SCOTLAND ISLAND
WATER AND WASTEWATER FEASIBILITY STUDY
STAGE 1b OPTIONS REPORT
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1 EXECUTIVE SUMMARY

Scotland Island is one of the largest villages in greater Sydney without a reticulated potable water supply or wastewater service. Scotland Island Residents’ Association (SIRA) has been lobbying the NSW State Government for improved water and sewerage services for over 30 years, and the issue has been raised in Parliament several times in a period from 2000 to 2010. Recently SIRA have engaged with Sydney Water to investigate servicing Scotland Island under the Priority Sewerage Program. There have been several studies undertaken, including an option assessment in 1997.

Scotland Island is located in the southern end of Pittwater, north of Sydney. Scotland Island has 377 lots and sits well within urban Sydney. The island is within close proximity to urban areas, being approximately 2.5km north of Mona Vale. Lot sizes are typical of urbanised areas. Figure 1-1 displays the regional context and proximity to urbanised areas which are serviced by reticulated water and wastewater systems. Scotland Island is less than 390m from Church Point, mainland Sydney, which is serviced by both reticulated water and sewerage systems.

Figure 1-1– Scotland Island – close proximity to urban Sydney

The 2016 Australian Bureau of Statistics (ABS) census recorded that 358 of the 377 lots have been developed with residential dwellings, with Scotland Island having a permanent population of 579 people. A proportion of the dwellings are holiday homes, resulting in the population on the Island increasing to approximately 1000 people during holiday periods.
2019 Feasibility study
To identify a pathway for provision of acceptable water supply and sewerage services on Scotland Island, the State Government’s Stronger Communities Fund has funded a feasibility study. This report is Stage 1b of a three-stage process:

- Stage 1a - identification of environmental and social factors associated with water infrastructure servicing (Completed March 2019);
- Stage 1b - review of previous reports and identification of servicing options, shortlisting two in each category, and
- Stage 2 is the commercial assessment and identification of the pathway to delivering services on Scotland Island.

The objective of this Stage 1b report is to identify and assess options for water and sewerage servicing of Scotland Island, and shortlist two options for the next stage of the project which is the commercial viability assessment. This report supplements the Environmental and Social report that was developed and submitted to Council in March 2019.

Existing Water Infrastructure Systems
The existing water supply consists of household rainwater tanks and an emergency pipeline, originally intended for firefighting purposes and emergency drinking water.

This current arrangement carries risk to public health. The water supply is non-potable, provided to residents without monitoring and used after being stored within rainwater tanks. As a result, there is potentially low to zero levels of disinfection. The filling process provides avenues for contamination of the supply though physical contact, exposure to soil (potentially containing septic runoff) and as a result of having no compliant backflow protection.

Wastewater systems consist of on-site management systems that are generally unsuitable for the topography and geology of the island. Scotland Island is steep-sided bedrock with shallow soils of sandy loam (highly permeable) with sandy clay loam subsoils (highly impermeable). Evidence of overflow of septic systems was observed during the site inspection and audit conducted as part of this investigation. Septic odours and high numbers of mosquitos were also observed, supporting anecdotal reports of these issues.

Water Balance
From the Water Balance analysis, the following design criteria has been used to establish the scheme’s inputs which in turn helped to establish the options for assessment.

<table>
<thead>
<tr>
<th>Table 1-1 Preliminary water balance assessment for Scotland Island</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td>Number of Lots</td>
</tr>
<tr>
<td>Ultimate Holiday Population</td>
</tr>
<tr>
<td>TOTAL Water</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Peak Sewage Daily Total</td>
</tr>
</tbody>
</table>

The only option for further development on Scotland Island is redevelopment of existing lots. This takes the form of knock-down-rebuilds or upgrading existing holiday house. Redevelopment has been
occurring for several years, however the Island’s population has seen a decrease since the 2011 Census suggesting development has been focussed on improvements to accommodation and not an increase in capacity. The size of housing is somewhat restricted by a requirement to maintain 80 percent of the property as landscaped area. Associated with an increase in the size and value of dwellings has been an expectation to have upgraded facilities such as dishwashers.

This report identifies the potential options for the Sewerage Collection System, Effluent Disposal, and Water Supply, assesses the options and shortlists two options in each category for commercial analysis in Stage 2.

The potential options for servicing Scotland Island identified in this report are:

**Table 1-2: Potential Services Options**

<table>
<thead>
<tr>
<th><strong>A. SEWAGE COLLECTION SYSTEMS</strong></th>
<th>Required for B. Sewage Treatment / Disposal options not utilising on-property disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1 Gravity Sewer</td>
<td></td>
</tr>
<tr>
<td>A.2 Pressure Sewer</td>
<td></td>
</tr>
<tr>
<td>A.3 Vacuum System</td>
<td></td>
</tr>
<tr>
<td>A.4 Hybrid System</td>
<td></td>
</tr>
<tr>
<td>A.5 Variable Grade Sewer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B. SEWAGE TREATMENT / DISPOSAL</strong></td>
<td></td>
</tr>
<tr>
<td>B.1 Do Nothing</td>
<td></td>
</tr>
<tr>
<td>B.2 Upgrade of existing Domestic Systems (Managed System)</td>
<td></td>
</tr>
<tr>
<td>B.3 On Site Grey Water Reuse using existing Septic Tank, with on-site reduced disposal</td>
<td></td>
</tr>
<tr>
<td>B.4 Tanker Truck Disposal from each lot</td>
<td></td>
</tr>
<tr>
<td>B.5 Tanker Truck disposal from common collection storage tank</td>
<td></td>
</tr>
<tr>
<td>B.6 * Upgrade existing on lot systems with disposal redirected to Pittwater;</td>
<td></td>
</tr>
<tr>
<td>B.7 * Septic Tank Pump Out System discharging to on Island Treatment with Pittwater Disposal</td>
<td></td>
</tr>
<tr>
<td>B.8 * Septic Tank Pump Out System discharging to Sydney Water</td>
<td></td>
</tr>
<tr>
<td>B.9 * Installation of a sewer collection system discharging to a treatment system on Scotland Island, with disposal to Pittwater</td>
<td></td>
</tr>
<tr>
<td>B.10 * Installation of a sewer collection system discharging to a treatment system on Scotland Island, with dry weather disposal to Sydney Water, wet weather disposal to Pittwater</td>
<td></td>
</tr>
<tr>
<td>B.11 * Collect Sewage and Pump to Sydney Water sewerage system</td>
<td></td>
</tr>
<tr>
<td>B.12 Non-potable Reuse</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>C. WATER SUPPLY</strong></td>
<td></td>
</tr>
<tr>
<td>C.1 Disconnect existing non potable supply</td>
<td></td>
</tr>
<tr>
<td>C.2 Do Nothing</td>
<td></td>
</tr>
<tr>
<td>C.3 Upgrade of rainwater storage tanks and water usage management</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Sewage Disposal Strategy requiring an A. Common Sewage Collection system option to be constructed
### Assessment of Options
Option assessment was undertaken by a multi-disciplined team including Water Infrastructure Strategic Planners, water services engineers, and Environmental Consultants, with input as required from Cost Planners and Construction Managers. With additional contributions from Northern Beaches Council and the Scotland Island Community, and peer review by Institute of Sustainable Futures.

The options were technically evaluated using a multi-criteria assessment matrix. The assessment categories included Environmental Performance, Community Acceptance, Stakeholder Acceptance, Technical Risk and Work Health and Safety. Each category was weighted for performance, with sensitivity analysis for alternate weighting profiles.

### Shortlisted Options
The options shortlisted from the selection process for detailed costing and commercial funding modelling analysis are:

**Sewage Collection System options**
- A.2 Pressure Sewerage System
- A.4 Hybrid System, combination of gravity and pressure sewerage systems

**Sewage Treatment and Disposal options**
- B.9 Installation of a sewerage collection system discharging to a treatment system on Scotland Island, with disposal to Pittwater
- B.11 Collect Sewage to central pumping station and pump to Sydney Water sewerage system at Church point

**Water Supply options**
- C.4 Replace Small Bore Supply and provide a low flow drinking water point within the residence and provide a low flow top up to rainwater tanks
- C.6 Direct mains pressure supply from Sydney Water mains / pressure boost if required

### Pathway to provision of services
The historical barriers to providing water and sewerage services have been commercial, with budget costing analysis showing negative return on investment. Scotland Islands has steep rocky topography and unsealed carriageways with informal road boundaries that add significant costs to construction, exacerbated by the remoteness of the Island requiring materials and labour to be transported by boat.

There have been cost estimates produced in previous studies, undertaken by Sydney Water and other stakeholders, but the costing and planning has been at a high level only. The key success factor for implementation of Water and Sewerage Infrastructure to Scotland Island is to develop a detailed cost
plan and delivery strategy to provide certainty for the project delivery. With a robust delivery plan and cost structure a funding model can be developed with consultation between Sydney Water, NSW Government, Constructors and service providers, and the Scotland Island community.

Summary of indicative costings
Preliminary capital cost estimates were prepared to assist in assessment of options. All costs including operation and maintenance will be refined and developed further in the next Stage 2 of the feasibility assessment.

Table 1-3: Indicative Capital Cost

<table>
<thead>
<tr>
<th>System</th>
<th>Option/Item *</th>
<th>Indicative cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>Project management</td>
<td>6,240,000</td>
</tr>
<tr>
<td>Project</td>
<td>Preliminaries and site establishment</td>
<td>12,137,034</td>
</tr>
<tr>
<td>Water</td>
<td>C4: Low flow from Sydney Water</td>
<td>16,029,637</td>
</tr>
<tr>
<td></td>
<td>C6: Full reticulated system from Sydney Water</td>
<td>16,730,267</td>
</tr>
<tr>
<td>Wastewater collection and delivery</td>
<td>A2: Pressure system</td>
<td>28,504,189</td>
</tr>
<tr>
<td></td>
<td>A4: Hybrid system</td>
<td>31,265,520</td>
</tr>
<tr>
<td>Wastewater treatment and disposal</td>
<td>B9: On-island treatment system</td>
<td>30,153,240</td>
</tr>
<tr>
<td></td>
<td>B11: Discharge to Sydney Water</td>
<td>7,361,263</td>
</tr>
<tr>
<td>Total cost systems combined</td>
<td>C6 + A2 + B11</td>
<td>70,972,753</td>
</tr>
<tr>
<td>Total cost per lot #</td>
<td>C6 + A2 + B11</td>
<td>188,257</td>
</tr>
<tr>
<td>Total cost systems combined</td>
<td>C6 + A2 + B9</td>
<td>93,764,730</td>
</tr>
<tr>
<td>Total cost per lot #</td>
<td>C6 + A2 + B9</td>
<td>248,713</td>
</tr>
</tbody>
</table>

* Scotland Island Lots = 377

* Water Supply options
C.4 Replace Small Bore Supply and provide a low flow drinking water point within the residence and provide a low flow top up to rainwater tanks
C.6 Direct mains pressure supply from Sydney Water mains / pressure boost if required

* Sewage Collection and Transport options
A.2 Pressure Sewerage System
A.4 Hybrid System, combination of gravity and pressure sewerage systems

* Sewage Treatment and Disposal options
B.9 Installation of a sewerage collection system discharging to a treatment system on Scotland Island, with disposal to Pittwater
B.11 Collect Sewage to central pumping station and pump to Sydney Water sewerage system at Church point
To provide certainty in the commercial delivery and operational aspects of the project a concept design is recommended to be prepared for each preferred option, and a delivery plan and construction strategy developed in conjunction with a detailed cost plan. The detailed planning is recommended to include a multidiscipline team of water services engineers, utility providers, council planners, project managers, cost planners, and contractors experienced in delivering this type of project.
2 INTRODUCTION

The State Government’s Stronger Communities Fund has funded a feasibility study for the provision of water and wastewater infrastructure to Scotland Island. Northern Beaches Council are managing the study and have commissioned Pressure System Solutions to undertake the initial scopes of work to identify options and make recommendations for water and sewerage servicing.

Scotland Island is about 55 ha and located at the southern end of the Pittwater estuary. In the 2016 Census there were 579 people living in 359 private dwellings on Scotland Island. Only 209 of those dwellings were occupied at the time of the census. Over half the population is employed. These figures are down from 715 residents in 344 dwellings in the 2011 Census, with 252 dwellings occupied at the time of the census. The proportion of permanent residents has gradually increased over time, although it has historically fluctuated.

Table 2-1: Scotland Island Population 2001 - 2016

<table>
<thead>
<tr>
<th>Census Data</th>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>579</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>715</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>642</td>
</tr>
<tr>
<td></td>
<td>2001</td>
<td>734</td>
</tr>
</tbody>
</table>

*Source: Australian Bureau of Statistics*

Figure 2-1: Scotland Island Location Plan

![Scotland Island Location Plan](image)
2.1 Existing Water and Sewage Services

Scotland Island is one of the larger villages in greater Sydney without a reticulated potable water supply or sewerage services. There are approximately 358 dwellings on Scotland Island with suburban development density.

*Figure 2-2: Scotland Island Urban Context*

Potential health risks have been identified in substandard water supply systems and from poorly performing on site disposal systems.\(^1\)\(^,\)\(^10\)

Water supply is from rainwater tanks. A small-bore pipeline was initially an emergency water supply pipeline set up for firefighting and then later used as an emergency drinking water supply. This supply is officially non-potable.

The small-bore supply pipework extends under Pittwater from a connection to Sydney Water supply at Church Point. Sydney Water ownership of the service ends at the Church Point connection. The council originally owned and maintained the service, but when council were going to disconnect the service SIRA accepted responsibility. The actual ownership of the pipeline in not clearly defined.
The reticulated non-potable water supply is not installed to AS3500, without the provision of mandatory back flow prevention devices required for protection of ingress of contaminated water into the pipeline. The small-bore service is not sufficient to fill the rainwater tanks on Scotland Island on demand, only a small number of rainwater tanks can be filled simultaneously. Residents are required to book for a fill period to fill their tanks. (SIRA)

**Photo 2-3: Small Bore Water Supply fixed to trees**

**Photo 2-4: Tank Filling from Small Bore Pipeline**

Environmental impacts from sewage surface run-off have been identified on Scotland Island \(^{(1,5)}\). The sewage disposal is on site systems with high variance in performance \(^{(11)}\). The on-site wastewater
systems on Scotland Island are generally not performing to required standards, which has contributed to water quality impacts on the Pittwater Estuary, particularly following rain events.\(^{(1,5)}\)

**Figure 2-5: Scotland Island Contiguity**

Scotland Island topography is generally not suitable for on-site sewage treatment and disposal systems\(^{(14)}\). Sewage systems with on-site disposal are best suited to level sites having deep soils with high absorption rates. Scotland Island is generally steeply sloping with shallow soils. In some locations surface rock is visible. The issue is exacerbated during rainy periods. Although the standard advice from the Office of Environment and Heritage (OEH) is to not use waterways in Sydney after wet weather, there is further anecdotal evidence of an informal agreement amongst the community not to use the waterways surrounding Scotland Island after wet weather periods due to pollution from contaminated stormwater run-off; indicating a heightened awareness of this issue on the Island. The on-site treatment systems are generally of insufficient capacity to cope with reticulated supply.

**Photo 2-6: Evidence of surcharge from poorly performing on-site disposal**
Figure 2-7: Small Lot On-Site Sewage Treatment and Rainwater Collection Risks
2.2 Lobbying Background

The Scotland Island Residents Association (SIRA) has taken an active role in lobbying for improved services to Scotland Island for over 30 years. The water and sewage servicing of Scotland Island has been the subject of discussion and various investigations for over 25 years.

A report ‘SCOTLAND ISLAND WATER AND SEWAGE OPTIONS STUDY’ was prepared by Marten and Associates in 1997 investigating the options for water and sewage servicing of Scotland Island.

The project was recorded in NSW Legislative Assembly Parliament Hansard in May 2000, March 2005, June 2007 and in March 2010. In 2000 Scotland Island Sewerage Servicing was identified as undergoing an assessment process, and in March 2005 was nominated in the Sydney Water Priority Sewerage Program Stage 2. In 2007 Hansard records state the project was expected to commence in 2010/11 and reconfirmed in 2010 to be expected to commence in 2011, subject to funding and upgrade of existing on island water supply.

In December 2012 NSW Government committed in the Northern Beaches Regional Action Plan (under NSW 2021) to better manage wastewater and upgrade wastewater treatment facilities to Scotland Island as a matter of priority. SIRA have met with NSW Government Ministers and Sydney Water on various occasions from 2014 to 2016 lobbying for action.

A Sewage Survey was undertaken in 2015 asking residents of Scotland Island if they supported a sewerage system for Scotland Island, with over 95% of the respondents voting yes.

Sydney Water recently met with SIRA to investigate servicing of Scotland Island under the Priority Sewerage Program.

Below is an overview of SIRA’s history in advocating for improved infrastructure for Scotland Island:

1997 Scotland Island Landcare Group won a grant, administered by SIRA to investigate the environmental and public health impacts of current on-site wastewater disposal on Scotland Island, and consider water and wastewater options for Scotland Island.

2001 Scotland Island announced as one of 20 villages to receive improved wastewater infrastructure as part of Stage 2 of the Priority Sewerage Program (PSP).

Jun 2005 SIRA held a workshop with key stakeholders to discuss future water and wastewater infrastructure for Scotland Island.

Mar 2010 Pittwater Council raised concerns directly with Sydney Water that Scotland Island appeared to have been removed from the program for PSP.

Apr 2010 The Hon. Rob Stokes (Member for Pittwater) raised in Parliament the question of when PSP work would begin on Scotland Island. The response was that planning would begin in 2011, subject to funding and a resolution by residents to upgrade local water infrastructure.

Jan 2011 Soon to be Premier Barry O’Farrell committed to the fast-tracking of wastewater connections to a number of PSP identified villages in Wollondilly and Hornsby Shires, and said the remaining villages including Scotland Island were a priority.
Dec 2012  NSW Government commitment in Northern Beaches Regional Action Plan (under NSW 2021) to better manage wastewater and upgrade wastewater treatment facilities to Scotland Island as a matter of priority.

Aug 2014  SIRA submission to review of Sydney Water’s Operating Licence review in support of Sydney Water retaining responsibility for delivery of the Priority Sewage Program as part of their next operating license.

Jan 2015  PR and letter campaign by SIRA and residents to Minister Humphries, IPART and EPA in response to a concern that Sydney Water was going to be released from the PSP as part of their Operating Licence conditions.

Jun 2015  Sydney Water’s new Operating Licence has no firm commitment to deliver the PSP to Scotland Island.

Aug 2015  SIRA met with The Hon. Rob Stokes, Member for Pittwater.

Nov 2015  SIRA met with The Hon. Niall Blair, Minister for Lands and Water regarding installation of wastewater infrastructure plus subsequent correspondence.

Apr 2016  SIRA met with The Hon. Rob Stokes and decentralised service providers regarding options for water and wastewater provision on Scotland Island.

2016  Draft Pittwater Waterways Review Discussion Paper notes key issues raised in stakeholder engagement were sewage runoff from Scotland Island.

Despite being listed on the State Government’s Priority Sewerage Program, there is currently no requirement on Sydney Water to service villages, and as such, the State Government has encouraged SIRA to consider alternative servicing options.

2.3  Report Objective

The objective of this report is to identify potential technical and commercial options for water and sewerage servicing of Scotland Island, and shortlist two options for commercial viability assessment.

Potential servicing options are identified, and a technical assessment process utilised to identify preferred solutions. High level cost planning is undertaken for solutions considered technically and commercially feasible.

The servicing options are to be capable of servicing all lots on Scotland Island, existing and potential ultimate loading including development on lots that are currently vacant.

A Hydraulic water consumption model was developed for Scotland Island, estimating a typical dwelling existing water usage and sewage discharge profile, and potential future usage profiles if reticulated towns water was available on Scotland Island and existing vacant lots were developed.

The hydraulic loading and servicing strategies did not assess any changes to zoning, excluding any commercial developments or high-density developments.
2.4 Feasibility Study Process Overview

The feasibility study is being prepared in stages.

**Stage 1a** of the process is a high-level review of Social and Environmental factors. (Completed)

**Stage 1b** (this report) is assessment of servicing options, including development of a Hydraulic Demand model, identification of potential water and sewerage servicing options, and an initial technical assessment, and shortlist of two options for further detailed commercial analysis. Two options are shortlisted for each water infrastructure category:

A. Sewerage Collection System  
B. Sewage Treatment and/or Disposal  
C. Water Supply

**Stage 2** is the preparation of a Commercial feasibility report examining the two short listed options from Stage 1b.

The feasibility study is being undertaken by a multi-disciplined team including Water Infrastructure Strategic Planners, water services engineers, and Environmental Consultants, with input as required from Cost Planners and Construction Managers. Northern Beaches Council provided an overview management role, including engaging UTS Institute for Sustainable Futures to undertake independent external peer review of the option identification and evaluation methodology. The Scotland Island Community was consulted and contributed at key milestones during the Stage 1b stakeholder workshops.
Figure 2-8: Feasibility Process Overview
2.5 Scope

This feasibility study is for the water supply and sewerage servicing of all the residential lots on Scotland Island. The scope of the study includes:

- Water Supply servicing from Sydney Water services on the mainland, Church Point
- Decentralised Sewage solutions
- Innovative solutions treatment and reuse and hybrid systems
- Centralised treatment and disposal system
- Pumped discharge to Sydney Water Sewerage System on the mainland

Key Areas

- Safety
- Environment
- Community / Key Stakeholder engagement
- Engineering / Technical
- Commercial / Legal / Financial
- Delivery / Operating Models

Figure 2-9: Plan of Scotland Island showing lots included in scope
2.6 Identification of Stakeholders

Key stakeholders include Northern Beaches Council, Scotland Island Residents Association, Sydney Water, NSW Department of Planning and Environment, NSW Office Environment and Heritage (including NSW National Parks and Wildlife Service), NSW Health, residents of Scotland Island, recreational users of the Pittwater waterway, and environmental and community groups associated with Pittwater and its environs.

**NORTHERN BEACHES COUNCIL**

<table>
<thead>
<tr>
<th>Business units</th>
<th>NECC and TCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Subject Matter</td>
<td>Ruby Ardren, Project Leader - Water Management</td>
</tr>
<tr>
<td>Experts</td>
<td></td>
</tr>
<tr>
<td>Executive Leadership</td>
<td>Yianni Mentis, Executive Manager - Natural Environment and Climate Change</td>
</tr>
<tr>
<td>Team</td>
<td>Todd Dickinson, Director of Environment and Sustainability</td>
</tr>
<tr>
<td>Councillors</td>
<td>Kylie Ferguson - Pittwater Ward</td>
</tr>
<tr>
<td></td>
<td>Alex McTaggart - Pittwater Ward</td>
</tr>
<tr>
<td></td>
<td>Ian White – Pittwater Ward</td>
</tr>
</tbody>
</table>

**Council and Government Stakeholders**

<table>
<thead>
<tr>
<th>Government Depts</th>
<th>The Hon. Rob Stokes, Member for Pittwater Dept Local Government</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rural Fire Service Dept Health</td>
</tr>
<tr>
<td></td>
<td>Office Environment and Heritage</td>
</tr>
<tr>
<td>Service providers</td>
<td>Northern Beaches Council</td>
</tr>
<tr>
<td>Utilities</td>
<td>Sydney Water</td>
</tr>
</tbody>
</table>

**External Stakeholders and Community**

<table>
<thead>
<tr>
<th>Local residents and property owners</th>
<th>Scotland Island</th>
<th>Tenants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local businesses</td>
<td>Operating from Scotland Island</td>
<td>Accommodation providers</td>
</tr>
<tr>
<td>Users of facility/ area</td>
<td>Island Visitors</td>
<td>Recreational Pittwater Waterway users</td>
</tr>
<tr>
<td>Community groups</td>
<td>Scotland Island Residents Association (SIRA)</td>
<td>Scotland Island Pipeline Company (SIPCO) - private consortium</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------------------------------------------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>Environment groups</td>
<td>Bushcare Groups</td>
<td></td>
</tr>
</tbody>
</table>

**Others**

- Beach Watch
- EPA
- Health Department
- Fisheries
- National Parks
3 IDENTIFICATION OF OPTIONS

3.1 Water and Sewerage Servicing options

The identification of options for water and sewerage services to Scotland Island was undertaken by a panel including Water Infrastructure Strategic Planners, water services engineers, and Environmental Consultants, with input as required installation contractors. The water and sewerage Servicing options identified include:-

### A. SEWAGE COLLECTION SYSTEMS
*Required for B. Sewage Treatment / Disposal options not utilising on-property disposal*

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1</td>
<td>Gravity Sewer</td>
</tr>
<tr>
<td>A.2</td>
<td>Pressure Sewer</td>
</tr>
<tr>
<td>A.3</td>
<td>Vacuum System</td>
</tr>
<tr>
<td>A.4</td>
<td>Hybrid System</td>
</tr>
<tr>
<td>A.5</td>
<td>Variable Grade Sewer</td>
</tr>
</tbody>
</table>

### B. SEWAGE TREATMENT / DISPOSAL

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.1</td>
<td>Do Nothing</td>
</tr>
<tr>
<td>B.2</td>
<td>Upgrade of existing Domestic Systems (Managed System)</td>
</tr>
<tr>
<td>B.3</td>
<td>On Site Grey Water Reuse using existing Septic Tank, with on-site reduced disposal</td>
</tr>
<tr>
<td>B.4</td>
<td>Tanker Truck Disposal from each lot</td>
</tr>
<tr>
<td>B.5</td>
<td>Tanker Truck disposal from common collection storage tank</td>
</tr>
<tr>
<td>B.6</td>
<td>Upgrade existing on lot systems with disposal redirected to Pittwater; *</td>
</tr>
<tr>
<td>B.7</td>
<td>Septic Tank Pump Out System discharging to on Island Treatment with Pittwater Disposal</td>
</tr>
<tr>
<td>B.8</td>
<td>Septic Tank Pump Out System discharging to Sydney Water</td>
</tr>
<tr>
<td>B.9</td>
<td>Installation of a sewer collection system discharging to a treatment system on Scotland Island, with disposal to Pittwater</td>
</tr>
<tr>
<td>B.10</td>
<td>Installation of a sewer collection system discharging to a treatment system on Scotland Island, with dry weather disposal to Sydney Water, wet weather disposal to Pittwater</td>
</tr>
<tr>
<td>B.11</td>
<td>Collect Sewage and Pump to Sydney Water sewerage system</td>
</tr>
<tr>
<td>B.12</td>
<td>Non-potable Reuse</td>
</tr>
</tbody>
</table>

* Sewage Disposal Strategy requiring an A. Common Sewage Collection system option to be constructed

### C. WATER SUPPLY

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.1</td>
<td>Disconnect existing non potable supply</td>
</tr>
<tr>
<td>C.2</td>
<td>Do Nothing</td>
</tr>
<tr>
<td>C.3</td>
<td>Upgrade of rainwater storage tanks and water usage management</td>
</tr>
<tr>
<td>C.4</td>
<td>Replace Small Bore Supply and provide a low flow drinking water point within the residence and provide a low flow top up to rainwater tanks</td>
</tr>
<tr>
<td>C.5</td>
<td>Provide supply from Sydney Water System to reservoir on Island</td>
</tr>
<tr>
<td>C.6</td>
<td>Direct mains pressure supply from Sydney Water mains / pressure boosted if required</td>
</tr>
<tr>
<td>C.7</td>
<td>Desal with new water reticulation</td>
</tr>
<tr>
<td>C.8</td>
<td>Reuse non potable</td>
</tr>
<tr>
<td>C.9</td>
<td>Reuse potable</td>
</tr>
</tbody>
</table>
3.2 Research and Investigation

The first stage of the option assessment process was identifying potential methods of providing water and sewage to Scotland Island. To ensure a comprehensive assessment no options were excluded from the initial discussion and appraisal.

Selection of the candidate options was an integrated process involving:

- Discussions with Stakeholders NBC and Community Groups
- Site inspections
- Review of Geotechnical Conditions
- Identification of new emerging technologies
- Review of Previous reports prepared in 1997
- Workshops with industry leaders in Sustainable Urban Water
- Review of previously prepared reports (SCOTLAND ISLAND WATER AND SEWAGE OPTIONS STUDY Marten and associates 1997 (1))
- Review with Northern Beaches Council
- Discussion with Scotland Island community group SIRA
- Peer Review with UTS Institute for Sustainable Futures
- Several workshops were held with the community and council during the option identification and assessment process.

Two site activities were undertaken to inform the option selection and assessment process.

1. Audit of selected properties; 21 properties were audited to determine construction and compliance issues on site to inform project scope, standard of existing services and cost planning.
2. Soil sampling was undertaking in strategic locations to confirm levels of contamination from on-site sewage treatment and disposal systems. (10)
4 OPTION ASSESSMENT METHODOLOGY

4.1 Option Assessment Methodology

The options assessment rating was undertaken in a two-part process.

The first part (Gate 1 - Technical) of the process assesses the options with a Multi-Criteria Analysis matrix. This assessment phase focuses on the technical aspects and rates the options without a cost assessment. A minimum scoring benchmark was determined and any options not reaching the benchmark were eliminated from further assessment. Options that scored a rating higher than 70 were taken forward to Gate 2 assessment. However, if there were not two options scoring 70 or higher, the two highest rating options were taken forward to gate 2.

The second part (Gate 2 – Estimated Cost) of the assessment applied an estimate cost to the remaining acceptable options. From this assessment two options were shortlisted for detailed commercial analysis and viability assessment undertaken within a separate report.

**Figure 4-1: ASSESSMENT PROCESS MODEL**

<table>
<thead>
<tr>
<th>GATE 1 EVALUATION; MINIMUM SCORE 70</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Environmental Impact</td>
<td>20</td>
</tr>
<tr>
<td>2 Community Acceptance</td>
<td>20</td>
</tr>
<tr>
<td>3 Stakeholder Acceptance</td>
<td>20</td>
</tr>
<tr>
<td>4 Technical Risk</td>
<td>20</td>
</tr>
<tr>
<td>5 Work Health and Safety</td>
<td>20</td>
</tr>
</tbody>
</table>
The assessment technical criteria were developed and weighted by collaboration with the project panel, including Water Infrastructure Planners and engineers, environmental consultants and contractors. Assessment Criteria were grouped into five categories

**Figure 4-2: Option Analysis Process**

<table>
<thead>
<tr>
<th>GATE 1 EVALUATION;</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Environmental Impact</td>
<td>20</td>
</tr>
<tr>
<td>Construction Disturbance</td>
<td></td>
</tr>
<tr>
<td>Operational Impact on Island</td>
<td></td>
</tr>
<tr>
<td>Operational Impact off Island</td>
<td></td>
</tr>
<tr>
<td>Sustainability: Water, Energy, Material, Life Cycle Performance</td>
<td></td>
</tr>
<tr>
<td><strong>2</strong> Community Acceptance</td>
<td>20</td>
</tr>
<tr>
<td>Equity: Sydney Water area of operation / Local Community</td>
<td></td>
</tr>
<tr>
<td>Cost to Community</td>
<td></td>
</tr>
<tr>
<td>Land Use Impact</td>
<td></td>
</tr>
<tr>
<td><strong>3</strong> Stakeholder Acceptance</td>
<td>20</td>
</tr>
<tr>
<td>Management complexity (Governance)</td>
<td></td>
</tr>
<tr>
<td>Regulatory / Compliance</td>
<td></td>
</tr>
<tr>
<td>Legal Risk</td>
<td></td>
</tr>
<tr>
<td><strong>4</strong> Technical Risk</td>
<td>20</td>
</tr>
<tr>
<td>Design</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td></td>
</tr>
<tr>
<td>Likelihood of failure</td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td></td>
</tr>
<tr>
<td><strong>5</strong> Work Health and Safety</td>
<td>20</td>
</tr>
<tr>
<td>Construction Risk</td>
<td></td>
</tr>
<tr>
<td>Operational Risk</td>
<td></td>
</tr>
<tr>
<td>Public Health</td>
<td></td>
</tr>
<tr>
<td>Fire Fighting</td>
<td></td>
</tr>
</tbody>
</table>

**GATE 2 EVALUATION**

| Indicative Cost NPV = Capex, Opex, IRR 7%, 30 years | Lowest 2 |

**GATE 2 - ESTIMATED COST EVALUATION**

| Lowest two options to be shortlisted |
4.2 Criteria Weighting

The initial option assessment weighting criteria placed all categories equal at 20. During the assessment process it was acknowledged the weighting may vary when appraised by different stakeholders.

Alternate weighting scenarios were evaluated to ensure the selected shortlisted options were not disproportionally biased.

The assessment team agreed on the following alternate weighting profiles for sensitivity analysis:

<table>
<thead>
<tr>
<th></th>
<th>Base</th>
<th>Increased focus on Environment and Community</th>
<th>Increase focus on Stakeholders and WHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVIRONMENTAL</td>
<td>20</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>COMMUNITY ACCEPTANCE</td>
<td>20</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>STAKEHOLDER ACCEPTANCE</td>
<td>20</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>TECHNICAL RISK</td>
<td>20</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>WORK HEALTH AND SAFETY</td>
<td>20</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

The outcomes of the sensitivity alternate weightings are provided in Attachment B. The alternate weightings did not change the highest scoring options.
5 OPTION ASSESSMENT

A workshop was undertaken with the panel to evaluate each option and apply the rating tool to identify the preferred solutions.

The full notes from the workshop are included in Attachment F, Stage 1b Option Evaluation Workshop Notes, to this report.

A summary of the evaluation for each option is provided within this section.
5.1 Sewage Collection System Options

Sewage collection systems are required for servicing options proposing central sewage treatment on Scotland Island or disposal of Island and are an integral part of the selection of the sewage treatment and disposal strategy.

**Figure 5-1: COLLECTION SYSTEM OPTION SELECTION MODEL**

![Diagram of Sewage Collection System Options]

**Table 5-1: Sewage Collection System Options**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1</td>
<td>Gravity Sewerage</td>
</tr>
<tr>
<td>A.2</td>
<td>Pressure Sewerage</td>
</tr>
<tr>
<td>A.3</td>
<td>Vacuum System</td>
</tr>
<tr>
<td>A.4</td>
<td>Hybrid System, Gravity and Pressure Sewerage</td>
</tr>
<tr>
<td>A.5</td>
<td>Variable Grade Sewerage</td>
</tr>
</tbody>
</table>
5.1.1 Option A.1: Gravity Sewerage

Description
A gravity sewerage option is the provision of traditional gravity drainage system collecting sewage from each property. The topography of Scotland Island would constrain the reticulation requiring multiple sewage pumping stations servicing many small catchments. The location of properties around the foreshore at Scotland Island would also constrain the spacing of the pump stations at water’s edge. Many pump stations would be required around Scotland Island to cater for the minimal runs before the gravity sewer became too deep below sea level adjacent to the foreshore.

The multiple sewage pumping stations will transfer to a central sewage pumping station pumping to the Sydney Water gravity sewerage at Church Point, or to the on-island treatment plant. Each lot provided with a gravity sewerage drainage connection point. Common collection pipework will be located in public areas where feasible. Gravity fall constrained lots will require creating of easements for common pipework located within private lots.

The environmental impact of gravity sewerage would be significant, requiring deep trenching in some locations, and trenching within private property.

Technology
Typical sewerage solution widely accepted as a sound servicing strategy.

Environmental Impact
Higher negative impact, deep extensive excavation, potential for infiltration and ingress of stormwater, extensive tree removal and root damage.

Community Acceptance
Community acceptance is likely to be high initially, based on an intuitive response. Then once educated on the damage that a gravity system would cause Scotland Island and the associated effect of amenity in the area, acceptance would become lower.

Stakeholder Acceptance
- High risk for any stakeholder to want to deliver, operate, maintain and manage impact
- High risk of inflow and infiltration (I&I) and overflows to the environment.

Technical Risk
- Risk is high with deep excavation, unstable soils,
- Costs could easily escalate, due to unmanageable delivery risk
- Chance of system failure is high, and
- Operation will be problematic with I&I.

Work, Health and Safety
- Construction works high risk in all aspects (e.g. procedures, property damage, environmental damage)
- Operational risk high – system will consistently be problematic, labour intensive, and require high expenditure.
- Public health risk high – overflows, odour
5.1.2 Option A.2: Pressure Sewerage

**Description**
A pressure sewerage system consists of a dedicated pressure sewage pumping unit located on each lot discharging to a common collection main. The common main discharges to a sewage pumping station for transfer to the Sydney Water sewerage on the mainland, or to on-island Treatment Plant. Common pipework is generally located in public spaces, roadways etc.

A limited amount of pipework may be required located across two or three private lots to facilitate system performance, to be resolved in detailed design.

This option was a preferred option outcome from the assessment matrix. A concept design for a pressure sewerage collection system was developed and this option was costed.

**Technology**
A proven technology, accepted and operating in Australia for over 20 years, and internationally for more than 50 years.
- Small diameter pipes, predominantly directionally drilled,
- Not constrained by pipe grades
- One sewage pumping station may be required, to boost flows across Pittwater

**Environmental Impact**
Negative impact, but less than gravity
- Most of the retrofitted sewerage reticulation could be directionally drilled,
- Sewage no longer leaching into soils and ground water – positive impact

**Community Acceptance**
Positive community acceptance anticipated:
- Provides an equitable servicing solution for Scotland Island;
- Residents will be required to supply and pay for the electricity – negative;
- Provides equity with other comparable Sydney Water customers, such as Dangar Island

**Stakeholder Acceptance**
Positive acceptance,
- Fully equitable solution;
- SWC currently have many systems of this type operating in their area of operations and previously produced a pressure sewerage system concept design for Scotland Island;
- Comparable to Dangar Island.

**Technical Risk**
Positive balance of risk,
- As before, any retrofit solution has its difficulties and complications, however
- Site investigations and audits has identified that there is nothing that has not been delivered previously, therefore risks are manageable,
- The gravity sewerage option has greater risk compared to a pressure sewerage option.

**Work, Health and Safety**
Positive balance of risk,
- Less odour,
- Less chance of overflow,
- Manageable risks
### Option A.3: Vacuum System

**Description**

A Vacuum system consists of a central collection vacuum chamber connecting to a pipework system reticulated to each property. Each property has a vacuum control valve that opens on high level in the collection well and allows the vacuum to draw the waste through the pipe to the vacuum collection chamber. Each chamber includes a sewage pumping unit discharging to a common central sewage pumping station to discharge to the Sydney Water sewerage system at Church Point or to the on-island treatment plant.

Pipework is generally located in public areas roadways etc. Because of the topography constraints on Scotland Island a very high number of systems would be required. The topographical constraints and technical challenges for vacuum collection resulted in a low score for this option in the assessment evaluation matrix.

**Technology**

A vacuum sewerage servicing strategy does not technically work with the constraints identified at Scotland Island. A vacuum sewerage system requires installation of a saw-tooth profile in the collection pipeline. A vacuum station and pumping station would be required on Scotland Island. Vacuum pots, with valves, would need to be located for property gravity sewer connection. The major difference, and failure point, of the system is that the system must be kept under constant vacuum, one valve failure and the whole system can be affected, and effects service to all connected properties.

**Environmental Impact**

Negative impact, comparable to gravity or pressure sewerage
- Likelihood is high that excavation in Pittwater will be required
- High likelihood of I&I into the system
- Deep trenches required to achieve saw-tooth profile along contours, disregarding property boundaries.
- Extensive tree removal and root damage will occur,

**Community Acceptance**

Negative acceptance, as less is known about vacuum sewerage, with the community already having a familiarity with pressure sewer from Dangar Island, therefore community perception will be cautious from the onset.

**Stakeholder Acceptance**

Negative impact,
- Too high risk for any stakeholder to want to operate, maintain and manage impact of I&I and overflows to the environment.

**Technical Risk**

Difficult to the implement with any certainty - risk is too high. Based on experience, ongoing operation will be problematic.

**Work, Health and Safety**

Extremely negative high-risk solution,
- Construction works high risk in all aspects (e.g. procedures, property damage, environmental damage)
- Operational risk high – system will consistently be problematic, labour intensive, and require high expenditure.
- Public health risk high – overflows, odour
5.1.4 Option A.4: Hybrid System

Description
A hybrid system is a combination of gravity sewerage and pressure sewerage. Gravity sewerage is provided where the topography is conducive to pipelines installed at grade, and in constrained areas lots are serviced by pressure sewerage. Refer to concept drawing.

Technology
The hybrid system in this analysis consists of a combination of gravity sewer, where feasible, and pressure sewer.

Environmental Impact
The environmental impact will be negative, between scoring higher than gravity alone, but lower than a complete pressure sewerage system.

Community Acceptance
One of the key issues associated with a hybrid system is that it does not provide and equitable service across the community, such as differing:
- connection costs depending on whether the property is serviced by gravity or pressure;
- on-property asset requirements, such as a pressure sewer unit, or direct connection;
- electricity costs supplied by the property to run the pump in a PSU;
- servicing arrangements on the property,
- I&I entry points into the system, can be monitored with a pressure sewer connection, very difficult to manage with a gravity connection.

Evaluation team deemed: Negative community acceptance anticipated.

Stakeholder Acceptance
Neutral acceptance,
- Operationally and logistically the system can be difficult
- Non equity will cause issues,
- Technical solution can be achieved

Technical Risk
Positive balance of risk.
- This system has the benefits of pressure sewerage and only utilises gravity sewerage where there are benefits. However, rated lower than pressure sewerage.
- Bigger pump stations would be required than for the full pressure sewerage system, due to I&I

Work, Health and Safety
Positive balance of risk, utilising the benefits of both gravity sewerage and pressure sewerage systems, however there is rated slightly lower than for pressure sewer, as the risks are higher.
5.1.5 Option A.5: Variable Grade Sewer

Description
Conveyance of treated sewage through collection system utilising variable grading acting under gravity and under pressure. This system is not considered a feasible solution for a wastewater collection system at Scotland Island.

Technology
Sealed gravity sewer carrier pipes, with intermediate lift stations. Unlikely to be technically feasible.

Environmental Impact
Negative impact,
- High likelihood of I&I into the system
- Trenching to provide variable grade sewer potentially more manageable than that gravity sewer
- Tree removal and root damage will occur.

Community Acceptance
Negative acceptance
- Trenching required
- Treatment plant at the bottom of the hill
- Multiple lift stations across Island,
- Odour and I&I will still be issues
- Accessibility required to across network to all lift stations

Stakeholder Acceptance
Negative acceptance,
- risk is high,
- costs could easily escalate,
- chance of system failure is high, and
- operation will be problematic.

Technical Risk
- Unlikely to be technical feasible
- Velocity in the pipes needs to be sufficient to carry solids, without them dropping out of the flow, increasing risks of blockages.

Work, Health and Safety
Negative high-risk solution,
- Construction works high risk
- Location of lift stations needs careful consideration for access and maintenance,
- Operational risk high – system will likely be problematic, labour intensive
- Public health risk high – overflows, odour
5.2 Wastewater Disposal Options

Sewage disposal options generally were in three categories,

- On site treatment and disposal
- On Island local treatment plant with disposal to Pittwater
- Off Island disposal, discharge to Sydney Water System
- Plus some combinations of the above solutions

Figure 5-2: SEWAGE DISPOSAL OPTION SELECTION MODEL
Table 5-2: Summary of Sewage Disposal Options

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.1</td>
<td>Do Nothing</td>
</tr>
<tr>
<td>B.2</td>
<td>Upgrade of existing Domestic Systems</td>
</tr>
<tr>
<td>B.3</td>
<td>On Site Grey Water Reuse using existing Septic Tank, with on-site reduced disposal</td>
</tr>
<tr>
<td>B.4</td>
<td>Tanker Truck Disposal from each lot</td>
</tr>
<tr>
<td>B.5</td>
<td>Tanker Truck disposal from common collection storage tank</td>
</tr>
<tr>
<td>B.6</td>
<td>Upgrade existing on lot systems with disposal redirected to Pittwater</td>
</tr>
<tr>
<td>B.7</td>
<td>Septic Tank Pump Out System discharging to on Island Treatment with Pittwater Disposal</td>
</tr>
<tr>
<td>B.8</td>
<td>Septic Tank Pump Out System discharging to Sydney Water</td>
</tr>
<tr>
<td>B.9</td>
<td>Installation of a sewerage collection system discharging to a treatment system on Scotland Island, with disposal to Pittwater</td>
</tr>
<tr>
<td>B.10</td>
<td>Installation of a sewerage collection system discharging to a treatment system on Scotland Island, with dry weather disposal to Sydney Water, wet weather disposal to Pittwater</td>
</tr>
<tr>
<td>B.11</td>
<td>Collect Sewage and Pump to Sydney Water sewerage system</td>
</tr>
<tr>
<td>B.12</td>
<td>Non-potable Reuse</td>
</tr>
<tr>
<td>B.13</td>
<td>Potable Reuse</td>
</tr>
</tbody>
</table>
5.2.1 Option B.1: Do Nothing

Description
The Do Nothing option is to leave the existing on-site disposal systems operating without any changes or upgrades. The existing water treatment and disposal systems are currently servicing Scotland Island without measured severe negative impact on the residents. There is anecdotal evidence of odours and minor health events attributed to the poorly performing systems, and a visual and negative impact on the surrounding waters.

However, investigations have shown the poor performing systems are surcharging, and discharging contaminants into the environment and waterways. Soil testing undertaken in Feb 2019 indicated high levels of Faecal Coliforms in the soil in several locations.[10] There is sufficient evidence of high health risk from the poorly performing on-site systems to confirm the ‘do nothing’ option is not acceptable, and scored low in the assessment matrix rating tool.

Environmental Impact
Negative,
- The majority of on-site systems are non-compliant to minimum standards and are causing environmental damage, ground water contamination and public health concerns.[1,10]

Community Acceptance
Negative,
- The majority (>95%) of residents want upgrade of sewerage services.
- If enforcement occurred to get each lot up to code and compliance, the lots would become uninhabitable – which is not an option – as Scotland Island was historically declared as having developable lots.

Stakeholder Acceptance
Negative,
- Stakeholders recognise that Scotland Island water and sewerage services require resolution

Technical Risk
Negative,
- Technically, it is impossible to make the ‘Do Nothing’ option plausible even with enforcement,
- Not technically possible to get on-site systems to meet Australian Standards compliance, primarily due to lot size and slope, and soil conditions.

Work, Health and Safety
Negative and high risk for public health on Scotland Island.
5.2.2 Option B.2: Upgrade of Existing On-Site System

**Description**
This option is the upgrade the underperforming onsite systems, supported by an operating strategy with ownership and management plan. Upgrade of the existing on-site treatment systems may include:
- Improvement of existing septic tanks to aerated sewage treatment systems
- Enlargement of septic tanks
- Sand Filter or Media Filter post treatment
- Extending existing absorption trench systems and transpiration beds
- Constructed mound systems to increase absorption / transpiration capacities
- Removal of all effluent by collection system for centralised disposal

The upgrade of the existing treatment systems through provision of larger septic tanks, and higher performing aerated systems, will improve primary treatment of the sewage, but will only provide marginal improvement on the overall performance of the on-site disposal systems. Implementation of these improved primary treatment devices however do not reduce the hydraulic load on the on-site disposal.

**Assumptions**
- Effluent disposal strategy is in place.
- Common body to make the system work

**Environmental Impact**
Negative impact,
- Sustainability of the option a concern – centrally managed system is required for there to be potential for improvement.
- Construction disturbance on property will be high, removing existing system, installing with a larger replacement system.
- Soil does not have capacity for effluent disposal volumes

**Community Acceptance**
Negative acceptance,
- If there is not enough land area on the property to irrigate, then system must be pumped-out.
- Solids require regular removal.

**Stakeholder Acceptance**
Negative acceptance,
- Compliance cannot be achieved
- Implications on environment and health,
- Servicing strategy for Scotland Island would lead to equity issues with other customers

**Technical Risk**
Negative impact / high risk,
- Likelihood of ongoing failure is high,
- Option may not even be technically achievable for some properties, insufficient land space
  - Clear distinction required for who owns the asset, and maintains the asset,

**Work, Health and Safety**
Negative impact / high risk,
- Despite implementation of a managed system and effluent disposal strategy, water logged ground will still exist; Effect on public health still a risk factor
5.2.3 Option B.3: On-Site Grey Water Reuse reusing existing Septic Tank

Description
This option focuses on reducing the volume of treated sewage site disposal by treating grey water for reuse as a non-potable supply. Grey water is the discharge from showers, basins, laundries and possibly kitchen sinks. Treatment of grey water is less complex than treating blackwater and has a less stringent approval process. This option is constrained by the limitations in grey water reuse volume, and complicated by the requirement to retrofit/diversion of drainage on most properties, and the retrofit of a second non-potable water supply. Many properties already have some form of water recycling.

The opportunities offered with this technology is not envisaged to significantly reduce the impact of the on-site treatment, with only a portion of the sewage removed from the requirement for site soil / transpiration disposal.

Environmental Impact
Negative impact, non-compliance unless approved grey water treatment is installed

Community Acceptance
Negative impact,
- More for the community to maintain

Stakeholder Acceptance
Negative impact,
- Does not achieve much improvement to the current situation

Technical Risk
Negative impact,
- Requires separate plumbing on the property,
- Quality of grey water at high risk

Work, Health and Safety
Negative impact,
- Does not improve on the current situation,
- Grey water reuse quality risk is high
5.2.4 Option B.4: Tanker Truck Disposal from each lot

**Description**
This option utilises the existing primary treatment system on each lot, with a storage tank being provided for collection of the treated sewage for pump out by a tanker. This eliminates disposal of sewage into the environment.

There are several obstacles to providing an effective tanker collection system to each property on Scotland Island. The roads are low standard, with only minimal sealed carriageways. There are only a small number of vehicles on Scotland Island utilised by tradesman and for firefighting. The roads are not considered suitable for heavy sewage pump out vehicle constant use. Transporting the trucks to Scotland Island by barge is weather dependant, and a conservative estimate is up to 20 truck movements per work day on Scotland Island. There would be high risk to pedestrians within a community with minimal car usage and family orientated outdoor activities.

**Environmental Impact**
Negative impact,
- Ongoing operational impact extremely high
- Upgrade to most Island roads would be required to transport tanker trucks
- Calculated that 20 tanker trucks per day would be required to service the 370 properties
  - High disturbance on Scotland Island
  - Low sustainability measure

**Community Acceptance**
Negative impact,
- Amenity on Scotland Island would be greatly affected,
- Holding tank may be required
- Costs for ongoing disposal
- Costs and implications of ordering a tanker truck for emergency pump-out,
- Odour

**Stakeholder Acceptance**
Negative impact,
- Not a sustainable ongoing strategy
- Disposal / discharge arrangement for 20 tanker trucks per day
- Council required to upgrade road network on Island to accommodate 20 tanker trucks per day.
- Public health and environment – ongoing concerns
- Not equitable

**Technical Risk**
Negative impact,
- Not a sustainable option for an Island

**Work, Health and Safety**
Negative impact, vehicle movement, odour, servicing difficulty in wet weather
5.2.5 Option B.5: Tanker Truck Disposal from common collection storage tank

Description
This option is the provision of a sewage system collecting the treated sewage from each property discharging to a common collection storage tank, or several tanks, for removal by tanker, possibly by a water barge. It may be necessary to upgrade some roads to provide suitable truck access if collection by a water borne vessel is not feasible. Collection will be at regular intervals carried of site to an approved Sydney Water dump point.

However, this option has the cost of an on-Island collection system plus the cost of removal by tanker. The only saving is the cost of the underbore below Pittwater for direct discharge to the Sydney Water sewerage system. The option of the underbore is more cost effective, and this option scored low in the assessment matrix rating tool.

Environmental Impact
Neutral impact,
- Reduces the risk of illegal discharges into the Pittwater
- Takes sewage off the property, reducing seepage into groundwater
- There will be issues with odour around the common collection tank on the foreshore

Community Acceptance
Negative acceptance,
- Takes sewage off the property, shifts responsibility
- There will be issues with odour around the common collection tank on the foreshore
  - Location of tank would be on the western foreshore, where the ferry’s land at Church Point
- Not equitable

Stakeholder Acceptance
Negative acceptance,
- Sydney Water may be resistant to 2 day old, highly septic, sewage being discharged into Sydney Water’s network.

Technical Risk
Neutral risk,
- Technical assessment would be required to determine a suitable location in the Sydney Water network to discharge the septic sewage
  - Required flow rate
  - Capacity within network
  - Adequate dilution
  - Odour

Work, Health and Safety
Neutral risk
5.2.6 Option B.6: Upgrade existing on Lot Systems with disposal redirected to Pittwater

Description
The intent of this option is to provide an economical modification to the on-site disposal systems and eliminate the problems with on-site disposal by direct discharge to Pittwater. The sewage will be collected in a piped system utilising the existing Island topography, generally following the existing surface stormwater paths and easements, and directing the sewage directly to the surrounding waters. In practice the sewage is currently discharged into Pittwater indirectly through ground water. However, the quality of the existing flow is improved through further treatment in the soil, so to improve the quality of the direct discharge the existing active on-site pre-treatment devices will be upgraded.

However, there are already problems identified with the quality of the surround waters during and following rain events. This option does not have high Environmental performance and would not be favoured by the community, and therefore scored low in the assessment matrix rating tool.

Environmental Impact
Negative impact,
- Scotland Island is already absorbing effluent
- Reduces the on-property works risks

Community Acceptance
Negative acceptance,
- Already a perception of pollution, disposing from the septic into Pittwater will add to this concern
- Kids playing in the creeks and along the waterways

Stakeholder Acceptance
Negative acceptance,
- This option cannot meet ANZECC (1992) guidelines
- NSW Public Health would have major concerns

Technical Risk
Negative impact / high risk
- This option cannot meet ANZECC (1992) guidelines
- NSW Public Health would have major concerns
- Increased monitoring would be required

Work, Health and Safety
Negative impact / high risk
- Concentration of risk
- Inground treatment is not adequate
5.2.7 Option B.7: Septic Tank Pump Out System discharging to on Island Treatment with Pittwater Disposal

**Description**
This option takes advantage of the existing sewage pre-treatment facilities on each lot, but instead on on-site disposal, the primary treated sewage is collected and discharged to a central treatment plant, treated, and disposed to Pittwater. The central sewage treatment plant would be designed for final polishing and sanitisation before disposal. The intent is the partial treatment in the on-site treatment devices would reduce the size of the on-Island treatment plant.

**Environmental Impact**
Neutral balance of impact,
- Site required for treatment plant
- Reduces the risk of illegal discharges into the Pittwater
- Takes sewage off the property, reducing seepage into groundwater, and therefore vegetation deterioration.

**Community Acceptance**
Negative acceptance anticipated,
- The inclusion of a treatment plant into this option, improves the acceptance from the previous option 6 (discharge to Pittwater)
- Not all septic tanks would suitable for the STEP system
  - Many will need upgrading to larger tanks

**Stakeholder Acceptance**
Negative acceptance,
- Responsibility, ownership and operation of a satellite plant and system

**Technical Risk**
Negative impact / very high risk
- Unknown number of sewage treatment systems requiring upgrade or replacement
- Implications on the treatment plant will be high as the septic tank will have left all the elements that are hardest to treat in the system e.g. nitrogen
  - Likely will need to add carbons back into the wastewater

**Work, Health and Safety**
Negative impact / high risk,
- Water tightness (extent of external water entering or exiting the system, such as I&I) of the independent property systems will now become a component of the entire system as this needs to be contemplated in the sizing and design of the treatment plant.
- Operational risk associated with a satellite plant.
5.2.8 Option B.8: Septic Tank Pump Out System discharging to Sydney Water

**Description**
Septic Tank Pump Out System discharging to Sydney Water

**Environmental Impact**
Slightly positive impact,

- Better than previous option 7 (pump out to treatment plant) from an environmental perspective.
- However, there’s not positive reason to keep the septic tank as part of the solutions for this option, as Sydney Water will treat the wastewater regardless of treatment in septic.

**Community Acceptance**
Slightly positive acceptance,

- Removal off property and removal off Island into Sydney Water’s network.

**Stakeholder Acceptance**
Slightly positive acceptance,

- Sydney Water would prefer non-treated wastewater into their network, rather than wastewater higher in nitrogens and more difficult to treat.
- Difficult utility ownership model is assets on private property not replaced; I.e. non-performing assets dedicated to utility is a high unacceptable risk structure

**Technical Risk**
Negative impact / high risk,

- Collection system required to transport septic effluent to a sewage pumping station
  - Various property connection configurations and arrangements required to collect waste.
- Underbore required across Pittwater
- Pump sewage across Pittwater for discharge into Sydney Water system
- Effluent pumps required at each property (different type of pumps but same principle as pressure sewerage system)
- Same construction works as pressure sewerage system

**Work, Health and Safety**
Negative impact / high risk,

- Construction risk and potential cost escalations associated with on-property works
- Residual risks from utilising onsite septics,
5.2.9 Option B.9: Installation of a sewerage collection system discharging to a treatment system on Scotland Island, with disposal to Pittwater

Description
Provision of a Sewage treatment Plant located on the Island, treating sewage to a tertiary level, suitable quality for discharge to Pittwater

Assumption: Pressure sewerage system was evaluated as the collection system for this option.

Environmental Impact
Slightly positive impact,
- Consent for disposing of effluent into Pittwater is the question associated with option
- Brooklyn, Dangar Island and Hawkesbury River systems discharge effluent into these waterways, however, and are not good examples of precedence for their disposal is into waterways better flushed than Pittwater.

Community Acceptance
Neutral acceptance,
- Community perception regarding treatment then discharge into Pittwater

Stakeholder Acceptance
Neutral acceptance,
- Council will no longer be looking after the septic tanks
- Effluent disposal consent is the key issue

Technical Risk
Slightly positive impact,
- Sewage will be easier to treat than the effluent from the septic tanks

Work, Health and Safety
Positive impact
- Removal of on-site treatment and disposal will eliminate the risk from contamination of soils, and waterways during wet weather events
5.2.10 Option B.10: Installation of a sewerage collection system discharging to a treatment system on Scotland Island, with dry weather disposal to Sydney Water, wet weather disposal to Pittwater

**Description**
The EPA would rather discharge treated effluent into waterways, than untreated wastewater with wet weather component.

- EPA review of nutrients into the Hawkesbury River

This option was removed from the evaluation process, due to the assumption at the beginning of the workshop that Sydney Water has adequate capacity in their network for servicing of Scotland Island.
5.2.11 Option B.11: Collect Sewage and Pump to Sydney Water sewerage system

**Description**
Collection of sewage and pump to Sydney Water Sewerage System at Church Point.

**Environmental Impact**
Positive impact,
- Most of the retrofitted sewerage reticulation could be directionally drilled,
- Sewage no longer leaching into soils and ground water – positive impact

**Community Acceptance**
Positive acceptance,
- Equity of service, reliability, health benefits comparative to customers on mainland Sydney
- Comparable to Dangar Island

**Stakeholder Acceptance**
Positive acceptance,
- Risk is transferred to the organisation best placed to manage the risks.
- Fully equitable solution;
- Comparable to Dangar Island, which was implemented and now operated by SWC;
- At some point, the viability measure needs to be determined,
  - Environment
  - Public health
  - System capacity

**Technical Risk**
Positive balance of risk,
- Any retrofit solution has its difficulties and complications, however
- Site investigations and audits has identified that there is nothing that has not been done before, therefore risks are manageable,
- Sewage pumping station may be required,
- Underbore across Pittwater

**Work, Health and Safety**
Positive balance of risk,
- Less odour,
- Less chance of overflow,
5.2.12 Option B.12: Non-potable Reuse

**Description**
Soil absorption capabilities and irrigation opportunities are limited on Scotland Island, and no other users on the Island have been identified that may be interested in non-potable reuse water. A typical customer for non-potable reuse water in other servicing areas is a Golf Course for irrigation purposes.

**Environmental Impact**
Slightly negative impact

**Community Acceptance**
Anticipated positive acceptance

**Stakeholder Acceptance**
Negative due to risk and commercial viability,

**Technical Risk**
Negative impact; Approved non potable water quality is technically difficult to achieve

**Work, Health and Safety**
Negative impact; Risk of technical failure and low quality non potable water
5.2.13 Option B.13: Potable Reuse

Description
REFER TO WATER SUPPLY OPTION C.9
5.3 Water Supply

Potential servicing options were identified during the first stage of the assessment process. To ensure a thorough analysis of available technologies a broad selection of options were included for assessment, even though some options were considered unlikely to be selected. Inclusion of the less favoured options facilitated the evaluation process by providing a comparative benchmark performance base. (E.g., The options ‘Disconnect Existing Small-Bore Supply’ and ‘Do Nothing’ options were included in the assessment evaluation to baseline performance).

Figure 5-3: WATER SUPPLY OPTION SELECTION MODEL

![Diagram of Water Supply Option Selection Model]
<table>
<thead>
<tr>
<th></th>
<th>Water supply options</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.1</td>
<td>Disconnect existing non-potable supply</td>
</tr>
<tr>
<td>C.2</td>
<td>Do Nothing</td>
</tr>
<tr>
<td>C.3</td>
<td>Upgrade of rainwater storage tanks and water usage management</td>
</tr>
<tr>
<td>C.4</td>
<td>Replace Small Bore Supply for drinking water with top up to rainwater tanks</td>
</tr>
<tr>
<td>C.5</td>
<td>Provide supply from Sydney Water System to reservoir on Island</td>
</tr>
<tr>
<td>C.6</td>
<td>Direct mains pressure supply from Sydney Water mains / pressure boosted if required</td>
</tr>
<tr>
<td>C.7</td>
<td>Desal with new water reticulation</td>
</tr>
<tr>
<td>C.8</td>
<td>Reuse non-potable</td>
</tr>
<tr>
<td>C.9</td>
<td>Reuse potable</td>
</tr>
<tr>
<td>C.10</td>
<td>Fire Fighting Sea Water</td>
</tr>
</tbody>
</table>
5.3.1 Option C.1: Disconnect existing non-potable supply

**Description**
Disconnect existing non-potable water supply. There are non-compliance issues with the existing reticulation with regard to back flow protection and pipework condition and location. Quality of the non-potable water supply and up-keep of aging infrastructure is of concern, therefore this option is to disconnect this supply and rely solely on potable water supply brought over by barge from the mainland.

**Environmental Impact**
Neutral impact:
- neutral construction disturbance and
- sustainability rated highly, as infrastructure no longer requires maintenance, however additional services will be required to transport water across to Scotland Island and distribute to the properties.

**Community Acceptance**
Disconnecting existing non-potable water likely to be unacceptable to the community.
- Increased costs to the community with all non rainwater systems water required to be supplied by alternate means;
- Many residents currently rely on the non-potable supply therefore they would be greatly affected.
- Deemed unacceptable to the Community

**Stakeholder Acceptance**
Marginally positive:
- Community perceive the non-potable supply as Council’s responsibility, with a current system in place and a lot of upgrades required.
- Eliminates risk to Council, however,
  - Council will receive more complaints from residents if the current non-potable supply is disconnected
- Quality and quantity performance to be considered;
  - Need to maintain a service to conduct essential services in the interest of public health and safety, such as toilet flushing and washing.
- Risk must outweigh opportunity,
  - Event of disease outbreak; fire-fighting capabilities

**Technical Risk**
Not an alternative solution.
- Cutting source of supply to properties
- Removal of tanks and pipes

**Work, Health and Safety**
Scored Neutral (10) impact in evaluation matrix, however score could be 15 or 5 depending on quality or quantity assessment perspective:
- **Score 15.** Broadly, from a whole community, health benefit. Current water quality is poor.
- **Score 5.** Individual property perspective, water source drastically impacted including ability to flush toilets and wash clothes.
5.3.2 Option C.2: Do Nothing

**Description**
Assumption: The ‘Do Nothing’ option was assessed as no changes to the existing water supply, but the assessment process did consider the ongoing maintenance and repair costs of the existing service. In order to maintain a service that has already served 30 years, it would be prudent to investigate the initial design life of the existing system, including the materials pipe material and rating, to ascertain technical viability of the system and anticipated time until replacement of system components, such as pipework, is required. The base assumption for the ‘Do Nothing’ option has implications in the comparable assessment of the subsequent options. In terms of if the evaluation is based on the solution providing –
- A design life of 5-10 years,
  - e.g. may get away with basic maintenance and repairs to keep the existing system operational; or
- A design with a 30–50 year horizon, which is consistent with industry solutions
  - Involves high likelihood of Pittwater crossing replacement.
  - In this respect other servicing options become comparatively viable.

**Consideration** -
- In the event of a failure/breakage of the existing Pittwater crossing pipeline supplying the non-potable water source for Scotland Island,
  - What are the failure response strategies?
  - Who are responsible for implementing and paying for these; Ownership etc?

**Environmental Impact**
Neutral impact: maintaining status quo.
- However it has been identified that the current system is impacting the environment.

**Community Acceptance**
Negative impact:
- Another feasibility study that has resulted in no action.
- Top-up of rainwater, is cheaper than supply from a tanker on a barge.
- Therefore assessed more positively than the disconnection option.

**Stakeholder Acceptance**
Negative impact:
- Investigations and soil sampling consistently flag serious public health and environmental concerns.

**Technical Risk**
Negative impact:
- Although this option requires no immediate action, the system is failing and is inadequate.
- Likelihood of failure increases daily, including the pipe across the Pittwater, and cross contamination of supply

**Work, Health and Safety**
Identified as a significant health issue.
5.3.3 Option C.3: Upgrade of rainwater storage tanks and water usage management

Description
This option involves the upgrade of on-site rainwater tanks, that are appropriately sized and managed according to roof size and occupancy. The second component of this option is a program to and assist community with water management strategies. The larger storage tanks would increase the reliability of the supply to the households, and with usage management through low flow fixtures etc the intent is to maximise rainwater collection and use. Emergency top ups would be required from tanker supply to Scotland Island. Roads on Scotland Island would need to be upgraded to accommodate the trucks.

- No top-up water, just rainwater - Less reliant or no reliance on non-potable water source
- Community to pay for upgrades
- Assumes community has operational responsibility - Residents to monitor and responsible for own water quality

Environmental Impact
Positive impact:
- Sustainability of this option is high
  - Water efficiency
  - Self-regulating and self-limiting.
- Issues with tannins may be a problem, this can be addressed in the technical solution options provided by Council such as utilising activated carbon filtration.

Community Acceptance
Neutral outcome / marginally negative:
- Community less / not reliant on poor quality non-potable water supply;
- Individually responsible for own water quality - not impacted on by others;
- There’s equity among community; But not across Sydney Metropolitan Area
- Costs for upgrades and top-up
- Implications during peak occupancy periods and increased demand requirements,

Stakeholder Acceptance
Positive impact:
- Stakeholders will be comfortable that a solution has been provided and the properties are capable of holding adequate water.

Technical Risk
Negative impact:
- Complexities with this option - cannot be certain the solution will work,
  - Storage volume can be based on roof collection area, or based on usage requirements and emergency supply
  - Site constraints
    - Storage tank size restrictions,
    - Pump up arrangements e.g. from gutter into rainwater tank
- System maintenance is critical.

Work, Health and Safety
Better than neutral impact:
- There are risks associated with this option however they are better than neutral,
- Supply is less likely to run-out
5.3.4 Option C.4: Replace existing non-potable supply with small bore supply for drinking water with top-up to rainwater tanks

Description
The existing small-bore water supply system is upsized to provide a permanent drinking water supply within each household at the kitchen sink, and a timed permanent top up supply to the rainwater storage tanks. The pipework required would be smaller than a full water supply service. The supply system would extend for the Sydney Water water supply system at Church Point. Refer to concept drawing. Existing pipe sizes and state of repair will result in the requirement to replace the current emergency water supply, however take away the manual interface.

Install one small bore tube into the house with one connection point into the kitchen, providing potable water to each house. Automated daily trickle top-up into rainwater tanks, at this point the source will no longer be potable supply.

This option does not try to provide a full potable water supply, but gives a balance between quality and quantity of water supply, and minimise interference with existing reliance on the non-potable supply arrangements at each property.
- Its estimated that 50-60% of the properties on Scotland Island use the non-potable supply source regularly, with the remainder a couple of times a year.
- Meter readings required at each property.

Environmental Impact
Positive Impact,
- Score is variable (within the positive range) depending on the base assumption of the ‘Do Nothing’ option, whether the Pittwater crossing requires replacement.

Community Acceptance
Positive Impact,
- Provides a reliable clean water supply to the Community
- Reduces health risks and provides top-up system to rainwater tanks
- Does not provide equity with Sydney Benchmark Water Services

Stakeholder Acceptance
Positive Impact,
- Can achieve regulatory compliance
- Reduces risks for stakeholders

Technical Risk
Positive Impact,
- Any retrofit is difficult, however option has minimised on property works
- Low likelihood of failures, however the more moving parts, such as the automation component of the system, the higher likelihood of failures.

Work, Health and Safety
Better than the previous option 3 (upgrade rainwater tanks):
- Doesn’t provide fire-fighting resource – too high velocity in 50mm pipe across Pittwater
- A 125PE pipe would provide larger diameter, remain a small bore and be supplied in coils.
  - All rainwater top-up could be turned off, during fire-fighting event.
- Potable water reservoir, if required, would likely be low level with VSD pumps.
5.3.5 Option C.5: Provide supply from Sydney Water System to reservoir on Island

**Description**
A new full potable water supply system extending from the Sydney Water water supply at Church point. The incoming supply would extend to a new reservoir at the top of Scotland Island, with a full-sized reticulated water supply reticulated around Scotland Island in the roadways with a supply point to each of the lots on Scotland Island. Each lot would be fitted with a Sydney Water meter.

**Assumption**
The reservoir would be approximately 1ML in size at the highest elevation on Scotland Island.

**Environmental Impact**
Negative impact:
- Major construction impact, road construction required for truck access to top of Island
- Major land use impact,
- Reservoir size would require clearing of land at site of reservoir,
- Additional clearing of land would be required by Sydney Water for all-weather road access up to the reservoir
- Some loss of open space

**Community Acceptance**
Slightly positive:
- Perceived as the equitable, gold-plated option, however impact of the reservoir will be major;
- Provide good equity;
- Residents generally like that they do not have a water bill and they may feel that it would destroy the place they are living in and impact on amenity of Scotland Island
- Only source of water to Scotland Island
  - Residents may want to keep rainwater tanks,
- Many trees will be cleared
- Reservoir would provide emergency water supply in the event of power failure, or main crossing break

**Stakeholder Acceptance**
Positive from majority of stakeholders, as it addresses many of the risks, except Sydney Water, who will be heavily opposed to this option.
- Sydney Water will not be in favour of a reservoir on an Island and the associated impact on resourcing for up-keep of roads and infrastructure for operations and maintenance.

**Technical Risk**
Slightly positive,
- Retrofitting a complete reticulated system will be hard, however
  - It is constructible, and
  - It is a typical solution.

**Work, Health and Safety**
Positive impact,
- Good for most aspects, operational risk, public health and firefighting.
5.3.6 Option C.6: Direct mains pressure supply from Sydney Water mains / pressure boosted if required

Description
A new full potable water supply system extending from the Sydney Water water supply at Church point. Similar to option 5, full reticulated potable water supply to Scotland Island, without the reservoir. The incoming supply would extend to a full sized reticulated water supply reticulated around Scotland Island located in the roadways with a supply point to each of the lots on Scotland Island. The higher lots on Scotland Island would be provided with a pressure boosted supply to ensure adequate water supply pressure. Each lot would be fitted with a Sydney Water meter. Refer to concept drawing.

Environmental Impact
Negative impact, however not an extreme impact like the previous reservoir option.
- Most of the retrofitted reticulation could be directionally drilled,
- Accessibility and road access may need to be upgraded by Council, for Sydney Water operations and maintenance of the system.
  - Council are planning for the upgrade of the stormwater system and overland flow paths – so potential for concurrent upgrades.
- Environmental risks increase if this option is not combined with reticulated sewage disposal, as a reticulated water supply results in increased wastewater disposal from properties.

Community Acceptance
Positive impact / high acceptance:
- Perceived as the gold-plated solution;
- Land use impact will be minimal
- Provides good equity;
- Scheme cost may be limiting factor.
- Equitable solution

Stakeholder Acceptance
Positive impact / high acceptance:
- Covers risks and responsibilities

Technical Risk
Technically better solution than the other options:

Work, Health and Safety
Addresses the WH&S risks better than the other options, with the difference being the fire-fighting resource of the reservoir on Scotland Island.
5.3.7  Option C.7: Desal plant with new water reticulation

**Description**
Extraction from Pittwater with local desalination plant supplying potable water to lots on Scotland Island.

**Environmental Impact**
Negative impact,
- Requires high energy consumption to produce the potable water
- Discharge of concentrated salt would be required –
  - There are uncertainties where this would be possible to discharge and what consent requirements would be imposed where this would be possible to discharge.

**Community Acceptance**
Very low community acceptance anticipated,
- Very expensive to construct and operate.
- May enable sense of independence from the mainland

**Stakeholder Acceptance**
Neutral acceptance,
- Guaranteed supply of water
- Not drought related,
- Sydney water or private sector could deliver and operate system,
  - Similar systems operate on Hayman Island and Rottnest Island.
- State government not likely to endorse a plant for only 370 properties.
  - Costs to provide the plant, undertake upgrades and maintain are massive on the mainland, therefore are going to be significantly more on an Island.
  - Potentially something to consider if the plant became a local issue/responsibility

**Technical Risk**
Not insignificant / negative,
- The water supplying the desalination plant needs to be of good quality, and
- The outlet, the location for the discharge of the brine, is likely to be difficult to determine.
- Accommodations of the system will factor into the final score for this option
  - E.g. who will own, operate, maintain system?

**Work, Health and Safety**
Positive impact,
- Provides a reliable source of potable water source for Scotland Island
- Operational risks are higher than for the two previous servicing options with supply from Sydney Water’s network.
5.3.8 Option C.8: Reuse non-potable

**Description**
Reticulated recycled water system for external use, and toilet and washing use if necessitated. Not a stand-alone solution, integrated with the sewerage system solution, and would require a third pipe (purple), such as Rouse Hill.

Less reliance on the potable water supply source.

**Environmental Impact**
This option is implemented in conjunction with sewage options utilising an on-island sewage treatment plant. The sewage is treated to a level suitable for reticulation as a non-potable water supply to each lot on Scotland Island. A dual pipe reticulation would be required.

Deemed to be a higher environmental impact than option 6 (reticulated water supply), two services installation now required, - 1. Potable Water and 2 – Recycled Water

**Community Acceptance**
Slightly positive acceptance,
- More overall reliability of service on Scotland Island,
- Not a lot of evidence of irrigation on Scotland Island, therefore need is questionable.

**Stakeholder Acceptance**
Negative,
- Implementation costs would outweigh any benefit, particularly for a scheme of this size.

**Technical Risk**
Main risk associated with this option is with end-user failure,
- E.g. cross-connections and contamination

**Work, Health and Safety**
Slightly negative,
- Not an essential service, therefore additional risks factors exist
5.3.9 Option C.9: Reuse potable

**Description**
Treatment plant on Island to provide reuse potable water.

**Environmental Impact**
Extremely negative,
- Plant would be small but complicated, with a brine stream that has to be disposed of, requiring approval for discharge into Pittwater.

**Community Acceptance**
Negative perception,
- Studies show that it requires on average 7 years of education to gain acceptance within a community, considering
  - Potable reuse on Scotland Island
  - Large fresh water dilution is typical in other schemes

**Stakeholder Acceptance**
Negative perception, requires a long journey of education to gather acceptance.

**Technical Risk**
Negative impact,
- Scheme is doable, however there are very few existing schemes of this scale to compare.

**Work, Health and Safety**
Deemed high risk in all areas associated with construction, operation, public health and fire fighting.
5.4 Location Options for Boring under Pittwater

The water servicing shortlisted options, and the option to discharge to sewage to Sydney Water sewerage at Church Point, all require a direction drill under Pittwater.

The initial concept drawings and cost planning are based on the direction bore to be from Church Point to Harold Reserve, the closest public land on the Island. However, there may be advantages in locating the bore in an alternate location. Infrastructure plant is required at the termination of the bore at Scotland Island, and there is limited open space at Harold Reserve. Harold Reserve may also be used by another utility for a under Pittwater bore termination, further reducing the land available, and increasing risk of a bore clashing with an existing service.

To minimise risk, and for potential planning benefits, two alternate bore locations have been identified. One location from Church Point to Leahvera Reserve on the west coast of the Island, and the second is from Church Point to Catherine Park on the North of the Island.

Selection of the bore location will be part of the detailed design. The highest cost option was included in the cost estimates for this study.

Figure 5-4: HDD Bore Locations for Boring Under Pittwater
Refer to Attachment for detailed assessment matrix scoring.

6.1 Sewage Collection Systems Gate 1 Ratings and selected options

<table>
<thead>
<tr>
<th>A. SEWAGE COLLECTION SYSTEMS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1 Gravity Sewerage</td>
<td>22</td>
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<tr>
<td>A.2 Pressure Sewerage</td>
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<tr>
<td>A.3 Vacuum System</td>
<td>11</td>
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<td>A.4 Hybrid System</td>
<td>54</td>
</tr>
<tr>
<td>A.5 Variable Grade Sewerage</td>
<td>21</td>
</tr>
</tbody>
</table>

Gate 1 Selected Sewage Collection System options

A.2 Pressure Sewerage

A pressure sewerage system consists of a dedicated pressure sewage pumping unit located on each lot discharging to a common collection main. The common main discharges to a sewage pumping station on site for transfer to the Sydney Water sewerage on the mainland, or to on-island Treatment Plant. Common pipework is generally located in public spaces, roadways etc.

A.4 Hybrid System Gravity Sewerage and Pressure Sewerage System

A hybrid system is Combination of gravity sewerage and pressure sewerage. Gravity sewerage is provided where the topography is conducive to pipelines installed at grade, and in constrained areas lots are serviced by pressure sewerage.

Refer to attachments for concept drawings of options.
6.2 Sewage Treatment and Disposal Gate 1 Ratings and selected options

<table>
<thead>
<tr>
<th>B. SEWAGE TREATMENT / DISPOAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B.1 Do Nothing</td>
<td>5</td>
</tr>
<tr>
<td>B.2 Upgrade of existing Domestic Systems (Managed System)</td>
<td>26</td>
</tr>
<tr>
<td>B.3 On Site Grey Water Reuse using existing Septic Tank, with on site reduced disposal</td>
<td>21</td>
</tr>
<tr>
<td>B.4 Tanker Truck Disposal from each lot</td>
<td>8</td>
</tr>
<tr>
<td>B.5 Tanker Truck disposal from common collection storage tank</td>
<td>42</td>
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<tr>
<td>B.6 Upgrade existing on lot systems with disposal redirected to Pittwater</td>
<td>25</td>
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<tr>
<td>B.7 Septic Tank Pump Out System discharging to on Island Treatment with Pittwater Disposal</td>
<td>36</td>
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<td>B.8 Septic Tank Pump Out System discharging to Sydney Water</td>
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<td>B.9 Installation of a sewerage collection system discharging to a treatment system on the Island, with disposal to Pittwater</td>
<td>58</td>
</tr>
<tr>
<td>B.10 Installation of a sewerage collection system discharging to a treatment system on the Island, with dry weather disposal to Sydney Water, wet weather disposal to Pittwater</td>
<td>67</td>
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<tr>
<td>B.11 Collect Sewage and Pump to Sydney Water sewerage system</td>
<td>79</td>
</tr>
<tr>
<td>B.12 Non potable Reuse</td>
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</table>

Note: B.10 option was removed from the evaluation process, due to the assumption at the beginning of the workshop that Sydney Water has adequate capacity in their network for servicing of Scotland Island.

Gate 1 Selected Sewage Treatment and Disposal options

B.9 Installation of a sewerage collection system discharging to a treatment system on Scotland Island, with disposal to Pittwater

Provision of a Sewage treatment Plant located on the Island, treating sewage to a tertiary level, suitable quality for discharge to Pittwater

B.11 Collect Sewage and pump to Sydney Water sewerage system

Collection of sewage and pump to Sydney Water Sewerage System at Church Point.

Refer to attachments for concept drawings of options.
6.3 Water Supply Gate 1 Ratings and selected options

<table>
<thead>
<tr>
<th>C. WATER SUPPLY</th>
<th></th>
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<tbody>
<tr>
<td>C.1 Disconnect existing non potable supply</td>
<td>42</td>
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<td>C.2 Do Nothing</td>
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<td>C.3 Upgrade of rainwater storage tanks and water usage management</td>
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<tr>
<td>C.4 Replace Small Bore Supply for drinking water with top up to rainwater tanks</td>
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<td>C.5 Provide supply from Sydney Water System to reservoir on Island</td>
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<td>C.6 Direct mains pressure supply from Sydney Water mains / pressure boosted if required</td>
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<td>C.7 Desal with new water reticulation</td>
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<td>C.8 Reuse non potable</td>
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<tr>
<td>C.9 Reuse potable</td>
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</tbody>
</table>

Gate 1 Selected Water Supply options

C.4 Replace Small Bore Supply for drinking water with top up to rainwater tanks

The existing small-bore water supply system is upsized to provide a permanent drinking water supply within each household at the kitchen sink, and a timed permanent top up supply to the rainwater storage tanks. The pipework required would be smaller than a full water supply service. The supply system would extend for the Sydney Water water supply system at Church Point. Refer to concept drawing. Existing pipe sizes and state of repair will result in the requirement to replace the current reticulated on-island supply, however take away the manual interface.

Install one small bore tube into the house with one connection point into the kitchen, providing potable water to each house. Automated daily trickle top-up into rainwater tanks, at this point the source will no longer be potable supply.

C.6 Direct mains pressure supply from Sydney Water mains / pressure boost if required

A new full potable water supply system extending from the Sydney Water water supply at Church point. Similar to option 5, full reticulated potable water supply to Scotland Island, without the reservoir. The incoming supply would extend to a full-sized reticulated water supply reticulated around Scotland Island located in the roadways with a supply point to each of the lots on Scotland Island. The higher lots on Scotland Island would be provided with a pressure boosted supply to ensure adequate water supply pressure. Each lot would be fitted with a Sydney Water meter.

Refer to attachments for concept drawings of options.
### Detailed Multi-Criteria Technical Assessment

<table>
<thead>
<tr>
<th>Option</th>
<th>ADJUSTED Total rated out of 100</th>
<th>Weighted Total Score</th>
<th>ENVIRONMENTAL Score</th>
<th>COMMUNITY ACCEPTANCE Score</th>
<th>STAKEHOLDER ACCEPTANCE Score</th>
<th>TECHNCIAL RISK</th>
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**Scotland Island Water and Sewerage Feasibility Study**

Stage 1b Options Report:

Issue L: 25/08/20
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## C. WATER SUPPLY

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<th>TECHNICAL RISK Score</th>
<th>WORK HEALTH AND SAFETY Score</th>
<th>Weighted Score</th>
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<td>C.3 Upgrade of rainwater storage tanks and water usage management</td>
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<td>C.4 Replace Small Bore Supply for drinking water with top up to rainwater tanks</td>
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<td>C.6 Direct mains pressure supply from Sydney Water mains / pressure boosted if required</td>
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<td>C.7 Desal with new water reticulation</td>
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8 CONCLUSION / RECOMMENDATIONS

Existing Water and Sewage Servicing to the Island is low standard
Scotland Island currently has a low standard of water supply and sewage disposal when benchmarked to similar density urban residential lots in Sydney. The low standard of servicing has been acknowledged by service providers and government authorities for several decades, but constraints have prevented the implementation of water infrastructure upgrades.

The servicing difficulties originate from the history of development on Scotland Island, combined with a topography and location that impacts on construction costs.

When Scotland Island was initially subdivided and developed it was primarily a holiday destination. Scotland Island is only accessible by boat. When first developed the dwellings were predominately intended for temporary occupation.

The existing geotechnical conditions were not ideal for on-site disposal, but when used for holiday accommodation the soil absorption/dispersal areas only received intermittent sewage discharges. With increasing permanent residents, the disposal areas became stressed through a higher constant hydraulic load.

The rainwater tanks generally were sufficient for the low usages for the non-permanent holiday occupant requirements, complimented with carry-on drinking water. The increased demands from permanents residents, especially families with children, has increased the reliance on the small bore top up supply. The top up supply pipework is non-compliant, and with limited flow capacity in the delivery system residents are required to book for a fill period to fill their tanks.

Changing demographic
The proportion of permanent residents has gradually increased over time, although it has historically fluctuated.

Table 8-1: Scotland Island Population 2001 - 2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>579</td>
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<tr>
<td>2011</td>
<td>715</td>
</tr>
<tr>
<td>2006</td>
<td>642</td>
</tr>
<tr>
<td>2001</td>
<td>734</td>
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</table>

Source: Australian Bureau of Statistics

The permanent population has increased without a corresponding upgrade to infrastructure. Many residents moved to Scotland Island to enjoy a less urbanised lifestyle, willing to offset some convenience for the benefits of a community based village lifestyle, or to enjoy isolation from the traffic and urbanisation. Historically there was some community reluctance to change the amenity on Scotland Island by development of urban infrastructure services.

The changing demographic and increase in families living on Scotland Island has increased the desire for upgrade of services. In 2016, the proportion of children under 14 years of age was 20.4%. For more than 20 years residents have been lobbying for provision of reticulated water
supply and connection to Sydney Water sewerage services. The sewerage servicing of Scotland Island has been listed in the Sydney Water priority sewerage program for nearly a decade.

**Need for improvement of services to Scotland Island**

Audit of Scotland Island water reticulation has identified a health risk in the existing drinking water supply. Scotland Island is densely vegetated and many of the rainwater collection roofs are under tree canopies, with high debris and organic matter impacting on the harvested rainwater quality, and some of the rainwater tanks have been contaminated by island fauna. The existing small-bore water supply is not installed to Australian standards and is classified as non-potable.

The on-site sewage treatment and disposal systems are underperforming, with evidence of environmental damage, and water and soil contamination.

Scotland Island is not connected to the mainland by road bridge, but it is located within the Sydney suburban/urban boundaries and is situated in an ecologically sensitive area with high human engagement and activity in the environs and surrounding waterways.

The upgrade of the existing water supply and sewage services are a critical requirement to negate the health risk for residents and recreational visitors.

**Key drivers for the recommended technical solution**

The brief for this report was to investigate opportunities for alternate technologies and potential commercial delivery models to provide Scotland Island with water infrastructure. The opportunities for alternate delivery models are limited by the topography and urban context of Scotland Island.

The size of island population and urban density is not conducive to the implementation of domestic type complex water treatment technology with high user dependant management of on-site sewage treatment systems. The density of development on Scotland Island and the shallow soils are not sufficient to manage the sewage hydraulic loading. Construction of mounds by importing granular material to increase the soil absorption capacity has significant negative environmental impact.

There are key servicing factors that influence the outcome of the options assessment process and recommendations in this report:

- Preliminary discussions with Sydney Water indicate there is sufficient capacity in the water and sewerage infrastructure located at Church Point required to service Scotland Island.
- Scotland Island is approximately 6 kms from Warriewood Sewage Treatment Plant. Sydney Water have indicated there is capacity in the treatment plant to accept the sewage from Scotland Island.

**Recommendations**

Both recommended shortlisted options for upgrade of water supply to Scotland Island include connection to the Sydney Water mains at Church Point.
No recommended option for sewage disposal considers on-site treatment and disposal. A common sewerage collection system is recommended, discharging to either the Sydney Water sewerage system at Church Point, or to an on island central sewerage treatment plant with disposal to Pittwater. Disposal to the Sydney Water sewerage system is the preferred option as determined by the option assessment process.

Discussions with Sydney Water revealed they undertook some investigation for servicing of Scotland Island in recent years but were not able to overcome the commercial requirements for implementation of the program. The cost of servicing Scotland Island was estimated to be extremely high, and not viable within Sydney Water commercial operational responsibilities.

The next phase of this feasibility study is a detailed commercial appraisal of the shortlisted options. The commercial appraisal study objectives will be to:

- Identify the most economical solution that is technically robust and develop certainty in the project delivery costs. Previous studies have been high level costing only. A detailed costing plan will facilitate definition of the potential funding models. It is recommended the costing is informed by contractors’ input.
- Assess the construction and operational costs against a commercial model to identify shortfalls in funding, and potential sources of top up finance to implement the services upgrade.

**Recommended Water Supply shortlisted options**

There are no potable water sources on Scotland Island, the only alternate potable water source is desalination or Black Water treatment and reuse. These options do not compare favourably to the option of connecting to the Sydney Water water source available from Church Point. There are no alternate technologies that are commercially sustainable on Scotland Island.

The recommended option is the removal of the existing non-compliant small-bore water reticulation, and installation of new water supply reticulation connecting to the Sydney Water mains at Church Point. A more detailed analysis is required to determine the preferred option, either:

- **OPTION C.4** Replace Small Bore Supply for drinking water an optimised size supply capable of constant trickle top up to rainwater tanks with a potable water supply point at the kitchen sink in each dwelling

<table>
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<th>OR</th>
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- **OPTION C.6** Typical direct mains pressure supply from Sydney Water mains / pressure boost if required

**Recommended Sewage Treatment and Disposal shortlisted options**

The topography and urban density on Scotland Island are not suited to an on-site treatment and disposal system. To satisfactorily reduce health risks on Scotland Island it is recommended the sewage is collected to a central point for either:

- **OPTION B.9** Installation of a sewerage collection system discharging to a treatment system on Scotland Island, with disposal to Pittwater

<table>
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- **OPTION B.11** Collect Sewage and pump to Sydney Water sewerage system at Church Point
Recommended Sewage Collection System shortlisted options

Both recommended options for Sewage Treatment and Disposal requires the provision of a sewage collection system. The two systems are recommended to be considered for further commercial assessment are:

- OPTION A.2 Pressure Sewerage Collection System
- OR
- OPTION A.4 A hybrid system combining pressure sewerage and gravity sewerage where feasible.
## 9 REFERENCED DOCUMENTS

<table>
<thead>
<tr>
<th>No</th>
<th>Title</th>
<th>Date</th>
<th>Prepared By</th>
<th>Purpose</th>
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| 1  | SCOTLAND ISLAND WATER AND SEWAGE OPTIONS STUDY                       | 1997      | Marten & Associates      | Second Report of Two Stage Study funded by a Landcare grant administered by SIRA; Report examines options for water and wastewater services. Recommendations:  
- Health risks identified  
- Upgrade of on-site treatment  
- Full reticulated Water Supply  
- On-going review of sewage systems performance. |
<p>| 2  | Lotsearch Enviro Pro Report Sample: Scotland island, Pittwater, NSW   | 28.11.18  | LOTSEARCH                | Database environmental risk and planning information: EPA assessed contamination significant enough to warrant regulation                                         |
| 3  | Scotland Island Community Engagement Plan: Issue 0.5                  | 1.2.19    | RPS / PSS                | 2019 Scotland Island feasibility study Community and stakeholder engagement                                                                                                                                  |
| 4  | Scotland Island Review of Environmental Factors; Issue 0.5            | 13.2.19   | RPS / PSS                | 2019 Scotland Island feasibility study: Review of previous environmental and social studies and identify knowledge gaps                                                                                         |
| 5  | SCOTLAND ISLAND COMMUNITY CALL TO ACTION                              | Undated   | SIRA (Scotland Island Resident’s Association) | Community Information document regarding                                                                                                                                         |
| 6  | Sydney Water Operating Licence                                        | 2015-2020 | IPART                    | Scotland Island included in PSP                                                                                                                                                                         |
| 7  | Sydney Water information Sheet; Bargo and Buxton Wastewater Scheme    | 06.14     | Sydney Water             |                                                                                                                                                                                                          |</p>
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<th>Purpose</th>
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ATTACHMENT A: WATER BALANCE MODEL

Hydraulic Loading Criteria

The Hydraulic Modelling was based on the following criteria

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<th>Item</th>
<th>Criteria</th>
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<tr>
<td>Number of Lots</td>
<td>377</td>
<td></td>
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<tr>
<td>EP / Lot</td>
<td>3</td>
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<tr>
<td>Holiday Loading</td>
<td>25%</td>
<td>Based on anecdotal discussions with SIRA</td>
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<tr>
<td>Existing Population</td>
<td>550 to 750 EP</td>
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<tr>
<td>Existing Holiday Loading</td>
<td>Approximately 1,000</td>
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</tr>
<tr>
<td>Ultimate Fully Developed</td>
<td>1,131 EP</td>
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</tr>
<tr>
<td>Ultimate Holiday Population</td>
<td>1,413 EP</td>
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Potable Water Consumption Criteria

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<th>Criteria</th>
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<tr>
<td>Drinking and Cooking</td>
<td>10 L/person/day OR 3,650 L/person/y Or Approx 11 kL/dw/y</td>
</tr>
<tr>
<td>Showering</td>
<td>80 L/person/day</td>
</tr>
<tr>
<td>Washing Machine</td>
<td>40 L/person/day</td>
</tr>
<tr>
<td>Toilet Flushing</td>
<td>25 L/person/day</td>
</tr>
<tr>
<td>General Use</td>
<td>25 L/person/day</td>
</tr>
<tr>
<td>Leakage</td>
<td>15% OR 27 L/person/day</td>
</tr>
<tr>
<td>TOTAL</td>
<td>207 L/person/day Or 234 kL/day for whole Island</td>
</tr>
<tr>
<td></td>
<td>Equating to approximately</td>
</tr>
<tr>
<td></td>
<td>75 kL/person per year OR 226 kL/home/y</td>
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### Sewage Production

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<tr>
<td>Sewage Loading</td>
<td>200 L/person/day</td>
</tr>
<tr>
<td>Average Day Total</td>
<td>226 kL/day</td>
</tr>
<tr>
<td>Peak Day Total</td>
<td>282 kL/day</td>
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<td>Trade Waste</td>
<td>None allowed</td>
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The assessment team agreed on the following alternate weighting profiles for sensitivity analysis:

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<th>Increased focus on Environment and Community</th>
<th>Increase focus on Stakeholders and WHS</th>
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<td>30</td>
<td>10</td>
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<td>COMMUNITY ACCEPTANCE</td>
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<td>30</td>
<td>20</td>
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<td>STAKEHOLDER ACCEPTANCE</td>
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<td>TECHNCIAL RISK</td>
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<td>10</td>
<td>10</td>
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<td>WORK HEALTH AND SAFETY</td>
<td>20</td>
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<td>30</td>
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### Weighting Sensitivity Scenario 1: Increased focus on Environment and Community

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<td></td>
<td><strong>A. WASTE WATER COLLECTION SYSTEMS</strong></td>
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<tr>
<td>A.1</td>
<td>Gravity Sewer</td>
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<td>A.2</td>
<td>Pressure Sewer</td>
<td>64</td>
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<td>A.3</td>
<td>Vacuum System</td>
<td>13</td>
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<tr>
<td>A.4</td>
<td>Hybrid System</td>
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<tr>
<td>A.5</td>
<td>Variable Grade Sewer</td>
<td>23</td>
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<tr>
<td></td>
<td><strong>B. WASTE WATER</strong></td>
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<tr>
<td>B.1</td>
<td>Do Nothing</td>
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<tr>
<td>B.2</td>
<td>Upgrade of existing Domestic Systems (Managed System)</td>
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<tr>
<td>B.3</td>
<td>On Site Grey Water Reuse using existing Septic Tank, with on site reduced disposal</td>
<td>23</td>
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<tr>
<td>B.4</td>
<td>Tanker Truck Disposal from each lot</td>
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<tr>
<td>B.5</td>
<td>Tanker Truck disposal from common collection storage tank</td>
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<tr>
<td>B.6</td>
<td>Upgrade existing on lot systems with disposal redirected to Pittwater</td>
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<tr>
<td>B.7</td>
<td>Septic Tank Pump Out System discharging to on Island Treatment with Pittwater Disposal</td>
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<td>B.8</td>
<td>Septic Tank Pump Out System discharging to Sydney Water</td>
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<tr>
<td>B.9</td>
<td>Installation of a sewer collection system discharging to a treatment system on the Island, with disposal to Pittwater</td>
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<td>Installation of a sewer collection system discharging to a treatment system on the Island, with dry weather disposal to Sydney Water, wet weather disposal to Pittwater</td>
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<td>Do Nothing</td>
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<tr>
<td>C.3</td>
<td>Upgrade of rainwater storage tanks and water usage management</td>
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<tr>
<td>C.4</td>
<td>Replace Small Bore Supply for drinking water with top up to rainwater tanks</td>
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<td>C.5</td>
<td>Provide supply from Sydney Water System to reservoir on Island</td>
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<tr>
<td>C.6</td>
<td>Direct mains pressure supply from Sydney Water mains / pressure boosted if required</td>
<td>72</td>
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<tr>
<td>C.7</td>
<td>Desal with new water reticulation</td>
<td>37</td>
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<tr>
<td>C.8</td>
<td>Reuse non potable</td>
<td>45</td>
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<td>C.9</td>
<td>Reuse potable</td>
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### Weighting Sensitivity Scenario 2: Increased focus on Stakeholders and WHS

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<td>A.3</td>
<td>Vacuum System</td>
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<td>Variable Grade Sewer</td>
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<td>On Site Grey Water Reuse using existing Septic Tank, with on site reduced disposal</td>
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<td>B.11</td>
<td>Collect Waste Water and Pump to Sydney Water sewerage system</td>
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<td>C.4</td>
<td>Replace Small Bore Supply for drinking water with top up to rainwater tanks</td>
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<td>C.7</td>
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### HIGH LEVEL DELIVERY STRATEGY: FOR COST PLANNING PURPOSES

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Scotland Island Water and Sewerage Feasibility Study
Stage 1b Options Report:
Issue L: 25/08/20
**ATTACHMENT E: CONCEPT DRAWINGS**

**Sewerage Collection System**

Pressure Sewer  
Dwg SK01  Pressure Sewer Collection System

Hybrid  
Dwg SK02  Hybrid Gravity and Pressure Collection System

Pressure and Hybrid  
Dwg SK07  Functional Sketches of Collection System arrangement

**Sewage Disposal System**

On Island Treatment System  
Dwg SK06: Concept Plan  

Discharge to Sydney Water  
Dwg SK01  Pressure Sewer Collection System

**Water Supply System**

Low Flow  
Dwg SK04  Low flow Water Supply from Sydney Water with single drinking water point and rainwater tank top up.

Full Reticulation  
Dwg SK03  Full mains pressure supply .
ATTACHMENTS F: OPTION ASSESSMENT WORKSHOP NOTES

Detail workshop notes from Option Assessment Workshop May 2019. The options assessment from this workshop has been summarised in Section ‘5 OPTION ASSESSMENT’.