resources & energy

MOUNT GILEAD PTY LTD AND S & A DZWONNIK

Mount Gilead Rezoning

Water & Wastewater Servicing Strategy

301015-03252 – WW-REP-001

4th September 2014

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PROJECT 301015-03252 - MOUNT GILEAD REZONING
WATER & WASTEWATER SERVICING STRATEGY

REV	DESCRIPTION	ORIGINATOR	REVIEW	WORLEY-PARSONS APPROVAL	DATE
F	Final Draft	TM T Michel	CT C Thomas		7th August 2014
G	Final	TM T Michel	CT C Thomas	C Thomas	4th September 2014

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APPENDICES

1 INTRODUCTION

1.1 Objectives of this Report

This report has been prepared to document the strategic planning process undertaken by WorleyParsons, Mount Gilead Pty Ltd, S & A Dzwonnik and Sydney Water (SWC) to establish preferred potable water and wastewater servicing strategies to support a rezoning application for the land identified as Mount Gilead (the site).

Mount Gilead is shown in the current Metropolitan Development Plan as being developed post 2026, which is beyond the planning horizon for SWC's Growth Servicing Plan.

In response to the rezoning application, Sydney Water has requested that a high level servicing strategy report be prepared to assess the feasibility of connecting the development to Sydney Water's water and wastewater systems and to provide a high level (± 50%) cost estimate for servicing the site.

This report has been prepared in response to a letter (refer to **Appendix 1**) prepared by Sydney Water, dated 10 October 2013 (draft letter issued 15 May 2013) and meetings between the landowners and Sydney Water. The letter provides a framework for the planning requirements for servicing the site in two Stages:

- Stage 1 – Strategic Planning
- Stage 2 – Detailed Planning (provided for information only)

These requirements indicated that the rezoning investigation would generally be carried out as a Stage 1 – Strategic Planning investigation, with requirements modified to reflect an early stage of design development of the site.

This project is to be forward funded by the developers who will then be reimbursed by Sydney Water under its commercial agreement principles.

This report will be reviewed and, subject to approval, endorsed by Sydney Water. Upon endorsement, and successful rezoning of the site, servicing strategies would be developed in accordance with the full Stage 2 detailed planning phase requirements. Sydney Water authorisation is required prior to proceeding with Stage 2.

1.2 Background

The land identified as Mount Gilead forms part of the Metropolitan Development Program (MDP) and occupies approximately 210 hectares. The site is situated within the Campbelltown City Council (Council) Local Government Area.

The site is located approximately 5 km to the south of the Campbelltown city centre and is bound by existing woodland to the north, Appin Road to the east and farmland to the south and west. A site locality plan has been included in **Figure 1-1**.

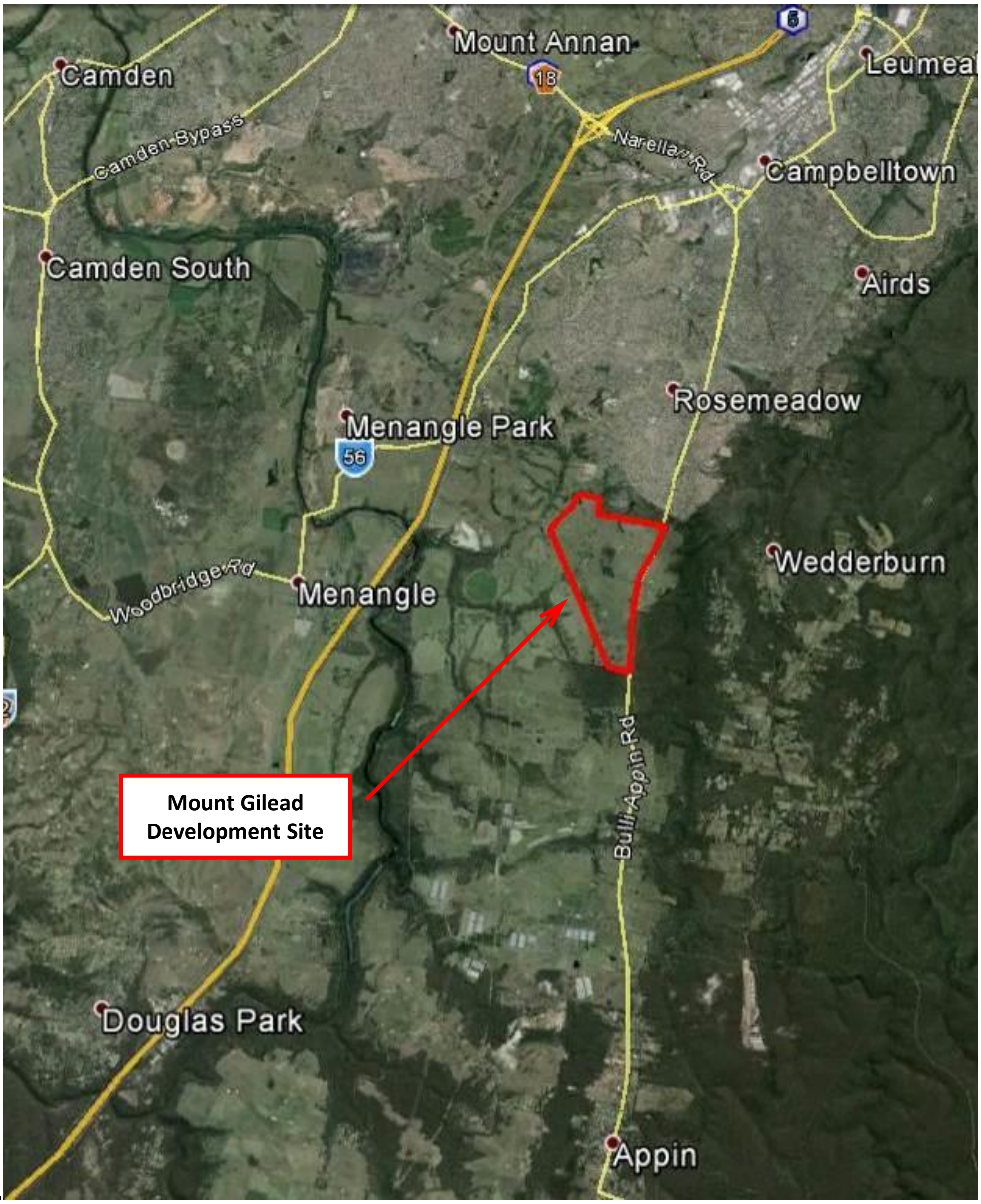

Figure 1-1: Site Locality Plan

At present the site is used for grazing. It contains a network of sealed and unsealed roadways and several farm dams. There are no existing buildings on the site.

The site is predominately flat with grades up to 7%. There is a small region of moderate grade (up to 25%) in the north-western corner of the site. The ground level varies from 130 mAHD at its lowest point in the north to 200 mAHD at its highest point in the south.

1.3 Stakeholders

In preparing the strategic planning report, the following key stakeholders have been consulted:

- Mount Gilead Pty Ltd (landowner);
- S & A Dzwonnik (landowner);
- Sydney Water; and
- City of Campbelltown Council.

1.4 Previous Studies

No previous studies have been undertaken in relation to the water and wastewater servicing of the site. Based on discussions with SWC staff, although Sydney Water has not specifically undertaken studies into water and wastewater servicing of the Mount Gilead site, the site is considered in the following reports for adjacent developments:

- Model Build Report - Rosemeadow Elevated Reservoir Zone, February 2009.
- Menangle Park Integrated Servicing Strategy Phase 3 Final Report, August 2011.

The Model Build Report for the Rosemeadow Elevated Reservoir Zone specifically makes no allowance for the Mount Gilead development; it indicates that the site will be supplied from Macarthur Water Treatment Plant (WTP) via the Trility bulk water supply main.

The Menangle Park report allows for 1340 dwellings (4690 EP) in the Mount Gilead development and assumes that this area will be developed post-2031. It allows an average water demand of 1130 kL/d and dry weather wastewater flow of 700 kL/d for the site.

1.5 Approval Methodology

In order to address the SWC's planning requirements, the following steps are being followed:

1. Discussion of potable water and wastewater servicing options for the site with Sydney Water;
2. Identification of alternative (non-Sydney Water) potable water and wastewater servicing options for the site;
3. Undertaking modelling of Sydney Water's potable water and wastewater systems using Sydney Water's existing models. The results of the model form the basis for determining demands and wastewater flows for options involving connections to Sydney Water's networks and otherwise; and

4. Submission of a Strategic Planning Report in accordance with Sydney Water's Letter of Requirements dated 10th October 2013 (i.e., this report) for endorsement of the rezoning.

2 PROPOSED DEVELOPMENT

The land owners are seeking approval from Council to have the site rezoned from rural uses to residential. The rezoning application documentation is based upon a Masterplan prepared for the site, included as **Figure 2-1**.

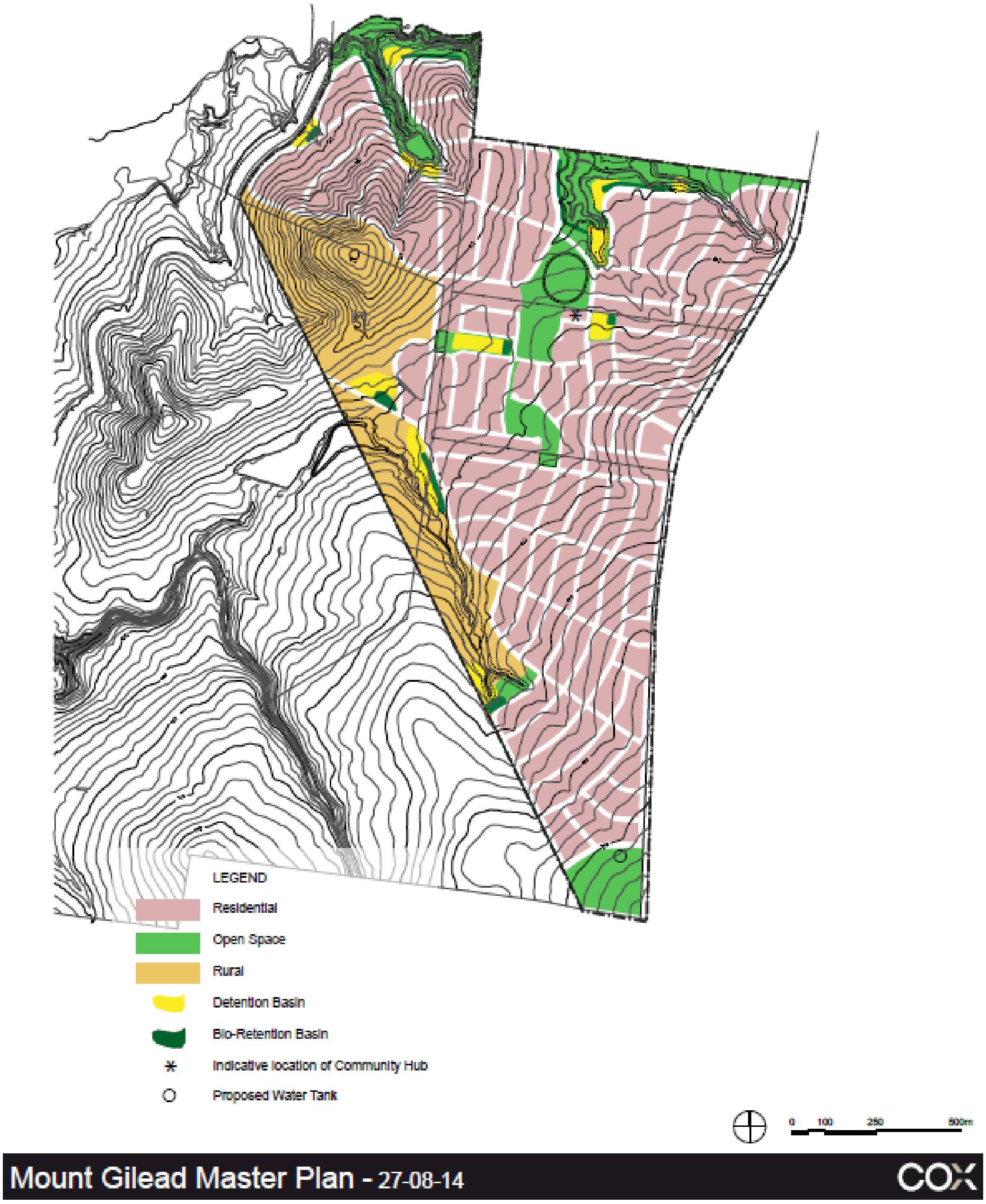

Figure 2-1: Mount Gilead Masterplan (Cox Richardson, 27th August 2014)

2.1 Design Population

The MDP lists the forecast dwelling numbers as 1500 low density residential dwellings. Current planning studies are investigating a range of between 1400-1700 dwellings, with any number above the 1500 MDP number to be justified on the basis of capacity of the site and infrastructure. This study has assumed the maximum number of 1700 dwellings (5950 EP) as a conservative base case for assessing water and wastewater servicing.

2.2 Development Staging

A preliminary staging plan has been developed which separates the site into six precincts. This is shown in **Figure 2-2** below.

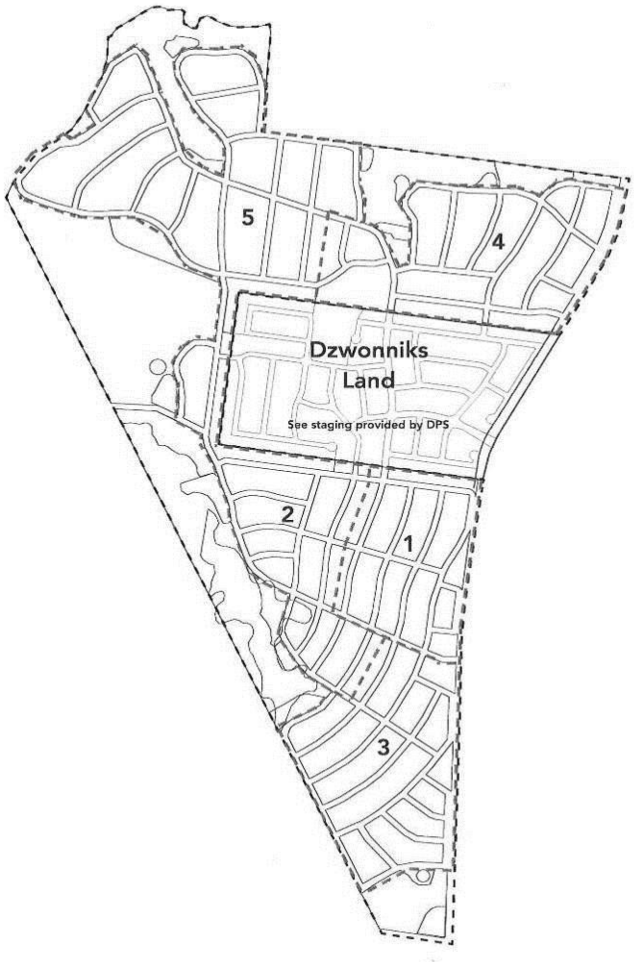

Figure 2-2: Indicative Staging Plan

Both landowners intend to develop the site in parallel, with 10 equal stages over 10 years, as shown in **Table 2-1**.

Table 2-1: Projected Development Staging

Stage	Year	Mount Gilead Precinct	Mount Gilead Lots	Precinct 6 (Dzwonnik)	Total	Total Lots
1	2016	1	125	45	170	170
2	2017	1	125	45	170	340
3	2018	2	125	45	170	510
4	2019	2	125	45	170	680
5	2020	3	125	45	170	850
6	2021	3	125	45	170	1020
7	2022	4	125	45	170	1190
8	2023	4	125	45	170	1360
9	2024	5	125	45	170	1530
10	2025	5	125	45	170	1700

All lots are low density residential free standing dwellings, with an assumed average lot size of 600m2.

The staging is preliminary and will be subject to change. These changes will be influenced by factors involving both water and wastewater servicing, as well as external factors (e.g. RMS, Council requirements).

2.3 Design Criteria

The design criteria for the potable water and wastewater servicing strategies were developed in consultation with Sydney Water personnel and are in general in accordance with the following documents:

- Water and Recycled Water System Growth Servicing Strategy – Criteria and Guideline, 2012.
- Wastewater Network Growth Servicing Strategy – Criteria and Guideline, 2012.
- Design Criteria Guidelines Supplement, 2010.

The projected demands and flows developed using the Sydney Water models have also been adopted for sizing the alternative (non-Sydney Water) options.

3 WATER DEMAND AND WASTEWATER FLOW PROJECTIONS

Water demand and wastewater flows for the Mount Gilead site were developed during the modelling investigation, based on the proposed development of 1700 low density lots (5950 EP), and are detailed in **Appendix 2** and **Appendix 3**, respectively.

Water demands were based on metered consumption data from nearby Campbelltown South, Campbelltown South Elevated and Rosemeadow Elevated Supply Zones were reviewed to determine the Average Day Demand for the Mount Gilead site. The metered consumption for Rosemeadow Elevated of ADD 601 L/dwelling/day was the nearest highest of the three reservoir zones. Maximum day demands were then determined by comparing actual high demand days experienced in the Rosemeadow Elevated zone. Modelling has been undertaken for the Rosemeadow Elevated Zone. The overall Macarthur water supply system has not been modelled.

Wastewater loadings for the Mount Gilead site are based on the existing model, with EP updated for the current proposal and proposed growth rates. Inflow to the sewer during wet weather utilised the existing hydrological factors in the model and has allowed for reticulation via low infiltration gravity sewers. Modelling has been undertaken for the entire Glenfield catchment including future major developments at Menangle Park and Appin.

The water demands and wastewater loadings presented in **Table 3-1** and **Table 3-2** respectively have been adopted for assessment of all servicing options, including determination of required infrastructure capacity.

Table 3-1: Mount Gilead Ultimate Potable and Recycled Water Demands

	ADD (kL/day)	MDD (kL/day)	MHD (L/s)
Potable Only	1021	1494	47
Potable (Dual Pipe)	681	996	29
Recycled (Dual Pipe)	477	2180	91

Table 3-2: Mount Gilead Ultimate Wastewater Loadings

	ADWF (kL/day)	Sewer Design Flow (L/s)	Sewer Mining Extraction (kL/day)
Wastewater Only	893	72	0
Wastewater with Sewer Mining	402	72	491

4 ASSESSMENT CRITERIA

Options for water and sewerage infrastructure need to be developed and assessed in accordance with Sydney Water's Sustainability Planning Manual. Technically viable solutions are assessed and compared on the basis of environmental, financial and social criteria (triple bottom line analysis). Objectives to be met and the criteria commonly used to assess servicing strategies are described below. Options have been subjected to a high level subjective assessment with detail quantified assessments to be undertaken in later planning.

4.1 Mandatory Objectives

Mandatory objectives applied by Sydney Water are set out in **Table 4-1** below.

Table 4-1: Sydney Water Mandatory Planning Objectives

Corporate Goals	Mandatory Objectives
Providing clean, safe drinking water	• compliance with Australian Drinking Water Quality Guidelines • compliance with NSW Health Guidelines • compliance with Sydney Water's Operating Licence (continuity & pressure requirements)
Helping develop a water efficient city	• support for BASIX compliant development
Contributing to clean beaches, ocean, rivers and harbours	• compliance with Protection of the Environment Operations (POEO) Act licences • Sydney Water Operating Licence Requirements overflow related (performance standard 3.3.3) • EPA requirements with respect to the protected local waterways
Optimising resource use	• compliance with applicable Recycled Water Guidelines
Serving customers	• compliance with Sydney Water Act and Operating Licence • compliance with applicable legislation, regulation and codes • meeting approved development timeframes as defined in the Metropolitan Development Program (MDP)
Developing a safe, capable, committed workforce	• Compliance with WH&S legislation, regulation and codes
Delivering an economically efficient business.	• Meeting regulatory requirements for economic feasibility, including full cost recovery on capital investments and O&M costs

Additional desirable objectives to be met are:

- Contribute to secure water supply and wastewater services;
- Provide reliable customer service and minimise impacts on the community;
- Protect catchment and water body health;
- Provide affordable and efficient water and sewerage services;
- Minimise flora and fauna impacts; and
- Minimise energy use (greenhouse gas emission targets).

4.2 Criteria and Measures

The criteria and measures used for comparison of options are set out in **Table 4-2** below.

Table 4-2: Criteria and Measures used for Analysis

Objective	Criterion	Measure
Helping develop a water efficient city	Minimise drinking water use	Estimated total drinking water savings
Contributing to clean beaches, ocean, rivers and harbours	Minimise wastewater discharge to sensitive water ways	Estimated increase in wet weather discharge (overflows) to receiving water ways
		Estimated average STP effluent discharge to receiving water ways
	Ability to contribute to developer's stormwater objectives	Stormwater pollution control and flow management
Optimising resource use	Minimise lifecycle energy use	Estimated total embodied energy use
		Estimated total operational energy use
Serving customers	Level of acceptance by customers and community (i.e. odour, noise)	Impact during construction
		Impacts during operation
	Integration with existing strategies, plans and works of developer, government and councils	Ability to integrate with other planning and development in local area
	Ability to accommodate change (growth rates / change in technology)	Flexibility to accommodate changes in growth and development at Mount Gilead
Environmental considerations	Impact on environment	Impact of the servicing option on the local environmental (i.e. flora and fauna, salinity, etc.)

4.3 Cost Criteria

Comparative estimates for capital and operational cost for all servicing options were calculated using Sydney Water's guidelines.

A total project cost was also calculated for each option which considers the cost to operate each option over a 30-year period through capital and operational costs. The 30-year cost is then converted into present value (PV).

Capital cost estimates options have been prepared using the Sydney Water "Cost Estimator" spreadsheet Version 02-2012.01. The cost and contingency loadings used are shown in **Table 4-3**.

Table 4-3: Cost and Contingency Loadings

Costs	Allowance/Loading
Direct Costs	
Scope Development Strategic - Greenfield (% of Direct Costs)	+ 50%
Indirect Costs	
Contractor Design Costs (% of Direct Costs)	10.00%
Contractor Indirect Costs (% of Direct Costs)	10.00%
Contractor Margin (% of DC+ Indirect Costs)	15.00%
Risk Contingency (% of (Direct Costs +Indirect Costs + Margin))	40.00%
SWC Client Costs	
SWC Design Costs (% of Construction Costs)	7.50%
SWC Tender Costs (% of Construction Costs)	0.50%
SWC Planning Costs (% of Construction Costs)	1.00%
SWC Project Management Costs (% of Construction Costs)	8.00%
SWC Insurances & Financing Costs (% of Construction Costs)	0.55%
SWC Risk Contingency (% of the SWC Client Future Costs only)	10.00%

CAPEX and OPEX estimates were compiled using information contained in the following documents

- Info sheet 1 – Operations and Maintenance Costs: October 2012
- Info sheet 2 – Contingency and Indirect allowances: February 2013
- Info sheet 3 – Storage Cost: September 2012

The cost estimates have been prepared based on the following assumptions:

- Sydney Water's current standard discount rate of 7% has been adopted for PV calculations.
- The allowance for greenfield strategic scope development has been applied directly to the direct costs rates.
- Due to the relative complexity of the treatment options, the on-site wastewater option estimate has been pro-rated from a similar proposed scheme elsewhere in Sydney Water's area of operations.
- Mechanical and electrical components will be replaced at 15 year intervals, with assumed costs of 15% CAPEX.
- Internal water and sewerage reticulation, or temporary/interim infrastructure at Mount Gilead has not been included in the financial calculations.
- Cost estimates for pressure and gravity sewerage lines allow for the following:
  - Excavation in rock to a depth of 500mm per metre for an appropriately sized trench for 20% of the total length.
  - Road restoration over 5% of the total length.
- Energy costs are dependent on the proposed population growth within the site e.g. 20% of the ultimate population equates to 20% of electricity costs.

5 SERVICING OPTIONS LONG LIST

A long list of potential final servicing initiatives was compiled and reviewed against the assessment criteria.

5.1 Final Servicing Options

Tables 5-1 to **5-3** show all of the options considered, those that were shortlisted and the reasons for the selection or rejection.

Table 5-1: Potable Water Supply Options

Potable Water Supply Option	Comment	Shortlisted
Connection to Rosemeadow Elevated Reservoir Zone	• Modelling indicates available capacity • Reservoir is close to site • Reliable high quality supply • Connection point is close to site	Yes (Options PW1, PW2 and PW3)
Connection to Trility pipeline from Macarthur WTP	• Available capacity • Reliable high quality supply • Pipeline is adjacent to site, with existing DN500 tee for connection.	Yes (Option PW4)
Raw water supply from Upper Canal with on-site treatment.	• Upper Canal is adjacent to the site • Raw water quality; Local WTP required, with high costs and energy use (GHG) • Limited yield • No guarantee of security of supply • Other water users • SCA controls asset – need their agreement • Additional land requirements at off-take point	No – Security of supply
Raw water supply from the Nepean River with on-site treatment.	• Local WTP required, with high costs and energy use • Extraction licence required • Limited yield • No guarantee of security of supply • Variable water quality	No – Security of supply

Potable Water Supply Option	Comment	Shortlisted
Rainwater tanks on each dwelling	• Dependent on rainfall within site • Top up by water tankers	No – Security of supply
Rain water tanks with mains top up	• Dependent on rainfall within site • Mains top up – a connection to Sydney Water's network is required.	No[1]
Extraction of ground water with on-site treatment	• Ground water conditions unknown, however it is expected that salt removal would be required • Extraction volumes expected to be low • Site possibly subject to underground mining (Bulli Seam, BHPB) and/or coal seam gas extraction(PEL2, AGL)	No – Capacity unknown, unlikely to be viable
Recycled water- Wastewater treated to level acceptable for human consumption and added to drinking water supply.	• High cost and energy requirements • Not previously adopted in Sydney area	No – Customer resistance. Not standard practice in NSW

1 – Rainwater tanks and stormwater harvesting schemes become depleted during prolonged hot, dry weather. SWC design guidelines size potable networks relying on rainwater tanks as if they are potable only systems. For the purposes of this investigation, rainwater tank options have not been shortlisted, however their impact should be considered during the Detail Planning phase.

Table 5-2: Wastewater Servicing Options

Wastewater Servicing Option	Comment	Shortlisted
Send to existing Glenfield RWP via new infrastructure	• Glenfield reticulation network adjacent to site • Modelling indicates available capacity • May or may not include sewer mining	Yes (Options WW1 and WW2)
Send to existing West Camden RWP	• West Camden system is 11 km to the west	No – CAPEX too high
New onsite treatment plant	• High cost and energy usage • Buffer zones potentially required • Disposal by reuse or irrigation • Staged Implementation	Yes (Options WW3 and WW4)

Wastewater Servicing Option	Comment	Shortlisted
Decentralised treatment systems (Individual lots have on site treatment)	• Lot sizes in Mount Gilead are too small for onsite disposal	No – Not acceptable to Council
Send to existing Glenfield RWP via connection to existing Appin rising main	• Appin is a pressure sewer area with reduced wet weather flows • Rising main is located on Mount Gilead site • Significant CAPEX savings • Gravity pressure main, need to pump	No – Initial advice from Sydney Water is that this main has insufficient capacity to service the site.
Send to existing Glenfield RWP via connection to 300mm diameter sewer	• Glenfield reticulation network to the north of the site • Would require crossing of the creek to the north of Mount Gilead (west of Noorumba Reserve).	No – unlikely to have sufficient capacity to service the site (subject to confirmation at Detailed Planning phase).
Individual precinct sewerage and treatment systems	• Excessive operational requirements • High capital and operating costs compared with a centralized plant	No- Financial and operational viability

Table 5-3: Non-Potable Water Supply Options

Non-Potable Water Supply Option	Comment	Shortlisted
Rainwater tanks at individual properties	• Affected by climate, • Mains top up required • Low costs, assists BASIX	No [1]
Centralised stormwater harvesting	• Affected by climate • Currently intended for open space use only	No [1]
Extension of other recycled water infrastructure to site	• Closest recycled water systems at West Camden RWP (11km) and Glenfield RWP (19km)	No
Lot scale grey water recycling	• High maintenance requirement for residents • Only viable for large lot sizes	No

Non-Potable Water Supply Option	Comment	Shortlisted
Wastewater recycling at centralised STP for dual pipe servicing	• Feasible for onsite STP or sewer mining wastewater option • Additional treatment cost for contact use is minor.	Yes (WW4, RW2)
Sewer mining for dual pipe servicing	• Extracts water from sewage. • Connection to STP still required, but reduces volume of flow to STP by 40%	Yes (WW2, RW1)
Local Groundwater extraction	• Ground Water profile unknown • Land may be subject to future mining • Ground water quality not known, however yield is expected to be low.	No- Capacity unknown; unlikely to be viable
Raw Water from Nepean River	• Extraction Licence required • Treatment facilities required • Possible restrictions during drought periods	No
Raw Water from Upper Canal	• Upper Canal supplies drinking water to Sydney, no net water saving	No

1 – Rainwater tanks and stormwater harvesting schemes become depleted during prolonged hot, dry weather. SWC design guidelines size networks relying on rainwater tanks as if they are mains systems only. For the purposes of this investigation, rainwater tank options have not been shortlisted, however their impact should be considered during the Detail Planning phase.

5.2 Interim Servicing Options

Sydney Water has indicated that it may be possible to implement interim servicing arrangements to minimise up front infrastructure expenditure and to speed development rates. This approach is a relatively recent innovation within Sydney Water, although it is noted that none of these schemes are currently approved for implementation. Sydney Water does not fund interim servicing infrastructure.

In the case of Mount Gilead, an interim scheme may involve:

- The construction of a booster water pumping station to temporarily offset the construction of a water reservoir:
- The construction of a temporary wastewater treatment plant that disposes to currently available land within the development site (i.e. future land releases), until the permanent servicing arrangement is in place.
- Sewerage connection to the existing Appin rising main.

- Utilise potable water to supply a dual pipe reticulation until a permanent option for non-potable water supply is available.
- Such interim options would need to meet all regulatory, environmental and operating licence requirements.

Interim servicing options would be assessed in greater detail during the Detailed Planning phase (i.e. post re-zoning) when the population, staging and arrangement of the development has been confirmed.

6 SHORT-LISTED OPTIONS

The following sections outline a description of potable water, wastewater and recycled water servicing concept options developed for the site. The options are concept in nature, and the locations shown for individual infrastructure items are likely to change as planning for the site continues.

- **Potable Water Servicing Options:** These options reflect potential sources and methods for servicing the Mount Gilead site (refer to **Section 7**).
- **Wastewater Servicing Options:** These options include wastewater disposal options for the site, including pumping to an existing Sydney Water system, irrigation and reuse (refer to **Section 8**).
- **Recycled Water Servicing Options:** These options assume that recycled water in a dual pipe system reduces potable water demand and is available from an appropriate wastewater option. The main difference between recycled water options is the source for potable water and the related reduction in potable water infrastructure capacity (refer to **Section 9**).

7 POTABLE WATER

Potable water can be supplied to the site by either connection to the adjacent Rosemead Elevated reservoir zone or connection to the Trility owned bulk water pipeline that passes to the west of the site.

The outcome of the modelling investigation was that whilst Rosemeadow Elevated reservoir zone has sufficient capacity to supply the site and amplification of existing assets is not required, the pressure provided by Rosemeadow Elevated reservoir is insufficient to supply the entire Mount Gilead site by gravity. Service extents are shown in **Figure 7-1**.

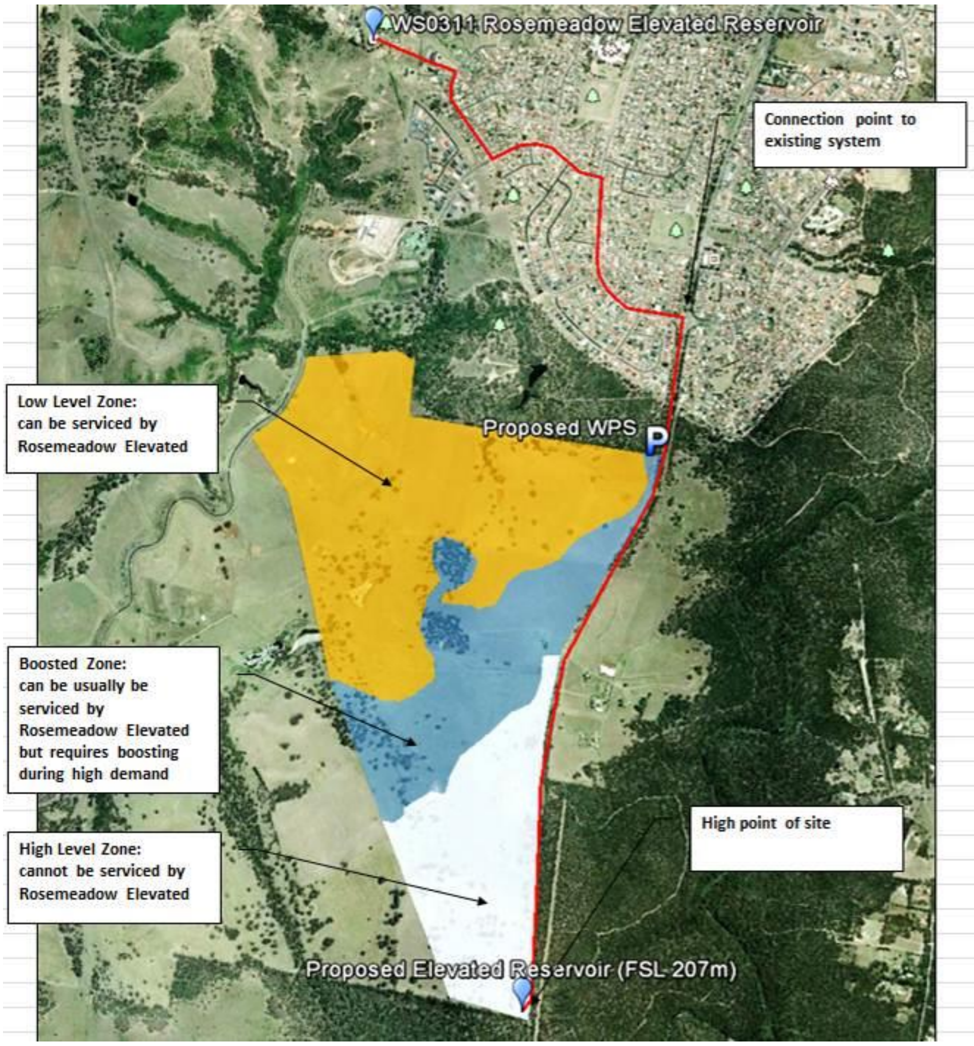

Figure 7-1: Potable Water Supply Zones

There are a number of ways to provide potable water supply to Mount Gilead with the following options considered to be appropriate:

- PW1 – New reservoir zone for all of Mount Gilead with a new water pumping station and reservoir;
- PW2 – New high level reservoir zone for Mount Gilead high level and boosted zones with a new water pumping station and reservoir, with the remainder supplied by gravity from Rosemeadow Elevated;
- PW3 – New boosted zone for Mount Gilead high level and boosted zones, with the remainder supplied by gravity from Rosemeadow Elevated;
- PW4 – Connection to the adjacent Trility pipeline from Macarthur WTP, utilising pipeline pressure to supply the site.

All options requiring connections to the Sydney Water network (PW1, PW2, and PW3) include a supply main from the Rosemeadow Elevated reservoir zone and some form of pumping station.

7.1 PW1 – New Reservoir Zone

The Mount Gilead development site is located adjacent to the Sydney Water Rosemeadow Elevated Supply zone. To create a new reservoir zone, the following infrastructure would be required. Refer to **Figure 7-3**.

Stage	Infrastructure
1	Connection to the existing DN450 pipe at the intersection of Appin Rd and Kellerman Drive
	580m long DN250 supply main along Appin Road.
	Water pumping station nominally located on the northern boundary of the Mount Gilead site. Approximate duty 50 L/s @ 62m (50kW duty).
	2300m DN200 rising main generally following Appin Rd, to the extreme southern end of the site.
	1.5ML elevated security reservoir located at the southern end of the site with TWL 207 mAHD

Based on the current staging, Stage 1 of the development is partially located in the high level pressure zones on the site and it has been assumed that all infrastructure would need to be completed for Stage 1. This may change depending on the detailed planning and final staging of the development.

A pressure reducing valve (PRV) would be required within the site reticulation to manage water pressure to customers in the lower portions of the site.

7.2 PW2 – New High Level Reservoir Zone

PW2 is to create a new high level reservoir zone serving approximately 56% of the site, with the remainder of the site fed by gravity. The following infrastructure would be required (refer to **Figure** 7-4):

Stage	Infrastructure
1	Connection to the existing DN450 pipe at the intersection of Appin Rd and Kellerman Drive
	580m long DN250 supply main along Appin Road.
	New water pumping station nominally located on the northern boundary of the Mount Gilead site. Approximate duty 28 L/s @ 52m (24kW duty).
	2300m DN150/200 rising main generally following Appin Rd, to the extreme southern end of the site.
	0.85ML elevated security reservoir located at the southern end of the site with TWL 207 mAHD.

Based on current staging, Stage 1 of the development is partially located in the high level pressure zones on the site and it has been assumed that all infrastructure would need to be completed for Stage 1. This may change depending on the detailed planning and final staging of the development.

7.3 PW3 – New High Level Boosted Zone

PW3 is to create a new high level boosted zone serving approximately 56% of the site, with the remainder of the site fed by gravity, the following infrastructure would be required (refer to **Figure 7-5**):

Stage	Infrastructure
1	Connection to the existing DN450 pipe at the intersection of Appin Rd and Kellerman Drive.
	New 580m long DN250 supply main along Appin Road.
	New booster water pumping station nominally located on the northern boundary of the Mount Gilead site. Approximate maximum duty 28 L/s @ 52m (24kW duty).
	New 1050m DN150 rising main generally following Appin Rd, to the northern end of the boosted zone.

Based on current staging, Stage 1 of the development is partially located in the high level pressure zones on the site and it has been assumed that all infrastructure would need to be completed for Stage 1. This may change depending on the detailed planning and final staging of the development.

7.4 PW4 – Trility Pipeline

The Trility-owned DN1200 potable water pipeline from the Macarthur WTP passes to the west of the Mount Gilead development on land owned by Mount Gilead Pty Ltd.

The Trility system feeds into the Sydney Water trunk network at Sugarloaf, to the north of Rosemeadow. The Trility pipeline is the ultimate bulk water source for Rosemeadow Elevated. The interconnection between the Macarthur WTP and Sydney Water systems are shown in **Figure 7-2**.

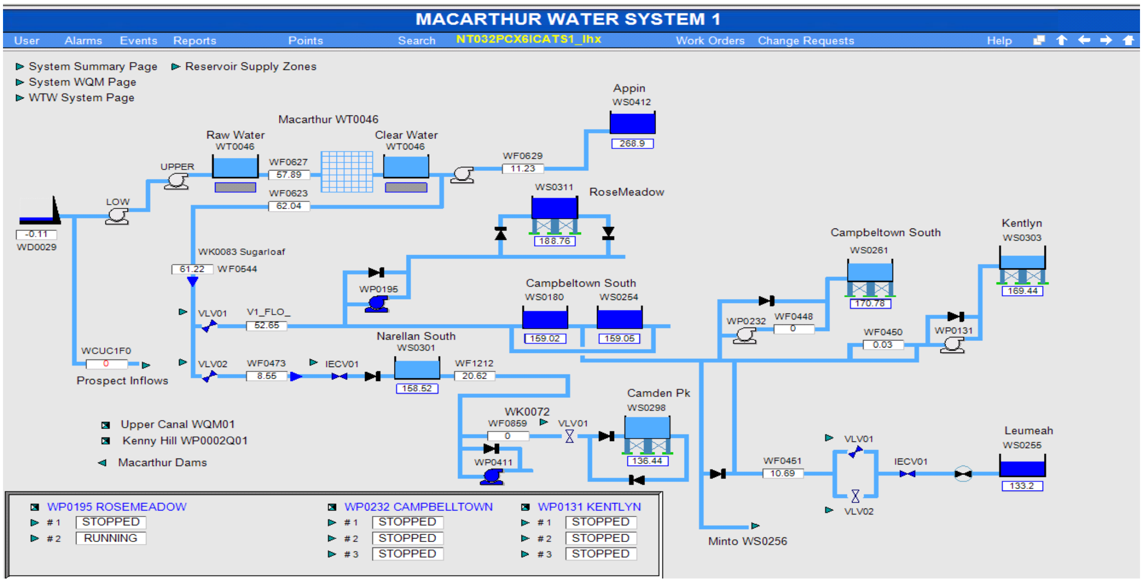

Figure 7-2: Macarthur Water Supply System

Initial enquiries to Trility Water resulted in an email response (refer to **Appendix 4**) and Work- As-Constructed drawings of the pipeline. The following key points were noted:

Sydney Water owns the distribution system and manages connections and distribution design. Sydney Water is also responsible for determining if capacity is available. Any offtake must be approved by Sydney Water in conjunction with Trility as there are operational complications to be considered by both parties.

There is a 500 mm offtake shown on Trility's drawings, however its location has not been confirmed.

The Macarthur WTP nominally operates continuously, 24 hours a day, 365 days a year. Two Clean Water Tanks (CWTs) upstream of the pipeline maintain flow through the pipeline should the plant shut down. Planned shutdowns of the WTP usually occur in winter when demand is low, although unplanned shutdowns due to process failure or poor raw water quality can happen at any time. The Trility CWTs have sufficient elevation (240 mAHD) to directly supply the entire Mount Gilead site via gravity; however this needs to be confirmed.

The standards of service and security of supply requirements for the Trility pipeline is unknown.

The CWTs at the treatment plant are required to provide emergency supply for the entire system and are used under normal circumstances to buffer flows into the system to cope with any surpluses or deficits in hourly production versus bulk water demand from the system. The two CWT's have a total capacity of 20 ML (2 x 10ML) and the average system demand is around 55ML/d. Therefore the tanks have capacity for approximately eight hours supply at average day demand across the entire system that is supplied by the Macarthur WTP.

There is no information available regarding the frequency and duration of shut downs of the pipeline, planned or unplanned. For the purposes of this investigation, it is assumed that Mount Gilead would require sufficient storage for 24 hours Maximum Day Demand to provide security of supply.

Mount Gilead Pty Ltd have indicated that in exchange for construction access for the pipeline an offtake was installed by the pipeline owners for a potential connection and supply of water. There are no details available regarding the agreement for the supply of water from the pipeline.

To supply the site by gravity via the Trility pipeline, the following infrastructure would be required. Refer to **Figure 7-6**:

Stage	Infrastructure
1	Connection to the existing DN500 offtake from the Trility pipeline including an AICV and flowmeter. Location to be confirmed. No allowance has been made for SWC costs for integration of the Mount Gilead offtake flow monitoring into the Trility / SWC IICATS control system; 1.7km DN250 internal transfer main to the extreme southern end of the site; 1.5ML elevated security reservoir located at the southern end of the site with TWL 207 mAHD

Based on the current staging, Stage 1 of the development is partially located in the high level pressure zones on the site, and it has been assumed that all infrastructure would need to be completed for Stage 1. This may change depending on Trility supply conditions, detailed planning and final staging of the development. A PRV would be required within the site reticulation to manage water pressure to customers in the lower portions of the site.

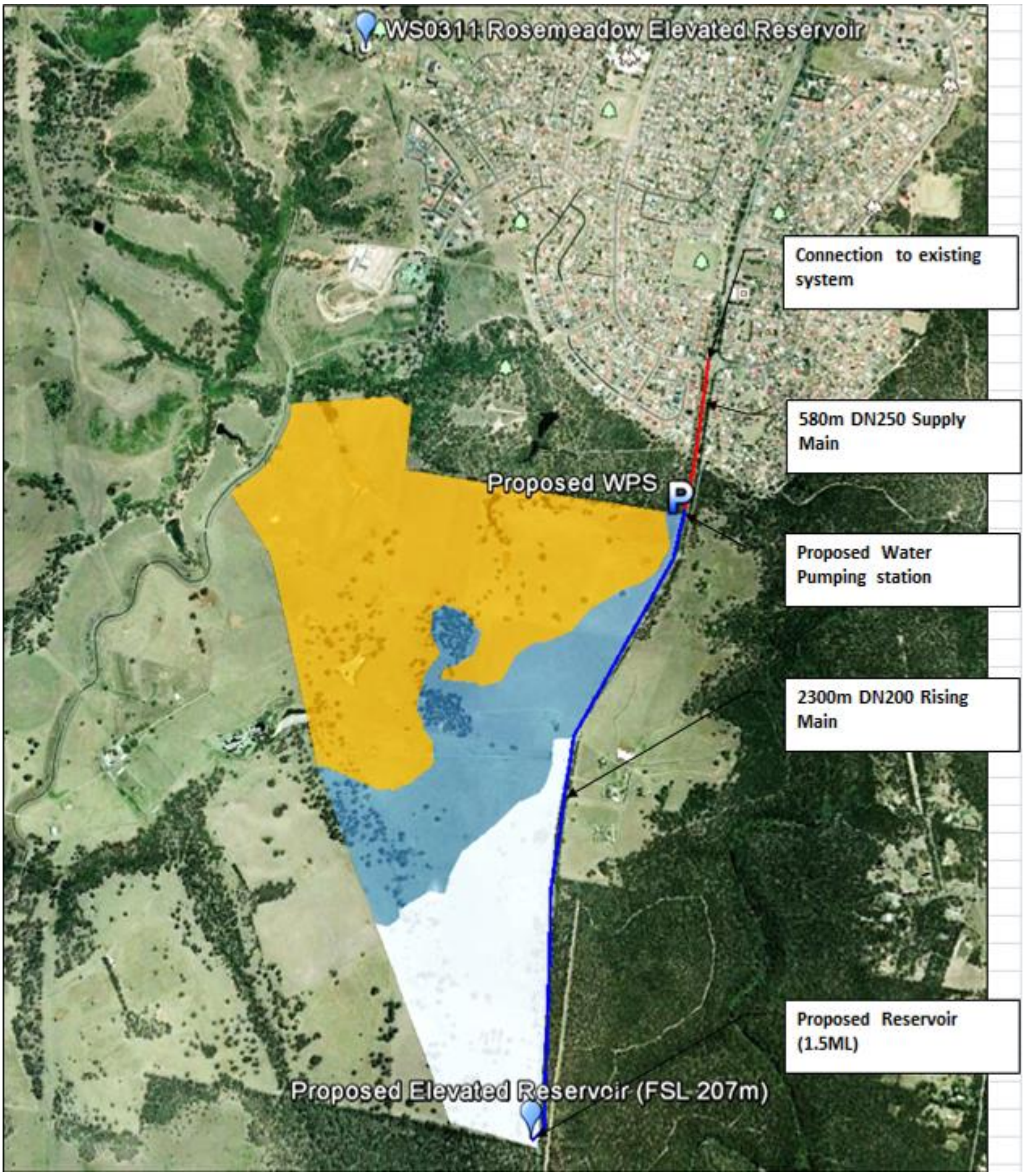

Figure 7-3: Potable Water Option PW1

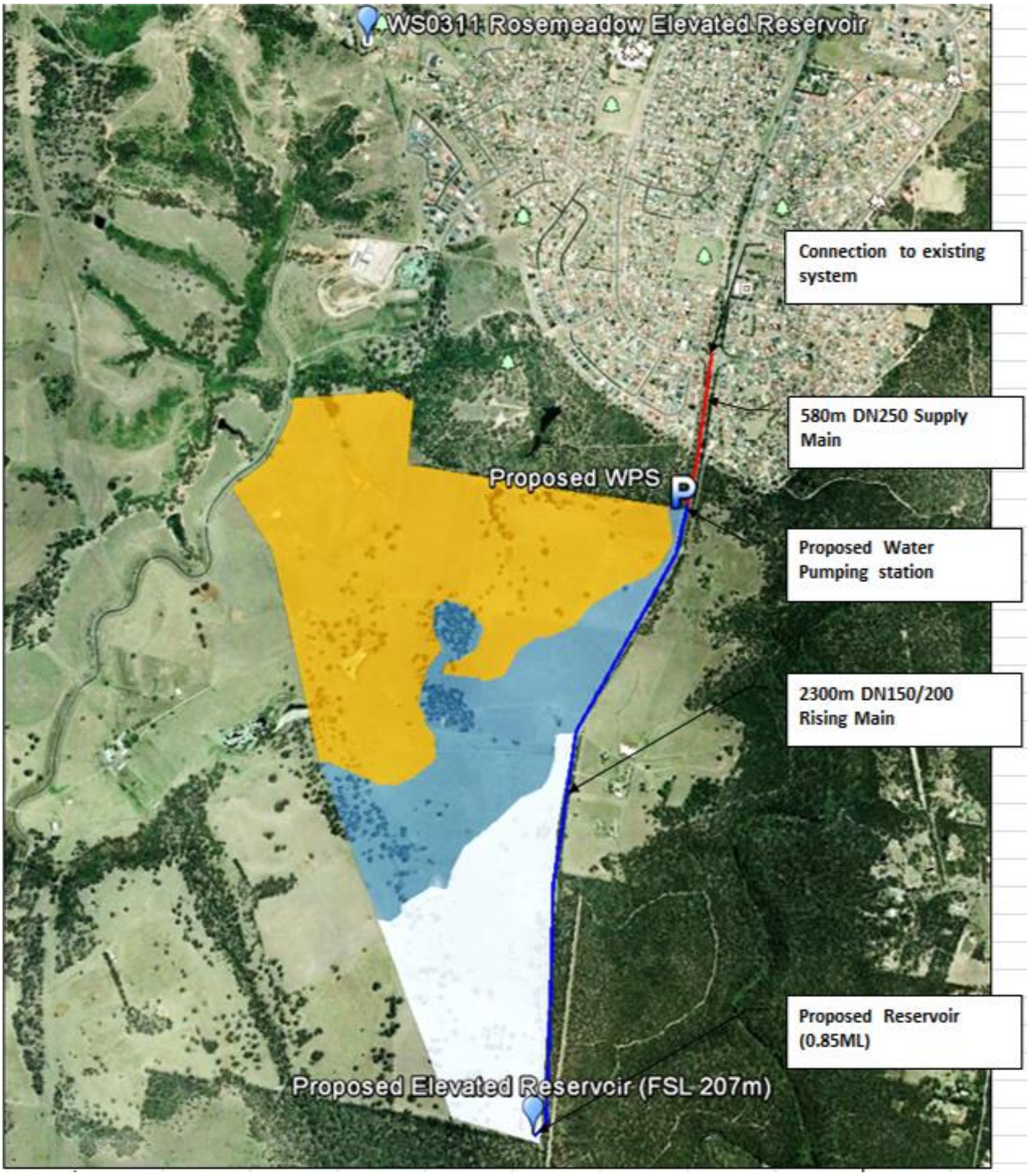

Figure 7-4: Potable Water Option PW2

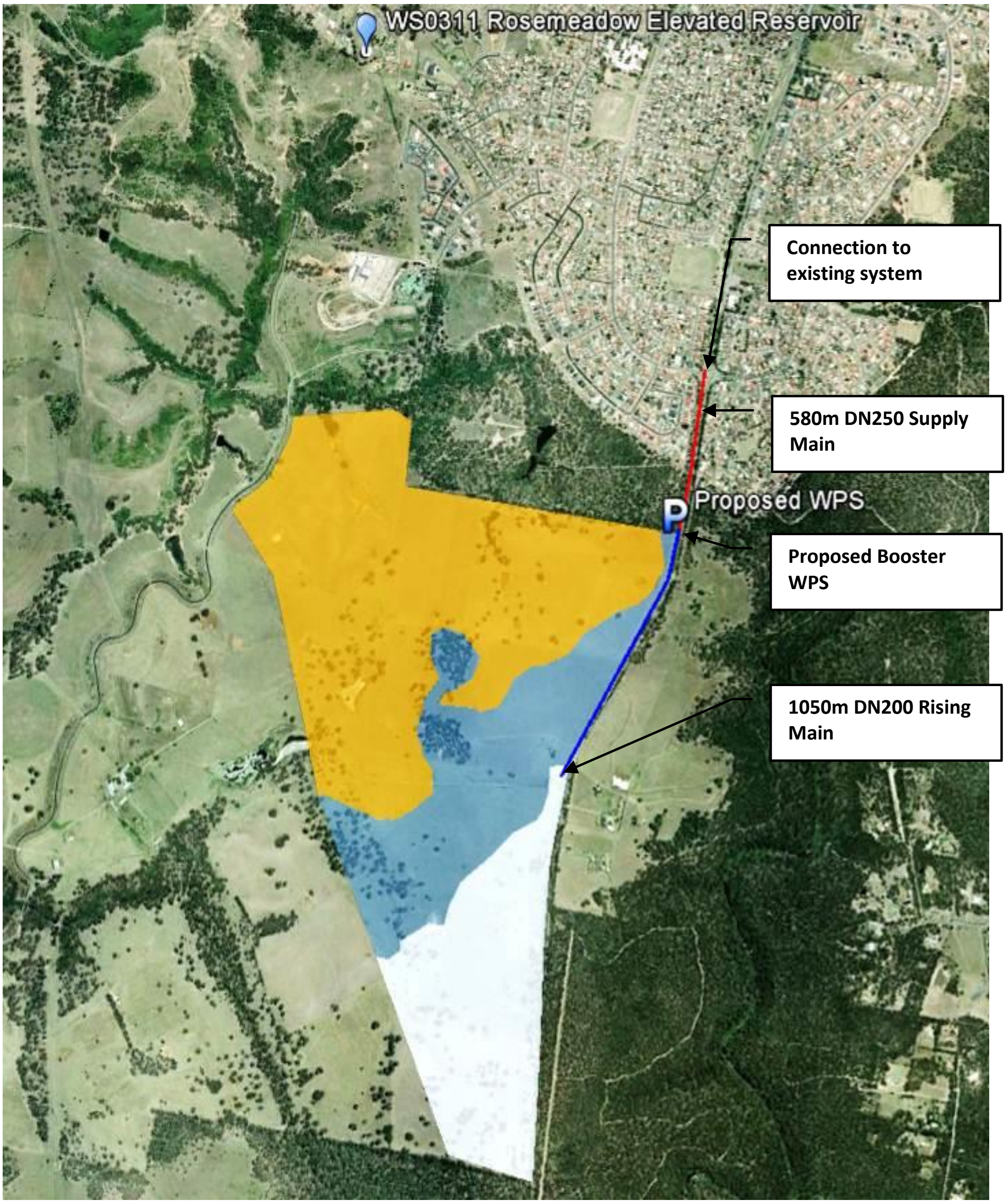

Figure 7-5: Potable Water Option PW3

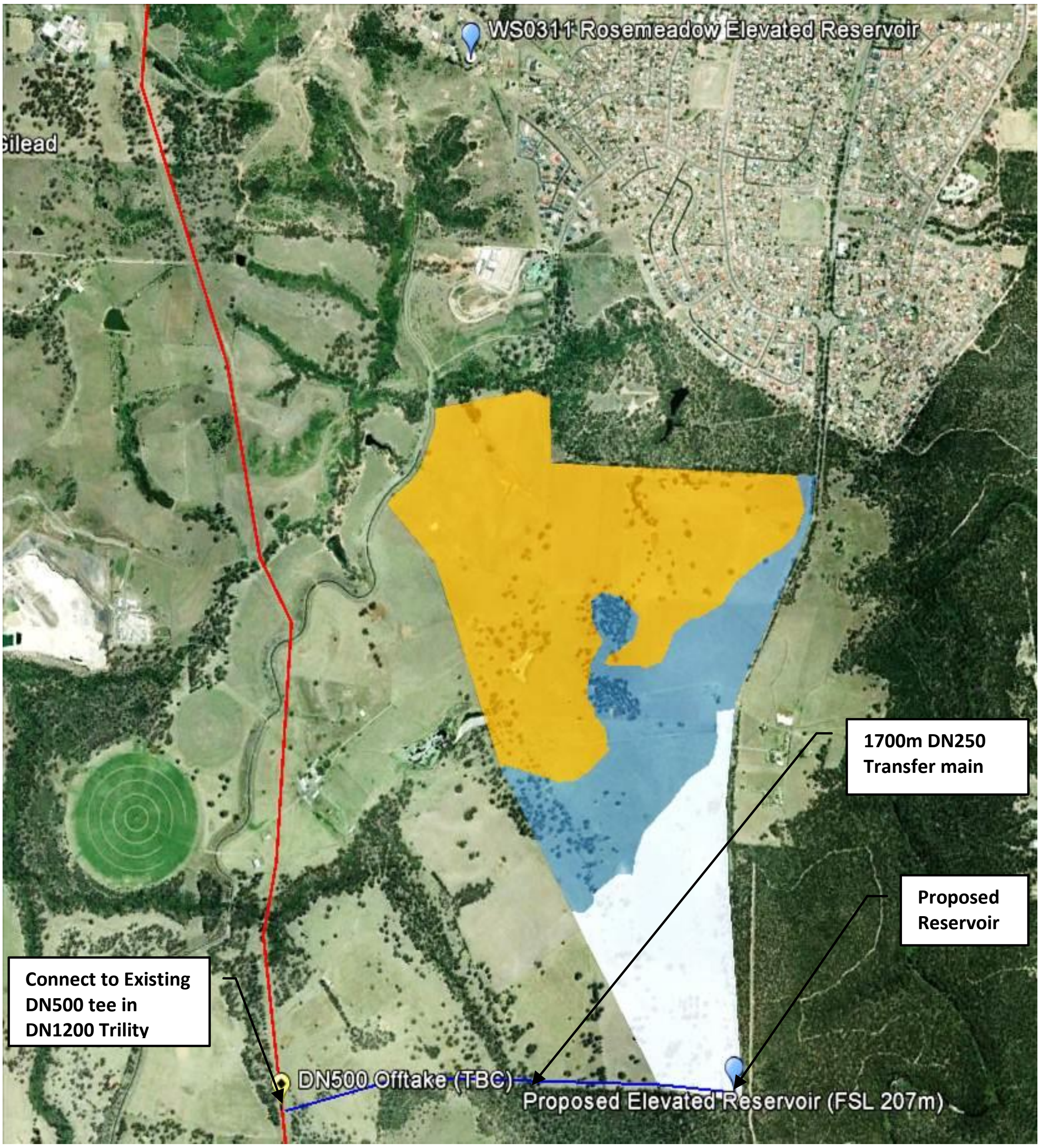

Figure 7-6: Potable Water Option PW4

7.5 Potable Water Option Assessment

The options for potable water have been compared against the cost and non-cost based assessment criteria. This assessment is a subjective review with a more detailed assessment to be carried out as part of detail planning. The assessment is as follows:

7.5.1 Contribute to secure water supply and wastewater services

Security of potable supply was assessed for the four options:

- PW1 and PW2 rely on pumping to service the elevated parts of the site but have backup supply from the new reservoir. Lower parts of the site can still be supplied by gravity from the Rosemeadow Elevated Reservoir.
- PW3 has the least secure supply due to the lack of a reservoir and total reliance on pumping to maintain supply to the higher parts of the site. Lower parts of the site can still be supplied by gravity from the Rosemeadow Elevated Reservoir.
- PW4 does not rely on pumping to provide supply from the clean water tanks at Macarthur WTP, however the CWT's have limited storage in the event of an outage.

7.5.2 Minimise drinking water use

All four potable water options have identical water consumption. The effect of use of rainwater tanks for source substitution, although not assessed in this report, would be identical for all potable water options.

The effect of water reuse on potable water consumption is addressed in the recycled water option comparison.

7.5.3 Stormwater pollution control and flow management

The potential use of rainwater tanks for source substitution and runoff reduction, although not assessed in this report, would be identical for all potable water options.

7.5.4 Minimise lifecycle energy use

PW4 has the least operational energy use, as supply to the site is provided by the elevation of the Macarthur WTP and no pumping is required.

PW2 and PW3 have the next least energy use, due to part of the development being supplied by gravity from Rosemeadow Elevated.

PW1 has the highest energy usage, as all water in the reservoir zone is pumped up to the new reservoir.

Macarthur WTP is the bulk water source for Sydney Water Networks in the area. Options PW1, PW2 and PW3 use additional energy to transfer water from the outlet of the Macarthur WTP pipeline, and back through the network to Rosemeadow Elevated and Mount Gilead. The cost of this additional energy loss has not been assessed for this report.

Embodied energy has been assessed on the basis of estimated mass of materials in the following increasing order:

- PW3 – Does not have a reservoir;
- PW4 – Large reservoir, but does not have a pumping station;
- PW2 – Small reservoir and pumping station;
- PW1 – Large reservoir, large pumping station.

7.5.5 Level of acceptance by customers and community (i.e. odour, noise)

Noise generation in the potable water system is typically due to pumping operations and reservoir filling to a lesser extent. Assessed on pump power, PW4 would have the least noise generation, followed by PW2, PW3 and PW1.

There is no difference between the options in regard to odours.

7.5.6 Impact during construction and operation

Potable water works are generally restricted in and around the site. In addition, most potable water servicing works are required prior to occupancy of the site, so there is little expected impact on residents.

PW4 would have the least construction impact, as all works would be restricted to the site, or land controlled by the owners of the site. However, these works would be undertaken in proximity to the Upper Canal and other services, with the design intended to mitigate any impact.

The other 3 options require construction of a pipeline along Appin Rd but would otherwise be on the site with limited impact.

7.5.7 Policy Integration

There is no known difference between potable water options for this criterion at this time.

7.5.8 Impact on the environment

Preliminary site investigations of the site have indicated that:

- The Mount Gilead study area site is primarily farm land with a long history of intensive agricultural use. The majority of watercourses in the study area are considered substantially to slightly modified as a result of this history of use. Threatened ecological communities exist in the study area, as sparsely spread low grade populations and a small number of high quality concentrated populations. The planning proposal for overall development allows for the removal of the low quality populations and the rehabilitation and protection of the high quality populations to meet biodiversity obligations. The retained and protected populations will not be affected by the construction of the water and wastewater infrastructure.

- A number of Aboriginal heritage sites have been identified at the site, and it is likely that all sites will be disturbed during the development of the site. Disturbance of these sites are likely to be due to the development in general, rather specifically attributable to potable water servicing works.
- The surface soils are generally composed of non-saline soils and are expected to yield negligible salinity effects, although localised salinity problems are possible.
- Development of the overall site will cause minor deterioration of some historically significant district views from the mill but not from the homestead. Mitigation measures have been proposed to ensure the effect is minimal.
- The proposed reservoir will be the only significant item of potable water infrastructure visible from the mill (but not the homestead), and this will be filtered through existing and planned proposed trees between the mill and the reservoir.
- Development of the overall site will cause deterioration of some historically significant district views from the Mount Gilead homestead and windmill some 800m to the west. The proposed reservoir will be the only significant item of potable water infrastructure visible from these buildings.
- There is no record of contaminated land or industries on the site.

In general, there are no significant environment impacts due to the provision of potable water infrastructure, nor are there significant differences between the options. Options PW1, PW2 and PW4 are likely to have the largest impact on the environment, primarily due to the visual amenity of the proposed reservoir.

7.6 Financial Evaluation

A Present Value cost analysis was undertaken (see **Appendix 5**) with the results summarised in **Table 7-1**.

Table 7-1: Potable Water Option Costs

Option	CAPEX	OPEX	PV
PW1	$9,613,261	$5,249,528	$10,354,064
PW2	$8,131,261	$4,077,707	$8,664,497
PW3	$1,775,691	$1,957,085	$2,159,400
PW4	$6,851,099	$2,501,445	$6,964,155

In summary:

- Option PW3 is the only option without a reservoir and is the lowest cost option in terms of PV and CAPEX for this reason.
- Option PW4 has the next lowest PV, as it does not require a pumping station.
- Option PW2 is the second most expensive option due to inclusion of a reservoir
- PW1 is the most expensive option.

For all options serviced from Rosemeadow Elevated (PW1, PW2 and PW3), the initial stages of the development are within the portion of the site that cannot be supplied by gravity, requiring all servicing infrastructure to be completed for Stage 1 of the development. This includes high cost items such as the reservoir and pumping station.

Options to delay initial expenditure on potable water infrastructure include:

- Modify staging to develop the lower parts of the site first as these areas can be serviced by gravity from Rosemeadow Elevated Reservoir.
- Provide smaller temporary pumping and storage facilities.
- Temporarily accept a lower security of supply for the higher properties. This approach would also be similarly applicable for PW4.

7.7 Summary

In summary;

- Option PW2 is the preferred option. Although it is the second most expensive option, it would result in a greater security of supply than options PW3 and PW4.
- Option PW1 has the highest impact, highest energy use and highest PV costs and is less preferable than PW2 for these reasons.
- Option PW4 has the second lowest PV, lowest energy consumption and low impact. The permissibility of a connection to the Trility pipeline is unknown at this time, and it is unclear if this option is available. The security of supply associated with this option is also less than for options PW1 and PW2.
- Option PW3 has a significantly lower PV than the other options as it does not require construction of a reservoir, and is generally similar to the other options for the other criteria. However, this option also has poor security of supply and is not preferred for this reason.

The servicing approaches described in PW2 and PW4 are repeated in the potable water component of the recycled water options, RW1 and RW2 respectively.

8 WASTEWATER

The outcome of the modelling investigation was that the Glenfield system had sufficient capacity to accept the flows from the Mount Gilead site. A number of options were identified to provide wastewater services to Mount Gilead with some providing treatment processes for disposal to irrigation or use in a dual pipe recycled water scheme. The following options were considered:

- WW1 – Transfer all wastewater to the Glenfield system with a new SPS and rising main.
- WW2 – Extract water from wastewater via sewer mining for recycled water in a dual pipe scheme and transfer the remaining flow to the Glenfield system.
- WW3 – Construct a new STP serving Mount Gilead with effluent disposal via irrigation.
- WW4 – Construct a new STP serving Mount Gilead with effluent disposal via irrigation and recycled water in a dual pipe scheme.

Low infiltration gravity sewerage reticulation has been adopted for all options, ahead of a pressure system, for the following reasons:

- The site is well graded and would require few, if any additional sewage pumping stations to service the entire site.
- Due to inflows from stormwater, gravity systems typically have a higher flow capacity than a pressure system. A gravity system has been adopted as it provides a more conservative estimate for sizing of the servicing infrastructure.

For the purposes of this investigation, a pressure sewer system has not been considered, however their impact should be considered during the Detailed Planning phase.

There would be little advantage in a vacuum sewerage system for this site.

8.1 WW1 – Discharge to the Glenfield sewer network

The Mount Gilead development site is located to the south of the Glenfield-Liverpool gravity wastewater system, part of the Malabar wastewater system.

The Glenfield System serves the suburbs of Glenfield, Casula, Macquarie Links, Macquarie Fields, Ingleburn, Minto and Bow Bowing. The nearest carrier to the Mount Gilead site is the Old Menangle Rd Carrier which drains to the Glenfield-Campbelltown Sub main and ultimately to the Glenfield RWP, located about 19 km away from the development.

Menangle Park sewerage is in the advanced stages of planning and will discharge to the Bow Bowing carrier. The Appin Low Pressure Sewer System is located to the south of Mount Gilead and connects to the Glenfield system via a DN250 rising main which traverses the Mount Gilead site, adjacent to Appin Rd.

Modelling results indicated that a pumping station with 70L/s capacity would be sufficient to service the ultimate Mount Gilead development during a 1 in 3 month event. Using WSAA design methodology, the pumping station would require a 130L/s design capacity, which forms the basis of the cost estimate.

The connection point to the Glenfield system (Node# SM0-03) represents the furthest upstream extent of the modelled system for connection from Mount Gilead, and is the closest point where sewer capacity can currently be modelled.

A twin rising main is proposed in order to:

- assist in reducing the impact of low rising main flows in the initial stages of the development; and
- allow the sewage from Mount Gilead to discharge into different points in the Glenfield system, close to Mount Gilead, thereby reducing the length of gravity sewer required.

To service the site, the following infrastructure would be required (refer to **Figure 8-1**):

Stage	Infrastructure
1	A new 310kW sewage pumping station located at the low point in the Mount Gilead site, RL130m. 1.2km DN150 rising main to the local high point in Rosemeadow. 3.8km DN300 gravity sewer to Woodhouse Drive, Ambarvale (Node SMO-03).
4	1.2km DN200 rising main to the local high point in Rosemeadow.

8.2 WW2 – Discharge to Glenfield sewer network with sewer mining for reuse

This option includes a local wastewater treatment plant to produce a disinfected tertiary effluent, suitable for human contact in a dual pipe recycled water system with the remaining wastewater and treatment waste transferred to Glenfield system via a new SPS and twin rising mains.

The treatment plant would be sized to meet the average day recycled water demand, 0.5 ML/day rather than maximum day demand to reduce the capital cost. It is expected that this would be able to meet 95% of Mount Gilead's annual non-drinking water demand, excluding the potential impact of rainwater tanks.

SWC permits a maximum of 600mg/L suspended solids to be discharged to sewers from sewer mining facilities. Based on a typical suspended solids load of 250mg/L for raw sewage, up to 55% of sewage flows could be reclaimed.

Daily production of recycled water can be adjusted to meet expected demand, with potable water used to supplement supplies during high demand. Potable water would be initially utilised in the recycled network until the site developed sufficient wastewater flows to sustain the sewer mining system.

Recycled water facilities such as storage and distribution pumping stations are described in the recycled water options (RW1 and RW2).

The treatment plant would include treatment elements such as:

- Membrane Bio Reactor (MBR) plant - The treatment process assumed for Mount Gilead RWP includes a Membrane Bio Reactor (MBR) plant which may be staged to reach full treatment capacity over multiple stages based on the development rate and size of the proposed development.

  The MBR plant is a modified activated sludge process with screening, pre-treatment process, bio reactor and a two tier membrane cartridge system contained within the MBR tank. A MBR plant has the distinct advantage of having a smaller footprint and reduced sludge production (typically 1.2% of inflow volume when compared to the conventional activated sludge process of about 15%). Sludge and other solids would be returned to the waste water system for pumping to the Glenfield system. The plant would be fully enclosed, with odour control to reduce or negate buffer zone requirements.
- Reverse osmosis (if required) – to prevent accumulation of dissolved solids within the recycled water system
- UV disinfection and chlorination – for pathogen control.

To service the site, the following infrastructure would be required (refer to **Figure 8-2**):

Stage	Infrastructure
1	A new 310kW sewage pumping station located at the low point in the Mount Gilead site, RL130m. 1.2km DN150 rising main to the local high point in Rosemeadow. 3.8km DN300 gravity sewer to Woodhouse Drive, Ambarvale (Node SMO-03).
3	Initial 50% capacity of a 0.5 ML/day MBR+RO treatment plant (tertiary) and sewer mining facility
4	1.2km DN200 rising main to the local high point in Rosemeadow.
5	50% capacity of 0.5 ML/day MBR+RO treatment plant (tertiary)

Recycled water infrastructure downstream of the STP outlet is addressed in the recycled water options.

8.3 WW3 – Onsite STP with disposal to irrigation

This option treats wastewater to produce a disinfected secondary effluent, suitable for spray irrigation of non-food crops (turf, pasture) for total disposal of all wastewater flows.

The treatment plant would be sized to meet the full wastewater loading, nominally 1.0 ML/day with 24 hours raw wastewater storage.

The treatment plant would include elements such as:

- Membrane Bio Reactor (MBR) plant - The treatment process assumed for Mount Gilead RWP includes a Membrane Bio Reactor (MBR) plant which may be staged to reach full treatment capacity over multiple stages based on the development rate and size of the proposed development.

  The MBR plant is a modified activated sludge process with screening, pre-treatment process, bio reactor and a two tier membrane cartridge system contained within the MBR tank. A MBR plant has the distinct advantage of having a smaller footprint and reduced sludge production (typically 1.2% of inflow volume when compared to the conventional activated sludge process of about 15%). The plant would be fully enclosed, with odour control to reduce or negate requirements for buffer zones. The sludge generated from the process would be pumped out and tankered away by a licensed contractor to West Camden or Glenfield RWP plants.
- UV disinfection and chlorination – for pathogen control.

The treated effluent from Mount Gilead STP will be reused for irrigation of parklands, fields etc. and existing turf farms with irrigation infrastructure to the west of the site, although other consumers may be identified in the future. A design irrigation rate of 4 ML/ha/yr (approximately 1.1 mm/day) has been assumed, requiring an irrigated area of 81 ha. The irrigation rate will need to be further refined after a land capability assessment for irrigation areas has been undertaken. No allowance has been made for the acquisition of irrigation land.

A storage pond will be required to balance flow during reduced periods of irrigation demands during winter and periods of wet weather. Wet weather storage ponds are to be PE lined and based on approximately 7 days of wet weather storage. In the event of prolonged wet weather treated effluent would be discharged to local waterways.

To service the site, the following infrastructure would be required. Refer to **Figure 8-3**.

Stage	Infrastructure
1	New 50kW lift sewage pumping station and short rising main to transfer sewage to STP 1 ML raw sewage buffer storage with odour removal; Initial 25% capacity (60% of costs) of a 1 ML/day MBR treatment plant (secondary) – up to 1500 EP New pumping station to transfer effluent to irrigation (30kW) New 4km DN150mm uPVC pipeline to irrigation areas New 7ML wet weather pond storage
3	Additional 25% capacity of a 1 ML/day MBR treatment plant – up to 3000 EP
5	Additional 25% capacity of a 1 ML/day MBR treatment plant – up to 4500 EP
8	Additional 25% capacity of a 1 ML/day MBR treatment plant – up to 6000 EP

8.4 WW4 – Onsite STP with disposal to irrigation and reuse

This option is similar to WW3 above except that wastewater would be treated to a tertiary standard, suitable for human contact and used for internal non-potable reuse (i.e. toilet flushing, washing machines). Excess water would be disposed of by irrigation although the preference would be to reduce effluent discharge into a sensitive environment by identifying additional recycled water customers. To service the site, the following infrastructure would be required. Refer to **Figure 8-4**.

Stage	Infrastructure
1	New 50kW lift sewage pumping station and short rising main to transfer sewage to STP 1 ML raw sewage buffer storage; Initial 25% capacity (60% of costs) of a 1 ML/day MBR +RO treatment plant (tertiary) New pumping station to transfer effluent to irrigation (30kW) New 4km DN150mm uPVC pipeline to irrigation areas New 7ML wet weather pond storage
3	Additional 25% capacity of a 1 ML/day MBR+RO treatment plant
5	Additional 25% capacity of a 1 ML/day MBR+RO treatment plant
8	Additional 25% capacity of a 1 ML/day MBR+RO treatment plant

Non-potable water infrastructure downstream of the STP outlet is addressed in the recycled water options.

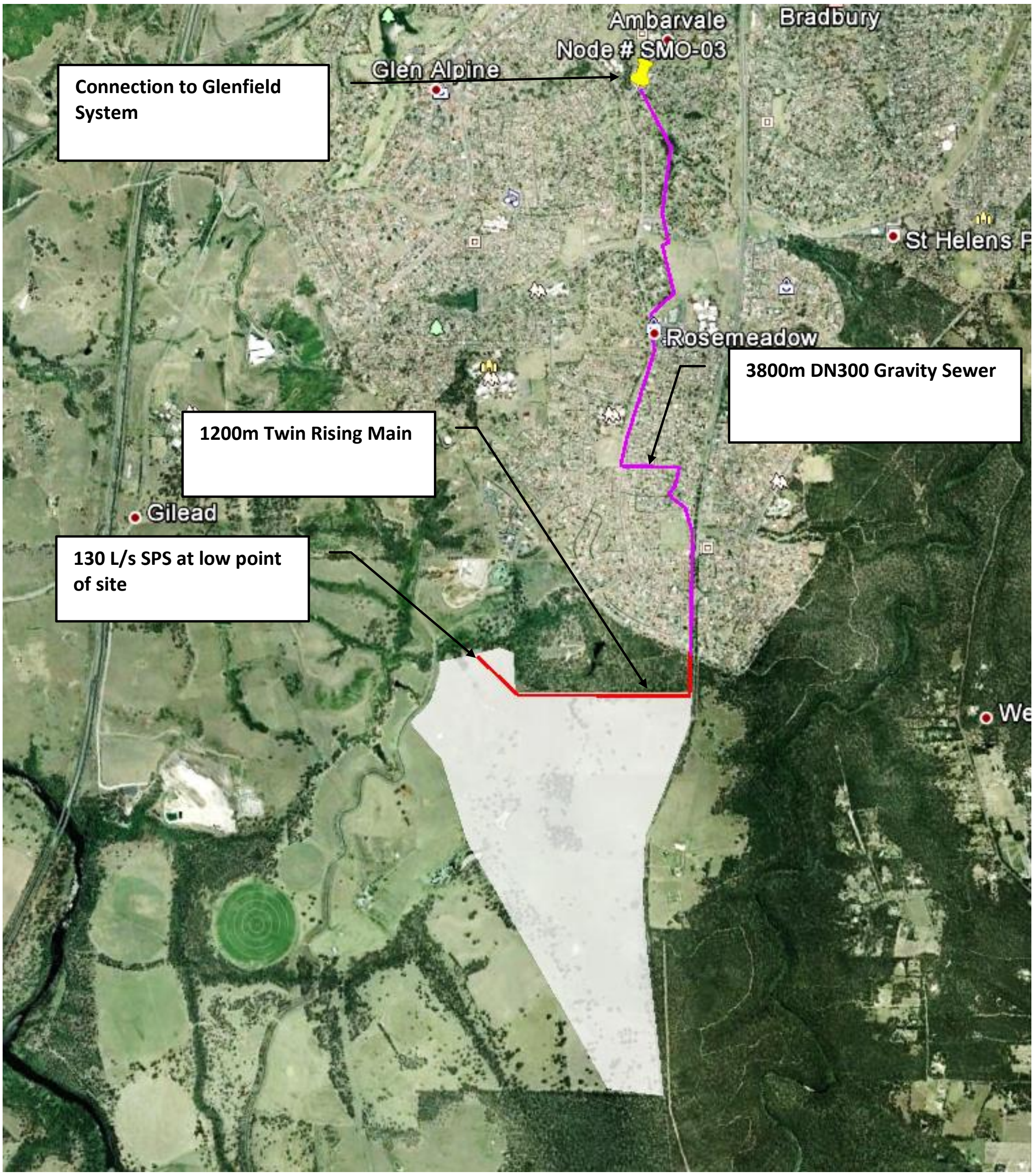

Figure 8-1: Wastewater Option WW1

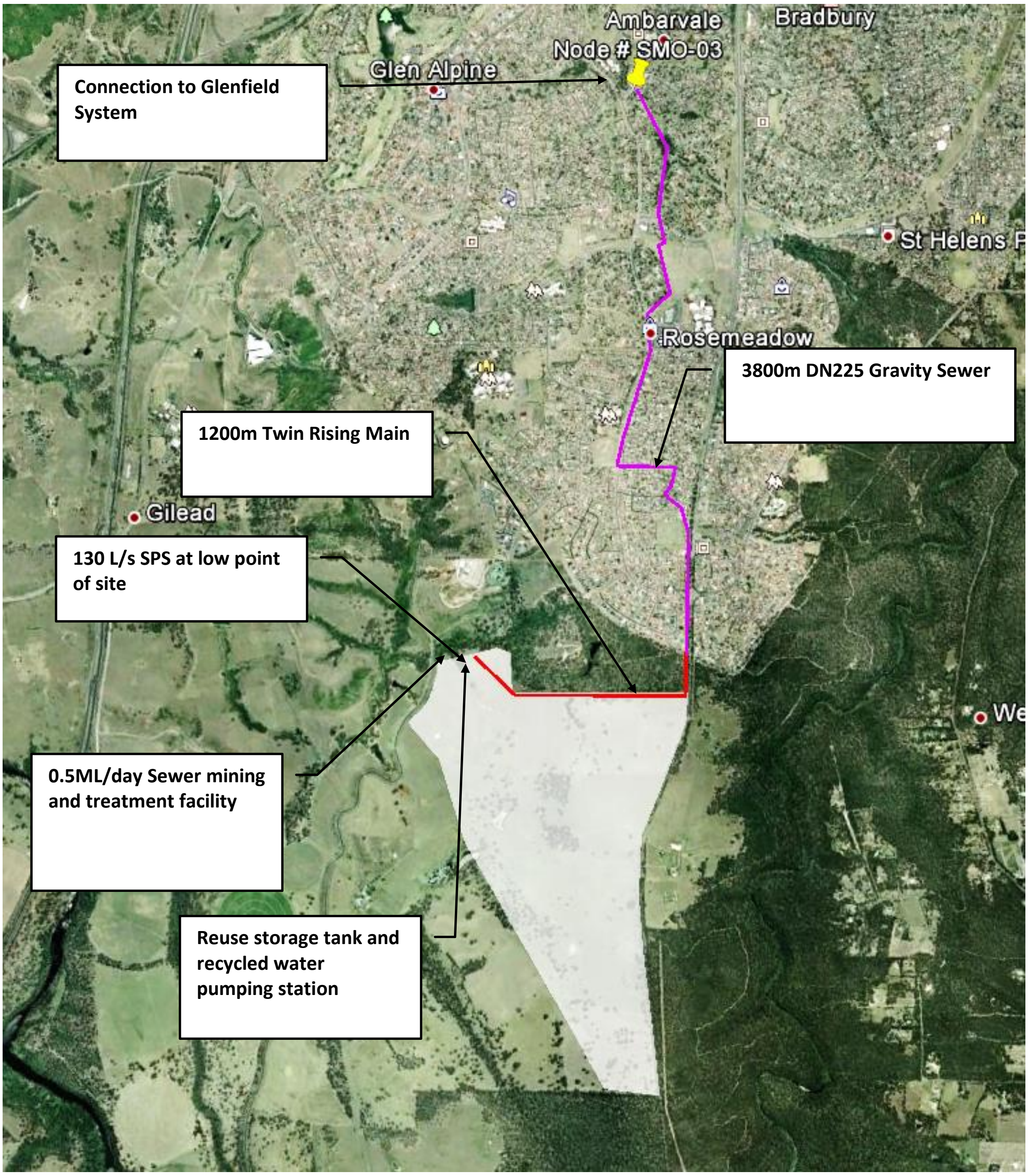

Figure 8-2: Wastewater Option WW2

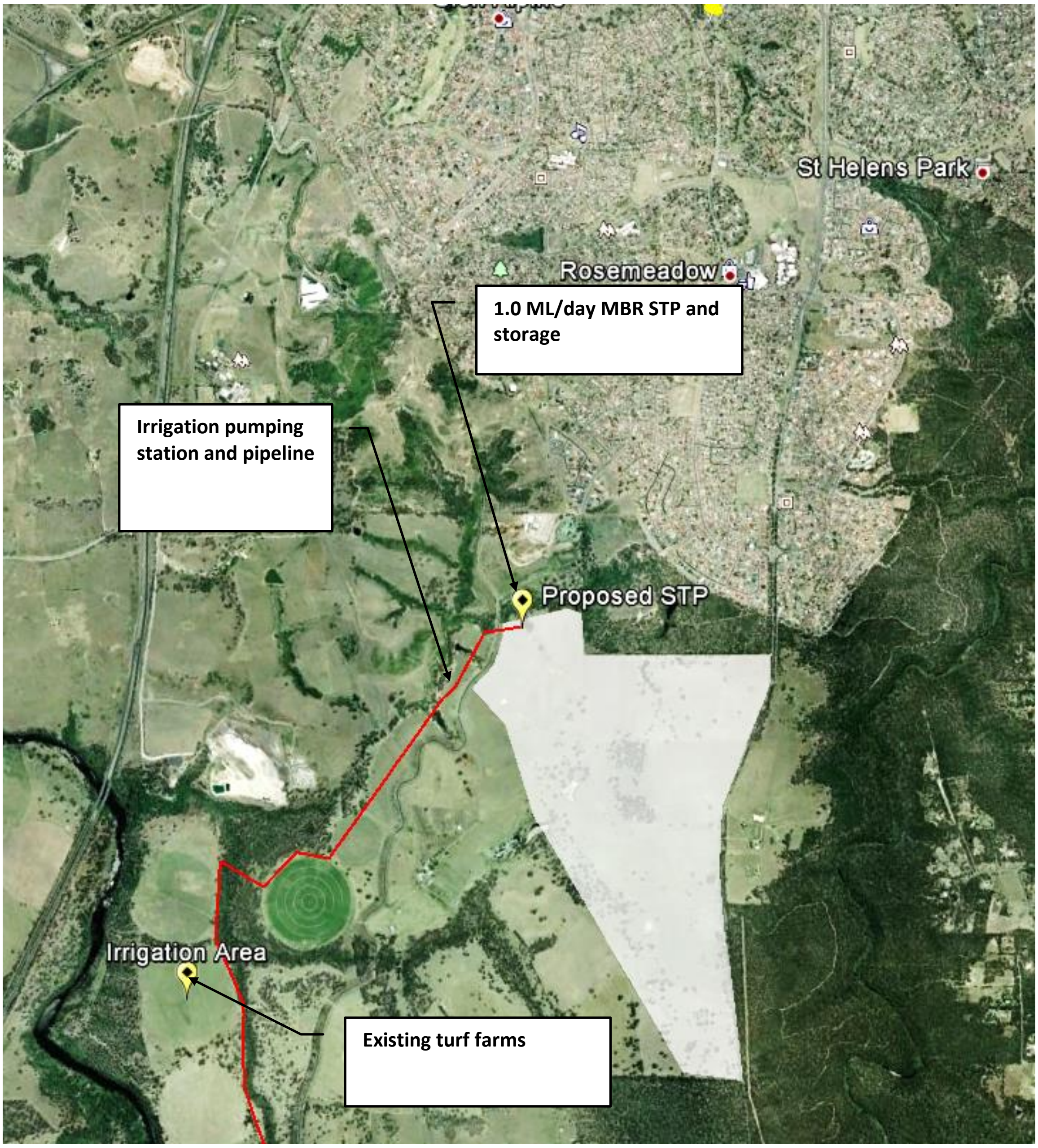

Figure 8-3: Wastewater Option WW3

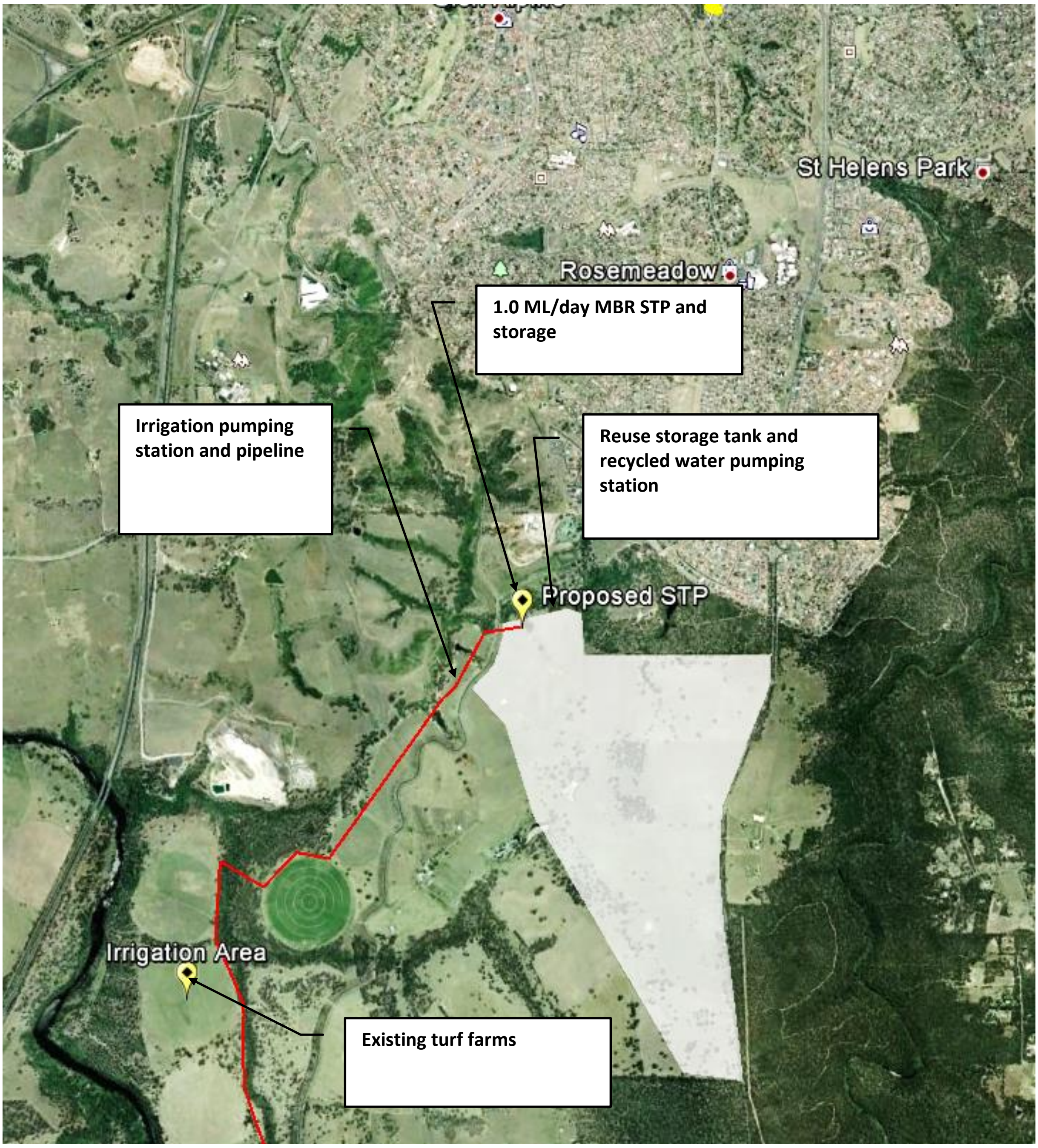

Figure 8-4: Wastewater Option WW4

8.5 Wastewater Option Assessment

The options for waste water have been compared against the cost and non-cost based assessment criteria. This assessment is a subjective review with a more detailed assessment to be carried out as part of the detail planning. The assessment is as follows:

8.5.1 Contribute to a secure water supply and wastewater services

All options require electrical power to operate, however the treatment options, WW2, WW3 and WW4 have the heaviest demand.

Option WW1 is considered to have the best security of service, as it would be easier to provide temporary generating facilities for a single pumping station than an entire wastewater treatment and disposal scheme. Similarly, WW2 is considered to have the next best service, due to the connection to the Sydney Water network.

Provisional emergency storage or backup power supply would be required for all options to meet incident response times.

8.5.2 Minimise drinking water use

Options WW2 and WW4 generate recycled water for use in a dual pipe network and reduce potable water consumption by approximately one third.

Options WW1 and WW3, do not reduce potable water use.

8.5.3 Minimise wastewater discharge to sensitive water ways

Modelling indicates no increase in wet weather discharge (overflows to water ways in a 1 in 3 month ARI event for Options WW1 and WW2).

A combination of low leak sewers within the development and a low water table, would mean that an overflow from the Mount Gilead internal reticulation would be unlikely during normal operation for all options.

In emergencies, the onsite treatment options WW3 and WW4 may discharge treated effluent to adjacent water ways.

8.5.4 Estimated average STP effluent discharge to receiving water ways

Options WW3 and WW4 ultimately dispose of treated effluent to land and do not discharge to waterways.

Options WW1 and WW2 ultimately discharge to rivers or the ocean. Due to sewer mining, Option WW2 has half the volume of Option WW1, but has the same total pollutant loading, so can be considered equivalent.

8.5.5 Stormwater pollution control and flow management

Not applicable for wastewater options.

8.5.6 Minimise lifecycle energy use

Option WW1 has the lowest energy requirements as this option does not involve treatment processes.

The treatment options have significant energy requirements. Option WW2 has the next lowest energy consumption, as it treats approximately 50% of the wastewater load, followed by WW3 and WW4.

Embodied energy has been assessed on the basis of estimated mass of materials and extent of works in the following increasing order:

- WW1 – Pump station and rising main only;
- WW3 – Onsite water treatment and irrigation disposal system
- WW4 – Onsite water treatment, including RO and irrigation disposal system
- WW2 – Pumping station and rising main to Glenfield system, as well as onsite treatment facility

8.5.7 Acceptance by customers and community (i.e. odour, noise)

Noise generation in the wastewater system will be typically due to treatment operations. Treatment plants contain a range of mechanical equipment such as pumps, blowers and solids handling equipment. Most of the equipment can be enclosed or muffled to reduce impact. In addition, treatment plants are associated with a higher number of heavy vehicle movements for waste removal and deliveries.

Pumping can also cause noise. However, most wastewater pumps are typically submerged most of the time, thus reducing noise.

- Option WW1 has the lowest noise impact as this option does not involve treatment processes.
- Option WW2 has the next lowest noise generating potential as it only treats approximately 50% of the wastewater load, and does not require waste handling facilities or associated truck movements.
- Options WW3 and WW4 will have the greatest noise generating potential.

The same ranking of the options would apply for odours.

Wastewater treatment works are generally restricted in and around the site. In addition, most wastewater servicing works are required prior to occupancy of the site, so there is little expected impact on residents.

WW3 and WW4 would have the least construction impact, as all works would be restricted to the site, or land controlled by the landowners. However, these works would be undertaken in proximity to the Upper Canal and other services, designed to mitigate any impact on third party infrastructure.

The other two options require construction of a pipeline along Appin Rd but would otherwise be on site, with limited impact.

8.5.8 Impact on the environment

Preliminary site investigations of the site have indicated that:

- The Mount Gilead study area site is primarily farm land with a long history of intensive agricultural use. The majority of watercourses in the study area are considered substantially to slightly modified as a result of this history of use. Threatened ecological communities exist in the study area, as sparsely spread low grade populations and a small number of high quality concentrated populations. The planning proposal for overall development allows for the removal of the low quality populations and the rehabilitation and protection of the high quality populations to meet biodiversity obligations. The retained and protected populations will not be affected by the construction of the water and wastewater infrastructure.
- A number of Aboriginal heritage sites have been identified at the site, and it is likely that all sites will be disturbed during the development of the site. Disturbance of these sites will be due to the development in general, rather specifically attributable to wastewater servicing works.
- The surface soils are generally composed of non-saline soils and are expected to yield negligible salinity effects, although localised salinity problems are possible.
- Development of the overall site will cause minor deterioration of some historically significant district views from the mill but not the homestead. Mitigation measures have been proposed to ensure the effect is minimal.
- There is no record of contaminated land or industries on the site.

In general, there are no significant environment impacts due to the provision of wastewater infrastructure; nor are there significant differences between options. Options WW3 and WW4 are likely to have the largest impact on the environment, primarily as these facilities are the largest. All options have some risk of overflow into the environment.

8.6 Financial Evaluation

A Present Value cost analysis was undertaken with the results summarised in **Table 8-1**.

Table 8-1: Wastewater Option Costs

Option	CAPEX	OPEX	PV
WW1	$13,324,003	$10,648,530	$15,378,123
WW2	$27,483,687	$29,245,905	$30,836,761
WW3	$23,197,487	$34,061,300	$30,066,773
WW4	$25,594,408	$34,835,087	$32,275,130

- Option WW1 is the only option without treatment facilities and is the lowest cost option for this reason.
- Option WW2 requires both a rising main to the Sydney Water system and a treatment facility, resulting in the highest CAPEX.
- Option WW3 treats wastewater to a lower quality of effluent than WW4, and has slightly lower CAPEX and OPEX.

8.7 Summary

In summary:

- Option WW1 has a significantly lower PV than the other options and is generally similar or better than the other options for other evaluation criteria.
- The other options contain a treatment component which generally results in higher impacts. and costs.
- Option WW2 has the highest CAPEX but lowest OPEX of the treatment options. It contains elements of both approaches to servicing, transfer to the Glenfield system and onsite treatment. It also contains the weaknesses of both approaches of servicing the site, but has superior waste handling capabilities, less impact on the site and ultimately has a backup contingency of being able to pump wastewater to the Glenfield network.
- Options WW3 and WW4 are similar in terms of costs and meeting the criteria, with the RO component of WW4 making the most expensive option for all criteria.

Ultimately, the options for wastewater need to integrate into a servicing scheme with potable water and possibly recycled water. Therefore, the options have been grouped on whether recycled water is generated:

- No recycled water – WW1 and WW3
- Recycled water – WW2 and WW4

Based on the above, Option WW1 is the preferred option for schemes that do not include a recycled water component (WW1 and WW3). It is also the preferred overall wastewater option.

Of the schemes that include a treatment process to produce recycled water (WW2 and WW4), option WW2 is the preferred option.

WW2 has the highest capital expenditure, however this option allows the expenditure on a sewer mining / recycled water system to be delayed by utilising potable water in lieu of recycled water, until the catchment matures.

9 RECYCLED WATER

The recycled water options reflect a dual pipe arrangement for domestic use of recycled water. Both of these options have a reduced potable water component and a recycled water component.

The recycled water elements for these two options are identical and consist of a recycled water storage tank at the STP and an adjacent distribution pumping station. The differences between RW1 and RW2 are from the source of potable water for the site.

The recycled water (i.e. toilet flushing, washing machines, and external use) supply options would be combined with the installation of water efficient fixtures so that residential developments are BASIX compliant.

Recycled water storage is sized to meet maximum day conditions and is distributed using a pumped pressure system i.e. no high level reservoir, with the potable system as a backup for the recycled water supply. The capacity of the potable water infrastructure is reduced in line with the reduced potable demand, although the connection between Rosemeadow Elevated to the site remains the same, to enable back up supply of the recycled water system.

It is assumed that potable water would be utilised in the recycled water system until a reliable source flow could be generated. It is further assumed that the recycled water servicing infrastructure would be required by Stage 3 of the development.

Wastewater options WW2 and WW4 both have sufficient capacity to supply recycled water by either sewer mining or from an on-site STP, respectively.

Two options for recycled water have been developed:

- RW1 – Potable Water from Rosemeadow Elevated (similar to PW2) with reduced capacity potable water infrastructure plus a recycled water pressurised distribution system.
- RW2 – Potable Water from the Trility Pipeline (similar to PW4) with reduced capacity potable water infrastructure plus a recycled water pressurised distribution system

9.1 RW1 – Potable Water from Rosemeadow Elevated Reservoir and Recycled Water

To service the site, the following infrastructure would be required to provide potable and recycled water servicing:

Stage	Potable Water Infrastructure
1	Connection to the existing DN450 pipe at the intersection of Appin Rd and Kellerman Drive
	580m long DN250 supply main along Appin Road.
	New water pumping station nominally located on the northern boundary of the Mount Gilead site Approximate duty 28 L/s @ 52m (24kW duty).
	2300m DN150/200 rising main generally following Appin Rd, to the extreme southern end of the site.
	1.0 ML elevated security reservoir located at the southern end of the site
Stage	**Recycled Water Infrastructure**
3	2.1ML recycled water storage tank
	New booster pumping station to maintain the reticulation system as a pressurised network.

9.2 RW2 – Potable Water from Trility Pipeline and Recycled Water

To supply the site by gravity via the Trility pipeline, the following infrastructure would be required to provide potable and recycled water servicing:

Stage	Potable Water Infrastructure
1	Connection to the existing DN500 offtake from the Trility pipeline including an AICV and flowmeter. Location to be confirmed. No allowance has been made for SWC costs for integration of the Mount Gilead offtake flow monitoring into the Trility / SWC IICATS control system;
	1.7km DN200 internal transfer main to the extreme southern end of the site; and
	1.0ML elevated security reservoir located at the southern end of the site
Stage	**Recycled Water Infrastructure**
3	2.1ML recycled water storage tank
	New booster pumping station to maintain the reticulation system as a pressurised network.

A PRV would be required within the site reticulation to manage the water pressure to customers in the lower portions of the site.

9.3 Recycled Water Option Assessment

The key benefits of a recycled water scheme are the reduction of potable water use. Unless these items are key drivers, a single pipe system will generally have less impact and expense than a dual pipe system.

The recycled water element of options RW1 and RW2 have identical assessments. The relative assessment of the potable water component for each option is the same as described in the potable water options, noting that for a dual pipe system, the potable water infrastructure is sized for the reduced potable flows.

9.4 Financial Evaluation

A Present Value cost analysis was undertaken with the results summarized in **Table 9-1** below:

Table 9-1: Recycled Water Option Costs

Option	CAPEX	OPEX	PV
RW1	$12,944,453	$8,687,252	$13,652,267
RW2	$10,353,820	$6,743,109	$10,994,181

A key strategy to delay expenditure on recycled water system is to utilise potable water in lieu of recycled water. Sewer mining has a distinct advantage in this regard, as only the transfer component of the scheme needs to be built initially and the entire sewer mining treatment plant can be deferred until the catchment matures. For the onsite STP, which also provides sewage treatment for the site, most of the infrastructure costs are required at the start of the development, with additional treatment modules installed later. Stage 3 has been adopted for commencement of recycled water

9.5 Summary

Option RW1, similar to PW2, including connection to the Rosemeadow elevated system, is the preferred option for supplying potable water under a dual pipe system.

10 SERVICING STRATEGY

In order to service the site, the various options must also be assessed in combination to provide an integrated servicing solution for the site.

The results of the option assessment against cost and non-cost criteria are ranked in preferential order in **Table 10-1** below:

Table 10-1: Option Assessment Summary

	Potable Water	Wastewater	Recycled Water
Most Preferred	PW2	WW1	RW2
	PW1	WW2 (recycled water)	RW1
	PW4	WW4 (recycled water)	
Least Preferred	PW3 (least cost but poor security of supply)	WW3	

There is a natural compatibility between options in regard to the use of recycled water. For example, combining a recycled water option with a wastewater option that doesn't allow for production of recycled water makes little sense. With this in mind, the combinations of the various compatible options with potable water supply from the Rosemeadow elevated system (PW2 and RW1), along with the PV estimates are presented in **Table 10-2**.

Table 10-2: Rosemeadow Elevated Supply Servicing Strategy

Potable Supply from Rosemeadow (preferred option)	Wastewater to Glenfield		On-site STP	
Potable Only	PW2 + WW1	$24,042,620	PW2 + WW3	$38,731,270
Potable and recycled (Dual Pipe)	RW1 + WW2	$44,489,028	RW1 + WW4	$45,927,396

The same process has been undertaken using the second preference for potable water servicing, (PW4 and RW2). The combinations of the various compatible options with potable water supply from the Trility pipeline (PW4 and RW2), along with the PV estimates are presented in **Table 10-3.**

Table 10-3: Trility Supply Servicing Strategy

Potable Supply from Trility pipeline (alternative option)	Wastewater to Glenfield		On-site STP	
Potable Only	PW4 + WW1	$22,342,278	PW4 + WW3	$37,030,928
Potable and Recycled (Dual Pipe)	RW2 + WW2	$41,830,942	RW2 + WW4	$43,269,311

Based on the preferred options above, the preferred servicing strategy for the site is the combination of:

- PW2 – New high level reservoir zone;
- WW1 – Pump wastewater to the Glenfield system;
- There is no recycled water servicing element.

These options provide the most cost effective solution and have the least overall impact. These options also represent the lowest risk approach in terms of security of supply. The preferred servicing strategy is shown in **Figure 10-1**.

Based on the preferred options above, the proposed expenditure plan for servicing the Mount Gilead site is shown in **Table 10-4**.

Table 10-4: Expenditure Plan

Year	Potable Water	Wastewater	Capital Expenditure [1] $M
2015 – 2019	Water pumping station 580m DN250 water main 2300m DN150/200 water main 0.85ML elevated security reservoir	Sewage pumping station. 2.0km DN150 rising main 2.0km DN200 rising main 3.5km DN300 gravity sewer	$21.5
2020 – 2024	None	None	$0
2025 – 2034	None	None	$0
2035 – 2044	None	None	$0

1 – Periodic replacement of mechanical and electrical equipment is included in PV analysis but not included in capital expenditure estimates for the expenditure plan.

From **Table 10-4**, all works are to be undertaken in the first five-year period. The ability to incrementally construct servicing infrastructure to delay expenditure is limited due to a combination of:

- The development of the entire site is planned to be complete within 10 years
- The main costs are initially required to connect the site to Sydney Water's systems.

Due to the close timing and relatively small size of servicing infrastructure, the benefits of staged servicing may be outweighed by the loss of economies of scale for a non-incremental approach.

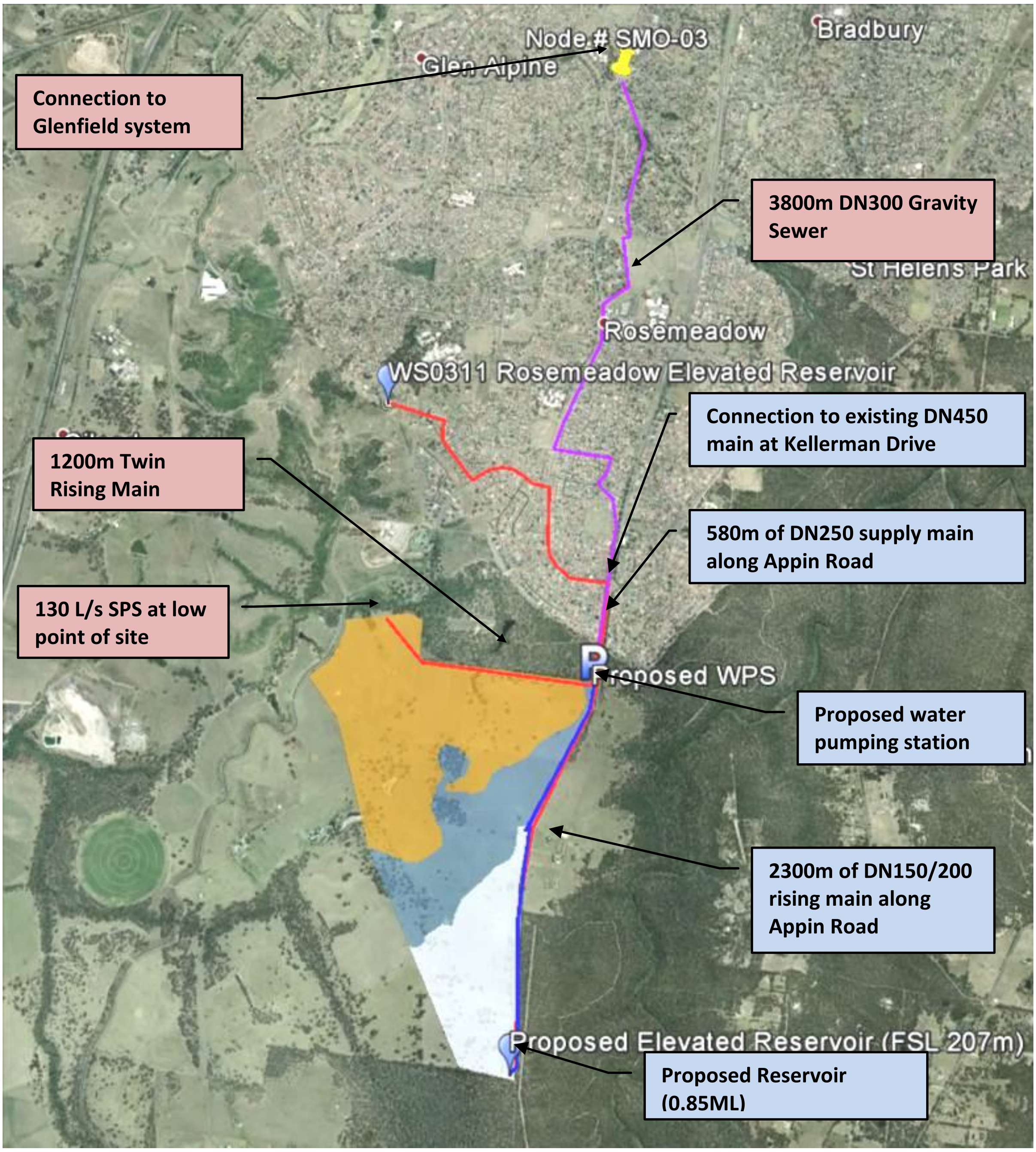

Figure 10-1 - Preferred Servicing Scheme

11 CONCLUSION

This is a high level servicing strategy report prepared to assess the ability of Sydney Water's existing water and wastewater systems to service the Mount Gilead development and also to identify alternative (non-Sydney Water) servicing options. The report considers both the current and future (2036) scenarios and provides a present cost estimate for servicing the site.

The costs developed in this investigation include significant additional allowances and contingencies that reflect the early stage of planning for this project, and would be expected to reduce as planning continues.

The staging of the development has a significant impact on the costs for servicing infrastructure and there is considerable scope for optimisation and refinement during the detailed planning phase.

11.1 Augmentation Works

From the results of this investigation, there is sufficient capacity in Sydney Water's existing water and wastewater systems to accommodate the proposed 1700 lot Mount Gilead development.

The impact on the performance of Sydney Water's systems would be minor and augmentation of existing infrastructure is not required.

11.2 Servicing Strategy

The preferred servicing strategy for potable water is to supply from a connection to the Trility pipeline and a new security reservoir on the site.

The preferred servicing strategy for wastewater is to pump sewage from Mount Gilead to the Glenfield network for treatment at Glenfield RWP.

The use of reclaimed effluent to provide a non-drinking water service to the development has been assessed as a non-preferred option considering both cost based and non-cost criteria. The use of other alternative sources to reduce potable water use, such as rainwater tanks or centralised stormwater collection, do not affect infrastructure sizing but should be considered in subsequent planning stages.

On this basis, it is recommended that Sydney Water give consent for the current rezoning application.

Appendix 1 Sydney Water Letter of Requirements

Sydney WATER

10 October 2013

Mr Darryl Kite
Director
Old Mill Properties Pty Ltd
C/- Summers and Summers Pty Ltd
PO Box 391
Miranda NSW 1490

Mt Gilead MDP Area – Planning Requirements Package

Dear Mr Kite

I refer to your discussions with Kate Wild about accelerating the water and wastewater servicing of the Mt Gilead release area and entering into a Commercial Agreement with Sydney Water.

Sydney Water will reimburse Mt Gilead Pty Ltd and S&A Dzwonnik for the reasonable and efficient costs of accelerating services to the Mt Gilead development through a per lot payment mechanism set up by a Commercial Agreement.

Servicing Strategy and Detailed Planning
There is currently no water or wastewater servicing strategy developed for the Mt Gilead release area. Therefore, as part of your investigations, the landowners will need to prepare a servicing strategy for the entire Mt Gilead development. To progress the development, Sydney Water requires investigative studies be carried out in two main stages:

1. **Stage 1: Strategic planning** — a single servicing strategy is prepared for the water related servicing needs of the Mount Gilead release area. This covers the initial investigation into strategic servicing options for drinking water, wastewater and non-drinking water and development of multi criteria analysis to identify a preferred servicing strategy. A full list of all the tasks is provided in Attachment A.

   Sydney Water currently only approves Mt Gilead Pty Ltd and S&A Dzwonnik to carry out Stage 1: Strategic planning. If, following strategic planning, you intend to proceed with the development, you will need to seek endorsement from Sydney Water to proceed with Stage 2: Detailed Planning.

2. **Stage 2: Detailed planning** - develop the options and concept designs for the drinking water and wastewater reticulation schemes and any feasible interim servicing options. And management and delivery of environmental activities up to and including completion of the environmental impact assessment. This will include
   - the preparation of needs specification and concept designs
   - obtaining all necessary approvals to allow construction of the infrastructure.

   A list of all the proposed tasks is provided in Attachment B. This list is provided for information only and must be reviewed following endorsement from Sydney Water that Mt Gilead Pty Ltd and S&A Dzwonnik intend to proceed with Stage 2.

Mt Gilead Pty Ltd and S&A Dzwonnik will be required to engage and fund appropriate consultancies to prepare the necessary studies. Some of these activities may be carried out in conjunction with each other.

The funding of these necessary planning studies will be at Mt Gilead Pty Ltd's and S&A Dzwonnik's own risk. Should the landowners choose not to progress the development of the site, Sydney Water will not reimburse Mt Gilead Pty Ltd and S&A Dzwonnik for any costs associated with the strategic planning.

Mt Gilead Pty Ltd and S&A Dzwonnik are to create a detailed project brief based on the tasks in Attachment A which is to be endorsed by Sydney Water prior to engagement of any consultants to complete the work. Sydney Water's preference is for the Mt Gilead Pty Ltd and S&A Dzwonnik to engage a Project Coordinator to manage the planning phase of the water and wastewater infrastructure required to service the development area. The role of the Project Coordinator is outlined in Attachment C. Sydney Water must review and endorse all project briefs and studies being carried out.

Procurement Process
Sydney Water requires that developers follow Sydney Water's procurement guidelines for the procurement of planning deliverables. This includes for the engagement of any consultants the landowners wish to use for the strategic or detailed planning phases. The procurement guidelines are available on Sydney Water's website at: http://www.sydneywater.com.au/SW/plumbing-building-developing/developing/land-development/index.htm.

Commercial Agreements
For Stage 2, Sydney Water will work with Mt Gilead Pty Ltd and S&A Dzwonnik to develop a Commercial Agreement to assist with the development of the site. The agreement will detail the funding arrangements, planning requirements and staging of the required infrastructure. Sydney Water will refund all reasonable and efficient planning costs as part of the Commercial Agreement.

Agreement of Terms
To progress these strategies, Sydney Water requires Mt Gilead Pty Ltd and S&A Dzwonnik to accept (in writing) the above conditions and to agree to undertake all appropriate tasks as listed in the enclosed attachments.

Should you choose to progress any of these strategies, or any requirements of the proposed commercial agreement, without Sydney Water endorsement or approval as required, Sydney Water may choose not to provide you with funding for that work.

Should you have any questions regarding this matter, please contact Kate Wild, Senior Growth Planner on 8849 5842.

Yours sincerely

Sharon Davies
Manager, Urban Growth
1/10/13

Attachment A – Strategic Planning Requirement Package

Task	Description	Deliverables
1	Sydney Water, Mt Gilead Pty Ltd and S&A Dzwonnik ("the landowners") agree on the project scope. The landowners arrange and facilitate an inception meeting with the landowners' consultants and Sydney Water to gain a clear understanding of the project. The landowners' consultants prepare a management control plan/project plan (including Sydney Water review periods, hold points, milestones and signoffs), and project briefs for specialist work to be completed. Sydney Water must confirm and endorse the plans and brief/s, and must approve the selected tender. The landowners' consultants and Sydney Water must exchange information to avoid rework.	▪ Description of agreed project ▪ Project Briefs ▪ Management Control Plan / Project Plan
2	In consultation with Sydney Water, the landowners' consultants develop Planning Criteria to be used for designing drinking water and wastewater infrastructure. The consultant can use Sydney Water Planning Criteria for Dual Reticulation Systems as an initial guide.	Basis of Planning Report
3	The landowners will confirm the development schedule (including total development and lot production for residential & commercial/industrial and other development) and (if any) the timing for other developments in the vicinity of Mount Gilead release area that have potential to be included in the proposed servicing scheme. The landowners prepare information on the general development pattern/precinct layout, lot yields and lot production and development sequencing for the Mount Gilead release area. The landowners' consultant determines lot and demand forecasts including staging and timing for each product. This report shall detail as a minimum all proposed design loadings, assumptions, proposed treatment processes and all identified potential customers (growth and non-growth) using text, tables, graphs and diagrams.	Proposed Servicing Area Including growth forecasts, water demand and wastewater flow projections
4*	Peer Review/Approval: Sydney Water to endorse the Basis of Planning and Proposed Servicing Area	
5	The landowners' consultant investigates the existing conditions (hydraulic system capability, system constraints, and system issues) within the existing drinking water, non-drinking water and wastewater systems. This will identify problems that may eliminate options from further review and/or provide input into the assessment of servicing options.	Existing Conditions Report

Task	Description	Deliverables
	Constraints, opportunities and issues to include: 1. capacity of existing drinking water, non-drinking water and wastewater systems to accommodate the Mount Gilead development and other nearby developments in the system 2. ability to stage delivery of new water-related infrastructure and operational efficiency 3. risk-based assessment in line with meeting Sydney Water's Operating Licence 4. climate and rainwater capture 5. mine subsidence areas 6. environmental issues such as salinity, flooding, flora and fauna 7. co-ordination with planning authorities and other service providers The consultant is to undertake an existing system capability assessment (including detailed hydraulic modelling) of all adjacent water and wastewater systems.	
6	The landowners' consultant develops a range of servicing concepts that provide water related infrastructure to the precinct. These concepts may include but are not limited to: ▪ Water o Transfer from existing system o Transfer from existing storage dams o Rainwater tanks with appropriate treatment o Recycled water ▪ Wastewater o Transfer to existing system o Local treatment and effluent management ▪ Non-drinking water o Local treatment and irrigation of all effluent o Local treatment and domestic reuse o Local treatment and continuous discharge The consultant is expected to investigate various different servicing options detailed above in regard to transfer routes, pumping station locations, reservoir locations, etc. The sizing of infrastructure is to be based on the design loadings, demands and assumptions identified in Task 2.	Strategic Servicing Options Report
11	Undertake Strategic Options Assessment ▪ Assess each short-listed strategic option including a total life cycle analysis.	Strategic Options Assessment

Task	Description	Deliverables
	▪ Facilitate workshop with Sydney Water staff and consultants to assess the short-listed options and select the preferred option ▪ Provide technical, economic, social and environmental justification for the selection of the preferred strategic option, including sensitivity assessment of the strategic option	
12	Produce a draft Servicing Strategy Report. The draft Strategic Options Report and Servicing Strategy Report shall consider, but not be limited to, the following issues where applicable: ▪ Development projection and demand forecasts ▪ Staging plan ▪ Description of the preferred strategic option including diagrams ▪ Overall cost efficiencies ▪ Existing system hydraulic constraints ▪ Land acquisition details (including any temporary/permanent easements) ▪ Cost (capital and NPV) and program estimates of proposal in five year intervals. Sydney Water will provide a typical 'table of contents' as part of input to this task.	Servicing Strategy Report
13*	Sydney Water peer reviews the Servicing Strategy Report.	
14	The landowners' consultant produces a final Integrated Servicing Strategy Report approved by Sydney Water. Sydney Water requires the final Servicing Strategy to be approved at the appropriate level.	Final report

* Hold Points

Attachment B – Detailed Planning Requirements Package (for information only)

Task	Activity	Key Information
1	Inception meeting and information gathering	The landowners' consultant will be required to: ▪ Prepare Management Control Plan ▪ Identify roles and responsibilities ▪ Confirm project objectives/methodologies ▪ Confirm deliverables, timing and budgets ▪ Confirm communication protocols ▪ Prepare a Sydney Water safety plan and procedures ▪ Identify internal and external stakeholders ▪ Liaise with Urban Growth, Servicing and Asset Strategy, Engineering and Environmental Services, and Service Delivery in regards to any system constraints or issues that may impact option development Any relevant reports/studies will to be handed over to the landowners' consultant. The deliverables for this task are: ▪ Project execution plan ▪ Project plan ▪ Project safety plan
2	Proposed servicing area and development details	Identify and document ALL possible development that can be included. The proposed servicing area to be endorsed by Sydney Water. Liaise with appropriate planning authorities. Carry out risk assessment using Sydney Water's risk methodology. This will need to be updated as the project develops. Updates should occur at least every 6 weeks.
3*	Basis of Planning Report	Include low infiltration sewers criteria or other alternative system where appropriate. Determine future system performance requirements. Develop projected demands and flows for the full service catchment, with proposed staging through to ultimate site development. Assess a number of scenarios (eg different growth scenarios, different demand design rates, etc). Detailed assessment of current system performance. Prepare technical memo.

Task	Activity	Key Information
4	Environmental Planning	Identify and map the key environmental constraints, opportunities and issues (environmental constraints mapping). Undertake any preliminary surveys and specialist studies that may be required to identify environmental constraints, opportunities or issues. Identify planning approval pathway. This environmental information will be used in the identification of options, and design and construction constraints. It will also be used in developing assessment criteria, assessment of options and for any Multi Criteria Analysis workshop. Liaise with necessary stakeholders during Environmental Planning Issue constraints mapping.
5*	Peer review	Peer review of work tasks (2-4)
6	Assessment criteria	Develop assessment criteria in consultation with Sydney Water including environmental, social, technical and economic assessment criteria. Project Team workshop.
7	Option development	Develop a list of options that are consistent with the approved Servicing Strategy. Identify different internal servicing options, different routes, different asset locations, and alternate pipeline/pumping/storage. Technical assessment (consider odour operation and maintenance issues) – undertake specialist studies as required eg odour, geotechnical, environmental. Present modelling results for each option/s and any specialist studies undertaken.
8*	Refine options and review information requirements	Refine option list by developing assessment criteria to develop a “short list” for futher detailed assessment. Identify likely inputs required to assess options and confirm information available to assess options. Sydney Water to approve options that are to proceed to detailed options assessment.
9	Detailed option assessment	▪ Preliminary hydraulic modelling ▪ Cost estimates ▪ Technical assessment

Task	Activity	Key Information
		▪ Environmental constraints/opportunities (see Task 6) ▪ Social impacts ▪ Stakeholder consultation (external/internal)
10	Determine preferred option	Determine preferred option with lowest life cycle cost with acceptable risk profile.
11	External stakeholder briefing	Briefing to key stakeholders on the preferred option.
12	Optimisation / sensitivity assessment	Assess impact on staging, cost and sizing of infrastructure from different design unit rates and population projections (determined in Task 7). Detailed modelling of preferred option.
13	Risk assessment	Performed on the preferred option and second best option. Workshop to be undertaken with appropriate Sydney Water personnel.
14*	Endorse preferred option / planning approval pathway	Sydney Water to endorse the preferred option and the appropriate planning approval pathway.
15	Draft options report	The Options Report is to provide a record of the planning process and outcomes. The report as a minimum must provide: ▪ objective of planning process ▪ catchment plants ▪ description of the existing system, evaluation of its performance and constraints, operation and design criteria and design loadings, demands, flows and assumptions, including geotechnical desktop study (this may determine the need for field geotechnical studies, with boring) ▪ summary of the existing environment and environmental constraints and opportunities. All the environmental factors do not need to be included in the main body of the report. The main body must include those factors that were relevant to the development and/or selection of the preferred option. The remaining environmental information may be included in an appendix and must include a description of the factor and why it was not considered relevant for the development and/or selection of the preferred option ▪ identify stakeholders, consultation and describe issues. As with the environmental information the main body of the report must include a description of the factors relevant to the development and/or selection of the preferred option.

Task	Activity	Key Information
		The remaining information may be included in an appendix and must include a reason why it was not used for the development and/or selection of the preferred option ▪ a description of all the options and the advantages and disadvantages of each option with respect to the technical, environmental and community factors. The technical costs for each option should also be included ▪ the assessment criteria and outcome of the MCA ▪ risk assessment ▪ include scheme plans ▪ include a short chapter on communication and engagement activities that were undertaken, including what information was collected and how it was used to back up the scoring/results for the preferred option. Allow 2 weeks for Sydney Water to comment on submitted document.
16	External stakeholder briefing	Only if required
17*	Final options report	Sydney Water approves options report and preferred option. Allow 2 weeks for approval process.
18	Concept design report	Prepare concept design report, including: ▪ Mech/Elect requirements ▪ Concept drawings ▪ CHAIR/FMECA
19	Needs specifications	Develop needs specifications for key infrastructure to be delivered following Sydney Water and Australia Standards and WSAA Codes requirements and relevant Government requirements. As a minimum, this work shall include, but is not limited to: ▪ description ▪ critical dimensions ▪ geotechnical information and foundation report for structured assets ▪ contamination report ▪ hydraulic modelling to review and confirm any sewer pumping stations, water pumping stations, reservoir concept designs and additional modelling required for finalisation of needs specification

Task	Activity	Key Information
		▪ prepare concept design and design data document ▪ odour control for any sewer pumping station and rising main – including effect of any staging of development ▪ CHAIR (construction hazard assessment impact review workshop) ▪ pre-detailed design construction cost estimate and construction timetable ▪ asset lifecycle analysis ▪ power supply and water supply requirements ▪ obtain environmental approvals ▪ draft needs specification report
20	Needs specifications approval and sign off	Allow 4 weeks for approval process
21	Design and construction (D&C) report (draft and final)	Assess design and construction issues related to the preferred option. Preliminary concept plans of the preferred option should be included. Must liaise with key stakeholders (eg RTA, Councils, electricity, gas etc) and where appropriate the local community to determine impact and requirements as a result of preferred option. Complete survey and/or geo-technical assessment if necessary to reduce risk of future variation in project scope (may be completed as part of option assessment if warranted).
22	Environmental assessment	Complete the appropriate environmental assessment, as determined, through the planning approval pathway (Task 19). Conduct any additional specialist studies. Liaise with necessary stakeholders during the Environmental Assessment process
23	Risk based cost estimate	Required if infrastructure is to be delivered or ultimately funded by Sydney Water or otherwise directed by Sydney Water.
24	Planning approval	Developer to gain all appropriate environmental approvals.

* Hold points

Attachment C - Role of Project Coordinator

Sydney Water encourages Mt Gilead Pty Ltd and S&A Dzwonnik to engage a Project Coordinator to manage the planning phase of the water and wastewater infrastructure required to service the development area. The Project Coordinator must have relevant experience in the delivery of water and wastewater infrastructure to Sydney Water's standards, requirements, processes and procedures.

Generally the role of the Project Coordinator may include:

- preparation and maintenance of a Management Control Plan (MCP) for the planning phase works
- chair monthly Project Control Group meetings and prepare and circulate minutes
- prepare monthly progress reports for issue to Sydney Water (if required)
- act as the Water Servicing Coordinator (WSC), the interface between the developer and Sydney Water
- prepare detailed project briefs as required for specialist study contracts for endorsement by Sydney Water
- assist the developer with calling and assessing tenders for each of the specialist study contracts (if required and appropriate)
- manage each of the planning phase contracts
- coordinate interfaces between each of the planning phase contracts, Sydney Water and other stakeholders as necessary.

Appendix 2 Potable Water Modelling Report

WorleyParsons
resources & energy

EcoNomics™

MOUNT GILEAD PTY LTD, DZWONNIK

Mount Gilead

Strategic Modelling Report - Potable Water

301015-03252 – CI-REP-001

04 March 2014

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Disclaimer

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PROJECT 301015-03252 - MOUNT GILEAD

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
E	Re-issued for SWC review	WB	HVR	CRT	04 Mar 14	N/A	
B	Issued for Client Review	WB	HVR	DS	22 Oct 13		
C	Issued for SWC Review	DS	WB	DS	12 Nov 13		
D	Issued for Client Review	WB	HVR		18 Feb 14		

CONTENTS

1 INTRODUCTION

An application is being prepared by the land owners to rezone the 210ha Mt Gilead site in anticipation of commencing residential development in 2016. Mt Gilead is included within the current Metropolitan Development Plan. However, development of the site is not covered by an existing funding plan.

In response to the rezoning application, Sydney Water has requested that a high level servicing strategy report be prepared to assess the performance of Sydney Water wastewater systems for the current and future (2036) scenarios.

WorleyParsons has been engaged by the landowners, Mt Gilead P/L and S & A Dwonnik, to undertake this investigation. This report documents the modelling undertaken to determine the impact of the Mt Gilead development on Sydney Water's potable water supply systems, and to establish the water demands from Mt Gilead for development of servicing options.

Analysis and costing of these options, including the impact of recycled water usage and staging is undertaken in the overall Strategic Planning Report. This report forms an appendix to the overall report.

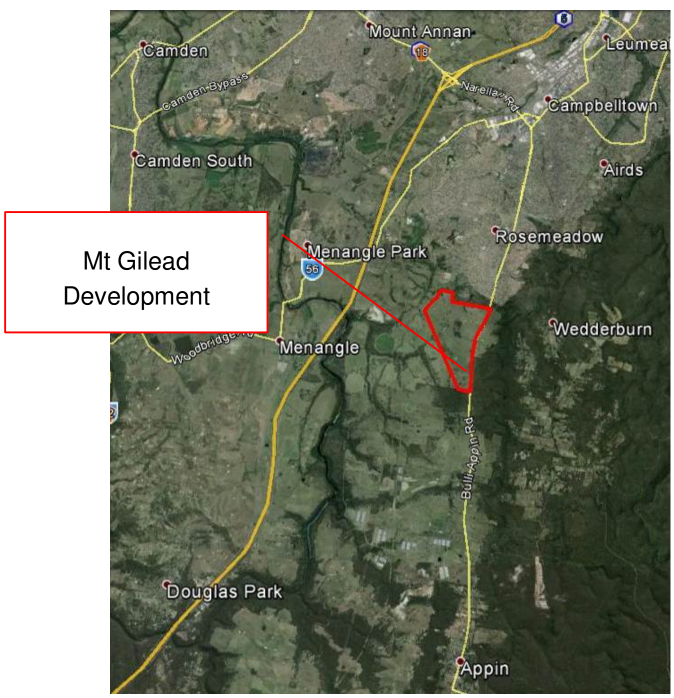

Figure 1-1: Site Locality Plan

2 PROPOSED DEVELOPMENT

The 210ha Mt Gilead site is currently undeveloped and is zoned for rural uses.

The proposed development is anticipated to contain between 1400 and 1700 low density residential lots, with 1700 lots adopted for the purposes of this report. The site will be developed in 10 equal stages over 10 years. Development is expected to commence in 2016 with the site being fully developed by 2026.

For the purposes of this report, an ultimate development of 1700 lots has been adopted to provide a conservative approach

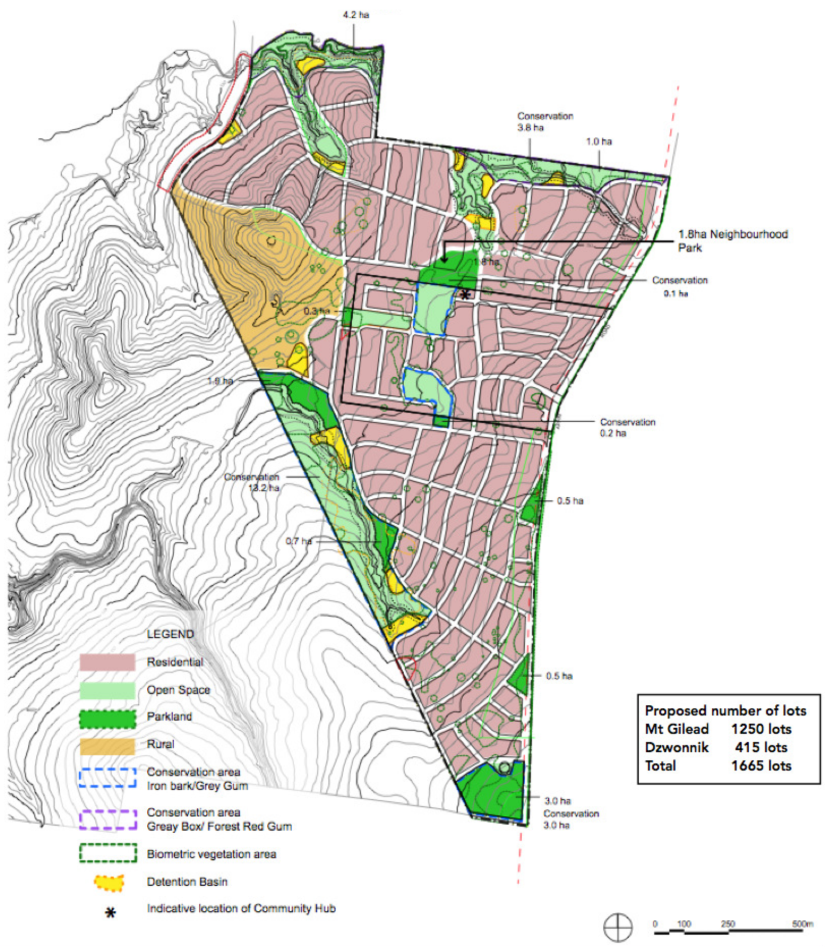

Figure 2-1: Indicative Masterplan

2.1 Development Staging

A preliminary staging plan has been developed which separates the site into six precincts. This is shown in Figure 2-2 below.

Figure 2-2: Indicative Staging Plan

Both landowners intend to develop the site in parallel, with 10 equal stages over 10 years, as shown in **Table 2-1**.

Table 2-1: Projected Development Staging

Stage	Year	Mt Gilead Precinct	Mt Gilead Lots	Precinct 6 (Dzwonnik)	Total	Total Lots
1	2016	1	125	45	170	170
2	2017	1	125	45	170	340
3	2018	2	125	45	170	510
4	2019	2	125	45	170	680
5	2020	3	125	45	170	850
6	2021	3	125	45	170	1020
7	2022	4	125	45	170	1190
8	2023	4	125	45	170	1360
9	2024	5	125	45	170	1530
10	2025	5	125	45	170	1700

All lots are low density residential free standing dwellings, with an assumed average lot size of 600m^2.

2.2 Design Population

The MDP lists the forecast dwelling numbers as 1500 low density residential dwellings. Current planning studies are investigating a range of between 1400-1700 dwellings, with any number above the 1500 MDP number to be justified on the basis of capacity of the site and infrastructure. This study has assumed the maximum number of 1700 dwellings as a conservative base case for assessing water and sewage servicing.

3 EXISTING SYSTEM

3.1 Potable Water

The Mt Gilead development site is located adjacent to the Rosemeadow reservoir zone.

The Rosemeadow system, shown schematically within the Macarthur system in **Figure 3-1**, starts from the 376 mm trunk main on Appin Road, close to the junction of Woodland Rd and Appin Rd in the Campbelltown South DSP zone, St Helens Park. Included within the zone are reservoir WS0311, pumping station WP195 (with two pumps), 70km of pipeline and 14 dividing valves. At present no boosters, AICVs or PRVs are located within the zone. One fixed head point, upstream of WP0195 represents the supply source to the system.

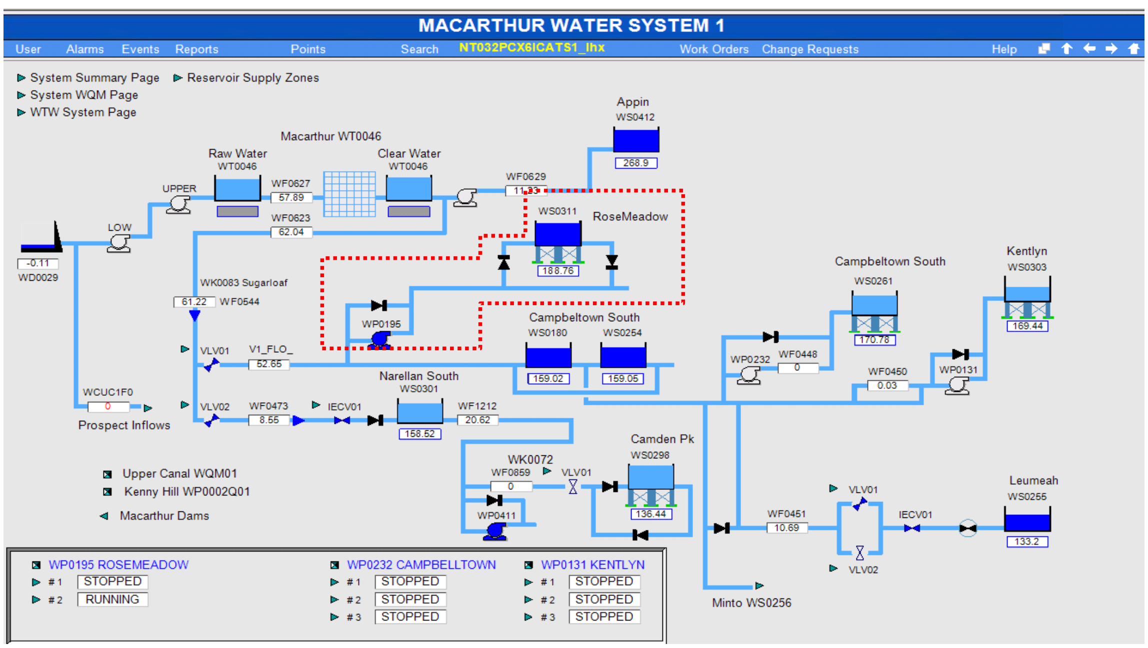

Figure 3-1: Macarthur Water System

Rosemeadow Elevated Reservoir (WS0311) is fed through the water pump WP0195 from a 376mm trunk in Campbelltown South. The Rosemeadow reticulation area is then gravity supplied, controlled through the Rosemeadow Elevated Reservoir level (WS0311). A flow meter (WF0447) at pump WP0195 suction measures the Rosemeadow system inlet flow.

Rosemeadow Elevated reservoir (WS0311) is a 10ML elevated reservoir with a minimum operating level of 180.2m.

The model average base demand is 42.7L/s for Rosemeadow Elevated, representing the billed customer demand from 1 July 2007 to 30 June 2008. Residential demand is the dominant demand type with 94% of the total demand.

3.2 Recycled Water

There are no Sydney Water recycled water systems in the vicinity of the Mt Gilead site. Effluent reuse projects for non-residential purposes are present and/or planned at West Camden and Glenfield RWPs. These facilities are 11km and 19km respectively from the Mt Gilead site and are not considered to be viable sources of recycled water.

No modelling of Sydney Water Recycled water has been undertaken for this report.

4 METHODOLOGY

The modelling and reporting for this investigation has been generally carried out in accordance with the "Potable Water Network Growth Servicing Strategy – Criteria and Guideline 2012". Noting that the Mt Gilead development is still to be rezoned is in a very high level and preliminary nature of this investigation, in some instances and with agreement from SWC Planners, an alternative approach has been adopted.

The modelling assumes the site will be serviced by potable water only, without the effects of alternative sources such as rainwater tanks or a dual reticulation system. This type of system has the highest potable water consumption and similarly, requires a higher investment in infrastructure to service the site. Using this approach:

- establishes an upper limit on the impact that the development will have on Sydney Water's systems;
- confirms that the site can be serviced;
- provides a basis for development and sizing of servicing options which include source substitution alternatives,

Estimates of recycled water demand have been prepared in accordance with the SWC "Design Criteria Guidelines Supplement (April 2010) and current water consumption information.

5 REVIEW OF THE EXISTING MODEL

The existing Rosemeadow model was constructed in 2009 and updated as part of the Menangle Park Integrated Servicing Strategy Phase 3 Final Report, dated August 2011. The model from the Menangle Park report was adopted as sufficiently recent to reflect the existing system.

Metered consumption data from nearby Campbelltown South, Campbelltown South Elevated and Rosemeadow Elevated Supply Zone were reviewed.

5.1 Population

Department of Planning growth rates for the Rosemeadow Elevated Supply Zone were supplied by Sydney Water and as shown in **Table 5-1**.

Table 5-1: Projected Growth Rates for Rosemeadow

Residential	**POP2011**	**POP2020**	**POP2031**	**POP2036**
Residential (LD)	15,946	16,050	16,881	17,260
Residential (HD)	1,256	2,237	3,006	3,355
Zone Total Residential	**17,203**	**18,287**	**19,888**	**20,615**
Residential (LD) %growth		1%	6%	8%
Residential (HD) %growth		78%	139%	167%
Zone total % Residential growth		6%	16%	20%
Other				
Commercial	566	697	814	892
Open Space	227	274	316	344
Miscellaneous	0	0	0	0
Special Uses	740	898	1045	1145
Unknown	0	0	0	0
Total Other	1533	1869	2175	2380
	0%	22%	34%	39%
Total				
Overall	18,735	20,156	22,063	22,995
		8%	18%	23%

Due to the predominance of residential demand (94%), an overall demand growth rate of 23% was applied uniformly across all customer types to represent increase in demand from 2011 (existing) to 2036 (future). This approach:

- Converts approximately 50% of commercial /industrial growth to an increase of 3% residential growth. This will tend to slightly exaggerate peak flows by a proportionate amount but does not increase overall water demand.
- Does not take into account the guidelines 4% reduction applied to commercial / industrial properties between 2011 and 2020. This will slightly over estimate commercial / industrial daily flow volumes, but as commercial/industrial demand represents 6% of overall demand, the effect is considered to be negligible.

This approach was discussed with Sydney Water staff and it was agreed that the effect will be to slightly overestimate growth in Rosemeadow, resulting a conservative assessment of the impact of Mt Gilead. The results of this estimate can be refined during the detailed planning phase.

5.2 Maximum Day Demand (MDD)

The modelled Max Day demand flow for Rosemeadow Elevated Reservoir is based on typical design criteria of 2.298 MDD/ADD ratios for water consumption. In line with the GSS guidelines, IICATS historical data was reviewed to determine if an actual MDD event has occurred for the system.

Historical IICATS daily demand data (refer **Figure 5-1**) from the start of the Water Wise Rules period (22/6/2009) till the current day was reviewed and the four highest daily flows were identified (over 60L/s).

Daily demand = flow through WP0195 ROSEMEADOW (WF0447 - FTX01) + outflow from WS0311 ROSEMEADOW reservoir (WS0311 - RES01) over a 24 hour model run.

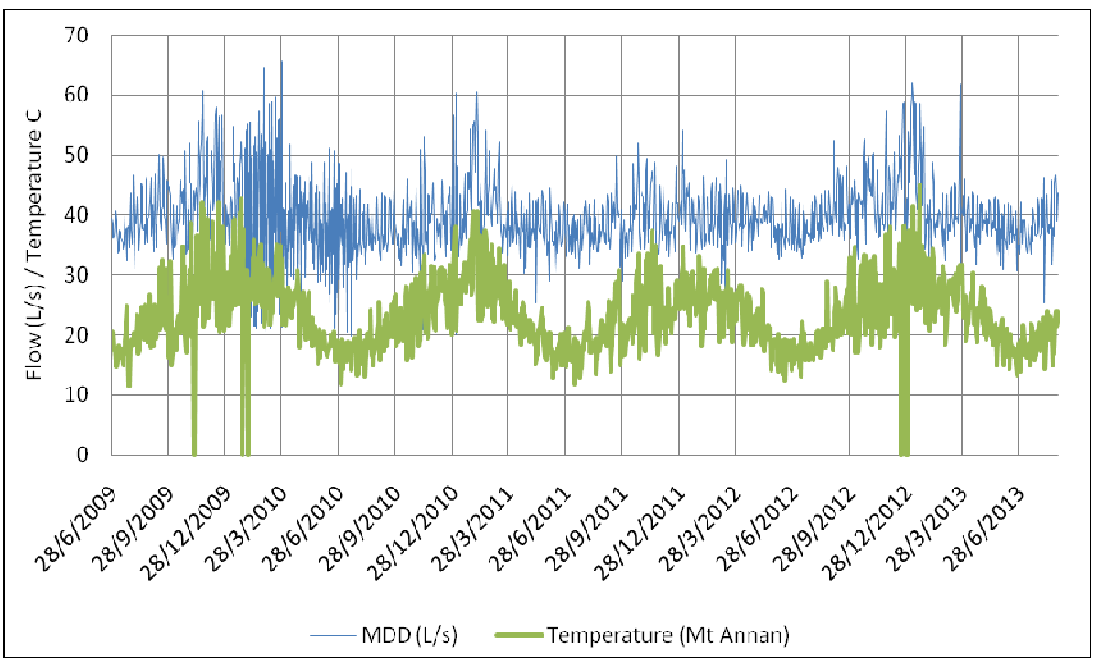

Figure 5-1: IICATS Historical Max Day Demand

These were then compared against temperature records from the Bureau of Meteorology weather station at Mt Annan (Station No 68257). The results from this comparison are listed in **Table 5-2**.

The highest four summer demands were then examined for a relationship to temperature to ensure it was a genuine maximum event rather than due to anomalies such as main breaks or reservoir maintenance.

Table 5-2: MDD to Temperature relationship

Date	MDD (L/s)	MDD (ML/day)	Temperature
27/02/2010	61.6	5.32	22.6ºC with slightly higher temperatures either side
28/03/2010	65.5	5.66	30.9ºC with similar temperatures either side
7/01/2013	62.0	5.36	31ºC with 33.3ºC and 41ºC, before and after
25/03/2013	61.8	5.34	31.7ºC with similar temperatures either side

It is noted that while seasonal variation in water demand is apparent, the level of correlation between overall water consumption and high temperatures is variable, with a 45ºC temperature on 18/01/2013 registering a daily demand of 58L/s. After consultation with SWC planners, it was agreed to adopt the 7/01/2013 demand.

The existing overall MDD/ADD ratio in the model 2.289 (98.2 L/s) was pro-rated down to match the IICATS flow of 62.0L/s, resulting In a revised MDD/ADD ratio of 1.452. The MDD was modified as per **Table 5-3**.

Table 5-3: Revised MDD

Category	Model ADWF (L/s)	Original MDD/ADD Ratio	Original MDD (L/s)	Original MDD/ADD Ratio	Revised MDD (L/s)	Revised MDD (ML/day)
Commercial	0.5	2.5	1.3	1.452	0.8	0.1
Miscellaneous	0.0	2.5	0.0	1.452	0.0	0.0
Open Space	0.3	2.5	0.9	1.452	0.5	0.0
Residential (HD)	1.3	2.5	3.3	1.452	1.9	0.2
Residential (LD)	33.5	2.5	83.8	1.452	48.6	4.2
Special Uses	1.3	2.5	3.1	1.452	1.8	0.2
UFW	5.8	1.0	5.8	1.452	8.4	0.7
Total	**42.7**	**2.3**	**98.2**	**1.452**	**62.1**	**5.4**

5.3 Mt Gilead Demands

5.3.1 Potable Water

Metered consumption data from nearby Campbelltown South, Campbelltown South Elevated and Rosemeadow Elevated Supply Zones were reviewed to determine the Average Day Demand for the Mt Gilead site. The metered consumption for Rosemeadow Elevated of ADD 601 L/dwelling/day was the highest of the three reservoir zones.

For this report, the ultimate development of the Mt Gilead site has been taken to be 1700 low density residential lots, with an ADD of 11.83 L/s and MDD of 21.2 L/s.

Table 5-4:Dual Reticulation Demand factors ratios

	Standard		Modelled	
	Potable	Recycled	Potable	Recycled
ADD (kl/dwelling /Day)	0.75	0	0.601	0
MDD/ADD	2.1	0	1.462	0
MHD/MDD	2.7	0	2.5	0

Table 5-5: Mt Gilead Single Pipe Water Demands

	ADD (kL/day)	MDD (kL/day)	MHD (L/s)
Potable (2036 Only)	1021	1494	47

Note: the growth factor of 23% has been applied to the Mt Gilead demand. This increases the impact on the existing Rosemeadow system and will be amended by further modelling, but in the meantime, the infrastructure sizing will be undertaken to reflect the modelled flows.

5.3.2 Recycled Water

There are no existing recycled water systems in close proximity to the site. It is assumed that any recycled water system will be provided within the development, and will not require external works to service the site. As a result, modelling of recycled water systems has not been undertaken, however these demands have been used to size potable water systems supplying a dual pipe servicing approach

However in order to assess the impact of recycled water on servicing, the demands derived for the potable water single pipe system have been modified in line with the SWC “Design Criteria Guidelines Supplement (April 2010), to derive a recycled water demand.

Dual reticulation demands are shown in T??? below and have been modified as follows:

- Potable and recycled water demand pro-rated to match current actual demand rates per dwelling
- Potable water demand factor ratios matched to single pipe system demands.
- Recycled water demand factor ratios are unchanged.

Table 5-6:Dual Reticulation Demand factors ratios

	Standard (T2.2.2 & T2.2.3)		Modified	
	Potable	Recycled	Potable	Recycled
ADD (kl/dwelling /Day)	0.5	0.35	0.4	0.28
MDD/ADD	1.6	4.6	1.462	4.6
MHD/MDD	2.7	3.6	2.5	3.6

Table 5-7: Mt Gilead Dual Pipe Water Demands

	ADD (kL/day)	MDD (kL/day)	MHD (L/s)
Potable (2036 Only)	681	996	28.8
Recycled (2036 Only)	477	2180	90.8

5.4 Scenarios

Based on the above, three (3) scenarios have been developed to investigate the impact of Mt Gilead on the SWC system:

- Scenario 1 - Rosemeadow Elevated only - existing demand with updated MDD to match historical performance (Existing_ROS_MDD)
- Scenario 2 - Future demand (2036) for Rosemeadow Supply Zone only (Future_2036_ROS_MDD)
- Future demand (2036) for Rosemeadow and Mt Gilead (Future_2036_ROS+MTG_MDD_DN250)

Table 5-8: Scenario Demand Parameters

Scenario	Model ADWF (L/s)	Growth 2036	MDD/ADD Ratio	MDD (L/s)	MDD (ML/day)
Scenario 1	42.7	0%	1.452	62.1	5.36
Scenario 2	42.7	23%	1.452	76.3	6.60
Scenario 3	54.6	23%	1.452	97.5	8.42
Mt Gilead Only	11.8	0%	1.452	17.2	1.48

For this investigation, it is proposed that the Mt Gilead site connect to the adjacent Rosemeadow Elevated Supply Zone via single water main from the DN450 pipe at the intersection of Appin Rd and Kellerman Drive, the closest large supply main.

The scenarios were modelled in the run groups as summarised in **Table 5-9** and are located in the directory:

- ***>Potable Retic>11. Macarthur>11.2 Campbelltown>Rosemeadow>20 Projects> MT GILEAD_AUG_2013 Group>***

Table 5-9: Run Group Summary

Scenario	1	2	3
Run Title	Existing ROS MDD	Future_2036_ROS_MDD	Future_2036_ROS+MTG_MDD
Network	Rosemeadow Network 1.0	Rosemeadow Network 1.0	Rosemeadow Network 1.0
Control	Rosemeadow Control Max Day - 0.1	Rosemeadow Control Max Day - 0.1	Rosemeadow Control Max Day - 0.1
Demand Diagram	Maximum Week Demand Diagram	Maximum Week Demand Diagram	Maximum Week Demand Diagram
Demand Scaling	Existing ROS MDD	Future_2036_ROS_MDD	Future_2036_ROS+MTG_MDD

6 PERFORMANCE CRITERIA

Water and Recycled Water System Growth Servicing Strategy – Criteria and Guideline 2012 requires system performance to be assessed against the following criteria for:

For Supply Zones:

- ✓ Determine whether any customers receive less than 15 metres pressure at any time under MDD conditions. In addition, the planner must determine for what period of time customers are receiving pressures of less than 15m.
- ✓ Where there are customers receiving pressures below 15m and above 12m, the period of time for this failure must be determined in the model. If over the course of one day the failure period multiplied by the number of customers exceeds 10 customer days, options to improve pressure will need to be considered in the next step. If the total number of customer days is less than 10, augmentations are not necessary.
- ✓ Where pressures fall below 12m solutions will need to be identified in the next step of the process.

Both Supply Zones and Trunk Systems:

- ✓ Non-customer supply mains must have 3 metres of pressure at any time under MDD conditions. This limit has been applied to ensure positive pressure in these mains given any potential uncertainty of the model.
- ✓ Reservoirs must not breach their respective Reserve Storage Level (RSL) over the course of the simulation day. Where the primary criteria for RSL is to maintain pressures in the zone, it can be breached so long as pressure to customers remain above limits discussed above.

System Deficiencies:

- ✓ Bottlenecks: the planner should consider mains with high velocities or headloss rates. Pressure reducing or sustaining valves may also contribute to problems and their settings should be investigated where appropriate.
- ✓ Pump capacity issues: If all units in a station are running and the downstream reservoir cannot recover this can be an indication of a capacity deficiency in the input system (combination of pump, rising main and reservoir).
- ✓ Storage Capacity: If a supply zone's reservoir is supplied via gravity and its RSL is breached, more storage for the system may be required. The inlet system should also be investigated for bottlenecks.
- ✓ Operational issues: This criteria is not assessed in this investigation.
- ✓ Pipe residual life: This criteria is not assessed in this investigation.

7 SYSTEM PERFORMANCE

The three scenarios were modelled for Maximum Day Demand, and compared against SWC performance criteria. The results are presented in the following sections:

7.1 Scenario 1 - MDD Existing Rosemeadow

The results for the Existing Rosemeadow scenario are shown diagrammatically in **Figure 7-1**.

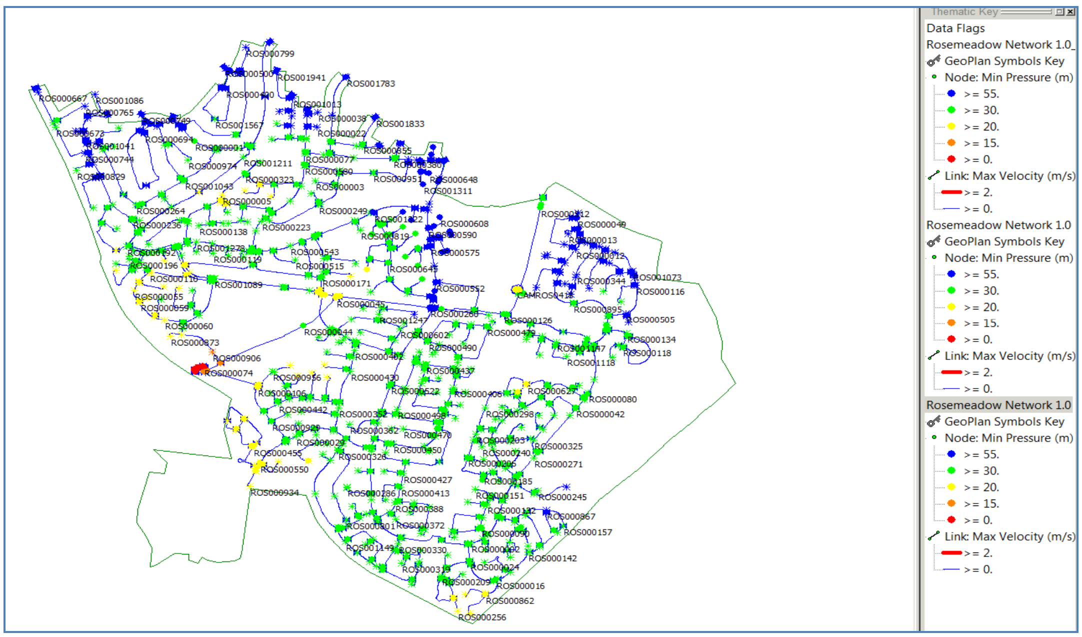

Figure 7-1: Scenario 1 MDD Results

The results indicate:

- Customer Pressure: All nodes had minimum pressures >15m except for those at the reservoir site;
- System Deficiencies : No bottlenecks were detected. Maximum flow velocities in all pipes were below 2m/s.

7.2 Scenario 2- MDD Future Rosemeadow

The results for the Future Rosemeadow scenario are shown diagrammatically in **Figure 7-2**.

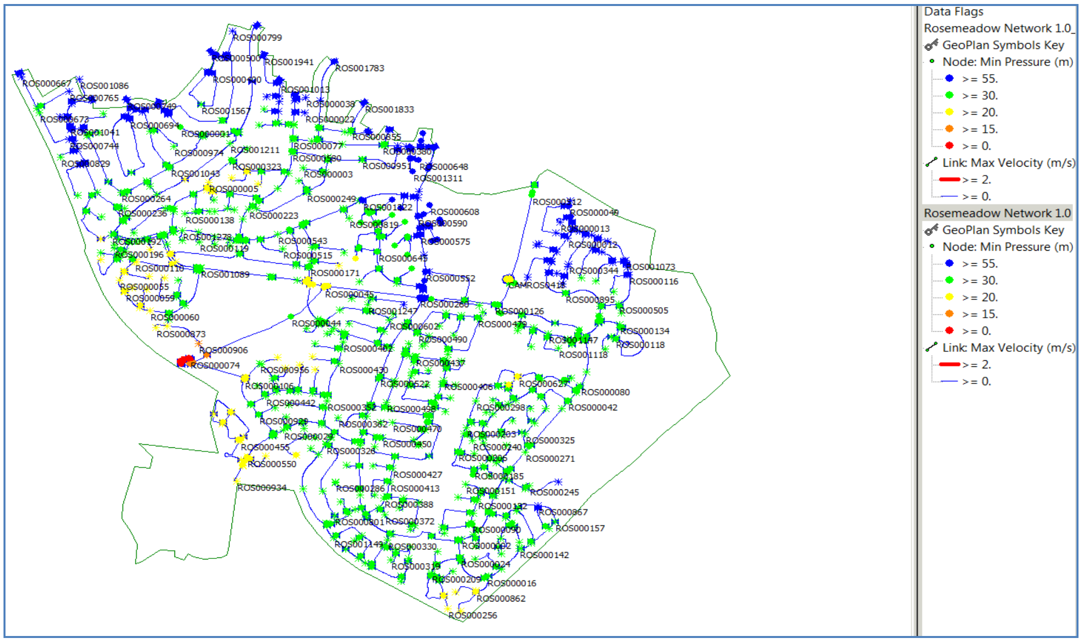

Figure 7-2: Scenario 2 MDD Results

The results indicate:

- Customer Pressure: All nodes had minimum pressures >15m except for those at the reservoir site;
- System Deficiencies: No bottlenecks were detected. Maximum flow velocities in all pipes were below 2m/s.

7.3 Scenario 3 - MDD Future Rosemeadow and Mt Gilead

The results for the Future Rosemeadow scenario are shown diagrammatically in **Figure 7-3**.

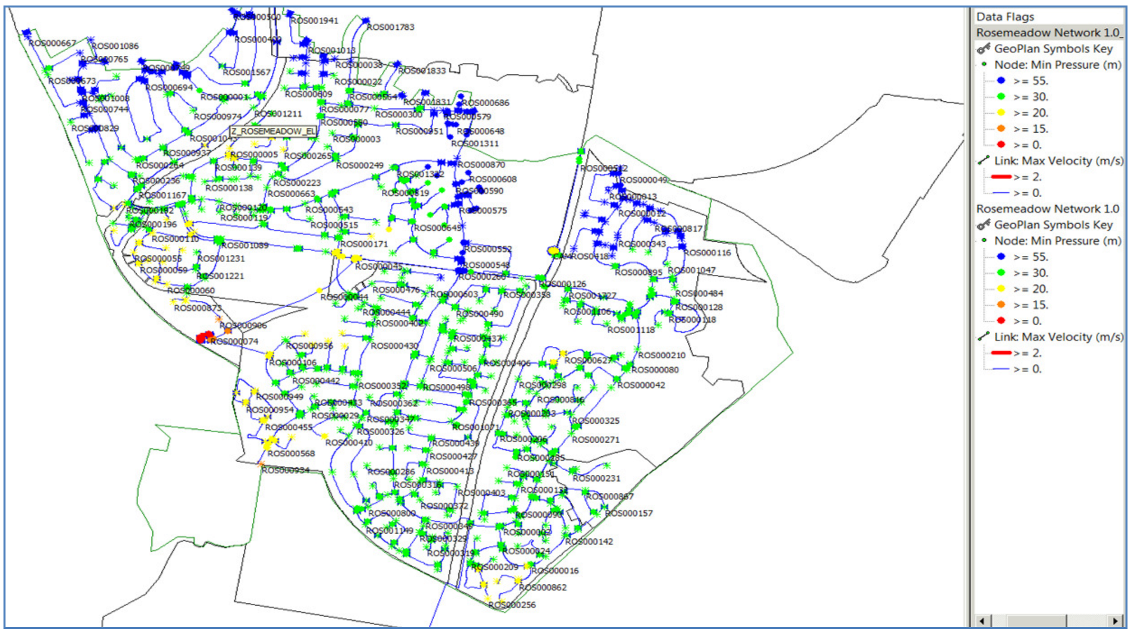

Figure 7-3: Scenario 3 MDD Results

The results indicate:

- Customer Pressure: All nodes had minimum pressures >15m except for those at the reservoir site;
- System Deficiencies : No bottlenecks were detected. Maximum flow velocities in all pipes were below 2m/s.

7.4 Mt Gilead Demand Profile

The demand profile from the ultimate Mt Gilead development in 2036 is shown in .

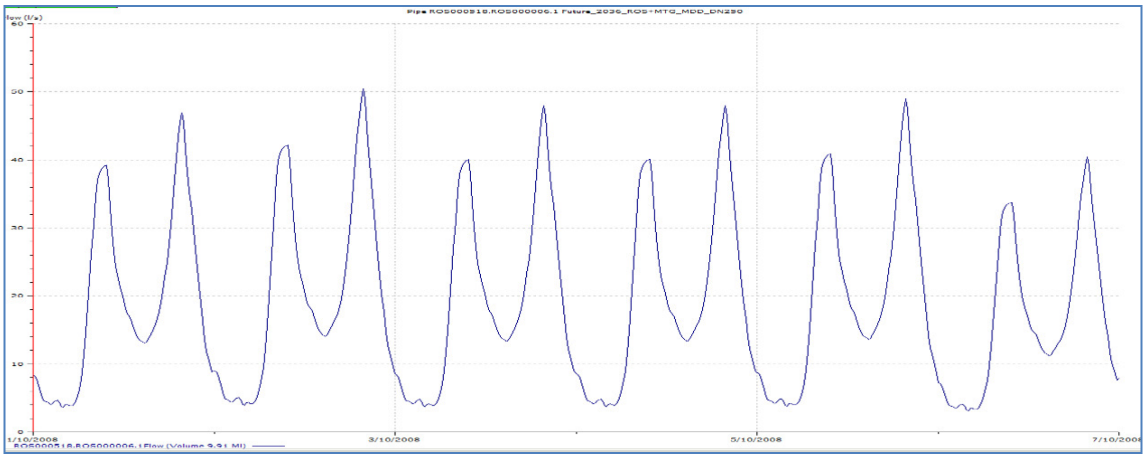

Figure 7-4: Demand Profile for Ultimate Mt Gilead Development

The results indicate:

- Peak flow for the development is approximately 50 L/s

7.5 Reservoir Supply Level

Comparison of WS0311 Rosemeadow levels for each scenario is shown in **Figure 7-5**.

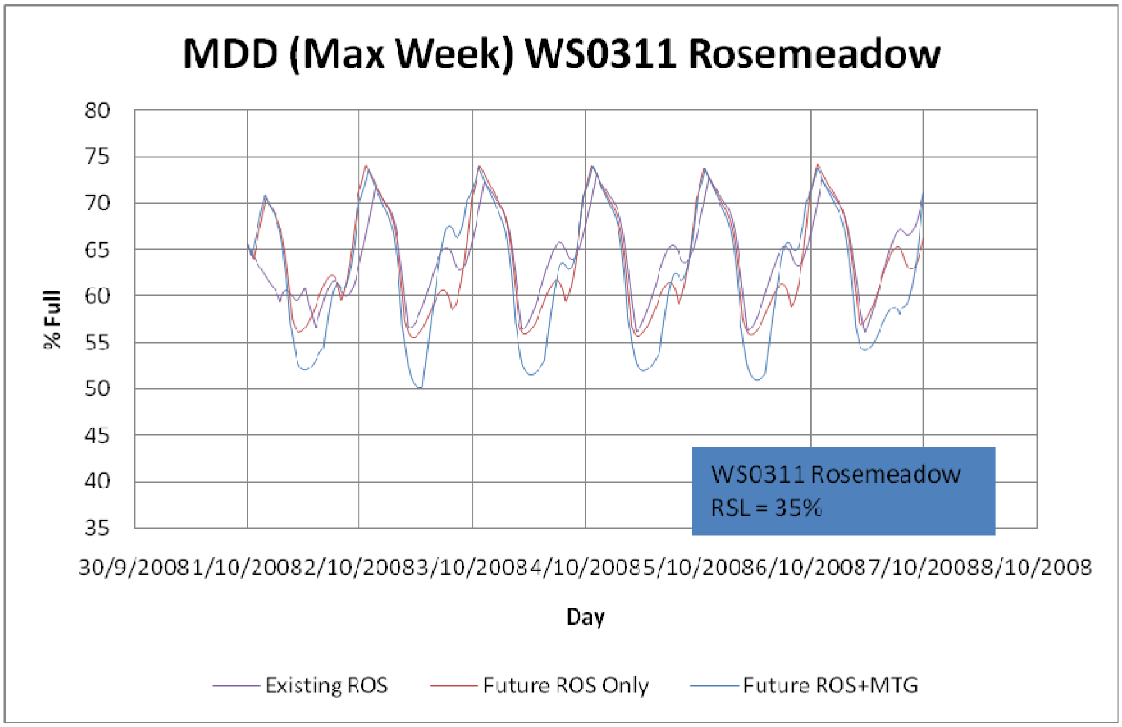

Figure 7-5: Comparison of MDD for All Scenarios

For all scenarios,

- The reservoir remains above the 35% RSL at all times;
- Water level within WS0311 recovers each day, however it is noted that both pumps at WP0195 are in operation at times.

8 DISCUSSION

8.1 Result Summary

From the modelling results:

- Rosemeadow Elevated has sufficient capacity to fully supply the ultimate Mt Gilead development without augmentation. Modelling of incremental stages within the development is not required;
- The maximum flow to Mt Gilead (Max Hour Demand) is 50 L/s which is within expectations.
- The average demand over the peak week is 1.5ML/day.

- The FSL of Rosemeadow Elevated Reservoir (WS0311) is 190m. This elevation is insufficent to supply the Mt Gilead site, which ranges between RL 130m at the north western corner to RL 200m in the south, by gravity from Rosemeadow Elevated.
    - Approximately 44% of the gross site area, below RL 156m, can be supplied by gravity by Rosemeadow Elevated.
    - Approximately 36% of the site, primarily to the south, can be serviced by gravity from Rosemeadow Elevated during Average Day Demand but there is inadequate pressure during Max Day Demand.
    - Approximately 20% of the site to the south is above RL 170m and cannot be serviced at all by gravity from Rosemeadow Elevated.
    - The approximate pressure zone areas are shown in Figure 8-1.

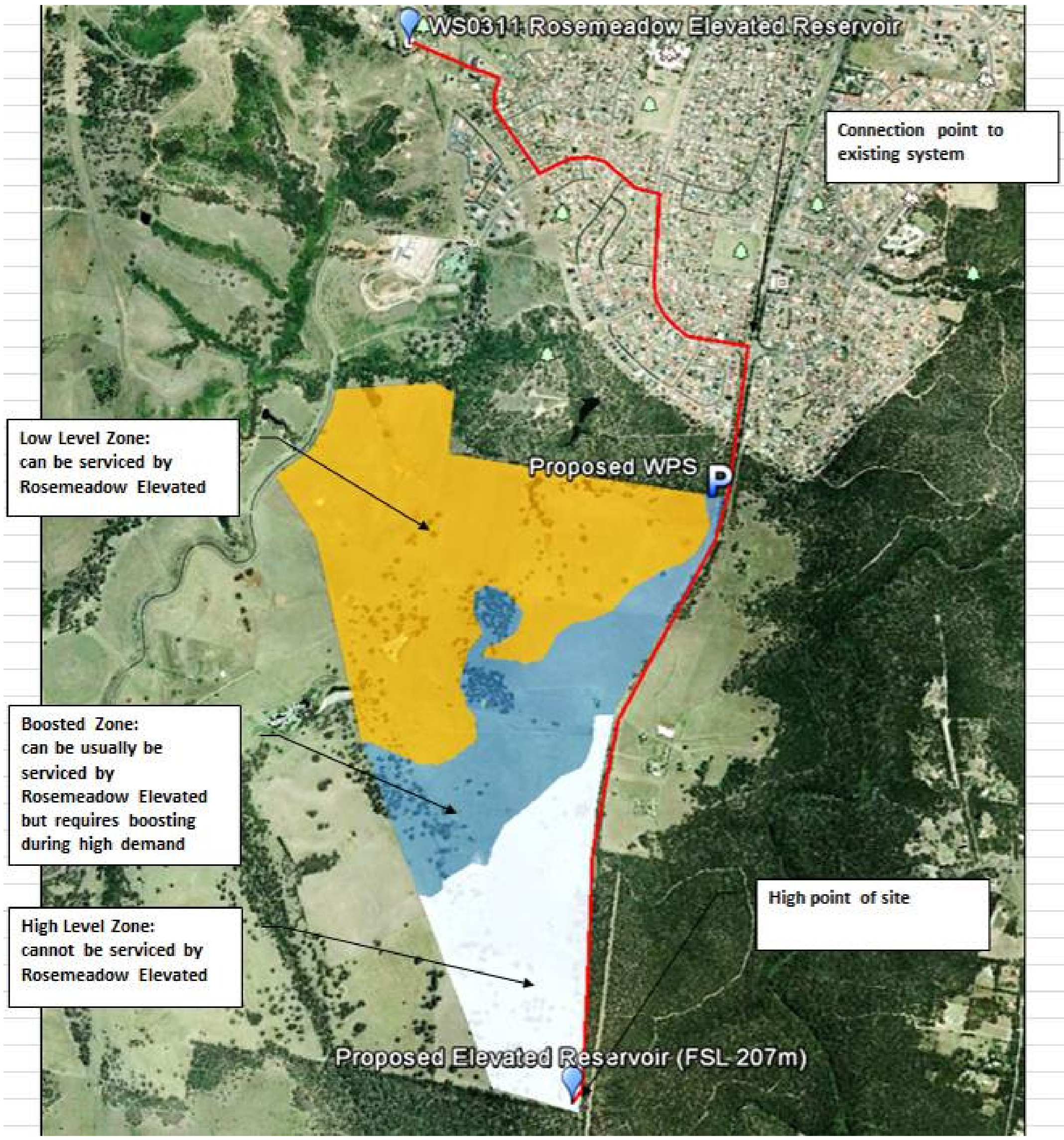

Figure 8-1 Mt Gilead Pressure Zones

8.2 Strategic Options

The Mt Gilead site is on the extreme southern end of the Campbelltown system. Modelling indicates that the adjacent reservoir zone (Rosemeadow Elevated) has sufficient capacity to fully supply the Mt Gilead site. As a result, no further investigation into alternative potential sources of potable water supply from the Sydney Water network was undertaken.

Supply from the nearby bulk water network, ie the Upper Canal and the Trility pipeline, are the only remotely viable alternatives, and are discussed as alternative options in the overall report.

8.3 Staging

As the supply from Rosemeadow Elevated is sufficient to supply ultimate development of the Mt Gilead, only the existing and 2036 scenarios have been modelled. Modelling of incremental scenarios within this period has not been undertaken.

8.4 Recycled Water

No modelling of Sydney Water recycled water systems was undertaken.

8.5 Servicing Options

Based on the results of the modelling, there are a number of ways to provide potable water supply from Rosemeadow Elevated to Mt Gilead with the following options considered to be appropriate:.

- New reservoir zone for all of Mt Gilead with a new water pumping station and reservoir;
- New high level reservoir zone for Mt Gilead high level areas with a new water pumping station and reservoir, with the remainder supplied by gravity from Rosemeadow Elevated;
- New boosted zone for Mt Gilead high level areas, with the remainder supplied by gravity from Rosemeadow Elevated;

All options include a supply main from the Rosemeadow Elevated reservoir zone and either a transfer or booster pumping station.

Analysis and costing of these options, including the impact of recycled water usage and staging is undertaken in the overall report.

9 CONCLUSION

This investigation is a high level conceptual assessment of the impacts of the Mt Gilead development upon Sydney Water's wastewater systems.

In general, the modelling and assumptions are considered to be conservative in terms of lot yields and general approach. No consideration has been given to measures to reduce wastewater flow, such as reclaimed water use or rainwater tanks.

The conclusions of this study are:

- ✓ The Rosemeadow Elevated Supply Zone has sufficient water supply capacity to supply the ultimate 1700 Lot Mt Gilead development, whilst maintaining current operating standards within the existing system.
  Augmentation to the supply capacity of Rosemeadow Elevated is <u>not</u> required;

- ✓ The Rosemeadow Elevated Supply Zone does not have sufficient elevation to service the entire Mt Gilead development.
  Additional pumping capability is required to be able to supply the entire Mt Gilead site.

The following demands and flow rates will be used for development of servicing options in the overall report.

Table 9-1: Mt Gilead Potable Water Demands

	ADD (kL/day)	MDD (kL/day)	MHD (L/s)
Potable Only (2036 Only)	1021	1494	47

Table 9-2: Mt Gilead Dual Pipe Water Demands

	ADD (kL/day)	MDD (kL/day)	MHD (L/s)
Potable (2036 Only)	681	996	28.8
Recycled (2036 Only)	477	2180	90.8

Appendix 3 Wastewater Modelling Report

WorleyParsons
resources & energy

EcoNomics™

MOUNT GILEAD PTY LTD, S & A DZWONNIK

Mt Gilead

Strategic Modelling Report - Wastewater

301015-03252 – CI-REP-002

04 March 2014

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MOUNT GILEAD PTY LTD, S & A DZWONNIK
MT GILEAD
STRATEGIC MODELLING REPORT - WASTEWATER

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PROJECT 301015-03252 - MT GILEAD

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
E	Re-Issued for SWC review	WB	HVR	N/A	04-Mar-2014	N/A	
B	Issued for Client Review	WB	HVR	DS	22-Oct-13		N/A
C	Issued for SWC Review	WB	HVR	DS	12-Nov-13		N/A
D	Issued for Client Review	WB	HVR		18-Feb-14		N/A

CONTENTS

Appendices

1 INTRODUCTION

An application is being prepared by the land owners to rezone the 210ha Mt Gilead site in anticipation of commencing residential development in 2016. Mt Gilead is included within the current Metropolitan Development Plan. However, development of the site is not covered by an existing funding plan.

In response to the rezoning application, Sydney Water has requested that a high level servicing strategy report be prepared to assess the performance of Sydney Water wastewater systems for the current and future (2036) scenarios.

WorleyParsons has been engaged by the landowners, Mt Gilead P/L and S & A Dwonnik, to undertake this investigation. This report documents the modelling undertaken to determine the impact of the Mt Gilead development on Sydney Water's wastewater systems, and to establish the wastewater loadings from Mt Gilead for development of servicing options.

Analysis and costing of these options, including the impact of recycled water reclamation and staging is undertaken in the overall Strategic Planning Report. This report forms an appendix to the overall report.

Mt Gilead Development

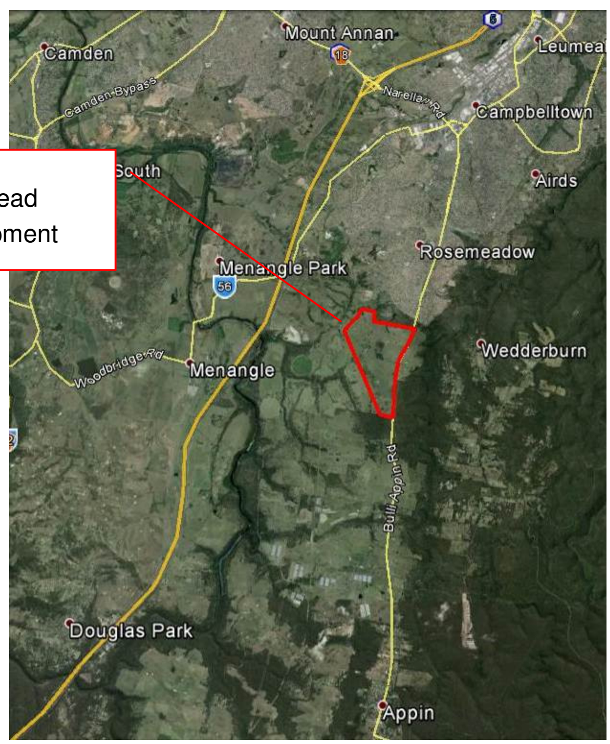

Figure 1-1 Site Locality Plan

2 PROPOSED DEVELOPMENT

The 210ha Mt Gilead site is currently undeveloped land and is zoned for rural uses.

At present, the proposed development is anticipated to contain between 1400 and 1700 low density residential lots developed in 10 equal stages over 10 years. Development is expected to commence in 2016 with the site being fully developed by 2026.

For the purposes of this report, an ultimate development of 1700 lots has been adopted to provide a conservative approach.

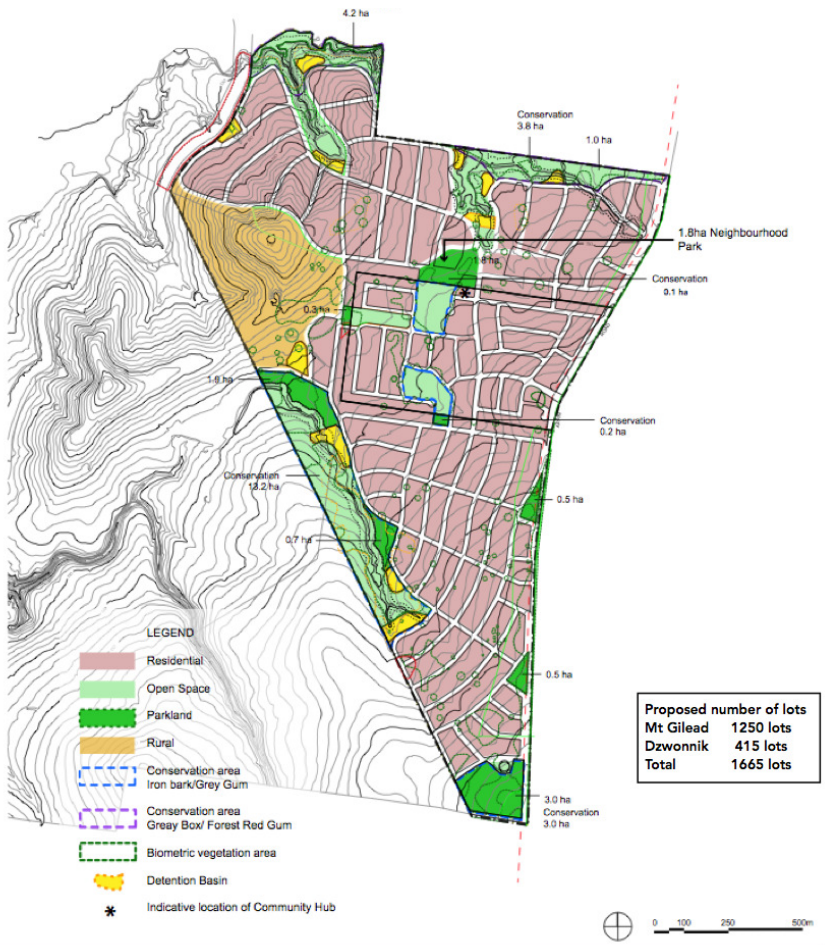

Figure 2-1: Indicative Masterplan

2.1 Development Staging

A preliminary staging plan has been developed which separates the site into six precincts. This is shown in Figure 2-2 below.

Figure 2-2: Indicative Staging Plan

Both landowners intend to develop the site in parallel, with 10 equal stages over 10 years, as shown in .

Table 2-1: Projected Development Staging

Stage	Year	Mt Gilead Precinct	Mt Gilead Lots	Precinct 6 (Dzwonnik)	Total	Total Lots
1	2016	1	125	45	170	170
2	2017	1	125	45	170	340
3	2018	2	125	45	170	510
4	2019	2	125	45	170	680
5	2020	3	125	45	170	850
6	2021	3	125	45	170	1020
7	2022	4	125	45	170	1190
8	2023	4	125	45	170	1360
9	2024	5	125	45	170	1530
10	2025	5	125	45	170	1700

All lots are low density residential free standing dwellings, with an assumed average lot size of $600m^2$.

2.2 Design Population

The MDP lists the forecast dwelling numbers as 1500 low density residential dwellings. Current planning studies are investigating a range of between 1400-1700 dwellings, with any number above the 1500 MDP number to be justified on the basis of capacity of the site and infrastructure. This study has assumed the maximum number of 1700 dwellings as a conservative base case for assessing water and sewage servicing.

3 EXISTING SYSTEM

3.1 Wastewater

The Mt Gilead development site is located to the south of the Glenfield-Liverpool gravity wastewater system, part of the Malabar wastewater system.

The Glenfield System serves the areas of Glenfield, Casula, Macquarie Links, Macquarie Fields, Ingleburn, Minto and Bow Bowing suburbs. The nearest carrier to the Mt Gilead site is the Old Menangle Road Carrier which drains to the Glenfield-Campbelltown Sub main and ultimately to the Glenfield RWTP, located about 19 km away from the development.

Currently, in dry weather flow, treated effluent is normally pumped at 550 L/s by SPS 580 to Liverpool Wastewater Treatment Plant and then to the North Georges River Sub main (NGRS) to Malabar WWTP.

In wet weather conditions, flows up to 1000 L/s are pumped to Liverpool RWTP. When influent is greater than the pumping rate of SPS 580, it is stored in a pond and excess flow treated and discharged to Georges River at Glenfield. In wet weather when there is no capacity in the WBMS or the NGRS, treated effluent will be disinfected before being pumped to the Georges River at Chipping Norton.

The Menangle Park development area is located approximately 5km to the west of Mt Gilead. Menangle Park sewerage system is in the advanced stages of planning and will also discharge to the Old Menangle Road carrier. The Appin Low Pressure Sewer System is located to the south of Mt Gilead and connects to the Glenfield system via a DN250 rising main which traverses the Mt Gilead site adjacent to Appin Rd. Sydney Water has advised that the Appin area is expected to be developed over a similar time frame to Mt Gilead, with an estimated ultimate population of approximately 17,000.

4 METHODOLOGY

The modelling and reporting for this investigation has been generally carried out in accordance with the "Wastewater Network Growth Servicing Strategy – Criteria and Guideline 2012". Noting the very high level and preliminary nature of this investigation, in some instances and with agreement from SWC Planners, an alternative approach has been adopted.

The modelling assumes the site discharge all sewage to Sydney Water's system, without the effects of onsite treatment or sewer mining on sewage flows. This approach produces the highest sewage volume and similarly, would require a higher investment in infrastructure to service the site. Using this approach:

- establishes an upper limit on the impact that the development will have on Sydney Water's systems;
- confirms that the site can be serviced;
- provides a basis for development and sizing of servicing options,

The capacity of Glenfield STP has not been assessed as part of this investigation.

5 REVIEW OF EXISTING MODEL

The methodology for this modelling investigation builds on the models prepared for Menangle Park Release Area Options Report Final (Feb 2013). (MAT11 – existing case, MAT 13 - 2036 future case) Use of these models is appropriate due to the following:

- Menangle Park and Mt Gilead are in close proximity and both discharge to the same trunk system;
- The Menangle Park model contains an allowance for Mt Gilead and Appin;
  - 5250 EP allowance for Mt Gilead
  - Constant flow of 35 L/s to simulate the average discharge of the SPS1175 rising main during the 1 in 3 month storm event
- This model is less than 12 months old and can be considered to be reasonably up to date.

The updated readme.text file for the MAX series of models is contained within Appendix 1.

5.1 Expected Wastewater Flows

Based on the WSAA Sewerage Code of Australia design calculation for Mt Gilead, the nominal nominal wastewater flows are shown in

Table 5-1: Nominal Wastewater Flows

Lots	EP / Lot	L/EP/Day	EP	ADWF	Area	Design Flow
1700	3.5	150	5950	893kL/day	210 ha	130L/s

Sewer mining was considered as a potential servicing option for the site. SWC permits a maximum of 600mg/L suspended solids to be discharged to sewers from sewer mining facilities. Based on a typical suspended solids load of 250mg/L for raw sewage, up to 55% of sewage flows could be reclaimed, resulting in the yield shown in Table 5-2

Table 5-2: Nominal Sewer Mining Yield

	ADWF (kL/day)	Sewer Design Flow (L/s)	Sewer Mining (kL/day)
Wastewater	893	130	0
Wastewater with Sewer mining	402	130	491

5.2 Population

Population for the model subcatchments that contained Mt Gilead was reviewed against the current SWC development database (SWC_Prop_V2) for which:

- Sub catchment 2890 includes the suburb of Rosemeadow and part of the allowance for the Mt Gilead site;

Sub catchment 3286 which covers the remainder of Mt Gilead **Table** 5-3 summarises the outcome of the review. These sub catchments discharge directly to model Nodes SMO-1 and SMO-3 respectively.

Table 5-3: Modelled Populations

Modelled	Catchment 2890 EP	Catchment 3286 EP	Total Modelled	SWC_Prop_V2 database	Variance
Current	23365	0	23365	22932	101.9%
POP_2020	29795	5250	35045	25905	135.3%
POP_2031	29795	5250	35045	31368	111.7%
POP_2036	29795	5250	35045	33105	105.9%

- The model populations for current and 2036 populations are slightly in excess of the population database;
- Populations for 2020 and 2031 scenarios are set at 2036 levels and significantly over estimate flows at these times;
- Flows from Mt Gilead were based on 1500 low density lots with an EP of 5250;

The increase in the poulation within the Appin sewerage scheme is shown in Table 5-4:

Table 5-4: Appin Population

SWC_Prop_V2	Appin
Current	1445
POP_2036	17000

5.3 Model Modifications

The models were updated to reflect changes in population and to provide additional focus on the Mt Gilead area.

The Mt Gilead site has been modelled as a single sub-catchment with a single SPS (SPSMTGI) and rising main connecting the site to the existing sewage system. The model does not include internal reticulation or any other infrastructure upstream of the pumping station. As agreed with SWC Planners, only the current and ultimate future (2036) scenarios have been modelled.

The SPS will be located at the low point of the Mt Gilead site, and will discharge into the Glenfield system at Woodhouse Drive, Ambarvale, the current extent of the existing Sydney Water model. Flows from Appin also discharge at this point.

To service the site, the Mt Gilead sewage pumping station and rising main was modelled, with the following characteristics determined by iteration:

    - Flow: 70 L/s
    - Head: 113m (60m Static head)

- 2.5km DN250 rising main to the highpoint RL190.
- 3km DN300 gravity main to Woodhouse Drive, Ambarvale (Node SMO-03).

The site is well graded and a gravity reticulation system has been assumed. The model sub catchments were updated as detailed in the following sections.

5.4 Existing System (Runcode: MAXA)

A copy of MAT 11 (Current), with the following modifications:

- ✓ SC 2890 (Rosemeadow area)
    - Population retained at 23365 EP.
    - The 35 L/s constant inflow time series from SPS1175 at Appin was removed.
    - The outline of the subcatchment was modified to represent the current extent of the Sydney Water sewer system (965ha).

- ✓ SC 3283 (Appin)
    - New subcatchment, 103ha.
    - A simple sewage pumping stationwith 72L/s flow was added to the model to connect Appin to the Glenfield gravity system.
    - Sub catchment details and pumping station performance were based on SPS1175 within the most recent Malabar trunk model (MAGA)

5.5 Future 2036 scenario, excluding Mt Gilead (Runcode: MAXB)

A copy of MAT 13 (Future 2036), modified to include ultimate development at Appin but exclude Mt Gilead, with the following modifications:

- ✓ SC 2890 (Rosemeadow area)
    - Population modified to include growth within sub catchment , a net increase to 29795 EP. (Gilead component excluded.)

- The 35 L/s constant inflow time series from SPS1175 at Appin was removed.
- The outline of the subcatchment was modified to represent the current extent of the Sydney Water sewer system (965ha).

✓ SC 3286 (Mt Gilead)
- The outline of the subcatchment was modified to represent the proposed extent of the Mt Gilerad site.
- Area modified to 132 ha, representing 1700 lots of 600m^2 each + 30% allowance for roads and open space.
- The population for Mt Gilead reduced from 1500 to 0 EP.

✓ SC 3288 (Appin)
- New subcatchment.
- Population for Appin increased to 17000 EP . Ultimate outline as supplied by Sydney Water Planners (972ha).
- A simple sewer pumping station with 150L/s flow was added to represent future upgrade of the exising SPS 1175, to connect Appin to the Glenfield gravity system.

5.6 Future, including Mt Gilead (Runcode: MAXC)

A copy of MAXB (Future 2036), modified to include Mt Gilead, with the following additional modifications:

✓ SC 2890 (Rosemeadow area)
- No change

✓ SC 3286 (Mt Gilead)
- Population for Mt Gilead increased from 0 to 5950 EP
- A simple sewer pumping station (SPSMTGI) with 70L/s flow was added to connect Mt Gilead to the Glenfield gravity system.

✓ SC 3288 (Appin)
- No change

6 SYSTEM PERFORMANCE

The above models were run for dry weather and wet weather performance and compared against SWC performance guidelines.

6.1 Performance Criteria

Wastewater Network Growth Servicing Strategy – Criteria and Guideline 2012 requires system performance to be assessed against the following criteria:

- for seven days of dry weather flow:
    - For each model run, the planner will prepare a figure showing Dry Weather Flow (DWF) capacity and a list of pipe sections where the depth exceeds 60% of pipe height.

- for wet weather 10 year simulation between 1985 and 1994:
    - The planner will prepare a summary table of all modelled SPSs listing the current and future detention times, and current contingency arrangements. Highlight the SPSs with less than 4hr and 2hr emergency storages and without contingency arrangements.

    - For relevant model runs the planner will prepare a figure showing predicted overflow frequency for standard 10 year rainfall time series and a table listing details of wet weather overflow activation of directed overflows and spilling manholes (MHs) for existing and future scenarios.

Use of the 10 year time series is noted as being for detailed studies. Given the high level nature of this investigation, and with aggreement from SWC planners, wet weather performance was assessed using the same approach and rainfall event used in the Menangle Park Release Area Options Report, using a single 1 in 3 month event withoverflow activation (on/off) and overflow cumulative volume used to compare scenarios

6.2 Dry Weather Performance

The DWF performance was analysed by running the DWF model for a nominal 7 days, between 1988-06-02 00:00:00 and 1988-06-09 00:00:00. for existing and 2036 scenarios. Peak DWF depths were checked in the system downstream of the Mt Gilead Site discharge manholes.

6.3 Sewage Pumping Station (SPS) Performance

Wastewater from the Mt Gilead system gravitates to Glenfield RWP, with the Glenfield RWP effluent pumping station (SPS 580) being the only major pump station within the Glenfield model. There are minor puming stations within the system, however these are not modelled. As agreed with SWC planners, SPS580 was not assessed due to the impact of Glenfield RWP operations.

6.4 Wet Weather Performance

The wet wether performance was analysed by running the WWF model for a 2 days, between 1988-06-05 03:45:00 and 1988-06-07 14:45:00 for existing and 2036 scenarios, as per the Menangle Park Release Area Options Report.

Overflow volumes and manhole flooding depths were checked in the system downstream of the Mt Gilead Site discharge manhole.

7 DISCUSSION

7.1 Result Summary

Model runs were undertaken as summarised in **Table 7-1**.

Table 7-1: Summary of Model Runs

	Runcode MAXA	Runcode MAXB	Runcode MAXC
Hydrological	MAXA_RD	MAXC_RD	MAXC_RD
Dry Weather	MAXA_DW	MAXC_DW	MAXC_DW
Wet Weather	MAXA_3M	MAXC_3M	MAXC_3M

MPR files for each model run are listed in Appendix 2.

The detailed results for Dry Weather pipe full performance are included in Appendix 3 and summarised below:

- In the existing system (MAXA), six (6) links have greater than 60% full flow during dry weather flow. Of these, five (5) are at Glenfield RWP and the sixth is the SPS1175 inlet main at Appin. Due to their location within the system, these results can be discounted in terms of dry weather capacity.
- In the future system, 18 and 21 links have greater than 60% full flow during dry weather flow for MAXB and MAXC respectively. Of the 18 links in common, 14 do not vary between scenarios and can be attributed to being in close proximity to Glenfield RWP or part of the dummy infrastructure as part of the Menangle Park or Appin schemes. Four (4) others show increases of <5% from MAXB to MAXC.
- Two of the three links that exceed the 60% threshold in MAXC but not in MAXB, are dummy infrastructure for the Mt Gilead sub catchment and can be ignored.
- The remaining link that exceeds the 60% threshold in MAXC but not in MAXB (L22266) is located on a relatively steep (8.4%) DN450 branch line feeding the DN1050 main sewer downstream of Appin, Mt Gilead and Menangle Park flows. Exceedance of the 60% threshold occurs at the downstream end of the pipe only and is due to backwater effects from the main line, rather than a lack of pipe capacity.

The detailed results for Dry Weather overflow and surcharge performance are included in Appendix 3 and summarised below:

- Addition of future flows from the Mt Gilead development does not cause the system to overflow from manholes or constructed overflows during dry weather. It is noted that the outlet to Glenfield RWP is modelled as a weir, and can be discounted as an overflow.

The detailed results for wet weather overflow and surcharge performance are included in **Appendix 4** and summarised below (also refer **Figure 7-1**):

- Due to the use of a single event, it is not possible to determine the increase in overflow frequency, however with the comparison of MAXA and MAXC scenarios below:
    - Inclusion of Mt Gilead results in an increase of overall flow volume of 3% for the 1 in 3 month event.
    - There are no wet weather overflows within the Glenfield reticulation system; however the bypass arrangements at Glenfield RWP do operate at higher flows.
    - The addition of Mt Gilead flows do not result in the operation of previously inactive overflows.

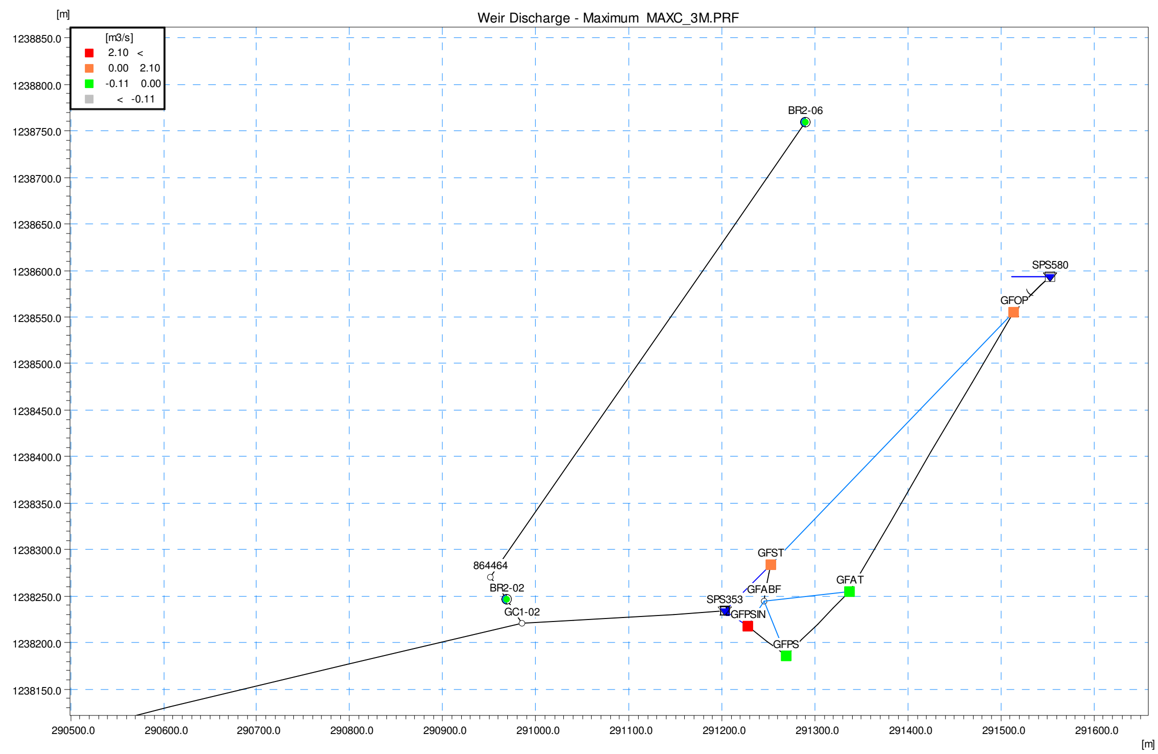

Figure 7-1: Active Overflows at Glenfield RWP

7.2 Strategic Options

The Mt Gilead site is on the extreme southern and upstream end of the Glenfield system. Modelling indicates that this sewerage system has sufficient capacity to accept flows from the Mt Gilead site. As a result, no further investigation into alternative connection points to the Sydney Water network was undertaken.

Alternative wastewater disposal options are discussed in the main report.

The key feature of the modelled scenarios is the assumed development of the significantly larger Appin and Menangle Park areas in parallel with the development of Mt Gilead. As Appin and Mt Gilead would discharge to the same point in the Glenfield system, and with Menangle Park discharging a short distance downstream, detailed staging and design information would be required to ascertain whether any specific impacts on the existing sewer system are due to the Mt Gilead development.

7.3 Staging

As the Glenfield system has sufficient capacity to accept flow from Mt Gilead, only the existing and 2036 scenarios have been modelled. Modelling of incremental scenarios within this period has not been undertaken.

7.4 Servicing requirements

Based on the results of the modelling, all options that require connection Sydney Water's network include

- A new sewer pumping station located at the low point in the Mt Gilead site, RL130m:
- 1.2 km rising main to the highpoint RL190.
- 3.8 km gravity main to Woodhouse Drive, Ambarvale (Node SMO-03).

Analysis and costing of these options, including the impact of recycled water reclamation, and staging is undertaken in the main report.

It is recognised that this option may not be the optimal solution. It is expected that it will be subject to modification and refinement as planning for the development progresses over time.

8 CONCLUSION

This investigation is a high level assessment of the impacts of the Mt Gilead development upon Sydney Water's Glenfield wastewater system.

In general, the modelling and assumptions are considered to be conservative in terms of lot yields and general approach. No consideration has been given to measures to reduce wastewater flow, such as sewer mining.

The conclusions of this study are:

- The system has the capacity to accept Mt Gilead flows for both dry weather and wet weather criteria which include:
    - No dry weather overflows from constructed overflows or manholes.
    - Future dry weather flows from Mt Gilead do not result in flows exceeding 60% of pipe capacity during dry weather. There is a single exception at 64% full, due to the local sewer arrangement and backwater effects in the main sewer.

Augmentation to the existing sewer nextork is not required;

The following wastewater loadings have been used for development of servicing options in the overall report.

Table 8-1 Design Loadings

	ADWF (kL/day)	Sewer Design Flow (L/s)	Sewer Mining (kL/day)
Wastewater	893	70	0
Wastewater with Sewer mining	402	32	491

Sewer mining flows are based on 250mg/L suspended solids in raw sewage, resulting in a sewer mining yield of 55%.

Appendix 1 Updated Readme.txt

MENANGLE PARK (by MWH) 1/06/2012

MAT11- Copy of MAT0. All network removed outside Glenfield area. Pump stations and treatment plant details updated according to Malabar STS model (MAEH). The model is updated to 2013 Population. Model II parameters updated according to the STS model. Contributing area of the flowMonitor catchment 823611 is increased to match with STS model (Area ID 3161 and 3221).

MAT13- Copy of MAT8. All network removed outside Glenfield area. Pump stations and treatment plant details updated according to Malabar STS model (MAEH). Model II parameters updated according to STS model. Contributing area of the flow Monitor catchment 823611 is increased to match with STS model (Area ID 3161 and 3221). Menangle Park is included. Population updated to 2035. II deterioration 0.5 %. II for greenfield area is 2%.

Mount Gilead by WorleyParsons / Final Run Codes

Modelling for rezoning of Mt Gilead site. September 2013. Changes to Residential population only - no additional infrastructure added.

MAXA - Copy of MAT11

SubCatchment 2890 resized to exclude Mt Gilead site. 35L/s TS inflow for Appin removed from SMO-1. A New SC created for Appin at 1445EP, Info from MAGA model. Appin flows pumped direct to extent of existing model (no rising main) at 72 L/s

MAXB - Copy of MAT 13

2036 Population. New SC's added for Appin 2036 extent 17000EP and 972 ha, and MT Gilead 0 EP 165ha. 35L/s TS inflow for Appin removed from SMO-1. SubCatchment 2890 Population modified to exclude Mt Gilead and Appin. Appin flows pumped direct to extent of existing model (no rising main). SPS1175 pump capacity increased to 150 L/s.

MAXC

Copy of MAXB - 2036 Population Ultimate Mt Gilead 5950EP..

Appendix 2 MPR files

MPR files for each model run are included below

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  RPF_file = 'MA2010.RPF'
  EndSect  // Basic_files
EndSect  // MOUSE_Project_files

[MOUSE_Computation]
 Computation_Type = 2
 Language_Type = 1
 Unit_Type = 1
 [MOUSE_Files]
  UND_file = 'MAXC.UND'
  ADP_file = 'MAXC.ADP'
  DWF_file = 'MAXC.DWF'
  RPF_file = 'MA2010.RPF'
  Generate_joblist = false
  PRFcomplete_file = 'MAXC_DW.PRF'
 EndSect  //  MOUSE_Files

 [MOUSE_HD_parameters]
  Model_type = 1, 'Dynamic wave'
  RTC_Computation = false
  TRAP_Computation = false
  TRAP_Setup = 1, 1, 0, 1, 1
  Simulation_start = '1988-06-02 00:00:00'
  Simulation_end = '1988-06-09 00:00:00'
  Dt_MaxSec = 10
  Dt_MinSec = 10
  Dt_IncreaseFactor = 1.00
  SaveStep_HrMiSec = 0, 5, 0
  Allow_OverWrite = true
  HD_summary = 1, 1, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0
  HD_summary_NSE = ''
  HD_summary_LSE = ''
 EndSect  //  MOUSE_HD_parameters

EndSect  //  MOUSE_Computation


==========================================================================

[MOUSE_Project_files]
  [Basic_files]
  UND_file = 'MAXC.UND'
  HGF_file = 'MAXC.HGF'
```

```
   DWF_file = 'MAXC.DWF'
   RPF_file = 'MA2010.RPF'
  EndSect  // Basic_files
EndSect  // MOUSE_Project_files

[MOUSE_Computation]
 Computation_Type = 2
 Language_Type = 1
 Unit_Type = 1
 [MOUSE_Files]
   UND_file = 'MAXC.UND'
   ADP_file = 'MAXC.ADP'
   CRF_file = 'MAXC_RD.CRF'
   HGF_file = 'MAXC.HGF'
   DWF_file = 'MAXC.DWF'
   RPF_file = 'MA2010.RPF'
   Generate_joblist = false
   PRFcomplete_file = 'MAXC_3M.PRF'
 EndSect  //  MOUSE_Files

 [MOUSE_HD_parameters]
   Model_type = 1, 'Dynamic wave'
   RTC_Computation = false
   TRAP_Computation = false
   TRAP_Setup = 1, 1, 0, 1, 1
   Simulation_start = '1988-06-05 03:45:00'
   Simulation_end = '1988-06-07 14:45:00'
   Dt_MaxSec = 10
   Dt_MinSec = 10
   Dt_IncreaseFactor = 1.00
   SaveStep_HrMiSec = 0, 5, 0
   Allow_OverWrite = true
   HD_summary = 1, 1, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0
   HD_summary_NSE = ''
   HD_summary_LSE = ''
 EndSect  //  MOUSE_HD_parameters

EndSect  //  MOUSE_Computation

================================================================================
```

Appendix 3 Dry Weather Flow Results – Pipe Full

	MAXA	MAXB	MAXC	% change B-> C	Comment
L27240 (MTGIL -> SPSMTGI) 338.97	#N/A	0.016	10.115	63119%	Dummy Pipe Mt Gilead SPS inlet
L27229 (SSTORAG -> SPO02W) 10.00	#N/A	5.774	5.774	0%	Menagle Park, No change
L27232 (NSTORAG -> SPO01W) 10.00	#N/A	4.802	4.802	0%	Menagle Park, No change
L27223 (GFOP -> SPS580) 30.92	#N/A	2.844	2.843	0%	Menagle Park, No change
L27224 (GFOP -> SPS580) 30.92	#N/A	2.844	2.843	0%	Menagle Park, No change
L27238 (APPINLP -> SPS1175) 321.44	#N/A	2.212	2.212	0%	Menagle Park, No change
L22764 (1147813 -> 1150189) 111.00	1.934	1.99	1.99	0%	No Change
L5317 (GFPSIN -> GFPS) 0.00	1.975	1.975	1.975	0%	No Change
L27241 (APPIN -> SMO-01) 0.00	#N/A	1.708	1.708	0%	Menagle Park, No change
L23890 (1151110 -> 4806894) 200.00	#N/A	1.235	1.235	0%	Menagle Park, No change
L3101 (GC1-02 -> SPS353) 217.99	0.927	0.93	0.938	1%	
L27223 (GFOP -> SPS580) 0.00	#N/A	0.88	0.881	0%	Menagle Park, No change
L27224 (GFOP -> SPS580) 0.00	#N/A	0.88	0.881	0%	Menagle Park, No change
L25607 (1088492 -> 1091216) 43.00	0.397	0.79	0.79	0%	No Change
L27240 (MTGIL -> SPSMTGI) 0.00	#N/A	0.001	0.727	72600%	Dummy Pipe Mt Gilead SPS inlet
L5316 (GFPS -> GFAT) 97.17	0.599	0.691	0.702	2%	
L4966 (823500a -> GC1-19) 125.09	0.559	0.66	0.672	2%	
L22365 (1151812 -> 1149240) 152.00	0.452	0.633	0.665	5%	
L22266 (1394619 -> 1149941) 73.00	0.187	0.562	0.638	14%	Backwater effects
L25706 (1149629 -> 1149633) 0.00	0.167	0.62	0.62	0%	
L22118 (1394539 -> 1151858) 69.00	0.104	0.607	0.607	0%	
Total >60% Full	6	18	21		

Appendix 4 Wet Weather Flow Results – Overflows

MAXA

Weir Discharge	Minimum	Maximum	Min.Time	Max.Time	Acumm.value
W3197 (GC1-29 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W3198 (GL1-03 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W3199 (BU3-03 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W3204 (823510 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W3205 (823402 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W4712 (BR2-02 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5007 (BU3-05 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5009 (BR2-06 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5233 (SMO-01 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5238 (1394627 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5241 (823660 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5242 (823660B -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5244 (823660A -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5247 (GC1-34 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5249 (823350U -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5250 (SMG-04 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5253 (SMG-02 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5256 (823610 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5307 (GFPS -> GFABF)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5309 (GFAT -> GFABF)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5311 (GFST -> GFOP)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5315 (GFOP -> 0)	0	0.192	5/06/1988 3:45	5/06/1988 16:04	4969.413
W5321 (GFPSIN -> GFABF)	-0.11	2.1	5/06/1988 17:10	5/06/1988 10:50	146771.8
W5451 (1152520 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5453 (1149633 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5457 (1030306 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27197 (1091491 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27199 (1083833 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27200 (1149784 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27201 (1151858 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27203 (1153714 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27204 (1153974 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27205 (1154198 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27206 (1150189 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27207 (1150161 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27209 (1154410 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27210 (1149098 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0

MAXB

Weir Discharge	Minimum	Maximum	Min.Time	Max.Time	Acumm.value
W3197 (GC1-29 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W3198 (GL1-03 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W3199 (BU3-03 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W3204 (823510 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W3205 (823402 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W4712 (BR2-02 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5007 (BU3-05 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5009 (BR2-06 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5233 (SMO-01 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5238 (1394627 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5241 (823660 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5242 (823660B -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5244 (823660A -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5247 (GC1-34 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5249 (823350U -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5250 (SMG-04 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5253 (SMG-02 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5256 (823610 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5307 (GFPS -> GFABF)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5309 (GFAT -> GFABF)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5311 (GFST -> GFOP)	-0.007	0.921	6/06/1988 1:00	5/06/1988 15:04	19300.991
W5315 (GFOP -> 0)	0	1.182	5/06/1988 3:45	5/06/1988 15:30	41783.609
W5321 (GFPSIN -> GFABF)	-0.11	2.1	6/06/1988 19:30	5/06/1988 10:09	236715.948
W5451 (1152520 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5453 (1149633 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5457 (1030306 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27197 (1091491 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27199 (1083833 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27200 (1149784 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27201 (1151858 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27203 (1153714 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27204 (1153974 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27205 (1154198 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27206 (1150189 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27207 (1150161 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27209 (1154410 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27210 (1149098 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27228 (SPO02W -> SSTORAG)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27231 (SPO01W -> NSTORAG)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27234 (SPO02W -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27235 (SPO01W -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0

MAXC

Weir Discharge	Minimum	Maximum	Min.Time	Max.Time	Acumm.value
W3197 (GC1-29 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W3198 (GL1-03 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W3199 (BU3-03 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W3204 (823510 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W3205 (823402 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W4712 (BR2-02 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5007 (BU3-05 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5009 (BR2-06 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5233 (SMO-01 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5238 (1394627 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5241 (823660 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5242 (823660B -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5244 (823660A -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5247 (GC1-34 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5249 (823350U -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5250 (SMG-04 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5253 (SMG-02 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5256 (823610 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5307 (GFPS -> GFABF)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5309 (GFAT -> GFABF)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5311 (GFST -> GFOP)	-0.01	0.921	6/06/1988 13:00	5/06/1988 15:00	21097.836
W5315 (GFOP -> 0)	0	1.182	5/06/1988 3:45	5/06/1988 15:30	44195.106
W5321 (GFPSIN -> GFABF)	-0.11	2.1	5/06/1988 20:35	5/06/1988 10:09	239933.726
W5451 (1152520 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5453 (1149633 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W5457 (1030306 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27197 (1091491 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27199 (1083833 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27200 (1149784 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27201 (1151858 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27203 (1153714 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27204 (1153974 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27205 (1154198 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27206 (1150189 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27207 (1150161 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27209 (1154410 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27210 (1149098 -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27228 (SPO02W -> SSTORAG)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27231 (SPO01W -> NSTORAG)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27234 (SPO02W -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0
W27235 (SPO01W -> 0)	0	0	5/06/1988 3:45	5/06/1988 3:45	0

Appendix 4 Correspondence with Trility Water

Brazel, Warren (Sydney)

Subject: FW: Water Supply Servicing Strategy
Attachments: Mt Gilead Development Site.png; GMC0101B.DWG; GMC0126B.DWG

From: Fiona Bullivant [mailto:FBullivant@TRILITY.com.au]
Sent: Wednesday, 24 July 2013 12:28 PM
To: Ta, Kenton (Sydney)
Cc: Tass Meli
Subject: Re: Water Supply Servicing Strategy

Kenton,
I'll give you some drawings so that you can further your investigations, but I am not authorised to give you any indication of permission or capacity. Sydney Water look after and own the distribution system and it is their role to manage connections and distribution design. I can confirm we do have a water main that runs to the west of your development site. It follows the gas pipeline easement in that location, and that it does have a 500mm offtake listed on our drawings (our water main is buried below ground, and I suspect the offtake is also buried). All negotiations must go through Sydney Water for development as we do not own the water and are unable to "sell it". Any offtake from our water main must be approved by Sydney Water in conjunction with TRILITY as there are some operational complications to be considered by both parties. On our part we currently use flow meters at either end of this pipeline to alarm for any discrepancy (in the event of a main break or leak), tapping off between these flow meters will result in that system no longer being functional. It will also result in us not having a backup if our plant flow meter should fail (at the moment we can use the flow meter at the other end of the pipeline at Sugarloaf, near the riding school, as there are no current offtakes between the two). So as you can see just from our side there are some considerable design considerations (please note that I am not an engineer so this list is just my best guess, and should not be relied upon). I would think that you may also have the option of tapping into the distributions system somewhere in Rosemeadow (which would be pipe owned by Sydney Water). Sydney Water control all the demand and distribution side of potable water and it is for them to decide if the capacity exists, as I am not informed of any other commitments they may have already made for development in our supply zone. I cannot advise you on this matter and you must get it directly from Sydney Water, but I will provide you with some drawings from our records to assist in your enquiries - please note that this does not in any way imply any consent from TRILITY for any connection.
(See attached file: GMC0126B.DWG)(See attached file: GMC0101B.DWG)
Regards,

Fiona Bullivant
Systems / Admin Coordinator

TRILITY
leading the way in water utility solutions

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"Ta, Kenton (Sydney)" ---24/07/2013 10:37:53 AM---Hi Fiona, Thank you for your time on the phone.

From: "Ta, Kenton (Sydney)" <kenton.ta@WorleyParsons.com>
To: "fbullivant@trility.com.au" <fbullivant@trility.com.au>,
Date: 24/07/2013 10:37 AM
Subject: Water Supply Servicing Strategy

Hi Fiona,

Thank you for your time on the phone.

As discussed, I am preparing a servicing strategy for a development application at 901 Appin Road, Gilead. The site boundary is shown on the attached map.

Consultation with Sydney Water has indicated the presence of an offtake from a Trility water supply pipeline in the vicinity of the site. Can you provide us with details of the pipe in addition to a map showing its location?

This is a water supply option that we are preparing for the Servicing Strategy to be reviewed by Sydney Water. As such, can you confirm the a capacity to service a 1700 lot residential development?

Thanks

Kenton Ta
Environmental Engineer, WorleyParsons
Tel: +61 2 8456 7381 | Fax: +61 2 8923 6877
Level 12 | 141 Walker St | North Sydney NSW 2060 Australia | WorleyParsons Services Pty Ltd | ABN 61 001 279 812
www.worleyparsons.com

(See attached file: Mt Gilead Development Site.png)

Appendix 5 Cost Estimates

Sydney WATER

Cost Estimator

Job Name: Mt Gilead Rezoning - PW1 - New Reservoir Zone (Direct Costs rate include +50% strategic scope development allowance)

Estimator: Warren Brazel

Estimate Date: **10/10/2013**

Print Date/Time: **03/03/2014 20:34**

Ver 02-2012.01

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1							
1		Water Main Greenfield DICL		250 dia	m	580	357	207,060
2		Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	kW-->	100	LS	1	836,542	836,542
3		Water Main Greenfield DICL		200 dia	m	2,300	302	693,450
4		Water Storage Steel Elevated (0.2 - 3ML)	ML-->	1.5	LS	1	2,521,531	2,521,531
		Sub Total Direct Costs						**4,258,584**
		INDIRECT COSTS				%		
5		Contractor Design Costs (% of Direct Costs)				10.00%		425,858
6		Contractor Indirect Costs (% of Direct Costs)				10.00%		425,858
7		Contractor Margin (% of DC+Indirect Costs)				15.00%		638,788
8		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				40.00%		2,299,635
		Total Construction Cost						**8,048,723**
		SWC CLIENT COSTS				**% of ConstC**		
9		SWC Costs to Date	Current as at:					
10		SWC Design Costs (% of Construction Costs)				7.50%		603,654
11		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000
12		SWC Planning Costs (% of Construction Costs)				1.00%		80,487
13		SWC Project Management Costs (% of Construction Costs)				8.00%		643,898
14		SWC Insurances & Financing Costs (% of Construction Costs)				0.55%		44,268
15		SWC Land Acquisition/Easement Costs						
16		SWC Risk Contingency (% of the SWC Client Future Costs only)				10.00%	**of Client Costs**	142,231
		TOTAL PROJECT BUDGET REQUIREMENT						**9,613,261**

Cost Estimator

Sydney Water

Job Name: Mt Gilead Rezoning - PW2 New High Level Reservoir Zone

Estimate Date: 14/02013

Estimator: Warren Brazel

Print Date/Time: 03/03/2014 20:38

Ver 02-2012.01

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1							
1		Water Main Greenfield DICL		250 dia	m	580	357	207,060
2		Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	kW-->	48	LS	1	770,186	770,186
3		Water Main Greenfield DICL		200 dia	m	2,300	302	693,450
4		Water Storage Steel Elevated (0.2 - 3ML)	ML-->	0.85	LS	1	1,927,599	1,927,599
		Sub Total Direct Costs						**3,598,295**
		INDIRECT COSTS				%		
5		Contractor Design Costs (% of Direct Costs)				10.00%		359,829
6		Contractor Indirect Costs (% of Direct Costs)				10.00%		359,829
7		Contractor Margin (% of DC+Indirect Costs)				15.00%		539,744
8		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				40.00%		1,943,079
		Total Construction Cost						**6,800,776**
		SWC CLIENT COSTS				% of ConstC		
9		SWC Costs to Date	Current as at:					
10		SWC Design Costs (% of Construction Costs)				7.50%		510,058
11		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000
12		SWC Planning Costs (% of Construction Costs)				1.00%		68,008
13		SWC Project Management Costs (% of Construction Costs)				8.00%		544,062
14		SWC Insurances & Financing Costs (% of Construction Costs)				0.55%		37,404
15		SWC Land Acquisition/Easement Costs						
16		SWC Risk Contingency (% of the SWC Client Future Costs only)				10.00%	of Client Costs	120,953
		TOTAL PROJECT BUDGET REQUIREMENT						**8,131,261**

Sydney WATER — COST ESTIMATOR

Job Name: Mt Gilead Rezoning PW3 - New High Level Boosted Zone

Estimator: Warren Brazel

Estimate Date: 14/02013

Print Date/Time: 03/03/2014 20:55

Ver 02-2012.01

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1							
1		Water Main Greenfield DICL		250 dia	m	580	357	207,060
2		Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)	kW-->	48	LS	1	231,976	231,976
3		Water Main Greenfield DICL		150 dia	m	1,050	312	327,600
		Sub Total Direct Costs						**766,636**
		INDIRECT COSTS				%		
4		Contractor Design Costs (% of Direct Costs)				10.00%		76,664
5		Contractor Indirect Costs (% of Direct Costs)				10.00%		76,664
6		Contractor Margin (% of DC+Indirect Costs)				15.00%		114,995
7		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				40.00%		413,984
		Total Construction Cost						**1,448,943**
		SWC CLIENT COSTS				**% of ConstC**		
8		SWC Costs to Date	Current as at:					
9		SWC Design Costs (% of Construction Costs)				7.50%		108,671
10		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000
11		SWC Planning Costs (% of Construction Costs)				1.00%		14,489
12		SWC Project Management Costs (% of Construction Costs)				8.00%		115,915
13		SWC Insurances & Financing Costs (% of Construction Costs)				0.55%		7,969
14		SWC Land Acquisition/Easement Costs						
15		SWC Risk Contingency (% of the SWC Client Future Costs only)				10.00%	**of Client Costs**	29,704
		TOTAL PROJECT BUDGET REQUIREMENT						**1,775,691**

Sydney WATER

COST ESTIMATOR

Job Name:	Mt Gilead Rezoning PW4 - Supply from Trility pipeline					Estimate Date:	10/10/2013
Estimator:	Warren Brazel					Print Date/Time:	03/03/2014 20:51
							Ver 02-2012.01

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1							
1		AICV Chamber (valve dia.)		250 dia	ea	1	71,000	71,000
2		Flowmeter Chamber (meter dia.)		200 dia	ea	1	49,500	49,500
3		Water Main Greenfield PVC		250 dia	m	1,700	227	385,900
4		Water Storage Steel Elevated (0.2 - 3ML)	ML-->	1.5	LS	1	2,521,531	2,521,531
		Sub Total Direct Costs						**3,027,931**
		INDIRECT COSTS				%		
5		Contractor Design Costs (% of Direct Costs)				10.00%		302,793
6		Contractor Indirect Costs (% of Direct Costs)				10.00%		302,793
7		Contractor Margin (% of DC+Indirect Costs)				15.00%		454,190
8		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				40.00%		1,635,083
		Total Construction Cost						**5,722,790**
		SWC CLIENT COSTS				**% of ConstC**		
9		SWC Costs to Date	Current as at:					
10		SWC Design Costs (% of Construction Costs)				7.50%		429,209
11		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000
12		SWC Planning Costs (% of Construction Costs)				1.00%		57,228
13		SWC Project Management Costs (% of Construction Costs)				8.00%		457,823
14		SWC Insurances & Financing Costs (% of Construction Costs)				0.55%		31,475
15		SWC Land Acquisition/Easement Costs						
16		SWC Risk Contingency (% of the SWC Client Future Costs only)				10.00%	**of Client Costs**	102,574
		TOTAL PROJECT BUDGET REQUIREMENT						**6,851,099**

Cost Estimator

Sydney WATER

Job Name: Mt Gilead Rezoning WW1 - Connection to Glenfield System

Estimator: Warren Brazel

Estimate Date: **10/10/2013**

Print Date/Time: **03/03/2014 21:06**

Ver 02-2012.01

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS					
	H1						
1		SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps) kW-->	310	LS	1	2,730,805	2,730,805
2		Pressure Sewer Greenfield PVC	200 dia	m	2,000	288	576,000
3		Pressure Sewer Greenfield PVC	150 dia	m	2,000	230	459,000
4		Gravity Sewer Greenfield PVC 2.5m deep	300 dia	m	3,800	564	2,143,200
		Sub Total Direct Costs					**5,909,005**
		INDIRECT COSTS			%		
5		Contractor Design Costs (% of Direct Costs)			10.00%		590,900
6		Contractor Indirect Costs (% of Direct Costs)			10.00%		590,900
7		Contractor Margin (% of DC+Indirect Costs)			15.00%		886,351
8		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))			40.00%		3,190,862
		Total Construction Cost					**11,168,018**
		SWC CLIENT COSTS			% of ConstC		
9		SWC Costs to Date Current as at:					
10		SWC Design Costs (% of Construction Costs)			7.50%		837,601
11		SWC Tender Costs (% of Construction Costs)			0.50%		55,840
12		SWC Planning Costs (% of Construction Costs)			1.00%		111,680
13		SWC Project Management Costs (% of Construction Costs)			8.00%		893,441
14		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		61,424
15		SWC Land Acquisition/Easement Costs					
16		SWC Risk Contingency (% of the SWC Client Future Costs only)			10.00%	of Client Costs	195,999
		TOTAL PROJECT BUDGET REQUIREMENT					**13,324,003**

Cost Estimator

Job Name: Mt Gilead Rezoning WW2 - Transfer to Glenfield system with sewer mining
Estimate Date: 10/10/2013
Estimator: Warren Brazel
Print Date/Time: 03/03/2014 21:11
Ver 02-2012.01

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1							
1		SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)	kW-->	310	LS	1	2,730,805	2,730,805
2		Pressure Sewer Greenfield PVC		200 dia	m	2,000	288	576,000
3		Pressure Sewer Greenfield PVC		150 dia	m	2,000	230	459,000
4		Gravity Sewer Greenfield PVC 2.5m deep		300 dia	m	3,800	564	2,143,200
5		SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	kW-->	50	LS	1	779,616	779,616
6		0.5 ML/day MBR treatment plant for sewer mining to secondary quality with disinfection			LS	1	5,500,000	5,500,000
		Sub Total Direct Costs						**12,188,621**
		INDIRECT COSTS				%		
7		Contractor Design Costs (% of Direct Costs)				10.00%		1,218,862
8		Contractor Indirect Costs (% of Direct Costs)				10.00%		1,218,862
9		Contractor Margin (% of DC+Indirect Costs)				15.00%		1,828,293
10		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				40.00%		6,581,855
		Total Construction Cost						**23,036,493**
		SWC CLIENT COSTS				**% of ConstC**		
11		SWC Costs to Date	Current as at:					
12		SWC Design Costs (% of Construction Costs)				7.50%		1,727,737
13		SWC Tender Costs (% of Construction Costs)				0.50%		115,182
14		SWC Planning Costs (% of Construction Costs)				1.00%		230,365
15		SWC Project Management Costs (% of Construction Costs)				8.00%		1,842,919
16		SWC Insurances & Financing Costs (% of Construction Costs)				0.55%		126,701
17		SWC Land Acquisition/Easement Costs						
18		SWC Risk Contingency (% of the SWC Client Future Costs only)				10.00%	**of Client Costs**	404,290
		TOTAL PROJECT BUDGET REQUIREMENT						**27,483,687**

Sydney WATER **COST ESTIMATOR**

Job Name:	Mt Gilead Rezoning WW3 - Onsite STP with disposal to irrigation
Estimator:	Warren Brazel
Estimate Date:	10/10/2013
Print Date/Time:	05/03/2014 11:07
	Ver 02-2012.01

ITEM	H#	DESCRIPTION	PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS					
	H1						
1		SPS Submersible Small (0 - 200KW incl.Stand-by Pumps) kW-->	50	LS	1	779,616	779,616
2		1 ML Wastewater Above Ground Storage	1	LS	1	1,449,000	1,449,000
3		1 ML/day MBR treatment plant to secondary quality with disinfection c/w 7 ML ww storage		LS	1	7,437,000	7,437,000
4		Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps) kW-	30	LS	1	322,136	322,136
5		Irrigation Water Main Greenfield PVC - (rural)	100 dia	m	4,000	75	300,000
		Sub Total Direct Costs					**10,287,752**
		INDIRECT COSTS			%		
6		Contractor Design Costs (% of Direct Costs)			10.00%		1,028,775
7		Contractor Indirect Costs (% of Direct Costs)			10.00%		1,028,775
8		Contractor Margin (% of DC+Indirect Costs)			15.00%		1,543,163
9		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))			40.00%		5,555,386
		Total Construction Cost					**19,443,851**
		SWC CLIENT COSTS			% of ConstC		
10		SWC Costs to Date Current as at:					
11		SWC Design Costs (% of Construction Costs)			7.50%		1,458,289
12		SWC Tender Costs (% of Construction Costs)			0.50%		97,219
13		SWC Planning Costs (% of Construction Costs)			1.00%		194,439
14		SWC Project Management Costs (% of Construction Costs)			8.00%		1,555,508
15		SWC Insurances & Financing Costs (% of Construction Costs)			0.55%		106,941
16		SWC Land Acquisition/Easement Costs					
17		SWC Risk Contingency (% of the SWC Client Future Costs only)			10.00%	of Client Costs	341,240
		TOTAL PROJECT BUDGET REQUIREMENT					**23,197,487**

Cost Estimator

Sydney Water

Job Name: Mt Gilead Rezoning WW4 - Onsite STP with disposal to irrigation and reuse

Estimator: Warren Brazel

Estimate Date: **10/10/2013**
Print Date/Time: **05/03/2014 11:07**
Ver 02-2012.01

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1							
1		SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	kW-->	50	LS	1	779,616	779,616
2		1 ML/day MBR + RO treatment plant to tertiary quality with disinfection c/w WW storage			LS	1	8,500,000	8,500,000
3		Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)	kW-	30	LS	1	322,136	322,136
4		Irrigation Water Main Greenfield PVC - (rural)		100 dia	m	4,000	75	300,000
5		1 ML Wastewater Above Ground Storage		1	LS	1	1,449,000	1,449,000
		Sub Total Direct Costs						**11,350,752**
		INDIRECT COSTS				%		
6		Contractor Design Costs (% of Direct Costs)				10.00%		1,135,075
7		Contractor Indirect Costs (% of Direct Costs)				10.00%		1,135,075
8		Contractor Margin (% of DC+Indirect Costs)				15.00%		1,702,613
9		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				40.00%		6,129,406
		Total Construction Cost						**21,452,921**
		SWC CLIENT COSTS				**% of ConstC**		
10		SWC Costs to Date	Current as at:					
11		SWC Design Costs (% of Construction Costs)				7.50%		1,608,969
12		SWC Tender Costs (% of Construction Costs)				0.50%		107,265
13		SWC Planning Costs (% of Construction Costs)				1.00%		214,529
14		SWC Project Management Costs (% of Construction Costs)				8.00%		1,716,234
15		SWC Insurances & Financing Costs (% of Construction Costs)				0.55%		117,991
16		SWC Land Acquisition/Easement Costs						
17		SWC Risk Contingency (% of the SWC Client Future Costs only)				10.00%	**of Client Costs**	376,499
		TOTAL PROJECT BUDGET REQUIREMENT						**25,594,408**

Cost Estimator

Job Name: Mt Gilead Rezoning RW1 - New High Level Reservoir Zone + Recyling

Estimator: Warren Brazel

Estimate Date: 14/02013

Print Date/Time: 05/03/2014 11:29

Ver 02-2012.01

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1							
1		Water Main Greenfield DICL		250 dia	m	580	357	207,060
2		Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	kW-->	48	LS	1	770,186	770,186
3		Water Main Greenfield DICL		150 dia	m	2,500	312	780,000
4		Water Storage Steel Elevated (0.2 - 3ML)	ML-->	1	LS	1	2,064,807	2,064,807
5		Recycled Water Storage Steel Surface (1 - 70ML)	ML--	2.1	LS	1	1,487,408	1,487,408
6		Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)	kW-->	100	LS	1	431,218	431,218
		Sub Total Direct Costs						**5,740,679**
		INDIRECT COSTS				%		
7		Contractor Design Costs (% of Direct Costs)				10.00%		574,068
8		Contractor Indirect Costs (% of Direct Costs)				10.00%		574,068
9		Contractor Margin (% of DC+Indirect Costs)				15.00%		861,102
10		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				40.00%		3,099,967
		Total Construction Cost						**10,849,884**
		SWC CLIENT COSTS				**% of ConstC**		
11		SWC Costs to Date	Current as at:					
12		SWC Design Costs (% of Construction Costs)				7.50%		813,741
13		SWC Tender Costs (% of Construction Costs)				0.50%		54,249
14		SWC Planning Costs (% of Construction Costs)				1.00%		108,499
15		SWC Project Management Costs (% of Construction Costs)				8.00%		867,991
16		SWC Insurances & Financing Costs (% of Construction Costs)				0.55%		59,674
17		SWC Land Acquisition/Easement Costs						
18		SWC Risk Contingency (% of the SWC Client Future Costs only)				10.00%	**of Client Costs**	190,415
		TOTAL PROJECT BUDGET REQUIREMENT						**12,944,453**

Sydney WATER **COST ESTIMATOR**

Job Name: Mt Gilead Rezoning RW2 - Potable Supply from Trility + Recycling
Estimate Date: **10/10/2013**

Estimator: Warren Brazel
Print Date/Time: **05/03/2014 11:27**

Ver 02-2012.01

ITEM	H#	DESCRIPTION		PARAMETER	UNIT	QUANTITY	RATE	TOTAL
		DIRECT COSTS						
	H1							
1		AICV Chamber (valve dia.)		200 dia	ea	1	91,500	91,500
2		Flowmeter Chamber (meter dia.)		200 dia	ea	1	49,500	49,500
3		Water Main Greenfield PVC		200 dia	m	1,700	273	464,100
4		Water Storage Steel Elevated (0.2 - 3ML)	ML-->	1	LS	1	2,064,807	2,064,807
5		Recycled Water Storage Steel Surface (1 - 70ML)	ML--	2.1	LS	1	1,487,408	1,487,408
6		Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)	kW-->	100	LS	1	431,218	431,218
		Sub Total Direct Costs						**4,588,533**
		INDIRECT COSTS				%		
7		Contractor Design Costs (% of Direct Costs)				10.00%		458,853
8		Contractor Indirect Costs (% of Direct Costs)				10.00%		458,853
9		Contractor Margin (% of DC+Indirect Costs)				15.00%		688,280
10		Risk Contingency (% of (Direct Costs+Indirect Costs+Margin))				40.00%		2,477,807
		Total Construction Cost						**8,672,326**
		SWC CLIENT COSTS				**% of ConstC**		
11		SWC Costs to Date	Current as at:					
12		SWC Design Costs (% of Construction Costs)				7.50%		650,424
13		SWC Tender Costs (% of Construction Costs)				0.50%	Adj. to Min Limit>>	50,000
14		SWC Planning Costs (% of Construction Costs)				1.00%		86,723
15		SWC Project Management Costs (% of Construction Costs)				8.00%		693,786
16		SWC Insurances & Financing Costs (% of Construction Costs)				0.55%		47,698
17		SWC Land Acquisition/Easement Costs						
18		SWC Risk Contingency (% of the SWC Client Future Costs only)				10.00%	**of Client Costs**	152,863
		TOTAL PROJECT BUDGET REQUIREMENT						**10,353,820**

PW1

Direct Capital costs are cut and paste from Capital Estimating Spreadsheet and include 50% Strategic Scoping Allowance, but not other O/H's

Direct Capital Cost is factored up by the ratio of (Total Project Budget Requirement for the Option / Direct Capital costs) for the overall option price and applied individually to each item to account for OH's and Allowances

Electricity costs are pro rated based % total population and assumes pumping 10 hrs per day (20hrs for booster water stations)

O&M costs are calculated on the capital expenditure to date (not total life time costs)

5/03/2014 11:33

Year					Total (copied text)	Markup allowance	Total	2014	0 2015	1 2016	2 2017	3 2018	4 2019	5 2020	6 2021	7 2022
Capital and Replacement Cost	PARAMETER	UNIT	QUANTITY	RATE												
Water Main Greenfield DICL	250 dia	m	580	$ 357	$ 207,060	226%	$ 467,414		$ 467,414							
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	100	LS	1	$ 836,542	$ 836,542	226%	$ 2,454,917		$ 1,888,398							
Water Main Greenfield DICL	200 dia	m	2,300	$ 302	$ 693,450	226%	$ 1,565,383		$ 1,565,383							
Water Storage Steel Elevated (0.2 - 3ML)	2	LS	1	$ 2,521,531	$ 2,521,531	226%	$ 5,692,065		$ 5,692,065							
						226%	$ -									
						226%	$ -									
						226%	$ -									
						226%	$ -									
						226%	$ -									
						226%	$ -									
Total Capital							$ 10,179,780	$ -	$ 9,613,260	$ -	$ -	$ -	$ -	$ -	$ -	$ -
O&M	Capital	Operations	Maintenance													
Water Main Greenfield DICL	467,414	0.20%	0.40%				$ 86,939	$ -	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	2,454,917	1.00%	1.50%				$ 1,583,894	$ -	$ 47,210	$ 47,210	$ 47,210	$ 47,210	$ 47,210	$ 47,210	$ 47,210	$ 47,210
Water Main Greenfield DICL	1,565,383	0.20%	0.40%				$ 291,161	$ -	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392
Water Storage Steel Elevated (0.2 - 3ML)	5,692,065	0.60%	0.50%				$ 1,940,994	$ -	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M							$ 3,902,988	$ -	$ 122,019	$ 122,019	$ 122,019	$ 122,019	$ 122,019	$ 122,019	$ 122,019	$ 122,019
Nominal Electricity Tarrif								$ 185	$ 197	$ 207	$ 211	$ 219	$ 226	$ 233	$ 238	$ 241
Staging (% population)								0%	0%	10%	20%	30%	40%	50%	60%	70%
	Duty Power	Hours Per Year	Usage MWh													
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	50	3,650	182.50				$ 1,346,540	$ -	$ -	$ 3,778	$ 7,702	$ 11,990	$ 16,498	$ 21,261	$ 26,061	$ 30,788
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power							$ 1,346,540	$ -	$ -	$ 3,778	$ 7,702	$ 11,990	$ 16,498	$ 21,261	$ 26,061	$ 30,788
Total							$ 15,429,308	$ -	$ 9,735,280	$ 125,797	$ 129,721	$ 134,010	$ 138,517	$ 143,281	$ 148,080	$ 152,807

NPV Calculation and Sensitivity

ROR	NPV
10%	$9,324,763
7%	$10,354,064
4%	$11,852,665

Year	8 2023	9 2024	10 2025	11 2026	12 2027	13 2028	14 2029	15 2030	16 2031	17 2032	18 2033	19 2034	20 2035	21 2036	22 2037	23 2038	24 2039	25 2040	26 2041	27 2042	28 2043	29 2044	30 2045
Capital and Replacement Cost																							
Water Main Greenfield DICL																							
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)								$ 283,260															$ 283,260
Water Main Greenfield DICL																							
Water Storage Steel Elevated (0.2 - 3ML)																							
Total Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 283,260	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 283,260
O&M																							
Water Main Greenfield DICL	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804	$ 2,804
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	$ 47,210	$ 47,210	$ 47,210	$ 47,210	$ 47,210	$ 47,210	$ 47,210	$ 54,291	$ 54,291	$ 54,291	$ 54,291	$ 54,291	$ 54,291	$ 54,291	$ 54,291	$ 54,291	$ 54,291	$ 54,291	$ 54,291	$ 54,291	$ 54,291	$ 54,291	$ 61,373
Water Main Greenfield DICL	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392	$ 9,392
Water Storage Steel Elevated (0.2 - 3ML)	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613	$ 62,613
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 122,019	$ 122,019	$ 122,019	$ 122,019	$ 122,019	$ 122,019	$ 122,019	$ 129,101	$ 129,101	$ 129,101	$ 129,101	$ 129,101	$ 129,101	$ 129,101	$ 129,101	$ 129,101	$ 129,101	$ 129,101	$ 129,101	$ 129,101	$ 129,101	$ 129,101	$ 136,182
Nominal Electricity Tarrif	$ 244	$ 248	$ 252	$ 256	$ 263	$ 268	$ 272	$ 277	$ 282	$ 287	$ 291	$ 296	$ 301	$ 306	$ 310	$ 315	$ 320	$ 324	$ 329	$ 334	$ 339	$ 343	$ 348
Staging (% population)	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	$ 35,624	$ 40,734	$ 45,990	$ 46,720	$ 47,973	$ 48,838	$ 49,703	$ 50,568	$ 51,433	$ 52,298	$ 53,163	$ 54,028	$ 54,893	$ 55,758	$ 56,623	$ 57,488	$ 58,352	$ 59,217	$ 60,082	$ 60,947	$ 61,812	$ 62,677	$ 63,542
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 35,624	$ 40,734	$ 45,990	$ 46,720	$ 47,973	$ 48,838	$ 49,703	$ 50,568	$ 51,433	$ 52,298	$ 53,163	$ 54,028	$ 54,893	$ 55,758	$ 56,623	$ 57,488	$ 58,352	$ 59,217	$ 60,082	$ 60,947	$ 61,812	$ 62,677	$ 63,542
Total	$ 157,643	$ 162,753	$ 168,009	$ 168,739	$ 169,993	$ 170,858	$ 171,722	$ 462,929	$ 180,534	$ 181,399	$ 182,264	$ 183,129	$ 183,994	$ 184,859	$ 185,723	$ 186,588	$ 187,453	$ 188,318	$ 189,183	$ 190,048	$ 190,913	$ 191,778	$ 482,984

PW2

Direct Capital costs are cut and paste from Capital Estimating Spreadsheet and include 50% Strategic Scoping Allowance, but not other O/H's

Direct Capital Cost is factored up by the ratio of (Total Project Budget Requirement for the Option / Direct Capital costs) for the overall option price and applied individually to each item to account for OH's and Allowances

Electricity costs are pro rated based % total population and assumes pumping 10 hrs per day (20hrs for booster water stations)

O&M costs are calculated on the capital expenditure to date (not total life time costs)

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Year					Total (copied text)	Markup allowance	Total	2014	0 2015	1 2016	2 2017	3 2018	4 2019	5 2020	6 2021	7 2022
Capital and Replacement Cost	PARAMETER	UNIT	QUANTITY	RATE												
Water Main Greenfield DICL	250 dia	m	580	$ 357	$ 207,060	226%	$ 467,905		$ 467,905							
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	48	LS	1	$ 770,186	$ 770,186	226%	$ 2,262,560		$ 1,740,431							
Water Main Greenfield DICL	200 dia	m	2,300	$ 302	$ 693,450	226%	$ 1,567,026		$ 1,567,026							
Water Storage Steel Elevated (0.2 - 3ML)	0.85	LS	1	$ 1,927,599	$ 1,927,599	226%	$ 4,355,898		$ 4,355,898							
						226%	$ -									
						226%	$ -									
						226%	$ -									
						226%	$ -									
						226%	$ -									
						226%	$ -									
Total Capital							$ 8,653,389	$ -	$ 8,131,260	$ -	$ -	$ -	$ -	$ -	$ -	$ -
O&M	Capital	Operations	Maintenance													
Water Main Greenfield DICL	467,905	0.20%	0.40%				$ 87,030	$ -	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	2,262,560	1.00%	1.50%				$ 1,459,786	$ -	$ 43,511	$ 43,511	$ 43,511	$ 43,511	$ 43,511	$ 43,511	$ 43,511	$ 43,511
Water Main Greenfield DICL	1,567,026	0.20%	0.40%				$ 291,467	$ -	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402
Water Storage Steel Elevated (0.2 - 3ML)	4,355,898	0.60%	0.50%				$ 1,485,361	$ -	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M							$ 3,323,645	$ -	$ 103,635	$ 103,635	$ 103,635	$ 103,635	$ 103,635	$ 103,635	$ 103,635	$ 103,635
Nominal Electricity Tarrif								$ 185	$ 197	$ 207	$ 211	$ 219	$ 226	$ 233	$ 238	$ 241
Staging (% population)								0%	0%	10%	20%	30%	40%	50%	60%	70%
	Duty Power	Hours Per Year	Usage MWh													
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	28	3,650	102.20				$ 754,063	$ -	$ -	$ 2,116	$ 4,313	$ 6,715	$ 9,239	$ 11,906	$ 14,594	$ 17,241
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power							$ 754,063	$ -	$ -	$ 2,116	$ 4,313	$ 6,715	$ 9,239	$ 11,906	$ 14,594	$ 17,241
Total							$ 12,731,097	$ -	$ 8,234,895	$ 105,751	$ 107,948	$ 110,350	$ 112,874	$ 115,542	$ 118,229	$ 120,876

NPV Calculation and Sensitivity

ROR	NPV
10%	$7,826,633
7%	$8,664,497
4%	$9,873,540

Year	8 2023	9 2024	10 2025	11 2026	12 2027	13 2028	14 2029	15 2030	16 2031	17 2032	18 2033	19 2034	20 2035	21 2036	22 2037	23 2038	24 2039	25 2040	26 2041	27 2042	28 2043	29 2044	30 2045
Capital and Replacement Cost																							
Water Main Greenfield DICL																							
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)								$ 261,065															$ 261,065
Water Main Greenfield DICL																							
Water Storage Steel Elevated (0.2 - 3ML)																							
Total Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 261,065	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 261,065
O&M																							
Water Main Greenfield DICL	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	$ 43,511	$ 43,511	$ 43,511	$ 43,511	$ 43,511	$ 43,511	$ 43,511	$ 50,037	$ 50,037	$ 50,037	$ 50,037	$ 50,037	$ 50,037	$ 50,037	$ 50,037	$ 50,037	$ 50,037	$ 50,037	$ 50,037	$ 50,037	$ 50,037	$ 50,037	$ 56,564
Water Main Greenfield DICL	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402	$ 9,402
Water Storage Steel Elevated (0.2 - 3ML)	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915	$ 47,915
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 103,635	$ 103,635	$ 103,635	$ 103,635	$ 103,635	$ 103,635	$ 103,635	$ 110,162	$ 110,162	$ 110,162	$ 110,162	$ 110,162	$ 110,162	$ 110,162	$ 110,162	$ 110,162	$ 110,162	$ 110,162	$ 110,162	$ 110,162	$ 110,162	$ 110,152	$ 116,688
Nominal Electricity Tarrif	$ 244	$ 248	$ 252	$ 256	$ 263	$ 268	$ 272	$ 277	$ 282	$ 287	$ 291	$ 296	$ 301	$ 306	$ 310	$ 315	$ 320	$ 324	$ 329	$ 334	$ 339	$ 343	$ 348
Staging (% population)	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	$ 19,949	$ 22,811	$ 25,754	$ 26,163	$ 26,865	$ 27,349	$ 27,834	$ 28,318	$ 28,802	$ 29,287	$ 29,771	$ 30,256	$ 30,740	$ 31,224	$ 31,709	$ 32,193	$ 32,677	$ 33,162	$ 33,646	$ 34,130	$ 34,615	$ 35,099	$ 35,584
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 19,949	$ 22,811	$ 25,754	$ 26,163	$ 26,865	$ 27,349	$ 27,834	$ 28,318	$ 28,802	$ 29,287	$ 29,771	$ 30,256	$ 30,740	$ 31,224	$ 31,709	$ 32,193	$ 32,677	$ 33,162	$ 33,646	$ 34,130	$ 34,615	$ 35,099	$ 35,584
Total	$ 123,585	$ 126,446	$ 129,390	$ 129,798	$ 130,500	$ 130,985	$ 131,469	$ 399,545	$ 138,964	$ 139,449	$ 139,933	$ 140,417	$ 140,902	$ 141,386	$ 141,870	$ 142,355	$ 142,839	$ 143,324	$ 143,808	$ 144,292	$ 144,777	$ 145,261	$ 413,937

PW3
Direct Capital costs are cut and paste from Capital Estimating Spreadsheet and include 50% Strategic Scoping Allowance, but not other O/H's
Direct Capital Cost is factored up by the ratio of (Total Project Budget Requirement for the Option / Direct Capital costs) for the overall option price and applied individually to each item to account for OH's and Allowances
Electricity costs are pro rated based % total population and assumes pumping 10 hrs per day (20hrs for booster water stations)
O&M costs are calculated on the capital expenditure to date (not total life time costs)
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									0	1	2	3	4	5	6	7
Year					Total (copied text)	Markup allowance	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022
Capital and Replacement Cost	PARAMETER	UNIT	QUANTITY	RATE												
Water Main Greenfield DICL	250 dia	m	580	$ 357	$ 207,060	226%	$ 467,905		$ 467,905							
Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)	48	LS	1	$ 231,976	$ 231,976	226%	$ 681,472		$ 524,210							
Water Main Greenfield DICL	150 dia	m	1,050	$ 312	$ 327,600	226%	$ 740,295		$ 740,295							
						226%	$ -		$ -							
						226%	$ -									
						226%	$ -									
						226%	$ -									
						226%	$ -									
						226%	$ -									
						226%	$ -									
Total Capital							$ 1,889,672	$ -	$ 1,732,410	$ -	$ -	$ -	$ -	$ -	$ -	$ -
O&M	Capital	Operations	Maintenance													
Water Main Greenfield DICL	467,905	0.20%	0.40%				$ 87,030	$ -	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807
Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)	681,472	1.00%	1.50%				$ 439,681	$ -	$ 13,105	$ 13,105	$ 13,105	$ 13,105	$ 13,105	$ 13,105	$ 13,105	$ 13,105
Water Main Greenfield DICL	740,295	0.20%	0.40%				$ 137,695	$ -	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M							$ 664,406	$ -	$ 20,354	$ 20,354	$ 20,354	$ 20,354	$ 20,354	$ 20,354	$ 20,354	$ 20,354
Nominal Electricity Tarrif								$ 185	$ 197	$ 207	$ 211	$ 219	$ 226	$ 233	$ 238	$ 241
Staging (% population)								0%	0%	10%	20%	30%	40%	50%	60%	70%
	Duty Power	Hours Per Year	Usage MWh													
Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)	24	7,300	175.20				$ 1,292,679	$ -	$ -	$ 3,627	$ 7,393	$ 11,511	$ 15,838	$ 20,411	$ 25,019	$ 29,556
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power							$ 1,292,679	$ -	$ -	$ 3,627	$ 7,393	$ 11,511	$ 15,838	$ 20,411	$ 25,019	$ 29,556
Total							$ 3,846,757	$ -	$ 1,752,764	$ 23,981	$ 27,748	$ 31,865	$ 36,193	$ 40,765	$ 45,373	$ 49,911

NPV Calculation and Sensitivity

ROR	NPV
10%	$1,866,595
7%	$2,159,400
4%	$2,625,196

	8	9	10	11	12	13	14	15	16	17	18	19
Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Capital and Replacement Cost												
Water Main Greenfield DICL												
Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)								$ 78,631				
Water Main Greenfield DICL												
Total Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 78,631	$ -	$ -	$ -	$ -
O&M												
Water Main Greenfield DICL	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807
Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)	$ 13,105	$ 13,105	$ 13,105	$ 13,105	$ 13,105	$ 13,105	$ 13,105	$ 15,071	$ 15,071	$ 15,071	$ 15,071	$ 15,071
Water Main Greenfield DICL	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 20,354	$ 20,354	$ 20,354	$ 20,354	$ 20,354	$ 20,354	$ 20,354	$ 22,320	$ 22,320	$ 22,320	$ 22,320	$ 22,320
Nominal Electricity Tarrif	$ 244	$ 248	$ 252	$ 256	$ 263	$ 268	$ 272	$ 277	$ 282	$ 287	$ 291	$ 296
Staging (% population)	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)	$ 34,199	$ 39,105	$ 44,150	$ 44,851	$ 46,054	$ 46,885	$ 47,715	$ 48,545	$ 49,376	$ 50,206	$ 51,036	$ 51,867
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 34,199	$ 39,105	$ 44,150	$ 44,851	$ 46,054	$ 46,885	$ 47,715	$ 48,545	$ 49,376	$ 50,206	$ 51,036	$ 51,867
Total	$ 54,553	$ 59,459	$ 64,505	$ 65,206	$ 66,409	$ 67,239	$ 68,069	$ 149,497	$ 71,696	$ 72,526	$ 73,357	$ 74,187

	20	21	22	23	24	25	26	27	28	29	30
Year	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Capital and Replacement Cost											
Water Main Greenfield DICL											
Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)											$ 78,631
Water Main Greenfield DICL											
Total Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 78,631
O&M											
Water Main Greenfield DICL	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807	$ 2,807
Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)	$ 15,071	$ 15,071	$ 15,071	$ 15,071	$ 15,071	$ 15,071	$ 15,071	$ 15,071	$ 15,071	$ 15,071	$ 17,037
Water Main Greenfield DICL	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442	$ 4,442
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 22,320	$ 22,320	$ 22,320	$ 22,320	$ 22,320	$ 22,320	$ 22,320	$ 22,320	$ 22,320	$ 22,320	$ 24,286
Nominal Electricity Tarrif	$ 301	$ 306	$ 310	$ 315	$ 320	$ 324	$ 329	$ 334	$ 339	$ 343	$ 348
Staging (% population)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Water Pumping Station Booster (15-2000kW incl.Stand-by Pumps)	$ 52,697	$ 53,527	$ 54,358	$ 55,188	$ 56,018	$ 56,849	$ 57,679	$ 58,509	$ 59,340	$ 60,170	$ 61,000
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 52,697	$ 53,527	$ 54,358	$ 55,188	$ 56,018	$ 56,849	$ 57,679	$ 58,509	$ 59,340	$ 60,170	$ 61,000
Total	$ 75,017	$ 75,848	$ 76,678	$ 77,508	$ 78,339	$ 79,169	$ 79,999	$ 80,830	$ 81,660	$ 82,490	$ 163,916

PW4
Direct Capital costs are cut and paste from Capital Estimating Spreadsheet and Include 50% Strategic Scoping Allowance, but not other O/H's
Direct Capital Cost is factored up by the ratio of (Total Project Budget Requirement for the Option / Direct Capital costs) for the overall option price and applied individually to each item to account for OH's and Allowances
Electricity costs are pro rated based % total population and assumes pumping 10 hrs per day (20hrs for booster water stations)
O&M costs are calculated on the capital expenditure to date (not total life time costs)
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									0	1	2	3	4	5	6	7
Year					Total (copied text)	Markup allowance	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022
Capital and Replacement Cost	PARAMETER	UNIT	QUANTITY	RATE												
AICV Chamber (valve dia.)	250 dia	ea	1	$ 71,000	$ 71,000	226%	$ 160,647		$ 160,647							
Flowmeter Chamber (meter dia.)	200 dia	ea	1	$ 49,500	$ 49,500	226%	$ 336,001		$ 112,000							
Water Main Greenfield PVC	250 dia	m	1,700	$ 227	$ 385,900	226%	$ 873,150		$ 873,150							
Water Storage Steel Elevated (0.2 - 3ML)	1.50	LS	1	$ 2,521,531	$ 2,521,531	226%	$ 5,705,302		$ 5,705,302							
						232%	$ -									
						232%	$ -									
						232%	$ -									
						232%	$ -									
						232%	$ -									
						232%	$ -									
Total Capital							$ 7,075,100	$ -	$ 6,851,099	$ -	$ -	$ -	$ -	$ -	$ -	$ -
O&M	Capital	Operations	Maintenance													
AICV Chamber (valve dia.) (incl power)	160,647	2.00%	1.80%				$ 189,242	$ -	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105
Flowmeter Chamber (meter dia.) (incl power)	336,001	2.00%	1.80%				$ 204,289	$ -	$ 4,256	$ 4,256	$ 4,256	$ 4,256	$ 4,256	$ 4,256	$ 4,256	$ 4,256
Water Main Greenfield PVC	873,150	0.20%	0.40%				$ 162,406	$ -	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239
Water Storage Steel Elevated (0.2 - 3ML)	5,705,302	0.60%	0.50%				$ 1,945,508	$ -	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M							$ 2,501,445	$ -	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358
Nominal Electricity Tarrif								$ 185	$ 197	$ 207	$ 211	$ 219	$ 226	$ 233	$ 238	$ 241
Staging (% population)								0%	0%	10%	20%	30%	40%	50%	60%	70%
			Usage MWh													
		3,650	-				$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total							$ 9,576,545	$ -	$ 6,929,457	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358

NPV Calculation and Sensitivity

ROR	NPV
10%	$6,372,209
7%	$6,964,155
4%	$7,776,530

	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Capital and Replacement Cost																							
AICV Chamber (valve dia.)																							
Flowmeter Chamber (meter dia.)								$ 112,000															$ 112,000
Water Main Greenfield PVC																							
Water Storage Steel Elevated (0.2 - 3ML)																							
Total Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 112,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 112,000
O&M																							
AICV Chamber (valve dia.) (incl power)	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105	$ 6,105
Flowmeter Chamber (meter dia.) (incl power)	$ 4,256	$ 4,256	$ 4,256	$ 4,256	$ 4,256	$ 4,256	$ 4,256	$ 8,512	$ 8,512	$ 8,512	$ 8,512	$ 8,512	$ 8,512	$ 8,512	$ 8,512	$ 8,512	$ 8,512	$ 8,512	$ 8,512	$ 8,512	$ 8,512	$ 8,512	$ 12,768
Water Main Greenfield PVC	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239	$ 5,239
Water Storage Steel Elevated (0.2 - 3ML)	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758	$ 62,758
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 86,870
Nominal Electricity Tarrif	$ 244	$ 248	$ 252	$ 256	$ 261	$ 268	$ 272	$ 277	$ 282	$ 287	$ 291	$ 296	$ 301	$ 306	$ 310	$ 315	$ 320	$ 324	$ 329	$ 334	$ 339	$ 343	$ 348
Staging (% population)	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 78,358	$ 194,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 82,614	$ 198,870

RW1
Direct Capital costs are cut and paste from Capital Estimating Spreadsheet and Include 50% Strategic Scoping Allowance, but not other O/H's
Direct Capital Cost is factored up by the ratio of (Total Project Budget Requirement for the Option / Direct Capital costs) for the overall option price and applied individually to each item to account for OH's and Allowances
Electricity costs are pro rated based % total population and assumes pumping 10 hrs per day (20hrs for booster water stations)
O&M costs are calculated on the capital expenditure to date (not total life time costs)
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Year					Total (copied text)	Markup allowance	Total
Capital and Replacement Cost	PARAMETER	UNIT	QUANTITY	RATE			
Water Main Greenfield DICL	250 dia	m	580	$ 357	$ 207,060	225%	$ 466,892
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	48	LS	1	$ 770,186	$ 770,186	225%	$ 2,257,665
Water Main Greenfield DICL	150 dia	m	2,500	$ 312	$ 780,000	225%	$ 1,758,794
Water Storage Steel Elevated (0.2 - 3ML)	1.0	LS	1	$ 2,064,807	$ 2,064,807	225%	$ 4,655,859
Recycled Water Storage Steel Surface (1 - 70ML)	2.1	LS	1	$ 1,487,408	$ 1,487,408	225%	$ 3,353,903
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	100	LS	1	$ 431,218	$ 431,218	225%	$ 1,493,338
						225%	$ -
						225%	$ -
						225%	$ -
						225%	$ -
Total Capital							$ 13,986,452
O&M	Capital	Operations	Maintenance				
Water Main Greenfield DICL	466,892	0.20%	0.40%				$ 86,842
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	2,257,665	1.00%	1.50%				$ 1,456,628
Water Main Greenfield DICL	1,758,794	0.20%	0.40%				$ 327,136
Water Storage Steel Elevated (0.2 - 3ML)	4,655,859	0.60%	0.50%				$ 1,587,648
Recycled Water Storage Steel Surface (1 - 70ML)	3,353,903	0.60%	0.50%				$ 1,033,002
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	1,493,338	1.00%	1.50%				$ 771,812
							$ -
Total O&M							$ 5,263,067
Nominal Electricity Tariff							
Staging (% population)							
	Duty Power		Usage MWh				
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	28	3,650	102.20				$ 754,063
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	50	7,300	365.00				$ 2,670,122
							$ -
							$ -
							$ -
Total Power							$ 3,424,185
Total							$ 22,673,704

Year	2014	0 2015	1 2016	2 2017	3 2018	4 2019	5 2020	6 2021	7 2022
Capital and Replacement Cost									
Water Main Greenfield DICL		$ 466,892							
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)		$ 1,736,665							
Water Main Greenfield DICL		$ 1,758,794							
Water Storage Steel Elevated (0.2 - 3ML)		$ 4,655,859							
Recycled Water Storage Steel Surface (1 - 70ML)					$ 3,353,903				
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P					$ 972,338				
Total Capital	$ -	$ 8,618,211	$ -	$ -	$ 4,326,241	$ -	$ -	$ -	$ -
O&M									
Water Main Greenfield DICL	$ -	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	$ -	$ 43,417	$ 43,417	$ 43,417	$ 43,417	$ 43,417	$ 43,417	$ 43,417	$ 43,417
Water Main Greenfield DICL	$ -	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553
Water Storage Steel Elevated (0.2 - 3ML)	$ -	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214
Recycled Water Storage Steel Surface (1 - 70ML)	$ -	$ -	$ -	$ -	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	$ -	$ -	$ -	$ -	$ 24,308	$ 24,308	$ 24,308	$ 24,308	$ 24,308
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ -	$ 107,985	$ 107,985	$ 107,985	$ 169,187	$ 169,187	$ 169,187	$ 169,187	$ 169,187
Nominal Electricity Tariff	$ 185	$ 197	$ 207	$ 211	$ 219	$ 226	$ 233	$ 238	$ 241
Staging (% population)	0%	0%	10%	20%	30%	40%	50%	60%	70%
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	$ -	$ -	$ 2,116	$ 4,313	$ 6,715	$ 9,239	$ 11,906	$ 14,594	$ 17,241
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	$ -	$ -	$ -	$ -	$ 23,981	$ 32,996	$ 42,523	$ 52,122	$ 61,576
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ -	$ -	$ 2,116	$ 4,313	$ 30,695	$ 42,235	$ 54,429	$ 66,716	$ 78,817
Total	$ -	$ 8,726,196	$ 110,101	$ 112,298	$ 4,526,123	$ 211,421	$ 223,615	$ 235,903	$ 248,003

NPV Calculation and Sensitivity

ROR	NPV
10%	$11,877,599
7%	$13,652,267
4%	$16,288,016

Year	8 2023	9 2024	10 2025	11 2026	12 2027	13 2028	14 2029	15 2030	16 2031	17 2032	18 2033	19 2034
Capital and Replacement Cost												
Water Main Greenfield DICL												
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)								$ 260,500				
Water Main Greenfield DICL												
Water Storage Steel Elevated (0.2 - 3ML)												
Recycled Water Storage Steel Surface (1 - 70ML)												
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P											$ 260,500	
Total Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 260,500	$ -	$ -	$ 260,500	$ -
O&M												
Water Main Greenfield DICL	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	$ 43,417	$ 43,417	$ 43,417	$ 43,417	$ 43,417	$ 43,417	$ 43,417	$ 49,929	$ 49,929	$ 49,929	$ 49,929	$ 49,929
Water Main Greenfield DICL	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553
Water Storage Steel Elevated (0.2 - 3ML)	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214
Recycled Water Storage Steel Surface (1 - 70ML)	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	$ 24,308	$ 24,308	$ 24,308	$ 24,308	$ 24,308	$ 24,308	$ 24,308	$ 24,308	$ 24,308	$ 24,308	$ 30,821	$ 30,821
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 169,187	$ 169,187	$ 169,187	$ 169,187	$ 169,187	$ 169,187	$ 169,187	$ 175,699	$ 175,699	$ 175,699	$ 182,212	$ 182,212
Nominal Electricity Tariff	$ 244	$ 248	$ 252	$ 256	$ 263	$ 268	$ 272	$ 277	$ 282	$ 287	$ 291	$ 296
Staging (% population)	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	$ 19,949	$ 22,811	$ 25,754	$ 26,163	$ 26,865	$ 27,349	$ 27,834	$ 28,318	$ 28,802	$ 29,287	$ 29,771	$ 30,256
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	$ 71,248	$ 81,468	$ 91,980	$ 93,440	$ 95,946	$ 97,676	$ 99,406	$ 101,136	$ 102,866	$ 104,596	$ 106,326	$ 108,055
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 91,197	$ 104,279	$ 117,734	$ 119,603	$ 122,811	$ 125,026	$ 127,240	$ 129,454	$ 131,668	$ 133,883	$ 136,097	$ 138,311
Total	$ 260,384	$ 273,466	$ 286,921	$ 288,790	$ 291,998	$ 294,212	$ 296,426	$ 565,653	$ 307,367	$ 309,582	$ 578,808	$ 320,523

Year	20 2035	21 2036	22 2037	23 2038	24 2039	25 2040	26 2041	27 2042	28 2043	29 2044	30 2045
Capital and Replacement Cost											
Water Main Greenfield DICL											
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)											$ 260,500
Water Main Greenfield DICL											
Water Storage Steel Elevated (0.2 - 3ML)											
Recycled Water Storage Steel Surface (1 - 70ML)											
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P											$ 260,500
Total Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 521,000
O&M											
Water Main Greenfield DICL	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801	$ 2,801
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	$ 49,929	$ 49,929	$ 49,929	$ 49,929	$ 49,929	$ 49,929	$ 49,929	$ 49,929	$ 49,929	$ 49,929	$ 56,442
Water Main Greenfield DICL	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553	$ 10,553
Water Storage Steel Elevated (0.2 - 3ML)	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214	$ 51,214
Recycled Water Storage Steel Surface (1 - 70ML)	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893	$ 36,893
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	$ 30,821	$ 30,821	$ 30,821	$ 30,821	$ 30,821	$ 30,821	$ 30,821	$ 30,821	$ 30,821	$ 30,821	$ 37,333
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 182,212	$ 182,212	$ 182,212	$ 182,212	$ 182,212	$ 182,212	$ 182,212	$ 182,212	$ 182,212	$ 182,212	$ 195,237
Nominal Electricity Tariff	$ 301	$ 306	$ 310	$ 315	$ 320	$ 324	$ 329	$ 334	$ 339	$ 343	$ 348
Staging (% population)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Water Pumping Station Small (1-400kW incl.Stand-by Pumps)	$ 30,740	$ 31,224	$ 31,709	$ 32,193	$ 32,677	$ 33,162	$ 33,646	$ 34,130	$ 34,615	$ 35,099	$ 35,584
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	$ 109,785	$ 111,515	$ 113,245	$ 114,975	$ 116,705	$ 118,435	$ 120,165	$ 121,895	$ 123,624	$ 125,354	$ 127,084
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 140,525	$ 142,740	$ 144,954	$ 147,168	$ 149,382	$ 151,596	$ 153,811	$ 156,025	$ 158,239	$ 160,453	$ 162,668
Total	$ 322,737	$ 324,951	$ 327,165	$ 329,380	$ 331,594	$ 333,808	$ 336,022	$ 338,237	$ 340,451	$ 342,665	$ 878,904

RW2

Direct Capital costs are cut and paste from Capital Estimating Spreadsheet and include 50% Strategic Scoping Allowance, but not other O/H's

Direct Capital Cost is factored up by the ratio of (Total Project Budget Requirement for the Option / Direct Capital costs) for the overall option price and applied individually to each item to account for OH's and Allowances

Electricity costs are pro rated based % total population and assumes pumping 10 hrs per day (20hrs for booster water stations)

O&M costs are calculated on the capital expenditure to date (not total life time costs)

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									0	1	2	3	4	5	6	7
Year					Total (copied text)	Markup allowance	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022
Capital and Replacement Cost	PARAMETER	UNIT	QUANTITY	RATE												
AICV Chamber (valve dia.)	200 dia	ea	1	$ 91,500	$ 91,500	226%	$ 206,466		$ 206,466							
Flowmeter Chamber (meter dia.)	200 dia	ea	1	$ 49,500	$ 49,500	226%	$ 335,084		$ 111,695							
Water Main Greenfield PVC	200 dia	m	2,400	$ 273	$ 655,200	226%	$ 1,478,430		$ 1,478,430							
Water Storage Steel Elevated (0.2 - 3ML)	1	LS	1	$ 2,064,807	$ 2,064,807	226%	$ 4,659,145		$ 4,659,145							
Recycled Water Storage Steel Surface (1 - 70ML)	2	LS	1	$ 1,487,408	$ 1,487,408	226%	$ 3,356,270					$ 3,356,270				
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	100	LS	1	$ 431,218	$ 431,218	226%	$ 1,118,978					$ 973,024				
						226%	$ -									
						226%	$ -									
						226%	$ -									
						226%	$ -									
Total Capital							$ 11,154,371	$ -	$ 6,455,734	$ -	$ -	$ 4,329,294	$ -	$ -	$ -	$ -
O&M	Capital	Operations	Maintenance													
AICV Chamber (valve dia.) (incl power)	206,466	2.00%	1.80%				$ 243,217	$ -	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846
Flowmeter Chamber (meter dia.) (incl power)	335,084	2.00%	1.80%				$ 203,731	$ -	$ 4,244	$ 4,244	$ 4,244	$ 4,244	$ 4,244	$ 4,244	$ 4,244	$ 4,244
Water Main Greenfield PVC	1,478,430	0.20%	0.40%				$ 274,988	$ -	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871
Water Storage Steel Elevated (0.2 - 3ML)	4,659,145	0.60%	0.50%				$ 1,588,768	$ -	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251
Recycled Water Storage Steel Surface (1 - 70ML)	3,356,270	0.60%	0.50%				$ 1,033,731	$ -	$ -	$ -	$ -	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	1,118,978	1.00%	1.50%				$ 728,552	$ -	$ -	$ -	$ -	$ 24,326	$ 24,326	$ 24,326	$ 24,326	$ 24,326
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M							$ 4,072,987	$ -	$ 72,211	$ 72,211	$ 72,211	$ 133,456	$ 133,456	$ 133,456	$ 133,456	$ 133,456
Nominal Electricity Tarrif								$ 185	$ 197	$ 207	$ 211	$ 219	$ 226	$ 233	$ 238	$ 241
Staging (% population)								0%	0%	10%	20%	30%	40%	50%	60%	70%
	Duty Power		Usage MWh													
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	50	7,300	365.00				$ 2,670,122	$ -	$ -	$ -	$ -	$ 23,981	$ 32,996	$ 42,523	$ 52,122	$ 61,576
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power							$ 2,670,122	$ -	$ -	$ -	$ -	$ 23,981	$ 32,996	$ 42,523	$ 52,122	$ 61,576
Total							$ 17,897,480	$ -	$ 6,527,946	$ 72,211	$ 72,211	$ 4,486,730	$ 166,452	$ 175,978	$ 185,578	$ 195,031

NPV Calculation and Sensitivity

ROR	NPV
10%	$9,572,775
7%	$10,994,181
4%	$13,059,121

	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Capital and Replacement Cost																							
AICV Chamber (valve dia.)																							
Flowmeter Chamber (meter dia.)								$ 111,695															$ 111,695
Water Main Greenfield PVC																							
Water Storage Steel Elevated (0.2 - 3ML)																							
Recycled Water Storage Steel Surface (1 - 70ML)																							
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P											$ 145,954												
Total Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 111,695	$ -	$ -	$ 145,954	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 111,695
O&M																							
AICV Chamber (valve dia.) (incl power)	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846	$ 7,846
Flowmeter Chamber (meter dia.) (incl power)	$ 4,244	$ 4,244	$ 4,244	$ 4,244	$ 4,244	$ 4,244	$ 4,244	$ 8,489	$ 8,489	$ 8,489	$ 8,489	$ 8,489	$ 8,489	$ 8,489	$ 8,489	$ 8,489	$ 8,489	$ 8,489	$ 8,489	$ 8,489	$ 8,489	$ 8,489	$ 12,733
Water Main Greenfield PVC	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871	$ 8,871
Water Storage Steel Elevated (0.2 - 3ML)	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251	$ 51,251
Recycled Water Storage Steel Surface (1 - 70ML)	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919	$ 36,919
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	$ 24,326	$ 24,326	$ 24,326	$ 24,326	$ 24,326	$ 24,326	$ 24,326	$ 24,326	$ 24,326	$ 24,326	$ 27,974	$ 27,974	$ 27,974	$ 27,974	$ 27,974	$ 27,974	$ 27,974	$ 27,974	$ 27,974	$ 27,974	$ 27,974	$ 27,974	$ 27,974
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 133,456	$ 133,456	$ 133,456	$ 133,456	$ 133,456	$ 133,456	$ 133,456	$ 137,700	$ 137,700	$ 137,700	$ 141,349	$ 141,349	$ 141,349	$ 141,349	$ 141,349	$ 141,349	$ 141,349	$ 141,349	$ 141,349	$ 141,349	$ 141,349	$ 141,349	$ 145,593
Nominal Electricity Tarrif	$ 244	$ 248	$ 252	$ 256	$ 263	$ 268	$ 272	$ 277	$ 282	$ 287	$ 291	$ 296	$ 301	$ 306	$ 310	$ 315	$ 320	$ 324	$ 329	$ 334	$ 339	$ 343	$ 348
Staging (% population)	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	300%	100%
Recycled Water Pumping Station Booster (15-2000kW incl.Stand-by P	$ 71,248	$ 81,468	$ 91,980	$ 93,440	$ 95,946	$ 97,676	$ 99,406	$ 101,136	$ 102,866	$ 104,596	$ 106,326	$ 108,055	$ 109,785	$ 111,515	$ 113,245	$ 114,975	$ 116,705	$ 118,435	$ 120,165	$ 121,895	$ 123,624	$ 125,354	$ 127,084
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 71,248	$ 81,468	$ 91,980	$ 93,440	$ 95,946	$ 97,676	$ 99,406	$ 101,136	$ 102,866	$ 104,596	$ 106,326	$ 108,055	$ 109,785	$ 111,515	$ 113,245	$ 114,975	$ 116,705	$ 118,435	$ 120,165	$ 121,895	$ 123,624	$ 125,354	$ 127,084
Total	$ 204,704	$ 214,924	$ 225,436	$ 226,896	$ 229,402	$ 231,132	$ 232,862	$ 350,531	$ 240,566	$ 242,296	$ 393,629	$ 249,405	$ 251,134	$ 252,864	$ 254,594	$ 256,324	$ 258,054	$ 259,784	$ 261,514	$ 263,244	$ 264,973	$ 266,703	$ 384,372

WW1
Direct Capital costs are cut and paste from Capital Estimating Spreadsheet and include 50% Strategic Scoping Allowance, but not other O/H's
Direct Capital Cost is factored up by the ratio of (Total Project Budget Requirement for the Option / Direct Capital costs) for the overall option price and applied individually to each item to account for OH's and Allowances
Electricity costs are pro rated based on % total population and assumes pumping 10 hrs per day (20hrs for booster water stations)
O&M costs are calculated on the capital expenditure to date (not total life time costs)

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Year					Total (copied text)	Markup allowance	Total
Capital and Replacement Cost	PARAMETER	UNIT	QUANTITY	RATE			
SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)	310	LS	1	$ 2,730,805	$ 2,730,805	225%	$ 8,004,872
Pressure Sewer Greenfield PVC	200 dia	m	2,000	$ 288	$ 576,000	225%	$ 1,298,802
Pressure Sewer Greenfield PVC	150 dia	m	2,000	$ 230	$ 459,000	225%	$ 1,034,983
Gravity Sewer Greenfield PVC 2.5m deep	300 dia	m	3,800	$ 564	$ 2,143,200	225%	$ 4,832,625
						225%	$ -
						225%	$ -
						225%	$ -
						225%	$ -
						225%	$ -
						225%	$ -
Total Capital							$ 15,171,281
O&M	Capital	Operations	Maintenance				
SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)	8,004,872	0.70%	1.80%				$ 5,164,682
Pressure Sewer Greenfield PVC	1,298,802	0.20%	0.40%				$ 218,199
Pressure Sewer Greenfield PVC	1,034,983	0.20%	0.40%				$ 192,507
Gravity Sewer Greenfield PVC 2.0m deep	4,832,625	0.20%	0.40%				$ 898,868
							$ -
							$ -
							$ -
Total O&M							$ 6,474,255
Nominal Electricity Tarrif							
Staging (% population)							
	Duty Power	Hours Per Year	Usage MWh				
SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)	155	3,650	565.75				$ 4,174,275
							$ -
							$ -
							$ -
							$ -
Total Power							$ 4,174,275
Total							$ 25,819,811

Year		0	1	2	3	4	5	6	7
	2014	2015	2016	2017	2018	2019	2020	2021	2022
SPS Submersible Large (capital)		$ 6,157,594							
Pressure Sewer Greenfield PVC 200 dia					$ 1,298,802				
Pressure Sewer Greenfield PVC 150 dia		$ 1,034,983							
Gravity Sewer Greenfield PVC 300 dia		$ 4,832,625							
Total Capital	$ -	$ 12,025,201	$ -	$ -	$ 1,298,802	$ -	$ -	$ -	$ -
SPS Submersible Large (O&M)	$ -	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940
Pressure Sewer Greenfield PVC	$ -	$ -	$ -	$ -	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793
Pressure Sewer Greenfield PVC	$ -	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210
Gravity Sewer Greenfield PVC 2.0m deep	$ -	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ -	$ 189,145	$ 189,145	$ 189,145	$ 196,938	$ 196,938	$ 196,938	$ 196,938	$ 196,938
Nominal Electricity Tarrif	$ 185	$ 197	$ 207	$ 211	$ 219	$ 226	$ 233	$ 238	$ 241
Staging (% population)	0%	0%	10%	20%	30%	40%	50%	60%	70%
SPS Submersible Large (power)	$ -	$ -	$ 11,711	$ 23,875	$ 37,170	$ 51,144	$ 65,910	$ 80,789	$ 95,442
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ -	$ -	$ 11,711	$ 23,875	$ 37,170	$ 51,144	$ 65,910	$ 80,789	$ 95,442
Total	$ -	$ 12,214,346	$ 200,857	$ 213,020	$ 1,532,910	$ 248,082	$ 262,848	$ 277,727	$ 292,380

NPV Calculation and Sensitivity

ROR	NPV
10%	$13,455,426
7%	$15,378,123
4%	$18,332,405

Year	8	9	10	11	12	13	14	15	16	17	18	19
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
SPS Submersible Large (capital)								$ 923,639				
Total Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 923,639	$ -	$ -	$ -	$ -
SPS Submersible Large (O&M)	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031
Pressure Sewer Greenfield PVC	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793
Pressure Sewer Greenfield PVC	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210
Gravity Sewer Greenfield PVC 2.0m deep	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 196,938	$ 196,938	$ 196,938	$ 196,938	$ 196,938	$ 196,938	$ 196,938	$ 220,029	$ 220,029	$ 220,029	$ 220,029	$ 220,029
Nominal Electricity Tarrif	$ 244	$ 248	$ 252	$ 256	$ 263	$ 268	$ 272	$ 277	$ 282	$ 287	$ 291	$ 296
Staging (% population)	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SPS Submersible Large (power)	$ 110,434	$ 126,275	$ 142,569	$ 144,832	$ 148,717	$ 151,398	$ 154,079	$ 156,761	$ 159,442	$ 162,123	$ 164,805	$ 167,486
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 110,434	$ 126,275	$ 142,569	$ 144,832	$ 148,717	$ 151,398	$ 154,079	$ 156,761	$ 159,442	$ 162,123	$ 164,805	$ 167,486
Total	$ 307,373	$ 323,214	$ 339,507	$ 341,770	$ 345,655	$ 348,336	$ 351,018	$ 1,300,429	$ 379,471	$ 382,153	$ 384,834	$ 387,515

Year	20	21	22	23	24	25	26	27	28	29	30
	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
SPS Submersible Large (capital)											$ 923,639
Total Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 923,639
SPS Submersible Large (O&M)	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 200,122
Pressure Sewer Greenfield PVC	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793	$ 7,793
Pressure Sewer Greenfield PVC	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210
Gravity Sewer Greenfield PVC 2.0m deep	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996	$ 28,996
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 220,029	$ 220,029	$ 220,029	$ 220,029	$ 220,029	$ 220,029	$ 220,029	$ 220,029	$ 220,029	$ 220,029	$ 243,120
Nominal Electricity Tarrif	$ 301	$ 306	$ 310	$ 315	$ 320	$ 324	$ 329	$ 334	$ 339	$ 343	$ 348
Staging (% population)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SPS Submersible Large (power)	$ 170,167	$ 172,849	$ 175,530	$ 178,211	$ 180,893	$ 183,574	$ 186,255	$ 188,936	$ 191,618	$ 194,299	$ 196,980
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 170,167	$ 172,849	$ 175,530	$ 178,211	$ 180,893	$ 183,574	$ 186,255	$ 188,936	$ 191,618	$ 194,299	$ 196,980
Total	$ 390,197	$ 392,878	$ 395,559	$ 398,241	$ 400,922	$ 403,603	$ 406,284	$ 408,966	$ 411,647	$ 414,328	$ 1,363,740

WW2

Direct Capital costs are cut and paste from Capital Estimating Spreadsheet and include 50% Strategic Scoping Allowance, but not other O/H's

Direct Capital Cost is factored up by the ratio of (Total Project Budget Requirement for the Option / Direct Capital costs) for the overall option price and applied individually to each item to account for OH's and Allowances

Electricity costs are pro rated based % total population and assumes pumping 10 hrs per day (20hrs for booster water stations)

O&M costs are calculated on the capital expenditure to date (not total life time costs)

Treatment costs based on previous projects

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									0	1	2	3	4	5	6
Year					Total (copied text)	Markup allowance	Total	2014	2015	2016	2017	2018	2019	2020	2021
Capital and Replacement Cost	PARAMETER	UNIT	QUANTITY	RATE											
SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)	310	LS	1	$ 2,730,805	$ 2,730,805	225%	$ 8,004,873		$ 6,157,594						
Pressure Sewer Greenfield PVC	100 dia	m	2,000	$ 173	$ 345,000	225%	$ 777,928		$ 777,928						
Pressure Sewer Greenfield PVC	150 dia	m	2,000	$ 230	$ 459,000	225%	$ 1,034,983		$ 1,034,983						
Gravity Sewer Greenfield PVC 2.0m deep	225 dia	m	3,500	$ 456	$ 1,596,000	225%	$ 3,598,764		$ 3,598,764						
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	50	LS	1	$ 779,616	$ 779,616	225%	$ 2,285,308		$ 1,757,929						
0.5 ML/day MBR treatment plant for sewer mining to secondary qualit	1	LS	1	$ 5,500,000	$ 5,500,000	225%	$ 14,262,017					$ 6,200,877		$ 6,200,877	
						225%	$ -								
						225%	$ -								
						225%	$ -								
						225%	$ -								
Total Capital							$ 29,963,872	$ -	$ 13,327,198	$ -	$ -	$ 6,200,877	$ -	$ 6,200,877	$ -
O&M	Capital	Operations	Maintenance												
SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)	8,004,873	0.70%	1.80%				$ 5,164,682	$ -	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940
Pressure Sewer Greenfield PVC	777,928	0.20%	0.40%				$ 144,695	$ -	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668
Pressure Sewer Greenfield PVC	1,034,983	0.20%	0.40%				$ 192,507	$ -	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210
Gravity Sewer Greenfield PVC 2.0m deep	3,598,764	0.20%	0.40%				$ 669,370	$ -	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	2,285,308	0.70%	1.80%				$ 1,474,463	$ -	$ 43,948	$ 43,948	$ 43,948	$ 43,948	$ 43,948	$ 43,948	$ 43,948
0.5 ML/day MBR treatment plant for sewer mining to secondary qualit		$ 350,000					$ 10,850,000	$ -	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M							$ 18,495,717	$ -	$ 580,358	$ 580,358	$ 580,358	$ 580,358	$ 580,358	$ 580,358	$ 580,358
Nominal Electricity Tarrif								$ 185	$ 197	$ 207	$ 211	$ 219	$ 226	$ 233	$ 238
Staging (% population)								0%	0%	10%	20%	30%	40%	50%	60%
	Duty Power	Hours Per Year	Usage MWh												
SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)	155	3,650	565.75				$ 4,174,275	$ -	$ -	$ 11,711	$ 23,875	$ 37,170	$ 51,144	$ 65,910	$ 80,789
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	25	3,650	91.25				$ 673,270	$ -	$ -	$ 1,889	$ 3,851	$ 5,995	$ 8,249	$ 10,631	$ 13,031
0.5 ML/day MBR treatment plant for sewer mining to secondary qualit			800.00				$ 5,902,642	$ -	$ -	$ 16,560	$ 33,760	$ 52,560	$ 72,320	$ 93,200	$ 114,240
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power							$ 10,750,188	$ -	$ -	$ 30,160	$ 61,485	$ 95,725	$ 131,713	$ 169,741	$ 208,060
Total							$ 59,209,777	$ -	$ 13,907,556	$ 610,518	$ 641,844	$ 6,676,960	$ 712,071	$ 6,950,976	$ 788,418

NPV Calculation and Sensitivity

ROR	NPV
10%	$25,611,918
7%	$30,836,761
4%	$38,924,022

	7	8	9	10	11	12	13	14	15	16	17	18
Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)									$ 923,639			
Pressure Sewer Greenfield PVC												
Pressure Sewer Greenfield PVC												
Gravity Sewer Greenfield PVC 2.0m deep												
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)									$ 263,689			
0.5 ML/day MBR treatment plant for sewer mining to secondary qualit												$ 930,132
Total Capital	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,187,329	$ -	$ -	$ 930,132
SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 153,940	$ 177,031	$ 177,031	$ 177,031	$ 177,031
Pressure Sewer Greenfield PVC	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668
Pressure Sewer Greenfield PVC	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210
Gravity Sewer Greenfield PVC 2.0m deep	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	$ 43,948	$ 43,948	$ 43,948	$ 43,948	$ 43,948	$ 43,948	$ 43,948	$ 43,948	$ 50,540	$ 50,540	$ 50,540	$ 50,540
0.5 ML/day MBR treatment plant for sewer mining to secondary qualit	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 580,358	$ 580,358	$ 580,358	$ 580,358	$ 580,358	$ 580,358	$ 580,358	$ 580,358	$ 610,041	$ 610,041	$ 610,041	$ 610,041
Nominal Electricity Tarrif	$ 241	$ 244	$ 248	$ 252	$ 256	$ 263	$ 268	$ 272	$ 277	$ 282	$ 287	$ 291
Staging (% population)	70%	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)	$ 95,442	$ 110,434	$ 126,275	$ 142,569	$ 144,832	$ 148,717	$ 151,398	$ 154,079	$ 156,761	$ 159,442	$ 162,123	$ 164,805
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	$ 15,394	$ 17,812	$ 20,367	$ 22,995	$ 23,360	$ 23,987	$ 24,419	$ 24,852	$ 25,284	$ 25,716	$ 26,149	$ 26,581
0.5 ML/day MBR treatment plant for sewer mining to secondary qualit	$ 134,960	$ 156,160	$ 178,560	$ 201,600	$ 204,800	$ 210,293	$ 214,085	$ 217,876	$ 221,668	$ 225,459	$ 229,251	$ 233,042
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 245,796	$ 284,406	$ 325,202	$ 367,164	$ 372,992	$ 382,997	$ 389,902	$ 396,807	$ 403,713	$ 410,618	$ 417,523	$ 424,429
Total	$ 826,154	$ 864,765	$ 905,561	$ 947,522	$ 953,350	$ 963,355	$ 970,260	$ 977,165	$ 2,201,083	$ 1,020,659	$ 1,027,565	$ 1,964,601

	19	20	21	22	23	24	25	26	27	28	29	30
Year	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)												$ 923,639
Pressure Sewer Greenfield PVC												
Pressure Sewer Greenfield PVC												
Gravity Sewer Greenfield PVC 2.0m deep												
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)												$ 263,689
0.5 ML/day MBR treatment plant for sewer mining to secondary qualit		$ 930,132										
Total Capital	$ -	$ 930,132	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,187,329
SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 177,031	$ 200,122
Pressure Sewer Greenfield PVC	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668
Pressure Sewer Greenfield PVC	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210	$ 6,210
Gravity Sewer Greenfield PVC 2.0m deep	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593	$ 21,593
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	$ 50,540	$ 50,540	$ 50,540	$ 50,540	$ 50,540	$ 50,540	$ 50,540	$ 50,540	$ 50,540	$ 50,540	$ 50,540	$ 57,133
0.5 ML/day MBR treatment plant for sewer mining to secondary qualit	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 610,041	$ 610,041	$ 610,041	$ 610,041	$ 610,041	$ 610,041	$ 610,041	$ 610,041	$ 610,041	$ 610,041	$ 610,041	$ 633,725
Nominal Electricity Tarrif	$ 296	$ 301	$ 306	$ 310	$ 315	$ 320	$ 324	$ 329	$ 334	$ 339	$ 343	$ 348
Staging (% population)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SPS Submersible Large (201 - 1200KW incl.Stand-by Pumps)	$ 167,486	$ 170,167	$ 172,849	$ 175,530	$ 178,211	$ 180,893	$ 183,574	$ 186,255	$ 188,936	$ 191,618	$ 194,299	$ 196,980
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	$ 27,014	$ 27,446	$ 27,879	$ 28,311	$ 28,744	$ 29,176	$ 29,609	$ 30,041	$ 30,474	$ 30,906	$ 31,339	$ 31,771
0.5 ML/day MBR treatment plant for sewer mining to secondary qualit	$ 236,834	$ 240,625	$ 244,417	$ 248,208	$ 252,000	$ 255,792	$ 259,583	$ 263,375	$ 267,166	$ 270,958	$ 274,749	$ 278,541
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 431,334	$ 438,239	$ 445,144	$ 452,050	$ 458,955	$ 465,860	$ 472,766	$ 479,671	$ 486,576	$ 493,481	$ 500,387	$ 507,292
Total	$ 1,041,375	$ 1,978,412	$ 1,055,186	$ 1,062,091	$ 1,068,996	$ 1,075,902	$ 1,082,807	$ 1,089,712	$ 1,096,618	$ 1,103,523	$ 1,110,428	$ 2,334,345

WW3

Direct Capital costs are cut and paste from Capital Estimating Spreadsheet and include 50% Strategic Scoping Allowance, but not other O/H's

Direct Capital Cost is factored up by the ratio of (Total Project Budget Requirement for the Option / Direct Capital costs) for the overall option price and applied individually to each item to account for OH's and Allowances

Electricity costs are pro rated based % total population and assumes pumping 10 hrs per day (20hrs for booster water stations)

O&M costs are calculated on the capital expenditure to date (not total life time costs)

Treatment costs based on previous projects

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Year					Total (copied text)	Markup allowance	Total
Capital and Replacement Cost	PARAMETER	UNIT	QUANTITY	RATE			
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	50	LS	1	$ 779,616	$ 779,616	225%	$ 2,285,308
1 ML/day MBR treatment plant to secondary quality with disinfection		LS	1	$ 7,437,000	$ 7,437,000	225%	$ 17,356,357
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P	30	LS	1	$ 322,136	$ 322,136	225%	$ 726,373
Irrigation Water Main Greenfield PVC - (rural)	100 dia	m	4,000	$ 75	$ 300,000	225%	$ 879,397
1 ML Wastewater Above Ground Storage	1	LS	1	$ 1,449,000	$ 1,449,000	225%	$ 3,267,299
						225%	$ -
						225%	$ -
						225%	$ -
						225%	$ -
						225%	$ -
Total Capital							$ 24,514,734
O&M	Capital	Operations	Maintenance				
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	2,285,308	2.00%	1.80%				$ 2,241,184
1 ML/day MBR treatment plant to secondary quality with disinfection	17,356,357	$ 600,000					$ 18,600,000
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P	726,373	1.00%	1.50%				$ 562,939
Irrigation Water Main Greenfield PVC - (rural)	879,397	0.20%	0.40%				$ 136,171
1 ML Wastewater Above Ground Storage	3,267,299	0.60%	0.50%				$ 1,114,149
							$ -
Total O&M							$ 22,654,443
Nominal Electricity Tarrif							
Staging (% population)							
	Duty Power	Hours Per Year	Usage MWh				
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	25	3,650	91.25				$ 673,270
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P	15	3,650	54.75				$ 403,962
1 ML/day MBR treatment plant to secondary quality with disinfection			1,400.00				$ 10,329,624
							$ -
							$ -
Total Power							$ 11,406,856
Total							$ 58,576,034

		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Capital and Replacement Cost																
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)		$ 1,757,930														
1 ML/day MBR treatment plant to secondary quality with disinfection		$ 10,061,656			$ 1,676,943		$ 1,676,943			$ 1,676,943						
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P		$ 726,373														
Irrigation Water Main Greenfield PVC - (rural)		$ 676,459														
1 ML Wastewater Above Ground Storage		$ 3,267,299														
Total Capital	$ -	$ 16,489,717	$ -	$ -	$ 1,676,943	$ -	$ 1,676,943	$ -	$ -	$ 1,676,943	$ -	$ -	$ -	$ -	$ -	$ -
O&M																
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	$ -	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801
1 ML/day MBR treatment plant to secondary quality with disinfection	$ -	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P	$ -	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159
Irrigation Water Main Greenfield PVC - (rural)	$ -	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059
1 ML Wastewater Above Ground Storage	$ -	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ -	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960
Nominal Electricity Tarrif	$ 185	$ 197	$ 207	$ 211	$ 219	$ 226	$ 233	$ 238	$ 241	$ 244	$ 248	$ 252	$ 256	$ 263	$ 268	$ 272
Staging (% population)	0%	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	100%	100%	100%	100%
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	$ -	$ -	$ 1,889	$ 3,851	$ 5,995	$ 8,249	$ 10,631	$ 13,031	$ 15,394	$ 17,812	$ 20,367	$ 22,995	$ 23,360	$ 23,987	$ 24,419	$ 24,852
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P	$ -	$ -	$ 1,133	$ 2,310	$ 3,597	$ 4,949	$ 6,378	$ 7,818	$ 9,236	$ 10,687	$ 12,220	$ 13,797	$ 14,016	$ 14,392	$ 14,651	$ 14,911
1 ML/day MBR treatment plant to secondary quality with disinfection	$ -	$ -	$ 28,980	$ 59,080	$ 91,980	$ 126,560	$ 163,100	$ 199,920	$ 236,180	$ 273,280	$ 312,480	$ 352,800	$ 358,400	$ 368,013	$ 374,648	$ 381,284
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ -	$ -	$ 32,002	$ 65,241	$ 101,572	$ 139,758	$ 180,109	$ 220,769	$ 260,810	$ 301,779	$ 345,067	$ 389,592	$ 395,776	$ 406,392	$ 413,719	$ 421,046
Total	$ -	$ 17,214,677	$ 756,962	$ 790,201	$ 2,503,475	$ 864,718	$ 2,582,011	$ 945,728	$ 985,770	$ 2,703,682	$ 1,070,027	$ 1,114,552	$ 1,120,736	$ 1,131,352	$ 1,138,679	$ 1,146,006

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Year	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Capital and Replacement Cost																
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	$ 263,689															$ 263,689
1 ML/day MBR treatment plant to secondary quality with disinfection	$ 1,509,248			$ 251,541		$ 251,541			$ 251,541							
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P																
Irrigation Water Main Greenfield PVC - (rural)	$ 101,469															$ 101,469
1 ML Wastewater Above Ground Storage																
Total Capital	$ 1,874,407	$ -	$ -	$ 251,541	$ -	$ 251,541	$ -	$ -	$ 251,541	$ -	$ -	$ -	$ -	$ -	$ -	$ 365,158
O&M																
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 86,842
1 ML/day MBR treatment plant to secondary quality with disinfection	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159
Irrigation Water Main Greenfield PVC - (rural)	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 4,668	$ 5,276
1 ML Wastewater Above Ground Storage	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 735,589	$ 735,589	$ 735,589	$ 735,589	$ 735,589	$ 735,589	$ 735,589	$ 735,589	$ 735,589	$ 735,589	$ 735,589	$ 735,589	$ 735,589	$ 735,589	$ 735,589	$ 746,218
Nominal Electricity Tarrif	$ 277	$ 282	$ 287	$ 291	$ 296	$ 301	$ 306	$ 310	$ 315	$ 320	$ 324	$ 329	$ 334	$ 339	$ 343	$ 348
Staging (% population)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	$ 25,284	$ 25,716	$ 26,149	$ 26,581	$ 27,014	$ 27,446	$ 27,879	$ 28,311	$ 28,744	$ 29,176	$ 29,609	$ 30,041	$ 30,474	$ 30,906	$ 31,339	$ 31,771
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P	$ 15,170	$ 15,430	$ 15,689	$ 15,949	$ 16,208	$ 16,468	$ 16,727	$ 16,987	$ 17,246	$ 17,506	$ 17,765	$ 18,025	$ 18,284	$ 18,544	$ 18,803	$ 19,063
1 ML/day MBR treatment plant to secondary quality with disinfection	$ 387,919	$ 394,554	$ 401,189	$ 407,824	$ 414,459	$ 421,095	$ 427,730	$ 434,365	$ 441,000	$ 447,635	$ 454,270	$ 460,905	$ 467,541	$ 474,176	$ 480,811	$ 487,446
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 428,373	$ 435,700	$ 443,027	$ 450,354	$ 457,682	$ 465,009	$ 472,336	$ 479,663	$ 486,990	$ 494,317	$ 501,644	$ 508,971	$ 516,298	$ 523,626	$ 530,953	$ 538,280
Total	$ 3,038,369	$ 1,171,289	$ 1,178,616	$ 1,437,485	$ 1,193,270	$ 1,452,139	$ 1,207,924	$ 1,215,252	$ 1,474,120	$ 1,229,906	$ 1,237,233	$ 1,244,560	$ 1,251,887	$ 1,259,214	$ 1,266,541	$ 1,649,656

NPV Calculation and Sensitivity

ROR	NPV
10%	$25,010,568
7%	$30,066,773
4%	$38,069,547

WW4
Direct Capital costs are cut and paste from Capital Estimating Spreadsheet and include 50% Strategic Scoping Allowance, but not other O/H's
Direct Capital Cost is factored up by the ratio of (Total Project Budget Requirement for the Option / Direct Capital costs) for the overall option price and applied individually to each item to account for OH's and Allowances
Electricity costs are pro rated based % total population and assumes pumping 10 hrs per day (20hrs for booster water stations)
O&M costs are calculated on the capital expenditure to date (not total life time costs)
Treatment costs based on previous projects
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									0	1	2	3	4	5	6
Year					Total (copied text)	Markup allowance	Total	2014	2015	2016	2017	2018	2019	2020	2021
Capital and Replacement Cost	PARAMETER	UNIT	QUANTITY	RATE											
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	50	LS	1	$ 779,616	$ 779,616	225%	$ 2,285,308		$ 1,757,930						
1 ML/day MBR treatment plant to secondary quality with disinfection c/w WW storage		LS	1	$ 8,500,000	$ 8,500,000	225%	$ 21,562,142		$ 11,499,809			$ 1,916,635		$ 1,916,635	
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P	30	LS	1	$ 322,136	$ 322,136	225%	$ 944,285		$ 726,373						
Irrigation Water Main Greenfield PVC - (rural)	100 dia	m	4,000	$ 75	$ 300,000	225%	$ 676,459		$ 676,459						
1 ML Wastewater Above Ground Storage	1	LS	1	$ 1,449,000	$ 1,449,000	225%	$ 3,267,299		$ 3,267,299						
						225%	$ -		$ -						
						225%	$ -								
						225%	$ -								
						225%	$ -								
						225%	$ -								
Total Capital							$ 28,735,493	$ -	$ 17,927,869	$ -	$ -	$ 1,916,635	$ -	$ 1,916,635	$ -
O&M	Capital	Operations	Maintenance												
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	2,285,308	2.00%	1.80%				$ 2,241,184	$ -	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801
1 ML/day MBR treatment plant to secondary quality with disinfection	21,562,142	$ 600,000					$ 18,600,000	$ -	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P	944,285	1.00%	1.50%				$ 609,245	$ -	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159
Irrigation Water Main Greenfield PVC - (rural)	676,459	0.20%	0.40%				$ 125,821	$ -	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059
1 ML Wastewater Above Ground Storage	3,267,299	0.60%	0.50%				$ 1,114,149	$ -	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M							$ 22,690,400	$ -	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960
Nominal Electricity Tarrif								$ 185	$ 197	$ 207	$ 211	$ 219	$ 226	$ 233	$ 238
Staging (% population)								0%	0%	10%	20%	30%	40%	50%	60%
	Duty Power	Hours Per Year	Usage MWh												
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)	25	3,650	91.25				$ 673,270	$ -	$ -	$ 1,889	$ 3,851	$ 5,995	$ 8,249	$ 10,631	$ 13,031
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P	15	3,650	54.75				$ 403,962	$ -	$ -	$ 1,133	$ 2,310	$ 3,597	$ 4,949	$ 6,378	$ 7,818
1 ML/day MBR treatment plant to secondary quality with disinfection			1,500.00				$ 11,067,455	$ -	$ -	$ 31,050	$ 63,300	$ 98,550	$ 135,600	$ 174,750	$ 214,200
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power							$ 12,144,687	$ -	$ -	$ 34,072	$ 69,461	$ 108,142	$ 148,798	$ 191,759	$ 235,049
Total							$ 63,570,580	$ -	$ 18,652,829	$ 759,032	$ 794,421	$ 2,749,737	$ 873,758	$ 2,833,354	$ 960,008

NPV Calculation and Sensitivity

ROR	NPV
10%	$26,841,481
7%	$32,275,130
4%	$40,952,118

	7	8	9	10	11	12	13	14	15	16	17	18
Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)									$ 263,689			
1 ML/day MBR treatment plant to secondary quality with disinfection c/w WW storage		$ 1,916,635							$ 1,724,971			$ 287,495
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P									$ 108,956			
Total Capital	$ -	$ 1,916,635	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,097,617	$ -	$ -	$ 287,495
O&M: SPS Submersible Small	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 66,801	$ 76,822	$ 76,822	$ 76,822	$ 76,822
O&M: 1 ML/day MBR treatment plant	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000
O&M: Irrigation Water Pumping Station Booster	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 18,159	$ 20,883	$ 20,883	$ 20,883	$ 20,883
O&M: Irrigation Water Main Greenfield PVC	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059
O&M: 1 ML Wastewater Above Ground Storage	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 724,960	$ 737,704	$ 737,704	$ 737,704	$ 737,704
Nominal Electricity Tarrif	$ 241	$ 244	$ 248	$ 252	$ 256	$ 263	$ 268	$ 272	$ 277	$ 282	$ 287	$ 291
Staging (% population)	70%	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Power: SPS Submersible Small	$ 15,394	$ 17,812	$ 20,367	$ 22,995	$ 23,360	$ 23,987	$ 24,419	$ 24,852	$ 25,284	$ 25,716	$ 26,149	$ 26,581
Power: Irrigation Water Pumping Station Booster	$ 9,236	$ 10,687	$ 12,220	$ 13,797	$ 14,016	$ 14,392	$ 14,651	$ 14,911	$ 15,170	$ 15,430	$ 15,689	$ 15,949
Power: 1 ML/day MBR treatment plant	$ 253,050	$ 292,800	$ 334,800	$ 378,000	$ 384,000	$ 394,300	$ 401,409	$ 408,518	$ 415,627	$ 422,736	$ 429,845	$ 436,955
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 277,680	$ 321,299	$ 367,387	$ 414,792	$ 421,376	$ 432,679	$ 440,480	$ 448,281	$ 456,082	$ 463,883	$ 471,684	$ 479,485
Total	$ 1,002,640	$ 2,962,894	$ 1,092,347	$ 1,139,752	$ 1,146,336	$ 1,157,638	$ 1,165,439	$ 1,173,240	$ 3,291,402	$ 1,201,586	$ 1,209,388	$ 1,504,884

	19	20	21	22	23	24	25	26	27	28	29	30
Year	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
SPS Submersible Small (0 - 200KW incl.Stand-by Pumps)												$ 263,689
1 ML/day MBR treatment plant to secondary quality with disinfection c/w WW storage		$ 287,495			$ 287,495							$ 1,724,971
Irrigation Water Pumping Station Booster (15-2000kW incl.Stand-by P												$ 108,956
Total Capital	$ -	$ 287,495	$ -	$ -	$ 287,495	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,097,617
O&M: SPS Submersible Small	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 76,822	$ 86,842
O&M: 1 ML/day MBR treatment plant	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000	$ 600,000
O&M: Irrigation Water Pumping Station Booster	$ 20,883	$ 20,883	$ 20,883	$ 20,883	$ 20,883	$ 20,883	$ 20,883	$ 20,883	$ 20,883	$ 20,883	$ 20,883	$ 23,607
O&M: Irrigation Water Main Greenfield PVC	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059	$ 4,059
O&M: 1 ML Wastewater Above Ground Storage	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940	$ 35,940
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total O&M	$ 737,704	$ 737,704	$ 737,704	$ 737,704	$ 737,704	$ 737,704	$ 737,704	$ 737,704	$ 737,704	$ 737,704	$ 737,704	$ 750,448
Nominal Electricity Tarrif	$ 296	$ 301	$ 306	$ 310	$ 315	$ 320	$ 324	$ 329	$ 334	$ 339	$ 343	$ 348
Staging (% population)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Power: SPS Submersible Small	$ 27,014	$ 27,446	$ 27,879	$ 28,311	$ 28,744	$ 29,176	$ 29,609	$ 30,041	$ 30,474	$ 30,906	$ 31,339	$ 31,771
Power: Irrigation Water Pumping Station Booster	$ 16,208	$ 16,468	$ 16,727	$ 16,987	$ 17,246	$ 17,506	$ 17,765	$ 18,025	$ 18,284	$ 18,544	$ 18,803	$ 19,063
Power: 1 ML/day MBR treatment plant	$ 444,064	$ 451,173	$ 458,282	$ 465,391	$ 472,500	$ 479,609	$ 486,718	$ 493,827	$ 500,936	$ 508,045	$ 515,155	$ 522,264
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Power	$ 487,286	$ 495,087	$ 502,888	$ 510,689	$ 518,490	$ 526,291	$ 534,092	$ 541,893	$ 549,694	$ 557,495	$ 565,296	$ 573,097
Total	$ 1,224,990	$ 1,520,286	$ 1,240,592	$ 1,248,393	$ 1,543,689	$ 1,263,995	$ 1,271,796	$ 1,279,597	$ 1,287,398	$ 1,295,199	$ 1,303,000	$ 3,421,162