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Engineering

Working Beyond Expectations

Wyndella Road Lochinvar
Water Servicing Strategy

Property:
Multiple properties within the Lochinvar Urban Release Area
New England Highway and Wyndella Road
Lochinvar NSW

Applicant:
Lochinvar Developments Pty Ltd

Date:
25th September 2023

Job Number:
240332

Revision:
FINAL

Document Control Sheet

Issue No.	Amendment	Date	Prepared By	Checked By
A	Initial Issue	8/03/2023	AF	CB
B	Revised Issue	7/07/2023	AF	CB
C	Final	25/09/2023	AF	CB

Executive Summary

ADW Johnson has been engaged by Lochinvar Developments Pty Ltd to prepare a water servicing strategy for the proposed development site at Wyndella Road, Lochinvar.

Development Background

The development constitutes the subdivision of multiple lots off the New England Highway and Wyndella Road within the Lochinvar Urban Release Area. The current masterplan for the development comprises 262 residential lots and a community parks area.

Servicing Options

The majority of the development site is situated below 52 m elevation, and will be serviced adequately through connection to the DN300 watermain within the New England Highway. The proposed gravity reticulation network is presented in **Appendix B**.

A small number of lots above 52 m elevation, located to the north east of the development site, are unable to maintain adequate service pressures through gravity reticulation alone. Two pressure boosting options were assessed for servicing the high elevation lots within the Wyndella Road development:

- Option 1 - Construction of a new WPS within the development site.
- Option 2 - Connection to the future boosted reticulation network to the south of the New England Highway through a lead-in main (approx. 1.6 km long).

Cost effective analysis over a 25-year evaluation period was undertaken to assess the net present values (NPVs) for each option, which are presented in **Table 1**.

Table 1 - Option NPVs (25yr evaluation and 7% discount rate)

Option 1	Option 2
$801,000	$900,000

Recommended Water Servicing Option

Option 1 has been recommended due to the following factors:

- Minimises community cost (lowest NPV);
- Minimises impact on surrounding infrastructure; and
- Eliminates potential water quality issues associated with the long lead-in mains proposed in Option 2.

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1.0 Background

ADW Johnson has been engaged by Lochinvar Developments Pty Ltd to prepare a water servicing strategy for the proposed residential development site at Wyndella Road, Lochinvar. The development site is referred to within the report as the "Wyndella Rd" development herein.

1.1 STUDY AREA

The Wyndella Road Lochinvar development constitutes the subdivision of multiple lots off the New England Highway and Wyndella Rd within the Lochinvar Urban Release Area. The development currently comprises the following lots zoned R1 General Residential; Lots 2, 3, 4, 5, 6 and 9 DP747391, and, Lots 12 and 13 DP1219648.

The location of the proposed development site is shown in **Figure 1**.

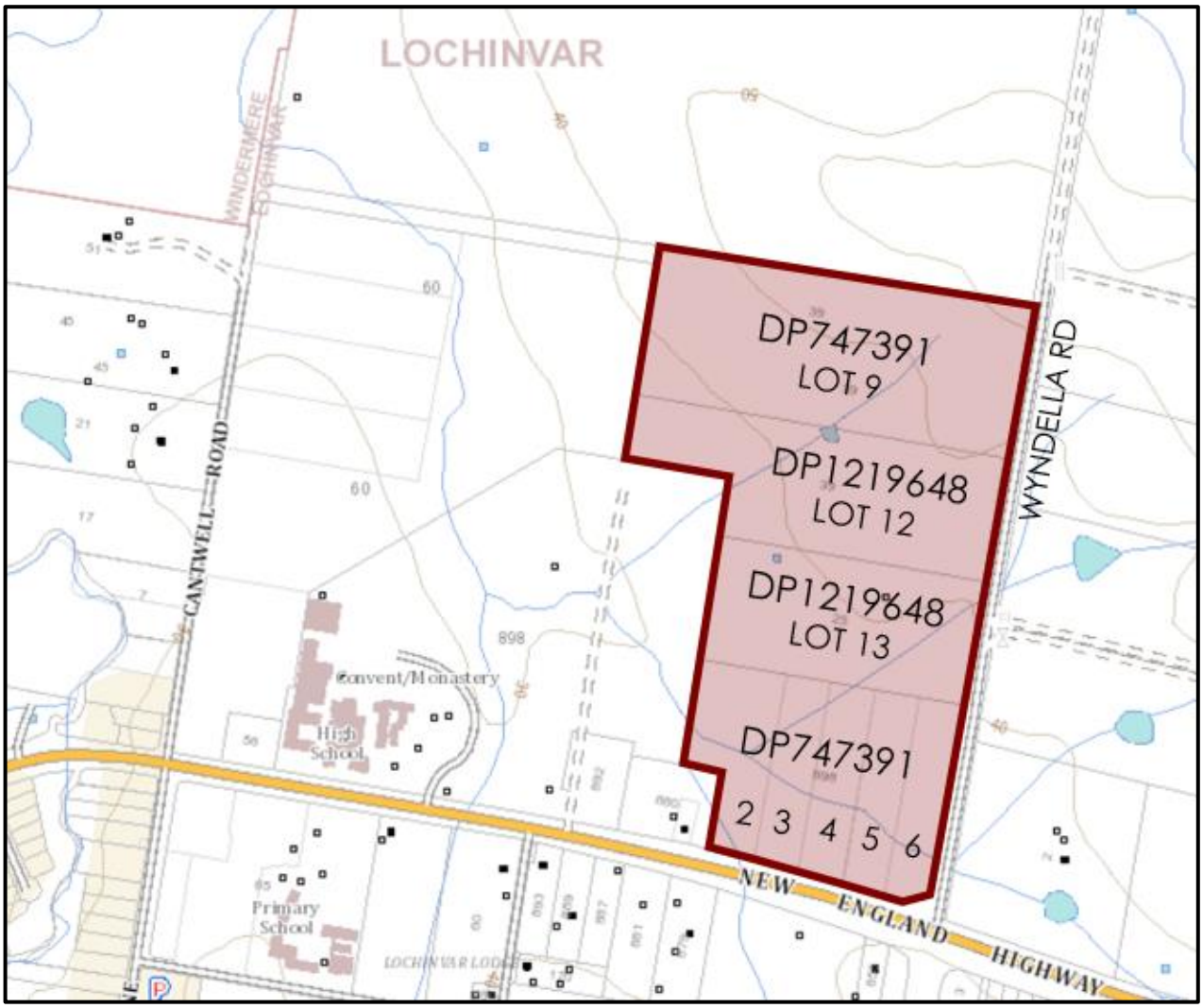

Figure 1 - Development Area.
Source: SIX Maps

The current masterplan for the development comprises 262 residential lots and a community park area. The current development masterplan is presented in **Appendix B**.

The topography of the site is dominated by a creek line to the south, running parallel to the New England Highway at approximately 37 m AHD, and a hill which peaks in the north-east at approximately 68 m AHD.

1.2 HUNTER WATER CORPORATION INFRASTRUCTURE

The development has frontage to an existing DN300 CICL water-main situated within the north side of the New England Highway. This main is supplied by the Four Mile Creek 1 Reservoir and has been nominated as the primary point of connection for the development. HWC have advised that the watermain will have sufficient capacity to supply the development site up to approximately 52 m AHD elevation.

Areas in the north-east of the development site are situated above 52 m elevation and therefore require boosting in order to achieve adequate service pressures. There are two nearby boosted networks in the vicinity which have been considered as potential connection points for options development. Of the two nearby boosted zones assessed, one was deemed feasible (discussed further in **Section 2.1**) whilst the other was found to result in a vastly inferior option and was not considered further (discussed further in **Section 3.1.3**).

HWC correspondence relating to the existing infrastructure is provided in **Appendix A**.

1.3 PLANNING CONTEXT

The subject site is located within Maitland City Council LGA. The subject site is entirely within the Lochinvar Urban Release Area and is zoned R1 General Residential (approx. 23 ha).

Figure 2 below shows the planning context of the study area.

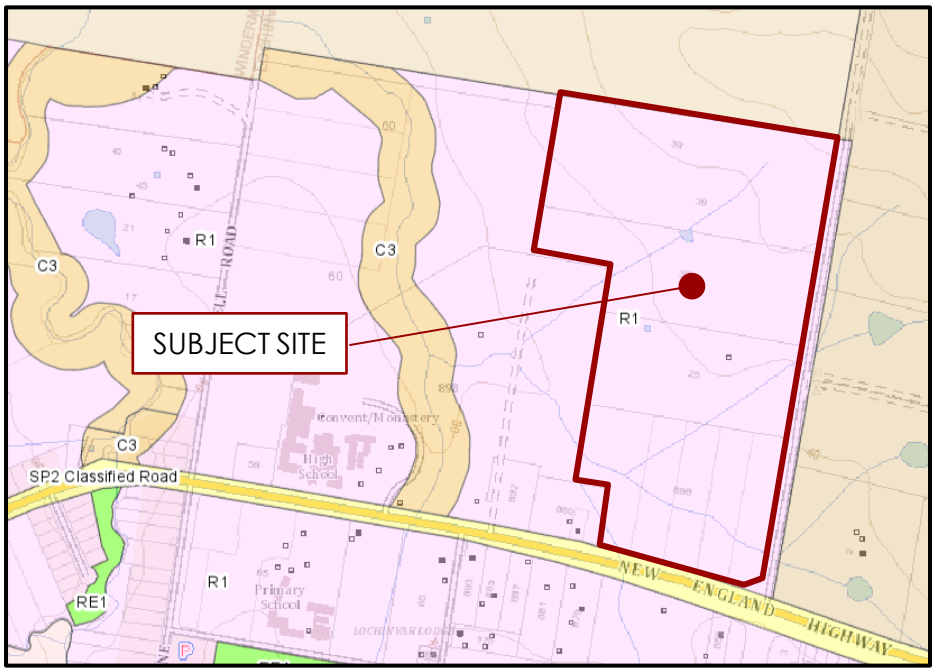

Figure 2 - Zoning Plan.
Source: NSW Government ePlanning Spatial Viewer

1.4 MINE SUBSIDENCE

The development site is not located within a Mine Subsidence District as identified by Subsidence Advisory NSW.

1.5 FLOODING

A Lochinvar flood study was undertaken by WMA Water in 2019. The flood study analysed the 1/100yr flood level for both local flooding and flooding from the Hunter River. The flood study determined local flooding impacts the development site surrounding the creek line to the south. Local flooding is proposed to be addressed as part of the civil works.

1.6 PROPOSED DEVELOPMENT IN THE STUDY AREA

The current development masterplan comprises 262 residential lots and a communal park area. The masterplan is presented in **Appendix B**.

1.7 DESIGN CODE / ASSUMPTIONS

In developing options, the design requirements of specified in the following manuals have been adhered to unless otherwise stated:

- Water Supply Code of Australia, Hunter Water Edition Version 2.1 (WSA 03-2011).

2.0 Options Development

2.1 POINTS OF CONNECTION AND AVAILABLE CAPACITY

The DN300 DICL water main within New England Highway is nominated as the primary point of connection for the development. The point of connection is adjacent the Wyndella Road and the New England Highway intersection. Boundary conditions for the DN300 watermain were provided by HWC and are summarised below in **Table 2**.

Table 2 - HWC boundary conditions for the New England Highway DN300 water-main at proposed connection point (Hydrant No. 359941) (elevation – 34.34m AHD)

Demand Scenario	HGL (m)
Average Day Demand (ADD)	78 (Max)
Peak Day Demand (PDD)	74 (Min)
95% Peak Day Demand (95PDD)	75 (Min)

Based on the boundary conditions presented in **Table 2** and making allowance for approx. 2 m of head-loss, the New England Highway watermain will supply suitable water pressures to development areas of elevation up to approximately 52 m AHD.

The development includes approx. 24 residential lots situated above the 52 m AHD elevation which will require connection to a boosted network. Looping the network in order to minimise dead ends results in an additional 27 lots proposed within the boosted network (based on the current masterplan).

Lochinvar East WPS

In addition to assessing construction of a new water pump station, the strategy also considered the option of connecting into a planned WPS nearby servicing multiple developments south of the New England Highway.

A regional water servicing strategy for the Lochinvar East precinct (south of the New England Highway) was developed by Barker Ryan Stewart (BRS) in 2021. The recommended option was to provide a high elevation boosted reticulation loop, supplied by a regional water pump station (WPS). This WPS is referred to as the Lochinvar East WPS herein. Hunter Water has indicated the Lochinvar East WPS will have a target HGL of 102.5 m AHD. The proposed WPS site is located to the south of the New England Highway, and would require a lead-in main extending from Lochinvar Ridge approx. 1.6 km to the Wyndella Rd development.

The BRS strategy did not encompass the Wyndella Rd development. However, the demand increase to the Lochinvar East WPS of 45 lots is considered minimal relative to the design catchment detailed in the BRS strategy of 1624 ET (approx. 3%). Therefore, drop-off in the delivery HGL during PDD following connection of the Wyndella Rd development is anticipated to be minimal. As such, upgrades to the Lochinvar East WPS are not anticipated to be required.

The existing water infrastructure and potential points of connection as described above are presented in **Figure 3**.

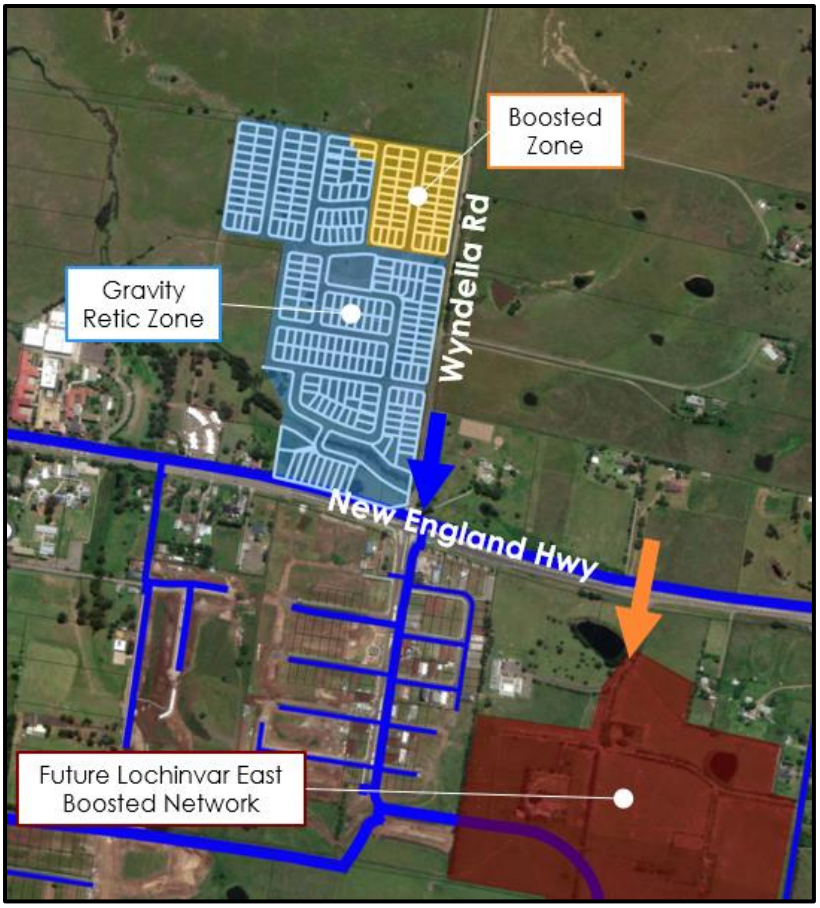

Figure 3 - Existing and Planned HWC Water Infrastructure and Potential Connection Points.

Blue arrows indicate potential connection points for supply of the gravity reticulation zone whilst orange arrows indicate potential connection points for supply of the boosted reticulation zone.

2.2 DESIGN LOADINGS

Design water demands have been determined in accordance with *Water Supply Code of Australia, Hunter Water Edition Version 2 (WSA 03-2011)*. Demands were calculated in accordance with Section 2.3 and Table HW 2.4. The adopted water consumption for the study area is as follows:

- Residential House – Maitland LGA: **285kL/year.**

The consumption values were applied to the development yields (based on current masterplans) to determine the design water demands, which are presented in **Table 3**.

Table 3 - Ultimate Water Supply Design Demands

Development	Demand (L/s)				
	Average Day Demands (ADD)	Peak Day Demand (PDD)	Peak Hour Demand (PHD)	95th Percentile PHD (95PHD)	95PHD + Fire Flow (10L/s)
Gravity Network – 216 Lots	1.9	6.2	12.6	10.1	20.1
Boosted Network – 51 Lots	0.5	1.5	3.0	2.5	12.5
Total	**2.4**	**7.7**	**15.6**	**12.6**	

Appendix D contains detailed calculations of the water demands for the study area.

3.0 Water Servicing Options

3.1 PROPOSED OPTIONS

The majority of the development site is situated below 52 m elevation, and will be serviced adequately through connection to the DN300 watermain within the New England Highway. The proposed gravity reticulation network is made up of a combination of DN150 and DN100 watermains located within the proposed road layout. A dual connection to the New England Highway watermain is proposed in order to ensure security of supply to the gravity reticulation network.

A small number of lots above 52 m elevation, located to the north east of the development site, are unable to maintain adequate service pressures through gravity reticulation alone. Therefore, the strategy assesses options for maintaining adequate service pressures for the high elevation lots within the Wyndella Rd development. Two options were assessed:

1. Construction of a new WPS within the development site.
2. Connection to the future boosted network to the south of the New England Highway through a lead-in main (approx. 1.6 km long).

The proposed infrastructure for each option is detailed in the following sections.

For each option, the alignment of reticulation mains and lead-in mains has been assumed based on current masterplans and is indicative only. The adopted layout ensures sound hydraulic assessment to ensure acceptable velocities, allowable head losses and acceptable pressure ranges are met for hydraulic design purposes. The adopted alignment would be subject to further assessment at the design stage; however, it is expected that a change in the layout would have negligible effect on service pressures.

3.1.1 Option 1

Option 1 involves construction of a WPS within the development site in order to boost service pressures for lots situated above 52 m elevation. The highest elevation lot within the development site is situated at approx. 60 m elevation.

For the purposes of the servicing strategy, preliminary specifications regarding the proposed WPS are provided in **Table 4** below. These specifications are based on preliminary modelling only (refer to **Section 3.3.1**) and would be refined during detail design of the pump station.

Table 4 - Preliminary Wyndella 1 WPS Specifications

Proposed Wyndella Rd 1 WPS		
	Peak Day Demands (PDD)	**Fire Fighting (95PDD + 10 L/s)**
Duty Flow (L/s)	3.0	12.5
Target Delivery HGL (m)	84	78

1. Head-losses of 1 m for PDD and 3 m for 95PDD + FF were modelled between the New England Highway connection point and the proposed WPS.

Due to the small number of lots within the boosted network, the pump station will be required to operate during low flow scenarios. The nominated fire flow of 10 L/s comprises the majority of the pump's duty flow. Therefore, difficulty is anticipated in selecting pumps which will operate efficiently during average day demands whilst maintaining suitable fire -fighting capability. An arrangement involving a combination of low duty jockey pumps with larger fire flow pumps may be optimal.

The proposed Option 1 infrastructure is provided in Exhibit STRAT-104 in **Appendix B**.

3.1.2 Option 2

Option 2 involves construction of a lead-in main (approximately 1.6 km long) from the future boosted reticulation network to the south of the New England Highway. This boosted network is understood to be currently under construction and services multiple developments within the Lochinvar Urban Release Area.

The proposed alignment involves making connection into the DN200 upstream of the non-return valve just south of the New England Highway. The alignment travels approx. 100 m north within the future road reserve before under boring the New England Highway (approx. 80 m length). The alignment then travels west within the New England Highway approx. 450 m to Wyndella Rd. The alignment travels a further approx. 900 m north within Wyndella Rd to the boosted reticulation network.

The boosted network is described in the Lochinvar East Water Servicing Strategy produced by Barker Ryan Steward (BRS) in April 2021. The BRS strategy anticipated an ultimate service area for the WPS comprising 1624 ET, generating a peak hour demand of 74.86 L/s. Therefore, the small increase in demand imposed by the Wyndella Rd development (2.7 L/s or approx. 4%) is unlikely to result in substantial pressure drop.

The proposed Option 2 infrastructure is provided in Exhibit STRAT-105 in **Appendix B**.

3.1.3 Dismissed Options

The option to make connection into the reticulation network boosted by the Windella 1 WPS was considered. However, the current residential area serviced by the Windella 1 WPS is small (approx. 280 lots) and the WPS is aged. ADW Johnson therefore understand that an upgrade to the Windella 1 WPS would be required prior to connection to avoid substantial residual pressure loss. Such upgrades would significantly impact the NPV of this option in comparison to Option 2.

In addition to the cost implications with upgrade of the Windella 1 WPS, the lead-in main would traverse through multiple private lots, impacting landowners and requiring easement acquisition. Maintenance access through such private lots would be limited. Therefore, this option was considered vastly inferior to Option 2 and was not assessed for multi-criteria analysis.

3.2 HYDRAULIC PERFORMANCE – GRAVITY RETICULATION

The proposed gravity reticulation network was modelled in WS Pro and its hydraulic performance assessed to ensure compliance to the requirements of WSA 03-2011. The WS Pro models for the ultimate scenario are provided in **Appendix D**. Results of the hydraulic analysis are outlined below.

3.2.1 Service Pressures

Customer points were modelled for each lot, to assess the minimum and maximum service pressures within the network. A simulation period of 24 hours was adopted to assess supply pressures under residential diurnal patterns. Fixed head values were applied at the nominated points of connection based on the Hunter Water supplied boundary conditions (see **Section 2.1**).

Service pressures were assessed under the following demand scenarios:

- Average Day Demand (ADD); and
- Peak Day Demand (PDD).

The modelled results for the gravity reticulation are provided in **Table 5** below.

Table 5 - Gravity Network Service Pressures – Ultimate Scenario

	Maximum ADD Pressure (m)	Minimum PDD Pressure (m)
Minimum Requirements	**60.0**	**20.0**
Modelled Results	46.7	22.3

All development lot property service connections meet HWC's service pressure requirements as shown in **Table 5**. Note that the internal reticulation network for each development lot has not been modelled as this pipework will be designed to *AS/NZS 3500:2003 Plumbing and drainage*.

3.2.2 Fire Flow Assessment

A fire flow analysis was undertaken using WS Pro under the 95th percentile demand scenario. A number of nodes distributed throughout the network were nominated as indicative hydrant locations for the fire flow analysis. See **Appendix D** for the assessed hydrant locations. The fire flow demand at the hydrant locations was:

- Residential – 10 L/s.

The hydrant assessment considered the above fire flow demand acting concurrently with 95th percentile network demands at 20:00 hours (peak diurnal demand).

The pressures in the network were compared with the minimum requirements nominated in accordance with WSA 03-2011 Table HW2.7, which are summarised below in **Table 6**.

Table 6 - Minimum Fire Flow Pressure Requirements

Scenario	Condition	Minimum Pressure at Hydrant	Minimum Residual Pressure Within Network
Ultimate	95PDD at Peak Hour + Fire Fighting Flow	15 m	3 m

Results of the fire flow analysis are summarised in **Table 7** below.

Table 7 - Water Servicing WS Pro Fire Flow Analysis Results

Critical Hydrant Node	Pressure at Hydrant Node at 10L/s (m)	Min Residual Customer Service Pressure (m)	Maximum Available Fire Flow (L/s)	Hydrant Pressure at Max Available Fire Flow (m)
1	18.0	19.7	14.9	15.0

As shown in **Table 7**, minimum fire flow requirements outlined in WSA 03-2011 are met for the critical hydrant node. The maximum available fire flow is 11.5 L/s before minimum pressure requirements are breached.

3.2.3 Security of Supply

As the gravity reticulation network is estimated to service 216 lots, an assessment of security of supply against system failures and maintenance has been undertaken. To assess security of supply, a critical link analysis on the network was performed in WS Pro.

A number of pipes within the system were nominated as critical links which are presented in **Appendix D**. WS Pro performs separate simulations for each of the nominated critical links, closing each link for their simulation. System pressures are assessed in each case and the number of properties which receive less than the minimum required pressure is reported. The minimum required pressure was nominated as 12 m in accordance with WSA 03-2011 Clause HW 1.4.3.

Results of the critical link analysis are summarised below in **Table 8**.

Table 8 - WS Pro Critical Link Analysis Results

Critical Link Shutdown Scenario	Minimum Customer Point Pressure (m)	Number of Customers Below 12 m Pressure
Link 1 (DN150)	20.9	0
Link 2 (DN150)	21.9	0
Link 3 (DN150)	21.6	0

As seen in **Table 8**, a minimum service pressure of 12 m is retained at all customer points under the closed critical link scenarios.

The layout of the gravity reticulation network is looped such that, considering typical isolation valve locations (confirmed in detail design), the maximum number of properties within an isolation area is less than 40 in accordance with WSA 03-2011 Table 8.2.

Wyndella Road Watermain

The length of lead-in watermain on Wyndella Road from the New England Highway to the development was not assessed in the critical link analysis (see **Figure D3** in **Appendix D**). The current hydraulic modelling assumes a single watermain which would therefore cut off supply to the entire development during maintenance or pipe-break scenarios.

Duplication of this lead-in main will be required at 100 lots if alternative security of supply measures are not available.

Alternative Connection Adjacent Park

An alternative option for providing security of supply is proposed through a potential DN100 main within the park at the south of the development, connecting into the New England Highway watermain. This main is presented in Appendix B drawing no. STRAT-103. **Table 9** presents minimum supply pressures utilising this alternative connection during an outage of the Wyndella Road DN200.

Table 9 – WS Pro Assessment of Alternative Security of Supply Connection

Critical Link Shutdown Scenario	Minimum Customer Point Pressure (m)	Number of Customers Below 12 m Pressure
Wyndella Road DN200	16.0	0

Hydraulic modelling indicates all customers achieve the minimum service pressure of 12 m. Therefore, this connection could be investigated during detail design as an alternative to duplication of the Wyndella Road watermain.

3.3 BOOSTED RETICULATION

3.3.1 Service Pressures and Fire Fighting Capacity

Option 1

The boosted reticulation network was modelled in WS Pro with a fixed head node modelled at the proposed WPS site. The required boundary conditions (or WPS delivery HGL) to ensure compliance to WSA 03-2011 was then deduced based on friction losses within the network. Calculation of the required pump station specifications are provided in **Table 10** below.

Table 10 - Preliminary Assessment of Wyndella Road 1 WPS Specifications

Scenario	Flowrate (L/s)	Critical Lot/Hydrant Elevation (m AHD)	Minimum Required Pressure (m)	Friction Losses (m)[1]	Target Delivery HGL (m AHD)
PDD	3.0	58 m	25	1	84
95PDD + 10 L/s	12.5	60 m	15	3	78

1. Friction losses throughout reticulation network calculated in WS Pro.

Option 2

The boosted reticulation network and lead-in main was modelled in WS Pro, with a fixed head node at the proposed point of connection for the lead-in main. The modelled

boundary conditions at the point of connection were based on the HWC advised target HGL for the Lochinvar East WPS and are presented in **Table 11** below.

Table 11 - Option 2 Modelled Boundary Conditions

Scenario	WPS Target Delivery HGL (m AHD)	Friction Loss to Connection Point (m)[1]	Modelled Boundary Condition HGL (m AHD)
PDD	102.5	0.5 m	102
95PDD + 10 L/s	102.5	3 m	99.5

1. Friction losses through the connection point were approximated based on 700 m length of DN200.

A preliminary assessment of service pressures and fire flow was undertaken based on the above modelled boundary conditions. The assessment results are summarised in **Table 12** below.

Table 12 - Option 2 Boosted Reticulation Service Pressure and Fire Flow Assessment

Scenario	Boundary Condition (m AHD)	Critical Lot/Hydrant Elevation (m AHD)	Friction Losses (m)[1]	Residual Lot/Hydrant Pressure (m)	Minimum Required Pressure (m)
PDD	102	58 m	1	43	25
95PDD + 10 L/s	99.5	60 m	8	31.5	15

1. Friction losses throughout reticulation network and lead-in main calculated in WS Pro.

As presented in **Table 12**, the minimum service pressure and fire-fighting requirements are met for the boosted reticulation network via connection into the Lochinvar East WPS.

The lowest elevation lot within the boosted reticulation network is situated at approx. 44 m AHD. Therefore, based on the assumed delivery HGL of the Lochinvar East WPS of 102.5 m, the maximum allowable pressure of 60 m will not be exceeded.

3.3.2 Security of Supply

In order to supply security of supply to the boosted network in the event of power outage/WPS failure, zone valves (normally closed) at the interface between the boosted and un-boosted networks are proposed.

The WPS outage scenario was assessed in WS Pro during PDD (see **Figure D4** in **Appendix D**). The results of the assessment are presented in **Table 13** below. All customers receive a minimum of 12 m pressure during the WPS outage scenario.

Table 13 - Boosted Reticulation – WPS Failure Scenario

Scenario	Minimum Customer Point Pressure (m)	Number of Customers Below 12 m Pressure
WPS Failure	13.4	0

4.0 Option Multi Criteria Analysis

The multi-criteria analysis was differentiated by the proposed servicing of the high elevation boosted zone for each option.

4.1 COMMUNITY/STAKEHOLDER CONSTRAINTS AND IMPACTS

Option 1 involves construction of a WPS within the development site. No landowners are anticipated to be impacted.

Option 2 involves construction of a lead-in main through existing and future road reserves. No landowners are anticipated to be impacted.

The lead-in main proposed in Option 2 is required to be minimum DN150 in order to minimise friction losses under fire flow scenarios and maintain fire-fighting capability. As a result, during average day demand velocities through the lead-in main will be minimal (less than 0.05 m/s). Based on the length of lead-in main (approx. 1.6 km), water-age is anticipated to be approx. 1 day from the New England Highway to the reticulation network. There is a likelihood of poor water quality during periods of low demand for these options.

Water main connection may have temporary impacts to the existing community during construction. Construction techniques, such as hot-tapping, will reduce water interruptions and consumer impacts.

4.2 ENVIRONMENTAL CONSTRAINT/IMPACT

No significant environmental constraints or impacts are anticipated between the proposed options.

4.3 TECHNICAL ASSESSMENT

An assessment of technical matters for the proposed water servicing strategy is provided below.

4.3.1 Performance and Security of Supply

The proposed strategy provides water supply to the development site meeting HWC's requirements under all operating scenarios. Further detail regarding the reticulation network performance is provided in **Section 3.0**.

4.3.2 Flexibility and Adaptability

Adequate provisions have been made for each option to ensure suitable supply, without requiring major upgrades, should the land use change in the future.

Demands from potential future developments to the west of the Wyndella Road development have not been applied to the modelling. No masterplans or servicing strategies have been developed for these lands, and therefore any additional demand which may be drawn from the proposed infrastructure is unknown. However, there is significant spare capacity within the DN150 and DN200 watermains in the proposed DRL. Combined with the lower elevation topography of the residential zoned lands to the west, servicing issues are not anticipated should such land be developed.

4.3.3 Constructability

The lead-in main proposed in Option 2 requires an under-bore of the New England Highway. Due to the magnitude of the highway and number of services within the corridor, construction difficulties are anticipated for the construction of the under-bore.

4.3.4 Maintainability

Option 1 proposes a new WPS which will require regular maintenance. Conversely, Option 2 proposes the construction of new lead-in mains. It is anticipated that these lead-in mains will require less maintenance than a new WPS.

4.4 COST ESTIMATE

Capital cost estimates were calculated using the Hunter Water estimating tool. As the gravity and boosted reticulation networks across all options were the same, cost estimation was only undertaken on infrastructure unique to each option, i.e., WPS's and lead-in mains. The estimated capital costs for each option are presented in **Table 14**.

Table 14 - Summary of capital cost estimates (WPS and lead-in mains)

OPTION 1	OPTION 2
$760,000	$900,000

The capital cost estimates for the WPS (Option 1) and lead-in mains (Option 2) presented in **Table 14** are based on the following assumptions and inclusions:

- The new WPS proposed in Option 1 was assumed to be a compliant WPS including a standard in-ground pit type construction. A nominal number of external fittings and one valve pit has been allowed for;
- Option 2 has made allowance for an under-bore of the New England Highway, based on an 80 m length directional drill required through rock;
- Lead-in main proposed in Option 2 is DN150 PVC pipe; and
- Allowance for traffic control, excavation close to services and tree pruning has been made where necessary.

Appendix E contains the full HWC cost estimating tool outputs.

Cost Effective Analysis (CEA) was then undertaken, considering operational and maintenance costs for each option over an appraisal period of 25 years. Operational and maintenance costs were estimated in accordance with the Hunter Water Guideline for the Financial Analysis of Strategic Water and Sewer Options. A discount rate of 7% was considered.

The calculated Net Present Values (NPV) for all options are presented in **Table 15**. The NPV calculations for each option are provided in **Appendix F**.

Table 15 - Summary of Option NPVs (7% discount rate)

OPTION 1	OPTION 2
$801,000	$900,000

The option NPVs are based on the following inclusions and assumptions:

- For Option 1, a pump and SCADA replacement of $50,000 has been allowed for at year 15;
- For Option 1, pump maintenance corresponding to an annual cost of $2,000 has been assumed; and
- As all options propose connecting into a WPS supplied boosted reticulation network, electricity costs have been assumed similar and therefore excluded.

5.0 Recommended Option

Option 1 has been recommended due to the following factors:

- Minimises community cost (lowest NPV); and
- Minimises impact on surrounding infrastructure; and
- Eliminates potential water quality issues associated with the long lead-in mains proposed in Option 2.

Appendix A

CORRESPONDENCE WITH HUNTER WATER

Andrew Fuller

From: Ronald Bridge <ronald.bridge@hunterwater.com.au>
Sent: Tuesday, 27 September 2022 3:14 PM
To: Andrew Fuller
Cc: Chris Barker; Barry Calderwood; Wesley Jones
Subject: RE: 2022-1185 Servicing Advice Lochinvar

Hi Andrew,

Thanks for your enquiry,

Please find the requested HGL's below (

(HGLs, not residual pressures):

DN300 CICL water main on New England Highway, Lochinvar
Hydrant No: 359941
Z (elevation): 34.34

Boundary Condition	HGL (m AHD)
ADD (max)	78
PDD (min)	74
95% PDD (min, no Fire Flow)	75

Kind Regards,

-
Ron Bridge
Land Development Engineer | Hunter Water Corporation
36 Honeysuckle Drive Newcastle NSW 2300 | PO BOX 5171 HRMC NSW 2310
Ph: (02) 4064 7844 | ronald.bridge@hunterwater.com.au | hunterwater.com.au

From: Andrew Fuller <andrewf@adwjohnson.com.au>
Sent: Tuesday, 27 September 2022 11:48
To: Ronald Bridge <ronald.bridge@hunterwater.com.au>

Cc: Chris Barker <chrisb@adwjohnson.com.au>; Barry Calderwood <barry.calderwood@hunterwater.com.au>
Subject: 2022-1185 Servicing Advice Lochinvar

Hi Ron,

We have reviewed the servicing advice attached. For the water supply, the advice states the minimum HGL of the Four Mile Creek 1 Reservoir is 72m.

However, to confirm the boundary conditions for our modelling, could you please provide the following at the point of connection to the DN300 CICL New England Highway watermain:

- ADD max HGL
- PDD min HGL
- 95PDD min HGL

Regards,

Andrew Fuller
CIVIL ENGINEER

Hunter Office
Ph: 02 4978 5100
Mob: 0401 421 564

ADW Johnson Pty Limited
Hunter 7/335 Hillsborough Road, Warners Bay NSW 2282
Central Coast 5 Pioneer Avenue, Tuggerah NSW 2259
Sydney Level 35 One International Towers, 100 Barangaroo Avenue, Sydney NSW 2000

Appendix B

EXHIBITS

240322–STRAT-100 – Study Area
240322–STRAT-101 – Proposed Development Masterplan
240322–STRAT-102 – Existing HWC Water Infrastructure
240322–STRAT-103 – Water Strategy – DRL Low Pressure Zone
240322–STRAT-104 – Water Strategy – DRL Boosted Pressure Zone – Option 1
240322–STRAT-105 – Water Strategy – DRL Boosted Pressure Zone – Option 2

240332-STRAT-100-B

1
DP65706

2
DP818314

9
DP747391

12
DP747391

11
DP1219648

13
DP747391

2
3
4
5
6
DP747391

14
DP1219648

1
DP741330

22
DP231

227

226

225
DP246447

224

223

WYNDELLA ROAD

TO SINGLETON

NEW ENGLAND HIGHWAY

FROM MAITLAND

LEGEND

DEVELOPMENT SITE
APPROX. 22.5 ha.

CADASTRAL BOUNDARIES (D.C.D.B.)

ver.	date	comment	drawn	pm	co-ordinate information	level information	scale (A1 original size)	notes
B	05.07.2023	UPDATED TO COMMENTS	RC	A.F.	CO-ORDINATE SYSTEM: N/A	DATUM: N/A CONTOUR INTERVAL: N/A	0 30 60 75m SCALE: 1:1500 (FULL)	

working beyond expectations

drawing title:

WATER STRATEGY STUDY AREA

location:
NEW ENGLAND HIGHWAY AND WYNDELLA ROAD, LOCHINVAR

council: MAITLAND CITY COUNCIL

dwg ref: 240332-STRAT-100-B

client:
CPG ESTATES

adw johnson
central coast office ph: (02) 4305 4300
hunter office ph: (02) 4978 5100
sydney office ph: (02) 8046 7411
www.adwjohnson.com.au

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Plotted By: Robert Cromarty Plot Date: 05/07/23 4:45:30PM Cad File: N:\240332\DWG\WATER & SEWER\STRAT\WATER\240332-STRAT-100-B.DWG

This plan includes coloured information. If you have a black and white copy you do not have all of the information. This note is coloured RED.

DP65706

STAGE 9

STAGE 8

STAGE 7

STAGE 5

STAGE 6

STAGE 3

STAGE 4

STAGE 1

STAGE 2

STAGE 10

WYNDELLA ROAD

NEW ENGLAND HIGHWAY

11
DP1219648

1
DP741330

L4
DP1219648

224

225

LEGEND

PROPOSED DEVELOPMENT LOT BOUNDARIES

ver.	date	comment	drawn	pm	co-ordinate information	level information	scale (A1 original size)	notes
B	05.07.2023	UPDATED TO COMMENTS	RC	A.F.	CO-ORDINATE SYSTEM: N/A	DATUM: N/A CONTOUR INTERVAL: 0.2m	0 25 50m SCALE: 1:1000 (FULL)	

working beyond expectations

drawing title:

WATER STRATEGY
DEVELOPMENT MASTER PLAN

location:
NEW ENGLAND HIGHWAY AND
WYNDELLA ROAD, LOCHINVAR

council: MAITLAND CITY COUNCIL

dwg ref: 240332-STRAT-101

client:

CPG ESTATES

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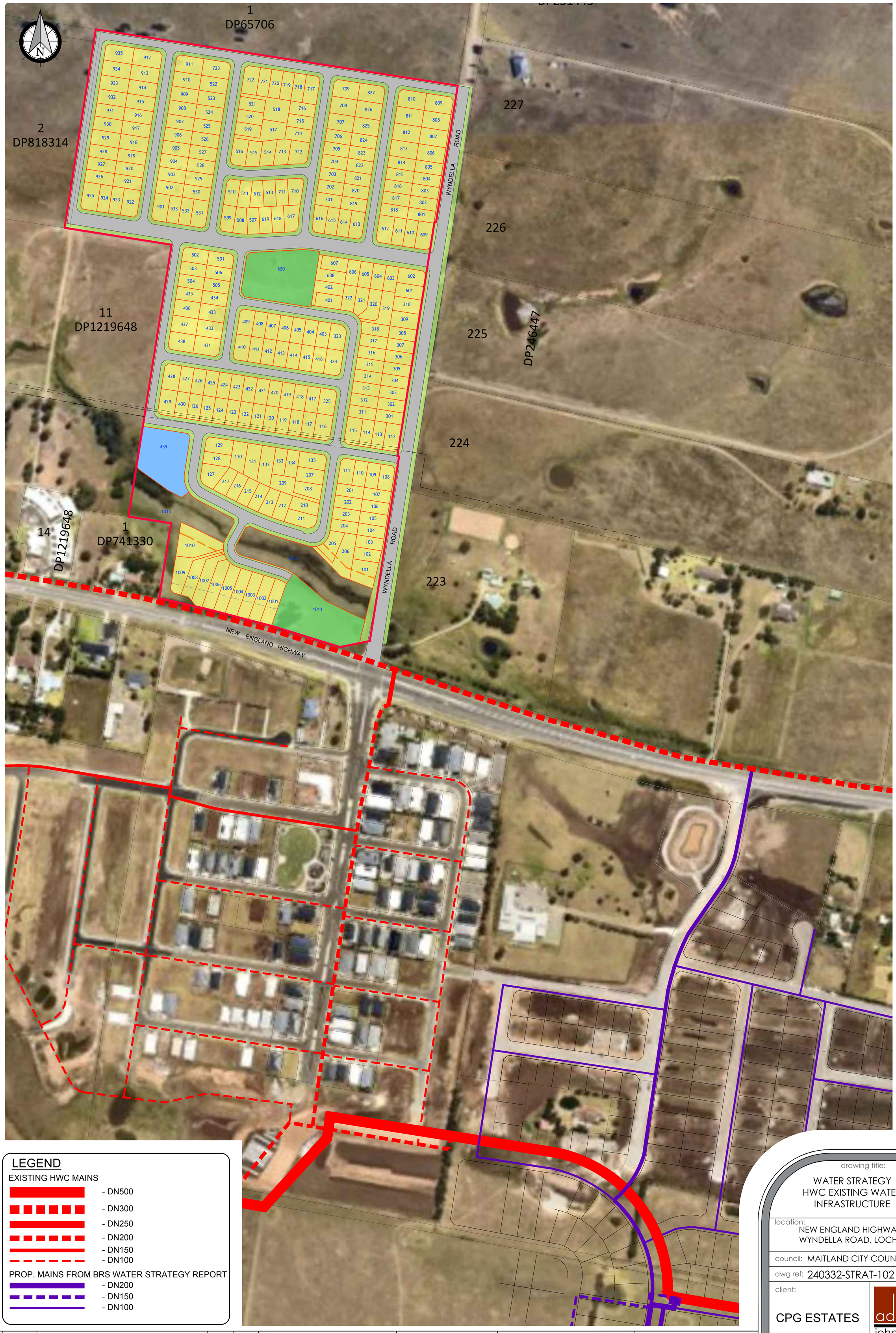
240332-STRAT-100-B



LEGEND

EXISTING HWC MAINS

- DN500
- DN300
- DN250
- DN200
- DN150
- DN100

PROP. MAINS FROM BRS WATER STRATEGY REPORT

- DN200
- DN150
- DN100

ver.	date	comment	drawn	pm	co-ordinate information	level information	scale (A1 original size)	notes
B	05.07.2023	UPDATED TO COMMENTS	RC	A.F.	CO-ORDINATE SYSTEM: N/A	DATUM: N/A CONTOUR INTERVAL: N/A	0 50 100m SCALE: 1:2000 (FULL)	

working beyond expectations

drawing title:

WATER STRATEGY
HWC EXISTING WATER INFRASTRUCTURE

location:
NEW ENGLAND HIGHWAY AND WYNDELLA ROAD, LOCHINVAR

council: MAITLAND CITY COUNCIL

dwg ref: 240332-STRAT-102

client:

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240332-STRAT-100-B

DP65706

DP1219648 11

DP741330 1

DP1219648 L4

DP1219648 225

DP1219648 224

WYNDELLA ROAD

NEW ENGLAND HIGHWAY

DUPLICATION OF WYNDELLA ROAD LEAD-IN MAIN REQUIRED AT 100 LOTS TO PROVIDE SECURITY OF SUPPLY TO DEVELOPMENT

POTENTIAL ALTERNATIVE DN100 SECURITY OF SUPPLY MAIN

CONNECTION TO NEW ENGLAND DN300 WATER MAIN

LEGEND

- PROPOSED LOT BOUNDARIES
- PROPOSED DN200 MAIN
- PROPOSED DN150 MAIN
- PROPOSED DN100 MAIN
- EXISTING HWC MAIN

ver.	date	comment	drawn	pm	co-ordinate information	level information	scale (A1 original size)	notes
B	05.07.2023	UPDATED TO COMMENTS	RC	A.F.	CO-ORDINATE SYSTEM: N/A	DATUM: A.H.D. CONTOUR INTERVAL: 1m	0 25 50m SCALE: 1:1000 (FULL)	

working beyond expectations

drawing title:

WATER STRATEGY
DRL LOW PRESSURE ZONE

location:
NEW ENGLAND HIGHWAY AND WYNDELLA ROAD, LOCHINVAR

council: MAITLAND CITY COUNCIL

dwg ref: 240332-STRAT-103

client:

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240332-STRAT-100-B

DP65706

PROPOSED WPS:
PDD
DUTY: 2.7 L/s
TARGET HGL: 84m

95PDD + FIRE FLOW
DUTY: 12.2 L/s
TARGET HGL: 78m

APPROX. 53 LOTS WITHIN THE BOOSTED ZONE

ZONE VALVE (NORMALLY CLOSED) BETWEEN BOOSTED AND LOW PRESSURE NETWORKS

ZONE VALVE (NORMALLY CLOSED) BETWEEN BOOSTED AND LOW PRESSURE NETWORKS

WYNDELLA ROAD

NEW ENGLAND HIGHWAY

11
DP1219648

1
DP741330

224

225

LEGEND

- PROPOSED BOUNDARIES
- PROPOSED DN200 MAIN
- PROPOSED DN150 MAIN
- PROPOSED BOOSTED DN150 MAIN
- PROPOSED DN100 MAIN
- PROPOSED BOOSTED DN100 MAIN
- LOTS WITHIN BOOSTED ZONE
- EXISTING HWC MAIN

ver.	date	comment	drawn	pm	co-ordinate information	level information	scale (A1 original size)	notes
B	05.07.2023	UPDATED TO COMMENTS	RC	A.F.	CO-ORDINATE SYSTEM: N/A	DATUM: A.H.D. CONTOUR INTERVAL: 1m	0 25 50m SCALE: 1:1000 (FULL)	

working beyond expectations

drawing title:
WATER STRATEGY
DRL BOOSTED ZONE - OPTION 1
NEW WPS

location:
NEW ENGLAND HIGHWAY AND WYNDELLA ROAD, LOCHINVAR

council: MAITLAND CITY COUNCIL

dwg ref: 240332-STRAT-104

client:
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240332-STRAT-100-B

DOWNSIZED DEAD END OR ALTERNATIVE LOOP

ZONE VALVES (NORMALLY CLOSED) BETWEEN BOOSTED AND LOW PRESSURE NETWORKS

WYNDELLA ROAD

NEW ENGLAND HIGHWAY

DN150 LEAD-IN MAIN

NEW ENGLAND HIGHWAY CROSSING

LEAD-IN MAIN CONNECTS INTO FUTURE LOCHINVAR EAST BOOSTED NETWORK

227

226

225

224

223

DP246447

11
219648

1
DP741330

LEGEND

- PROPOSED BOUNDARIES
- PROPOSED DN200 MAIN
- PROPOSED DN150 MAIN
- PROPOSED BOOSTED DN150 MAIN
- PROPOSED DN100 MAIN
- PROPOSED BOOSTED DN100 MAIN

EXISTING HWC MAINS

- DN300
- DN250
- DN200
- DN150
- DN100

PROP. MAINS FROM BRS WATER STRATEGY REPORT

- DN200
- DN100

ver.	date	comment	drawn	pm
B	05.07.2023	UPDATED TO COMMENTS	RC	A.F.

co-ordinate information: CO-ORDINATE SYSTEM: N/A

level information: DATUM: A.H.D.
CONTOUR INTERVAL: 1m

scale (A1 original size): 0 30 60 75m
SCALE: 1:1500 (FULL)

notes:

working beyond expectations

drawing title:
WATER STRATEGY - RETICULATION PLAN
BOOSTED ZONE OPT.2 - LEAD-IN MAIN FROM LOCHINVAR EAST BOOSTED NETWORK

location:
NEW ENGLAND HIGHWAY AND WYNDELLA ROAD, LOCHINVAR

council: MAITLAND CITY COUNCIL

dwg ref: 240332-STRAT-105

client:
CPG ESTATES

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Appendix C

DETAILED LOAD CALCULATIONS

WSAA HWC Edition Water Loading Calculations

Project:	240332
Client:	
Prepared by:	ADW Johnson
Designer:	A. Fuller
Date:	31/10/2022
Description:	Preliminary Water Loading

		AVERAGE					PEAK							EXTREME		95th PERCENTILE (FIRE FLOWS)				
Type	**Lots/ET**	**Average Annual Demand (kL/yr/ET)**	**Total Annual Consumption (kL/yr)**	**Average Day Demand (kL/day)**	**Average Hour Flow (L/s)**	**Customer Point Demand (L/day)**	**Peak Day Factor**	**Diversity Factor (Based on Total)**	**Peak Day Demand (kL/day)**	**Peak Hour Factor**	**Peak Hour Demand (kL/day)**	**Peak Hour Flow (L/s)**	**Customer Point Demand (L/day)**	**Extreme Day Factor**	**Extreme Day Demand (kL/day)**	**95^{th}p Factor**	**95^{th}p peak day demand (kL/day)**	**95^{th}p peak hour demand (kL/day)**	**95^{th}p peak hour flow (L/s)**	**95^{th}p peak hour flow (L/s) + Fire Fighting (10L/s)**	**Customer Point Demand (L/day)**
Residential - Gravity	210	285.0	59850.0	**164.0**	**1.898**	780.8	2.25	1.47	540.5	2.02	1091.9	**12.64**	2574.05	1.15	**621.6**	1.8	432.4	873.5	**10.11**	**20.1**	2059.24
Residential - Boosted	51	285.0	14535.0	**39.8**	**0.461**	780.8	2.25	1.47	131.3	2.02	265.2	**3.07**	2574.05	1.15	**151.0**	1.8	105.0	212.1	**2.46**	**12.5**	2059.24
Total	261	285.0	74385.0	**203.8**	**2.4**	780.8	2.25	1.47	671.8	2.02	1357.1	**15.71**	2574.05	1.15	**772.6**	1.8	537.5	1085.7	**12.57**	**22.6**	2059.24

Appendix D

WS PRO MODELLING LAYOUTS

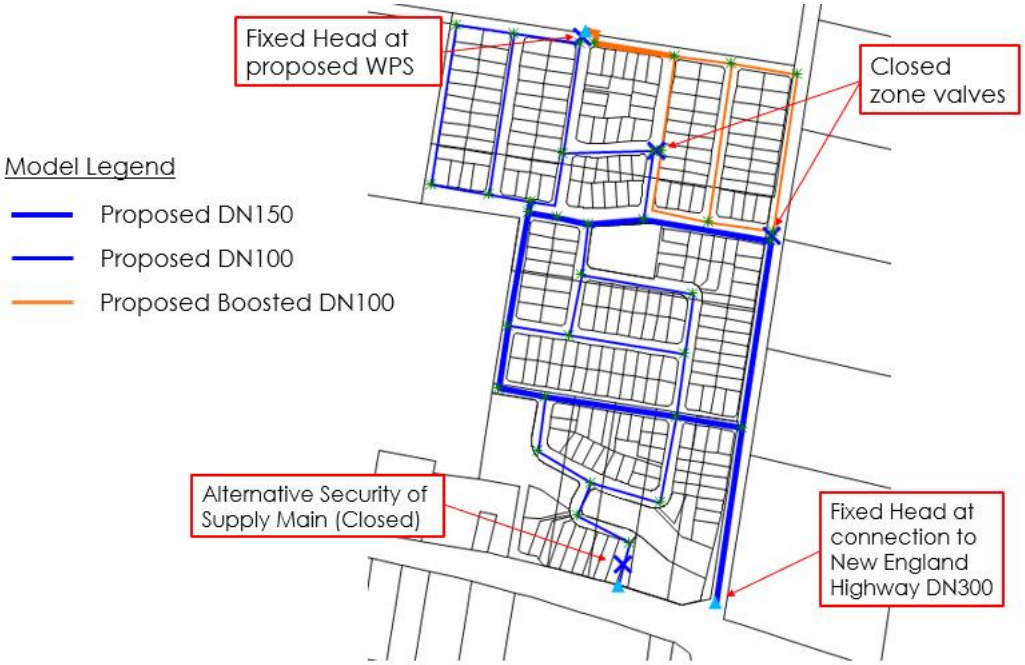

Figure D1 – WS Pro Model – Gravity Network and Option 1 Boosted Network

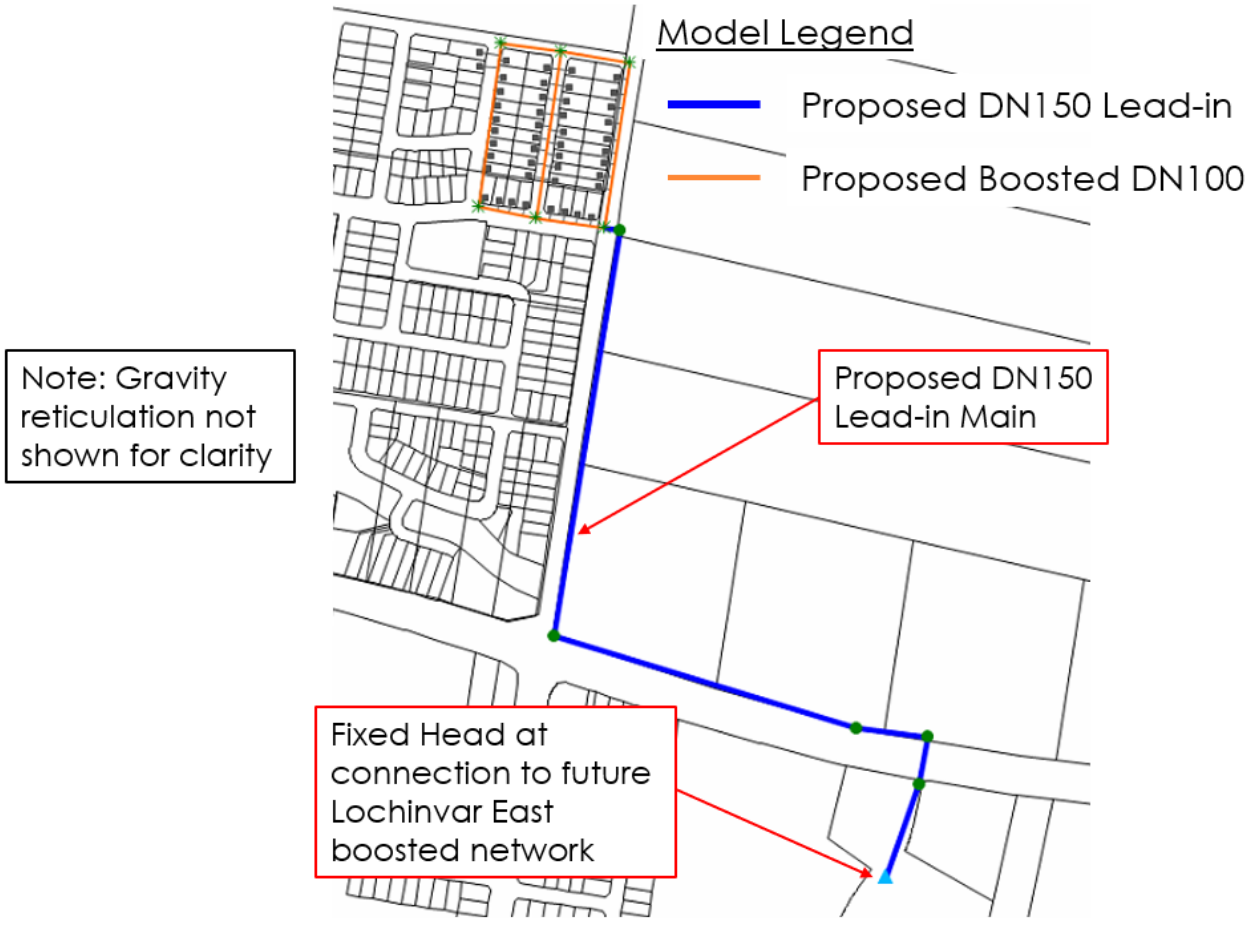

Figure D2 – WS Pro Model – Option 2 Lead-in and Boosted Network

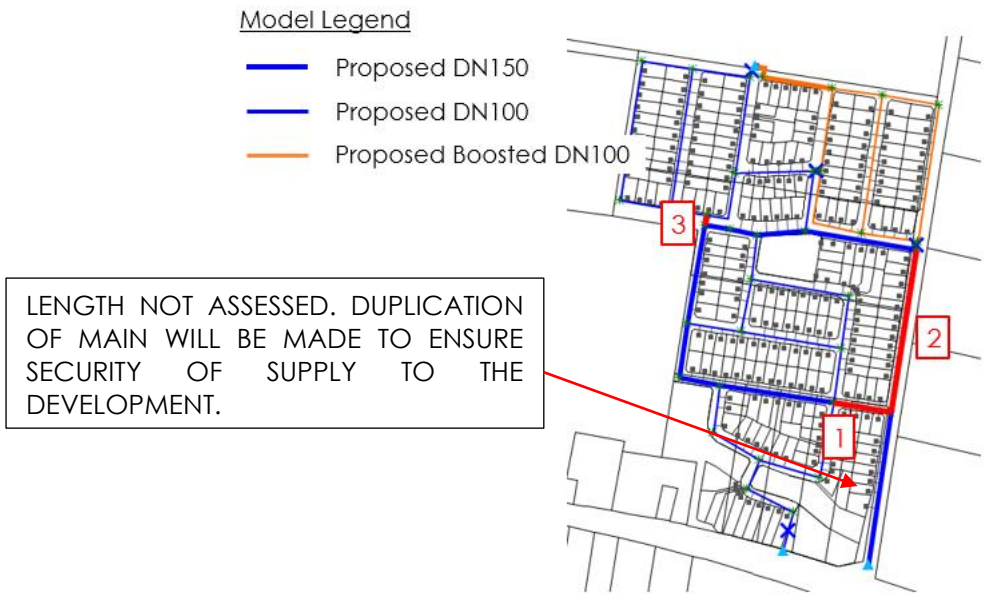

Figure D3 – WS Pro Model – Gravity Network Critical Links

Note: Red Links denote links nominated for Critical Link Analysis

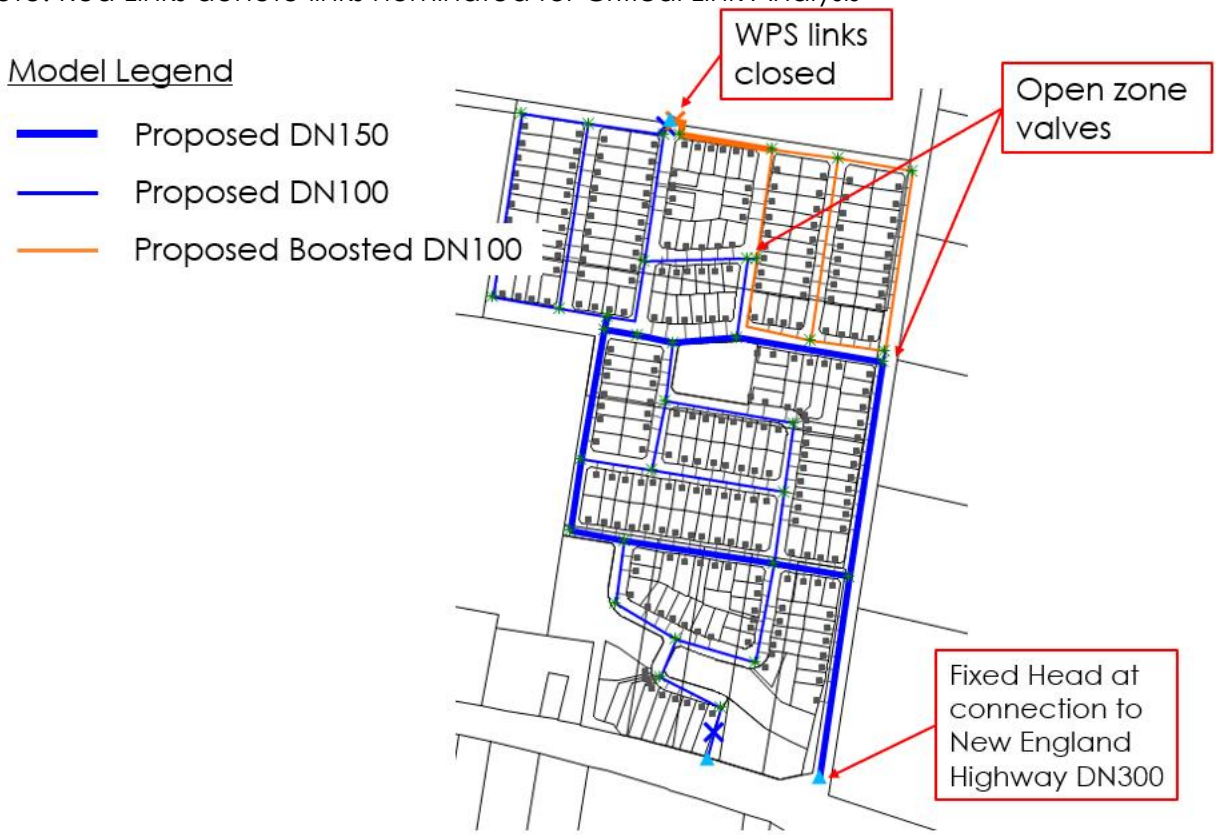

Figure D4 – WS Pro Model – WPS Failure Scenario

Figure D5 – WS Pro Model – Alternative Security of Supply Main Scenario

Figure D6 – WS Pro Model – Hydrant Locations

Appendix E

OUTPUT FROM HWC ESTIMATING GUIDELINES

ESTIMATING SHEET

PROJECT DESCRIPTION: 240332-Option 1-WPS

Item No.	Item Description	Qty	Unit	Rate $/Unit	Amount $	Application of Schedule of Rates	Capital Project Estimate Code	WBS
HW0001	All work not included elsewhere in this schedule	Item	Lump Sum	$ 6,648.00	$ 6,648.00	**Payment**: Maximum of 10% shall be due each month until 70% of the amount has been paid. Remainder at Practical Completion.	Delivery	
HW0002	Site Establishment <Insert Max $>	Item	Lump Sum	$ 28,000.00	$ 28,000.00	**Payment**: 100% after completion.		
HW0003	Site Disestablishment <Insert Min $>	Item	Lump Sum	$ 28,000.00	$ 28,000.00	**Payment**: 100% after completion.		
HW0004	Preparation and implementation of the Construction EMP	Item	Lump Sum	$ 8,200.00	$ 8,200.00	**Payment**: Maximum of 30% on submission of complying Construction EMP, then 10% per month up to maximum of 80%. Remainder at Practical Completion. **Submit:** Construction EMP.		
HW0005	Preparation and implementation of the Safety Management Plan.	Item	Lump Sum	$ 14,200.00	$ 14,200.00	**Payment**: Maximum of 30% on submission of complying plan, then 10% per month up to maximum of 80%. Remainder at Practical Completion. **Submit:** Safety Management Plan.		
HW0007	Preparation and Implementation of Quality Management Plan	Item	Lump Sum	$ 5,690.09	$ 5,690.09	**Payment**: Maximum of 30% on submission of complying Quality Management Plan, then 10% per month up to maximum of 80%. Remainder at Practical Completion.		

WPS

Item	*Pump Station - Name*	Qty	Unit	Rate $/Unit	Amount $	Application of Schedule of Rates	Code	WBS
HW0101	**WPS 2.1m dia 2 Pump(s)**						Delivery	
	Clear, excavate & backfill in OTR conditions, supply & construct pipework, 1.5m deep pump pit, tread plate, ancillary metal work & fittings. Supply & place formwork, reinforcement, concrete, valve & pump supports, thrust blocks, valve pit covers.	Item	Lump Sum	$ 88,050.00	$ 88,050.00	**Payment**: <Insert appropriate percentages to reflect the value of work at key milestones eg excavation, pump well, metalwork etc>. **Submit:** Relevant Quality Records.		
HW0102	**Pumps for Pumping Stations** - Supply and install pumps and associated fittings, connection to pipework, testing and commissioning.	2	Lump Sum	$ 5,315.00	$ 10,630.00	**Payment**: <Insert appropriate percentages for key milestones eg installation, precommissioning, commissioning>. **Submit:** Relevant Quality Records including those for pump test.		
HW0103	**Pumping Station Electricals**							
HW0103.01	Pit and Conduit System	Item	Lump Sum	$ 3,875.00	$ 3,875.00	**Payment**: Percentage of work completed. **Submit:** Relevant Quality Records.		
HW0103.02	LV Station Power Supply	Item	Lump Sum	$ 6,120.00	$ 6,120.00	**Payment**: Percentage of work completed. **Submit:** Relevant Quality Records.		
HW0103.05	Switchboard	Item	Lump Sum	$ 68,000.00	$ 68,000.00	**Payment**: Percentage of work completed. **Submit:** Relevant Quality Records.		
HW0103.06	PLC / Telemetry Hardware	Item	Lump Sum	$ 16,120.00	$ 16,120.00	**Payment**: Percentage of work completed. **Submit:** Relevant Quality Records.		
HW0103.07	PLC / Telemetry / Scada Engineering and Software Development	Item	Lump Sum	$ 31,720.00	$ 31,720.00	**Payment**: Percentage of work completed. **Submit:** Relevant Quality Records.		
HW0103.10	Pressure Transmitter/Gauge Board	Item	Lump Sum	$ 11,875.00	$ 11,875.00	**Payment**: Percentage of work completed. **Submit:** Relevant Quality Records.		
HW0103.11	Installation/Cabling (Electrical)	Item	Lump Sum	$ 11,987.00	$ 11,987.00	**Payment**: Percentage of work completed. **Submit:** Relevant Quality Records.		
HW0106	**Service Location**	Item	Lump Sum	$ 352.80	$ 352.80	**Payment**: Maximum of 10% shall be due each month until 70% of the amount has been paid. Remainder at Practical Completion.		
HW0115	Acid sulphate soil							
HW0115.01	Initial testing for acid sulphate soils and prepare and submit report	5	per test	$ 140.00	$ 700.00	**Submit:** Result for each test. **Limits of Accuracy:** <To be inserted>		
HW0117	Supply and Install valve pit concrete formwork, reinforced concrete complete with aluminium tread plate covers and including excavation and backfill	Item	Lump Sum	$ 7,490.00	$ 7,490.00	**Payment**: <Insert appropriate percentages to reflect the value of work at key milestones eg excavation, reinforced concrete, metalwork etc>. **Submit:** Relevant Quality Records.		
HW0118	Supply and install pipework items inside valve pit	Item	Lump Sum	$ 2,070.00	$ 2,070.00	**Payment**: Valued at percentage of work completed. Retention of 20% <or other percentage> until satisfactory testing. **Submit:** Relevant Quality Records.		
HW0128	**Miscellaneous**							
HW0128.01	Stormwater Headwalls	2	Each	$ 10,000.00	$ 20,000.00			
HW0129	Preparation and submission of Operation and Maintenance Information	Item	Lump Sum	$ 4,800.00	$ 4,800.00	**Payment:** 100% at Practical Completion. **Submit:** Complying Work As Constructed Information.		
HW0130	Pre commissioning and commissioning	Item	Lump Sum	$ 8,000.00	$ 8,000.00	**Payment**: 50% at completion of satisfactory precommissioning. Remainder at Practical Completion. **Submit:** Relevant Quality Records.		
HW0131	Preparation and submission of Work as Constructed Information	Item	Lump Sum	$ 7,200.00	$ 7,200.00	**Payment:** 100% at Practical Completion. **Submit:** Complying Work As Constructed Information.		
HW1WP	***Sub Total***				$298,990			

Includes: ladder(s), B(t) Terrain Allowance,

Item No.	Item Description	Qty	Unit		Amount $	Application of Schedule of Rates	Capital Project Estimate Code	WBS
HW0012	Preconstruction record							

A.	**TOTAL ESTIMATED CONTRACT AWARD SUM**	$ 389,727.89

B.	**PRE-CONSTRUCTION COST (Table 10)**	
HW0016	Design	$ 77,945.58
HW0017	Project Management of Design	$ 31,589.12
HW0024	Community Consultation	
	Sub Total(B1)	$ 109,534.69
	Pre construction contingency (30% of B1)	$ 32,860.41
	TOTAL PRE-CONSTRUCTION COST (B)	$ 142,395.10

C.	**CONSTRUCTION COST**		
	Total Estimated Contract Award Sum (A)		$ 389,727.89
HW0023	Construction Management (Table 11)		$ 85,740.14
	Sub Total (C1)		$ 475,468.03
	Construction contingency (Table 12) (30% of C1)	Preliminary Estimate	$ 142,640.41
	TOTAL CONSTRUCTION COST (C)		$ 618,108.43

	TOTAL PRELIMINARY PROJECT ESTIMATE (B+C) (Preliminary Estimate)	$ 760,503.54

Development	
Delivery	
Total Cost	

ESTIMATING SHEET

PROJECT DESCRIPTION: 240332-Option3-Leadin Watermain

Date Priced: 17-Jan-2023

Date Cost Tables updated: 24-Oct-2018

Item No.	Item Description	Qty	Unit	Rate $/Unit	Amount $	Application of Schedule of Rates	Capital Project Estimate Code	WBS
HW0001	All work not included elsewhere in this schedule	Item	Lump Sum	$ 7,822.00	$ 7,822.00	**Payment**: Maximum of 10% shall be due each month until 70% of the amount has been paid. Remainder at Practical Completion.	Delivery	
HW0002	Site Establishment <Insert Max $>	Item	Lump Sum	$ 28,000.00	$ 28,000.00	**Payment**: 100% after completion.		
HW0003	Site Disestablishment <Insert Min $>	Item	Lump Sum	$ 28,000.00	$ 28,000.00	**Payment**: 100% after completion.		
HW0004	Preparation and implementation of the Construction EMP	Item	Lump Sum	$ 4,800.00	$ 4,800.00	**Payment**: Maximum of 30% on submission of complying Construction EMP, then 10% per month up to maximum of 80%. Remainder at Practical Completion. **Submit:** Construction EMP.		
HW0005	Preparation and implementation of the Safety Management Plan.	Item	Lump Sum	$ 11,000.00	$ 11,000.00	**Payment**: Maximum of 30% on submission of complying plan, then 10% per month up to maximum of 80%. Remainder at Practical Completion. **Submit:** Safety Management Plan.		
HW0006	Preparation and implementation of the Traffic Control Plan.	Item	Lump Sum	$ 4,100.00	$ 4,100.00	**Payment**: Maximum of 30% on submission of complying Traffic Control Plan, then 10% per month up to maximum of 80%. Remainder at Practical Completion.		
HW0007	Preparation and Implementation of Quality Management Plan	Item	Lump Sum	$ 6,306.46	$ 6,306.46	**Payment**: Maximum of 30% on submission of complying Quality Management Plan, then 10% per month up to maximum of 80%. Remainder at Practical Completion.		

Water Pipeline - Reticulation - section will be present if one or more reticulation watermains are specified

Item	Construction of Reticulation Watermains	Qty	Unit	Rate $/Unit	Amount $	Application of Schedule of Rates	Code	WBS
HWW001	Service Location	Item	Lump Sum	$ 1,216.00	$ 1,216.00	**Payment**: Maximum of 10% shall be due each month until 70% of the amount has been paid. Remainder at Practical Completion.	Delivery	
HWW02.02	DN150 Valves / Flowmeters	Item	Lump Sum	$ 9,120.00	$ 9,120.00			
HWW03.02	DN150 Fittings	Item	Lump Sum	$ 2,290.00	$ 2,290.00			
HWW004	Supply all pipes materials including detector tape, pipe protection wrapping, rubber rings and lubricant for following pipe sizes:					**Measurement**: Actual metres (effective length) of pipe delivered to site. **Submit:** Relevant Quality Records including Compliance Certificates. Note: Limits of Accuracy to be inserted for each pipe size.		
20FVSS	Nominal DN150 PVC pipe	1600	m	$ 35.53	$ 56,848.00			
HWW005	Clear, excavate, lay, join, bed, backfill & test pipelines (installation). Up to **1.5 m depth** to invert in OTR.					**Measurement:** Actual metres of pipe installed to design depth of excavation up to and including 1.5m. **Retention:** 10% <or other appropriate percentage> until satisfactory testing. **Submit:** Relevant Quality Records including as constructed lengths, levels and coordinates. **Limits of Accuracy:** <To be inserted>.		
20FVDB	Nominal DN150 PVC (Trench type B)	1600	m	$ 123.77	$ 198,032.00			
HWW015	Supply & place ballast			$ 91.80		**Measurement**: Actual tonnes placed as directed. **Submit:** Relevant Quality Records including certified weighbridge dockets. **Limits of Accuracy:** <To be inserted>.		
HWW018	Road / creek crossings					**Measurement**: Length in metres of casing installed. **Submit:** Relevant Quality Records. **Limits of Accuracy:** <To be inserted>.		
HWW018.01	Wyndella	15	m	$ 114.00	$ 1,710.00			
HWW018.02	New England Highway	80	m	$ 1,088.49	$ 87,079.00			
HWW027	Preparation of line sheets	1600	m	$ 1.16	$ 1,856.00	**Measurement**: Length of pipelines constructed as per design. **Limits of Accuracy:** <To be inserted>.		
HWW029	**Miscellaneous**							
HWW000	***Sub Total***				$358,151			

Pipeline 1 - B(t)errain allowance, 600m under powerlines, 800m near services, 400sqm of tree clearing,

Item No.	Item Description	Qty	Unit		Amount $	Application of Schedule of Rates	Capital Project Estimate Code	WBS
HW0013	Work as Constructed Information <Insert Min $>	Item	Lump Sum	$ 13,040.00	$ 13,040.00	**Payment**: 100% at Practical Completion.		

A.	**TOTAL ESTIMATED CONTRACT AWARD SUM**	$ 461,219.46

B.	**PRE-CONSTRUCTION COST (Table 10)**		Development
HW0016	Design	$ 92,243.89	
HW0017	Project Management of Design	$ 34,448.78	
HW0024	Community Consultation		
	Sub Total(B1)	$ 126,692.67	
	Pre construction contingency (30% of B1)	$ 38,007.80	
	TOTAL PRE-CONSTRUCTION COST (B)	$ 164,700.47	

C.	**CONSTRUCTION COST**			Delivery
	Total Estimated Contract Award Sum (A)		$ 461,219.46	
HW0023	Construction Management (Table 11)		$ 101,468.28	
	Sub Total (C1)		$ 562,687.74	
	Construction contingency (Table 12) (30% of C1)	Preliminary Estimate	$ 168,806.32	
	TOTAL CONSTRUCTION COST (C)		$ 731,494.06	

	TOTAL PRELIMINARY PROJECT ESTIMATE (B+C) (Preliminary Estimate)	$ 896,194.54

Total Cost

Appendix F

NPV CALCULATIONS

ADW Johnson
240332 - NPV Analysis
Sewer Option 1 - WPS

Base year	2023																														
Discount Rate	7.0%																														
Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
Period	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
CAPITAL COSTS																															
Preliminary Estimate																															
Deep Sewer HWC Estimating Tool	$ 760,000.00																														
TOTAL CAPITAL COST	**$760,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
O&M																															
Pump Replacement @ 15 Years																$40,000															
Maintenance	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
TOTAL O&M COST	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$42,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
TOTAL COSTS (Capital)	$760,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL COSTS (O&M)	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$42,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
PV of costs (Capital)	$760,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
PV of costs (O&M)	$2,000	$1,869	$1,747	$1,633	$1,526	$1,426	$1,333	$1,245	$1,164	$1,088	$1,017	$950	$888	$830	$776	$15,223	$677	$633	$592	$553	$517	$483	$451	$422	$394	$368	$344	$322	$301	$281	$263
Cumulative Present Value	$762,000	$763,869	$765,616	$767,249	$768,774	$770,200	$771,533	$772,779	$773,943	$775,030	$776,047	$776,997	$777,885	$778,715	$779,491	$794,714	$795,391	$796,024	$796,616	$797,169	$797,686	$798,169	$798,620	$799,042	$799,437	$799,805	$800,149	$800,471	$800,772	$801,053	$801,316
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

	Discount Rate		
	4%	7%	10%
NET PRESENT VALUE OF TOTAL COSTS	$818,795	**$801,316**	$790,430