BEFORE THE HEARINGS COMMISSIONERS
APPOINTED BY THE CENTRAL OTAGO DISTRICT COUNCIL

UNDER	the Resource Management Act 1991
IN THE MATTER	of a submission on a Plan Change under clause 6 of Schedule 1 of the Act
BY	**ONE FIVE FIVE DEVELOPMENTS LP**
	Submitter

STATEMENT OF EVIDENCE OF STUART CALDER

Dated: 16 May 2023

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LAWYERS | NOTARY PUBLIC

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Statement of Evidence of Stuart Calder

Introduction

[1] My name is Stuart Allan Calder. I am a professional land surveyor at Calder Surveying Limited.

[2] My qualifications are Licensed Cadastral Surveyor, NZIS, RPSURV.

[3] I have 23 years post registration experience in small to medium residential subdivisions, involving consenting, design, engineering design of wastewater and stormwater piped systems, and basic water design.

Code of conduct for expert witnesses

[4] I confirm I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2023 and that I have complied with it when preparing my evidence. Other than when I state I am relying on the advice of another person, this evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope of evidence

[5] I have been requested by One Five Five Developments LP to give expert evidence regarding yield calculations and possible wastewater disposal in respect of its submission on Plan Change 19 by the Central Otago District Council.

[6] I have relied on the following material:

(a) memorandum by Mott Macdonald to the CODC, dated 19 November 2020 assessing water supply and wastewater infrastructure for 269 Dunstan Road, Alexandra (**Mott MacDonald report**);

(b) CODC's GIS services portal; and

(c) GRIP property software based on Land Information New Zealand property data.

[7] I am unable to run modelling software to confirm available pipeline capacities and have relied on simple calculations and empirical observations from the Mott Macdonald reports and existing Council GIS wastewater network, based on experience.

[8] My evidence addresses:

(a) wastewater capacity for further development at 131-157 Dunstan Road (**subject site**), relying on the Mott MacDonald report; and

(b) a yield analysis of the subject site.

Wastewater capacity for further intensification of 131 -157 Dunstan Road

[9] The Mott MacDonald report is attached as **Appendix A** to this evidence.

[10] The report was initially prepared for the 60 lots proposed as part of the Molyneux Lifestyle Village, located on the east side of Dunstan Road and abutting Waldron Road on the northern boundary. It was then updated for the proposed additional lots on the land on the eastern side of Dunstan Road which has been notified to be rezoned as Large Lot Residential (**LLR**) Zone under the CODC's Plan Change 19. The report assumed 300 new lots could be created on this land based on the LLR Zoning.

[11] The land includes the Molyneux Lifestyle Village to the north and extends to the Fulton Hogan Yard to the south.[1]

Proposed options

[12] The report explored two options for wastewater reticulation:

(a) connection via 36 Henderson Drive (**Option 1**); and

(b) connection via 99 Russel Street (**Option 2**).

[1] Page 17 of Mott MacDonald report.

[13] Option 2 in the Mott MacDonald report via Russell Street has been discounted due to capacity issues associated with the number of lots proposed. This evidence therefore focuses on Option 1.

[14] The Mott MacDonald report notes that Option 1 is via a pumping line to drain into an existing 225mm wastewater main in Henderson Drive, within Molyneux Estate. Figure 3.7 of the Mott MacDonald report shows a 150mm wastewater main flowing at near full capacity (although the Council GIS shows this to be a 225mm wastewater main).

Identified constraint to increase loading for Option 1

[15] The Mott McDonald report (section 4.2) notes that an additional downstream pipe is under capacity in Wet Weather Flows (**WWF**) as a result of the 300 lots. The report identifies this as being a 300mm trunk line located at 1 Dunorling Street (asset ID 20031215141651).

[16] This asset is in fact serving the main township of Alexandra and does not form part of the downstream reticulation from the proposed 300 Lot command area or the Molyneux Estate area. The plan attached at **Appendix B** (3114-WW) shows the sizing of the downstream pipework based on Council GIS records. The minimum gravity pipe size west of the Clyde - Alexandra Road is in fact 375mm all the way to the last pump station at Dunorling Street. The wastewater main located within Molyneux Estate is shown as a 225mm diameter pipe.

Alternative solution to allow significantly more intensification of Lots at 131-157 Dunstan Road

[17] It should be noted that a 375mm diameter pipe has approximately 50% more capacity than a 300mm pipe, laid at the same grade, so no WWF capacity constraints are anticipated.

[18] Given the area of area of land proposed for medium density development immediately northwest of Molyneux Estate, it is likely that the existing 225mm pipe can accommodate the original design command area. However, the 300 additional lots proposed to the East of Dunstan Road may require an additional sewer main to be laid to the pumping station at the entrance of Molyneux Estate. Given the depth of

the manhole of 4.3 metres (CODC GIS) beside this pumping station, it is likely that a new gravity main could be installed along most of the route shown in magenta on the plan at **Appendix B**.

[19] The downstream wastewater network from the start of the 375mm pipeline in Pines Road appears to have plenty of additional capacity, and the network can be relatively easily extended to the pump station in the Clyde-Alexandra Road, at the entrance to Molyneux Estate through undeveloped land. The pumping line between the downstream 375mm wastewater pipeline and the pump station at the entrance of Molyneux Estate is 100mm. This may be adequate in size if the pumping time is increased, or storage capacity for moderate flows is provided.

Conclusion as to wastewater capacity

[20] Based on the above, I consider that further intensification of the land at 131 to 151 Dunstan Road is achievable with an alternative connection to the existing wastewater network. I note that no modelling has been carried out to support the comments above. This would need to be remodelled by Mott Macdonald.

Yield Study 131-157 Dunstan Road, Alexandra

Average lot yield

[21] As explained above, CODC commissioned Mott MacDonald to prepare a wastewater and water assessment of the area notified as being rezoned as LLR Zone under Plan Change 19, to confirm servicing ability for wastewater and water. A capacity of 300 lots was used which over a total area of 92 hectares calculates to an average of 3067 m² per gross lot.

[22] With internal roading, utility service areas, recreation areas and transmission line corridors yet to be deducted, this provides an average yield of 65% based on the minimum 2000 m² lots. In practice there will be some larger lots, so a number of 300 lots is I believe a fair estimate for potential dwelling volume.

Molyneux Lifestyle Village - Furthest from Alexandra township

[23] The Molyneux Lifestyle Village has a site area of approximately 16.5 hectares and a proposed 60 allotments. Therefore, the average lot size is 2750 m² before roading and other such matters are accounted for. The yield of the lots for the Lifestyle Village based on a minimum area of 2000 m² is 73%.

The subject site

[24] These properties are located closer to the Alexandra township. The total area is approximately 12.35 hectares and have five established dwellings located throughout. I understand one of the dwellings (Lot 1 DP 518150) is to be removed.

[25] The site also has overhead Transpower transmission lines that bisect the sites which reduces the area available for residential development. Allowing for a suitable area to be left around the existing dwellings (as shown in yellow on the plan attached at Appendix C) and the setbacks from the transmission lines, the available number of lots at a minimum of 2000 m² is 39. This includes the four existing dwellings and the one hectare area within part of Lot 3 DP 399742. On that basis, the average size of the lots calculates at 3166 m², with an average yield of 63% based on a minimum area of 2000 m².

[26] Given that this site is located close to the Alexandra Township and directly opposite the area proposed to be rezoned as Medium Density, it seems viable that a higher yield should be available within this area.

[27] Should the property be rezoned as Low Density zoning, the requirements are a minimum area of 500 m². On the same area this would allow for around additional 109 properties, excluding an area around the existing dwellings to be contained within the four additional existing properties and with four large lot residential sites (LLRZ) located within part of Lot 3 DP 399742. This equates to a total of 117 lots, being an additional 78 Lots than would be possible under the proposed LLRZ zoning and provides an overall yield of 46% based on a relevant

minimum site area of 500m² for the 113 lots (The 113 calculation excludes the 4 lots located with Lot 3 399742 (LLRZ)).

[28] Potable water was not identified as a restrictive issue in the Mott MacDonald report and has not been investigated. Large potable water design is also outside my area of expertise.

Conclusion

[29] I believe that capacity can be made available to much more intensive development on 131-157 Dunstan Road.

Stuart Calder
Licensed Cadastral Surveyor
16 May 2023

Appendices:

A. Mott MacDonald Wastewater modelling report November 2020.

B. 3114-WW – Calder Surveying Existing and Alternative Wastewater schematic.

C. 3114_05-2000 – Calder Surveying 2000m² yield study plan.

D. 3114_05-500 – Calder Surveying 500m² yield study plan.

Appendix A

MOTT MACDONALD

Technical Memo
Central Otago District Council

Project:	Proposed development query: Molyneux Lifestyle Village in Alexandra		
Our reference:	385321	**Revision:**	B - draft
Prepared by:	Hannah Law & Giulio Pozzuto	**Date:**	19 November 2020
Approved by:	Julie Plessis	**Checked by:**	Tom Lecomte
Subject:	269 Dunstan Road: water supply and wastewater infrastructure assessment		

In October 2020, Mott MacDonald was commissioned by Central Otago District Council (CODC) to assess the system performance of the water supply (WS) and wastewater (WW) networks; specifically, at the location of the proposed Molyneux Lifestyle Village (MLV), in Alexandra. The development consists of a total of 60 residential units, which has been modelled using the Lake Dunstan (Alexandra and Clyde) models.

1 Background

1.1 Background and Disclaimer

The Alexandra WS model was built by Rationale in 2014 and reviewed by Mott MacDonald in 2017. The WS Alexandra model was merged with the Clyde model and renamed Lake Dunstan WS model. Mott MacDonald carried out the model update using the latest GIS data and recalibrated the model in 2019.

The Alexandra WW model was built by Rationale in 2015 and reviewed by Mott MacDonald in 2017. Some critical issues were highlighted, and a model update was carried out by Mott MacDonald in 2018. However, the Alexandra WW model has not been recalibrated.

The information and recommendations presented within this assessment are dependent upon the accuracy and reliability of the existing hydraulic models and the data available to Mott MacDonald at the time of the assessment. This technical note has been prepared to assess the impact of the proposed development WS demands and WW discharge on the existing Alexandra WS and WW networks.

Mott MacDonald has followed the accepted procedure in providing the services but given the residual risk associated with any prediction, Mott MacDonald takes no liability for, and gives no warranty against, the consequences of wastewater overflows in relation to the performance of the service and damage to any property (client's or third party). Any third-party developing detailed design should not rely on assumptions made in this report but should satisfy themselves in that regard.

1.2 Development Location

The document summarises the results of the assessment undertaken for the proposed MLV development at 269 Dunstan Road, which is situated immediately northbound of the Alexandra township. The development will be serviced via the Alexandra WS and WW network schemes, which can both be seen in Figure 1-1 and Figure 1-2, respectively.

Figure 1-1: Proposed development and the Alexandra WS network

Figure 1-2: Proposed development and the Alexandra WW network

As part of the WS and WW infrastructure assessment, a system performance analysis (SPA) has been undertaken within the two Alexandra networks. The analysis consists in reviewing the network capacities both prior and post-development, determining whether the levels of services (LOS) can be maintained (WS LOS detailed in Section 2.2), and assess the overall impact upon the two networks. However, as they were not finalised, the internal networks within the proposed MLV development were not assessed for both the WS and WW reticulations.

The WS network analysis also involves the firefighting (FF) capability testing. Additionally, the minimum pipe size required along Dunstan Road (Figure 1-1) has also been determined as part of this assessment, in order to adequately supply the proposed development and provide the required FF (25 l/s – FW2).

2 Modelling assumption

2.1 Demand and discharge calculations

As informed by the New Zealand Standards (4404:2010) and the CODC addendum, the WS demand was calculated using the criteria listed below and the results are tabulated in Table 2.1.

- Persons per lot: 3
- Daily consumption: 500 litres/person/day
- Total number of lots: 60
- Residential peak hour factor: 5

Table 2.1: WS demand at the proposed MVL development

	Daily flow (m^3/d)	Instantaneous peak demand (l/s)
Total demand	90	5.21

The WW discharges for the proposed development were calculated in accordance with New Zealand Standard for Land Development and Subdivision Infrastructure (NZS 4404:2010) and the CODC Addendum to NZS 4404:2010 (dated July 2008). The calculated wastewater loads for the development are summarised below in Table 2.2. These demands are based on the following assumptions:

- Persons per lot: 3
- Total number of lots: 60
- Residential peaking factor: 2.5
- Wastewater daily demand: 250 litres/person/day
- Infiltration and inflow peaking factor: 2

Table 2.2: WW discharge at the proposed MVL development

Catchment	Number of lots	Assumed population	Peak Dry Weather Flow (PDWF) (l/s)	Peak Wet Weather Flow (PWWF) (l/s)
Molyneux Lifestyle Village	60	180	1.30	2.60

2.2 LOS and FF requirements

As informed by the New Zealand Standards (4404:2004) and the CODC addendum, the following standards and levels of service have been used for WS network:

- The required operating pressure must fall between 30-80 metres
- The head losses through pipes must be no greater than:
  - 5 m/km in pipes smaller than DN 150 mm
  - 3 m/km in pipes greater than DN 200 mm

- The firefighting water standard for this study is FW2 (no sprinkler system) and all lots must be located within a 90 metres-radius from a hydrant (compliant with SNZ PAS 4509).
  - Importantly, the location of hydrants surrounding the proposed development remains unknown.

2.3 Scenario investigated and confirmed developments

The following two scenarios (including the demand associated with developments on Ngapara Street and Henderson Drive) were considered in the modelling of the WS and WW networks and determined the base scenario for this assessment:

- **WS**: Calibration scenario (including Ngapara Street and Henderson Drive).
- **WW**: Uncalibrated base scenario (including Ngapara Street and Henderson Drive).

Continually, to assess the impact of the proposed MLV development upon the existing Alexandra WW network, the following scenarios were modelled using Mike Urban 2020:

- **Base model (pre-development scenario):**
  - Dry Weather Flow (DWF) scenario
  - 10-Year Average Recurrence Interval (ARI) Wet Weather Flow (WWF) scenario
- **Post-development Option 1 model:**
  - DWF scenario
  - 10-Year ARI WWF scenario
- **Post-development Option 2 model:**
  - DWF scenario
  - 10-Year ARI WWF scenario

2.4 Network setup and connection points

As instructed by the CODC, the following configurations were used for WS and WW:

WS network and connection point

- A watermain will be built along Dustan Road, in order to supply the proposed development;
- The proposed connection point will be situated at 269 Dunstan Road;
- Connection to the network is not possible via the future trunk main between Clyde and Alexandra;
- See Figure 1-1.

WW network and connection point(s)

- Two rising main options have been provided by the council. Both options consist of a new pump station and rising main to enable discharge from the development into the existing Alexandra network.
- The proposed discharge point will be situated at 269 Dunstan Road and will be connected to the network via one of the following two options:
  - **Sewer Option 1**: 36 Henderson Drive
  - **Sewer Option 2**: 99 Russel Street
- Connection to the network is not possible via the future trunk main between Clyde and Alexandra;
- See Figure 1-2.

2.5 Site elevation

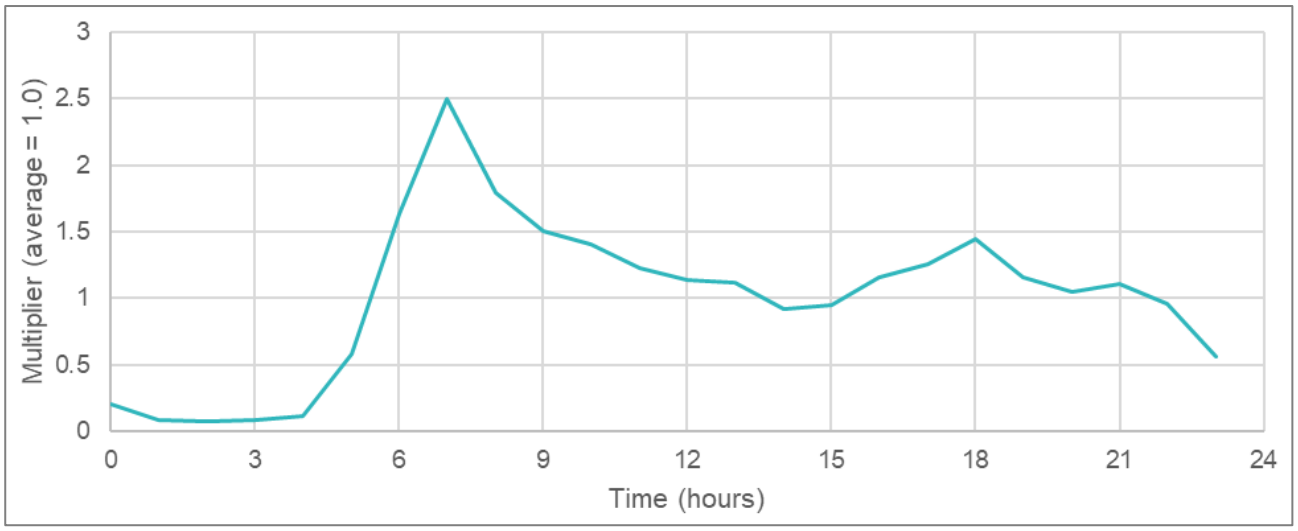
As informed by the ‘A4814_PLAN_1A_Modelling’ drawing, provided by the CODC; the recorded elevation at the point of connection and discharge is 155.75 mRL and the highest elevation within the development is 156.15 mRL (northern boundary of the proposed MLV development site).

2.6 WW model build assumptions

For the MLV wastewater model, the following assumptions have been made:

- The MLV pump station is assumed to have a fixed pump rate of 5 l/s and have no storage in the wet well.
- A standard residential 24-hour diurnal profile, with a peak factor of 2.5, has been assumed for the proposed MLV wastewater flows. The diurnal profile used for the proposed development is shown in Figure 2-1 below.

Figure 2-1: Residential diurnal profile in Alexandra WW network



3 Modelling results

3.1 WS network modelling

The internal WS network within the MLV development was not assessed as part of this study, as such, the modelled pressure and headloss was assessed at the development's connection point to the WS network. The results have been analysed, to verify whether the required LOS and FF classification can be maintained.

3.1.1 Minimum pipe size required along Dunstan Road

Currently, the network extends as far as 147 Dunstan Road, which is approximately 1.2 km south from the proposed MLV development site. Therefore, a new watermain pipe is required along Dunstan Road (delimited in Figure 1-1), to enable the integration of the development into the Alexandra WS network.

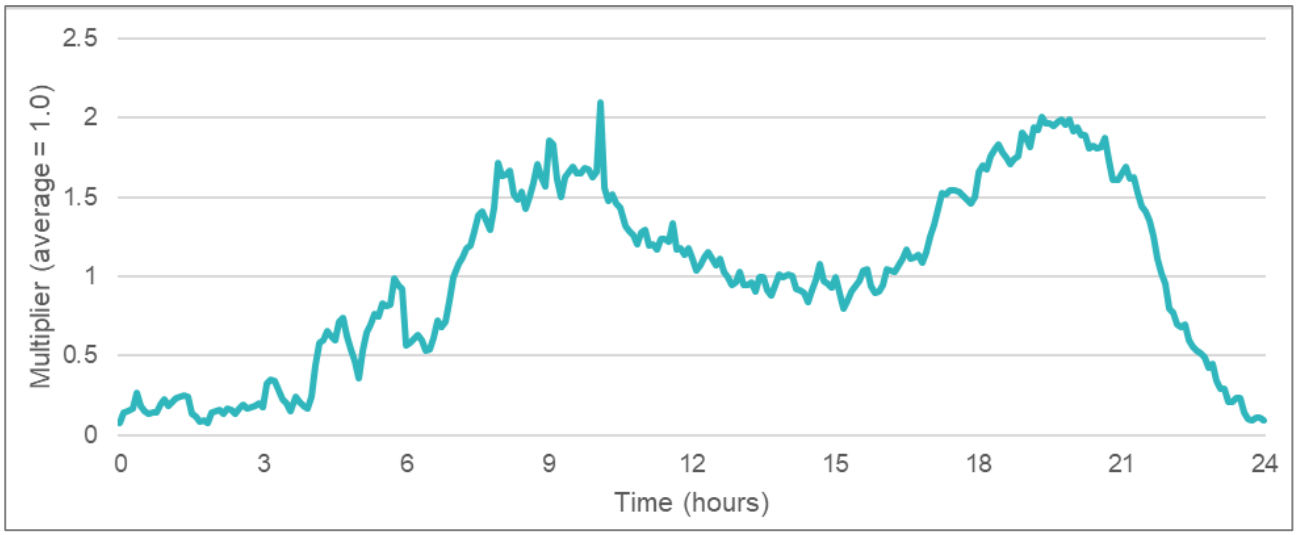
The minimum pipe size required along Dunstan Road, to adequately service the proposed development and provide the required FF classification (25 l/s – FW2), has also been determined using EPAnet (version 2.2). In order to comply with the LOS (stated in Section 2.2), the residual pressure at the node (considered a hydrant in this exercise) cannot drop below 10 metres. A reiterative approach was undertaken in order to determine the minimum pipe size required and the final two iterations (resulting in 10 metres or higher) are shown in Table 3.1, alongside the pipe material, nominal and internal diameters.

3.1.2 Table 3.1: Minimum pipe size required along Dunstan Road

Pipe material	Nominal Diameter (mm)	Internal Diameter (mm)	Minimum pressure when simulating FW2 at 'MolyLV_Node_2' (m)
HDPE (PE100) PN 12.5	280	237.9	11.8
	315	267.6	33.9

Importantly, the reiterative process took into consideration the demand associated with the proposed MLV development, The FF flow was simulated during the diurnal time where the average usage is equal to 60% of the peak demand observed within the Alexandra residential pattern (see Figure 3-1).

Figure 3-1: Residential diurnal profile in Alexandra WS network



Modelling indicated the pipe size DN 280 mm would enable the LOS and FF flow required; however, the modelled residual pressure was only 1.8 metres above the recommended LOS. Network variability and margin of error must be taken into consideration, therefore, the next pipe size available (DN 315 mm) was recommended and is used in the system performance analysis.

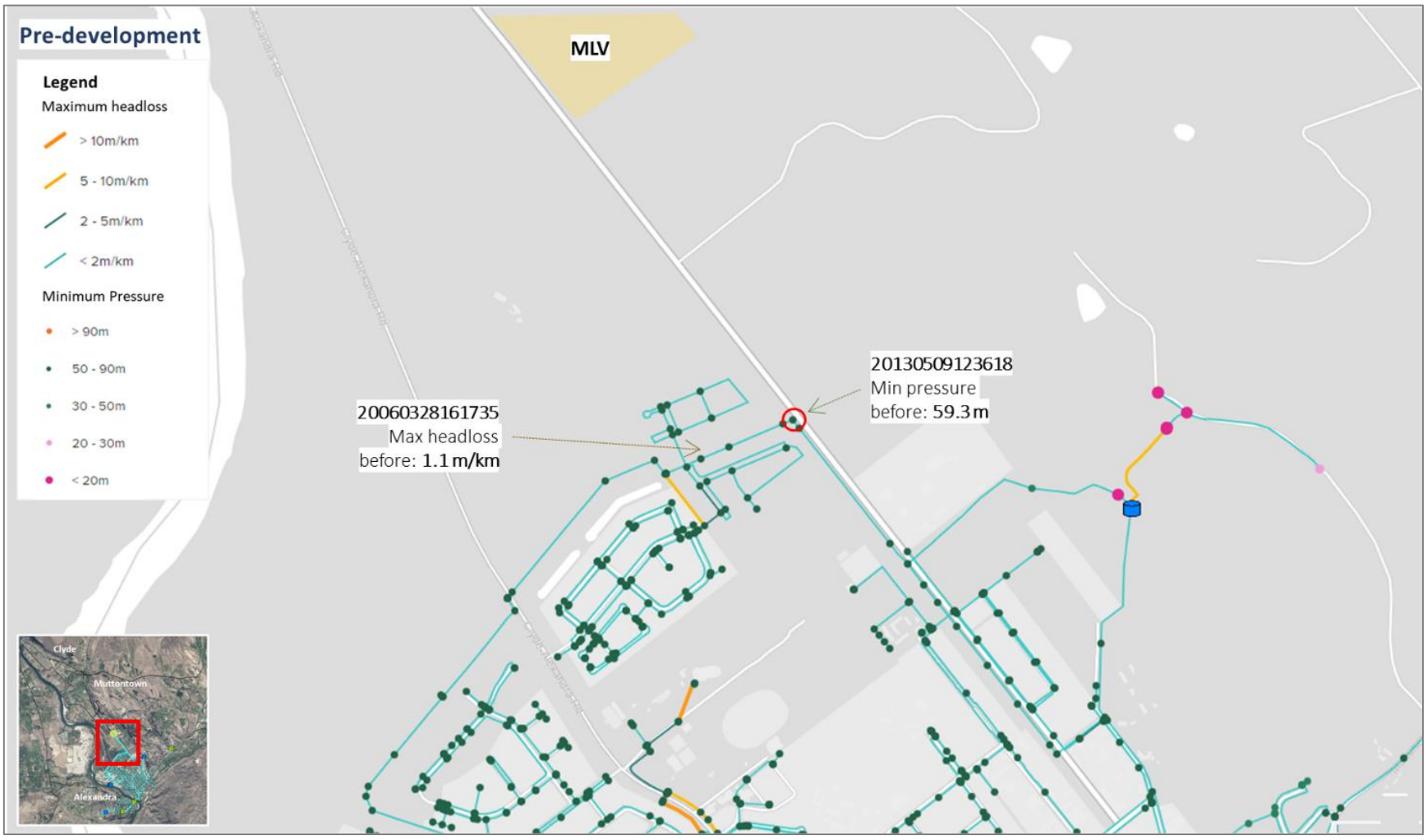
Notably, if a care facility is to be integrated within the MLV development, FW3 (50 l/s) would be required. Thusly, the minimum pipe size that would be required along Dunstan Road would be DN 355 mm (ID 301.6 mm), if constructed as HDPE pipe (PE100 & PN12.5). This sizing was not considered during the SPA, as the CODC specified the FF capability required is FW2. Therefore, it is assumed there will be no care facility.

3.1.3 WS system performance analysis results

The section describes the results of the SPA undertaken for the calibration scenario, before and after the proposed MLV development (including the associated demand) was added to the WS network model. Results have been analysed to verify whether the LOS can be met at the point of connection and at the highest elevation within the development (excluding the internal WS network – remains unknown). The LOS have been assessed assuming the pipe size recommended in Section 3.1.1 (or similar) will be constructed.

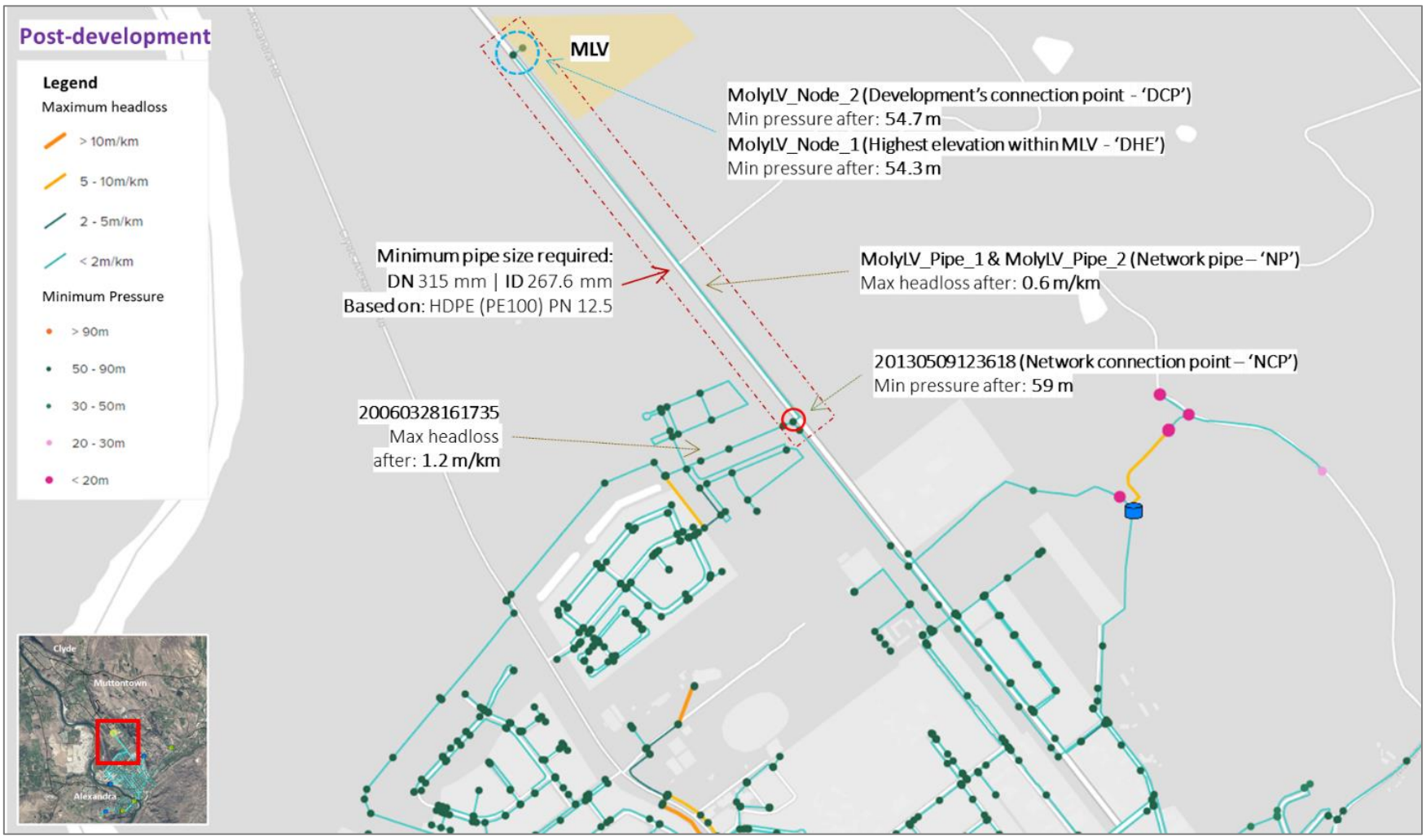
Figure 2-1 and Figure 3-1 illustrate the SPA results before and after the development was added to the WS network, the same information is tabulated in Table 3.2 and Table 3.3.

Figure 3-2: System performance analysis results (pre-development)



Source: Mott MacDonald, 2020

Figure 3-3: System performance results (post-development)



Source: Mott MacDonald, 2020

Table 3.2: Minimum pressure comparison (pre and post development)

Nodes	Minimum pressure at selected nodes (m)		Variance (+/-)
	Pre-development	Post-development	
20130509123618	59.3	59.0	-0.3
MolyLV_Node_1	-	54.3	n/a
MolyLV_Node_2	-	54.7	n/a

Table 3.3: Maximum head losses comparison (pre and post development)

Pipes	Maximum head losses at proximal pipes (m/km)		Variance (+/-)
	Pre-development	Post-development	
20060328161735	1.1	1.2	+0.1
MolyLV_Pipe_1 (NP)	-	0.6	n/a
MolyLV_Pipe_2 (NP)	-	0.6	n/a

Within the area surrounding the connection point, there is a negligible drop in pressure (-0.3 m) and a minor increase in head losses (+0.1 m/km). The maximum head loss is predicted to be 0.6 m/km in the proposed DN 315 mm). At the development connection point and highest elevation location, the pressures are predicted to be 54.7 m and 54.3 m, respectively.

Regarding the LOS stated in Section 2.2, both the operating pressure and maximum permitted head losses comply with the required LOS.

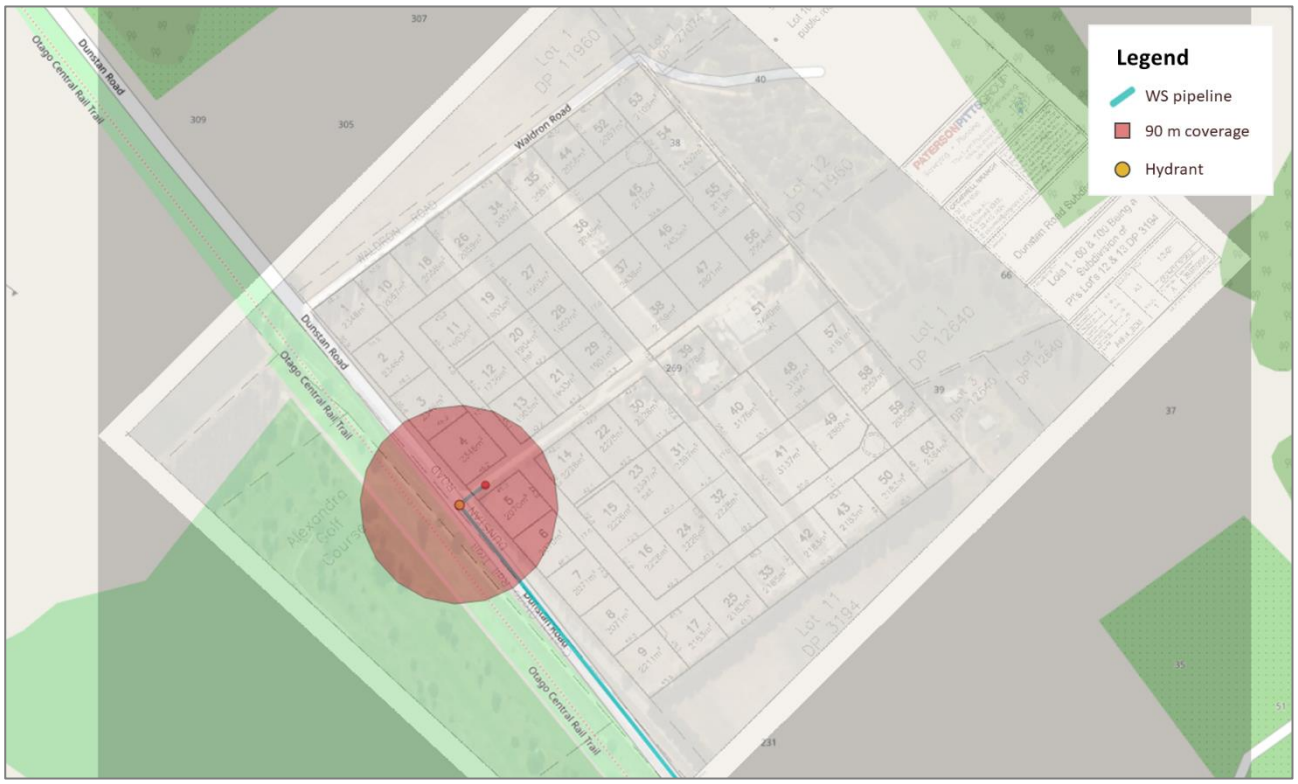
3.1.4 FF capability and hydrant locations

As instructed by the CODC, the required FF capacity for the proposed development is 25 l/s, which is equivalent to FW2 (no sprinkler system).

Assuming a proposed DN 315 mm watermain servicing the development, the predicted pressure drop is 21 m and the residual pressure is predicted at 33.9 m (above the lowest recommended LOS at 10 m). Additionally, the pressure does not drop below null within the remainder of the Alexandra WS network.

Furthermore, the proximity of each proposed lot in relation to the selected (DCP) has been assessed and visualised in Figure 3-4. Evidently, multiple hydrants will need to be integrated within the development's internal WS network, in order to comply with the LOS and FF water standards stated in Section 2.2. This should be taken into consideration by the developer and the CODC during the detailed design stages.

Figure 3-4: DCP proximity from the MLV development



Regarding the LOS stated in Section 2.2, both the predicted FF flow and capability is compliant with the required LOS and FF water standards at the development connection point. However, this should be reassessed once the internal WS network is finalised and the location of hydrants is known.

3.2 WW network modelling

3.2.1 WW system performance analysis criteria

An assessment of the model results was carried out for the Base Model and Post-Development Models to investigate the existing Alexandra wastewater network performance considering:

- Pipe capacity
- Overflow volume

Pipe capacities were evaluated in two ways. Firstly, by comparing the modelled peak flow with the theoretical pipe full capacity (Q_{max}/Q_f) and secondly, by comparing the modelled peak depth with the pipe diameter (H_{max}/Diameter).

Peak flows above the theoretical pipe capacity indicate that the pipe is undersized and cannot convey the peak flows that are required through the network. Pipes where the capacity is exceeded show that $Q_{max}/Q_f > 1$. In cases where pipes have capacity but are surcharged (due to downstream constraints), the model results will show that $Q_{max}/Q_f < 1$ and H_{max}/Diameter > 1.

The system performance was carried out for the model scenario for both the Dry Weather Flow (DWF) and the 10-year Average Recurrence Interval (ARI) Wet Weather Flow (WWF) events. The results of the wastewater system performance analysis are summarised in the sections below.

3.2.2 Dry Weather Flow system performance

The pipe capacity results for the DWF scenarios are summarised in Table 3.4 below. Table 3.4 indicates that

- for Option 1, the additional wastewater flows from the MLV development are not predicted to increase the number of pipes that are under capacity in the existing network during the DWF event.
- for the Option 2, the number of pipes that are under capacity in the existing network are predicted to increase by one for the DWF event, when compared to the pre-development scenario.

The model results indicate that the increase in wastewater discharge from the development is predicted to cause existing pipe 20031203001638 to be under capacity, during the DWF event, when the proposed rising main is connected to the existing wastewater network at 99 Russel Street (Option 2). This 150 mm diameter pipe is located downstream of the proposed Option 2 connection point, as shown on Figure 3-5 below.

The results do not predict overflows to occur during the DWF event for the base model and the Options 1 and 2 models.

Table 3.4: DWF System Performance – Pipe Capacity Summary

Scenario	Number of Pipes with Capacity Exceeded	Total Length of Pipe with Capacity Exceeded (m)	% of Total	Number of Pipes Surcharged due to Downstream Conditions*	Total Length of Pipe Surcharged due to Downstream Conditions (m)	% of Total
Base Model	8	468	0.9%	60	2,017	7%
Post-Development Option 1 Model	8	653	1%	60	2,017	7%
Post-Development Option 2 Model	9	743	1%	60	2,017	7%

Source: Mott MacDonald
*Number of pipes which have capacity but are surcharged (due to downstream conditions)

Figure 3-5: Location of additional pipe under capacity in Option 2 DWF scenario

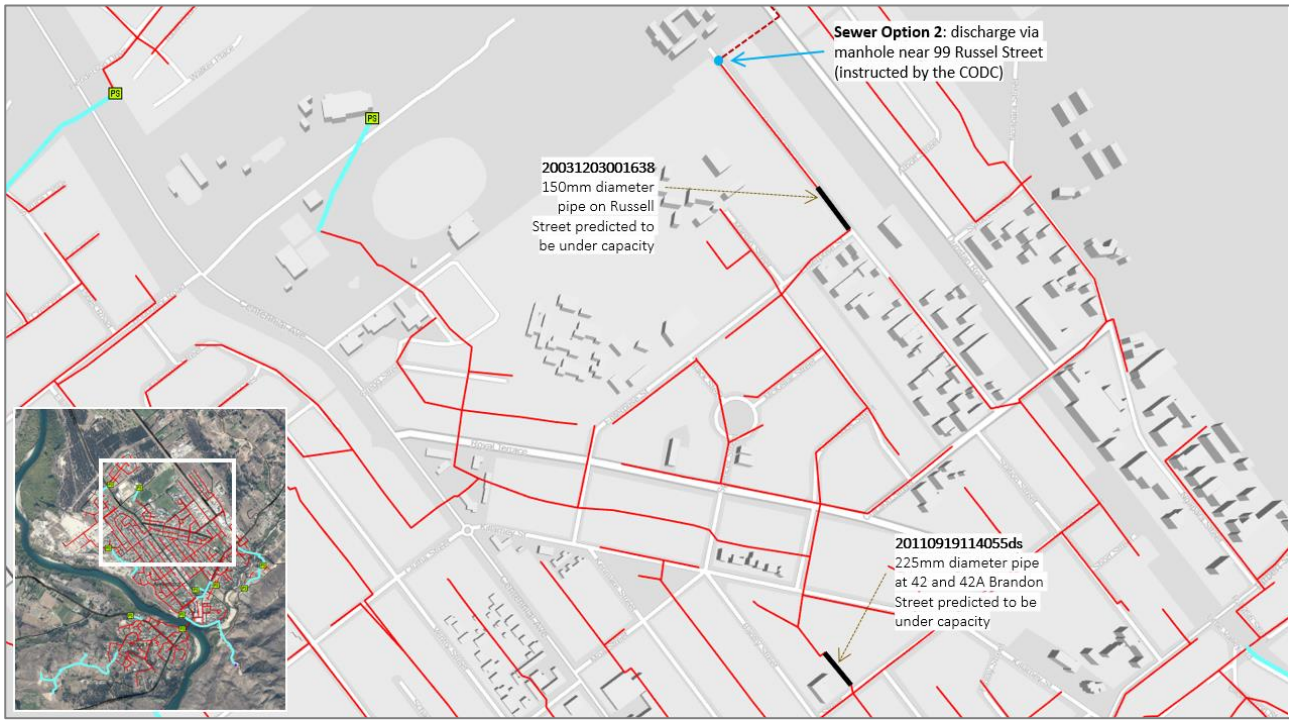
Source: Mott MacDonald, 2020

3.2.3 Wet Weather Flow system performance

The pipe capacity and overflow results for the WWF scenarios are summarised in Table 3.5 and Table 3.6 below. For the WWF event, the additional wastewater flows from the MLV development are not predicted to increase the number of pipes under capacity when the proposed rising main is connected to the existing network outside of 36 Henderson Drive (Option 1).

The model results indicate that the additional flows from the MLV development for the Option 2 WWF scenario are predicted to increase the number of pipes under capacity by two, when compared to the pre-development scenario. The location of these additional pipes that are predicted to be under capacity are shown on Figure 3-6 below. For the WWF event, the model does not predict that the additional flows from MLV development (Option 1 and 2 scenarios) will cause additional overflows to occur.

Figure 3-6: Location of additional pipe under capacity in Option 2 WWF scenario



Source: Mott MacDonald, 2020

Table 3.5: WWF System Performance – Pipe Capacity Summary

Scenario	Number of Pipes with Capacity Exceeded	Total Length of Pipe with Capacity Exceeded (m)	% of Total	Number of Pipes Surcharged due to Downstream Conditions*	Total Length of Pipe Surcharged due to Downstream Conditions (m)	% of Total
Base Model	19	955	2%	129	6,360	15%
Post-Development Option 1 Model	19	955	2%	129	6,276	15%
Post-Development Option 2 Model	21	1,108	2%	130	6,403	15%

Source: Mott MacDonald
*Number of pipes which have capacity but are surcharged (due to downstream conditions)

Table 3.6: WWF System Performance – Overflow Summary

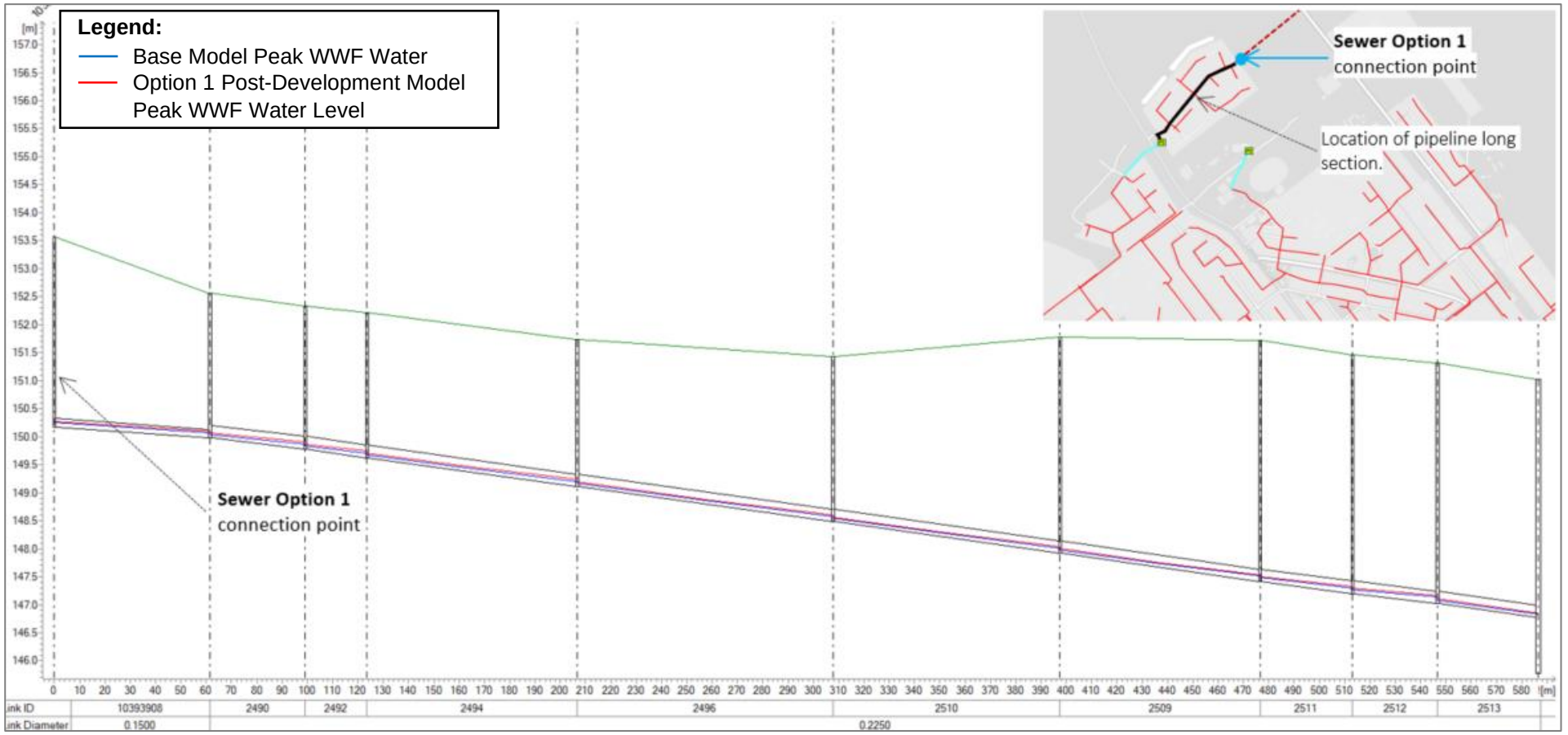
Scenario	Total Number of Overflows	Total Overflow Volume (m^3)*
Base Model	2	23.0
Post-Development Option 1 Model	2	22.9
Post-Development Option 2 Model	2	22.9

Source: Mott MacDonald
*Minor differences in overflow volumes for the model scenarios are negligible and within the modelling tolerance.

The WWF peak water level long section results for the pipeline located downstream of the proposed Option 1 rising main connection point (pipeline 20060329140821 to Molyneux East Pump Station) is shown on Figure 3-7 below. The long section results indicate the proposed development flows are predicted to slightly increase the water levels in this downstream existing pipeline during the WWF event. However, for the post-development scenario, the additional flows from the development are not predicted to cause pipeline to surcharge during the WWF event.

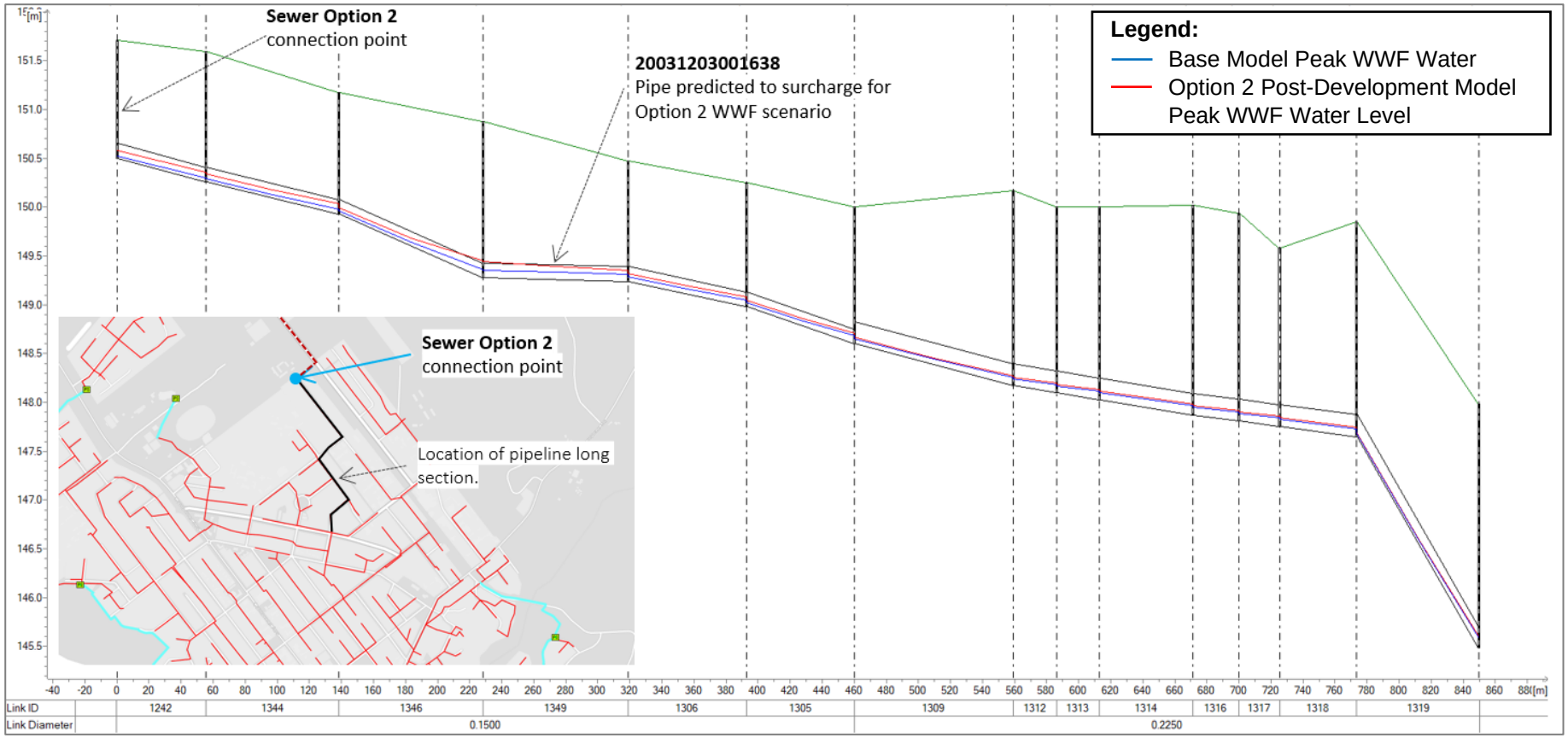
Figure 3-8 below illustrates the WWF peak water level long section results for the pipeline located downstream of the proposed Option 2 rising main connection point (pipeline 20031201222707 to 20031202230318). The results indicate the proposed flows from the MLV development are predicted to increase the water levels in the downstream pipeline 20031201222707 to 20031202230318. The results also predict that the proposed development will cause the upstream end of pipe 20031203001638 to surcharge during the WWF event.

Figure 3-7: WWF Peak Water Level Long Section Result for Pipeline 20060329140821 to Molyneux East Pump Station - Base Model and Option 1 Post Development Scenario



Source: Mott MacDonald, 2020

Figure 3-8: WWF Peak Water Level Long Section Result for Pipeline 20031201222707 to 20031202230318 - Base Model and Option 2 Post Development Scenario

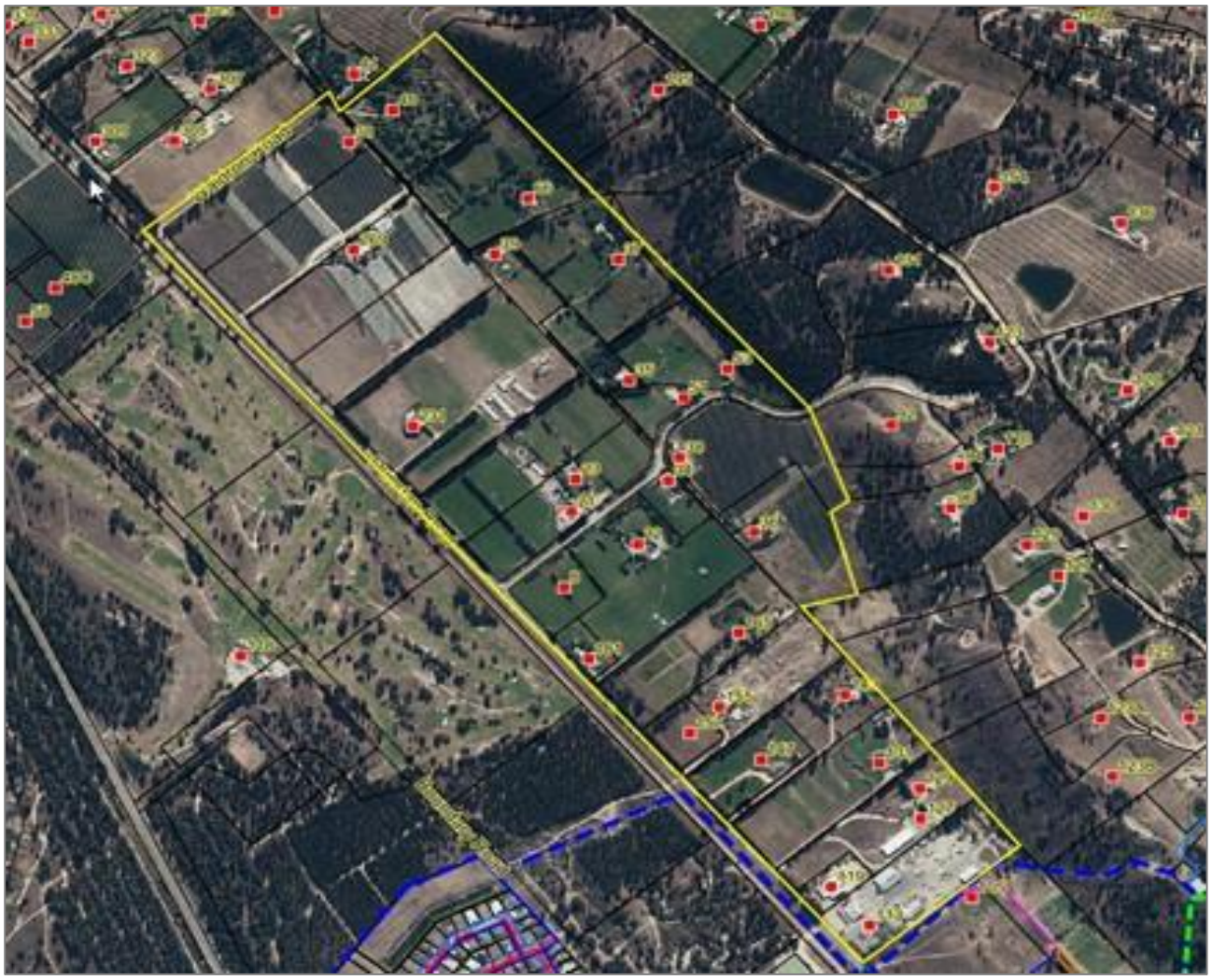


Source: Mott MacDonald, 2020

4 Impact on the network from a plan change

The impact on the WS and WW networks from a plan change between the proposed development and Alexandra town was also assessed. Figure 4-1 below shows the extent of the potential future development considered. As agreed with CODC, the total number of lots assumed in this area was 300, which also includes the 60 lots considered in the above sections of this study.

Figure 4-1: Potential future development extent



4.1 Water Supply

The additional 300 lots (total) have a negligible impact on the pipe network, with a head loss difference of 0.1m/km compared to the pre-development scenario. Minimum pressure at the connection point is predicted to drop from 59.3 m to 57.7 m. This is due to the Northern Reservoir draining to 0.5m during the evening peak demand period (instead of 1.8 m in the pre-development scenario). This is likely related to the model operational set up (bores pumping times may vary depending on the level in the Northern Reservoir). However, it should be noted that the peak day demand corresponds to 450 m^3/day, which corresponds to 23% of the existing Norther Reservoir.

4.2 Wastewater

The impact of the proposed plan change area was assessed using the two options that were proposed for the MLV development (a new pump station and rising main to connect to the downstream existing network at either 36 Henderson Drive or 99 Russel Street). For this assessment, the pump station was assumed to have a fixed pump rate of 15 l/s and have no storage in the wet well.

The wastewater flows from the proposed plan change area were calculated based on an assumed total number of lots of 300 and the assumptions listed in Section 2.1 of this technical memo. The model results for the post-development plan change scenarios are summarised in Table 4.1, Table 4.2 and Table 4.3 below.

The results indicate that for the Option 1, the additional flows from the plan change area are not predicted to increase the number of pipes under capacity for the DWF event. For Option 2, the results predict that the additional flows from the proposed plan change area will cause an additional two pipes to be under capacity when compared to the MLV Development Option 2 model for the DWF event. These additional pipes are located on Russel Street (downstream of the proposed Option 2 connection point to the existing network).

The results do not predict overflows to occur during the DWF event for the base model, the MLV Development Options 1 and 2 models and the Plan Change Options 1 and 2 models.

Table 4.1: Plan Change Impact Assessment - DWF Pipe Capacity Summary

Scenario	Total Number of Proposed Lots	Number of Pipes with Capacity Exceeded	% of Total	Number of Pipes Surcharged due to Downstream Conditions*	% of Total
Base Model	N/A	8	0.9%	60	7%
Post-Development Option 1 Model	60 (MLV Development Only)	8	1%	60	7%
	300 (Plan Change)	8	1%	62	7%
Post-Development Option 2 Model	60 (MLV Development Only)	9	1%	60	7%
	300 (Plan Change)	11	1%	67	8%

Source: Mott MacDonald
*Number of pipes which have capacity but are surcharged (due to downstream conditions)

For the WWF event, the model results indicate that the additional flows from the plan change area are predicted to increase the number of pipes under capacity by one, when compared to the MLV Option 1 model. This additional pipe (asset ID 20031215141651) is a 300mm diameter trunk main which is located downstream of the site at 1 Dunorling Street. The Option 1 results predict that the additional flows from the plan change area will not increase the number of overflows during the WWF event.

The Option 2 plan change WWF results indicate that the additional flows from the site are predicted to increase the number of pipes under capacity by eight, when compared to the MLV Option 2 WWF model. The Option 2 results also predict that the additional flows from the plan change area will cause one additional overflow to occur during the WWF event. The model predicts a WWF overflow volume of 2.1m^3 from this additional overflow location. The pipe capacity issues and overflows that are predicted to occur due to the additional wastewater flows from the plan change area are located downstream of the proposed Option 2 connection point, as shown on Figure 4.2 below.

Table 4.2: Plan Change Impact Assessment - WWF Pipe Capacity Summary

Scenario	Total Number of Proposed Lots	Number of Pipes with Capacity Exceeded	% of Total	Number of Pipes Surcharged due to Downstream Conditions*	% of Total
Base Model	N/A	19	2%	129	15%

Scenario	Total Number of Proposed Lots	Number of Pipes with Capacity Exceeded	% of Total	Number of Pipes Surcharged due to Downstream Conditions*	% of Total
Post-Development Option 1 Model	60 (MLV Development Only)	19	2%	129	15%
	300 (Plan Change)	20	2%	180	21%
Post-Development Option 2 Model	60 (MLV Development Only)	21	2%	130	15%
	300 (Plan Change)	29	3%	140	16%

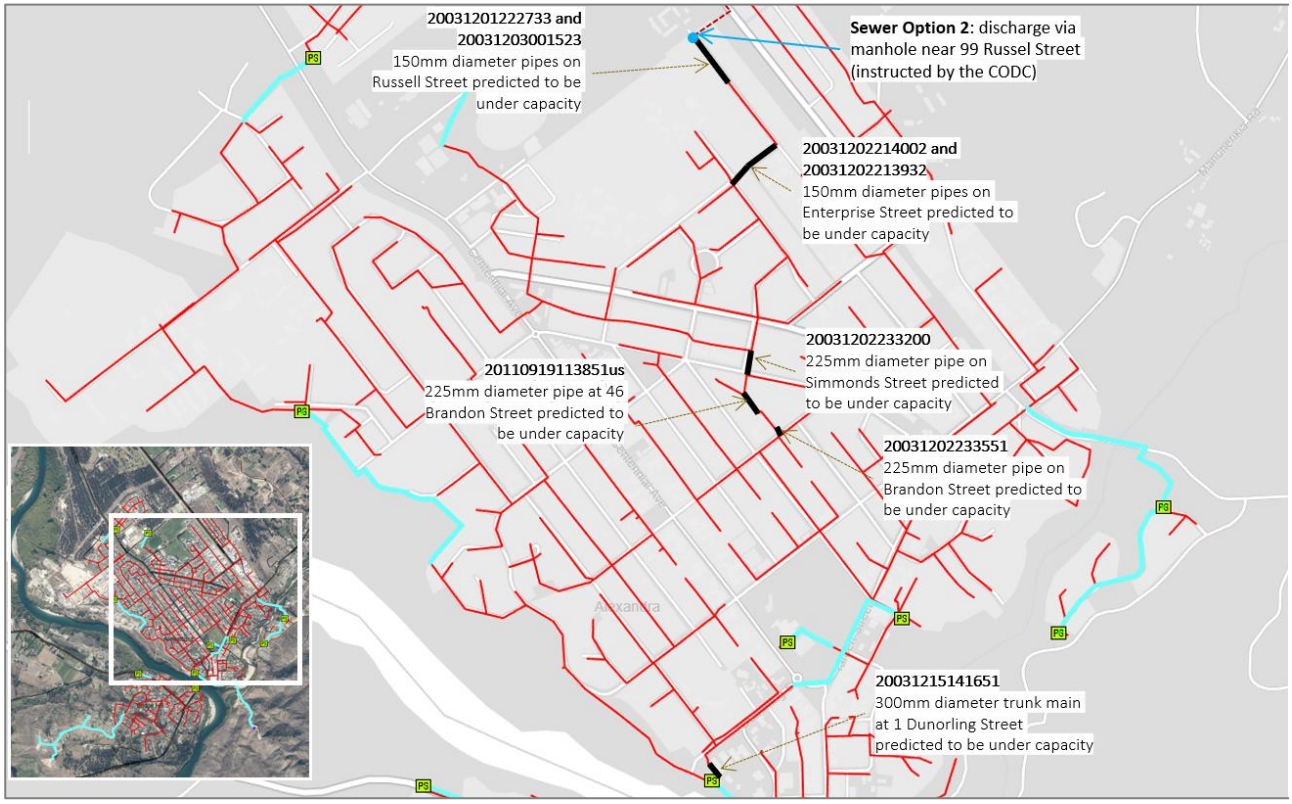
Source: Mott MacDonald
*Number of pipes which have capacity but are surcharged (due to downstream conditions)

Table 4.3: Plan Change Impact Assessment - WWF Overflow Summary

Scenario	Total Number of Proposed Lots	Total Number of Overflows	Total Overflow Volume (m^3)
Base Model	N/A	2	23.0*
Post-Development Option 1 Model	60 (MLV Development Only)	2	22.9*
	300 (Plan Change)	2	23.1*
Post-Development Option 2 Model	60 (MLV Development Only)	2	22.9*
	300 (Plan Change)	3	25.2

Source: Mott MacDonald
*Minor differences in overflow volumes for the model scenarios are negligible and within the modelling tolerance.

Figure 4.2: Location of additional pipes under capacity and overflows in Option 2 Plan Change WWF scenario



Source: Mott MacDonald, 2020

5 Conclusion and recommendations

5.1 Water supply

The demand from the proposed MLV development (60 lots) has been added to the network under the calibration scenario conditions. The proposed MLV development's internal network was not modelled as part of this study; however, the total demand was modelled proximal to the development connection point at the highest elevation, to determine whether suitable LOS and FF water standards could be maintained.

Additionally, the minimum pipe size required along Dustan Road to service the development and provide FW2 fire flow was determined to be DN 315 mm (Section 3.1.1). Further modelling should be considered once the development's WS detailed design is confirmed, to assess the suitability of hydrants location.

The SPA predicted pressure drops and head losses to be negligible within the remainder of the network, therefore, compliant with the LOS stated in Section 2.2. Based on the results from the WS modelling, the following recommendations can be made:

- The minimum pipe size required to service the development along Dunstan Road is DN 315 mm;
- Multiple hydrants are required within the development's internal WS network to be compliant.

5.2 Wastewater

The Alexandra wastewater network model was updated to incorporate the proposed Molyneux Lifestyle Village development. The modelling carried out for this assessment consisted of three scenarios:

- Base model (pre-development scenario).
- Option 1: connection of the proposed MLV rising main to the existing network outside 36 Henderson Dr.
- Option 2: connection of the proposed MLV rising main to the existing network outside of 99 Russel St.

The model results indicate that for the DWF event, Option 1 is not predicted to increase the number of pipes under capacity and Option 2 is predicted to increase the number of pipes under capacity by one. The results do not predict overflows to occur for the base model and the Options 1 and 2 models during the DWF event.

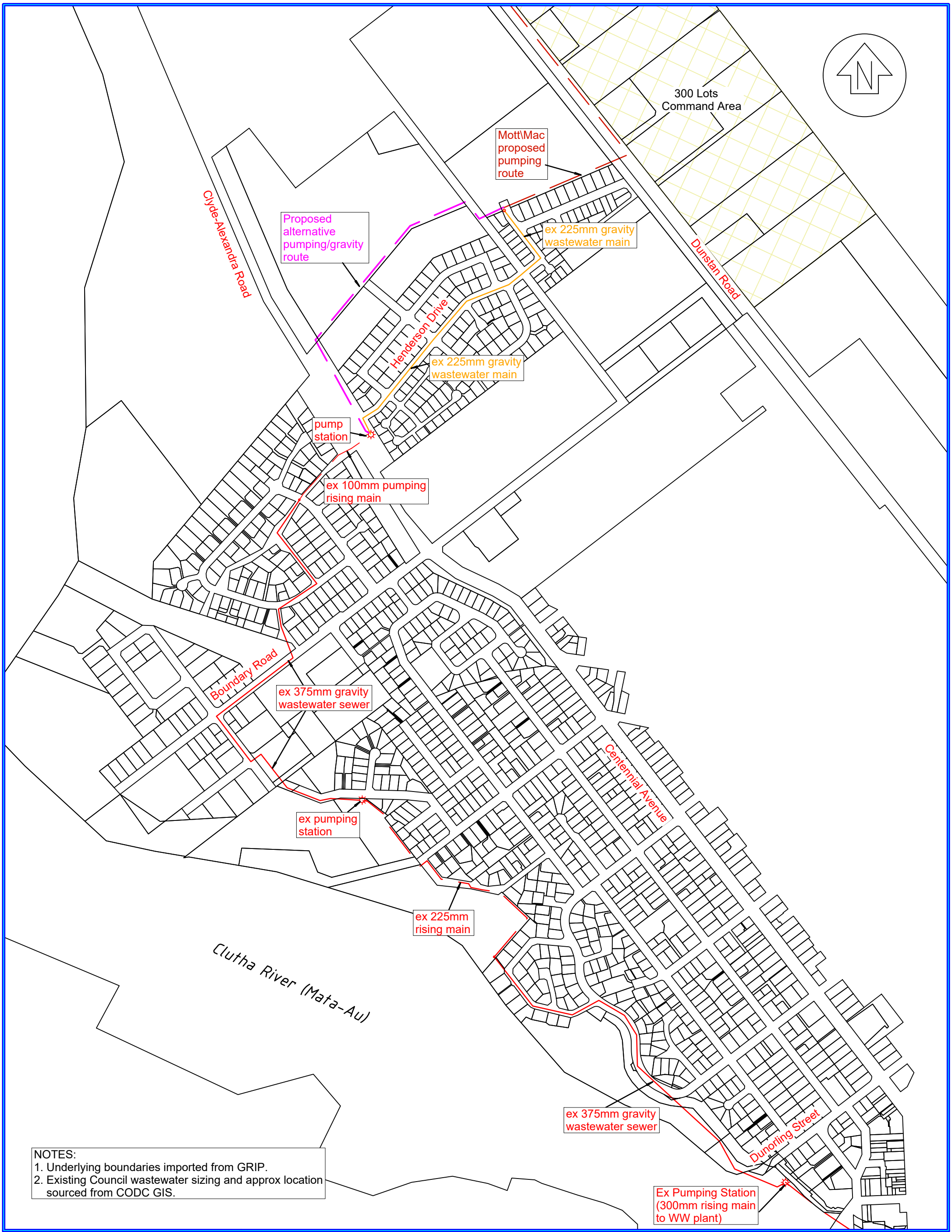
For the WWF events, the proposed development is not predicted to increase the number of pipes under capacity in the existing Alexandra wastewater network for Option 1. The results predict that two additional pipes will be under capacity for Option 2 during the WWF event. The results did not predict that the proposed development for Options 1 and 2 will cause additional overflows to occur from the existing network during the WWF event.

5.3 Plan Change Impact

The impact on the WS and WW networks from a plan change (total of 300 lots) between the proposed development and Alexandra town was also assessed.

- **WS network**:
  - The predicted impact is negligible, however, it should be noted that the 300 lots' demand (peak day) would represent 23% of the existing Northern Reservoir volume.
- **WW network**:
  - Option 1: the number of pipes under capacity is predicted to increase the by one under WWF, when compared to the proposed 60 lots development
  - Option 2: the number of pipes under capacity is predicted to increase the by two under DWF and eight under WWF. One additional overflow is predicted to occur ($2.1m^3$).

Appendix B



NOTES:
1. Underlying boundaries imported from GRIP.
2. Existing Council wastewater sizing and approx location sourced from CODC GIS.

CALDER SURVEYING

EXISTING AND PROPOSED WASTEWATER RETICULATION (SCHEMATIC ONLY)

Date:	11 May 2023
Scale:	1:7500 @ A3
Drawn by:	S. Calder
Client:	Navigate Property Ltd
Job No:	3114-WW

Appendix C

Lot 3
DP 535181

Lot 2
DP 7449

Lot 3
DP 322981

Lot 3
DP 399742

Lot 6
DP 6740

3.98ha
16

Lot 1
DP 546912

Lot 1
DP 518150

'C'

Lot 2
DP 546912

YARD

1.45ha
4

Lot 3
DP 523111

'A'

Lot 2
DP 518150

0.58ha
2

GRID

R

Lot 2
DP 350011

NATIONAL

'B'

'D'

0.60ha
3

Lot 3
DP 6740

2.30ha
10

DUNSTAN ROAD

Part Lot 2
DP 6740

Lot 1
DP 17723

Practical yield:
35 + 4 existing = ~39 lots

CALDER SURVEYING

YIELD STUDY SCHEME
131 - 157 DUNSTAN ROAD
ALEXANDRA

Date:	30 Mar 2023
Scale:	1:2000 @ A3
Drawn by:	J. Sobek
Client:	Navigate Property Ltd.
Job No:	3114_05-2000

Appendix D

Lot 3
DP 535181

Lot 2
DP 7449

Lot 3
DP 322981

Lot 6
DP 6740

Lot 3
DP 399742

1.00ha
4
(large lot)

Lot 1
DP 546912

2.98ha
40

Lot 1
DP 518150

'C'

Lot 2
DP 546912

0.90ha
14

YARD

Lot 3
DP 523111

'A'

Lot 2
DP 518150

0.65ha
8

GRID

R

Lot 2
DP 350011

NATIONAL

0.25ha
4

'B'

'D'

R

DUNSTAN ROAD

0.53ha
8

Lot 3
DP 6740

2.30ha
35

R

Part Lot 2
DP 6740

Lot 1
DP 17723

Practical yield:
113 + 4 existing = ~117 lots

CALDER SURVEYING

YIELD STUDY SCHEME
131 - 157 DUNSTAN ROAD
ALEXANDRA

Date:	30 Mar 2023
Scale:	1:2000 @ A3
Drawn by:	J. Sobek
Client:	Navigate Property Ltd.
Job No:	3114_05-500