly for private shared toilets 	
Service standards (consumer perspective)	FSM safety	• Typically low due to ineffective treatment of pathogens by septic tanks, poor maintenance of tanks and unsafe FS disposal.
	Affordability	• Capital and O&M costs potentially too high for many settlement consumers
	Accessibility	<ul style="list-style-type: none"> • Can be good if close to, or inside house and not difficult physical terrain to access at night and by children and people with disability • Design of user interface will need to consider people with disability and children (e.g. squatting difficult for many – raised seat preferred,
	SDG Sanitation ladder position	• Probably only “basic” sanitation achieved (due to pathogenic load of effluent)
Health/wellbeing considerations	<ul style="list-style-type: none"> • Some health gains from reduction of immediate contact with human waste/pathogens. But possible spread of pathogens via effluent. • Health - (reduced spread of pathogens) gains only if all in settlement use safe sanitation (→ settlement-scale mobilisation required) • In-house facilities offer BEST wellbeing outcomes for all (e.g. privacy and safety for women) • Health significantly improved if handwashing facilities available (and HWWS promoted) • No mosquito breeding compared with dry sanitation 	
Other	<ul style="list-style-type: none"> • Requires water use (not suited to households carting water unless an alternative source is available at the house) • Significant investment by consumer so better suited to settlements planned for formalisation 	

SEPTIC SYSTEM

(TILLEY ET AL., 2014)



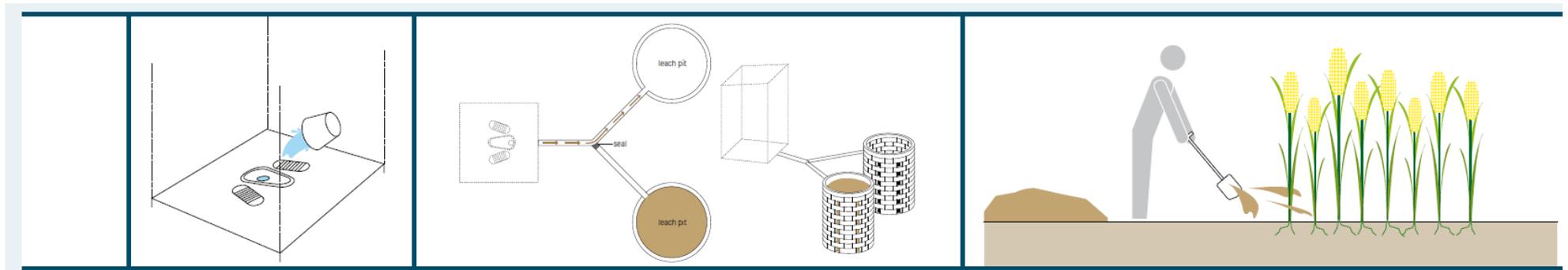
POUR FLUSH LATRINES

Name of service delivery model		POUR FLUSH LATRINES				
Service Delivery Chain		Access (site of use)	User interface (CAPTURE of waste)	Waste storage	Treatment & disposal technology	Further transport, treatment or disposal
Technical aspects	Technology	<p>Access via</p> <ul style="list-style-type: none"> public toilets; shared private household toilets; or individual household toilets (can be inside) <p>Superstructure (housing) can be built with local materials</p> <ul style="list-style-type: none"> Drainage from handwashing facility required (e.g. garden bed) 	<ul style="list-style-type: none"> sitting or squatting slab with pour flush design including a water-seal (accessible by PWD, children – may need multiple options) concrete/plastic slab for hygiene <p>Also required:</p> <ul style="list-style-type: none"> handwashing with soap facility (need water access) bins for menstrual hygiene management and infant faeces management 	<ul style="list-style-type: none"> twin pits used alternately (each one ideally for 12-24 months) pits not sealed but walls sometimes lined (e.g. concrete rings, large drums without tops/bottoms) often dug manually, but machine-dug may be necessary (soil type, ability) (and is preferable) <p>Life of each pit – dependent upon number users and depth of pit. Large twin pit system can last decades, with occasional emptying of humus. Ideally store for 12-24 months in pit to destroy pathogens before removing humus.</p>	<ul style="list-style-type: none"> in pit: seepage of liquids for 'treatment' by natural ground processes; double-pit: decomposition from faecal sludge to humus; single pit little faecal sludge treatment disposal: when pit is full either covered and new pit dug (or for double pit, second pit used), or pit is emptied for offsite disposal (not safe for onsite disposal) <p>Double Pit option Longer life than single and more effective treatment (formation of humus from faecal sludge)</p>	<ul style="list-style-type: none"> some pits may be emptied for disposal and treatment offsite (or onsite semi-centralised treatment site) Manual excavation of humus. Excavation of humus from twin pit is easier than faecal sludge. Potential for use of stored faecal material or humus as soil conditioner
	Environmental and physical considerations	<ul style="list-style-type: none"> physical accessibility during night – prefer location in/adjacent to house for safety need access to a water supply suitable for handwashing and cleaning and toilet flushing (not necessarily potable) 	<ul style="list-style-type: none"> protection from flooding maybe required (draining and lip around slab) 	<p>Not suited to:</p> <ul style="list-style-type: none"> rocky ground that can't be dug shallow groundwater (especially if accessed for human use nearby). ~ 30 metres from water access point (more for bore-pumps) flood-prone areas (pits may overflow with waste during floods) <p>Higher risk of groundwater contamination due to more leachate than with waterless systems</p>	<ul style="list-style-type: none"> On-site treatment & disposal not suited to shallow groundwater (especially if accessed for human use nearby) Small land area required 	<ul style="list-style-type: none"> location to dispose or use excavated humus
	Key operational tasks	<ul style="list-style-type: none"> Easy (not technical) use required by consumer (system is fairly resilient to mis-use) Clogging is frequent when bulky cleansing materials are used Must use bucket/container of water to flush and maintain water seal Promotion of sanitation use generally is required (see service providers – community mobilisation) 				

	Key maintenance tasks	Maintain: <ul style="list-style-type: none"> Hygienic facilities (at least daily cleaning depending on level of use, maybe several times per day) Supplies: anal cleansing materials handwashing facility bins promotional materials (notices etc) Super structure (building/housing maintenance) 	<ul style="list-style-type: none"> Repairs to toilet interface (cracks etc) and functional lid 	<ul style="list-style-type: none"> Minimal maintained of pipes if exposed No maintenance of pit if pit prepared well alternate toilet riser between pits (2-yearly) 	Safe management of humus if not in pit for 24 months		
Actors and their potential roles	Service providers	As for VIPs: <ul style="list-style-type: none"> Sanitation promotion is required – city-wide (or country-wide urban) communication materials need to be developed; can be implemented by HCC, NGOs and SW1 Construction of superstructure (optional) 	<ul style="list-style-type: none"> Potential sale of risers, slabs, concrete rings etc individually or as a kit (HCC sells some low-cost options) Possible on-site construction/manufacture of slab, riser, rings etc for difficult to access locations (take moulds and concrete-making materials). Construction could be undertaken by community members with training (possible role for SW – HCC also has capacity for this) and support for plumbing Recommend local distributor nearby with delivery (for accessible locations) 		<ul style="list-style-type: none"> NA 		
	Consumer roles	<ul style="list-style-type: none"> Public toilets: pay-per-use Construction of superstructure (optional) 			Shift to second pit Arrange pit emptying		
Costs	O&M costs	Minimal (mostly local materials can be used for super structure) Cost score: 1	Minimal costs to repair Cost of water Cost score: 2	Minimal Cost score: 1		Cost score: 1	
	Capital costs (relative indication)	<ul style="list-style-type: none"> Low (but variable) capital costs depending on materials and pit depth Pour flush slabs and raisers available from HSS for purchase: \$100 squat slab with water seal; \$500 raised seat with water seal Cost score: 1 					
Regulatory considerations	Same as for all sanitation <ul style="list-style-type: none"> Superstructure: building regulations Limitations on building on steep slopes 	<ul style="list-style-type: none"> HCC: encourage pour-flush. Land owner permission not required 					
Social considerations	<ul style="list-style-type: none"> more desirable than dry-based sanitation Community mobilisation requirements: sanitation promotion at settlement scale Need separate male and female toilet houses, with discrete entrance doors, for public toilet and possibly for private shared toilets 						

Service standards (consumer perspective)	FSM safety	<ul style="list-style-type: none"> • Double pit should allow for adequate treatment of waste inside the pit, before humus is emptied. If humus is used in correct locations (away from water sources, flooding) then FSM is acceptable • Flies (and odours) are significantly reduced (compared to dry sanitation)
	Affordability	<ul style="list-style-type: none"> • Low cost (similar to VIP)
	Accessibility	<ul style="list-style-type: none"> • Can be good if close to, or inside house and not difficult physical terrain to access at night and by children and people with disability • Design of user interface will need to consider people with disability and children (e.g. squatting difficult for many – raised seat preferred,
	SDG Sanitation service level	<ul style="list-style-type: none"> • Safely managed (highest) and shared (depending on FSM)
Health/wellbeing considerations	<ul style="list-style-type: none"> • No mosquito breeding compared with dry sanitation • Health (reduced spread of pathogens) gains only if all in settlement use safe sanitation (→ settlement-scale mobilisation required) • In-house facilities offer BEST wellbeing outcomes for all (e.g. privacy and safety for women) • Health significantly improved if handwashing facilities available (and HWWS promoted) 	
Other	<ul style="list-style-type: none"> • Some water use (not suited to households carting water unless an alternative source is available at the house) • May also suit settlements not (yet or not ever) planned for formalisation (where residents may eventually be required to move). 	

POUR FLUSH – TWIN PIT SYSTEM (TILLEY ET AL., 2014)



VENTILATED IMPROVED PIT (VIP) LATRINES

Name of service delivery model		VIP (VENTILATED IMPROVED PIT) LATRINES (and FOSSA ALTERNA variation)				
Service Delivery Chain		Access (site of use)	User interface (CAPTURE of waste)	Waste storage	Treatment & disposal technology	Further transport, treatment or disposal
Technical aspects	Technology	<p>Access via</p> <ul style="list-style-type: none"> public toilets; shared private household toilets; or individual household toilets <ul style="list-style-type: none"> Superstructure (housing) can be built with local materials <ul style="list-style-type: none"> Superstructure must be fairly dark when not in use (to encourage flies to leave) <ul style="list-style-type: none"> Drainage from handwashing facility required (e.g. garden bed) 	<ul style="list-style-type: none"> sitting or squatting riser (accessible by PWD, children – may need multiple options) MUST have a functional lid concrete/plastic slab for hygiene ventilation pipe with screen FOSSA ALTERNA variation requires addition of soil, leaves and ash etc (worms, soft carbon) <p>Also required:</p> <ul style="list-style-type: none"> handwashing with soap facility (need water access) bins for menstrual hygiene management and infant faeces management 	<ul style="list-style-type: none"> single or double pit, not sealed but walls sometimes lined (e.g. concrete rings, large drums without tops/bottoms) often dug manually, but machine-dug may be necessary (soil type, ability) (and is preferable) Life of each pit – dependent upon number users and depth of pit FOSSA ALTERNA: max depth 1.5m (to support aerobic treatment) 	<ul style="list-style-type: none"> in pit: seepage of liquids for ‘treatment’ by natural ground processes; double-pit: decomposition from faecal sludge to humus; single pit little faecal sludge treatment disposal: when pit is full either covered and new pit dug (or for double pit, second pit used), or pit is emptied for offsite disposal (not safe for onsite disposal) <p>Double Pit option Longer life than single VIP (indefinite if maintained properly) and more effective treatment (formation of humus from faecal sludge)</p> <p>FOSSA ALTERNA: the added carbon-rich bulking material speeds the degradation process → content is ready for excavation and use much faster than in a Double VIP</p>	<ul style="list-style-type: none"> some pits may be emptied for disposal and treatment offsite (or onsite semi-centralised treatment site) pit emptying: <ul style="list-style-type: none"> small sludge pump-out carts/trucks (after adding water to create slurry) manual emptying not recommended (health and unlikely safe disposal) Excavation of humus from double pit is easier than faecal sludge (from single pit) Potential for use of stored faecal material or humus as soil conditioner FOSSA ALTERNA: empty pit after 12-24 months for safe humus (similar to compost)

Environmental and physical considerations	<ul style="list-style-type: none"> physical accessibility during night – prefer location in/adjacent to house for safety need access to a water supply suitable for handwashing and cleaning 	<ul style="list-style-type: none"> protection from minor flooding maybe required (draining and lip around slab) 	VIP Not suited to: <ul style="list-style-type: none"> rocky ground that can't be dug shallow groundwater (especially if accessed for human use nearby). ~ 30 metres from water access point (more for bore-pumps) – but is better than water-based sanitation for these areas flood-prone areas (pits may overflow with waste during floods) FOSSA ALTERNA can be built above ground (possibly also VIP) 	On-site treatment & disposal not suited to <ul style="list-style-type: none"> shallow groundwater (especially if accessed for human use nearby) Small land area required	<ul style="list-style-type: none"> pit emptying machinery requires access to pit disposal location required
Key operational tasks	Easy (not technical) use required by consumer (system is fairly resilient to mis-use) Toilet lid must be closed when not being used FOSSA ALTERNA can only tolerate small volumes of water (urine good though) and requires consistent addition of soil, ash, leaves Promotion of sanitation use generally is required (see service providers – community mobilisation)				
Key maintenance tasks	Maintain: <ul style="list-style-type: none"> Hygienic facilities (at least daily cleaning depending on level of use, maybe several times per day) Supplies: anal cleansing materials handwashing facility bins promotional materials (notices etc) Super structure (building/housing maintenance) 	<ul style="list-style-type: none"> Repairs to toilet interface (cracks etc) and functional lid Maintain fly screen and ventilation pipe 	None if pit prepared well	<ul style="list-style-type: none"> Covering: seal so no access by humans/animals, and protect from flooding/excessive water penetration OR Arrange for emptying 	<ul style="list-style-type: none"> Maintain emptying machinery

Actors and their potential roles	Service providers	Sanitation promotion is required – city-wide (or country-wide urban) communication materials need to be developed; can be implemented by HCC, NGOs and SW1	<ul style="list-style-type: none"> Potential sale of risers, slabs, pipes with screens, concrete rings etc individually or as a kit (HCC sells some low-cost options) Possible on-site construction/manufacture of slab, riser, rings etc for difficult to access locations (take moulds and concrete-making materials). Construction could be undertaken by community members with training (possible role for SW – HCC also has capacity for this) Recommend local distributor nearby with delivery (for accessible locations) 	<ul style="list-style-type: none"> NA 	<ul style="list-style-type: none"> Pit-emptying service provider (new business required? Or extension to septage truck business) Disposal site service
	Consumer roles	<ul style="list-style-type: none"> Public toilets: pay-per-use Can construct super structure 		Sealing of full pits, shift to second pit, OR Arrange pit emptying	
Costs	O&M costs	Minimal (mostly local materials can be used for super structure)	Minimal costs to repair		<ul style="list-style-type: none"> Machinery Excavation of pits can be costly
	Capital costs (relative indication)	Low (but variable) capital costs depending on materials and pit depth Cost score: 1			<ul style="list-style-type: none"> Pit-emptying cart/truck suited to drier humus/faecal sludge (compared with septic sludge) (only a few small trucks required for Honiara) <p>Cost score: 3</p>
	Regulatory considerations	<ul style="list-style-type: none"> Superstructure: building regulations Limitations on building on steep slopes 	<ul style="list-style-type: none"> HCC: Ordinary pit and Ventilated Improved Pit latrines (with pipe) are not allowed in the city boundary as they can give out odour nuisance when not properly constructed. Land owner permission not required 		<ul style="list-style-type: none"> Truck and waste service licensing Waste disposal regulations
	Social considerations	<ul style="list-style-type: none"> Less desirable than water-based sanitation – if water access is improved, this may be even more difficult Community mobilisation requirements: sanitation promotion at settlement scale Need separate male and female toilet houses, with discrete entrance doors, for public toilet and possibly for private shared toilets 			
Service standards (consumer perspective)	FSM safety	<ul style="list-style-type: none"> Single-pit with emptying → FSM risks If no pit emptying (or only second pit emptied after ‘treatment’) and used in correct locations (away from water sources, flooding) then FSM is acceptable Significant reduction in pathogens from double-pit model compared with single-pit model Flies (and odours) are significantly reduced (compared to non-ventilated pits) and further reduced by FOSSA ALTERNA model 			
	Affordability	Low cost (though higher than unimproved pit)			
	Accessibility	<ul style="list-style-type: none"> Can be good if close to house and not difficult physical terrain to access at night and by children and people with disability Design of user interface will need to consider people with disability and children (e.g. squatting difficult for many – raised seat preferred) 			
	SDG Sanitation service level	<ul style="list-style-type: none"> Safely managed (highest) and shared (depending on FSM) 			

Health/wellbeing considerations	<ul style="list-style-type: none"> • Mosquito breeding can be a problem • Health (reduced spread of pathogens) gains only if all in settlement use safe sanitation (→ settlement-scale mobilisation required) • Well-constructed facilities offer privacy and safety for women • Health significantly improved if handwashing facilities available (and HWWS promoted)
Other	<ul style="list-style-type: none"> • Very low water use (suited to households carting water) • May also suit settlements not (yet or not ever) planned for formalisation (where residents may eventually be required to move).

COMPOSTING TOILETS

Name of service delivery model		COMPOSTING TOILETS (HOUSEHOLD / SHARED HOUSEHOLD/ PUBLIC) (FOSSA ALTERNA alternative also possible – see VIP variation)				
Service Delivery Chain		Access (site of use)	User interface (CAPTURE of waste)	Waste storage	Treatment & disposal technology	Further transport, treatment or disposal
Technical aspects	Technology	<p>Access via</p> <ul style="list-style-type: none"> public toilets shared private household toilets; or individual household toilets <ul style="list-style-type: none"> Superstructure (housing) can be built with local materials <ul style="list-style-type: none"> Superstructure must be fairly dark when not in use (to encourage flies to leave) <ul style="list-style-type: none"> Superstructure usually needs to be above ground (unless on a slope) therefore requires stairs / ramp with rails etc <ul style="list-style-type: none"> Drainage/seepage area for handwashing waste, septage leakage – (e.g. Banana Circle, planted bed around facility) 	<ul style="list-style-type: none"> riser (accessible by PWD, children – MUST have a functional lid. Cleanable surface preferred (wooden ok if painted) (design important – sufficient height above piling waste) recommended: urine diversion riser or separate urine facility concrete/plastic/cleanable floor surface for hygiene container of Bulking agent: readily available woody, high carbon, material with a high surface area to volume ratio: e.g. sawdust; coconut husk fibre. with scoop <p>Also required:</p> <ul style="list-style-type: none"> handwashing with soap facility (need water access) bins for menstrual hygiene management and infant faeces management (containing plastic) 	<p>Batch-processing models:</p> <ul style="list-style-type: none"> single chamber with large bins that are rotated (e.g. wheelie-bins) and optional storage area (so need only one bin) (better for >6 people than double chamber) double-chamber design: ~1m³ each, usually bricks, sloping earthen floor, lined with sticks for aeration) – good for 4-6 people Life of each chamber – dependent upon number users and depth of pit. Ideal to plan for 12 months use (to enable timely rotation and treatment) <p>Continuous processing model:</p> <ul style="list-style-type: none"> Single long chamber with access point at base <p>Ventilation pipe from bottom of chamber to outside (screened)</p> <ul style="list-style-type: none"> If urine diversion in place: urine catching containers (small, carryable) 	<ul style="list-style-type: none"> Usually On-site treatment and disposal Need access to chambers to remove compost (or bins) 2 years in the Pacific to eliminate all pathogens (including worms) <p>Batch</p> <ul style="list-style-type: none"> Best and safest: compost is left inside the chamber 6-12 months after inputs have ceased, then the compost placed into a shallow pit and covered with earth for another year before use <p>Continuous</p> <ul style="list-style-type: none"> Design to allow for waste to be in chamber for 1 year before reach access point (incremental movement through chamber) Access of treated humus via hatch 	<ul style="list-style-type: none"> If desired, compost (partially or fully treated) can be transport for use / sale elsewhere

Environmental and physical considerations	<ul style="list-style-type: none"> • Larger size facility than VIP – more space required • physical accessibility during night – prefer location in/adjacent to house for safety • need access to a water supply suitable for handwashing and cleaning 	<ul style="list-style-type: none"> • local supply of bulking agent e.g. coconut husk fibres (has proven difficult to secure in some Pacific islands) 	<p>Is suited to:</p> <ul style="list-style-type: none"> • rocky ground that can't be dug • shallow groundwater (especially if accessed for human use nearby) • slight flood-prone areas (depending upon design) <p>Double-chamber: slightly sloping ground best (can be manmade slope)</p> <p>Continuous removal system – larger area and slope helpful</p> <p>Seepage management space – e.g. Banana circle</p>	<ul style="list-style-type: none"> • Sufficient and safe area to store/use compost (away from water sources) • Not too dry 	
Key operational tasks	<p>Correct use of bulking agent by user is required (not too much, not too little)</p> <p>Toilet lid must be closed when not being used</p> <p>Promotion of sanitation use generally is required (see service providers – community mobilisation)</p>				
Key maintenance tasks	<ul style="list-style-type: none"> • Hygienic facilities (at least daily cleaning depending on level of use, maybe several times per day) • handwashing facility • bins • promotional materials (notices etc) • Super structure (building/housing maintenance) 	<ul style="list-style-type: none"> • Maintain user materials: anal cleansing materials and bulking agent (and scoop) • Repairs to toilet interface (cracks etc) and functional lid 	<ul style="list-style-type: none"> • Maintain aeration inside chamber (design important, addition of sticks/vents etc), but some turning may be required • Partially treated compost if removed, must be stored safely from animals and humans 		

Actors and their potential roles	Service providers	<p>AS FOR VIP:</p> <ul style="list-style-type: none"> For Public toilet block: pay-per-use service. several possible service delivery models; including: <ul style="list-style-type: none"> Owned and managed by utility Owned by utility and leased to operator (as for HCC public toilet in Honiara near library) Don't recommend community-operated public toilets (private operator – who could be community member ok) <ul style="list-style-type: none"> Constructed and owned and operated by community (unlikely to be successful) Sanitation promotion is required – city-wide (or country-wide urban) communication materials need to be developed; can be implemented by HCC, NGOs and SW1 Construction of superstructure (optional) 	<ul style="list-style-type: none"> Whole system can be home built with local supplies (pipe, concrete blocks etc) Or commercially available: whole systems, or parts of systems. Existing commercial operator in Honiara: SOLBRIDGE <p>Possible Roles for SW (in addition to construction/owning/leasing public facilities):</p> <ul style="list-style-type: none"> Technical support and awareness to users (direct or via NGOs and HCC) 	<ul style="list-style-type: none"> Optional service provider to purchase settlement compost for resale
	Consumer roles	<ul style="list-style-type: none"> Public toilets: pay-per-use gathering of bulking agent Construction of superstructure (optional) 	<ul style="list-style-type: none"> Home systems require maintenance by consumer 	If want to on-sell, make compost available to third-parties
Costs	O&M costs	<ul style="list-style-type: none"> Minimal (mostly local materials can be used for super structure) 	<ul style="list-style-type: none"> Low – purchase of bulking agent of can't be sourced locally 	<ul style="list-style-type: none"> Some commercial composting systems require electricity Manage leachate (garden bed)

	Capital costs (relative indication)	Super structure cost Dependent upon model of composting system – more than VIP Cost score: 1-3	Batch processing model: cheaper to construct than Continuous process systems. Can have very long-life span (continuous): <ul style="list-style-type: none"> SOLBRIDGE (local supplier/manufacturer): Prices TBA Clivus Multrum Units (14 p capacity): \$25k SBD – no install or delivery (from Aus); requires electricity Clivus Multrum Units (5 p capacity): \$20k SBD – no install or delivery (from Aus); requires electricity small container-integrated system: small family: \$6k SBD Cost score (best for systems shared between 2-3 houses): 4	NA
	Regulatory considerations	<ul style="list-style-type: none"> Superstructure: building regulations Limitations on building on steep slopes 	<ul style="list-style-type: none"> HCC: not clear yet – they don't allow other waterless sanitation (VIP, and basic pits) and seem to prefer water-based sanitation. General composting is promoted. Waste disposal regulations applicable to private shared and/or public facilities? Reasonably significant financial investment required for insecure and tenure → better suited to settlements with planned settlement formalisation process underway (MLHS list classification) 	
	Social considerations	<ul style="list-style-type: none"> Community mobilisation on re-use of compost required (As for VIP): Less desirable than water-based sanitation – if water access is improved, this may be even more difficult Community mobilisation requirements: sanitation promotion at settlement scale Need separate male and female toilet houses, with discrete entrance doors, for public toilet and possibly for private shared toilets 		
Service standards (consumer)	FSM safety	<ul style="list-style-type: none"> If composting technique is correct, FSM is safe 		
	Affordability	HH toilets: high cost Shared private: medium cost		
	Accessibility	<ul style="list-style-type: none"> Can be good if close to house and not difficult physical terrain to access at night and by children and people with disability Design of user interface will need to consider people with disability and children (e.g. squatting difficult for many – raised seat preferred, 		
	SDG Sanitation ladder position	<ul style="list-style-type: none"> Safely managed (highest) and shared 		
	Health/wellbeing considerations	<ul style="list-style-type: none"> Health (reduced spread of pathogens) gains only if all in settlement use safe sanitation (→ settlement-scale mobilisation required) Well-constructed facilities offer privacy and safety for women Health significantly improved if handwashing facilities available (and HWWS promoted) 		
	Other	<ul style="list-style-type: none"> generally, continuous systems are more complex than batch systems (may use fans and heaters), and higher cost, but provide a greater capacity relative to space requirements, and are more suitable for inclusion into houses, whereas the batch systems are often used in stand-alone 'out-house' toilet buildings urine diversion recommended to reduce leachate (groundwater contamination) minimise odours, especially from home-built systems examples in Honiara: <ul style="list-style-type: none"> SOLBRIDGE – locations to be determined Pay-per-use Public toilet facility near bridge (confirm is composting, or may be communal septic) Finance support for purchase of composting systems likely to be required – microfinancing or subsidy (such as by donor programs underway) FOSSA ALTERNA – is essentially a composting toilet using a dug pit. Rotation is achieved by using two pits. Pit is left for 12 months (after 12 months of use) then manually dug out. Cheaper and lower technology option. Harder to dig out than concrete chambers. 		

WHEELY BIN BATCH COMPOST (Leney, 2017)

)DOUBLE CHAMBER – CONCRETE BLOCKS (Leney, 2017).

SOLBRIDGE (local manufacturer)

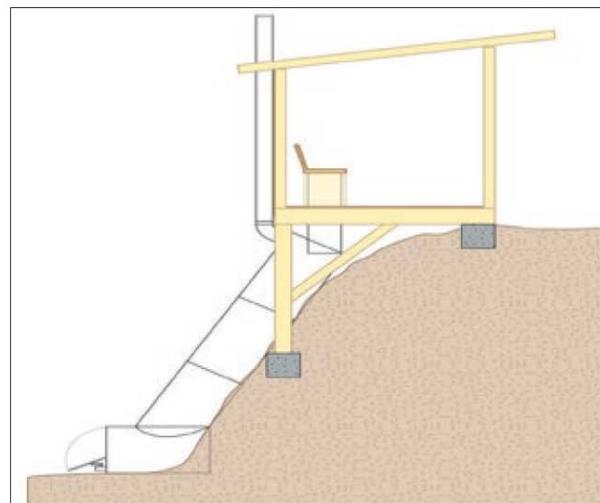
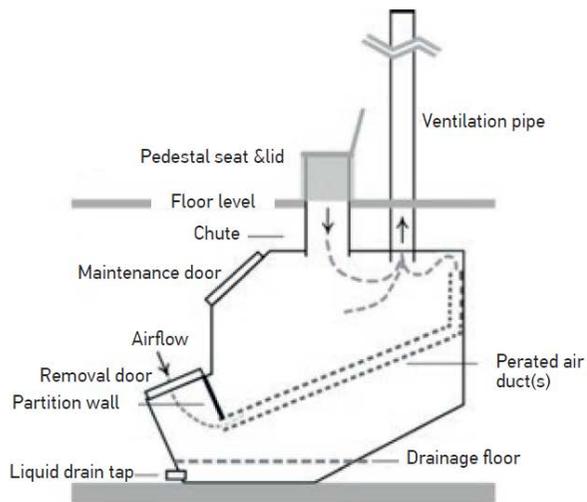
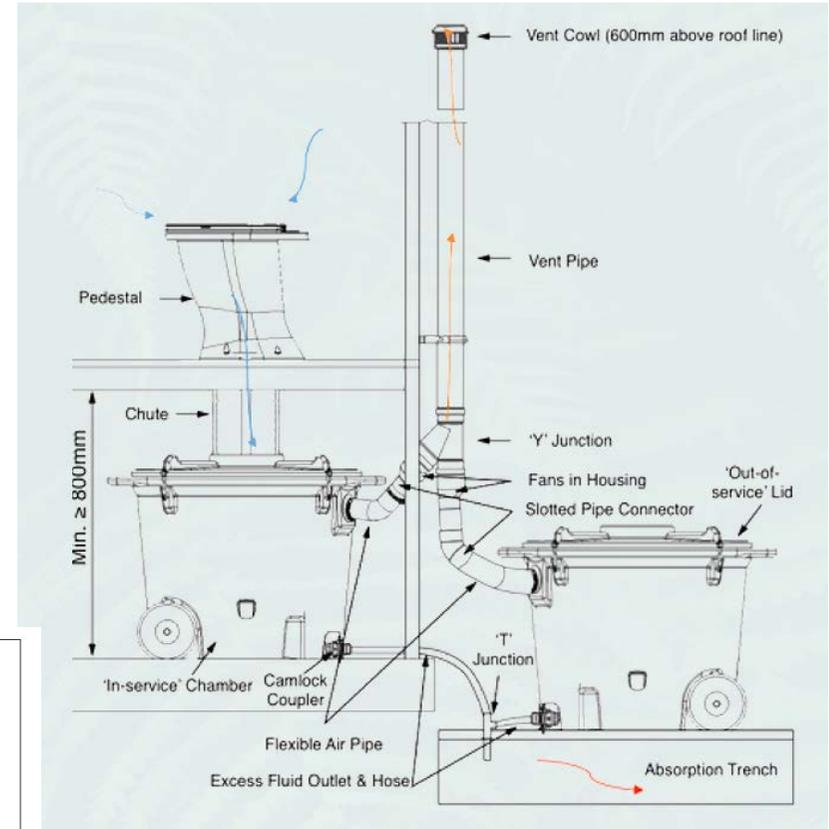
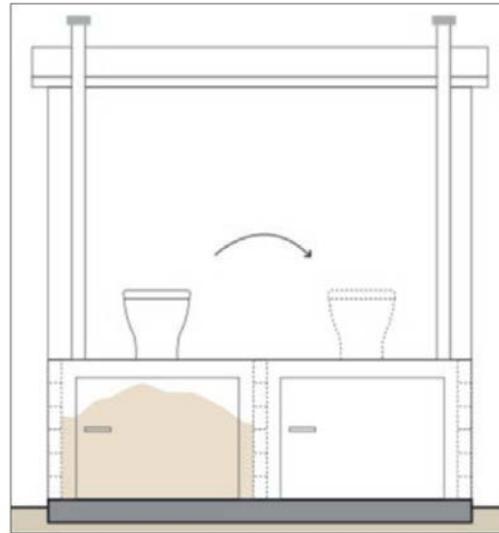
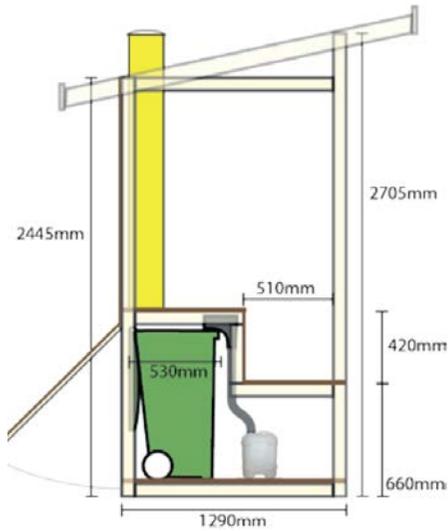


Figure 5: commercial Continuous composting type, Clivis Multrum

Figure 6: Schematic of a simple home-built continuous composting type of toilet

Biogas system

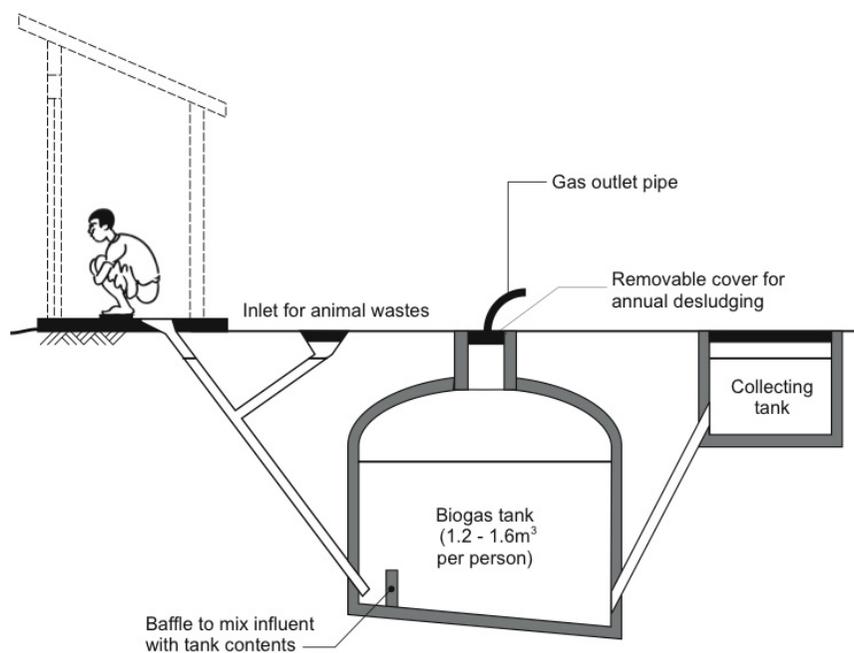
Name of service delivery model		BIOGAS SYSTEM (HOUSEHOLD / SHARED HOUSEHOLD / PUBLIC)				
Service Delivery Chain		Access (site of use)	User interface (CAPTURE of waste)	Waste storage & treatment	Treatment & disposal technology	Further transport, treatment or disposal
Technical aspects	Technology	<p>Access via</p> <ul style="list-style-type: none"> public toilets shared private household toilets (minimal advantage to individual household toilets since treatment system is shared) individual household toilets (linked to a common biogas reactor, or household scale reactor) <p>Note: one biogas system could support all options simultaneously)</p> <ul style="list-style-type: none"> Superstructure (housing) can be built with local materials Drainage/seepage area for handwashing waste, (e.g. Banana Circle, planted bed around facility) 	<ul style="list-style-type: none"> Pour-flush or vacuum flush (or Urine diversion if urine to be used in gardens) Vacuum toilets use suction for the removal of waste resulting in a minimal requirement of water (0.5 to 1.5 litres) Pour-flush with water seal – require accessible water and bucket <p>Allowable inputs: Urine, Faeces, Flush-water, Anal Cleansing Water, Dry Cleansing Materials, Organics (e.g., market or kitchen waste) and, if available, animal waste</p> <p>As for all toilets: Also required:</p> <ul style="list-style-type: none"> handwashing with soap facility (need water access) bins for menstrual hygiene management and infant faeces management (containing plastic) 	<ul style="list-style-type: none"> Pipe from multiple toilets to Biogas digester additional access point for organic materials brick-constructed domes or prefabricated tanks, installed above or below ground Capacity: 1,000 L for a single family up to 100,000 L for institutional or public toilet) 	<ul style="list-style-type: none"> onsite treatment and production of biogas (mix of methane, carbon dioxide and other trace gases) hydraulic retention time (HRT) in the reactor should be at least 15 days in hot climates digestate (partially treated) is continuously discharged and needs to be manually removed and required further treatment Biogas that is produced needs to be used (to prevent build-up in reactor – will push out untreated sludge) 	<p>Transport of digestate offsite may be required for dense urban areas where sludge cannot be safely stored year around)</p> <p>Biogas use:</p> <ul style="list-style-type: none"> Biogas can be burned for cooking, lighting or electricity generation – but most efficient is for cooking. best used locally to avoid transport (loss, and hazardous). Maintenance of gas lines (higher water vapour content) conventional gas appliances need to be modified when they are used for biogas combustion

Environmental and physical considerations	<ul style="list-style-type: none"> Minimal and flexible need access to a water supply suitable for handwashing and cleaning 	<ul style="list-style-type: none"> Access to water for flushing 	<p>Is suited to:</p> <ul style="list-style-type: none"> shallow groundwater (especially if accessed for human use nearby) slight flood-prone areas (depending upon design) Moderate land area required: most of the structure can be built underground (including under roads), but space needed to store partially-treated sludge requires significant inputs of high organic materials (e.g. animal manure, green garden waste, organic market or household waste) to produce biogas. Many settlements have piggeries or chicken houses – excellent source of organic waste. Limited gas production below 15°C 	
Key operational tasks	<ul style="list-style-type: none"> Bulky materials can clog (user education required) care should be taken not to overload the system with either too many solids or too much liquid (e.g., Greywater should not be added into the Biogas Reactor as it substantially reduces the hydraulic retention time). Promotion of sanitation use generally is required (see service providers – community mobilisation) Is fairly resistance to shock loading 			
Key maintenance tasks	<p>As for all other toilet types</p> <ul style="list-style-type: none"> Hygienic facilities (at least daily cleaning depending on level for use, maybe several times per day) handwashing facility bins promotional materials (notices etc) Super structure (building/housing maintenance) 	<ul style="list-style-type: none"> Maintain user materials: anal cleansing materials Repairs to toilet interface (cracks etc) and functional lid Vacuum system if used requires regular maintenance 	<ul style="list-style-type: none"> Once bioreactor has become properly established, maintenance is minimal (check gas pipes, general maintenance). No desludging but removal of inappropriate materials may be required (stones etc) Digestate must be managed (stored safely at all times) 	

Actors and their potential roles	Service providers	<p>AS FOR VIP:</p> <ul style="list-style-type: none"> For Public toilet block: Sanitation promotion is required – city-wide (or country-wide urban) communication materials need to be developed; can be implemented by HCC, NGOs and SW1 Construction of superstructure (optional) 	<ul style="list-style-type: none"> LOCAL MANUFACTURER: SOLBRIDGE YWAM: youth trained to maintain (and construct?) – may offer maintenance service, training open to youth (and possibly others) <p>Occasional maintenance/technical support could be provided by above providers, or others</p> <p>Possible Roles for SW (in addition to construction/owning/leasing public facilities):</p> <ul style="list-style-type: none"> Technical support and awareness to users (direct or via NGOs and HCC) 		
	Consumer roles	<ul style="list-style-type: none"> Public toilets: pay-per-use Construction of superstructure (optional) 	<ul style="list-style-type: none"> Home systems require maintenance by consumer including management of digestate 	<ul style="list-style-type: none"> Consumers required to use biogas (it must be used) 	
Costs	O&M costs	<ul style="list-style-type: none"> Minimal (mostly local materials can be used for super structure) <p>Cost score: 1</p>	<ul style="list-style-type: none"> Low (except for vacuum flush systems) <p>Cost score (no vacuum): 1</p>	<ul style="list-style-type: none"> Biogas production can reduce local electricity costs (no electricity required unless using vacuum flush) <p>Cost score: 2</p>	<p>Cost score: 1</p>
	Capital costs (relative indication – 1 = low cost)	<p>Super structure of latrine low cost</p> <p>Cost score: 1</p>	<p>Requires expert design and skilled construction (vacuum flush adds significantly to capital cost)</p> <p>Cost score: 3</p>		<p>Purchase/Modification/replacement of gas-burning appliances</p> <p>Cost score: 2</p>
Regulatory considerations	<p>Same as for other toilets</p> <ul style="list-style-type: none"> Superstructure: building regulations Limitations on building on steep slopes 	<ul style="list-style-type: none"> Waste disposal regulations 			
Social considerations	<ul style="list-style-type: none"> Community mobilisation on use of biogas Supports water-based sanitation so more acceptable than dry-based sanitation (As for VIP): Community mobilisation requirements: sanitation promotion at settlement scale Need separate male and female toilet houses, with discrete entrance doors, for public toilet and possibly for private shared toilets 				
Service standards (consumer)	FSM safety	<ul style="list-style-type: none"> Incomplete pathogen removal, the digestate requires further treatment and safe management 			
	Affordability	<ul style="list-style-type: none"> Low (once installed) 			
	Accessibility	<ul style="list-style-type: none"> Toilets can be inside houses – good accessibility possible Design of user interface will need to consider people with disability and children (e.g. squatting difficult for many – raised seat preferred, 			
	SDG Sanitation ladder position	<ul style="list-style-type: none"> Safely managed (highest) and shared 			

Health/wellbeing considerations	<ul style="list-style-type: none"> • Can support inhouse toilets – BEST for wellbeing • Health (reduced spread of pathogens) gains only if all in settlement use safe sanitation (→ settlement-scale mobilisation required) • Well-constructed facilities offer privacy and safety for women • Health significantly improved if handwashing facilities available (and HWWS promoted)
Other	<ul style="list-style-type: none"> • Generation of renewable energy • Conservation of nutrients • Long service life • Biogas production not high unless significant inputs of high organic materials (e.g. animal manure, organic market or household waste) <p>Local example: Burns Creek Youth With A Mission (YWAM) Local provider: SOLBRIDGE</p>

BIOGAS SYSTEM (BASIC) (SSWMINFO)



Guidance note: City-Wide Sanitation Plans

(prepared IWC, 2019)

A city-wide sanitation plan is.....

- A plan for which sanitation services will be promoted and available in different parts of a city, which organisations will be involved in promoting/providing those services, the targets and plans to achieve these sanitation services.
- Usually includes a **map identifying different sanitation needs and services** to be available in different locations.
- ➔ This ensures there are no areas that a suitable and feasible sanitation option AND allows for sanitation options to suit the local situation (not one sanitation option for a whole city)

Benefits of city-wide sanitation plans

- Develop sanitation in all parts of the city (city-wide), prioritizing poor residential areas where the health risks are highest.
- Employ appropriate technologies that are suitable to user needs, while ensuring that they are relevant to the city's actual conditions, comply with technical standards, and prevent potential impacts.
- Enhance synergy among the actors in sanitation development, including municipal government agencies, the private sector, NGOs, and others.
- Foster better use of existing sanitation services, which becomes the basis for developing new services.
- Create opportunities and incentives for private sector initiatives in the development and operation of sanitation services.
- Adopt step-wise sanitation development as available resources allow.
- Increase funding from sources other than municipal government, such as from the national and provincial governments, donor agencies, the private sector and the public.

A **citywide sanitation strategy** includes the vision, missions, and goals of sanitation development as well as strategies to meet these goals.

Often a citywide sanitation plan will include plans for:

- Latrines and faecal waste
- Domestic wastewater
- Drainage
- Solid waste management.

5 key steps (which may take 6-12 months, or more):

- Establish sanitation working group – multiagency & other sanitation actors and stakeholders (legitimacy from political leaders)
- Sanitation mapping (describe the sanitation status across different parts of the city and develop general recommendations for sanitation improvement initiatives)
- Develop 'sanitation development framework' (vision, mission, goals and strategic policies)
- Develop strategies with specific targets and programs, projects for:
 - sanitation services (sanitation targets and services for different areas, developed through bottom-up and top-down planning approaches)
 - non-technical aspects (community awareness and participation; policy and regulation; institutional capacity; private sector engagement; NGO engagement; financing and tariffs; monitoring and evaluation).

Note: the PROCESS of developing the plan is more important than the plan itself – this is when cooperation is established, champions emerge and action can follow.

It may take iterations of plans to progressively improve sanitation.

