Northshore Hamilton PDA

Water Supply and Sewer Preliminary Analysis

DSDMIP-EDQ-1502-19

Prepared for

Economic Development Queensland

4 November 2020

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

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4.0	30 October 2019	Water cost changed	SS	MW
5.0	18 December 2019	Update Table 2-1, Figure 201	SS	MW
6.0	4 November 2020	Includes comments from Urban Utilities	JL	MW

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Appendices

Tables

Figures

1 Introduction

Cardno were engaged to review the water supply and wastewater augmentation strategy proposed for the Northshore Hamilton Priority Development Area (PDA). Figure 1-1 below illustrates the PDA.

This report adopts the servicing strategy presented in the *Sewer and Water Investigation and Masterplan for the Northshore Hamilton Redevelopment (*Bornhorst and Ward, November 2018) report as the basis of the assessment. Cardno's report will, where necessary, revise any strategies and infrastructure accordingly.

All water supply and sewerage network models were provided by Urban Utilities for this assessment.

Figure 1-1 Location Plan of Northshore Hamilton PDA

LEGEND

PDA Boundary

2 Assumptions

2.1 PDA Population

The PDA includes a mix of residential, commercial/industrial and green space land uses. Urban Utilities use an Equivalent Person (EP) for the basis of water supply and sewerage network planning. The current yield for the PDA, and Urban Utilities EP conversion rates were used to develop the water supply and sewerage EP for the PDA, refer Table 2-1. Table 2-2 details the water supply and sewerage EP projected for the PDA.

Appendix A, Figure 201 illustrates the land use distribution within PDA and Appendix A Figure 305 shows the population and yield details. Development staging is outlined in Appendix B Figure 306.

Table 2-1 Water Supply and Sewerage Population Conversion Rates

Planning Scheme Use Type	Value	Units	Use	Document	Reference
Attached Dwelling	1.79	EP/ET	Residential	SEQCODE	Table A6 (Pg. 43)
Detached Dwelling	2.65	EP/ET	Residential	SEQCODE	Table A6 (Pg. 43)
Multi-Purpose Centers - Suburban Centre M3	65	EP/Ha	Retail/Commercial	Urban Utilities advice 05/05/14[1]	(Bornhorst and Ward, November 2018)
General Industry	65	EP/Ha	Community	Urban Utilities advice 05/05/14[1]	(Bornhorst and Ward, November 2018)
Community Facilities	65	EP/Ha	Industrial	Urban Utilities advice 05/05/14[1]	(Bornhorst and Ward, November 2018)

Note: 1 - Adopting Urban Utilities advice from 05/05/2014 for *Multi-Purpose Centres - Suburban Centre M3, General Industry* and *Community Facilities* imposes a relatively minor 8% increase in total population.

Table 2-2 PDA Water Supply and Sewerage Population Summary

Land Use	EP
Residential	24,820
Retail	454
Commercial	2,689
Community	103
Industrial	2,159
TOTAL	**30,224**

2.1.2 Comparison with Past Planning

The population developed for this assessment are consistent with the population presented in Bornhorst and Ward, 2018 report. No modification or change is proposed or required.

2.1.3 Northshore Hamilton PDA Growth

The 2018 report by Bornhorst and Ward projected a population of 8,269 EP, 11,217 EP and 30,214 EP for the existing, 2031 and Ultimate scenarios respectively. The newly derived existing and ultimate EP is 5,000 EP and 30,225 EP respectively. The Ultimate EP within PDA is almost equal to the projections in the 2018 Bornhorst and Ward report.

2.2 Standards of Service

The *South East Queensland Water Supply and Sewerage Design and Construction Code* (SEQ WS&S D&C Code) has been adopted for assessment. This is included in Appendix C Figure 307.

The following additions and exceptions have been adopted:

- Gravity Sewers (NuSewer):
  - Depth of Flow, PWWF: Existing gravity sewers must maintain PWWF depth no greater than 1.2m from ground level
  - Minimum Shear stress: Proposed sewers shall achieve self-cleansing shear stress of 1.6Pa at PDWF. This is in lieu of minimum velocity requirements outlined in SEQ Code, but consistent with WSA02-2014.

2.3 Staging of Infrastructure

Water supply and sewerage infrastructure has been assumed to be delivered following the sequence of development, i.e. Stage 2 (2022-2026), Stage 3 (2026-2031), and Stage 4 (post 2031), refer Appendix B Figure 306.

However, where necessary the staging of water and sewer infrastructure has been brought forward to coincide with planned roadworks to optimise delivery.

2.4 Costing Parameters

Cardno have adopted standard unit rates which have been previously developed by Cardno via benchmarking and recent construction costs. These rates have been used to determine capital works costs for the augmentations identified within this report. The adopted rates are nominal and represent an indicative cost as at 2016. However, the costs developed for this report would require updating with up to date data for each new budget year.

The indicative total costs include:

> Project management and design costs (13%)

\- Construction Contingency (25%)

3 Water Supply Network Planning

This section identifies the inputs and results of the water supply network modelling and planning for the Northshore Hamilton PDA.

3.1 Water Supply Network Demands

The projected demand within the Northshore Hamilton PDA was compared to that in the Urban Utilities network model. The Urban Utilities model projects an ultimate population of 22,173 EP within the PDA compared to the projected 30,224 EP for this report, representing a 36% increase. This increase will be assessed to determine the need for additional network augmentation.

Based on the adopted design criteria, Table 3-1 below shows a summary of the projected water supply demand within the PDA.

Table 3-1 Estimated Total Water Supply Demand

Zoning	Water Demand (EP)	Average Day (L/s)	Maximum Day (L/s)	Maximum Hour (L/s)
Residential	24,820	74.7	140.8	272.9
Retail	454	1.37	2.57	3.54
Commercial	2,689	8.09	15.25	20.98
Community	103	0.31	0.58	0.80
Industrial	2,159	6.50	12.24	16.84
TOTAL	**30,224**	**91**	**171.4**	**315.1**

3.2 Urban Utilities Existing Infrastructure

The Northshore Hamilton PDA is located within the Bartley's Hill Reservoir Water Supply Zone (WSZ) which is supplied by Bartley's Hill Reservoir with a capacity of 19 ML. The existing trunk network including the DN300/315 main along Kingsford Smith Drive will supply the site.

3.3 Urban Utilities Future Infrastructure

The model provided by Urban Utilities included an extract of the Barley's Hill WSZ. The provided model included future population scenarios but only existing infrastructure. No augmentations have been identified outside of the PDA.

Network planning for the wider zone will be undertaken by Urban Utilities. The model is considered appropriate for assessing the network performance internal to the PDA. However, no assessment has been made of the impact of the PDA upon the future external network as this is not viable without UU's planned network augmentations.

3.4 Proposed PDA Water Supply Network

The proposed network includes a connection to the existing network along Kingsford Smith Drive, Theodore Street, Fison Avenue, Links Avenue, and MacArthur Avenue.

It should be noted that the proposed network, Appendix D, Figure 202 and Figure 203 is representative at this time. Further detailed assessment during the next stages of planning and design should confirm:

> the alignment of mains with consideration to other services,

> the location of valves, with consideration to maintaining service during planned and un-planned shutdowns, and

> the location of service connections and other fittings (hydrants etc) not considered at this stage

Further, it is recommended that detailed geotechnical assessment is undertaken to ensure all mains are appropriately designed and installed with due consideration to the known poor-quality ground conditions within the PDA.

The proposed infrastructure and staging within the PDA are illustrated in Appendix D Figures 202 and Figure 203 and detailed in Table 3-2.

Table 3-2 Proposed PDA Water Supply Network

Diameter (DN -mm)	Length (mm)
180	2,470
250	991
315	1,151
355	326
450	304

3.5 Water Supply Modelling

Water Supply modelling was undertaken to confirm the water supply infrastructure required to service the Northshore Hamilton PDA. WaterGEMS simulations were undertaken for base and Ultimate scenarios. Only a steady state simulation of the maximum hour design flow was undertaken for the PDA network.

3.5.1 Water Model

Urban Utilities provided the following Bentley's WaterGEMS water supply model for assessment:

- BRH2.wtg received on 28 Aug 2019.

3.5.2 Model Set-up

The following updates are undertaken in the planning model provided by Urban Utilities:

- Proposed water supply pipes within the PDA have been added to the model (Appendix D Figures 202 and Figure 203)
- Water supply pipes proposed to be decommissioned within the PDA have been removed from the model (Appendix D Figures 202 and Figure 203 show the decommissioned mains)
- Previous load allocations within the PDA have been removed from the model
- Fire-flow demand has been allocated within the PDA based upon proposed land use zones. Although the PDA technically 'Brownfield', Greenfield fire-flow demands have been applied where network augmentations are proposed.
  - Low Density Urban = 25 L/s (Greenfield)
  - Medium Density Urban = 45 L/s (Greenfield)
  - High Density Urban = 60 L/s
  - Commercial/Industrial 45 L/s (Greenfield) and 30 L/s (Brownfield)
- Residual pressure has been set as 12m minimum in the main as per design criteria.

3.6 Water Supply Modelling Results

Results from modelling completed by Cardno, for the ultimate planning horizon have been outlined below with results from the model provided by Urban Utilities for comparison.

3.6.1 Peak Hour Results

Modelling has shown that the proposed network for the PDA will maintain minimum pressures within the PDA during peak hour, refer Figure 3-1.

Deficiencies were observed within the wider water supply zone during peak hour in the model provided by Urban Utilities and the modelling completed by Cardno, refer Figure 3-3 and Figure 3-1 respectively. Peak Hour performance of the proposed network within the PDA will not be adversely impacted by Urban Utilities augmenting the water supply zone capacity to resolve network deficiencies external to the PDA.

3.6.2 Fire-flow Results

Modelling has shown that the proposed network for the PDA maintain minimum pressures within the PDA during fire flow, Figure 3-2.

The model provided by Urban Utilities does not define the fire flow requirements outside of the PDA. Allocating appropriate fire flow loading to the wider water supply zone is beyond the scope of this assessment and has not been completed.

Fire flow performance of the proposed network within the PDA will not be adversely impacted by Urban Utilities augmenting the water supply zone capacity to resolve network deficiencies external to the PDA.

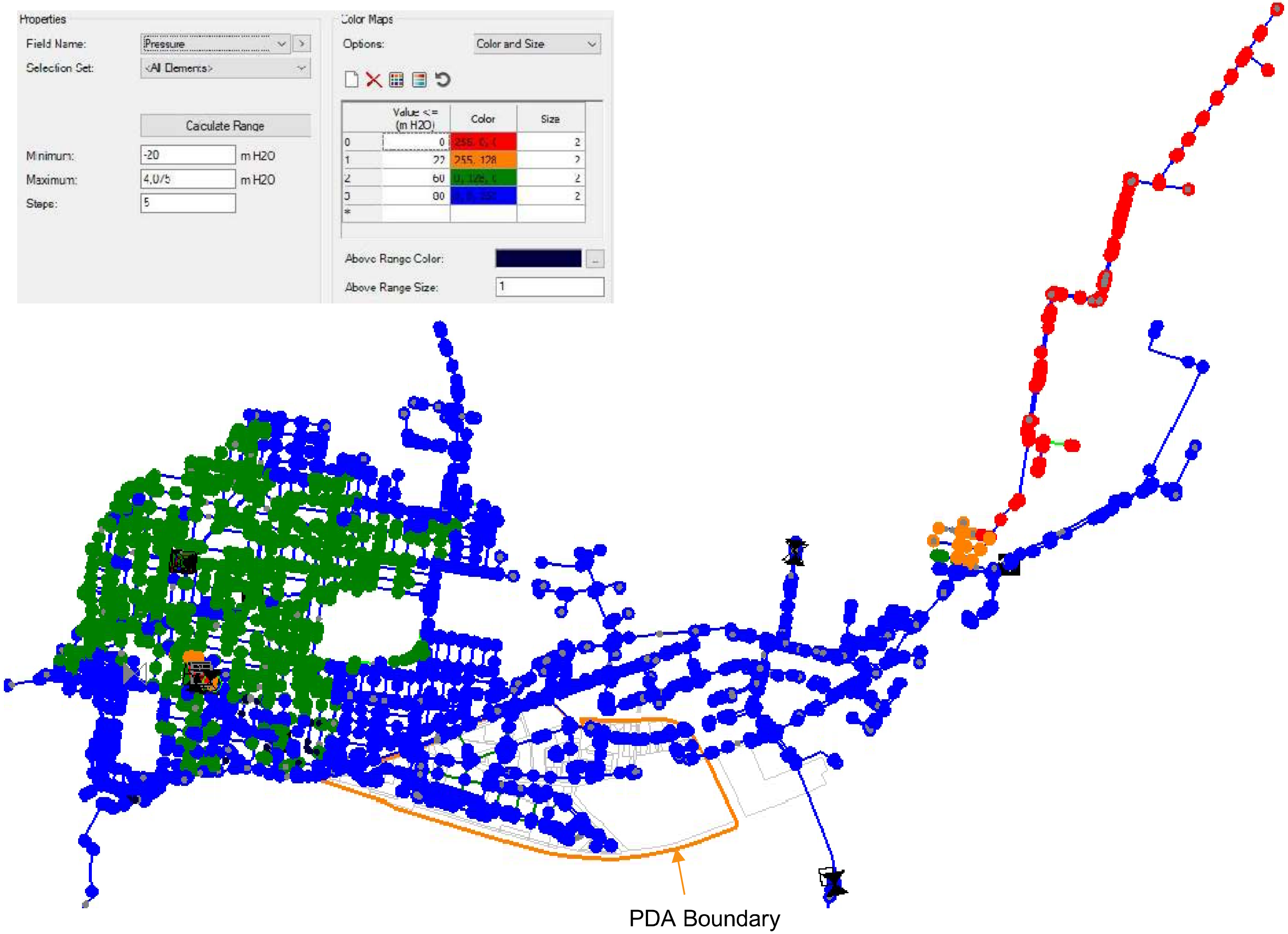


Figure 3-1 Peak-Hour pressure results – Ultimate Scenario – Modelling completed by Cardno

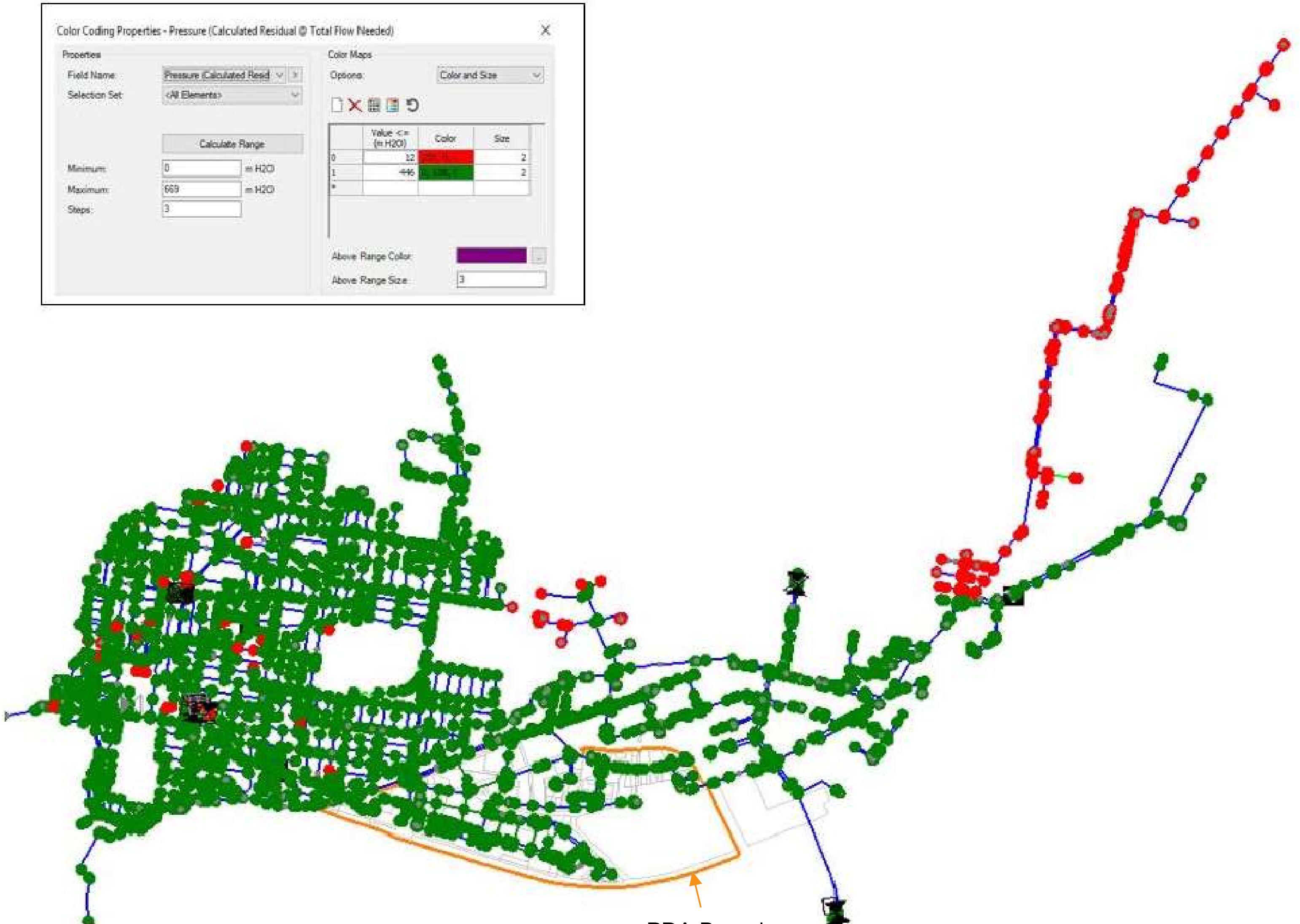


Figure 3-2 Fire-flow residual pressure results – Ultimate Scenario – Modelling completed by Cardno

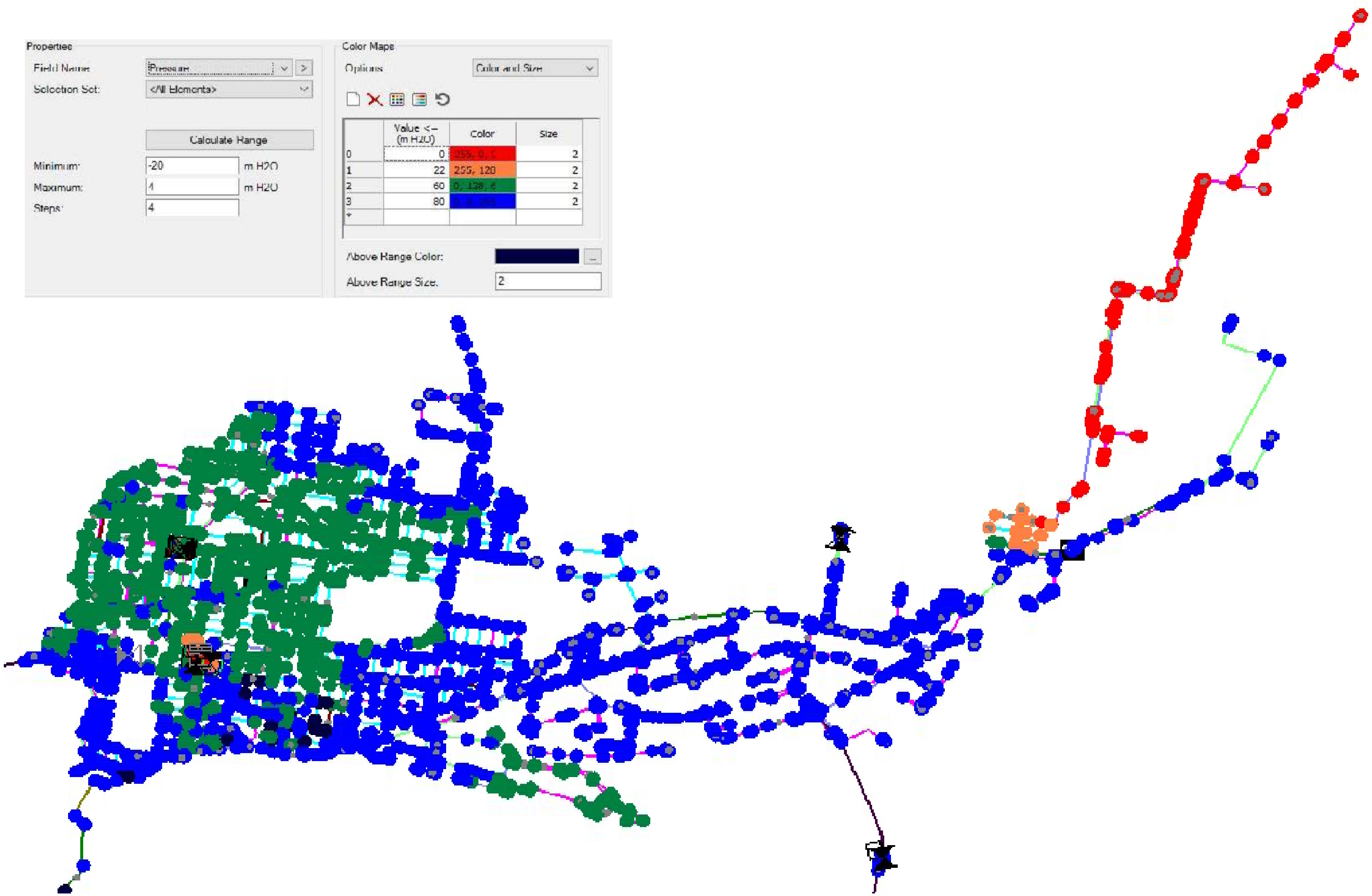


Figure 3-3 Peak-Hour pressure results – Ultimate Scenario – Model provided by Urban Utilities

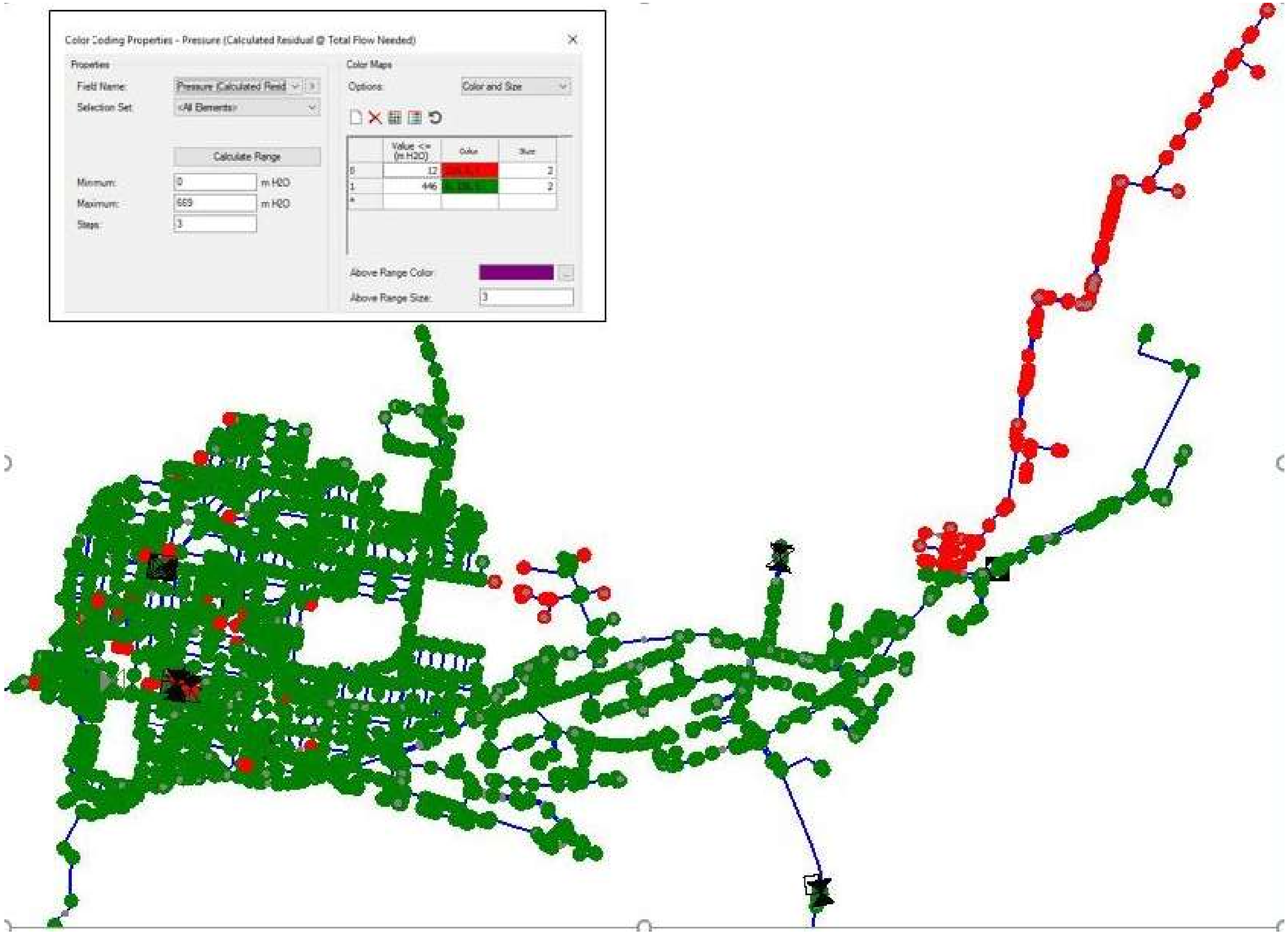


Figure 3-4 Fire-flow residual pressure results – Ultimate Scenario – Model provided by Urban Utilities

4 Sewerage Network Planning

4.1 Sewerage Network Loads

The projected demand within the Northshore Hamilton PDA was compared to that in the Urban Utilities network model. The Urban Utilities model projects an ultimate population of 22,184 EP within the PDA compared to new projected 30,225 EP within the same area, representing a 36% increase.

Based on the adopted design criteria, the Table 4-1 below shows a summary of the projected sewage load within the PDA.

Table 4-1 Estimated Total Sewage Load

Sewage Load (EP)	Average Dry Weather Flow, ADWF (L/s)	Peak Dry Weather Flow, PDWF (L/s)	Peak Wet Weather Flow, PWWF (L/s)
30,225	73.5	113.7	239.6

4.2 Urban Utilities Existing Network

The Northshore Hamilton PDA is located within the Luggage Point Wastewater Treatment Plant (WWTP) catchment. Urban Utilities administers the wastewater conveyance and treatment.

Presently, the PDA is serviced by a number of gravity connections to the external network and existing pump station SP164.

All loads from the PDA are conveyed to the S1 trunk sewers DN1400 along Kingsford Smith Drive and onwards to the Luggage Point WWTP.

4.3 Urban Utilities Future Network

The provided model included future population scenarios but only existing infrastructure. No augmentations have been identified outside of the PDA. Network planning for the wider catchment will be undertaken by Urban Utilities.

4.4 Proposed PDA Sewerage Infrastructure

All sewers within the PDA have been planned as Nusewers. The proposed infrastructure and staging within the PDA are illustrated in Appendix E Figures 301 and Figure 302. Grades for proposed sewers are outlined in Figure 4-4.

It should be noted that the proposed network is representative at this time. It is recommended that detailed geotechnical assessment is undertaken to ensure all mains are appropriately designed and installed with due consideration to the known poor-quality soil conditions within the PDA.

4.5 Sewerage Modelling

4.5.1 Sewerage Model

Urban Utilities provided the following InfoWorks ICM sewer model for assessment:

- S1 Luggage Pt and S2 Fairfield WW Models.icmt received on 28 Aug 2019. This model has been adopted for assessment.

The model:

- Has been adopted and modified by Cardno for this assessment
- Includes various load scenarios with the existing sewer network
- Does not include the planned augmentations (as confirmed by Urban Utilities)
- Does not include InfoWorks ICM Wastewater or previous Runs

4.5.2 Model Set-up

In the above model, the following updates are done:

- Proposed sewers within the PDA have been added to the model (Appendix E Figures 301 and Figure 302)
- Sewers proposed to be decommissioned within the PDA have been removed from the model (Appendix E Figures 301 and Figure 302 show the decommissioned sewer mains)
- Proposed loads within the PDA have been added to the model
- Previous load allocations within the PDA have been removed from the model
- A wastewater group was created with a PWWF unit flow of 750L/EP/d. This results in a PWWF from the total PDA area consistent with the method outlined in SEQ Code, refer Section 2.1.

4.6 Sewerage Modelling Results

Results from modelling completed by Cardno for the Ultimate planning horizon have been outlined below.

Modelling completed by Cardno shows, the Ultimate PWWF water depth with in the PDA sewer network maintains design service standards, refer Figure 4-1. The key outcomes are:

- Proposed sewers within the PDA maintain PWWF within <75% pipe full
- Existing sewers within the PDA maintain PWWF flood depth no greater than 1.2m from ground level in accordance with Standards of service. More specifically, only one sewer exceeds pipe capacity but this is only marginal, refer Figure 4-3.

Figure 4-4 shows the longitudinal profiles of the proposed sewer mains within the PDA.

Outside the PDA, some surcharges occur in the network, refer Figure 4-2. These sewer sections are shown in RED and represent locations where the sewage depth is greater than 1m below ground. These are expected as the model provided by Urban Utilities does not include augmentations to cater for future growth.

There are no network performance non-compliances within close proximity to the PDA.

The impact of the PDA on the S1 trunk sewer and greater external network is not able to be determined with the model provided by Urban Utilities as it does not include future planned augmentations to the upstream network. Notwithstanding, it is Cardno's opinion that the loads from the PDA should not have a material impact to the S1 trunk system given the relatively large scale of the S1 system compared with the relatively small loads from the PDA.

Liaison with Urban Utilities should be undertaken to ensure any augmentations in the vicinity of the PDA are compatible with the proposed network for the PDA.

There may be opportunity to decommission pump station SP164 in future when land parcels 44 and 50 develop post 2038 (as per zoning plan), refer Figure 4-1. These lands would be serviced by proposed gravity sewers located in the vicinity.

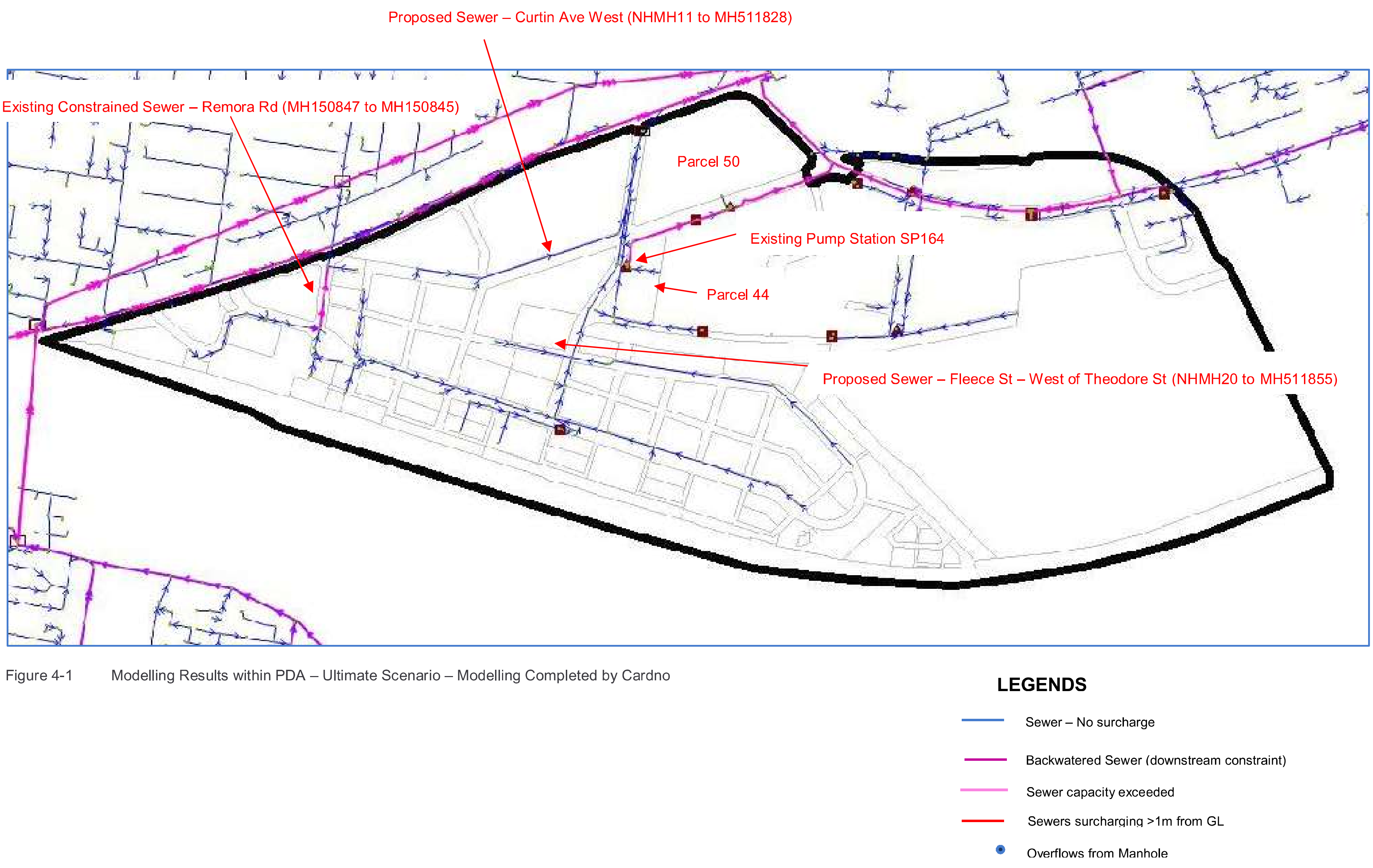


Figure 4-1 Modelling Results within PDA – Ultimate Scenario – Modelling Completed by Cardno

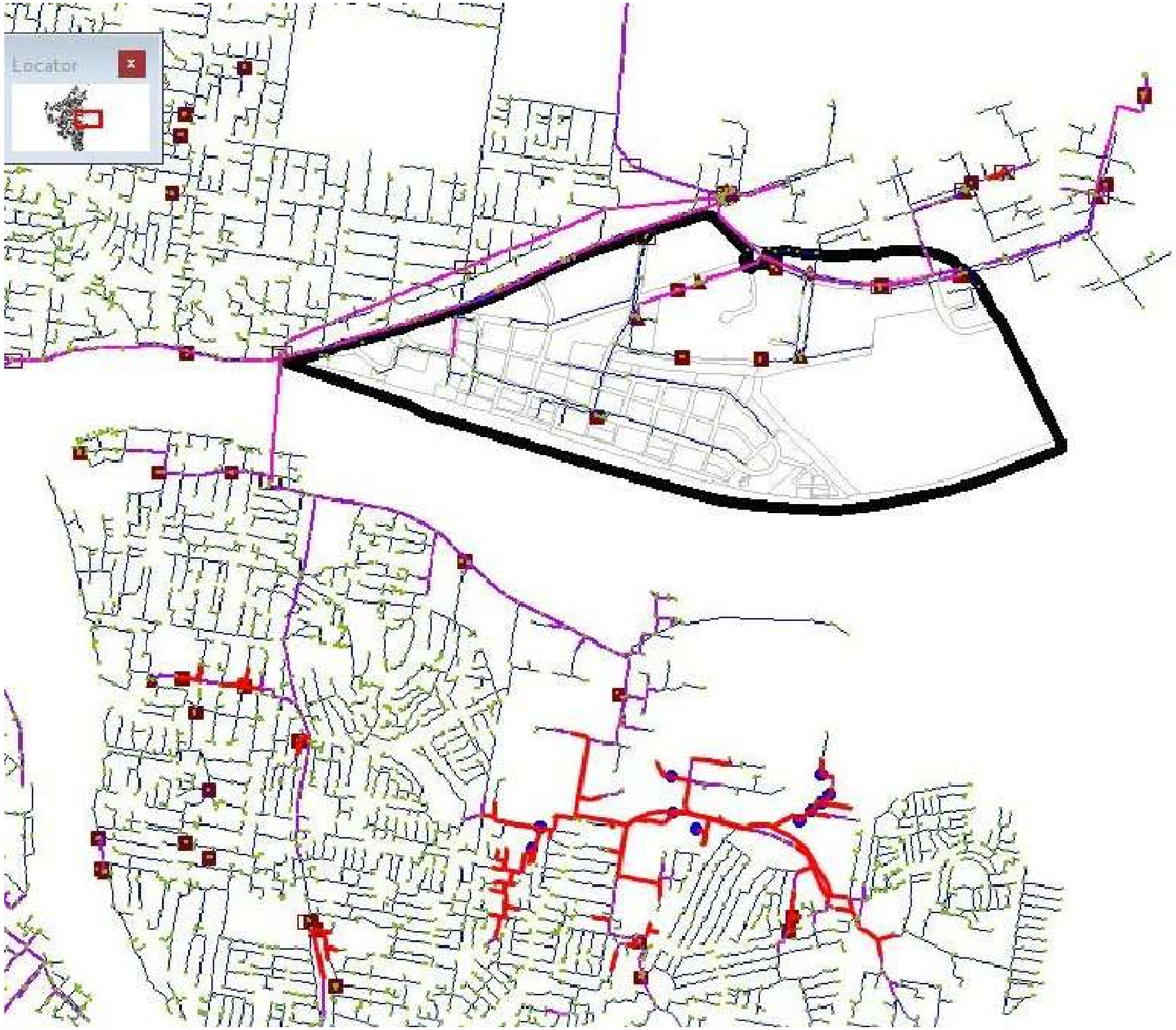


Figure 4-2 Modelling Results for the Wider Network – Ultimate Scenario – Modelling Completed by Cardno

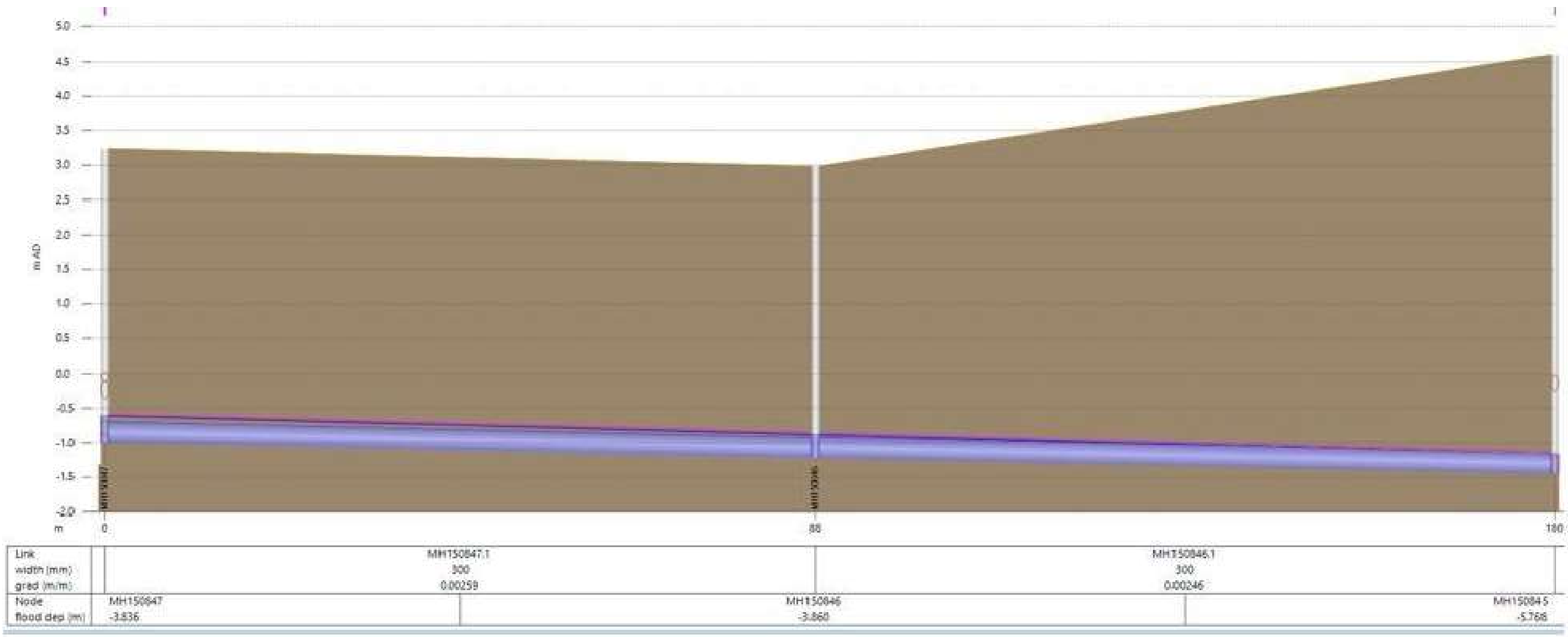
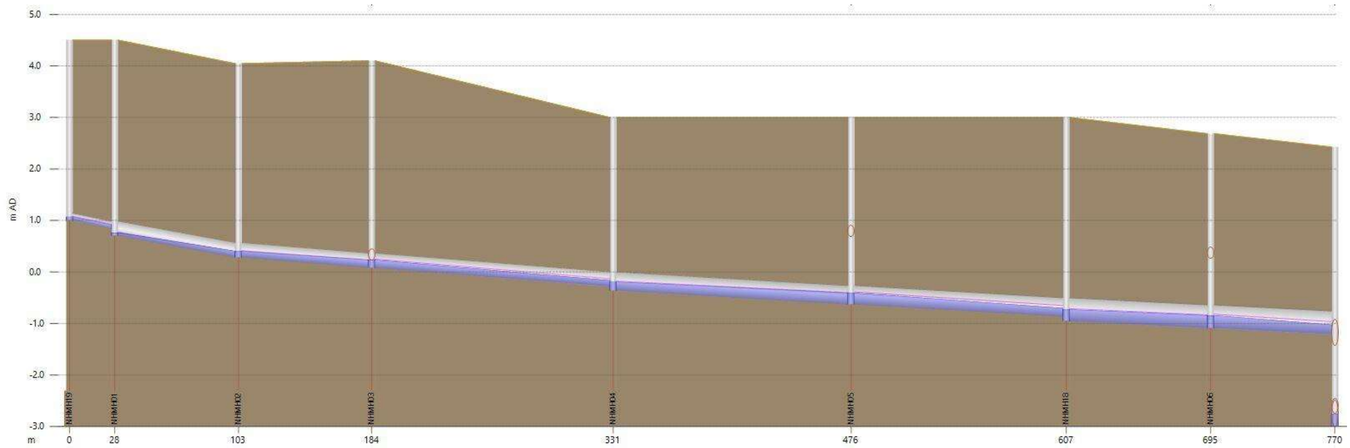


Figure 4-3 Longitudinal Profile – Existing Constrained Sewer – Remora Road (MH150847 to MH150845) – Ultimate Scenario

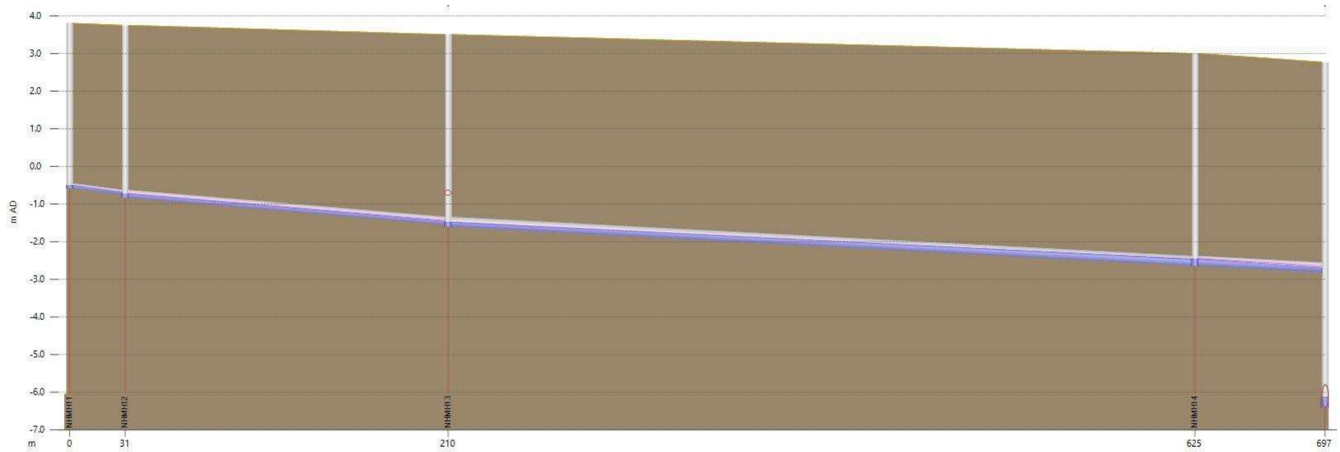
Proposed Sewer on Macarthur Ave (NHMH 19 to MH511858)



Link	-	NHMH01.1	NHMH02.1	NHMH03.1	NHMH04.1	NHMH05.1	NHMH18.1	NHMH06.1
width (mm)	144	285	285	285	362	362	452	452
grad (m/m)	0.00556	0.00556	0.00249	0.00250	0.00182	0.00182	0.00158	0.00157

Node	-	NHMH01	NHMH02	NHMH03	NHMH04	NHMH05	NHMH18	NHMH06	MH511858
flood dep (m)	-	-3.741	-3.646	-3.872	-3.196	-3.411	-3.734	-3.534	-5.186

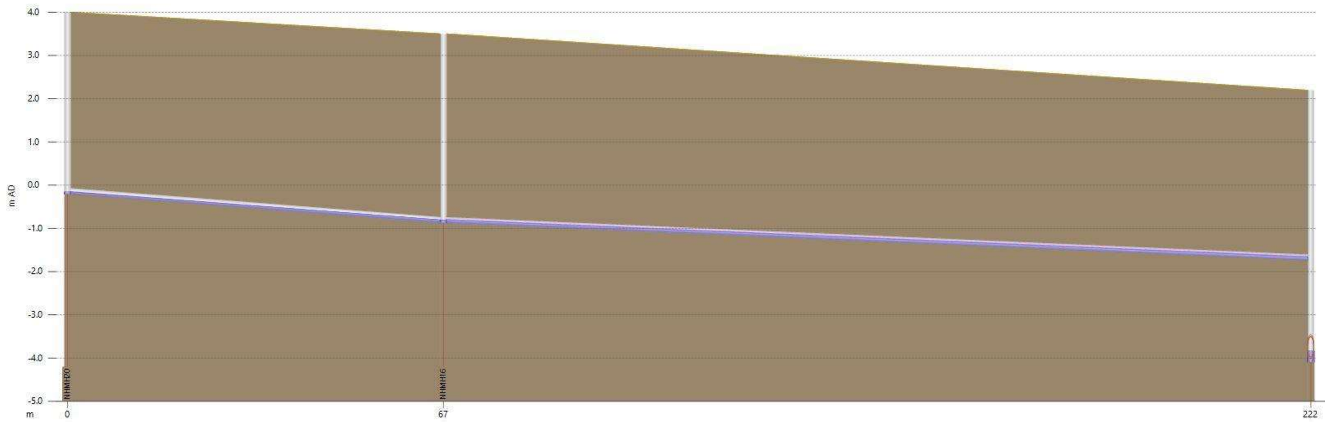
Proposed Sewer on Curtin Ave West (NHMH 11 to MH511828)



Link	NHMH11.1	NHMH12.1	NHMH13.1	NHMH14.1
width (mm)	145	226	285	285
grad (m/m)	0.00556	0.00400	0.00250	0.00250

Node	-	NHMH12	NHMH13	NHMH14	MH511828
flood dep (m)	-	-4.481	-4.990	-5.472	-8.909

Proposed Sewer - Fleece St – West of Theodore St (NHMH 20 to MH511855)



Link	NHMH20.1	NHMH16.1
width (mm)	144	144
grad (m/m)	0.00999	0.00556

Node	NHMH20	NHMH16	MH511855
flood dep (m)	-4.160	-4.307	-6.038

Figure 4-4 Longitudinal Profiles – Proposed Sewer Main Within PDA – Ultimate Scenario

5 Cost Estimate

Capital cost estimates have been prepared for the proposed water and sewer mains identified within this report. Costs have been developed from Cardno's cost model developed by Cardno from benchmarking recent construction projects. This method is considered fit for purpose for the Northshore Hamilton PDA.

The adopted rates are nominal and represent costs as at 2019.

Table 5-1 below shows the base unit cost adopted for water supply infrastructure and Table 5-2 details the base unit rates for sewerage infrastructure.

Table 5-1 Water Supply Infrastructure Unit Rates

Diameter (DN- mm)	Unit Rate ($/m)
160	264
200	312
250	374
400	719
450	990

Table 5-2 Sewerage Infrastructure Unit Rates

Diameter (DN- mm)	Unit Rate ($/m) per depth 1.5-3.0m	Unit Rate ($/m) per depth 3.0-4.5m	Unit Rate ($/m) per depth >4.5m
160		671	
250	574	778	1,139
315		785	1,114
400		1090	
450			
500		1436	

The indicative total costs include:

- Construction Contingency (25% as requested by EDQ)
- Project Owners Cost (Project management and designing depends – 13% to align with transport).
- Unit Cost adjustment factors:
  - Scaling Factor: Pipe length of 200m-500m is considered.
  - Construction Constraints: High Constraints: High concentration of office, retail, commercial or industrial containing high-to-heavy traffic density and heavily congested services. Large amounts of high-quality footpaths and road pavement.
  - Soil Types: Acid Sulphate Soils (ASS): Areas where the presence of acid sulphate is detected, and is characterised by a marine mud / clay type soil with high organics and pungent odour.

5.2 Water Supply

Table 5-3 outlines the capital cost estimate for the proposed water supply infrastructure within the PDA. A detailed breakdown has been provided in Appendix Figure 308.

Table 5-3 Water Supply Infrastructure Capital Cost Estimate

Planning Horizon	Capital Cost
2022-2026 (Stage 2)	$3,413,822
2027-2031 (Stage 3)	$713,623
Post 2031 (Stage 4)	$2,931,248
TOTAL	**$7,058,693**

5.3 Sewerage

Table 5-4 shows the breakdown of the sewerage cost. The detailed cost estimate is shown in Appendix Figure 309.

Table 5-4 Northshore Hamilton PDA Proposed Sewerage Cost

Planning Horizon	Capital Cost	Items
2022-2026 (Stage 2)	$3,178,337	MacArthur Ave (East) / Theodore St
2027-2031 (Stage 3)	-	
Post 2031 (Stage 4)	$3,444,678	Curtin Ave (West) / Fleece St
TOTAL	**$6,623,015**	

6 Conclusion

The study considers the latest population projection within Northshore Hamilton PDA and the impact of this population on the proposed water and sewerage network within the PDA. Urban Utilities' water and sewerage model was updated with this proposed population to assess the impact on the water and sewerage network.

The following summarises the findings of this assessment and the further work required:

6.1 Water

> Proposed growth within the PDA represents increase in load to 30,225EP from Urban Utilities' previous forecast of 22,173EP, representing a 36% increase.

> The proposed network within the PDA is adequate to supply peak hour and fire flow requirements within the PDA.

> Deficiencies are observed outside of the PDA in Urban Utilities' planning model under both Peak Hour and fire-flow scenarios. It is not expected that external network augmentations will affect the network performance within the PDA.

> Subsequent network planning and design stages shall consider the location of valves to optimise network conditions during planned or unplanned events to minimise disruption.

> Detailed geotechnical investigations shall be undertaken to minimise construction risks.

6.2 Sewerage

> Proposed growth within the PDA represents increase in load to 30,225EP from Urban Utilities' previous forecast of 22,174EP, representing a 36% increase.

> The proposed network within the PDA is adequate to support development within the PDA. The key findings are:

- Proposed sewers within the PDA maintain PWWF within <75% pipe full
- Existing sewers within the PDA maintain PWWF flood depth no greater than 1.2m from ground level
- No deficiencies are observed in the external network adjacent the PDA, including the network between the PDA and the S1 trunk sewers (DN1400) which services the PDA.

> Loads from the PDA should not have a material impact to the S1 trunk system given the relatively large scale of the S1 system compared with the relatively small loads from the PDA.

> Detailed geotechnical investigations shall be undertaken as part of future sewer detailed design to minimise sewer design & construction risks.

APPENDIX

A

POPULATION FIGURE AND TABLE

- FIGURE 201
- FIGURE 305

N

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0 250 500 m

1:10000 Scale at A3

Northshore Hamilton PDA

Figure 201 - Northshore Population

Cardno

Map Produced by APAC North (Traffic & Transport)
Date: 12/9/2019
Coordinate System: GDA 1994 - MGA Zone 56
Project: QTT19059
Map:QTT19059 Northshore Hamiton LGIP Map 20190808.qgs RevA

FIGURE 305

		Ultimate Yield Estimates					Resulting EP			
Block	Zone	Residential Units	Retail (GFA)	Commercial (GFA)	Community (GFA)	Industrial (GFA)	EP Residential	EP Retail/Commercial	EP Community	EP Industrial
551	Community	0	188	2,820	15,792	0	0	20	103	0
56	District Centre	114	10,239	81,912	0	0	204	599	0	0
57	District Centre	236	10,000	170,120	0	0	423	1,171	0	0
3	High MU	869	3,228	8,111	0	0	1,556	74	0	0
8	High MU	729	690	2,762	0	0	1,304	22	0	0
15	High MU	483	2,500	1,831	0	0	865	28	0	0
23	High MU	253	239	957	0	0	452	8	0	0
24	High MU	266	252	1,009	0	0	477	8	0	0
25	High MU	320	303	1,214	0	0	573	10	0	0
26	High MU	456	432	1,728	0	0	816	14	0	0
27	High MU	456	432	1,728	0	0	816	14	0	0
28	High MU	456	432	1,728	0	0	816	14	0	0
29	High MU	456	432	1,728	0	0	816	14	0	0
30	High MU	478	6,000	1,813	0	0	856	51	0	0
31	High MU	459	6,000	1,741	0	0	822	50	0	0
32	High MU	603	571	2,286	0	0	1,080	19	0	0
33	High MU	580	549	2,197	0	0	1,038	18	0	0
34	High MU	172	535	3,736	0	0	308	28	0	0
401	High MU	1,635	16,417	759	0	0	2,927	112	0	0
402	High MU	700	2,007	2,652	0	0	1,253	30	0	0
58	Industrial	0	57	0	0	56,771	0	0	0	369
59	Industrial	0	130	0	0	129,930	0	1	0	845
60	Industrial	0	64	0	0	63,769	0	0	0	414
61	Industrial	0	32	0	0	32,197	0	0	0	209
62	Industrial	0	4	0	0	3,890	0	0	0	25
63	Industrial	0	20	0	0	20,167	0	0	0	131
49	Industry Business	0	815	65,239	0	15,494	0	429	0	101
51	Industry Business	0	0	0	0	0	0	0	0	0
52	Industry Business	0	0	0	0	0	0	0	0	0
53	Industry Business	0	0	0	0	0	0	0	0	0
54	Industry Business	0	527	42,152	0	10,011	0	277	0	65
901	Max MU	456	3,000	1,728	0	0	816	31	0	0
111	Max MU	456	432	1,728	0	0	816	14	0	0
131	Max MU	456	432	1,728	0	0	816	14	0	0
1	Med MU	115	0	0	0	0	206	0	0	0
902	Med MU	86	81	324	0	0	153	3	0	0
112	Med MU	86	81	324	0	0	153	3	0	0
132	Med MU	86	81	324	0	0	153	3	0	0
17	Med MU	201	0	0	0	0	360	0	0	0
18	Med MU	12	0	0	0	0	21	0	0	0
19	Med MU	10	0	0	0	0	18	0	0	0
21	Med MU	159	0	0	0	0	285	0	0	0
22	Med MU	240	0	0	0	0	430	0	0	0
35	Med MU	95	1,006	930	0	0	170	13	0	0
36	Med MU	234	221	885	0	0	418	7	0	0
37	Med MU	236	223	894	0	0	422	7	0	0
38	Med MU	108	102	408	0	0	193	3	0	0

		Ultimate Yield Estimates					Resulting EP			
Block	Zone	Residential Units	Retail (GFA)	Commercial (GFA)	Community (GFA)	Industrial (GFA)	EP Residential	EP Retail/Commercial	EP Community	EP Industrial
39	Med MU	133	126	503	0	0	238	4	0	0
40	Med MU	112	106	424	0	0	200	3	0	0
41	Med MU	143	135	541	0	0	255	4	0	0
42	Med MU	186	177	706	0	0	334	6	0	0
43	Med MU	231	219	877	0	0	414	7	0	0
44	Med MU	171	162	649	0	0	306	5	0	0
45	Med MU	115	109	436	0	0	206	4	0	0
46	Med MU	19	0	0	0	0	34	0	0	0
2	Open Space	0	0	0	0	0	0	0	0	0
5	Open Space	0	0	0	0	0	0	0	0	0
6	Open Space	0	0	0	0	0	0	0	0	0
7	Open Space	0	0	0	0	0	0	0	0	0
10	Open Space	0	0	0	0	0	0	0	0	0
12	Open Space	0	0	0	0	0	0	0	0	0
14	Open Space	0	0	0	0	0	0	0	0	0
16	Open Space	0	0	0	0	0	0	0	0	0
20	Open Space	0	0	0	0	0	0	0	0	0
47	Open Space	0	0	0	0	0	0	0	0	0
48	Open Space	0	0	0	0	0	0	0	0	0
50	Open Space	0	0	0	0	0	0	0	0	0
552	Open Space	0	0	0	0	0	0	0	0	0
64	Open Space	0	0	0	0	0	0	0	0	0
TOTAL		***13,866***	***69,791***	***413,633***	***15,792***	***332,230***	***24,820***	***3,142***	***103***	***2,159***

APPENDIX

B

PROPOSED ROAD INFRASTRUCTURE AND DEVELOPMENT STAGING PLAN

- FIGURE 101
- FIGURE 306

N

Queensland Government

0 250 500 m

1:10000 Scale at A3

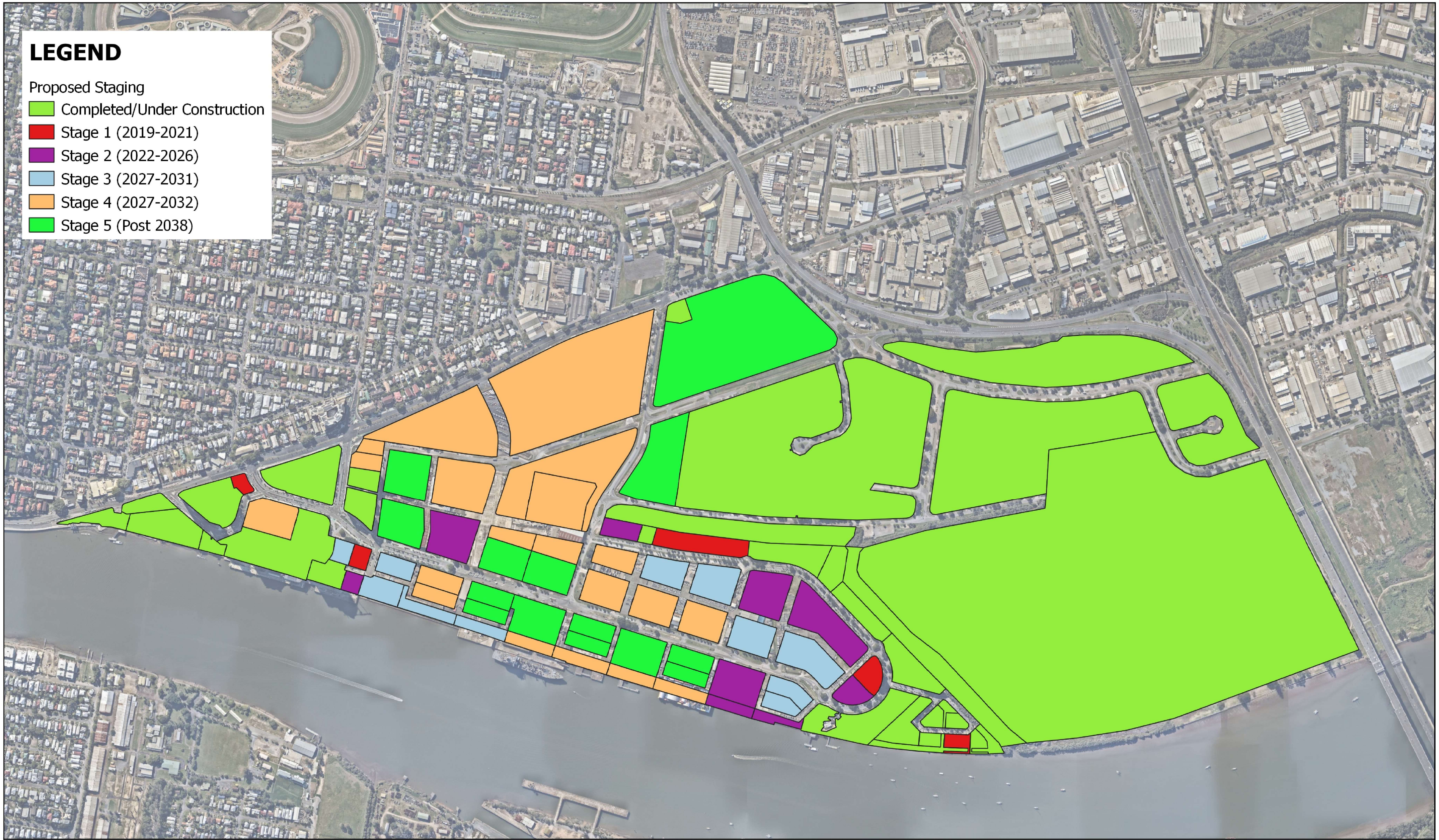
Northshore Hamilton PDA

Figure 101 - Proposed Road Infrastructure

Cardno

Map Produced by APAC North (Traffic & Transport)
Date: 12/9/2019
Coordinate System: GDA 1994 - MGA Zone 56
Project: QTT19059
Map:QTT19059 Northshore Hamiton LGIP Map 20190808.qgs RevA

FIGURE 306



Hamilton Northshore PDA

Figure 1 - Proposed Staging

Map Produced by APAC North (Traffic & Transport)
Date: 10/9/2019
Coordinate System: GDA 1994 - MGA Zone 56
Project: QTT19059
Map:QTT19059 Northshore Hamiton LGIP Map 20190806.qgs RevA

Water Supply and Sewer Preliminary Analysis

APPENDIX C

SEQ DESIGN CODE TABLES

- FIGURE 307

FIGURE 307

Table 4.1 - Water Network Design Criteria – Single Supply (Drinking Water Only) Network

<table>
<tr><th>No</th><th>Parameter
A. Drinking Water – Conventional (Single Supply Zone)</th><th colspan="6">Gold Coast</th><th>Logan</th><th>Redland</th><th>Queensland Urban Utilities</th><th>Unitywater</th></tr>
<tr><td>A1</td><td>Average Day Demand (AD) per EP, excluding NRW (Note: EP/ET conversion rate provided in separate tables from Water Service Provider)</td><td colspan="6">220 L/EP/d</td><td colspan="4">230 L/EP/d</td></tr>
<tr><td>A2</td><td>Estimated Non-Revenue Water (NRW)</td><td colspan="6">20 L/EP/d</td><td colspan="4">30 L/EP/d</td></tr>
<tr><td>A3</td><td>Peaking Factors</td><td>Residential (single det.)</td><td>Multi-Residential</td><td>Commercial /Public</td><td>Indus.</td><td>Tourist</td><td>Open Space</td><td colspan="2">Low and Med Density Res</td><td>High Density Res</td><td>Commercial/Industrial</td></tr>
<tr><td></td><td>MDMM/AD</td><td>1.75</td><td>1.27</td><td>1.06</td><td>1.06</td><td>1.76</td><td>1.15</td><td colspan="2">1.5</td><td>1.5</td><td>1.5</td></tr>
<tr><td></td><td>PD/AD</td><td>2.12</td><td>1.45</td><td>1.12</td><td>1.12</td><td>2.51</td><td>1.37</td><td colspan="2">2</td><td>2</td><td>2</td></tr>
<tr><td></td><td>PH/PD</td><td>2.84</td><td>2.05</td><td>2.07</td><td>1.38</td><td>2.40</td><td>1.75</td><td colspan="2">2</td><td>1.75</td><td>1.4</td></tr>
<tr><td></td><td>PH/AD</td><td>6.03</td><td>2.97</td><td>2.32</td><td>1.54</td><td>6.03</td><td>2.40</td><td colspan="2">4</td><td>3.5</td><td>2.8</td></tr>
<tr><td>A4</td><td>Pressure</td><td colspan="6"></td><td colspan="4"></td></tr>
<tr><td></td><td>minimum SERVICE pressure (at PH on PD with Reservoirs at MOL) with no flow through service, Urban and Rural

Normal operating conditions</td><td colspan="6">22 m in the main adjoining the Property boundary.</td><td colspan="4">22 m at the property boundary</td></tr>
<tr><td></td><td>In areas defined by the SP, properties requiring domestic private boosters</td><td colspan="10">12 m at the property boundary</td></tr>
<tr><td></td><td>Maximum SERVICE Pressure</td><td colspan="6">Target maximum pressure 55 m
Maximum pressure 80 m</td><td colspan="4">55 m</td></tr>
<tr><td></td><td>Emergency fire operating conditions (Minimum Residual Mains Pressures)</td><td colspan="6">12m min at the main at the hydrant
9m minimum for infrastructure in small isolated or high elevated areas within the existing water supply zone</td><td colspan="4">12 m min in the main at the flowing hydrant
6 m elsewhere in mains that have customer connections
Positive pressure throughout</td></tr>
<tr><td>A5</td><td>Fire Fighting
Rural and Small Communities
(Definitions as per Glossary)</td><td colspan="8">Rural Residential only: 7.5L/s for 2 hours

Rural Commercial: 15L/s for 2 hours</td><td>Rural (>5,000m2 lots): 7.5L/s for 2 hours</td><td>Rural Residential only: 7.5L/s for 2 hours

Rural Commercial/Industrial: 15L/s for 2 hours</td></tr>
<tr><td></td><td>Urban</td><td colspan="7">Residential: 15 L/s for 2 hours
Commercial/Industrial: 30 L/s for 4 hours</td><td>Detached Res (<= 3 storeys): 15 Ls for 2hrs w background Demand

Multi storey Res (> 3 storeys): 30 L/s for 4 hours w background Demand

Commercial/Industrial buildings: 30 L/s for 4 hours w background Demand

Risk Hazard Buildings – assessed on needs basis</td><td>Semi-Rural (1,000 to 5,000 m^2 lots): 15 L/s for 2 hours

Low Density Urban (1-3 storeys) Tin /Timber: 25 L/s for 2 hours

Low Density Urban (1-3 storeys) Brick/Tile:
Greenfield 25 L/s for 2 hrs
Brownfield 15 L/s for 2 hrs

Medium Density Urban (4-6 storeys):
Greenfield 45 L/s for 4 hrs
Brownfield 30 L/s for 4 hrs

High Density Urban (>6 storeys): 60 L/s for 4 hrs

City CBD/Inner City High Rise: Case by case but in the order of 300 L/s for 4 hrs

Commercial/Industrial:
Greenfield 45 L/s for 4 hrs
Brownfield 30 L/s for 4 hrs</td><td>Detached Res (<= 3 storeys): 15 L/s for 2hrs w background Demand

Multi story Res (> 3 storeys): 30 L/s for 4 hours w background Demand

Commercial/Industrial buildings: 30 L/s for 4 hours w background Demand

Risk Hazard Buildings – assessed on needs basis</td></tr>
<tr><td></td><td>Background Demand</td><td colspan="7">Res: 2/3 PH (not less than AD) and +ve residual pressure at PH
Non Res: PH for localised Commercial/industrial or 2/3 PH for water supply zone. Worst case scenario should be used based on reservoir at MOL,based on single residential or single commercial/industrial fire within water supply zone</td><td>Res(Detached/ Multi storey): Highest of 2/3 PH or AD
Commercial/Industrial: PH demand (between 10am and 4pm)
(single fire event only)</td><td>2/3 x residential peak hour demands plus 1 x non-residential peak hour demands.</td><td>Res (Detached/ Multi storey): Highest of 2/3 PH or AD
Commercial/ Industrial: PH demand (between 10am and 4pm)
(single fire event only)</td></tr>
</table>

No	Parameter A. Drinking Water – Conventional (Single Supply Zone)	Gold Coast	Logan	Redland	Queensland Urban Utilities	Unitywater
A6	**Reservoir storage—operational capacity** (Min Operating Storage – four consecutive hours of demand)	GROUND LEVEL RESERVOIR: 3 x (PD – MDMM) + Emergency Storage (Emergency Storage - Greater of 4 hrs at MDMM or 0.5 ML. For less than 1000 EP, 150 kL)			GROUND LEVEL RESERVOIR: 3 x (PD – MDMM) + greater of 4 hrs MDMM and Firefighting Storage, subject to a minimum reservoir size of 150 kL (Firefighting Storage based on flow and duration requirements stated under item A5 for development types serviced by the reservoir)	GROUND LEVEL RESERVOIR: 3 x (PD – MDMM) + Emergency Storage (Emergency Storage - Greater of 4 hrs at MDMM or 0.5 ML. For less than 1000 EP, 150 kL)
		ELEVATED RESERVOIR: 6 x (PH – 1/12 MDMM)+150kL fire storage In supply zones where 8xPH is less than or equal to MDMM the following equation is used (2xPH)+150kL fire storage Note: PH is in kL/h, MDMM is in kL/d and reservoir storage is in kL in the above formulae.				
A7	**Reservoir Pump Servicing Requirements**					
	Ground level reservoir – Duty Pump	MDMM over 20 hrs				
	Elevated reservoir – Duty Pump	Capacity (L/s) = Peak Hour (L/s)				
	Standby pump capacity	Match largest single pump unit capacity				
A8	**Pipeline Capacity Requirements**	Trunk gravity system: MDMM in 24hours; Reticulation Mains: Maintain pressure for PH and fire flow performance Pump system: MDMM in 20 hours	Transport MDMM in 20 hrs Reticulation mains; Maintain pressure for Peak Hour and fire flow performance			
A9	**Pipe Friction Losses** **Hazen Williams Friction Factors** Based on the preferred material types outlined in the SEQ Water Supply Code (as amended). Any variation from these material types needs to be subject to further investigation.	<=150, C=100 >150 -300mm, C=110				
	Maximum Allowable Headloss (PH) (m/km)	5m/km for DN<=150 3m/km for DN>=200				
	Maximum allowable velocity	2.5m/s				

Table 10 - Sewerage Network Design Criteria

No	Parameter	Gold Coast	Logan	Redland	Unitywater	Queensland Urban Utilities
D1	**Smart Sewer Option**	RIGS			NuSewer or RIGS	NuSewer
D2	**Average Dry Weather Flow (ADWF)**	For RIGS 200 L/EP/d For NuSewer 180 L/EP/d For "baseline" calculations for existing Conventional Sewer 210L/EP/d				
D3	**Peak Dry Weather Flow (PDWF)**	PDWF = C2 X ADWF where C2 = 4.7 X $(EP)^{-0.105}$				NuSewer - d x SF + GWI Where: SF = Sanitary Flow of 150L/EP/d GWI = Groundwater Infiltration of 30L/EP/d EP: 30 / 300 / 600 / 1.2k / 3k / 12k / 20k / 50k / 100k / 500k d": 7.8 / 4.2 / 3.7 / 3.2 / 2.7 / 2.2 / 2.0 / 1.9 / 1.8 / 1.7
D4	**Peak Wet Weather Flow (PWWF)**	For RIGS PWWF = 5 x ADWF NuSewer and Coomera Pimpama in Gold Coast Area[11]: PWWF=4 x ADWF				PWWF = PDWF + Rainfall Dependent Inflow(RDF) RDF = 360L/EP/d
		Vacuum Sewer/Low Pressure Sewer PWWF = (4 x ADWF)				
D5	**Pump Station Servicing Requirements**	Ops Storage = 0.9 x Q / N				(0.9 x Single pump capacity L/s)/ N N = 12 starts per hr for motors less than 50kW. N = 5 starts per hr for motors greater than 50kW.
	Operating storage (m3)	Q = pump rate (L/s) of duty pump or Total Pump Capacity (L/s) if multiple duty pumps. However, Number of starts per hr are: N=12 for motors<100kw N=8 for 100-200kw N=5 of motors >200kw				
	Minimum Wet Well diameter	As shown in the Sewer Pump Station Code (As amended)				
	Emergency storage (new) Required storage based on "in catchment" flows (i.e. upstream pump stations turned off)	4hrs at ADWF			6hrs at ADWF	3 hrs Ultimate PDWF (New PStn)
	Emergency storage (existing)				Minimum 4 hours (up to 6hours)	3 hrs Ultimate ADWF (existing)
	Pump Operation Mode[12]	Duty/assist				Duty/Standby
	Single pump capacity	Min pump capacity for PStns(duty & assist) = C1 x ADWF Where C1 = 15 x $(EP)^{-0.1587}$				For SPS with 3 pumps, 2 pumps delivers PWWF (third pump has same capacity as the larger of the other 2) For SPS with 2 pumps, EACH pump delivers PWWF
		Value of C1 to be within the range 3.5 - 5			Value of C1 to be minimum of 3.5	
	Total pump station capacity	PWWF			PWWF (i.e. 5 x ADWF min or C1 x ADWF; Whichever is the greater) Overflows should not occur at flow < 5 x ADWF or C1 x ADWF (whichever is the larger).	PWWF
	Size of Pump Station Lot (and buffer)	Refer Clause 5.2.4 of Sewer Pump Station Code (As amended)				
D6	**Low Pressure Sewer Flow** -	900 L/EP/d				
D7	**Rising Main Requirements**					
	Preferred Velocity	1.0 – 1.5 m/s				
	Minimum velocity	0.75m/s				

[11] Based on licence requirements

[12] For "Duty/standby" arrangement, in a 2 pump sewerage pump station, EACH pump delivers PWWF and only 1 pump runs at a time. Under a "Duty/Assist" operating philosophy each pump delivers C1 x ADWF and 2 pumps together deliver PWWF

No	Parameter	Gold Coast	Logan	Redland	Unitywater	Queensland Urban Utilities
	Maximum velocity	3m/s				
	Roughness	As per Clause 10.3.3 of WSA 04 Sewage Pumping Station Code				
	Odour Management Requirements	Odour management requirements (including detention times) to be determined as part of the odour impact study for the site (refer Sewerage Pump Station Code (as amended) Clause 2.5)				
D8	**Gravity Sewer Requirements (Conventional)** **- Roughness Equation** **- Pipe friction coefficient**	Manning's All Smart Sewers (Nu Sewer and RIGS) - n = 0.0128				
	- Minimum pipe grades (subject to minimum velocity stated below)	Minimum Sewer Grades (see table below)				
	Maximum depth of flow	75% d (at PWWF)				
	Minimum Velocity	0.7m/s at PDWF Maximum: 3.0m/s (refer Cl 4.5.9.1 of the 2002 Sewer Code)				
D9	**Average Dry Weather Flow (ADWF) for Treatment Plants**	263L/EP/d	As per network flows			

Minimum Sewer Grades

RIGS (PVC) (mm)	NuSewer (PE) (mm)	Nominal Bore (mm)	slope
100	110	100	House Connection Branch, one allotment only at 1:60
150	160	150	House connection Branch and/or sewers for first 10 allotments: 1:100 Sewer after first 10 allotments 1:180 (see note 1)
225	250	225	1:300
300	315	300	1:400
375	400	375	1:550
	500	450	1:700
		525	1:750
	630	600	1:900
		675	1:1050
	800	750	1:1200
		825	1:1380
	1000	900	1:1600
	1200	1050	1:2000
		1200	1:2400
		1350	1:2800
		1500	1:3250
		1650	1:3700
		1800	1:4200
		Note 1 – where approved by the Water Agency, DN 150 main line sewers may be laid at 1:200 in Canal Developments together with a Water Agency agreed reduction in the minimum PDWF Velocity Criteria for the DN 150 main line sewer	

APPENDIX D

WATER INFRASTRUCTURE PLANS

- FIGURE 202
- FIGURE 203
- FIGURE 204
- FIGURE 205

N

Queensland Government

0 250 500 m

1:5,000 Scale at A3

Northshore Hamilton PDA

Figure 202 - Proposed Water Infrastructure (Western Area)

Cardno

Map Produced by APAC North (Traffic & Transport)
Date: 3/11/2020
Coordinate System: GDA 1994 - MGA Zone 56
Project: 790523
Map:790523 Northshore Hamiton LGIP Map 20190822.qgs RevA

Note:
1. Water main design shall ensure isolation valves are provided to support network future maintenance and minimise disruption. If in doubt, early consultation is recommended with Urban Utilities.
2. Detailed geotechnical assessment is recommended to ensure all mains are appropriately designed and installed with due consideration to the known poor-quality soil conditions within the PDA.

Queensland Government

Northshore Hamilton PDA

Figure 203 - Proposed Water Infrastructure (Eastern Area)

Cardno

Map Produced by APAC North (Traffic & Transport)
Date: 3/11/2020
Coordinate System: GDA 1994 - MGA Zone 56
Project: 790523
Map:790523 Northshore Hamiton LGIP Map 20190822.qgs RevA

N

Queensland Government

0 250 500 m

1:1 Scale at A3

Northshore Hamilton PDA

Figure 204 - Existing and to be Decommissioned Water Infrastructure (Western Area)

Cardno

Map Produced by APAC North (Traffic & Transport)
Date: 18/9/2019
Coordinate System: GDA 1994 - MGA Zone 56
Project: 790523
Map:790523 Northshore Hamiton LGIP Map 20190822.qgs RevA

N

Queensland Government

0 250 500 m

1:1 Scale at A3

Northshore Hamilton PDA

Figure 205 - Existing and to be Decommissioned Water Infrastructure (Eastern Area)

Cardno

Map Produced by APAC North (Traffic & Transport)
Date: 18/9/2019
Coordinate System: GDA 1994 - MGA Zone 56
Project: 790523
Map:790523 Northshore Hamiton LGIP Map 20190822.qgs RevA

Water Supply and Sewer Preliminary Analysis

APPENDIX E

SEWERAGE INFRSTRUCTURE PLANS

- FIGURE 301
- FIGURE 302
- FIGURE 303
- FIGURE 304

Cardno

Note:
1. All new sewers shall be NuSewer, unless otherwise approved by Urban Utilities.
2. Detailed geotechnical assessment is recommended to ensure all mains are appropriately designed and installed with due consideration to the known poor-quality soil conditions within the PDA.

N

Queensland Government

0 250 500 m

1:1 Scale at A3

Northshore Hamilton PDA

Figure 301 - Proposed Sewer (Western Area)

Cardno

Map Produced by APAC North (Traffic & Transport)
Date: 2/11/2020
Coordinate System: GDA 1994 - MGA Zone 56
Project: 790523
Map:790523 Northshore Hamiton LGIP Map 20190822.qgs RevA

Note:
1. All new sewers shall be NuSewer, unless otherwise approved by Urban Utilities.
2. Detailed geotechnical assessment is recommended to ensure all mains are appropriately designed and installed with due consideration to the known poor-quality soil conditions within the PDA.

N

Queensland Government

0 250 500 m

1:1 Scale at A3

Northshore Hamilton PDA

Figure 302 - Proposed Sewer (Eastern Area)

Cardno

Map Produced by APAC North (Traffic & Transport)
Date: 2/11/2020
Coordinate System: GDA 1994 - MGA Zone 56
Project: 790523
Map:790523 Northshore Hamiton LGIP Map 20190822.qgs RevA

N

Queensland Government

0 250 500 m

1:1 Scale at A3

Northshore Hamilton PDA

Figure 303 - Existing and to be Decommissioned Sewer (Western Area)

Cardno

Map Produced by APAC North (Traffic & Transport)
Date: 18/9/2019
Coordinate System: GDA 1994 - MGA Zone 56
Project: 790523
Map:790523 Northshore Hamilton LGIP Map 20190822.qgs RevA

Queensland Government

0 250 500 m

1:1 Scale at A3

Northshore Hamilton PDA

Figure 304 - Existing and to be Decommissioned Sewer(Easern Area)

Cardno

Map Produced by APAC North (Traffic & Transport)
Date: 18/9/2019
Coordinate System: GDA 1994 - MGA Zone 56
Project: 790523
Map:790523 Northshore Hamiton LGIP Map 20190822.qgs RevA

APPENDIX F

COST ESTIMATE – WATER AND SEWERAGE

- FIGURE 308
- FIGURE 309

FIGURE - 308

NORTHSHORE HAMILTON PDA - FUTURE ASSETS

ASSET ID	TRUNK / NON-TRUNK	STAGING	ASSET DESCRIPTION	MATERIAL	DIA (mm)	LENGTH (m)	UNIT COST EX ADJ. FACTOR ($2019/UNIT)	SOIL TYPE	CONSTRUCTION CONSTRAINTS	UNIT COST ADJ. FACTOR	UNIT COST INC. ADJ. FACTOR	BASE COST	PROJECT MANAGEMENT & DESIGN COSTS	CONTINGENCY COST	TOTAL CAPITAL COST
WATER													13%	25%	
WATER SUPPLY MAINS															
P-15	NON-TRUNK	3	WATERMAIN	**PE**	180	108	$ 312	ASS areas	HIGH	2.28	$ 711	$ 76,590	$ 9,957	$ 21,637	$ 108,183
P-17	NON-TRUNK	2	WATERMAIN	**PE**	180	125	$ 312	ASS areas	HIGH	2.28	$ 711	$ 88,740	$ 11,536	$ 25,069	$ 125,345
P-18	NON-TRUNK	4	WATERMAIN	**PE**	180	127	$ 312	ASS areas	HIGH	2.28	$ 711	$ 90,430	$ 11,756	$ 25,546	$ 127,732
P-19	NON-TRUNK	4	WATERMAIN	**PE**	180	137	$ 312	ASS areas	HIGH	2.28	$ 711	$ 97,680	$ 12,698	$ 27,595	$ 137,973
P-21	TRUNK	4	WATERMAIN	**PE**	450	194	$ 990	ASS areas	HIGH	2.28	$ 2,256	$ 437,640	$ 56,893	$ 123,633	$ 618,167
P-22	TRUNK	4	WATERMAIN	**PE**	450	55	$ 990	ASS areas	HIGH	2.28	$ 2,256	$ 123,600	$ 16,068	$ 34,917	$ 174,585
P-23	TRUNK	4	WATERMAIN	**PE**	450	56	$ 990	ASS areas	HIGH	2.28	$ 2,256	$ 125,470	$ 16,311	$ 35,445	$ 177,226
P-24	NON-TRUNK	4	WATERMAIN	**PE**	180	41	$ 312	ASS areas	HIGH	2.28	$ 711	$ 29,260	$ 3,804	$ 8,266	$ 41,330
P-20(1)	NON-TRUNK	4	WATERMAIN	**PE**	180	241	$ 312	ASS areas	HIGH	2.28	$ 711	$ 171,190	$ 22,255	$ 48,361	$ 241,806
P-20(2)	NON-TRUNK	4	WATERMAIN	**PE**	180	202	$ 312	ASS areas	HIGH	2.28	$ 711	$ 143,870	$ 18,703	$ 40,643	$ 203,216
P-25	TRUNK	4	WATERMAIN	**PE**	355	142	$ 719	ASS areas	HIGH	2.28	$ 1,638	$ 232,920	$ 30,280	$ 65,800	$ 329,000
P-29	TRUNK	2	WATERMAIN	**PE**	315	25	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 24,990	$ 3,249	$ 7,060	$ 35,298
P-30	TRUNK	2	WATERMAIN	**PE**	315	14	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 14,720	$ 1,914	$ 4,158	$ 20,792
P-31	TRUNK	2	WATERMAIN	**PE**	315	52	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 52,930	$ 6,881	$ 14,953	$ 74,764
P-34	TRUNK	2	WATERMAIN	**PE**	315	157	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 160,210	$ 20,827	$ 45,259	$ 226,297
P-35	TRUNK	2	WATERMAIN	**PE**	315	105	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 107,490	$ 13,974	$ 30,366	$ 151,830
P-16(1)	NON-TRUNK	3	WATERMAIN	**PE**	180	79	$ 312	ASS areas	HIGH	2.28	$ 711	$ 55,890	$ 7,266	$ 15,789	$ 78,945
P-16(2)	NON-TRUNK	2	WATERMAIN	**PE**	180	37	$ 312	ASS areas	HIGH	2.28	$ 711	$ 26,220	$ 3,409	$ 7,407	$ 37,036

NORTHSHORE HAMILTON PDA - FUTURE ASSETS

ASSET ID	TRUNK / NON-TRUNK	STAGING	ASSET DESCRIPTION	MATERIAL	DIA (mm)	LENGTH (m)	UNIT COST EX ADJ. FACTOR ($2019/UNIT)	SOIL TYPE	CONSTRUCTION CONSTRAINTS	UNIT COST ADJ. FACTOR	UNIT COST INC. ADJ. FACTOR	BASE COST	PROJECT MANAGEMENT & DESIGN COSTS	CONTINGENCY COST	TOTAL CAPITAL COST
WATER													13%	25%	
WATER SUPPLY MAINS															
P-36	TRUNK	2	WATERMAIN	**PE**	315	135	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 138,190	$ 17,965	$ 39,039	$ 195,193
P-37(1)	NON-TRUNK	4	WATERMAIN	**PE**	180	258	$ 312	ASS areas	HIGH	2.28	$ 711	$ 183,140	$ 23,808	$ 51,737	$ 258,685
P-37(2)	NON-TRUNK	4	WATERMAIN	**PE**	180	23	$ 312	ASS areas	HIGH	2.28	$ 711	$ 16,350	$ 2,126	$ 4,619	$ 23,094
P-39	NON-TRUNK	2	WATERMAIN	**PE**	250	46	$ 374	ASS areas	HIGH	2.28	$ 853	$ 39,530	$ 5,139	$ 11,167	$ 55,836
P-40	NON-TRUNK	2	WATERMAIN	**PE**	250	62	$ 374	ASS areas	HIGH	2.28	$ 853	$ 53,140	$ 6,908	$ 15,012	$ 75,060
P-42	NON-TRUNK	2	WATERMAIN	**PE**	250	72	$ 374	ASS areas	HIGH	2.28	$ 853	$ 61,250	$ 7,963	$ 17,303	$ 86,516
P-43	NON-TRUNK	2	WATERMAIN	**PE**	250	359	$ 374	ASS areas	HIGH	2.28	$ 853	$ 306,155	$ 39,800	$ 86,489	$ 432,444
P-44	NON-TRUNK	4	WATERMAIN	**PE**	180	102	$ 312	ASS areas	HIGH	2.28	$ 711	$ 72,470	$ 9,421	$ 20,473	$ 102,364
P-45	NON-TRUNK	4	WATERMAIN	**PE**	180	13	$ 312	ASS areas	HIGH	2.28	$ 711	$ 8,960	$ 1,165	$ 2,531	$ 12,656
P-41(1)	NON-TRUNK	2	WATERMAIN	**PE**	250	70	$ 374	ASS areas	HIGH	2.28	$ 853	$ 59,960	$ 7,795	$ 16,939	$ 84,694
P-41(2)	NON-TRUNK	2	WATERMAIN	**PE**	250	125	$ 374	ASS areas	HIGH	2.28	$ 853	$ 106,390	$ 13,831	$ 30,055	$ 150,276
P-46	NON-TRUNK	4	WATERMAIN	**PE**	180	21	$ 312	ASS areas	HIGH	2.28	$ 711	$ 15,200	$ 1,976	$ 4,294	$ 21,470
P-33(1)	TRUNK	2	WATERMAIN	**PE**	315	103	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 104,620	$ 13,601	$ 29,555	$ 147,776
P-32(2)	TRUNK	2	WATERMAIN	**PE**	315	62	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 62,760	$ 8,159	$ 17,730	$ 88,649
P-32(1)(2)	TRUNK	2	WATERMAIN	**PE**	315	157	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 159,860	$ 20,782	$ 45,160	$ 225,802
P-50	NON-TRUNK	3	WATERMAIN	**PE**	180	152	$ 312	ASS areas	HIGH	2.28	$ 711	$ 108,270	$ 14,075	$ 30,586	$ 152,931
P-32(1)(1)(1)	TRUNK	2	WATERMAIN	**PE**	315	55	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 55,700	$ 7,241	$ 15,735	$ 78,676
P-32(1)(1)(2)	TRUNK	2	WATERMAIN	**PE**	315	127	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 129,080	$ 16,780	$ 36,465	$ 182,326
P-47(1)	NON-TRUNK	4	WATERMAIN	**PE**	180	36	$ 312	ASS areas	HIGH	2.28	$ 711	$ 25,470	$ 3,311	$ 7,195	$ 35,976
P-47(2)	NON-TRUNK	3	WATERMAIN	**PE**	180	176	$ 312	ASS areas	HIGH	2.28	$ 711	$ 124,930	$ 16,241	$ 35,293	$ 176,464
P-38(1)	NON-TRUNK	2	WATERMAIN	**PE**	250	154	$ 374	ASS areas	HIGH	2.28	$ 853	$ 131,520	$ 17,098	$ 37,154	$ 185,772
P-38(2)	NON-TRUNK	2	WATERMAIN	**PE**	250	103	$ 374	ASS areas	HIGH	2.28	$ 853	$ 87,600	$ 11,388	$ 24,747	$ 123,735
P-48(1)	NON-TRUNK	3	WATERMAIN	**PE**	180	196	$ 312	ASS areas	HIGH	2.28	$ 711	$ 139,540	$ 18,140	$ 39,420	$ 197,100
P-48(2)	NON-TRUNK	2	WATERMAIN	**PE**	180	33	$ 312	ASS areas	HIGH	2.28	$ 711	$ 23,590	$ 3,067	$ 6,664	$ 33,321
P-49(1)	NON-TRUNK	2	WATERMAIN	**PE**	180	202	$ 312	ASS areas	HIGH	2.28	$ 711	$ 143,490	$ 18,654	$ 40,536	$ 202,680
P-49(2)	NON-TRUNK	2	WATERMAIN	**PE**	180	33	$ 312	ASS areas	HIGH	2.28	$ 711	$ 23,330	$ 3,033	$ 6,591	$ 32,954
P-51(1)	NON-TRUNK	2	WATERMAIN	**PE**	180	97	$ 312	ASS areas	HIGH	2.28	$ 711	$ 69,090	$ 8,982	$ 19,518	$ 97,590
P-51(2)	NON-TRUNK	2	WATERMAIN	**PE**	180	32	$ 312	ASS areas	HIGH	2.28	$ 711	$ 22,510	$ 2,926	$ 6,359	$ 31,795
P-26(1)	TRUNK	4	WATERMAIN	**PE**	355	146	$ 719	ASS areas	HIGH	2.28	$ 1,638	$ 238,430	$ 30,996	$ 67,356	$ 336,782
P-26(2)	TRUNK	4	WATERMAIN	**PE**	355	39	$ 719	ASS areas	HIGH	2.28	$ 1,638	$ 63,140	$ 8,208	$ 17,837	$ 89,185
P-33(2)(1)	TRUNK	2	WATERMAIN	**PE**	315	75	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 76,850	$ 9,991	$ 21,710	$ 108,551
P-33(2)(2)	TRUNK	2	WATERMAIN	PE	315	85	$ 448	ASS areas	HIGH	2.28	$ 1,020	$ 86,950	$ 11,304	$ 24,563	$ 122,817
												$ 4,997,305			**$ 7,058,693**

FIGURE - 309

NORTHSHORE HAMILTON PDA - FUTURE ASSETS

ASSET ID	TRUNK / NON-TRUNK	STAGING	ASSET DESCRIPTION	DIA (mm)	LENGTH (m)	MATERIAL	UNIT COST EX ADJ. FACTOR ($2019/UNIT)	SOIL TYPE	DEPTH (m)	CONSTRUCTION CONSTRAINTS	UNIT COST ADJ. FACTOR	UNIT COST INC. ADJ. FACTOR	BASE COST	PROJECT MANAGEMENT & DESIGN COST	CONTINGENCY COST	TOTAL ESTIMATED COST
SEWER														13%	25%	
GRAVITY MAINS																
NHP01	Trunk	2	Gravity main along Macarthur Ave (East)	315	75	PE	$ 778	ASS areas	3.63	High	2.50	$ 1,943	$ 146,470	$ 19,041	$ 41,378	$ 206,889
NHP02	Trunk	2	Gravity main along Macarthur Ave (East)	315	81	PE	$ 778	ASS areas	3.75	High	2.50	$ 1,943	$ 157,350	$ 20,456	$ 44,451	$ 222,257
NHP03	Trunk	2	Gravity main along Macarthur Ave (East)	315	147	PE	$ 778	ASS areas	3.51	High	2.50	$ 1,943	$ 285,760	$ 37,149	$ 80,727	$ 403,636
NHP04	Trunk	2	Gravity main along Macarthur Ave (East)	400	145	PE	$ 1,090	ASS areas	3.27	High	2.50	$ 2,722	$ 394,370	$ 51,268	$ 111,410	$ 557,048
NHP05	Trunk	2	Gravity main along Macarthur Ave (East)	400	131	PE	$ 1,090	ASS areas	3.52	High	2.50	$ 2,722	$ 356,270	$ 46,315	$ 100,646	$ 503,231
NHP06	Trunk	2	Gravity main along Macarthur Ave (East)	500	88	PE	$ 1,436	ASS areas	3.56	High	2.50	$ 3,585	$ 315,460	$ 41,010	$ 89,117	$ 445,587
NHP07	Non-Trunk	2	Gravity main SC along Macarthur Ave (East)	250	36	PE	$ 574	ASS areas	2.52	High	2.28	$ 1,308	$ 46,450	$ 6,039	$ 13,122	$ 65,611
NHP08	Trunk	2	Gravity main along Macarthur Ave (East)	500	76	PE	$ 1,436	ASS areas	3.40	High	2.50	$ 3,585	$ 271,010	$ 35,231	$ 76,560	$ 382,802
NHP09	Non-Trunk	2	Gravity main SC along Macarthur Ave (East)	250	34	PE	$ 574	ASS areas	2.51	High	2.28	$ 1,308	$ 45,010	$ 5,851	$ 12,715	$ 63,577
NHP10	Non-Trunk	2	Gravity main SC along Macarthur Ave (East)	250	34	PE	$ 785	ASS areas	3.57	High	2.50	$ 1,960	$ 66,650	$ 8,665	$ 18,829	$ 94,143
NHP11	Non-Trunk	2	Gravity main SC along Macarthur Ave (West)	160	45	PE	$ 671	ASS areas	3.36	High	2.50	$ 1,675	$ 75,050	$ 9,757	$ 21,202	$ 106,008
NHP18	Non-Trunk	2	Gravity main SC along Theodore St	180	26	PE	$ 671	ASS areas	3.51	High	2.50	$ 1,675	$ 44,230	$ 5,750	$ 12,495	$ 62,475
NHP19	Non-Trunk	2	Gravity main SC along Macarthur Ave (East)	160	28	PE	$ 671	ASS areas	3.58	High	2.50	$ 1,675	$ 46,070	$ 5,989	$ 13,015	$ 65,074
NHP12	Non-Trunk	4	Gravity main SC along Curtin Ave (West)	160	31	PE	$ 671	ASS areas	4.44	High	2.50	$ 1,675	$ 51,430	$ 6,686	$ 14,529	$ 72,645
NHP13	Trunk	4	Gravity main along Curtin Ave (West)	250	179	PE	$ 1,139	ASS areas	4.73	High	2.63	$ 2,994	$ 536,910	$ 69,798	$ 151,677	$ 758,385
NHP14	Trunk	4	Gravity main along Curtin Ave (West)	315	415	PE	$ 1,114	ASS areas	5.24	High	2.63	$ 2,927	$ 1,213,440	$ 157,747	$ 342,797	$ 1,713,984
NHP15	Trunk	4	Gravity main along Curtin Ave (West)	315	72	PE	$ 1,114	ASS areas	5.48	High	2.63	$ 2,927	$ 211,070	$ 27,439	$ 59,627	$ 298,136
NHP16	Non-Trunk	4	Gravity main SC along Curtin Ave (West)	160	32	PE	$ 671	ASS areas	3.94	High	2.50	$ 1,675	$ 53,780	$ 6,991	$ 15,193	$ 75,964
NHP17	Trunk	4	Gravity main along Fleece St	160	155	PE	$ 671	ASS areas	4.15	High	2.50	$ 1,675	$ 259,670	$ 33,757	$ 73,357	$ 366,784
NHP20	Trunk	4	Gravity main along Fleece St	160	67	PE	$ 671	ASS areas	4.29	High	2.50	$ 1,675	$ 112,410	$ 14,613	$ 31,756	$ 158,779
					1,896								**$ 4,688,860**			**$ 6,623,015**