

# FEASIBILITY STUDY

November 2019

## SCOTLAND ISLAND WATER AND WASTEWATER FEASIBILITY STUDY STAGE 2 COMMERCIAL ASSESSMENT REPORT



PRESSURE SYSTEM SOLUTIONS PTY LTD  
[www.pssolutions.net.au](http://www.pssolutions.net.au)



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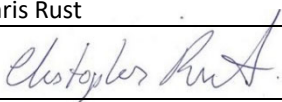
## Contact Information: Pressure System Solutions Pty Ltd

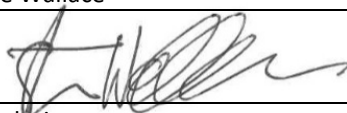
A B N 57 097 164 899  
 Unit 1/47-51 Lorraine Street  
 Peakhurst NSW 2210  
 Sydney Australia  
 T: +61 2 9584 1177  
 E: admin@pssolutions.net.au  
 PO Box 630 Jannali NSW 2226

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## Approval

<b>Prepared By:</b>	
<b>Name:</b>	Chris Rust
<b>Signature:</b>	
<b>Organisation:</b>	PS Solutions
<b>Title:</b>	Design Manager
<b>Date:</b>	30/11/20

<b>Approved by:</b>	
<b>Name:</b>	Steve Wallace
<b>Signature:</b>	
<b>Organisation:</b>	PS Solutions
<b>Title:</b>	Technical Director
<b>Date:</b>	30/11/20

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## TABLE OF CONTENTS

<b>1</b>	<b>EXECUTIVE SUMMARY .....</b>	<b>5</b>
1.1	FUNDING ANALYSIS SUMMARY .....	7
1.2	PROJECT CONTEXT .....	7
<b>2</b>	<b>INTRODUCTION.....</b>	<b>9</b>
2.1	REPORT OBJECTIVE .....	10
2.2	SCOTLAND ISLAND .....	10
2.3	FEASIBILITY STUDY PROCESS OVERVIEW .....	12
2.4	PREFERRED OPTIONS .....	14
<b>3</b>	<b>RISK .....</b>	<b>15</b>
3.1	INDICATIVE COSTINGS FROM RISK ASSESSMENT.....	15
<b>4</b>	<b>COMMERCIAL ANALYSIS METHODOLOGY .....</b>	<b>16</b>
4.1	METHODOLOGY .....	16
<b>5</b>	<b>CONSTRUCTION AND OPERATIONAL COSTS .....</b>	<b>17</b>
5.1	COSTING SUMMARIES .....	19
5.1.1	<i>Summary Capital Costs by Cost Centre .....</i>	<i>19</i>
5.1.2	<i>Summary Capital Costs with Project and Construction Management attributed pro-rata to each option:-</i>	<i>19</i>
5.1.3	<i>Capital Cost Summary Combinations of Options .....</i>	<i>20</i>
5.1.4	<i>Summary NPV Costs .....</i>	<i>21</i>
<b>6</b>	<b>CASE FOR INVESTMENT AND FUNDING ANALYSIS .....</b>	<b>22</b>
6.1	CASE FOR INVESTMENT .....	22
6.2	SUMMARY FUNDING ANALYSIS.....	23
<b>7</b>	<b>DELIVERY AND FUNDING STRATEGY.....</b>	<b>24</b>
7.1	DELIVERY ELEMENTS AND THE KEY PROVIDERS .....	25
7.2	DELIVERY MODEL OPPORTUNITY ASSESSMENT .....	28
7.3	RECOMMENDATION FORM OF PROJECT DELIVERY .....	28
7.4	RISK MANAGEMENT .....	29
<b>8</b>	<b>CONCLUSION .....</b>	<b>30</b>
<b>9</b>	<b>GLOSSARY .....</b>	<b>31</b>
<b>10</b>	<b>ATTACHMENT A: CAPITAL COSTS DETAIL SCHEDULES.....</b>	<b>1</b>
10.1	CAPITAL COST SCHEDULES .....	1
10.1.1	<i>PROJECT PLANNING, COORDINATION AND CONSULTATION PRELIMINARIES .....</i>	<i>1</i>
10.1.2	<i>PROJECT CONSTRUCTION PRELIMINARIES .....</i>	<i>2</i>
10.1.3	<i>COLLECTION SYSTEM OPTION A2: PRESSURE SEWER .....</i>	<i>4</i>
10.1.4	<i>COLLECTION SYSTEM OPTION A4: HYBRID GRAVITY AND PRESSURE .....</i>	<i>7</i>

10.1.5	WASTE DISPOSAL SYSTEM OPTION B9: ON ISLAND TREATMENT DISPOSAL TO PITTWATER .....	10
10.1.6	WASTE DISPOSAL SYSTEM OPTION B11: PUMP TO SYDNEY WATER .....	11
10.1.7	WATER C4 LOW FLOW SYSTEM FROM SYDNEY WATER .....	12
10.1.8	WATER C6 FULL RETICULATION FROM SYDNEY WATER .....	16
<b>10.2</b>	<b>PV DETAILED SCHEDULES .....</b>	<b>19</b>
10.2.1	OPTION A2/B11: Pressure Sewerage System - Discharge to SWC Network .....	20
10.2.2	OPTION A2/B9: Pressure Sewerage System - "On Island" STP .....	21
10.2.3	OPTION A4/B11: Hybrid Sewerage System - Discharge to SWC Network .....	23
10.2.4	OPTION A4/B9: Hybrid Sewerage System - "On Island" STP .....	24
10.2.5	OPTION C4: Low Flow Supply .....	26
10.2.6	OPTION C6: Full Flow Supply .....	27
<b>11</b>	<b>ATTACHMENT B: RISK ASSESSMENT .....</b>	<b>1</b>
11.1	RISK ASSESSMENT PROCESS .....	1
11.2	RISK ASSESSMENT EVALUATION CRITERIA .....	2
11.3	RISK ASSESSMENT MATRIX .....	4
<b>12</b>	<b>ATTACHMENT C: RPS REPORT: SCOTLAND ISLAND CASE FOR INVESTMENT .....</b>	<b>17</b>

## FIGURES

Figure 2-1: Scotland Island Location Plan .....	10
Figure 2-2: Scotland Island Urban Context .....	11
Figure 2-3: Feasibility Process Overview .....	13
Figure 7-1: Recommended Construction Strategy .....	29

## TABLES

Table 2-1: Scotland Island Population 2001 – 2016: Census Data .....	11
Table 3-1: Risk Item Costings .....	15
Table 5-1: Cost Plan Structure .....	17
Table 5-2: Summary Capital Costs by Cost Centre .....	19
Table 5-3: Summary Costs by Option .....	19
Table 5-4: Summary NPV Costs .....	21
Table 7-1: Delivery Strategy key Elements and Providers .....	25
Table 7-2: Delivery Model Options .....	28

## 1 EXECUTIVE SUMMARY

Northern Beaches Council engaged Pressure System Solutions to undertake a feasibility study for provision of water and wastewater services to Scotland Island. RPS were engaged by Pressure System Solutions to undertake the Cost Benefit Analysis part of the feasibility study.

This Stage 2 report is the final report of the overall feasibility study, a commercial feasibility assessment. The Stage 2 report also includes a separate report 'SCOTLAND ISLAND WATER INFRASTRUCTURE, Case for Investment; RPS 2020'.

### Previous Reports:

Stage 1a report provided a high-level review of Social and Environmental factors.

Stage 1b report provided a technical assessment of water and wastewater servicing to Scotland Island, and analysed feasible servicing options, shortlisting two options in each area as follows:

SHORTLISTED OPTIONS FROM STAGE 1B REPORT
<b>WATER SUPPLY OPTIONS</b>
Low flow from Sydney Water
Full reticulated system from Sydney Water
<b>WASTEWATER SERVICING OPTIONS</b>
Pressure system
Hybrid system
<b>WASTEWATER DISPOSAL OPTIONS</b>
On-island treatment system
Discharge to Sydney Water

For commercial assessment preferred servicing options were selected from the Stage 1b report shortlisted options. The preferred servicing options are:

- Water Supply: Full reticulated water supply system from Sydney Water.
- Wastewater Servicing: Pressure Sewer System
- Wastewater Disposal: Disposal to Sydney Water sewage system.

This stage 2 report provides the commercial feasibility assessment including

- Case for Investment: assessing the economic, environmental, and indirect benefits of providing reticulated water and wastewater to the island, including
- a definition of the problem and the project need.
- a presentation of four infrastructure options that address these problems.
- a qualitative assessment of the benefits of supply infrastructure (Benefits Assessment); and
- an analysis of the potential funding models (Funding Analysis).
- Costs analysis: compilation of costs for construction and operation, and present value (PV) costs.

- Risk analysis of the water and wastewater servicing options.

The key outcomes of the feasibility study are that providing Scotland Island with potable reticulated water supply and wastewater collection system will:

- significantly reduce health risks,
- alleviate existing liability risks of Government stakeholders associated with the facilitation and acceptance of current solutions not complying to Australian Standards.
- Provide equity by addressing a long-standing community need for the services, which have been provided to similar communities in the past, and at a cost that is comparable to similar schemes.
- improve the quality of service for island residents; and
- significantly improve the local environment, both on and off the island.

These benefits accrue to a broad range of stakeholders including island residents and visitors, the Council, the local environment, and recreational users of the Pittwater bay.

#### Costing Summary:

- The preliminary estimate for the construction cost for the preferred water and wastewater servicing option is \$68,428,764; equating to approximately \$181,509 per lot.

#### Scotland Island

Scotland Island is located at the southern end of the Pittwater estuary. There are 377 lots (358 dwellings) on Scotland Island, and it is one of the largest villages in greater Sydney without a reticulated potable water supply or wastewater service. The Island is in close proximity to the northern beaches and urban areas of Church Point, Bayview and Bigola Plateau. The Pittwater Estuary has substantial recreational usage and high community and cultural significance.

The drinking water supply consists of household rainwater tanks and an emergency pipeline intended for firefighting purposes. The pipeline is non-compliant to Australian drinking water supply standards, and is classified as non-potable, but is now servicing the majority of residents on an ongoing basis. The use of the emergency pipeline for drinking water is a health risk to the community.

There is no centralised wastewater system on the island. The topography of the Island is not conducive to on-lot treatment and disposal, resulting in poorly treated wastewater being discharged into Pittwater.

Septic systems with soil absorption trenches account for the majority of wastewater disposal. Approximately a third of properties have aerobic wastewater treatment systems (AWTS). Most new developments on the island are now required to install an AWTS. Disposal areas are generally smaller than recommended in the Australian Standard AS/NZS1547. Some of the waterfront properties dispose of wastewater directly into estuarine sands, and for some, tidal sea water accesses and 'flushes' their disposal area. In these cases, little post-disposal treatment occurs before the water enters Pittwater.

Northern Beaches Council has identified the following compliance issues with Wastewater systems on the island:

- few properties meet the NSW Environmental & Health Protection Guidelines On-site Sewage Management for Single Households buffer distances to a permanent water source.
- few properties meet the NSW Environmental & Health Protection Guidelines On-site Sewage Management for Single Households buffer distance to boundaries.
- few properties meet the AS/NZS1547 for wet weather storage; and



- few properties meet the AS/NZS1547 for reserve land application areas.

The issues with the sewerage infrastructure that led to these challenges included the unsuitability of the local geology with shallow soils and high rock levels, land reservation requirements, lack of compliance with Australian Standards and island generally steeply sloping topography. Poorly performing systems pose a potential health risk through:

- direct or indirect exposure to pathogens in effluent or effluent contaminated soil. Direct exposure includes contact with pooled effluent while indirect exposure includes recreation in an affected waterway; or
- exposure to pathogens by recreational users of local waterways.

They can also impact local residential amenity through increased mosquito numbers, the generation of odours, dieback of native vegetation and proliferation of noxious weeds. There is evidence of each of these impacts on the Island.

Provision of potable reticulated water and centralised wastewater services to Scotland Island will significantly reduce the above mentioned environmental and health risks to the community.

## 1.1 Funding Analysis Summary

The Capital Funding Analysis investigated how the cost of the scheme could be recovered through funding from either SWC / the NSW Government (Funding Option 1), or by SWC / the NSW Government through co-contributions from island residents (Funding Option 2).

Funding the infrastructure through SWC (Funding Option 1) is assessed as the most favourable option, as it leverages SWC's strong balance sheet and is much more likely to be accepted by the various stakeholders (i.e. SWC and island residents).

- Note: Attachment C: Report: 'RPS- Scotland Island Water Infrastructure – Case for Investment' provides additional commentary on Funding Options

## 1.2 Project Context

In February 1997, the NSW Government announced the Priority Sewerage Program (PSP), which nominated 16 unsewered villages, with high environmental sensitivity, for improved sewerage services. All schemes listed in the first stage of the scheme have been completed, including Brooklyn and Dangar Island. Scotland Island was included among another 20 villages identified in Stage 2 of the program, announced in 2001.

Sydney Water funded previous PSP schemes through the Sewer Service Charge that is levied on all existing Sydney Water wastewater customers. Sydney Water's Operating Licences between 2005 and 2015 obligated Sydney Water to implement the PSP in a number of nominated villages.

Sydney Water made submissions to IPART in 2014 arguing that an obligation to implement the PSP should not be included in their Operating Licence, as the Operating Licence was meant to ensure a minimum standard of service to existing customers (which residents of Scotland Island are not). However, Scotland Island is mentioned in the Sydney Water Operating Licence 2019-2023, requiring Sydney Water to participate cooperatively with NSW Government review of the PSP and implement and comply with any outcomes from a review of the PSP.

In light of IPART's considerations and noting that they did not discount the need for delivery of improved services to Scotland Island, it is considered that changes in delivery efficiency, occupancy patterns on the island and impacts from existing systems warrant reconsideration of delivery of these essential services to Scotland Island.

As discussed above, there is an economic benefit in providing these services. Investigations suggest that it could be done at a cost lower than identified in Sydney Water's IPART submission. If so, the wastewater services could also be delivered at a lower indexed cost than those provided to Dangar Island, which was similar to Scotland Island in terms of servicing scope, environmental impact and need.



## 2 INTRODUCTION

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This report is to be read in conjunction with the reports ' Stage 1a Report: High Level Review of Environmental Factors', and 'Stage 1b Report: Scotland Island Feasibility Options' November 2019.

### 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. 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. RPS were engaged by Pressure System Solutions to undertake the Economic and Funding analysis component of the study.

This report is Stage 2 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.

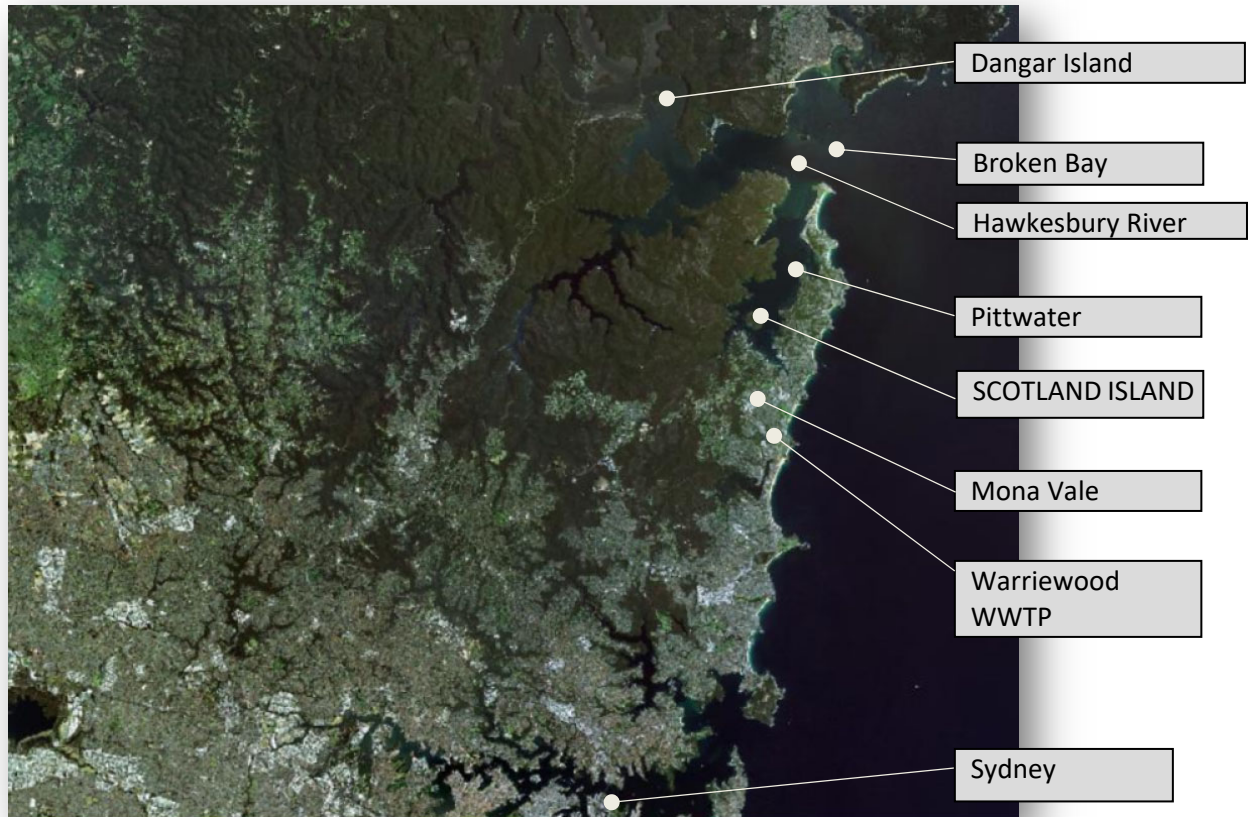
The objective of this Stage 2 report is to undertake a commercial assessment of the options shortlisted in Stage 1b.

### Stage 2 Commercial Assessment

The stage 2 commercial assessment includes.

- Economic Assessment
- Risk Assessment for
- Planning
- Technical
- Environmental
- Stakeholder and Community Acceptance
- Construction
- Commercial Assessment

**Figure 2-1: Scotland Island Location Plan**



## 2.1 Report Objective

The objective of this report is to present the Commercial Assessment of the Wastewater and Water Servicing Options for Scotland Island, and present information on potential funding and financing models, and project delivery options.

## 2.2 Scotland Island

Scotland Island is one of the larger villages in greater Sydney without a reticulated potable water supply or sewerage services. Scotland Island is about 55 ha and located at the southern end of the Pittwater estuary. There are approximately 358 dwellings on Scotland Island with suburban development density. The Island is in close proximity to the northern beaches and urban areas of Church Point, Bayview and Bigola Plateau. 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 historically fluctuated.

**Table 2-1: Scotland Island Population 2001 – 2016: Census Data**

Year	Population
2016	579
2011	715
2006	642
2001	734

Source: Australian Bureau of Statistics

**Figure 2-2: Scotland Island Urban Context**





## 2.3 Feasibility Study Process Overview

The feasibility study is being prepared in stages.

**Stage 1a** of the process was a high-level review of Social and Environmental factors.

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

- A. Wastewater Collection System Collection System
- B. Wastewater Treatment and/or Disposal
- C. Water Supply

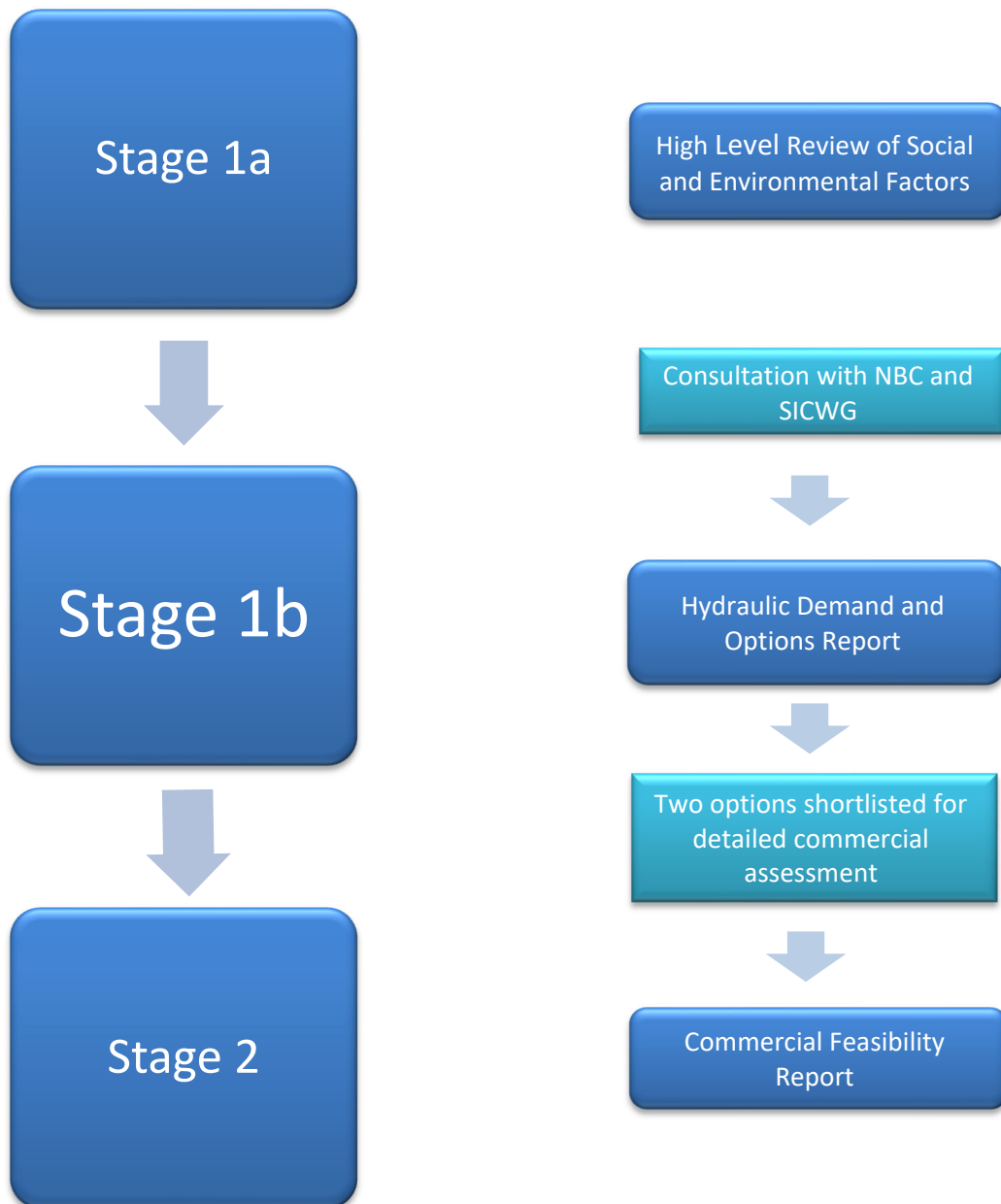
SHORTLISTED OPTIONS FROM STAGE 1B REPORT
<b>WASTEWATER SERVICING OPTIONS</b>
Pressure system
Hybrid system
<b>WASTEWATER DISPOSAL OPTIONS</b>
On-island treatment system
Discharge to Sydney Water
<b>WATER SUPPLY OPTIONS</b>
Low flow from Sydney Water
Full reticulated system from Sydney Water

**Stage 2** (this report) is the preparation of a commercial feasibility report examining the two short listed options for each category as determined in the Stage 1b report.

Preferred servicing options were selected from the Stage 1b report shortlisted options to facilitate some aspects of the commercial assessment. The preferred servicing options are:

- A. **WASTEWATER SERVICING: Pressure Sewer System**  
A pressure Sewer system is the preferred option because of the lower PV costs, and environmental benefits from less impact during construction.
- B. **WASTEWATER DISPOSAL: Disposal to Sydney Water sewage system.**  
Disposal of the wastewater to Sydney Water sewage system is preferred because of the lower PV costs, and reduced environmental impact to Pittwater.
- C. **WATER SUPPLY: Full reticulated water supply system from Sydney Water.**  
A fully reticulated water supply is preferred because it provides a level of service equitable to other customers within the Sydney Water area of operations.

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 with a community working group contributing at key milestones.



**Figure 2-3: Feasibility Process Overview**

## 2.4 Preferred Options

Refer to the Pressure System Solutions Stage 1b Report November 2019 for the determination of the Shortlisted Options.

The options shortlisted from the Stage 1b selection process for detailed costing and commercial funding modelling analysis are:

### **Wastewater Collection System options**

A.2 Pressure Sewerage System

A.4 Hybrid System, combination of gravity and pressure sewerage systems

### **Wastewater 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 Transport wastewater to a central pumping station and pump to Sydney Water sewerage system at Church point

### **Water Supply options**

C.4 Replace existing small bore supply, 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

### 3 RISK

A risk assessment was undertaken for the options. The risk assessment workshop was attended by

NAME	COMPANY	ROLE
Ruby Ardren	Northern beaches Council	Project Leader Water
Craig Kennedy	PS Solutions	Senior Civil Engineer
Steve Wallace	PS Solutions	Project Director
Gavin Ovens	GOH / PSS	Water Infrastructure Advisor
Chris Rust	PS Solutions	Design Manager
Kurt Dahl	Permeate Partners	Wastewater Treatment Consultant
Gareth Thomas	RPS	Environmental
Kapil Kulkarni	RPS	Investment Analysis

Refer to ATTACHMENT B: RISK ASSESSMENT for full risk analysis matrix including risk costing allowances.

#### 3.1 Indicative Costings from Risk Assessment

Each option was evaluated for risk and risk mitigation strategies and assessed as low, medium, high or extreme risk level.

Indicative costs were allocated to Risks rated as medium or higher after identification of mitigation strategies. These costs are not including in the project costing budgets.

**Table 3-1: Risk Item Costings**

RISK ITEMS CARRIED FORWARD FROM RISK ASSESSMENT		
Risk Item	Description	\$ (Excl GST)
P.1	Delays - Planning approvals	\$ 324,000
P.21	Coordination risk in underbore	\$ 100,000
E.2	Option B9 only, stringent operational conditions	\$ 1,500,000
C.4	Land slip, unstable ground	\$ 500,000
C.8	Excavations near structures requiring additional structural engineers assessment / support	\$ 40,000
C.25	Construction equipment / machinery access & movement around the Island	\$ 250,000
<b>TOTAL</b>		<b>\$ 2,714,000</b>



## 4 COMMERCIAL ANALYSIS METHODOLOGY

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### 4.1 Methodology

Commercial Analysis of the Scotland Island water servicing feasibility study included:

#### **COST ANALYSIS**

Indicative cost analysis for construction and operation, including capital costs, maintenance and operational costs, and present value estimates.

#### **CASE FOR INVESTMENT**

Case for Investment: assessing the economic, environmental, and indirect benefits of providing reticulated water and wastewater to the island, including

- a definition of the problem and the project need.
- a presentation of four infrastructure options that address these problems.
- a qualitative assessment of the benefits of supply infrastructure (Benefits Assessment); and
- an analysis of the potential funding models (Funding Analysis).

#### **DELIVERY MODELS**

Discussion on alternative delivery models, linked to financing model strategies.

## 5 CONSTRUCTION AND OPERATIONAL COSTS

Schedules of rates were prepared based on concept designs for all options. Costings for pipework infrastructure was developed with input from four contractors experienced in the construction of water and wastewater infrastructure.

- Abergeldie Complex Infrastructure
- Ledonne Constructions Pty Ltd
- Hills to Harbour Plumbing Pty Ltd
- Trenchless UEA

Costings for on property pressure sewer installations and water supply were prepared with input from two contractors experienced in retrofitting pressure sewer pump out systems into existing properties.

- Ledonne Constructions Pty Ltd
- Hills to Harbour Plumbing Pty Ltd

Costings for the Pittwater underbores were benchmarked from similar projects and consultation with HDD Contractors.

Costings for the On-site wastewater treatment plant was developed with input from Permeate Partners, Wastewater Treatment consultants.

### PRESENT VALUE ANALYSIS

Present Value analysis was undertaken on operational data obtained for existing similar wastewater collection systems, and similar scale local wastewater treatment plants.

**Table 5-1: Cost Plan Structure**

<b>COST PLAN STRUCTURE</b>
<b>SUMMARIES</b>
<b>CAPITAL COSTS SUMMARIES FOR ALL OPTIONS</b>
<b>NPV FOR ALL OPTIONS</b>
<b>SUMMARY OF CAPITAL COST COMBINATIONS OF OPTIONS</b>
<b>SUMMARY OF NPV COST COMBINATIONS OF OPTIONS</b>
<b>NPV DETAIL ASSESSMENTS</b>
<b>WASTEWATER NPV OPTION A2 and B11</b>
<b>WASTEWATER NPV OPTIONS A2 and B9</b>

COST PLAN STRUCTURE	
WASTEWATER NPV OPTIONS A4 and B11	
WASTEWATER NPV OPTIONS A4 and B9	
WATER SUPPLY NPV OPTIONS C4	
WATER SUPPLY NPV OPTIONS C6	
CAPITAL COST DETAIL SHEETS	
Wastewater Collection System Options	
A.2	Pressure Sewer System (377 LOTS)
A.4	Hybrid System
Wastewater Treatment and Disposal	
B.9	'On Island' Treatment System
B.11	Discharge to Sydney Water
Water Supply	
C.4	Low Flow from Sydney Water
C.6	Full Retic from Sydney Water

## 5.1 Costing Summaries

Refer to Attachment A for Capital Cost Detail Sheets

### 5.1.1 Summary Capital Costs by Cost Centre

**Table 5-2: Summary Capital Costs by Cost Centre**

COST CENTRE	ITEM		\$ (Excl GST)
<b>1: PROJECT MANAGEMENT</b>	1.1	Project Management	\$ 5,631,600
<b>2: DESIGN MANAGEMENT AND CONSTRUCTION MANAGEMENT</b>	2.1	Project Construction: Preliminaries and Site Establishment	\$ 11,485,722
<b>3: DESIGN AND CONSTRUCTION</b>	3.1	Wastewater Collection System Options	
		A.2 Pressure Sewer System (377 LOTS)	\$ 26,948,415
		A.4 Hybrid System	\$ 35,422,764
	3.2	Wastewater Treatment Disposal	
		B.9 'On Island' Treatment System	\$ 28,941,978
		B.11 Discharge to Sydney Water	\$ 9,586,700
	3.3	Water Supply	
		C.4 Low Flow from Sydney Water	\$ 14,110,728
		C.6 Full Retic from Sydney Water	\$ 14,776,326

### 5.1.2 Summary Capital Costs with Project and Construction Management attributed pro-rata to each option:-

**Table 5-3: Summary Costs by Option**

Option	\$ (Excl GST)
<b>Wastewater Collection System Options</b>	
A.2 Pressure Sewer System (377 LOTS)	\$ 35,174,419
A.4 Hybrid System	\$ 43,648,767
<b>Wastewater Treatment Disposal</b>	
B.9 'On Island' Treatment System	\$ 34,023,444
B.11 Discharge to Sydney Water	\$ 14,668,167
<b>Water Supply</b>	
C.4 Low Flow from Sydney Water	\$ 17,920,580
C.6 Full Retic from Sydney Water	\$ 18,586,178

### 5.1.3 Capital Cost Summary Combinations of Options

				COMBINATION 1		COMBINATION 2		COMBINATION 3		COMBINATION 4	
COST CENTRE	ITEM		\$ (Excl GST)	\$ (Excl GST)	Cost per Lot 377 serviced	\$ (Excl GST)	Cost per Lot 377 serviced	\$ (Excl GST)	Cost per Lot 377 serviced	\$ (Excl GST)	Cost per Lot 377 serviced
1: PROJECT MANAGEMENT	1.1	Project Management	\$5,631,600	\$ 5,631,600	\$ 14,938	\$ 5,631,600	\$ 14,938	\$ 5,631,600	\$ 14,938	\$ 5,631,600	\$ 14,938
2: DESIGN MANAGEMENT AND CONSTRUCTION MANAGEMENT	2.1	Project Construction: Preliminaries and Site Establishment	\$11,485,722	\$ 11,485,722	\$ 30,466	\$ 11,485,722	\$ 30,466	\$ 11,485,722	\$ 30,466	\$ 11,485,722	\$ 30,466
3: DESIGN AND CONSTRCTION	3.1	Wastewater Collection System Options									
		A.2 Pressure Sewer System (377 LOTS)	\$ 26,948,415	\$ 26,948,415	\$ 71,481						
		A.4 Hybrid System	\$ 35,422,764			\$ 35,422,764	\$ 93,960	\$ 35,422,764	\$ 93,960	\$ 35,422,764	\$ 93,960
	3.2	Wastewater Treatment Disposal									
		B.9 'On Island' Treatment System	\$ 28,941,978							\$ 28,941,978	\$ 76,769
		B.11 Discharge to Sydney Water	\$ 9,586,700	\$ 9,586,700	\$ 25,429	\$ 9,586,700	\$ 25,429	\$ 9,586,700	\$ 25,429		
	3.3	Water Supply									
		C.4 Low Flow from Sydney Water	\$ 14,110,728			\$ 14,110,728	\$ 37,429				
		C.6 Full Retic from Sydney Water	\$ 14,776,326	\$ 14,776,326	\$ 39,194			\$ 14,776,326	\$ 39,194	\$ 14,776,326	\$ 39,194
TOTAL				\$68,428,764	\$ 181,509	\$76,237,514	\$ 202,222	\$76,903,112	\$203,987	\$96,258,390	\$255,327

#### 5.1.4 Summary NPV Costs

**Table 5-4: Summary NPV Costs**

NPV Assessment		\$ (Excl GST)
<b>Wastewater Option Combination</b>	OPTION A2/B11: Pressure Sewerage System - Discharge to SWC Network	\$ 52,197,652.90
<b>Wastewater Option Combination</b>	OPTION A2/B9: Pressure Sewerage System - "On Island" STP	\$ 79,103,323.29
<b>Wastewater Option Combination</b>	OPTION A4/B11: Hybrid Sewerage System - Discharge to SWC Network	\$ 54,908,118.54
<b>Wastewater Option Combination</b>	OPTION A4/B9: Hybrid Sewerage System - "On Island" STP	\$ 82,229,397.19
<b>Water Supply Option</b>	OPTION C4: Low Flow Supply	\$ 18,261,285.62
<b>Water Supply Option</b>	OPTION C6: Full Flow Supply	\$ 18,912,047.93

## 6 CASE FOR INVESTMENT AND FUNDING ANALYSIS

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For detailed report refer to Attachment C: Report 'RPS: Scotland Island Water Infrastructure – Case for Investment: RPS May 2020'

### 6.1 Case for Investment

The 'case for Investment' assessment includes:

- a definition of the problem and the project need.
- a presentation of four infrastructure options that address these problems.
- a qualitative assessment of the benefits of supply infrastructure (Benefits Assessment); and
- an analysis of the potential funding models (Funding Analysis).

It should be noted that water and wastewater services are considered essential services. Moreover, these services are very rarely priced for full cost recovery (i.e. they are not financially self-sufficient), and cost benefit analyses (CBA) often do not always show a favourable economic benefit-cost ratio. However, such services are still provided to communities and considered to be in the public interest. In this case, the investigation of reticulated water and wastewater services responds to three main problems:

- **Problem 1:** Existing infrastructure not fit-for-purpose and failing / non-compliant.
- **Problem 2:** Perception of high cost without sufficient investigation.
- **Problem 3:** Inequity due to comparable services having been provided to similar communities.

The Case for Investment considered the following four potential infrastructure options:

- **Infrastructure Option 1:** Fully reticulated water supply with a pressure sewerage system that discharges to Sydney Water sewerage infrastructure located at Church Point.
- **Infrastructure Option 2:** Low flow reticulated water supply with a hybrid sewer system (pressure and gravity sewerage systems) that discharges to Sydney Water sewerage infrastructure located at Church Point.
- **Infrastructure Option 3:** Fully reticulated water supply with a hybrid sewer system that discharges to Sydney Water sewerage infrastructure located at Church Point.
- **Infrastructure Option 4:** Fully reticulated water supply with on island treatment for sewage and effluent discharging to Pittwater.



The Benefits Assessment shows that the options for water and sewerage servicing for the residents of Scotland Island:

- will significantly reduce health risks,
- provide equity by addressing a long-standing community need for the services, which have been provided to similar communities in the past, and at a cost that is comparable to similar schemes,
- improve the quality of service for island residents, and
- significantly improve the local environment, both on and off the island.

These benefits accrue to a broad range of stakeholders including island residents and visitors, the Council, the local environment, and recreational users of the Pittwater Bay.

Importantly, all infrastructure options were found to address problems 1-3, by providing water and wastewater services that are reliable and compliant with the required standards (addressing Problem 1), providing these at a cost comparable to previous schemes (addressing Problem 2), and resolving the inequity currently felt by the residents of Scotland Island (addressing Problem 3).

Among the four options, Infrastructure Option 1 is the most cost effective and is therefore the recommended option.

## 6.2 Summary Funding Analysis

The Funding Analysis investigated how the cost of the scheme could be recovered through funding from either SWC / the NSW Government (Funding Option 1), or by SWC / the NSW Government through co-contributions from island residents (Funding Option 2).

Funding the infrastructure through SWC (Funding Option 1) is the preferred option, as it leverages SWC's strong balance sheet and is much more likely to be accepted by the various stakeholders (i.e. SWC and island residents).

## 7 DELIVERY AND FUNDING STRATEGY

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This section of the report gives an overview of the potential delivery strategies for the Scotland Island water supply and wastewater schemes. Future refinement of the project planning will determine the strategy that will achieve the delivery of the services in the most effective way.

To consider the most effective delivery strategy requires the following key elements of the delivery process to be understood and considered. These key elements are as follows.

- Planning
- Ownership
- Funding \*
- Design
- Construction.
- O&M
- Revenue collection and customer management

\* Note: Attachment C: Report: 'RPS- Scotland Island Water Infrastructure – Case for Investment' provides additional commentary on Funding Options

The following table provides an initial review of these elements. These elements have been evaluated using the following criteria.

- cost of financing and
- delivery effectiveness for the scheme (in terms magnitude, complexity, and sensitivity).

The delivery elements were rated on a scale of 1 to 10 for likelihood of success, with 10 representing the highest likelihood of success.

## 7.1 Delivery Elements and the Key Providers

This opinion is provided for discussion purposes only, and is based on the industry and project experience of our team within the context of a feasibility study level of detail.

**Table 7-1: Delivery Strategy key Elements and Providers**

Delivery Element	Assessment Category	Key Provider and commentary				Preferred Provider Opportunity & Comment
<b>Asset Ownership (Administration to generate and manage the asset)</b>		Sydney Water	Investor / Superannuation fund	Private Water Utility		Sydney Water
	Cost of Financing	10	5	7		
	Delivery	7	3	8		
<b>Funding</b>		NSW Govt / TCorp	Sydney Water	Investor / Superannuation fund	Private Water Utility	NSW Govt / Sydney Water
	Cost of Financing	10	8	3	3	
	Delivery	10	9	3	3	

Delivery Element	Assessment Category	Key Provider and commentary				Preferred Provider Opportunity & Comment
<b>Design</b>		Sydney Water	Tier 1 Consultants	Industry Specialist Design Expert		Industry Specialist Design Expert
	Cost of Financing (Expensive to inexpensive)	6	7	9		
	Delivery	6	7	9		
<b>Construction.</b>		Tier 1 – e.g. John Holland Constructions, Acciona,  Lend Lease, Downer EDI, Ventia	Tier 2 – e.g., Abergeldie, Comdain,  Fulton Hogan,	Tier 3 – e.g. Ledonne Constructions, Ford Civil, Diona,		Tier 3 Contractor
	Cost of Financing ( 1 = High Cost: 10 = Low Cost )	6	7	8		
	Delivery	5	8	9		

Delivery Element	Assessment Category	Key Provider and commentary				Preferred Provider Opportunity & Comment
<b>Operation and Maintenance</b>		Sydney Water / Ventia	Tier 1 – e.g. Veolia, Tenix, Suez, Ventia	Private Water Utility		Sydney Water
	Cost of Financing ( 1 = High Cost: 10 = Low Cost )	7	8	7		
	Delivery	7	6	6		
<b>Revenue collection and customer management</b>		Sydney Water	Veolia, Suez, Trility	Private Water Utility		Sydney Water
	Cost of Financing	9	7	8		
	Delivery	9	7	8		

## 7.2 Delivery model opportunity assessment

An additional assessment has been undertaken on the various forms of delivery and is presented in the table below. The traditional delivery models presented below include a high-level description of each option. The delivery model would be developed during the next phase of the project to allocate the construction risk and identify the most effective structure to deliver the assets for both the Scotland Island residents and the asset owner.

**Table 7-2: Delivery Model Options**

Delivery Model Options	Description
<b>Construct only:</b>	The proponent retains full responsibility for design and documentation (via engaging a design consultant) and tenders for construction contractors.
<b>Early tenderer involvement (ETI):</b>	As a subset of the Construct Only delivery model, this model involves selecting shortlisted competing contractors to participate in value engineering and refinement of a client's preliminary designs.
<b>Design and construct (D&amp;C):</b>	The proponent contracts with a single entity that is responsible for both design and construction of the project
<b>Early contractor involvement (ECI):</b>	As a subset of the D&C delivery model, this model involves engaging a construction contractor prior to commencing a project to work in collaboration with the project sponsor
<b>Design, construct, maintain and operate (DCMO):</b>	The proponent contracts with a single entity that is responsible for both design and construction of the project, as well as the operations and maintenance components
<b>Alliance:</b>	The proponent enters into a transparent 'open book' co-operative contracting arrangement with the private sector wherein unforeseen risks and benefits are essentially shared
<b>Availability payment public private partnership (PPP):-</b>	A Special Purpose Vehicle (SPV) receives a guaranteed fixed payment from the proponent in return for delivering a project on behalf of the public sector (i.e. an availability payment)
<b>Build, own, operate, transfer (BOO/T)</b>	A SPV builds, owns and operates an asset for a specified period during which time the SPV is entitled to collect user charges

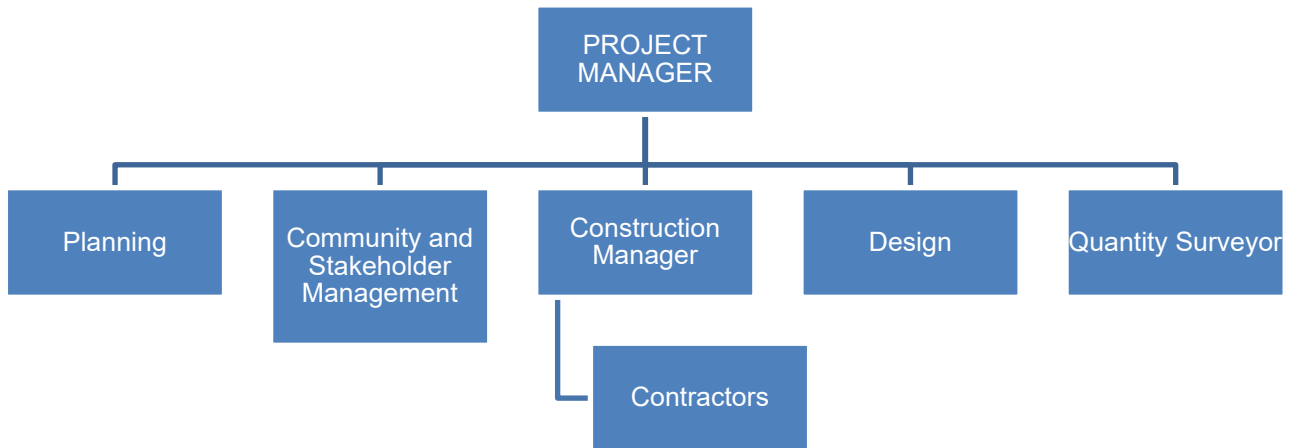
NOTE: This report is a technical and commercial assessment of water and wastewater servicing for Scotland Island. Determination and finalisation of funding and delivery models will need to be further assessed during the next planning phase of the project.

## 7.3 Recommendation form of project delivery

The complexities and planning constraints for the delivery of services on Scotland Island require a high level of environmental and community engagement capabilities. The level of integration required for planning and

design are not considered to favour a Design and Construct delivery model. A Project Manager with suitable capabilities in planning and design management is considered essential for successful management of social, environmental, technical, commercial and delivery risk.

**Figure 7-1: Recommended Construction Strategy**



## 7.4 Risk management

Within the contracting plan, a key success factor is to ensure each risk is allocated to the party best able to manage that risk.

A risk management plan will be developed and updated by the proponent if the project proceeds to tendering.

To minimise the risk of contract price escalation and construction risks, it is essential that the project scope and approval conditions are clearly defined, including the provision of pretender investigative information, such as geotechnical surveys etc.



## 8 CONCLUSION

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Scotland Island is a significant suburb within the greater metropolitan area of Sydney that is currently without a reticulated potable water service, or a wastewater collection system. The existing on-site wastewater systems are not operating efficiently, and the topography of Scotland Island, combined with the average lot size, present challenges to achieving compliant on-site disposal.

The existing water supply to Scotland Island is from rainwater tanks that are insufficiently sized to continuously supply a standard household without supplementary filling. Some supplementary filling takes place from a non-potable water supply that poses health risks to the community. The existing water supply pipework is unreliable, a small pipeline installed for emergency fire fighting purposes. The provision of reticulated water supply to Scotland Island is considered to be an essential health obligation.

There are health risks on the Island from poorly treated septic effluent discharge. Scotland Island is located in Pittwater, an area with significant recreational use, and there is a high risk of contaminants being discharged into the surrounding waterways, especially during wet weather events.

There is a history of lobbying by the community for provision of services, and several investigations have been undertaken regarding provision of services, including a preliminary project assessment by Sydney Water. There are challenges in providing the water and wastewater services to Scotland Island, such as limited sealed roadways, and steep topography with shallow soils. The high cost per lot of the project has, to date, prevented implementation of any works.

Servicing Scotland Island with a reticulated water supply and wastewater collection and disposal system will provide benefits to the residents of Scotland Island and the broader community.

It is considered there is sufficient local market capability and interest to enable a competitive tendering process.

## 9 GLOSSARY

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AS	Australian Standard
AWTS	Aerated Wastewater treatment System
BOO	Build Own Operate
BOOT	Build Own Operate Transfer
CBA	Commercial Benefit Analysis
CBR	Cost Benefit Ratio
D&C	Design and Construct
DBO	Design build Operate
DCMO	Design Construct Maintain and Operate
ECI	Early Contractor involvement
ETI	Early Tenderer Involvement
Ha	Hectare
HDD	Horizontal Direction Drill
IPART	Independent Pricing and regulatory Tribunal of NSW
M	meter
mm	millimetre
NBC	Northern Beaches Council
NPV	Nett Present Value
NZS	New Zealand Standard
O&M	Operation and Maintenance
PPP	Public Private Partnership
PSP	Priority Sewer Program
PV	Present Value
SPV	Special Purpose Vehicle
SWC	Sydney Water Corporation
TCorp	NSW Treasury Corporation
UTS	University of Technology Sydney

## 10 ATTACHMENT A: CAPITAL COSTS DETAIL SCHEDULES

### 10.1 CAPITAL COST SCHEDULES

#### 10.1.1 PROJECT PLANNING, COORDINATION AND CONSULTATION PRELIMINARIES

PROJECT PLANNING, COORDINATION AND CONSULTATION PRELIMINARIES					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>1</b>	Project Planning, Coordination and Consultation				
<b>1.1</b>	Environmental Impact Statement and Assessment including cultural and heritage assessment, TPZ and Arborists report,	1	Item	\$ 500,000	\$ 500,000
<b>1.2</b>	Engineering Survey includes individual properties, roads, public areas, HDD bore path across Pittwater	1	Item	\$ 400,000	\$ 400,000
<b>1.3</b>	Geotechnical Investigations across the entire Island.	1	Item	\$ 150,000	\$ 150,000
<b>1.5</b>	Community & Public Consultation	1	Item	\$ 250,000	\$ 250,000
<b>1.7</b>	Client Project Management Group	1	Item	\$ 2,500,000	\$ 2,500,000
	Subtotal Planning, Coordination and Consultation				\$ 3,800,000
	Plus Profit and Overheads 14%				\$ 532,000
	Total for Project Planning Preliminaries				\$ 4,332,000
	Plus 30% Contingency				\$ 1,299,600
	<b>Total Project Planning, Coordination and Consultation with contingency</b>				<b>\$ 5,631,600</b>

## 10.1.2 PROJECT CONSTRUCTION PRELIMINARIES

PROJECT CONSTRUCTION PRELIMINARIES					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>1</b>	<b>PRELIMINARY'S AND SITE ESTABLISHMENT</b>				
<b>1.1</b>	Mobilisation / Demobilisation including site amenities. Includes the following: 2 x portable site offices, 1 x Unisex Toilet block with showers and waste tank, 1 x Lunchroom, Poly rainwater tank, connection of power to the existing Community Hall, wireless NBN, installation and freight costs	1	Item	\$ 267,500	\$ 267,500
<b>1.1.1</b>	Barge hire (55ton 17m barge) and materials management including crane hire, loader hire and ancillary equipment to load and unload equipment at Church Point and the Island.	470	Days	\$ 5,750	\$ 2,702,500
<b>1.1.2</b>	Extra over ferry costs for transporting workers	1	Item	\$ 50,000	\$ 50,000
<b>1.2</b>	Prepare and Manage Construction Program (2hrs per week x \$120 per hour x 90 week construction period)	1	Item	\$ 21,600	\$ 21,600
<b>1.3</b>	Prepare & maintain Construction, Traffic & Environmental Management Plans. (40hrs initially to prepare plans plus 8 hrs per week to manage @ \$120 per hour)	1	Item	\$ 91,200	\$ 91,200
<b>1.4</b>	Prepare & maintain Environmental Controls and Waste Management Controls (8hrs per week x 2 guys plus materials)	1	Item	\$ 170,000	\$ 170,000
<b>1.5</b>	Prepare & maintain, Quality Assurance, Occupational Health & Safety Plans, including ITP's. (8hrs per week x \$120 per hour x 90 week construction period)	1	Item	\$ 86,400	\$ 86,400
<b>1.6</b>	Preparation of all permits, plans, community consultation and approvals required from statutory authorities and pay all required fees and charges. (Provisional Sum)	1	Item	\$ 100,000	\$ 100,000
<b>1.7</b>	'Dial Before You Dig' services locating including liaison with all relevant authorities for water/sewerage, power, communications etc	1	Item	\$ 9,600	\$ 9,600
<b>1.8</b>	Site setout and survey as per design documentation	1	Item	\$ 157,000	\$ 157,000
<b>1.9</b>	Prepare photographic record and Dilapidation Reports of existing site conditions prior to construction. (Includes Individual property photos and street main alignments)	1	Item	\$ 52,000	\$ 52,000

PROJECT CONSTRUCTION PRELIMINARIES					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
1.10	Traffic control including personnel, barriers, control signals etc. 90 wk program - 63 wks of TM	63	Week	\$ 7,500	\$ 472,500
1.11	Prepare and submit operations and maintenance manuals. (Provisional Sum)	1	Item	\$ 20,000	\$ 20,000
1.12	Work as Executed Documentation	377	Item	\$ 450	\$ 169,650
1.13	Construction Management/Engineering/Administration, Site Supervision, Community Consultation per week - includes, 1 x Senior Project Manager/Engineer, 1 x Mid Level Site Engineers, 2 x Site Supervisors, 1 x Community Liaison Officer 1 x admin support staff.	90	Item	\$ 24,780	\$ 2,230,200
1.14	Design, supply and install Scheme operations and maintenance depot/shed - includes power, water connection, lunch room, workshop, internet, air conditioning, storage, all weather access, security, fencing, architecture design, DA approval.	1	Item	\$ 350,000	\$ 350,000
1.15	Tree Removal, Arborist Report and Management, Removal off Island of wood and mulch as required.	1	Item	\$ 300,000	\$ 300,000
1.16	Existing storm water system upgrades/augmentation to prevent soil erosion from the construction activities.	20	Item	\$ 25,000	\$ 500,000
	Subtotal for Construction Preliminaries and Site Establishment				\$ 7,750,150
	Plus Head Contractor Profit and Overheads 14%				\$ 1,085,021
	Construction Preliminaries Total				\$ 8,835,171
	Plus 30% Contingency				\$ 2,650,551
	<b>Construction Preliminaries Total with Contingency</b>				<b>\$ 11,485,722</b>

### 10.1.3 COLLECTION SYSTEM OPTION A2: PRESSURE SEWER

COLLECTION SYSTEM OPTION A2: PRESSURE SEWER					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>1</b>	<b>PRELIMINARY'S AND DESIGN</b>				
<b>1.1</b>	Civil Design	1		\$ 540,000	\$ 540,000
<b>1.2</b>	On Property Design including plumbing, drainage and electrical assessments	377	Item	\$ 1,200	\$ 452,400
<b>Subtotal for Preliminaries and design.</b>					\$ 992,400
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>2</b>	<b>PIPE SUPPLY AND INSTALLATION BY OPEN CUT OR HDD</b>				
	Excavation by open cut &/or by horizontal directional boring, supply and installation of pipe ( <b>excluding wastage</b> ), fittings, detection tape (or wire where HDD), marker blocks and posts bedding, backfill, compaction, spoil disposal, shoring (as necessary) dewatering, restoration etc. All pressure sewerage system works required to co-ordinate, avoid and maintain soundness of existing underground services. QA/OH&S requirements, Principal's requirements & Australian Standards Pipe quantities are indicative only				
<b>2.1</b>	50 mm pipe (Polyethylene PE100 PN16 as specified)	1386	M	\$ 240.00	\$ 332,640
<b>2.2</b>	63 mm pipe (Polyethylene PE100 PN16 as specified)	1068	M	\$ 280.00	\$ 299,040
<b>2.3</b>	75 mm pipe (Polyethylene PE100 PN16 as specified)	1578	M	\$ 320.00	\$ 504,960
<b>2.4</b>	90 mm pipe (Polyethylene PE100 PN16 as specified)	1128	M	\$ 360.00	\$ 406,080
<b>2.5</b>	110mm pipe (Polyethylene PE100 PN16 as specified)	774	M	\$ 420.00	\$ 325,080
<b>2.6</b>	140mm pipe (Polyethylene PE100 PN16 as specified)	168	M	\$ 520.00	\$ 87,360
<b>2.6</b>	50mm rider mains	1000	M	\$ 240.00	\$ 240,000
<b>2.7</b>	Additional for excavation in rock (Provisional Sum average metre rate divided in half)	7102	M	\$ 170.00	\$ 1,207,340
<b>Subtotal for Pipe Supply and Installation</b>					\$ 3,402,500
<b>4</b>	TESTING AND COMMISSIONING OF THE PRESSURE SEWERAGE PIPELINE.	7102	M	\$ 8.00	\$ 56,816
<b>Subtotal for Testing and Commissioning of the Pressure Sewer Pipeline</b>					\$ 56,816
<b>5</b>	VALVING				

COLLECTION SYSTEM OPTION A2: PRESSURE SEWER					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
	Isolation Valves with polyethylene stub connections including electro fusion connection couplers, reducers and other fittings where required, path box, spindle riser, orange spindle cap identifying any Normally Closed valves, back fill, identification plate or post and restoration.				
	OR				
	Isolation valve including 316 stainless steel backing rings, nuts, bolts, washers and extension spindles, orange spindle cap identifying any Normally Closed valves, path box, spindle riser, back fill, identification plate or post and restoration.				
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
5.1	50 mm Isolation Valves	20	No	\$ 2,500	\$ 50,000
5.2	80 mm Isolation Valves	30	No	\$ 3,500	\$ 105,000
5.3	100 mm Isolation Valves	10	No	\$ 4,500	\$ 45,000
<b>Sub Total for Isolation valves</b>					\$ 200,000
6	FLUSHING POINTS				
	Flushing Point supply and installation of end of line or in-line flushing point including connection to the pressure sewer system street main				
6.1	Connection to main 50mm to 100mm (Light duty trafficable Class B)	25	No	\$ 4,500	\$ 112,500
<b>Subtotal for Flushing Points</b>					\$ 112,500
7	AIR VALVES				
	Supply and install air valves connected to the pressure sewer main including materials, labour, testing, commissioning, restoration				
7.1	Inground Air Valve supply and installation connected to the pressure sewer main	10	Item	\$ 30,000	\$ 300,000
<b>Subtotal for Air Valves</b>					\$ 300,000
8	ON PROPERTY WORKS				
8.1	Property Connections (including installation of Boundary Kit & Access Box and supply and installation of required 40mm PE100 PN16 polyethylene pipe and conduit where required, identification plate or post)				
	Connection to Pressure Sewer Main	377	No.	\$ 3,000	\$ 1,131,000
	On Property Works - Pressure Sewer Unit Supply incl telemetry	377	No.	\$ 6,700	\$ 2,525,900
	On Property Works - Pressure Sewer Unit Installation and Commissioning	377	No.	\$ 17,000	\$ 6,409,000



COLLECTION SYSTEM OPTION A2: PRESSURE SEWER					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
	On Property Works - Plumbing Connection, Upgrade and Septic Decommissioning	377	No.	\$ 7,500	\$ 2,827,500
	Boundary kits (Supply)	377	No.	\$ 600	\$ 226,200
<b>Subtotal for Miscellaneous Items</b>					\$ 13,119,600
<b>Pressure Sewerage Collection System Cost Estimate Summary</b>					
Item	Description of Work Item				Total (Excluding GST)
1	PRELIMINARY'S AND DESIGN				\$ 992,400
2	PIPE SUPPLY AND INSTALLATION BY OPEN CUT OR HDD				\$ 3,402,500
4	TESTING AND COMMISSIONING OF THE PRESSURE SEWERAGE PIPELINE.				\$ 56,816
5	VALVING				\$ 200,000
6	FLUSHING POINTS				\$ 112,500
7	AIR VALVES				\$ 300,000
8	ON PROPERTY WORKS				\$ 13,119,600
				TOTAL	\$ 18,183,816
	PLUS LEAD CONTRACTOR OVERHEADS AND PROFIT 14%				\$ 2,545,734
<b>TOTAL COST ESTIMATE</b>					
A	COLLECTION SYSTEM COST ESTIMATE				\$ 20,729,550
C	CONTINGENCY			30%	\$ 6,218,865
				TOTAL	\$ 26,948,415

#### 10.1.4 COLLECTION SYSTEM OPTION A4: HYBRID GRAVITY AND PRESSURE

COLLECTION SYSTEM OPTION A4: HYBRID GRAVITY AND PRESSURE					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>1</b>	<b>PRELIMINARIES AND DESIGN</b>				
<b>1.1</b>	Civil Design	1		\$ 1,050,000	\$ 1,050,000
<b>1.2</b>	Extra Over Geotech Report for Land Stabilisation Report	1		\$ 150,000	\$ 150,000
<b>1.3</b>	Extra Over Tree Removal, Arborist Report and management	1		\$ 300,000	\$ 300,000
<b>1.4</b>	On Property Design including plumbing, drainage and electrical assessments	275	Item	\$ 1,200	\$ 330,000
<b>1.5</b>	On Property Design including nominating the gravity connection point and depth	102	Item	\$ 250	\$ 25,500
<b>Subtotal for Preliminaries and Design</b>					\$ 1,830,000
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>2</b>	<b>PIPE SUPPLY AND INSTALLATION BY OPEN CUT OR HDD</b>				
	Excavation by open cut &/or by horizontal directional boring, supply and installation of pipe (excluding wastage), fittings, detection tape (or wire where HDD), marker blocks and posts bedding, trench stops, backfill, compaction, spoil disposal, shoring (as necessary) dewatering, restoration etc. All pressure sewerage system works required to co-ordinate, avoid and maintain soundness of existing underground services. QA/OH&S requirements, Principal's requirements & Australian Standards Pipe quantities are indicative only				
<b>2.1</b>	50 mm pipe (Polyethylene PE100 PN16 as specified)	750	M	\$ 240.00	\$ 180,000
<b>2.2</b>	63 mm pipe (Polyethylene PE100 PN16 as specified)	400	M	\$ 280.00	\$ 112,000
<b>2.3</b>	110 mm pipe (Polyethylene PE100 PN16 as specified)	1250	M	\$ 420.00	\$ 525,000
<b>2.4</b>	125 mm pipe (Polyethylene PE100 PN16 as specified)	800	M	\$ 490.00	\$ 392,000
<b>2.5</b>	180 mm pipe (Polyethylene PE100 PN16 as specified)	400	M	\$ 600.00	\$ 240,000
<b>2.6</b>	150mm PVC DWV SN8	3300	M	\$ 900.00	\$ 2,970,000
<b>2.7</b>	Additional for excavation in rock (Provisional Sum)	6900	M	\$ 203.00	\$ 1,400,700
<b>Subtotal for Pipe Supply and Installation</b>					\$ 5,819,700
<b>4</b>	<b>TESTING AND COMMISSIONING OF THE PRESSURE SEWERAGE AND GRAVITY PIPELINES.</b>	6900	M	\$ 12.00	\$ 82,800
<b>Subtotal for testing and commissioning</b>					\$ 82,800
<b>5</b>	<b>VALVING</b>				
	Isolation Valves				
	Isolation Valves with polyethylene stub connections including electro fusion connection couplers, reducers and other fittings where required, path box, spindle riser, orange spindle cap identifying any Normally Closed valves, back fill, identification plate or post and restoration.				

COLLECTION SYSTEM OPTION A4: HYBRID GRAVITY AND PRESSURE					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
	OR				
	Isolation valve including 316 stainless steel backing rings, nuts, bolts, washers and extension spindles, orange spindle cap identifying any Normally Closed valves, path box, spindle riser, back fill, identification plate or post and restoration.				
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
5.1	50 mm Isolation Valves	6	No	\$ 2,500	\$ 15,000
5.2	100 mm Isolation Valves	20	No	\$ 4,500	\$ 90,000
5.3	150 mm Isolation Valves	5	No	\$ 6,000	\$ 30,000
<b>Sub Total for Isolation valves</b>					\$ 135,000
6	FLUSHING POINTS				
	Flushing Point supply and installation of end of line or in-line flushing point including connection to the pressure sewer system street main				
6.1	Connection to main 50mm to 100mm (Light duty trafficable Class B)	15	No	\$ 4,500	\$ 67,500
<b>Subtotal for Flushing Points</b>					\$ 67,500
7	AIR VALVES				
	Supply and install air valves connected to the pressure sewer main including materials, labour, testing, commissioning, restoration				
7.1	Inground Air Valve supply and installation connected to the pressure sewer main	6	Item	\$ 30,000	\$ 180,000
<b>Subtotal for Air Valves</b>					\$ 180,000
8	PROPERTY CONNECTIONS				
8.1	Property Connections				
	100mm Gravity Connection Point - Same Side of Road as main line	51	No.	\$ 5,500	\$ 280,500
	100mm Gravity Connection - Other Side of Road	51	No.	\$ 9,000	\$ 459,000
	Pressure Sewer Connection to Main	275	No.	\$ 5,000	\$ 1,375,000
	On Property Works - Pressure Sewer Unit Supply	275	No.	\$ 6,000	\$ 1,650,000
	On Property Works - Pressure Sewer Unit Installation and Commissioning	275	No.	\$ 17,000	\$ 4,675,000
	On Property Works - Plumbing Connection, Upgrade and Septic Decommissioning for Pressure Sewer Properties	275	No.	\$ 7,500	\$ 2,062,500
	On Property Works - Plumbing Connection, Upgrade and Septic Decommissioning for Gravity Sewer Properties	102	No.	\$ 12,500	\$ 1,275,000
	Boundary kits (Supply)	275	No.	\$ 600	\$ 165,000
<b>Subtotal for Miscellaneous Items</b>					\$ 11,942,000
9	GRAVITY SEWER WORKS				
9.1	Supply and install concrete Manholes/Access Chambers/Maintenance Shafts	65	No	\$13,000	\$845,000

COLLECTION SYSTEM OPTION A4: HYBRID GRAVITY AND PRESSURE					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
8.2	Satellite SPS including telemetry controls and overflow storage. Includes hard stand areas for maintenance, servicing, retaining walls, fencing, safety rails, lighting and earthworks if required.	4	Item	\$ 750,000	\$ 3,000,000
<b>Subtotal for Gravity Sewer</b>					\$ 3,845,000
<b>Pressure Sewerage Collection System Cost Estimate Summary</b>					
Item	Description of Work Item				Total (Excluding GST)
1	PRELIMINARIES AND DESIGN				\$ 1,830,000
2	PIPE SUPPLY AND INSTALLATION BY OPEN CUT OR HDD				\$ 5,819,700
4	TESTING AND COMMISSIONING OF THE PRESSURE SEWERAGE AND GRAVITY PIPELINES.				\$ 82,800
5	VALVING				\$ 135,000
6	FLUSHING POINTS				\$ 67,500
7	AIR VALVES				\$ 180,000
8	PROPERTY CONNECTIONS				\$ 11,942,000
9	GRAVITY SEWER WORKS				\$ 3,845,000
				TOTAL	\$ 23,902,000
	PLUS LEAD CONTRACTOR PROFIT AND OVERHEAD			14%	\$ 3,346,280
<b>TOTAL COST ESTIMATE</b>					
A	COLLECTION SYSTEM COST ESTIMATE				\$ 27,248,280
C	CONTINGENCY			30%	\$ 8,174,484
				TOTAL	\$ 35,422,764

### 10.1.5 WASTE DISPOSAL SYSTEM OPTION B9: ON ISLAND TREATMENT DISPOSAL TO PITTWATER

WASTE DISPOSAL SYSTEM OPTION B9: ON ISLAND TREATMENT DISPOSAL TO PITTWATER			
<b>WASTEWATER TREATMENT PLANT</b>			
Installed capacity (kL/day)		Capacity	150 kL/day
Preliminaries			
Inlet works			\$ 705,000
Odour treatment			\$ 262,000
Bioreactor			\$ 2730,000
Membrane filtration			\$ 630,000
UV Disinfection			\$ 165,000
Treated water storage and distribution			\$ 202,000
Sludge handling			\$ 315,000
Chemical systems/storage			\$ 412,000
Plant sump			\$ 156,000
Buildings			\$ 1500,000
Roadways, earthworks, siteworks, landscaping and fencing			\$ 1,600,000
Electrical, control, and instrumentation			\$ 1,042,000
Commissioning, validation and training			\$ 300,000
Services			\$ 130,000
<b>WASTEWATER TREATMENT PLANT SUB TOTAL</b>	<b>SUB-TOTAL CAPEX</b>		<b>\$ 10,149,000</b>
<b>ASSOCIATED WORKS</b>			
Extra Over Environmental Impact Statement			\$ 500,000
Specific Site Engineer for Treatment Plant Construction			\$ 180,000
Land Acquisition			\$ 1,500,000
Access Roads			\$ 1,000,000
Wastewater Outfall to Pittwater			\$ 6,200,000
Sub Total			\$ 19,529,000
Plus Head Contractor Profit and Overheads 14%			\$ 2,734,060
Sub Total for 'On Island' Treatment Plant and associated works			<b>\$ 22,263,060</b>
Plus 30% Contingency			\$ 6,678,918
<b>Total for Island Treatment Plant</b>			<b>\$ 28,941,978</b>

## 10.1.6 WASTE DISPOSAL SYSTEM OPTION B11: PUMP TO SYDNEY WATER

WASTE DISPOSAL SYSTEM OPTION B11: PUMP TO SYDNEY WATER					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
9	HDD Bay Crossing and SPS				
9.1	SPS including telemetry controls and overflow storage	1	Item	\$ 3,500,000	\$ 3,500,000
9.2	Chemical dosing facility	1	Item	\$ 400,000	\$ 400,000
9.3	Connection to Church Point Sewer	1	Item	\$ 250,000	\$ 250,000
9.4	Supply and installation of DN 100 ABB WaterMaster Flowmeter in pre-cast 900x1200 pit connected with remote mounted display unit inside SPS panel	1	Item	\$ 15,000	\$ 15,000
9.6	Design	1	item	\$ 200,000	\$ 200,000
	Sub Total SPS				\$ 4,365,000
9.7	HDD Bay Crossing				
	PE100 PN20, 280mm conduit with 140mm product pipe	680	M	\$850	\$578,000
	Equipment set-up	1	Item	\$250,000	\$250,000
	140mm Pipe Supply	680	M	\$60	\$40,800
	280mm PE Conduit Supply	680	M	\$120	\$81,600
	Pipe Jointing	115	No	\$400	\$46,000
	Leak detection system	1	No	\$150,000	\$150,000
	Subtotal				\$1,146,400
	Design, Geotech & Survey	15%			\$171,960
	Contingency	20%			\$263,672
	Prelims, supervision, overheads and profit	37%			\$521,727
	Subtotal HDD Bay Crossing				\$2,103,759
<b>SUBTOTAL HDD BAY CROSSING AND SPS</b>					<b>\$ 6,468,759</b>
<b>Sewer Pump Station and Rising Main across Pittwater Cost Estimate Summary</b>					
Item	Description of Work Item				Total (Excl GST)
9	HDD Bay Crossing and SPS				\$ 6,468,759
	Plus Head Contractor Profit and Overheads 14%				\$ 905,626
<b>TOTAL COST ESTIMATE</b>					
A	DISCHARGE SYSTEM				\$ 7,374,385
C	CONTINGENCY			30%	\$ 2,212,315
				TOTAL	\$ 9,586,700

## 10.1.7 WATER C4 LOW FLOW SYSTEM FROM SYDNEY WATER

WATER C4 LOW FLOW SYSTEM FROM SYDNEY WATER					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>1</b>	PRELIMINARY'S AND DESIGN				
<b>1.14</b>	Civil Design	1	Item	\$ 300,000	\$ 300,000
<b>1.16</b>	Wate Booster Pumping Station Design	1	Item	\$ 120,000	\$ 120,000
<b>1.3</b>	On Property Design - water assessment to verify RWT connection and potable supply to kitchen.	377	Item	\$ 450	\$ 169,650
<b>Subtotal for Preliminaries and Design</b>					\$ 420,000
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>2</b>	PIPE SUPPLY AND INSTALLATION BY OPEN CUT OR HDD				
	Excavation by open cut &/or by horizontal directional boring, supply and installation of pipe (excluding wastage), fittings, detection tape (or wire where HDD), marker blocks and posts bedding, backfill, compaction, spoil disposal, shoring (as necessary) dewatering, restoration etc. All pipework required to co-ordinate, avoid and maintain soundness of existing underground services. QA/OH&S requirements, Principal's requirements & Australian Standards				
<b>2.1</b>	110 mm pipe (Polyethylene PE100 PN16 as specified)	5000	M	\$ 420.00	\$ 2,100,000
<b>2.6</b>	140mm pipe (Polyethylene PE100 PN16 as specified)	400	M	\$ 520.00	\$ 208,000
<b>2.7</b>	Additional for excavation in rock	5400	M	\$ 470.00	\$ 2,538,000
<b>Subtotal for Pipe Supply and Installation</b>					\$ 4,846,000
<b>4</b>	TESTING AND COMMISSIONING	5400	M	\$ 15.00	\$ 81,000
<b>5</b>	VALVING				
	Isolation Valves with polyethylene stub connections including electro fusion connection couplers, reducers and other fittings where required, path box, spindle riser, orange spindle cap identifying any Normally Closed valves, back fill, identification plate or post and restoration.				
	OR				
	Isolation valve including 316 stainless steel backing rings, nuts, bolts, washers and extension spindles, orange spindle cap identifying any Normally Closed valves, path box, spindle riser, back fill, identification plate or post and restoration.				

WATER C4 LOW FLOW SYSTEM FROM SYDNEY WATER					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>Item</b>	<b>Description of Work</b>	<b>Qty</b>	<b>Unit</b>	<b>Rate \$</b>	<b>Totals \$</b>
5.1	100 mm Isolation Valves	35	No	\$ 4,500	\$ 157,500
<b>Sub Total for Isolation valves</b>					\$ 157,500
6	Hydrant POINTS				
	Supply and Install Hydrants as per Sydney Water specification				
6.1	Hydrants	55	No	\$ 3,500	\$ 192,500
<b>Subtotal for hydrant Points</b>					\$ 192,500
7	AIR VALVES				
	Supply and install air valves connected to the water main including materials, labour, testing, commissioning, restoration				
7.1	In ground Air Valve supply and installation	6	Item	\$ 7,500	\$ 45,000
<b>Subtotal for Air Valves</b>					\$ 45,000
8	PROPERTY CONNECTIONS				
8.1	Property Connections (including installation of Water Meter and supply and installation of required 25mm PE100 PN16 polyethylene pipe and conduit where required, identification plate or post)				
	Connection of Property to Water Main	377	No.	\$ 3,000	\$ 1,131,000
	Water Meters including copper upstand and isolation valve (Supply and install)	377	No.	\$ 450	\$ 169,650
<b>Subtotal for Property Connections</b>					\$ 1,300,650
9	MISCELLANEOUS ITEMS				
9.1	Supply and install WPS including telemetry controls	1	Item	\$ 250,000	\$ 250,000
9.3	Connection to Church Point Water Main	1	Item	\$ 100,000	\$ 100,000
9.4	Supply and installation of DN 100 flow meter at the WPS	1	Item	\$ 25,000	\$ 25,000
<b>Subtotal for Miscellaneous Items</b>					\$ 375,000
10	HDD Bay Crossing				
10.1	HDD Bay Crossing				
	PE100 PN20, 280mm conduit with 140mm product pipe	680	M	\$850	\$578,000
	Equipment set-up	1	Item	\$250,000	\$250,000
	140mm PE Pipe Supply	680	M	\$60	\$40,800



WATER C4 LOW FLOW SYSTEM FROM SYDNEY WATER					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
	280mm PE Conduit Supply	680	M	\$120	\$81,600
	Pipe Jointing	115	No	\$400	\$46,000
	Leak detection system	1	No	\$150,000	\$150,000
	Subtotal				\$1,146,400
	Design, Geotech & Survey	15%			\$171,960
	Contingency	20%			\$263,672
	Prelims, supervision, overheads and profit	37%			\$521,727
	Subtotal HDD Bay Crossing				\$2,103,759
<b>Sub Total Low Flow Water Reticulation Cost Estimate Summary</b>					
Item	Description of Work Item				Total (Excluding GST)
1	PRELIMINARY'S AND DESIGN				\$ 420,000
2	PIPE SUPPLY AND INSTALLATION BY OPEN CUT OR HDD				\$ 4,846,000
4	TESTING AND COMMISSIONING				\$ 81,000
5	VALVING				\$ 157,500
6	HYDRANT POINTS				\$ 192,500
7	AIR VALVES				\$ 45,000
8	PROPERTY CONNECTIONS				\$ 1,300,650
9	MISCELLANEOUS				\$ 375,000
10	HDD Bay Crossing				\$ 2,103,759
<b>Sub Total Low Flow Water Reticulation Cost Estimate Summary</b>					\$ 9,521,409
	Plus Head Contractor Profit and Overheads 14%				\$ 1,332,997
					\$ 10,854,406
	Plus Contingency 30%				\$ 3,256,322
	<b>Total Low Flow Water Reticulation Cost Estimate Summary</b>				\$ 14,110,728
<b>ON PROPERTY WORKS FOR WATER CONNECTION TO A LOW FLOW SYSTEM</b>					
	Connect a 25mm PE water supply pipe from the water meter to the properties existing RWT with float valve and flow restrictor.	377	No.	\$ 3,500	\$ 1,319,500

WATER C4 LOW FLOW SYSTEM FROM SYDNEY WATER					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
	Connect a 25mm PE water supply pipeline from the water meter connection to the kitchen area of the house providing a potable water supply for drinking/cooking etc	377	No.	\$ 2,500	\$ 942,500
<b>TOTAL CONNECTION COST FOR COMMUNITY TO CONNECT TO THE LOW FLOW WATER SYSTEM</b>					\$ 2,262,000
<b>Cost per lot</b>		377			\$ 6,000

## 10.1.8 WATER C6 FULL RETICULATION FROM SYDNEY WATER

WATER C6 FULL RETICULATION FROM SYDNEY WATER					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>1</b>	PRELIMINARY'S AND DESIGN				
<b>1.1</b>	Civil Design	1	Item	\$300,000	\$ 300,000
<b>1.2</b>	WPS Design	1	Item	\$120,000	\$ 120,000
<b>Subtotal for Preliminaries and Design</b>					\$ 420,000
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>2</b>	PIPE SUPPLY AND INSTALLATION BY OPEN CUT OR HDD				
	Excavation by open cut &/or by horizontal directional boring, supply and installation of pipe (excluding wastage), fittings, detection tape (or wire where HDD), marker blocks and posts bedding, backfill, compaction, spoil disposal, shoring (as necessary) dewatering, restoration etc. All pipework required to co-ordinate, avoid and maintain soundness of existing underground services. QA/OH&S requirements, Principal's requirements & Australian Standards				
<b>2.1</b>	125 mm pipe (Polyethylene PE100 PN16 as specified)	2700	M	\$ 490.00	\$ 1,323,000
<b>2.2</b>	180 mm pipe (Polyethylene PE100 PN16 as specified)	2700	M	\$ 600.00	\$ 1,620,000
<b>2.7</b>	Additional for excavation in rock	5400	M	\$ 272.00	\$ 1,468,800
<b>Subtotal for Pipe Supply and Installation</b>					\$ 4,411,800
<b>4</b>	TESTING AND COMMISSIONING OF THE WATER MAIN	5400	M	\$ 15.00	\$ 81,000
<b>5</b>	VALVING				
	Isolation Valves with polyethylene stub connections including electro fusion connection couplers, reducers and other fittings where required, path box, spindle riser, orange spindle cap identifying any Normally Closed valves, back fill, identification plate or post and restoration.				
	OR				
	Isolation valve including 316 stainless steel backing rings, nuts, bolts, washers and extension spindles, orange spindle cap identifying any Normally Closed valves, path box, spindle riser, back fill, identification plate or post and restoration.				
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>5.1</b>	100 mm Isolation Valves	15	No	\$ 4,500	\$ 67,500
<b>5.2</b>	150 mm Isolation Valves	20	No	\$ 6,000	\$ 120,000

WATER C6 FULL RETICULATION FROM SYDNEY WATER					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
<b>Sub Total for Isolation valves</b>					\$ 187,500
<b>6</b>	Hydrant POINTS				
	Supply and Install Hydrants as per Sydney Water specification				
<b>6.1</b>	Hydrants	55	No	\$ 3,500	\$ 192,500
<b>Subtotal for hydrant Points</b>					\$ 192,500
<b>7</b>	AIR VALVES				
	Supply and install air valves connected to the water main including materials, labour, testing, commissioning, restoration				
<b>7.1</b>	In ground Air Valve supply and installation.	6	Item	\$ 7,500	\$ 45,000
<b>Subtotal for Air Valves</b>					\$ 45,000
<b>8</b>	PROPERTY CONNECTIONS				
<b>8.1</b>	Property Connections (including installation of Water Meter and supply and installation of required 25mm PE100 PN16 polyethylene pipe and conduit where required, identification plate or post)				
	Connection of Property to Water Main	377	No.	\$ 3,000	\$ 1,131,000
	Water Meters including copper upstand and isolation valve (Supply and install)	377	No.	\$ 450	\$ 169,650
<b>Subtotal for Property Connections</b>					\$ 1,300,650
<b>9</b>	MISCELLANEOUS ITEMS				
<b>9.1</b>	Supply and install WPS including telemetry controls	1	Item	\$ 250,000	\$ 250,000
<b>9.3</b>	Connection to Church Point Water Main	1	Item	\$100,000	\$ 100,000
<b>9.4</b>	Supply and installation of DN 100 flow meter at the WPS	1	Item	\$ 25,000	\$ 25,000
<b>Subtotal for Miscellaneous Items</b>					\$ 375,000
<b>10</b>	HDD Bay Crossing				
	PE100 PN16, 450mm conduit with 280mm product pipe	680	M	\$1,300	\$884,000
	Equipment set-up	1	Item	\$250,000	\$250,000
	250mm PE Pipe Supply	680	M	\$80	\$54,400
	450mm PE Conduit Supply	680	M	\$300	\$204,000
	Pipe Jointing	115	No	\$600	\$69,000
	Leak detection system	1	No	\$150,000	\$150,000
	Subtotal				\$1,611,400
	Design, Geotech & Survey	15%			\$241,710
	Contingency	20%			\$370,622

WATER C6 FULL RETICULATION FROM SYDNEY WATER					
Item	Description of Work	Qty	Unit	Rate \$	Totals \$
	Prelims, supervision, overheads and profit	37%			\$733,348
	Subtotal HDD Bay Crossing				\$2,957,080
<b>Sub Total Full Flow Water Reticulation Cost Estimate Summary</b>					
Item	Description of Work Item				Total (Excluding GST)
1	PRELIMINARY'S AND DESIGN				\$ 420,000
2	PIPE SUPPLY AND INSTALLATION BY OPEN CUT OR HDD				\$ 4,411,800
4	TESTING AND COMMISSIONING OF THE WATER MAIN				\$ 81,000
5	VALVING				\$ 187,500
6	HYDRANT POINTS				\$ 192,500
7	AIR VALVES				\$ 45,000
8	PROPERTY CONNECTIONS				\$ 1,300,650
9	MISCELLANEOUS ITEMS				\$ 375,000
9	HDD Bay Crossing				\$ 2,957,080
					\$ 9,970,530
	Plus Head Contractor Profit and Overheads 14%				\$ 1,395,874
	Sub Total Full Flow Water Reticulation Cost Estimate Summary				\$ 11,366,404
	Plus 30% Contingency				\$ 3,409,921
	Total Full Flow Water Reticulation Cost Estimate Summary			Total	\$ 14,776,326
<b>ON PROPERTY WORKS FOR WATER CONNECTION TO A FULL FLOW SYSTEM</b>					
	Connect a 25mm PE water supply pipe from the water meter to the properties existing water pipe infrastructure, where required upgrade piping to ensure compliance with AS/NZS3500.	377	No.	\$ 5,000	\$ 1,885,000
<b>TOTAL CONNECTION COST FOR COMMUNITY TO CONNECT TO THE FULL FLOW WATER SYSTEM</b>					\$ 1,885,000
<b>Cost per lot</b>		377			\$ 5,000

## 10.2 PV DETAILED SCHEDULES

### PV Criteria and Factors

CRITERIA	
PV	50 yr.
Interval Factors	
yr.	NPV Factor
1	13.8007
5	0.713
10	0.5083
15	0.3624
20	0.2584
25	0.1842
30	0.1313
35	0.0936
40	0.0668
45	0.0476
50	0.0339

### 10.2.1 OPTION A2/B11: Pressure Sewerage System - Discharge to SWC Network

1. WASTEWATER								Rev	A
OPTION A2/B11: Pressure Sewerage System - Discharge to SWC Network								Date	12/11/2019
NPV ANALYSIS	50 Year								
ITEM	COST \$	Interval yr.		Present Value Calculation		Present Value \$			
		yr.	Factor	Unit	No.	Capital Investment	Operating	Maintenance	Replacement
Pressure Sewer System - Discharge to SWC Network	\$ 49,842,585					\$ 49,842,585			
Operating Costs (PSS Units, Booster SPS)	\$ 6,598	1	13.8007	Overall	1		\$ 91,057		
Maintenance Costs (PSS Units, Booster SPS, Telemetry, Chemical Dosing Plant, Network Mains)	\$ 123,269	1	13.8007	Overall	1			\$ 1,701,198	
Replacement PSU Pump and Control Panel including transducer and aux float switch)	\$ 3,350	15	0.3624	PSU	377				\$ 457,693
Replacement PSU Pump and Control Panel including transducer and aux float switch)	\$ 3,350	30	0.1313	PSU	377				\$ 165,825
Replacement PSU Pump and Control Panel including transducer and aux float switch)	\$ 3,350	45	0.0476	PSU	377				\$ 60,116
Replacement SPS Pump and Control Panel	\$ 90,000	15	0.3624	SPS	1				\$ 32,616
Replacement SPS Pump and Control Panel	\$ 90,000	30	0.1313	SPS	1				\$ 11,817
Replacement SPS Pump and Control Panel	\$ 90,000	45	0.0476	SPS	1				\$ 4,284
Replacement Dosing Pump and Control Panel	\$ 10,000	15	0.3624	SPS	1				\$ 3,624
Replacement Dosing Pump and Control Panel	\$ 10,000	30	0.1313	SPS	1				\$ 1,313
Replacement Dosing Pump and Control Panel	\$ 10,000	45	0.0476	SPS	1				\$ 476
						\$ 49,842,585	\$ 91,057	\$ 1,701,198	\$ 737,765
TOTAL PRESENT VALUE	\$ 52,372,606								

## 10.2.2 OPTION A2/B9: Pressure Sewerage System - "On Island" STP

WASTEWATER								Rev	A
OPTION A2/B9: Pressure Sewerage System - "On Island" STP								Date	12/11/2019
NPV ANALYSIS	50 Year								
ITEM	COST \$	Interval yr		Present Value Calculation		Present Value \$			
		yr	Factor	Unit	No.	Capital Investment	Operating	Maintenance	Replacement
Pressure Sewer System - Discharge to "On Island" STP	\$ 69,197,863					\$ 69,197,863			
Operating Costs (PSS Units, TE Pump Station)	\$ 5,624	1	13.8007	Overall	1		\$ 77,615		
Maintenance Costs (PSS Units, TE Pump Station, MBR STP, Telemetry, Network Mains, Ebb Tide Release Structure including electricity and chemical costs)	\$ 643,236	1	13.8007	Overall	1			\$ 8,877,107	
Replacement PSU Pump and Control Panel including transducer and aux float switch)	\$ 3,350	15	0.3624	PSU	377				\$ 457,693
Replacement PSU Pump and Control Panel including transducer and aux float switch)	\$ 3,350	30	0.1313	PSU	377				\$ 165,825
Replacement PSU Pump and Control Panel including transducer and aux float switch)	\$ 3,350	45	0.0476	PSU	377				\$ 60,116
Replacement TE Pump and Control Panel	\$ 85,000	15	0.3624	WWTP	1				\$ 30,804
Replacement TE Pump and Control Panel	\$ 85,000	30	0.1313	WWTP	1				\$ 11,161
Replacement TE Pump and Control Panel	\$ 85,000	45	0.0476	WWTP	1				\$ 4,046
Replacement key MBR equipment									
Aeration Diffusers	\$ 15,000	5	0.713	WWTP	1				\$ 10,695
Aeration diffusers, membranes, pumps, blowers	\$ 275,000	10	0.5083	WWTP	1				\$ 139,783
Aeration Diffusers, Inlet Screens	\$ 115,000	15	0.3624	WWTP	1				\$ 41,676
Aeration diffusers, membranes, pumps, blowers	\$ 275,000	20	0.2584	WWTP	1				\$ 71,060
Aeration Diffusers	\$ 15,000	25	0.1842	WWTP	1				\$ 2,763
Aeration diffusers, membranes, pumps, blowers and inlet screens	\$ 375,000	30	0.1313	WWTP	1				\$ 49,238
Aeration Diffusers	\$ 15,000	35	0.0936	WWTP	1				\$ 1,404
Aeration diffusers, membranes, pumps, blowers	\$ 275,000	40	0.0668	WWTP	1				\$ 18,370
Aeration Diffusers, Inlet Screens	\$ 115,000	45	0.0476	WWTP	1				\$ 5,474
Aeration diffusers, membranes, pumps, blowers	\$ 275,000	50	0.0339	WWTP	1				\$ 9,323
Replacement Ebb Tide Release Equipment									
Duckbill Valve	\$ 8,000	5	0.713	WWTP	1				\$ 5,704



WASTEWATER									Rev	A
OPTION A2/B9: Pressure Sewerage System - "On Island" STP									Date	12/11/2019
NPV ANALYSIS		50 Year								
ITEM	COST \$	Interval yr		Present Value Calculation		Present Value \$				
		yr	Factor	Unit	No.	Capital Investment	Operating	Maintenance	Replacement	
Duckbill Valve	\$ 8,000	10	0.5083	WWTP	1				\$ 4,066	
Duckbill Valve, Anodes	\$ 58,000	15	0.3624	WWTP	1				\$ 21,019	
Duckbill Valve	\$ 8,000	20	0.2584	WWTP	1				\$ 2,067	
Duckbill Valve	\$ 8,000	25	0.1842	WWTP	1				\$ 1,474	
Duckbill Valve, Anodes	\$ 58,000	30	0.1313	WWTP	1				\$ 7,615	
Duckbill Valve	\$ 8,000	35	0.0936	WWTP	1				\$ 749	
Duckbill Valve	\$ 8,000	40	0.0668	WWTP	1				\$ 534	
Duckbill Valve, Anodes	\$ 58,000	45	0.0476	WWTP	1				\$ 2,761	
Duckbill Valve	\$ 8,000	50	0.0339	WWTP	1				\$ 271	
						\$ 69,197,863	\$ 77,615	\$ 8,877,107	\$ 1,125,691	
TOTAL PRESENT VALUE	\$ 79,278,276									

### 10.2.3 OPTION A4/B11: Hybrid Sewerage System - Discharge to SWC Network

1. WASTEWATER						Rev	A
OPTION A4/B11: Hybrid Sewerage System - Discharge to SWC Network						Date	12/11/2019
NPV ANALYSIS							
50 Year							
ITEM	COST \$	Interval yr		Present Value Calculation		Present Value \$	
		yr	Factor	Unit	No.	Capital Investment	Operating
Hybrid Sewer System - Discharge to SWC Network	\$ 58,316,934					\$ 58,316,934	
Operating Costs (PSS Units, Booster SPS)	\$ 5,960	1	13.8007	Overall	1		\$ 82,252
Maintenance Costs (PSS Units, Booster SPS, Telemetry, Chemical Dosing Plant, Network Mains)	\$ 123,994	1	13.8007	Overall	1		\$ 1,711,204
Replacement PSU Pump and Control Panel including transducer and aux float switch)	\$ 3,350	15	0.3624	PSU	275		\$ 333,861
Replacement PSU Pump and Control Panel including transducer and aux float switch)	\$ 3,350	30	0.1313	PSU	275		\$ 120,960
Replacement PSU Pump and Control Panel including transducer and aux float switch)	\$ 3,350	45	0.0476	PSU	275		\$ 43,852
Replacement SPS Pump and Control Panel	\$ 315,000	15	0.3624	SPS	1		\$ 114,156
Replacement SPS Pump and Control Panel	\$ 315,000	30	0.1313	SPS	1		\$ 41,360
Replacement SPS Pump and Control Panel	\$ 315,000	45	0.0476	SPS	1		\$ 14,994
Replacement Dosing Pump and Control Panel for 4 pump stations	\$ 10,000	15	0.3624	SPS	1		
Replacement Dosing Pump and Control Panel for 4 pump stations	\$ 10,000	30	0.1313	SPS	1		\$ 1,313
Replacement Dosing Pump and Control Panel for 4 pump stations	\$ 10,000	45	0.0476	SPS	1		\$ 476
						\$ 58,316,934	\$ 82,252
							\$ 1,711,204
							\$ 670,971
TOTAL PRESENT VALUE	\$ 60,781,361						

## 10.2.4 OPTION A4/B9: Hybrid Sewerage System - "On Island" STP

1. WASTEWATER							Rev	A	
OPTION A4/B9: Hybrid Sewerage System - "On Island" STP							Date	12/11/2019	
NPV ANALYSIS		50 Year							
ITEM	COST \$	Interval yr		Present Value Calculation		Present Value \$			
		yr	Factor	Unit	No.	Capital Investment	Operating	Maintenance	Replacement
Pressure Sewer System - Discharge to "On Island" STP	\$ 77,672,212					\$ 77,672,212			
Operating Costs (PSS Units, TE Pump Station, Intermediate SPS)	\$ 7,420	1	13.8007	Overall	1		\$ 102,401		
Maintenance Costs (PSS Units, TE Pump Station, MBR STP, Telemetry, Network Mains, Ebb Tide Release Structure including electricity and chemical costs)	\$ 654,447	1	13.8007	Overall	1			\$ 9,031,827	
Replacement PSU Pump and Control Panel including transducer and aux float switch)	\$ 3,350	15	0.3624	PSU	377				\$ 457,693
Replacement PSU Pump and Control Panel including transducer and aux float switch)	\$ 3,350	30	0.1313	PSU	377				\$ 165,825
Replacement PSU Pump and Control Panel including transducer and aux float switch)	\$ 3,350	45	0.0476	PSU	377				\$ 60,116
Replacement TE Pump and Control Panel	\$ 85,000	15	0.3624	WWTP	1				\$ 30,804
Replacement TE Pump and Control Panel	\$ 85,000	30	0.1313	WWTP	1				\$ 11,161
Replacement TE Pump and Control Panel	\$ 85,000	45	0.0476	WWTP	1				\$ 4,046
Replacement key MBR equipment									
Aeration Diffusers	\$ 15,000	5	0.713	WWTP	1				\$ 10,695
Aeration diffusers, membranes, pumps, blowers	\$ 275,000	10	0.5083	WWTP	1				\$ 139,783
Aeration Diffusers, Inlet Screens	\$ 115,000	15	0.3624	WWTP	1				\$ 41,676
Aeration diffusers, membranes, pumps, blowers	\$ 275,000	20	0.2584	WWTP	1				\$ 71,060
Aeration Diffusers	\$ 15,000	25	0.1842	WWTP	1				\$ 2,763
Aeration diffusers, membranes, pumps, blowers and inlet screens	\$ 375,000	30	0.1313	WWTP	1				\$ 49,238
Aeration Diffusers	\$ 15,000	35	0.0936	WWTP	1				\$ 1,404
Aeration diffusers, membranes, pumps, blowers	\$ 275,000	40	0.0668	WWTP	1				\$ 18,370
Aeration Diffusers, Inlet Screens	\$ 115,000	45	0.0476	WWTP	1				\$ 5,474
Aeration diffusers, membranes, pumps, blowers	\$ 275,000	50	0.0339	WWTP	1				\$ 9,323

1. WASTEWATER								Rev	A
OPTION A4/B9: Hybrid Sewerage System - "On Island" STP								Date	12/11/2019
NPV ANALYSIS		50 Year							
ITEM	COST \$	Interval yr		Present Value Calculation		Present Value \$			
		yr	Factor	Unit	No.	Capital Investment	Operating	Maintenance	Replacement
Replacement Ebb Tide Release Equipment									
Duckbill Valve	\$ 8,000	5	0.713	WWTP	1				\$ 5,704
Duckbill Valve	\$ 8,000	10	0.5083	WWTP	1				\$ 4,066
Duckbill Valve, Anodes	\$ 58,000	15	0.3624	WWTP	1				\$ 21,019
Duckbill Valve	\$ 8,000	20	0.2584	WWTP	1				\$ 2,067
Duckbill Valve	\$ 8,000	25	0.1842	WWTP	1				\$ 1,474
Duckbill Valve, Anodes	\$ 58,000	30	0.1313	WWTP	1				\$ 7,615
Duckbill Valve	\$ 8,000	35	0.0936	WWTP	1				\$ 749
Duckbill Valve	\$ 8,000	40	0.0668	WWTP	1				\$ 534
Duckbill Valve, Anodes	\$ 58,000	45	0.0476	WWTP	1				\$ 2,761
Duckbill Valve	\$ 8,000	50	0.0339	WWTP	1				\$ 271
Replacement SPS and Control Panels	\$ 315,000	15	0.3624	WWTP	1				\$ 114,156
Replacement SPS and Control Panels	\$ 315,000	30	0.1313	WWTP	1				\$ 41,360
Replacement SPS and Control Panels	\$ 315,000	45	0.0476	WWTP	1				\$ 14,994
						\$ 77,672,212	\$ 102,401	\$ 9,031,827	\$ 1,296,200
TOTAL PRESENT VALUE	\$ 88,102,640								

## 10.2.5 OPTION C4: Low Flow Supply

1. WATER								Rev	A
OPTION C4: Low Flow Supply								Date	12/11/2019
NPV ANALYSIS	50 Year								
ITEM	COST \$	Interval yr		Present Value Calculation		Present Value \$			
		yr	Factor	Unit	No.	Capital Investment	Operating	Maintenance	Replacement
Low Flow Water Supply Network	\$ 17,920,580					\$ 17,920,580			
Operating Costs - Booster Pump System	\$ 2,598	1	13.8007	Overall	1		\$ 35,854		
Maintenance Costs - Network Booster Pumps	\$ 8,628	1	13.8007	Overall	1			\$ 119,072	
Replacement Booster Pumps and Control Panel	\$ 20,000	15	0.3624	Booster Pump	1				\$ 7,248
Replacement Booster Pumps and Control Panel	\$ 20,000	30	0.1313	Booster Pump	1				\$ 2,626
Replacement Booster Pumps and Control Panel	\$ 20,000	45	0.0476	Booster Pump	1				\$ 952
						\$ 17,920,580	\$ 35,854	\$ 119,072	\$ 10,826
TOTAL PRESENT VALUE	\$ 18,086,333								

## 10.2.6 OPTION C6: Full Flow Supply

1. WATER								Rev	A
OPTION C6: Full Flow Supply								Date	12/11/2019
NPV ANALYSIS									
50 Year									
ITEM	COST \$	Interval yr		Present Value Calculation		Present Value \$			
		yr	Factor	Unit	No.	Capital Investment	Operating	Maintenance	Replacement
Low Flow Water Supply Network	\$ 18,586,178					\$ 18,586,178			
Operating Costs - Booster Pump System	\$ 2,536	1	13.8007	Overall	1		\$ 34,999		
Maintenance Costs - Network Booster Pumps	\$ 7,615	1	13.8007	Overall	1			\$ 105,092	
Replacement Booster Pumps and Control Panel	\$ 20,000	15	0.3624	Booster Pump	1				\$ 7,248
Replacement Booster Pumps and Control Panel	\$ 20,000	30	0.1313	Booster Pump	1				\$ 2,626
Replacement Booster Pumps and Control Panel	\$ 20,000	45	0.0476	Booster Pump	1				\$ 952
						\$ 18,586,178	\$ 34,999	\$ 105,092	\$ 10,826
TOTAL PRESENT VALUE	\$ 18,737,095								

## 11 ATTACHMENT B: RISK ASSESSMENT

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### 11.1 Risk Assessment Process

A risk assessment workshop was undertaken to identify and analyse potential risks and opportunities. The analysis included the identification of strategies to mitigate the level of risk or implement the opportunity.

Risk Process:

- Identification of risks and opportunities
- Evaluation each risk / opportunity for likelihood and consequence
- A level of risk was derived from the likelihood / consequence levels, Low – Medium – High or Extreme.
- Mitigation / implementation strategies were identified for items with risks levels greater than medium.
- An indicative costing was compiled for risks greater than medium that were not mitigated

Risks were assessed under five categories

- Planning
- Technical
- Environmental
- Stakeholder and Community Assessment
- Construction

Risk Workshop Attendees

NAME	COMPANY	ROLE
<b>Ruby Ardren</b>	Northern beaches Council	Project Leader Water
<b>Craig Kennedy</b>	PS Solutions	Senior Civil Engineer
<b>Steve Wallace</b>	PS Solutions	Project Director
<b>Gavin Ovens</b>	GOH / PSS	Water Infrastructure Advisor
<b>Kurt Dahl</b>	Permeate Partners	Wastewater Treatment Consultant
<b>Gareth Thomas</b>	RPS	Environmental
<b>Kapil Kulkarni</b>	RPS	Investment Analysis

## 11.2 Risk Assessment Evaluation Criteria

Risk Matrix						
Likelihood		Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
		1	2	3	4	5
5	Almost Certain	Medium	High	High	Extreme	Extreme
4	Likely	Medium	Medium	High	High	Extreme
3	Possible	Low	Medium	Medium	High	High
2	Unlikely	Low	Low	Medium	Medium	High
1	Rare	Low	Low	Low	Medium	Medium

### Likelihood

Rating	Description	Frequency	Description
1	Rare	< 100 years	No evidence of it occurring.
2	Unlikely	< 20 years	Never known to occur, but considered a possibility
3	Possible	< 5 years	Has been known to occur
4	Likely	< 1 year	Known to occur
5	Almost Certain	<6 months	Expected to occur more than once per year



Consequence							
		1	2	3	4	5	6
Rating	Description	Commercial Impact Guide	Planning	Technical	Environmental	Stakeholder and Community Assessment	Construction
1	Insignificant	< \$5,000	Oversight with no Process Delays	Technical compliance breach No legal significance.	Minimal environmental impact.	Of interest to individuals only. No media interest.	Negligible impact on cost and time;
2	Minor	< \$20,000	Approval Resubmissions.	Compliance or legal breach resulting in minor corrective action.	Noticeable environmental impact.	Interest to local community only.	Minor alternate methods required .
3	Moderate	< \$50,000	Additional planning constraints identified	Moderate compliance or legal breach	Significant environmental impact. Release effecting moderate area.	Stakeholder actively expressing dissatisfaction.	System functional changes, redesign required
4	Major	< \$500,000	Delays in planning approval	Serious compliance or legal breach resulting in court imposed penalties	Extensive environmental impact. Large release requiring long term remediation.	Stakeholder alarm or grave concern.	Major obstacle or delay greater than 3 months
5	Catastrophic	> \$500,000	Prevents planning approval	Extensive breach with fines & litigation with possible class action. Loss of charter to operate.	Massive impact on the environment. Massive clean up and rehabilitation.	Irreparable loss of community and stakeholder confidence in the organisation.	Significant component of construction not buildable or failure in installation

### 11.3 Risk Assessment Matrix

Project: SCOTLAND ISLAND WATER/WASTEWATER FEASIBILITY	Phase	Feasibility Risk Analysis	Date: 12-11-2019
Documents:			
			Rev D

			Pressure Sewer	Hybrid System	Treated / Pittwater	To SW Church Pt	Water Low Flow	Water Full Supply						
			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
Planning & Approval														
P.1	R	EIS required to be expanded to include Pittwater			B.9				Program Delays, expansion in EIS Scope.	Possible	Moderate	Medium	Early engagement in planning & design phases	Allowance for all Delay Items compiled into one item: Allowance 6 months PM x 2 = \$324,000
P.2	R	REF Scope	A.1	A.4		B.11	C.4	C.6	Program Delays, expansion in REF Scope. May preclude option B.9	Rare	Minor	Low	Early engagement in planning & design phases	
P.3	R	Not getting approval from DPIE & DPI	A.1	A.4	B.9	B.11	C.4	C.6	Delays and Resubmission of Planning documents	Rare	Moderate	Low	Early engagement in planning & design phases	
P.4	R	Delay in approval from DPIE, DPI, RMS, EPA, NBC, Energy Aust.	A.1	A.4	B.9	B.11	C.4	C.6	Delays	Unlikely	Moderate	Medium	Early engagement in planning & design phases	Included in item P1; More likely for B9
P.5	R	Change of State Govt	A.1	A.4	B.9	B.11	C.4	C.6	Delays in Construction	Possible	Insignificant	Low		
P.6	R	Change of Council	A.1	A.4	B.9	B.11	C.4	C.6	Delays in Construction	Possible	Insignificant	Low		
P.7	R	Modifications to approvals	A.1	A.4	B.9	B.11	C.4	C.6	Delays in Construction	Rare	Moderate	Low		
P.8	R	Stop work delays due to non compliance with conditions	A.1	A.4	B.9	B.11	C.4	C.6	Delays in Construction	Rare	Moderate	Low	Project QA	
P.9	R	Design not consistent with what is approved	A.1	A.4	B.9	B.11	C.4	C.6	Possible Fines, delays	Rare	Moderate	Low	Multiple QA sign offs	
P.10	R	Not getting heritage item approvals	A.1	A.4	B.9	B.11	C.4	C.6	Delays	Rare	Moderate	Low		
P.11	R	Onerous conditions of approval - Heritage & Environmental	A.1	A.4	B.9	B.11	C.4	C.6		Possible	Moderate	Medium		Included in P1; May impact significantly on B.9

			Pressure Sewer	Hybrid System	Treated / Pittwater	To SW Church Pt	Water Low Flow	Water Full Supply						
			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
P.12	R	Not getting authority to enter private property	A.1	A.4			C.4	C.6	Delays	Likely	Minor	Medium	Include in provisional allowance; Council authority to facilitate community engagement	Nil, mitigation
P.13	R	Failure to adhere to correct procedure re: entry of properties	A.1	A.4			C.4	C.6	Delays	Unlikely	Minor	Low	n/a	
P.14	R	Changes to scheme parameters, number of lots, zoning changes etc.	A.1	A.4	B.9		C.4	C.6	Redesign, delays	Unlikely	Minor	Low	Detailed survey & consultation with NBC	
P.15	R	Failure to gather information for future development, prior to construction start	A.1	A.4	B.9		C.4	C.6	Redesign, delays	Unlikely	Minor	Low	Detailed survey & consultation with NBC	
P.16	R	Delays due to land acquisition/resumption for pump stns, STP, Operations workshop/storage			B.9	B.11			Project Delays	Possible	Moderate	Medium	Early engagement in planning & design phases	Delays included in item P1
P.17	R	Property boundaries may need to be surveyed to ensure infrastructure is accurately located	A.1	A.4			C.4	C.6	Relocation of installed services	Almost Certain	Moderate	High	Survey included in Scope	nil
P.18	R	Insurance gaps	A.1	A.4	B.9	B.11	C.4	C.6	Litigation, cost implications	Unlikely	Minor	Low	Workshop risks & allocate to the party that has main control over the risk	Nil
P.19	R	Maritime incident	A.1	A.4	B.9	B.11	C.4	C.6	Project Delays	Unlikely	Minor	Low		
P.20	R	Rates charges and structure;	A.1	A.4	B.9	B.11	C.4	C.6	Resistance from community to increase rates through property value increase	Unlikely	Minor	Low	Early engagement	
P.21	R	Finalising location of underbore				B.11	C.4	C.6	Project Delays	Possible	Major	High	Detailed design and coordination	Allowance for increase in difficulty; \$100,000
P.22	R	Sydney Water technical & procedural requirements	A.1	A.4	B.9	B.11	C.4	C.6	Project Delays	Likely	Major	High	Collaborative design; Full engagement with Sydney Water; Review of Sydney Water similar projects for costings. Alternate delivery models	Included in item P.1 Delay Costs

			Pressure Sewer	Hybrid System	Treated / Pittwater	To SW Church Pt	Water Low Flow	Water Full Supply						
			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
P.23	R	Sydney Water augmentation requirements				B.11	C.4	C.6	Project Delays	Unlikely	Major	Medium	Sydney Water have confirmed capacity is available at Church Point	Nil
P.24	R	Procurement model not fit for purpose / does not meet long term project objectives	A.1	A.4	B.9	B.11	C.4	C.6	Cost increases, delays	Likely	Major	High	Due diligence in planning, and greater assessment of options with the potential delivery agents	Nil
P.25	O	Fast Track Planning Approvals	A.1	A.4	B.9	B.11	C.4	C.6	Accelerated delivery	Possible	Moderate	Medium	Agency alignment	Percent of approval process, included in item P.1
Design / Technical														
D.1	R	Services locations (power, water, comms, effluent mains)	A.1	A.4			C.4	C.6	Damage to existing services and service interruptions	Possible	Moderate	Medium	Scope to include services locating and potholing, policies etc	Nil
D.2	R	Survey errors	A.1	A.4	B.9	B.11	C.4	C.6		Unlikely	Minor	Low		
D.3	R	Insufficient allowance for prolonged consultation with customers in siting tanks, manholes, SPS's	A.1	A.4		B.11			Delays, design changes	Possible	Minor	Medium	Community planning sessions, early engagement, established policies and procedures	Nil
D.4	R	Inflow & Infiltration to sewer system	A.1	A.4	B.9					likely	Moderate	High	Project QA audits due diligence	Nil
D.5	R	Water demand higher than expected					C.4	C.6	Operational issues, low pressures	likely	Moderate	High	Community education	Nil
D.6	R	Water pipe burst in underbore					C.4	C.6	Operational issues	Unlikely	Major	Medium	Locate product pipe in sleeve pipe. Higher pressure rated pipe to be employed. Leak detection.	Nil

			Pressure Sewer	Hybrid System	Treated / Pittwater	To SW Church Pt	Water Low Flow	Water Full Supply						
			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
D.8	R	SPS additional odour control design changes	A.1			B.11				Possible	Minor	Medium	Collaborative design	Nil
D.9	R	STP additional odour control design changes			B.9					Possible	Minor	Medium	Collaborative design	Nil
D.10	R	Additional telemetry / comms infrastructure due to location	A.1	A.4	B.9	B.11	C.4	C.6	Unable to commission. Unable to operate remotely.	Possible	Moderate	Medium	Test telemetry/coverage on site during design phase	Nil
D.11	R	Potential for requirement to upgrade power to sites &/or delay	A.1	A.4					Delays, additional costs for upgrade of electrical panels	Likely	Moderate	High	Property audits	Community homeowner costs. Benchmark to similar projects
D.13	R	Adequacy of electrical supply	A.1	A.4	B.9	B.11	C.4	C.6	Additional construction costs	Unlikely	Major	Medium	Early engagement in planning & design phases	Telemetry to manage peak power demand
D.14	O	Eliminate pumping stations				B.11			Reduced scope	Possible	Moderate	Medium	Opportunity to be reviewed in detailed design, replaced with flushing system	Eliminate Pumping Station for Pressure Sewer Option
D.15	O	Recycled Water			B.9				Income stream, maintaining rainwater tanks	Possible	Minor	Medium	Not considered commercially viable	Nil
D.16	R	Integrity of existing house drainage	A.1	A.4	B.9	B.11			Wet weather flow disrupting service	Possible	Minor	Medium	Due diligence in audit of existing house drainage	Nil
Environmental														
E.1	R	threatened species - flora / fauna	A.1	A.4	B.9		C.4	C.6	Damage to existing flora and fauna	Unlikely	Minor	Low	EIS, REF	
E.2	R	Precautionary water monitoring treated water discharge, not comply with EPA requirements, stringent EPA licence conditions			B.9				Operational risk, quality going out of spec.	Almost Certain	Moderate	High	Design to include monitoring and controls, flexible allowance negotiation	\$1.5m, plus \$100k operating

			Pressure Sewer	Hybrid System	Treated / Pittwater	To SW Church Pt	Water Low Flow	Water Full Supply						
			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
E.3	R	Discharge of wastewater into environment	A.1	A.4	B.9	B.11			Fines. Pollution.	possible	Moderate	Medium	Design modelling. Emergency storage. Containment controls in work method statements	Nil
E.4	R	Discharge of wastewater into Pittwater	A.1	A.4	B.9	B.11			Fines. Pollution.	possible	Moderate	Medium	Design modelling. Emergency storage. Containment controls in work method statements	Nil
E.7	R	Acid sulphate soil	A.1	A.4	B.9	B.11	C.4	C.6	Additional costs for ASS management. Pollution.	Almost Certain	Moderate	High	Early Geotech survey. ASS Management Plan.	Nil mitigated
E.8	R	Septic effluent/sludge removal & disposal	A.1	A.4					Pollution, customer complaints	Possible	Minor	Medium	Community Cost	Nil
E.9	R	Drilling slurry disposal / management	A.1	A.4	B.9	B.11	C.4	C.6	Contamination	Unlikely	Major	Medium	Specification to include suitable controls	Nil
E.10	R	Flooding - during construction	A.1	A.4	B.9	B.11	C.4	C.6	Delays. Remediation costs. Pollution.	Unlikely	Minor	Low		
E.12	R	Construction erosion – water pollution	A.1	A.4	B.9	B.11	C.4	C.6	Contamination	Possible	Moderate	Medium	Work site erosion control to be appropriately specified	Nil
E.13	R	Inadequate restoration	A.1	A.4	B.9	B.11	C.4	C.6	Customer complaints. Erosion. Pollution.	Unlikely	Moderate	Medium	Project QA, dilapidation surveys	Nil
E.14	R	Underbore construction				B.11	C.4	C.6	Delays. Remediation costs. Pollution.	Possible	Major	High	Pre-qualified, experienced contractors	Nil
E.15	R	Tree roots encountered / cut. Re-route &/or stoppage &/or fines	A.1	A.4			C.4	C.6	Delays, increased excavation costs. Environmental damage.	Possible	Minor	Medium	Detailed mains layout survey during design phase. HDB where possible	Nil
E.16	R	Odour – from air release points	A.1	A.4		B.11			Customer complaints. Pollution. Operational issues.	Possible	Minor	Medium	Odour management to be implemented at all air release points in pressure sewer system	Mitigated

			Pressure Sewer	Hybrid System	Treated / Pittwater	To SW Church Pt	Water Low Flow	Water Full Supply						
			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
E.17	R	Visual issues re: air release points	A.1	A.4					Customer complaints	Possible	Minor	Medium	Early community engagement in Planning & design phases	Nil
E.18	R	Damage to heritage items	A.1	A.4	B.9	B.11	C.4	C.6		Unlikely	Minor	Low		
E.19	R	Visual impacts adjacent to heritage items	A.1	A.4	B.9	B.11	C.4	C.6		Unlikely	Minor	Low		
E.20	R	Bush fire	A.1	A.4	B.9	B.11	C.4	C.6	Risk to life and injury, Delays, loss of materials	Unlikely	Major	Medium	Bushfire emergency plan, evacuation plan	Nil
E.21	R	Encountering heritage site & subsequent scope change	A.1	A.4	B.9	B.11	C.4	C.6	Delays, design changes	Unlikely	Moderate	Medium		Including planning delay item P.1
E.22	R	Climate change and sea level rises	A.1	A.4	B.9	B.11	C.4	C.6	Planning implications	Unlikely	Moderate	Medium	Allowance for NBC climate policy	Nil
E.23	O	Improved environment on the Island	A.1	A.4	B.9	B.11			Improved health	Almost Certain	Moderate	High	Intangible benefit to be include in overall commercial assessment	
E.24	O	Improved water quality in Pittwater	A.1	A.4	B.9	B.11			Improved amenity	Almost Certain	Moderate	High	Intangible benefit to be include in overall commercial assessment	
E.25	R/O	Environmental support of business case	A.1	A.4	B.9	B.11	C.4	C.6	Advantages / disadvantages not able to be measured as capital cost	Almost Certain	Moderate	High	Intangible benefit to be include in overall commercial assessment	Nil
Stakeholder & Community														
S.1	R	Infrastructure ownership / demarcation	A.1	A.4	B.9	B.11	C.4	C.6	Project delays, reputation damage	Possible	Insignificant	Low	Early stakeholder engagement	
S.2	R	Setting customer expectations too high	A.1	A.4	B.9	B.11	C.4	C.6	Reputation damage	Unlikely	Moderate	Medium	Implementation of detailed community consultation plan	Nil
S.3	R	Acceptance at handover stage	A.1	A.4	B.9	B.11	C.4	C.6		Unlikely	Minor	Low	Project QA	

			Pressure Sewer	Hybrid System	Treated / Pittwater	To SW Church Pt	Water Low Flow	Water Full Supply						
			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
S.4	R	Not managing customer expectations	A.1	A.4	B.9	B.11	C.4	C.6	Reputation damage	Unlikely	Minor	Low	Implementation of detailed community consultation plan	
S.5	R	Not managing events to meet expectations	A.1	A.4	B.9	B.11	C.4	C.6	Reputation damage	Unlikely	Minor	Low	Implementation of detailed community consultation plan	
S.6	R	Delays in being able to connect – Delay to Project - Willingness to connect - Service availability charges	A.1	A.4	B.9	B.11	C.4	C.6	Delays	Unlikely	Moderate	Medium	Council to implement connection policies	Mitigated
S.7	R	Changes to local / cultural amenity	A.1	A.4	B.9	B.11	C.4	C.6	Delays, redesign	Unlikely	Minor	Low	Early community engagement in Planning & design phases	
S.8	R	Poorly performing contractors	A.1	A.4	B.9	B.11	C.4	C.6	Cost overruns, reputation damage	Possible	Major	High	Pre-qualified, experienced contractors, due diligence in tender and procurement process	Mitigated
S.9	R	Land owners causing delays &/or scope changes &/or additional restoration	A.1	A.4			C.4	C.6	Extension of time delays	Possible	Minor	Medium	Early engagement in planning & design phases Council policies	
S.10	R	Extra over costs for additional dilapidation surveys	A.1	A.4			C.4	C.6		Unlikely	Minor	Low		
S.11	R	Community protests - e.g. service availability charges	A.1	A.4	B.9	B.11	C.4	C.6	Reputational damage	Likely	Moderate	High	Implementation of detailed community consultation plan	
S.12	R	Additional consultation / workshops due to scope change	A.1	A.4	B.9	B.11	C.4	C.6		Possible	Minor	Medium	Contingency	
S.13	R	Customers not “trusting” technology	A.1	A.4	B.9	B.11	C.4	C.6	Delays	Unlikely	Moderate	Medium	Implementation of detailed community consultation plan	Mitigated
S.14	R	Customers along the rising main cannot connect	A.1	A.4					Commercial viability	Possible	Moderate	Medium	Financial commercial plan for compulsory connection	DELETE



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			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
S.15	R	Customer not agreeing with facility location			B.9				Reputational damage, project delays	Likely	Moderate	High	Implementation of detailed community consultation plan	Mitigated
S.16	R	Restoration disputes	A.1	A.4	B.9	B.11	C.4	C.6		Possible	Minor	Medium	Project QA and dilapidation reports	Mitigated
S.17	R	“Poor” restoration perception	A.1	A.4	B.9	B.11	C.4	C.6		Possible	Minor	Medium	Project QA and dilapidation reports	Mitigated
S.18	R	Pump electricity disputes	A.1	A.4						Unlikely	Minor	Low		
S.19	R	Disagreements re meter box upgrades	A.1	A.4						Unlikely	Minor	Low		
S.20	R	Poor customer education – ongoing/commitment	A.1	A.4	B.9	B.11	C.4	C.6		Unlikely	Minor	Low		
S.21	R	Education – Homeowner perceives too complex	A.1	A.4	B.9	B.11				Unlikely	Minor	Low		
S.22	R	Equity issues for on island customers (hybrid scheme)		A.4					Reputational issues, project objections and delays	Likely	Minor	Medium	Eliminate Hybrid System?	Additional allowance; \$1000 per lot 115
S.23	O	Reduced public health risks	A.1	A.4	B.9	B.11				Almost Certain	Major	Extreme	Intangible Benefit	
S.24	O	Reduced risk to on island operators of water supply system					C.4	C.6		Almost Certain	Moderate	High		
S.25	O	Reduced supply costs for water supply					C.4	C.6		Almost Certain	Moderate	High		
S.26	O	Improved property value	A.1	A.4	B.9	B.11	C.4	C.6		Almost Certain	Moderate	High		
S.27	O	Improved convenience	A.1	A.4	B.9	B.11	C.4	C.6		Almost Certain	Moderate	High		
S.28	O	Improved amenity on island	A.1	A.4	B.9	B.11	C.4	C.6		Almost Certain	Moderate	High		
S.29	R/O	Increased development								Almost Certain	Moderate	High		
S.30	O	Reduced Bushfire risk								Possible	Moderate	Medium		
S.31	R	Funding not forthcoming	A.1	A.4	B.9	B.11	C.4	C.6	Project does not proceed	Possible	Major	High	Confidence in development of delivery model and cost structure	

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			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
Construction / Commissioning														
C.1	R	Inclement weather beyond estimate allowances	A.1	A.4	B.9	B.11	C.4	C.6	Delays	Unlikely	Moderate	Medium	Appropriate cost plan allowance	Mitigated
C.2	R	Restoration after heavy rain	A.1	A.4	B.9	B.11	C.4	C.6	Delays	Unlikely	Moderate	Medium	Appropriate cost plan allowance	Mitigated
C.3	R	Stormwater upgrades	A.1	A.4		B.11	C.4	C.6		Possible	Minor	Medium	Included in design	Mitigated
C.4	R	Potential land slip affecting residences, infrastructure etc &/or revised scope	A.1	A.4			C.4	C.6	Land slip, contamination	Possible	Major	High	Detailed geophysical & geotechnical surveys.	CR to review. Allowance 500m retaining wall @ \$1000 / m
C.5	R	Escalation of material supply over contract period	A.1	A.4	B.9	B.11	C.4	C.6	Cost overruns, reputation damage	Possible	Moderate	Medium	Tender clauses to exclude escalation,	nil
C.6	R	Boulders encountered during boring	A.1	A.4	B.9	B.11	C.4	C.6	See C.7				Detailed geophysical & geotechnical surveys	
C.7	R	Unexpected rock	A.1	A.4	B.9	B.11	C.4	C.6	Cost overruns	Likely	Moderate	High	Allowance included in cost plan	Mitigated
C.8	R	Structural damage to residences	A.1	A.4			C.4	C.6	Damage to dwellings	Rare	Major	Medium	Structural Engineers certification included in tender documentation	\$ 37,700.00
C.9	R	Lack of available resources - labour &/or materials	A.1	A.4	B.9	B.11	C.4	C.6	Project delays, cost overruns	Unlikely	Moderate	Medium	Pre-qualified contractor workshop at tender stage	Nil
C.10	R	Vandalism	A.1	A.4	B.9	B.11	C.4	C.6	Loss, additional costs	Unlikely	Minor	Low		
C.11	R	Theft	A.1	A.4	B.9	B.11	C.4	C.6	Loss, additional costs	Unlikely	Minor	Low		
C.12	R	Additional PM/ management costs due to scope changes	A.1	A.4	B.9	B.11	C.4	C.6	Additional design and construction costs	Possible	Moderate	Medium	Detailed design completed prior to construction tender stage	Nil; GENERIC DELAYS

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			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
C.13	R	New conditions of approval due to scope changes	A.1	A.4	B.9	B.11	C.4	C.6	Project delays, cost overruns	Possible	Moderate	Medium	Detailed design completed prior to construction tender stage	Nil
C.14	R	Requirement for alternative pipe materials/piers required due to unstable ground	A.1	A.4			C.4	C.6	Refer C.8	Unlikely	Minor	Low	Detailed design completed prior to construction tender stage	Mitigated
C.15	R	Damage to existing services	A.1	A.4	B.9	B.11	C.4	C.6	Refer D.1	Unlikely	Minor	Low		
C.16	R	Unknown heritage items – delays / management	A.1	A.4	B.9	B.11	C.4	C.6	Project delays	Unlikely	Minor	Low	Detailed survey	
C.17	R	Managing pipeline testing - water availability	A.1	A.4			C.4	C.6	Project delays	Unlikely	Minor	Low	Contractors risk	
C.18	R	Contractor default	A.1	A.4	B.9	B.11	C.4	C.6	Project delays, cost overruns	Unlikely	Major	Medium	Due diligence in tender process	Nil
C.19	R	Industrial disputes	A.1	A.4	B.9	B.11	C.4	C.6	Project delays, cost overruns	Unlikely	Moderate	Medium	Contractors risk	Nil
C.20	R	Commissioning delays due to Authorities not happy with work	A.1	A.4	B.9	B.11	C.4	C.6	Project delays, cost overruns	Unlikely	Moderate	Medium	Quality Management Plan monitoring and auditing	Nil
C.21	R	Quality of house plumbing inspections	A.1	A.4			C.4		Project delays, cost variations	Unlikely	Moderate	Medium	Due diligence in selection of auditor, scope of work, specifications and inspections	Nil
C.22	R	Pressure test failure	A.1	A.4		B.11	C.4	C.6	Project delays	Unlikely	Minor	Low	Quality management during construction, contractors' risk	
C.23	R	Programme risk due to re-design works	A.1	A.4	B.9	B.11	C.4	C.6	Project delays	Possible	Moderate	Medium		Included in delay items P.1
C.24	R	Early commissioning/start-up – odours etc	A.1	A.4	B.9	B.11	C.4	C.6	Project delays	Unlikely	Minor	Low		
C.25	R	Foreign exchange risk	A.1	A.4	B.9	B.11	C.4	C.6	Additional costs	Unlikely	Minor	Low	Tender clauses to exclude escalation	
C.26	R	Delayed equipment delivery	A.1	A.4	B.9	B.11	C.4	C.6	Delays	Unlikely	Moderate	Medium	Contractors risk, lump sum tender	Nil

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			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
C.27	R	Loss of warranty time on pumps	A.1	A.4	B.9	B.11	C.4	C.6	Additional costs	Possible	Minor	Medium	Consider pumps not to be installed until placed in service, procurement structure	Mitigated
C.28	R	Sabotage from community	A.1	A.4	B.9	B.11	C.4	C.6	Refer C.11 and C.10					
C.29	R	Handover documentation not complete	A.1	A.4	B.9	B.11	C.4	C.6	Project delays	Unlikely	Minor	Low	Management of QA Process	
C.30	R	Decommissioning of septic	A.1	A.4					Incorrect decommission leaving health risk and/or non compliances	Unlikely	Minor	Low		
C.31	R	Disposal of materials (waste)	A.1	A.4	B.9	B.11	C.4	C.6		Possible	Moderate	Medium	Waste management to be appropriately addressed in project management plan	Community cost
C.32	R	Weather dependent transport - barges, boats	A.1	A.4	B.9	B.11	C.4	C.6	Refer to C.2; Delays and cost overruns					
C.33	R	Availability / location of 'laydown' areas	A.1	A.4		B.11	C.4	C.6	Cost overruns, redesign and cost increases	Unlikely	Moderate	Medium	Suitable project planning and consultation with trenchless consultants during design	Mitigated early project planning
C.34	R	Construction equipment / machinery access & movement around the Island	A.1	A.4	B.9	B.11	C.4	C.6	Injury to residents / visitors	Possible	Major	High	Contractors risk; Traffic management and work site management; suitable project insurances	Nil
C.35	R	Construction equipment / machinery access & movement around the Island	A.1	A.4	B.9	B.11	C.4	C.6	Damage to roadways, residents' access, laydown areas.	Possible	Major	High	Contractors risk; Traffic management and work site management; suitable project insurances. Moved into cost plan	Allowance included; Construction staging, laydown areas, temporary access; 142 work areas, 8 hrs x 2 p, plus 160 per hour plant x 4 hrs, plus materials = \$250,000

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			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
C.36	R	Logistics, temporary access provision	A.1	A.4			C.4	C.6	Delays, access to residents	Possible	Major	High	Included C.35	Nil
C.37	R	Maintaining supply / damage to existing water	A.1	A.4			C.4	C.6	Delays	Unlikely	Minor	Low	Easy to repair. Contractor to have materials and equipment on island for immediate repair.	
C.38	R	Latent conditions	A.1	A.4	B.9	B.11	C.4	C.6	Delays, additional costs	Likely	Moderate	High	Detailed geophysical & geotechnical surveys	Included in Contingency:
Operational														
O.1	R	Poor location air valves	A.1	A.4			C.4	C.6	Operational issues	Unlikely	Minor	Low	Design modelling	Nil: Operational
O.2	R	Odour from “air valves “ generation / control	A.1	A.4					Pollution, customer complaints	Unlikely	Minor	Low	Odour scrubbing	Nil: Operational
O.3	R	Failure to get air management correct	A.1	A.4			C.4	C.6	Operational issues	Unlikely	Minor	Low	Design modelling	Nil: Operational
O.4	R	Blockage potential in sewer mains (low points, drain down, low velocity sections)	A.1	A.4					Operational issues	Unlikely	Minor	Low	Design modelling	Nil: Operational
O.5	R	Poor location of tanks	A.1	A.4					Operational issues	Unlikely	Minor	Low		Nil: Operational
O.6	R	Cannot use full emergency capacity of tanks							Operational issues	Unlikely	Minor	Low		Nil: Operational
O.7	R	High 'after power outage' discharges	A.1	A.4		B.11			Operational issues	Unlikely	Minor	Low	Design modelling	Nil: Operational
O.8	R	Loss of service during extended power outages	A.1	A.4					Operational issues	Unlikely	Minor	Low	Option for genset backup	Nil: Operational
O.9	R	Equipment not fit for purpose	A.1	A.4	B.9		C.4	C.6	Operational issues, increased O&M Costs	Unlikely	Minor	Low	Use only approved products. Engage suppliers in design process	Nil: Operational
O.10	R	Unable to access equipment for service/maintenance	A.1	A.4	B.9	B.11	C.4	C.6	Operational issues, increased O&M Costs	Unlikely	Minor	Low		Nil: Operational

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			Relevant Option											
No	R/O	Risk / Opportunity	A.1	A.4	B.9	B.11	C.4	C.6	Consequences	Likelihood	Consequence	Level of Risk	Risk Mitigation / Opportunity Realisation	Quantitative (Per Relevant Option)
O.11	R	Sewer pipe burst in underbore	A.1	A.4		B.11			Operational issues	Unlikely	Major	Medium	Locate product pipe in sleeve pipe. Higher pressure rated pipe to be employed. Leak detection. Specify design life	Nil: Operational
O.12	R	Inadequate emergency storage	A.1	A.4	B.9	B.11			Operational issues				Design modelling	Nil: Operational
O.13	R	Illegal discharges into the sewer system	A.1	A.4	B.9	B.11			Operational issues. Pollution.	Unlikely	Moderate	Medium	Community education	Nil: Operational
O.14	R	Chemical spills at SPS's, STP; Risk in chemical transport	A.1		B.9	B.11			Operational issues. Fines. Pollution.	possible	Moderate	Medium	Compliant design for chemical containment	Nil: Operational
O.15	R	Flooding - during operation	A.1	A.4	B.9	B.11			Operational issues. Pollution.	Unlikely	Moderate	Medium	Design modelling	Nil: Operational



