

ANNEXURE D

INFRASTRUCTURE REPORT & RFI RESPONSE

Infrastructure Report

Hornby Quadrant • Shands Road, Christchurch

Calder Stewart Industries Limited

PCXX – Marsh's Road Industrial Extension

20992

December 2023



DAVIE LOVELL-SMITH

PLANNING SURVEYING ENGINEERING

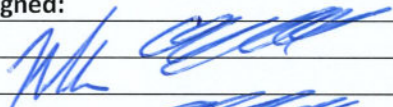
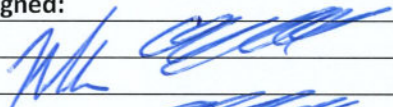
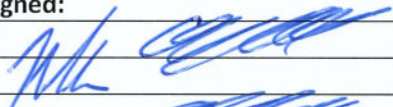


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Revision History

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Document Control

Action:	Name:	Signed:	Date:
Prepared By	Andy Hall		3/12/23
Reviewed By	Jamie Verstappen		3/12/23
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1. General

1.1 Introduction

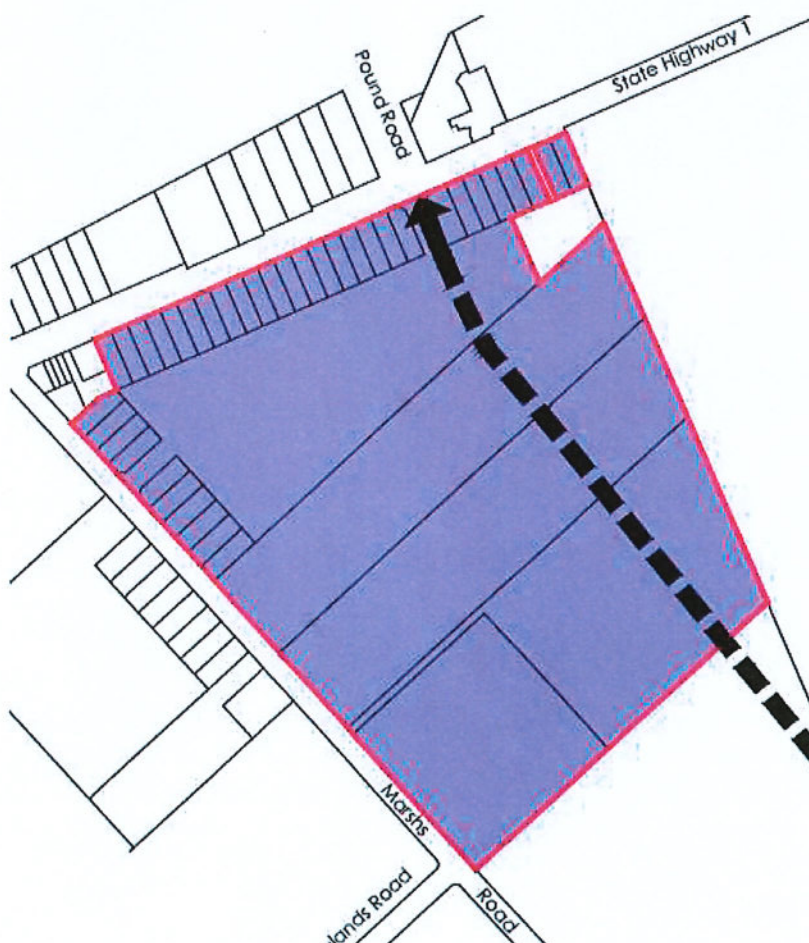
This infrastructure report addresses the servicing of the proposed Plan Change for an industrial development at the corner of Marsh's Road and Main South Road, Hornby. The total area of the Plan Change is approximately 22.59ha. It is proposed to subdivide the land into approximately 10 industrial lots, as well as a stormwater reserve and vested roads.

This report addresses all aspects of servicing of the proposed subdivision including stormwater disposal and reticulation, sewer reticulation, water supply, earthworks, roading, pavements, power and telecommunications. In addition, the suitability of the soils over the site to accommodate Industrial development is addressed.

Consultation will be undertaken with Orion and Enable to ensure the coordinated provision of power and telecommunications.

The design and construction of the proposed subdivision infrastructure will comply with the requirements of Christchurch City Council's Infrastructure Design Standard and Construction Standard Specifications. Council consultations and modelling have been completed

Any works carried out on site for the benefit of other developments or Council will need to have the associated costs addressed by Council at the time of 224c certification.



Outline Development Plan

2. Site Description

The subject site is currently zoned Rural Urban Fringe. Despite this, there are 34 small residential sites with homes along the street frontages. There are also five lifestyle blocks with homes. None of the properties appear to be productive farming units. All but two of these properties are on council water supplies and wastewater connections. All stormwater is to ground.

Two parcels of land in the area are notably excluded from the proposed plan change. An existing Recreational Reserve in the northern corner and a small Commercial Local zoned area of land directly on the corner of Marsh's and Main South Roads.

The site is bounded by Main South Road to the north and Marshs Road to the west. The remaining boundaries abut existing Industrial Heavy Zoned Land owned by the applicant.

Previous land development has created potential future road connections to Main South Road opposite Pound Road and also onto Marshs Road. It is expected that the connection to Pound Road will be created and a connection made to the end of Bruce Stewart Drive. This will form a link from Pound Road to Shands Road.

The site is relatively flat and generally falls at approximately 1 in 200 to the south east. The majority of tree lines will be removed as part of the development; however the shelter belt along Marshs Road will remain until new planting has been established.

The site is bordered by a water race running along Marshs Road. The water race is to remain open and will be protected and maintained during development works. There will not be access into future site off Marshs Road.

3. Site Conditions

3.1 Soils

The Canterbury Plains consist of intermingled alluvial and glacial fans composed of clays, silts, sands and graded combinations of these soils. The soil profile of the application site is consistent with surrounding areas and generally comprises layers of silt and clay, overlying silts, transitioning into sand and gravel layers at a depth of approximately 1.5m.

There is approximately 300mm of topsoil on the site.

The soils have the potential to create a capable subgrade for the roads. CGW Ltd has undertaken Scala testing to confirm bearing capacities. A consistent reading of 3 blows per 100mm of penetration was achieved. The results suggest a California Bearing Ratio (CBR) of 6 in the worst case. This equates to a pavement depth of approximately 550mm for the intended traffic loads.

A Preliminary Site Investigation into contamination has been completed by Pattle Delamare Partners Ltd, which concluded that HAIL activities were undertaken on the application site. Please refer to their report attached to the application. Their recommendation is that a Detailed Site Investigation be undertaken as part of any subdivision but there is no reason from a site contamination perspective why the proposed plan change from Rural Urban Fringe Zone to an Industrial zone, cannot proceed.

4. Geotechnical Assessment

A full geotechnical investigation was undertaken by CGW Limited. This consisted of a desktop study as well as numerous site tests. Please refer to their report attached to the application.

5. Earthworks

Earthworks will be carried out on the site to ensure that all future sites will drain towards the new or existing roads at a grade of at least 1/500.

The site is not located within a 50 or 200 year flood zone or within a Flood Management Area. The site is not in a Liquefaction Management Area.

The total estimated cut to fill volume is 70,000m³. The significant areas of cut are in the roadways where the depth to the subgrade may be up to a metre below existing ground level. Trenching for stormwater and other services will be lower than this again. A significant amount of fill is expected to be required to central areas of the site to ensure all Lots drain towards the roads.

There are two natural channels across the site draining from northwest to southeast. These channels will be filled and the secondary flows that would have otherwise been contained in these channels, will be diverted to the roading network. Please refer to the 1 in 200-year flood model in Appendix B.

All topsoil on site will be stripped, stockpiled and replaced on the land immediately following bulk earthworks. All disturbed topsoil will be re-sown with Council specification grass seed mixes. A balance of cut and fill will be maintained on site and removal of material from site will be kept to a minimum. Excess topsoil is proposed to be used in a landscape bund parallel to Marshs Road within the allocated 10m landscape setback. Material from under the bund will also be excavated out and used on site. The excavation will be filled with excess topsoil. This excavation will be within 50m of the water race on Marshs Road and this will result in consent being required from Environment Canterbury.

Sediment runoff within the site will be controlled as per Council requirements. The basis of the sediment control will be the Environment Canterbury Guidelines and the discharge during construction will be undertaken either under Council's overall discharge consent or in accordance with Environment Canterbury rules. All dust created on the site will be controlled by water cart or other such Council approved methods. An erosion, sediment and dust control plan will be compiled and submitted to both local and regional council for approval.

All bulk Earthfill will be compacted in accordance with NZS 4431:2022. All fill testing will be carried out by an independent laboratory.

6. Roding

The key route through the site will be the extension of Bruce Stewart Dr, from its existing end in the adjacent Phase 1 of the Hornby Quadrant development, through to the intersection of Main South Road and Pound Road. Please refer to the Outline Development Plan in Appendix A. This will be a 23m wide Road reserve with a 12m carriageway. A 1.5m wide footpath will be located on the southern side and a 2.5m wide shared path will be constructed on the north side.

Any other roading will have a reserve width of 22m with a 12m carriageway and 1.5m footpaths either side. Please refer to a potential subdivision layout in Appendix D.

It is not expected that there will be any parking on the legal roads. As with the existing Hornby Quadrant development, a 3m wide flush median will be painted on all roads for traffic turning into sites. This is consistent with previous stages.

Comprehensive Scala Penetrometer testing has been carried out to determine the road subgrade CBR. The worst case CBR was found to be 6%. Based on this, it is expected a road pavement of 550mm will suffice, however traffic loading is to be confirmed by CCC.

All roads will be constructed with an AC14 asphalt surface and formed widths will comply with the Christchurch District Plan.

The intersection with Main South Road will require specific design and consultation with NZTA. This work will be undertaken at the time of Subdivision Consent. Please refer to the traffic report included in the application.

Streetlights will be installed along all vested roads to Council standards.

Please refer to Appendix E for typical roading cross-sections.

7. Water Supply

A request to Council for modelling advice has resulted in a report from WSP. Please refer to Appendix F. This initial model for the site has been compiled to determine the available supply capacity and required water main pipe sizes to be used within the proposed development area. It is expected that there will be two connection points to the existing council system surrounding the overall development area;

- The 200mm main in Bruce Stewart Drive as constructed as part of Phase 1
- The 200mm dia uPVC main in Aruhe Road.

No connection can be made to Main South Road as this network is in a different pressure zone.

To determine the potential water supply demands, it is estimated that the 22.59ha may eventually evolve into 30 sites.

The peak water supply demand for the development has been calculated in accordance with the CCC IDS Part 7, Chart 2 for industrial development areas. Using Chart 2 from the IDS, this equates to 0.77l/s/site.

30 sites would have a peak demand of 23.1l/s

Added to that the sites may potentially be Fire Hazard Category 3 with Fire Cells up to 800m². This dictates a Fire Water Supply Classification FW5. FW5 has a demand of 75l/s. Please note that the Fire Water Demand could be reduced as part of the modelling process.

Total peak plus fire flow = 98.1l/s.

The water supply modelling has been undertaken in accordance with District Council specifications and SNZ PAS 4509:2008, New Zealand Fire Service Firefighting Water Supplies Code of Practice. Please refer to Appendix F for the water supply modelling.

Following modelling, it became clear that whilst it is confirmed that the proposed plan change area can be serviced, the fire flows can only service an FW3 arrangement. Alternative onsite fire protection may be required on individual sites or potentially a private fire supply could be considered.

The proposed council supply mains on Quadrant Drive and Shands Road are required to be upgraded to DN 300 to reduce losses. This upgrading will be further investigated at the time of detailed design.

Each Lot to be served with a 63mm (OD) lateral.

Hydrants within the development will be spaced at approximately 50m intervals which will ensure compliance with the requirements of the New Zealand Fire Service Firefighting Water Supplies Code of Practice if future subdivision of larger lots was to occur.

The construction of all water infrastructure will be completed to Council standards and in particular the CCC CSS.

Water Supply is not considered to be a problem for the rezoning of this land to Heavy Industrial.

8. Sewer

The application site is to be serviced for wastewater by a Local Pressure Sewer network. Each industrial site will have a private individual pump reservoir tank connected to a common pressure sewer pipe in the street.

The pump units and reservoirs will be installed at the time of building consent for each Lot. The development works will include the installation of a lateral pipe, isolation valve and boundary box to each Lot located at the road boundary.

The power to the pump reservoirs will be provided by the future owner and future maintenance will be the responsibility of the owner.

The pressure pipes in the street will be designed and sized by IOTA. The network modelling will consider the potential flows from future stages.

As part of the overall investigation of the wastewater, the Council were able to provide advice and modelling from their consultants WSP.

Please refer to Appendix G for the sewer modelling and conclusions.

The site is expected to be restricted to a daily average sewer flow of 0.09l/s/ha at the instruction of CCC. 22.59ha equates to a flow of 2.033l/s. The max flow is expected to be approximately 5 times the average flow. The maximum flow will therefore have an expected discharge rate of 10.16l/s.

The proposed outlet point can be a number of options:

- The gravity pipe in Marshs Road that drains to Pump Station 87
- The gravity pipework at the sites entrance off Main South Road
- Directly to Pump Station 88
- Directly to the 375mm dia gravity main at the intersection of Pound Road and Waterloo Road

For the purposes of the modelling, the discharge point was chosen as WwAccess43671, on the 225mm dia pipe in Main South Road. The connection location is detailed in the modelling report. This pipe drains to PS87 on Marshs Road from where it is pumped to WwAccessID29871 on Waterloo Road.

It should be noted that the Plan Change includes for several existing wastewater connections to residential sites. The total number of residential connections amounts to 34. 34 residential connections with 2.7 people per connection and each person creating 220l of discharge amounts to an average flow of 0.234l/s and a maximum discharge of 1.17l/s. The model may be refined to take this into account.

The Dry Weather Flow (DWF) modelling shows that no overflows are predicted however there is some surcharging of the system.

The Wet Weather Flow modelling increases surcharging in the downstream pipes but no overflows.

The increase in surcharge levels during DWF leads the report to recommend that no additional flows can be accommodated above that already predicted from the existing zoned land. However, an interesting point made in the modelling report is that the capacity of the Waterloo Road pipe is less than the combined flows of the contributing pump stations. It is this discrepancy that is causing the surcharging. Further consultation has been conducted with the council to see if the capacity in the Waterloo Road Pipe can be better managed by telemetrically coordinating the outflows of the upstream pump stations.

This scenario was posed to the City Councils Strategic Planning Engineer Michele McDonnald who responded;

Re, wastewater, we will have to consider whether and how, operational adjustments can be made to support additional flow – but agree that it seems that there will be a solution. We will however also have to consider this in the context of growth to ensure that we leave space for current zoned land versus new areas – our ‘growth’ model does not necessarily assign growth for complete development of all existing zoned land and therefore, we will have to further interrogate this aspect.

In consideration of this along with the flows already emanating from the area, we believe that we have a method of ensuring that capacity can be created in the existing system.

Added to this, we need to recognise two factors that will improve the situation further;

1. The proposed sewer network is Local Pressure Sewer. There is very little infiltration of stormwater or groundwater into these systems as it is fully enclosed.
2. The Local Pressure system has the ability to have controlled outflow. The outflow can be restricted to times of low flow in the Waterloo Road network.

I believe that in these circumstances, wastewater capacity should not be an issue in the rezoning of this land to Heavy Industrial.

9. Stormwater

The Stormwater facility will be constructed in Phase 2 of the Hornby Quadrant development. The facility will provide for Phase 2 and this proposed rezoned area.

The proposed stormwater design consists of a forebay, a first flush stormwater facility, a redundant retention basin and rapid soakage chambers for storms larger than the nominal first flush event of 25mm. These will be complete and commissioned prior to any stormwater discharge from completed development areas.

Through consultation with CCC it is expected that stormwater will be treated and disposed of under CCC's global CRC190445 in the following ways:

1. It is assumed 40% of Lot coverage will be roof area. The flows off the roof will be disposed of to ground via on site rapid soakage chambers. These are to be sized to attenuate up to and including the critical 2% AEP storm event
2. The remaining 60% of Lot coverage is assumed to be car parking and landscaped areas which will be pipe to the mains in the road and discharge to the first flush, retention and disposal facilities.
3. Pipes in roads are sized to accommodate the 20% AEP to the stormwater facilities.
4. All overland flow from the Lots and roads is to be conveyed towards the stormwater facilities for treatment and storage of up to and including the 2% AEP critical storm event.
5. Redundant soakage and storage of the 10% AEP 18 hour storm will be provided.
6. Any storms exceeding the critical 2% AEP will over top the facilities and discharge to Marshs Road via Phase 1 of the development.

The stormwater facilities have been sized in accordance with the Christchurch City Council's WWDG and prior discussion with CCC's Brian Norton. Refer to Appendix H for the stormwater catchment plan and basin calculations.

Secondary flow paths within the site will follow the road network. All roads will be graded to convey the secondary flow towards the eastern corner of the site where the proposed basins are located.

All works will be designed to Council Standards.

Stormwater disposal should not hinder this land being rezoned Heavy Industrial.

10. Power, Telecommunications and Street Lights

Power and Telephone will be provided to all sites to utility company and industry standards. All cables will be placed underground and all kiosks will be constructed on separate individual lots. The kiosk sites will be forwarded to Council for approval following the power design.

Existing power connections to the site will be incorporated into the proposed power design.

Street lights will be provided to the roading to Council Standards. The applicant will also provide a street light style to Council for approval.

Appendix A – Outline Development Plan



Appendix B – 1 in 200 year Flood Model.

Find address or place

Layer List

Layers

Land Parcels

Current District Plan

Flood Zones

-  Lake Ellesmere Flood Area
-  Lower Plains Flood Area
-  Waimakariri Flood Plain

200-year ARI rainfall flood depth (m)



200-year ARI Selwyn River flood depth (m)

500-year ARI rainfall flood depth (m)

500-year ARI Selwyn River flood depth (m)

500-year ARI rainfall hazard - Max of Depth (m) and Depth (m) x Velocity (m/s) - copy

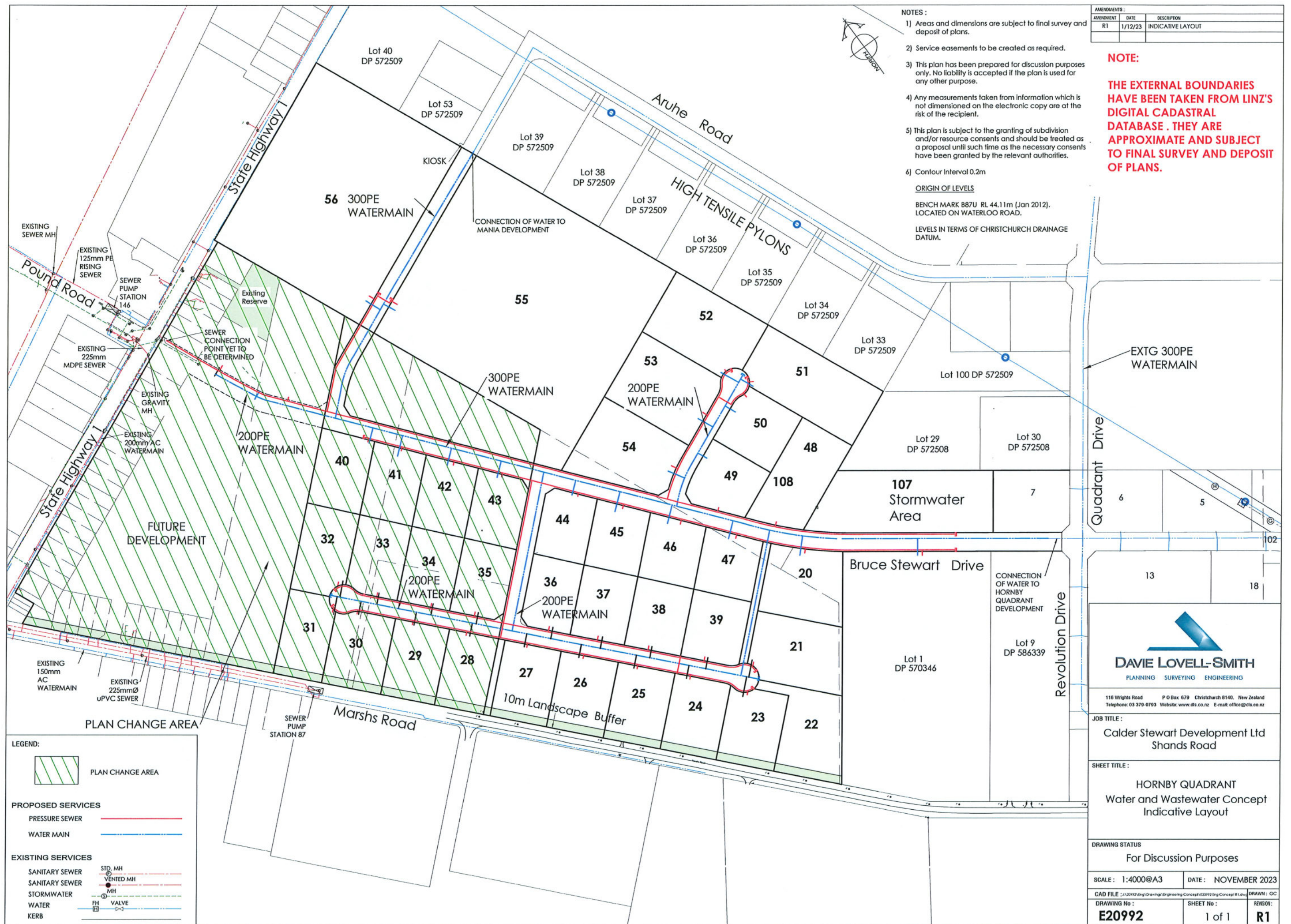
500-year ARI Selwyn River hazard - Max of Depth (m) and Depth (m) x Velocity (m/s)

100m

Land Information New



Appendix C – Engineering Concept



NOTES :

- 1) Areas and dimensions are subject to final survey and deposit of plans.
- 2) Service easements to be created as required.
- 3) This plan has been prepared for discussion purposes only. No liability is accepted if the plan is used for any other purpose.
- 4) Any measurements taken from information which is not dimensioned on the electronic copy are at the risk of the recipient.
- 5) This plan is subject to the granting of subdivision and/or resource consents and should be treated as a proposal until such time as the necessary consents have been granted by the relevant authorities.
- 6) Contour Interval 0.2m

ORIGIN OF LEVELS

BENCH MARK B87U RL 44.11m (Jan 2012). LOCATED ON WATERLOO ROAD.

LEVELS IN TERMS OF CHRISTCHURCH DRAINAGE DATUM.

AMENDMENTS :		
AMENDMENT	DATE	DESCRIPTION
R1	1/12/23	INDICATIVE LAYOUT

NOTE:

THE EXTERNAL BOUNDARIES HAVE BEEN TAKEN FROM LINZ'S DIGITAL CADASTRAL DATABASE . THEY ARE APPROXIMATE AND SUBJECT TO FINAL SURVEY AND DEPOSIT OF PLANS.

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JOB TITLE:
Calder Stewart Development Ltd
Shands Road

SHEET TITLE:
HORNBY QUADRANT
Water and Wastewater Concept
Indicative Layout

DRAWING STATUS
For Discussion Purposes

SCALE: 1:4000@A3 **DATE:** NOVEMBER 2023

CAD FILE : J:\2019\Eng\Drawings\Engineering Concept\201912 Eng Concept R1.dwg **DRAWN:** GC

DRAWING No : **E20992** **SHEET No :** 1 of 1 **REVISION:** R1

Appendix D – Potential Subdivision Layout

DRAFT



AMENDMENTS:		
AMENDMENT	DATE	DESCRIPTION
R1	27.11.23	ABBUTALS UPDATED

- NOTES:
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 - 2) Service easements to be created as required.
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 - 5) This plan is subject to the granting of subdivision and/or resource consents and should be treated as a proposal until such time as the necessary consents have been granted by the relevant authorities.

DRAFT

NOTE:

THE EXTERNAL BOUNDARIES HAVE BEEN TAKEN FROM LINZ'S DIGITAL CADASTRAL DATABASE. THEY ARE APPROXIMATE AND SUBJECT TO FINAL SURVEY AND DEPOSIT OF PLANS.



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JOB TITLE:
Calder Stewart Development Ltd
Shands Road

SHEET TITLE:

Proposed Subdivision
OPTION 4

DRAWING STATUS
For Discussion Purposes

SCALE: 1:4000@A3	DATE: November 2023
CAD FILE: J:\2017\Subcon\H20973 Concept\Opt 4 R1.dwg	DRAWN: GC
DRAWING No: H20973	SHEET No: 1 of 1
	REVISION: R1

Appendix E – Typical Road Cross Sections

AMENDMENTS:		
AMENDMENT	DATE	DESCRIPTION
R1	1/12/23	INDICATIVE LAYOUT

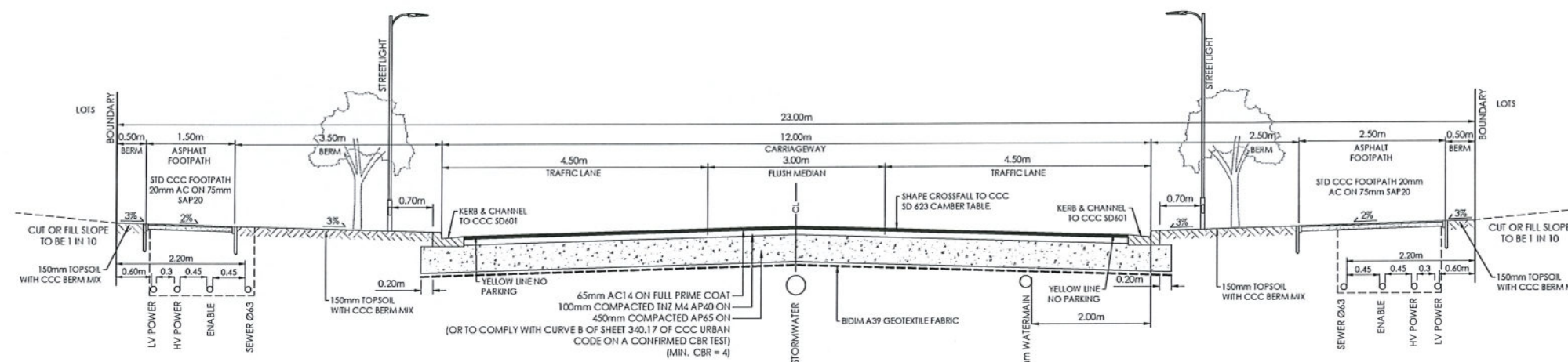
NOTES:

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- 6) Contour Interval 0.2m

ORIGIN OF LEVELS

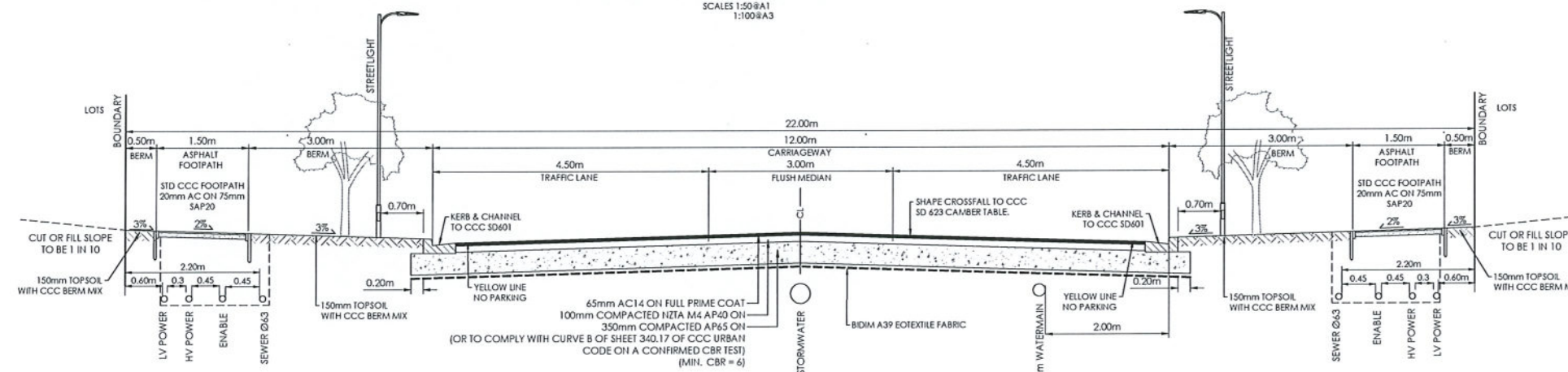
BENCH MARK B87U RL 44.11m (Jan 2012).
LOCATED ON WATERLOO ROAD.

LEVELS IN TERMS OF CHRISTCHURCH DRAINAGE
DATUM.



TYPICAL CROSS SECTION 23m ROAD

SCALES 1:50@A1
1:100@A3



TYPICAL CROSS SECTION 22m ROAD

SCALES 1:50@A1
1:100@A3



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JOB TITLE:

Calder Stewart Development Ltd
Shands Road

SHEET TITLE:

HORNBY QUADRANT
Typical Roading Cross Sections

DRAWING STATUS

For Discussion Purposes

SCALE: 1:100@A3

DATE: NOVEMBER 2023

CAD FILE: J:\2019\2\Eng\Drawings\Engineering Concept\20192 Eng Concept R1.dwg

DRAWING No:

E20992

SHEET No:

1 of 1

REVISION:

R1

Appendix F – Water Modelling

Christchurch City Council

MASHS ROAD INDUSTRIAL DEVELOPMENT WATER SUPPLY MODELLING ASSESSMENT

3-CHCH3.42

CONFIDENTIAL





MARSHS ROAD INDUSTRIAL DEVELOPMENT FIRE FLOW ASSESSMENT

Christchurch City Council

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REV	DATE	DETAILS
1.0	21/09/2023	Report for client review
2.0	12/10/2023	Updated report following client review
3.0	24/10/2023	Final

	NAME	DATE	SIGNATURE
Prepared by:	Pramodi Galabadage	24/10/2023	P. Galabadage
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EXECUTIVE SUMMARY

WSP has carried out a water supply development assessment for the proposed Marshs Road industrial development. The purpose of this assessment was to investigate if the development meets the Level of Services (LoS) criteria and will meet the fire flow requirements.

The following scenarios have been conducted in this assessment.

MODEL	SCENARIO	DESCRIPTION
Base Model	LoS assessment	The network was tested for minimum pressure and maximum headloss criteria.
	FW5 fire flow criteria	Six hydrants were tested for available fire flow against FW5 fire flow criteria
	FW4 fire flow criteria	Four hydrants were tested for available fire flow against FW4 fire flow criteria
	FW3 fire flow criteria	Two hydrants were tested for available fire flow against FW3 fire flow criteria
Base Model + Marshs Road Development Demands	LoS assessment	The network was tested for minimum pressure and maximum headloss criteria.
	FW4 fire flow criteria	Four hydrants were tested for available fire flow against FW4 fire flow criteria
	FW3 fire flow criteria	Two hydrants were tested for available fire flow against FW3 fire flow criteria

The results of the modelling assessment are summarised in the table below.

MODEL	SCENARIO	SUMMARY
Base Model	LoS assessment	Minimum pressure and maximum headloss and velocity criteria are met. DN 200 supply pipes on Quadrant Drive and Shands Road experience a max. headloss around 8 m/km.
	FW5 fire flow criteria - Fail	Hydrants are not maintaining a minimum residual pressure of 10 m. Maximum headlosses of DN 200 supply pipes on Quadrant Drive and Shands Road exceeds 20 m/km.
	FW4 fire flow criteria - Pass	Hydrants achieve a total flow of 100 L/s while maintaining a minimum residual pressure greater than 10 m. Maximum headlosses of DN 200 supply pipes on Quadrant Drive and Shands Road decreases to range between 10 – 15 m/km.
	FW3 fire flow criteria - Pass	Maximum headlosses of DN 200 supply pipes on Quadrant Drive and Shands Road further improves to range between 6 – 8 m/km.

MODEL	SCENARIO	SUMMARY
Base Model + Marshs Road Development Demands	LoS assessment	Minimum pressure and maximum headloss and velocity criteria are met. DN 200 supply pipes on Quadrant Drive and Shands Road experience a max. headloss around 8 m/km.
	FW4 fire flow criteria - Fail	FW4 fire flow criteria was not met, as the hydrants fail to maintain a residual pressure of 10 m at the required fire flow. Maximum headlosses of DN 200 supply pipes on Quadrant Drive and Shands Road decreases to range between 10 – 15 m/km.
	FW3 fire flow criteria - Pass	FW3 fire flow criteria is met as the hydrants achieve a total flow of 50 L/s while maintaining a residual pressure greater than 10 m.

In summary, the water supply network (supplied from Denton Station Well) can provide sufficient flow to the proposed Marshs Road development to meet FW3 fire flow criteria.

It is recommended to upgrade the DN 200 supply pipe sections on Quadrant Drive and Shands Road to DN 300 to reduce the maximum unit headloss along the pipelines and to ensure future demand and fire flow demands can be provided to the area.

1 PROJECT BACKGROUND

1.1 INTRODUCTION

Christchurch City Council (Council) engaged WSP on behalf of the plan change applicant, to carry out a demand and fire flow assessment of a proposed industrial development on the corner of Marshs Road and Main South Road. A plan change request has been submitted to rezone this area from "Rural Fringe" to "Industrial Heavy. The proposed development contains 30 industrial sites with a peak demand of 23.1 L/s within a total area of 22.59 Ha.

There are two recently developed large-scale industrial sites (NTP and CSD) located closer to the proposed Marshs Rd development. These two industrial sites are located between Main South Road and Shands Road and are connected to the existing water supply network at Shands Road and Quadrant Drive. The internal water supply pipe network for the developments was provided by Council and updated to the existing water supply model.

The Marshs Road industrial site is located within the West Pressure Zone, which includes the Templeton booster zone. The Marshs Road site will need to be supplied from the West Pressure Zone, as it cannot be supplied from the Templeton booster zone as this services the Templeton area, which includes a small number of customers situated north of Main South Road, and West of the Templeton booster pump station at a higher pressure to ensure levels of service can be met. The overview of the proposed development and water supply connections are shown in Figure 1-1.

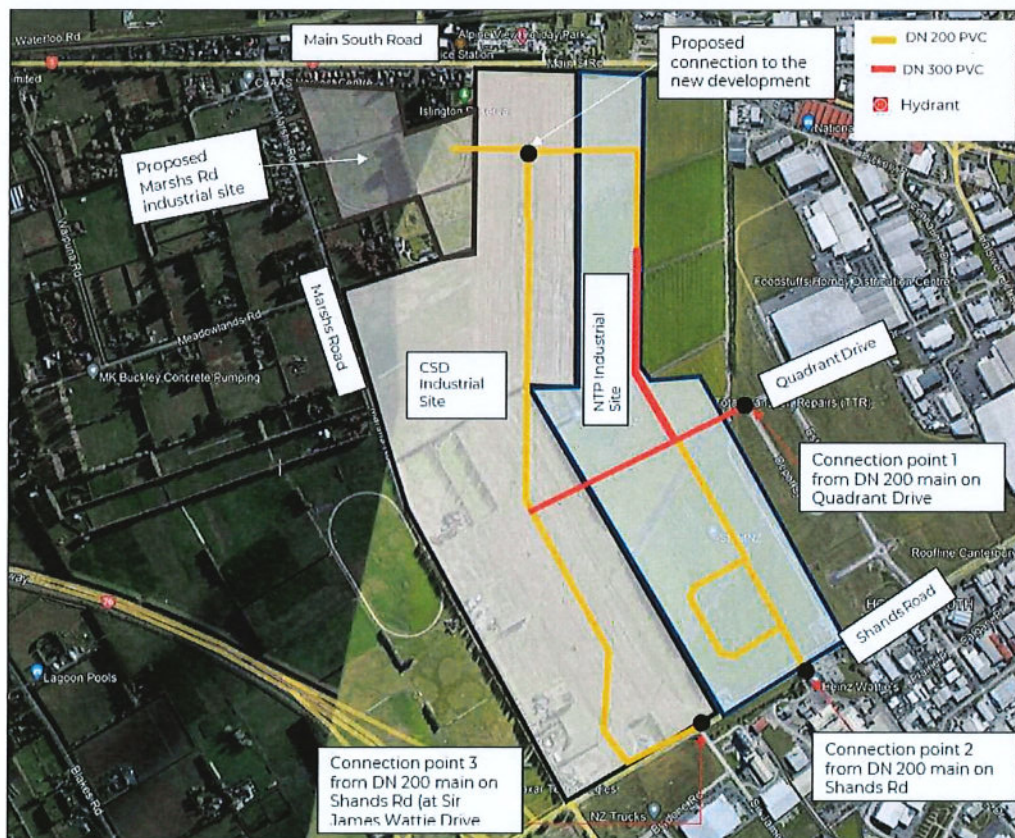


Figure 1-1: Overview of the new development and proposed water supply connections

1.2 OBJECTIVES

The objective of this study is to assess the available fire flow to the Marshs Road industrial site.

The developer has requested to model the available fire flow for three scenarios; FW3, FW4 and FW5 criteria as per New Zealand Fire Service Code of Practice (CoP).

The locations of the hydrants within the proposed industrial developments are currently not available. Therefore, for this assessment, we have allocated six hydrants to the proposed network. This is to measure the available fire flow to the proposed Marshs Rd industrial site. The distance between each hydrant is 90 m as per the CoP. Figure 1-2 shows the approximate locations of hydrants.

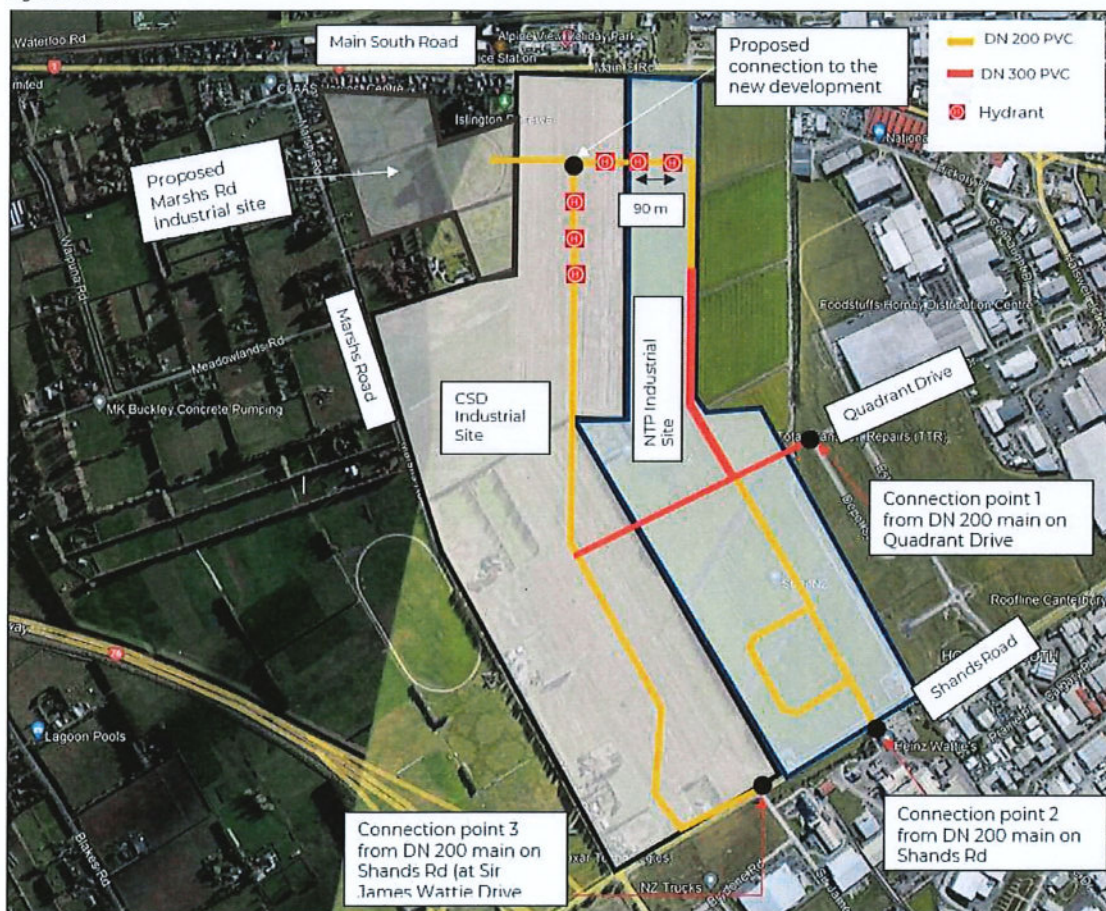


Figure 1-2: Overview of the new development and hydrant locations

2 INFORMATION / DATA PROVIDED TO THE CONSULTANT

This section summarises the information received from the Council and the assumptions applied for the fire flow assessment.

2.1 PROPOSED INDUSTRIAL SITE DEMANDS

A summary of information related to the proposed industrial development sites received from the client has been listed in Table 2-1.

Table 2-1: Summary of proposed industrial demands

DEVELOPMENT	DEMAND CATEGORY	AREA (HA)	PEAK DEMAND (L/s)	WATER SUPPLY SOURCE
Marshs Rd Development	Commercial-10 Hours	22.6	23.1	Denton Station Well
CSD Industrial Site		71	28	
NTP Industrial Site		42	65.3	

2.2 PERFORMANCE CRITERIA

The following performance criteria were used for the hydraulic assessment:

- Level of Service (LoS) – Minimum pressure: 200 kPa (20m) pressure at customer connection
- Pipe Performance –Maximum pipe headloss of 10 m/km under normal conditions and maximum pipe headloss of 5 m/km for trunk mains; and maximum velocity ≤ 1.5 m/s for normal conditions, < 3.0 m/s for emergency conditions
- Fire flow Assessment New Zealand Fire Service Code of Practice; SNZ PAS 4509:2008 and subsequent amendments, to the satisfaction of the New Zealand Fire Service. Table 2-2 lists the minimum fire flow requirements (for a single hydrant).

Table 2-2: Fire Flow Requirements as per Fire Fighting Water Supply Code of Practice

CODE	DESCRIPTION	MAX. NUMBER OF HYDRANTS TO PROVIDE FLOW	REQUIREMENTS	
			Required Fire Flow (L/s)	Residual Pressure at Required Fire Flow (m)
FW3	Industrial	3	50	10
FW4	Industrial	4	100	10
FW5	Industrial	6	150	10

2.3 ASSUMPTIONS

The following assumptions have been applied for this modelling assessment:

- WSP has used the InfoWorks WS Pro current peak day demand (PDD) model for this assessment:
 - Model Name: Christchurch Peak Day Demand Model:
 - o Network: Marshs Road Industrial Development
 - o Control: Marshs Road Industrial Development - Control
 - o Demand Diagram: Peak Day Demand 02/02/2020
 - Run Files: Templeton Industrial Plan Change Run Group
- WSP has used elevation data from LINZ to allocate ground levels to the proposed developments.
- WSP has followed the report (637 Main South Road & 320 Shands Road Industrial Park Development Water Supply Design Report- prepared by Ngai Tahu Property Ltd) provided by the Council for the data and layouts of the industrial development sites.

3 MODELLING ASSESSMENT

3.1 BASE MODEL RESULTS

3.1.1 MINIMUM PRESSURE AND MAXIMUM UNIT HEADLOSS

This section presents the base model outcomes with the demands at the NTP and CSD industrial sites included in the network.

Figure 3-1 shows the minimum pressure and maximum unit headloss results in the base model.

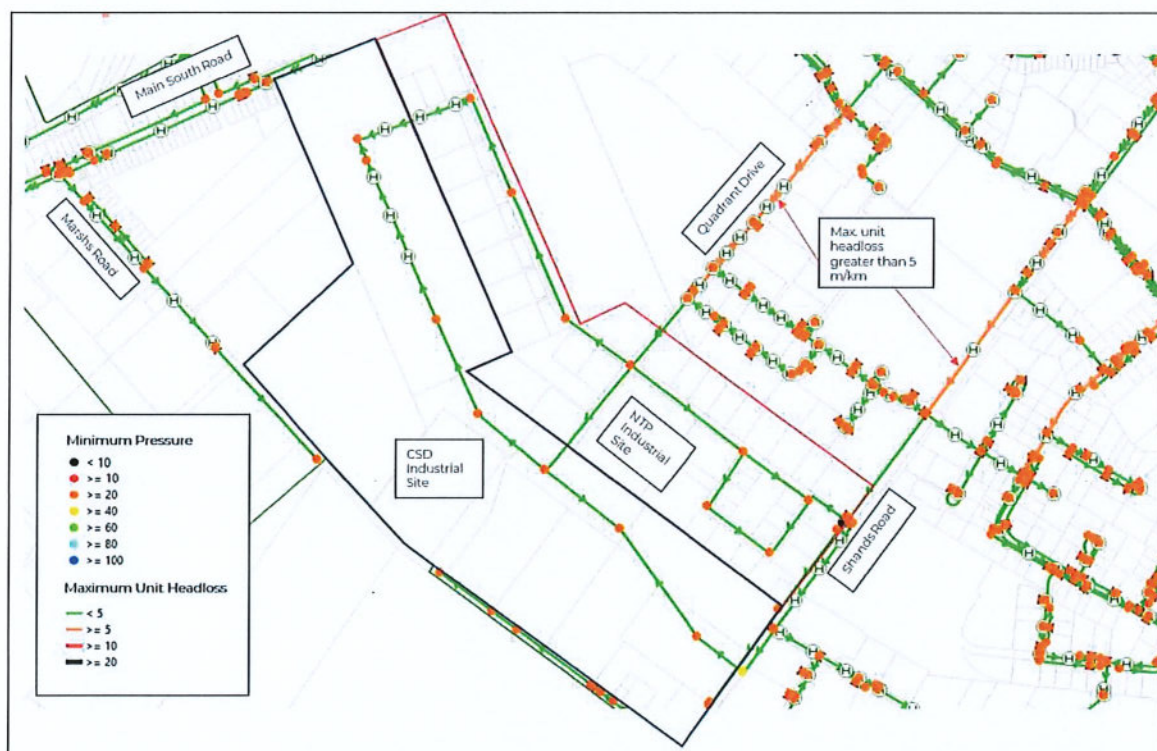


Figure 3-1: LoS results of the base model

As shown in Figure 3-1 above, the minimum pressure results within the industrial development site are above 20 m (ranges between 30 – 40 m). The nearby existing water supply network also meets the minimum pressure criteria.

Most pipe sections within the industrial site have a maximum pipe headlosses less than 1.5 m/km.

The existing DN 200 PVC pipe section on Quadrant Drive and the existing DN 200 AC pipe section on Shands Road experience a maximum headloss greater than 5 m/km.

3.1.2 AVAILABLE FIRE FLOW TO THE EXISTING NETWORK

Fire flow tests were run to investigate the available fire flow to the proposed Marshs Road industrial development.

An FW5 (150 L/s) fire flow assessment was modelled in accordance with the CoP, and as identified by the developer as the required fire flow for the development site.

As discussed in Section 1.2, six fire hydrants (90 m apart) were allocated close to the Marshs Road development for the fire flow assessment. No hydrant location information was provided for the development of the existing network.

An exceptional flow of 25 L/s was allocated to each hydrant for a 30-minute period at the 60% peak day demand, to supply a total flow of 150 L/s. The fire flow results are summarised in Table 3-1.

Table 3-1: Summary of fire flow results FW5 criteria

HYDRANT	FIRE FLOW ACHIEVED (L/S)	RESIDUAL PRESSURE AT REQUIRED FIRE FLOW (M)
1	25	4.7
2	25	5.6
3	25	3.4
4	25	3.3
5	25	6.4
6	25	3.6

As shown in Table 3-2, the network cannot provide the FW5 fire flow criteria as the residual pressure is less than 10 m at the required fire flow. Figure 3-2 shows the LoS results in the nearby network during the fire flow simulation.

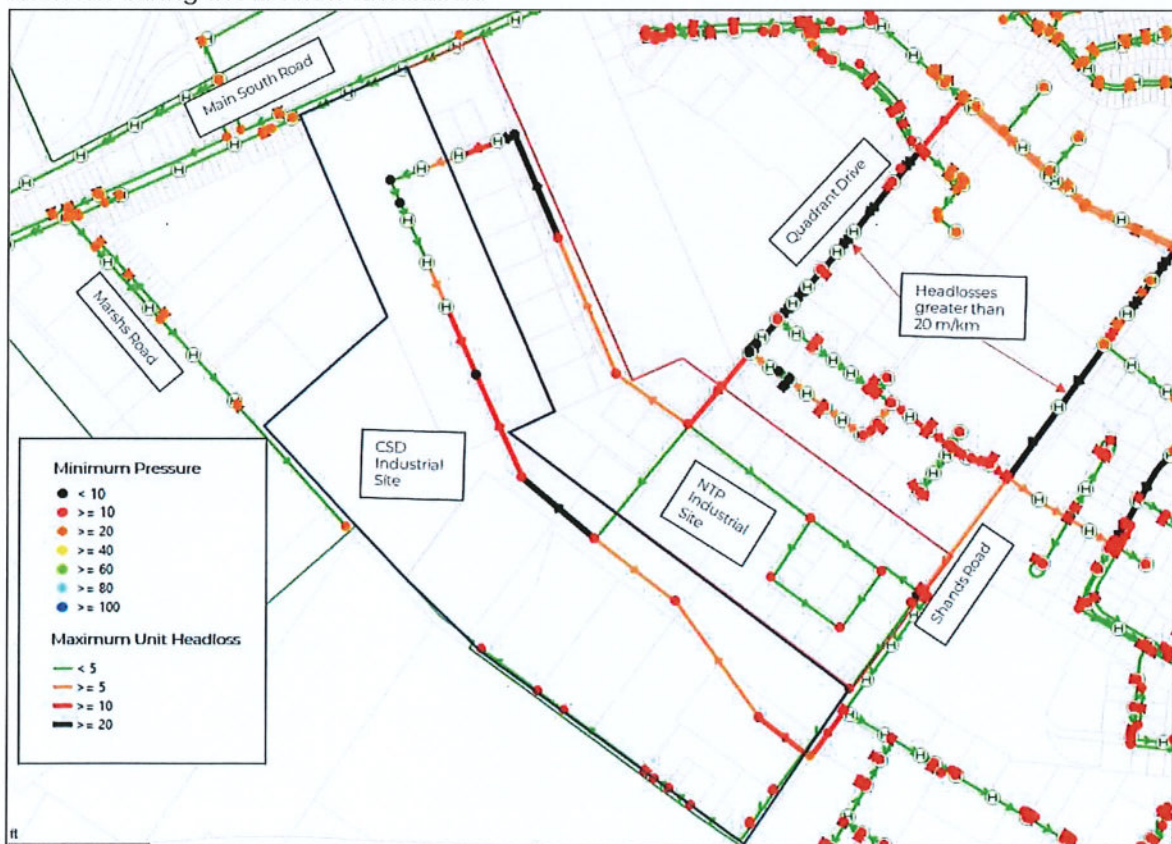


Figure 3-2: LoS results in the available fire flow scenario for FW5 criteria

As shown in Figure 3-2, the development site area closer to the hydrants fail to maintain a minimum pressure of 10 m during the fire flow test period. The rest of the development site and nearby areas (i.e., Sir James Wattie Drive, Gallagher Drive, Klondyke Drive, Edmonton Road, Establishment Drive, Depot Street, and Quadrant Drive) maintain a minimum pressure between 10 – 20 m.

The maximum headloss of the existing DN 200 pipe sections on Quadrant Drive and Shands Road has exceeded 20 m/km. Similarly, some proposed DN 200 pipes within the CSD and NTP development sites experience a maximum unit headloss greater than 20 m/km.

In summary, the available fire flow to the proposed Marshs Road development site does not meet the FW5 criteria. Significant pipe upgrades to the upstream supply pipes are required to achieve FW5 fire flows at the proposed Marshs Road industrial site.

The next approach was to test the available fire flow for FW4 fire flow criteria. In this case, an exceptional flow of 25 L/s was allocated to the closest 4 hydrants, to achieve a total fire flow of 100 L/s. This was done during the 60% peak day demand for 30 minutes to simulate a fire event. The selected hydrants for the FW4 fire flow test are shown in Figure 3-3.



Figure 3-3 : Selected hydrants for FW4 fire flow criteria

The fire flow results are summarised in Table 3-2.

Table 3-2: Summary of fire flow results for FW4 criteria

HYDRANT	MINIMUM FIRE FLOW (L/S)	RESIDUAL PRESSURE AT MINIMUM FIRE FLOW (M)
1	25	16.25
2	25	15.04
3	25	15.11
4	25	15.15

As shown in Table 3-2, there is sufficient capacity in the network to meet the FW4 fire flow criteria at the hydrants receive the required fire flow of 25 L/s to provide a total of 100 L/s (FW4). The hydrants also maintain a residual pressure greater than 10 m at the required fire flow. Figure 3-4 shows the LoS results in the nearby network during the fire flow simulation.

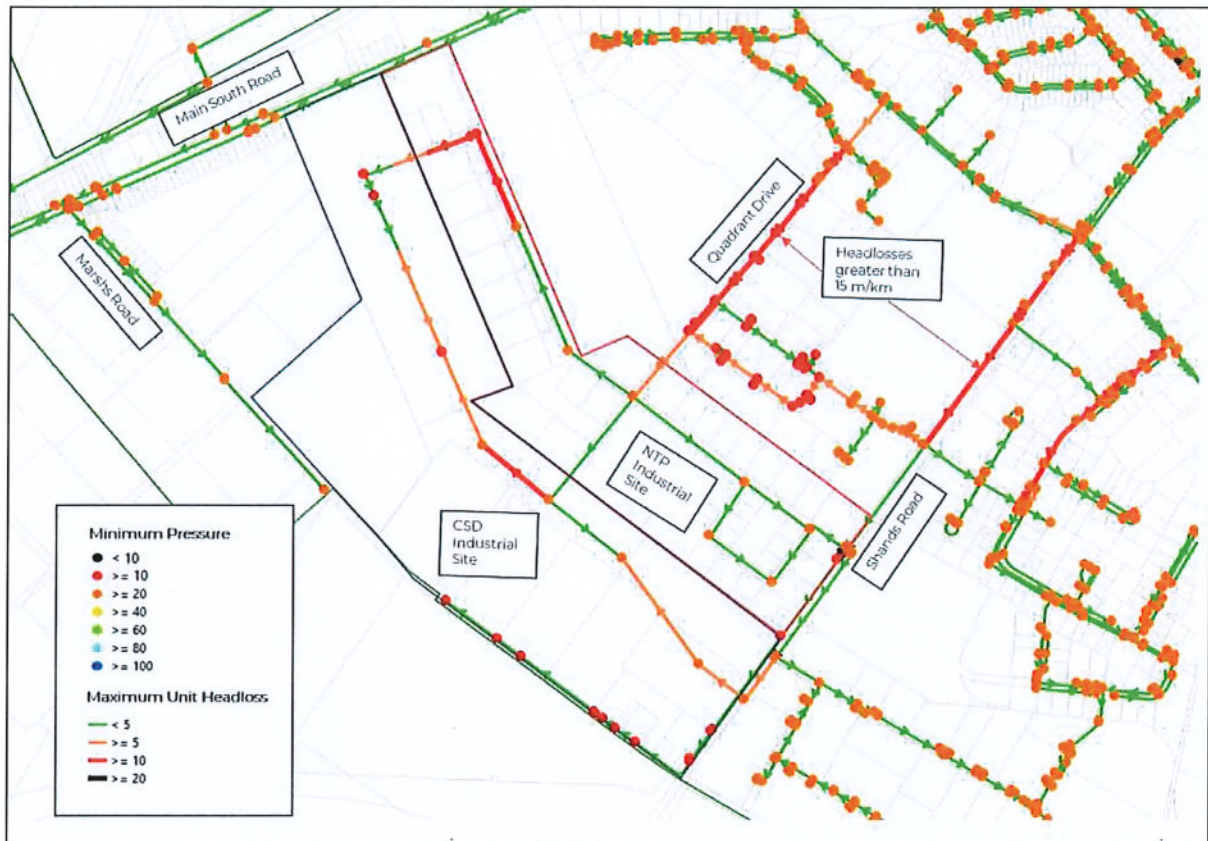


Figure 3-4 : LoS results in the available fire flow scenario for FW4 criteria

As shown in Figure 3-4, the area within the site closer to the hydrants maintain a minimum pressure between 10m – 20m, The rest of the development site and nearby localised are has minimum pressures greater than 20 m during the fire flow test period.

The maximum headloss of the existing DN 200 pipe sections on Quadrant Drive (north of Depot St) and Shands Roads still exceeds the criteria. However, the maximum unit headloss of these pipe sections has decreased from the previous scenario. The velocity in these pipe sections meets the criteria of < 3 m/s for emergency conditions.

In summary, the available fire flow to the proposed Marshs Road development site meets the FW4 criteria.

The maximum headlosses of the pipes further improve with FW3 fire flow criteria. The headlosses of existing DN 200 pipe sections on Quadrant Drive and Shands Roads further reduce to range between 6 – 8 m/km.

3.2 MARSHS ROAD INDUSTRIAL DEVELOPMENT

3.2.1 MINIMUM PRESSURE AND MAXIMUM UNIT HEADLOSS

This section discusses the modelling results after adding the demands of the proposed Marshs Road industrial development to the base model.

Figure 3-5 shows the minimum pressure and maximum unit headloss results for this scenario.

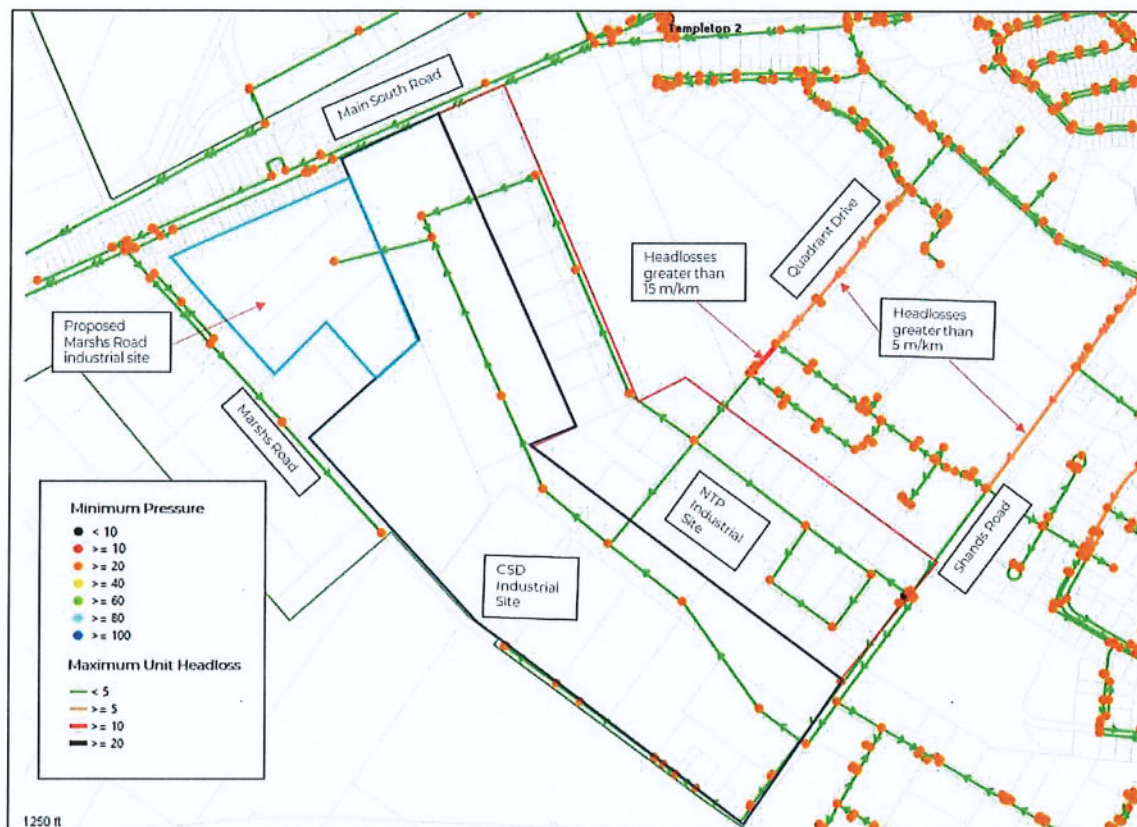


Figure 3-5 : LoS results with the Marshs Rd Industrial development demand

As shown in Figure 3-5, the minimum pressure of the proposed Marshs Road development at an elevation of 33.34 m is 28 m, and therefore, the minimum network pressure criteria are met. The nearby water supply network also maintains a minimum pressure greater than 20 m (generally ranges between 30-40 m).

The DN 200 supply pipe to Marshs Road development also meets the headloss criteria, as the maximum unit headloss of the pipe is approximately 2 m/km.

Like the base scenario, pipe sections within the NTP and CSD industrial sites have a maximum unit pipe headlosses of less than 1.5 m/km. Approximately 93 m long section of existing DN 200 pipe section on Quadrant Drive has a maximum unit pipe headloss greater than 20 m/km. In addition, the existing DN 200 PVC pipe section on Quadrant Drive and the existing DN 200 AC pipe section on Shands Road experience a maximum headloss greater than 5 m/km.

3.2.2 FIRE FLOW

A fire flow assessment was modelled with the Marshs Road industrial development demand added to the network. This fire flow assessment was based on the FW4 criteria. An exceptional flow 25 L/s was allocated to the closest 4 hydrants (shown in Figure 3-3), to achieve a total fire flow of 100 L/s. This was applied during the 60% peak day demand for 30 minutes to simulate a fire event.

The fire flow results are summarised in Table 3-3.

Table 3-3: Summary of fire flow results for FW4 criteria

HYDRANT	FIRE FLOW ACHIEVED (L/S)	RESIDUAL PRESSURE AT REQUIRED FIRE FLOW (M)
1	25	1.3
2	25	0.6
3	25	0
4	25	0.4

As shown in Table 3-3, the hydrants are not able to maintain a residual pressure of 10 m at the required fire flow. Therefore, FW4 fire flow criteria cannot be met when the Marshs Rd Industrial demands are added. Figure 3-6 shows the LoS results in the nearby network during the fire flow simulation.

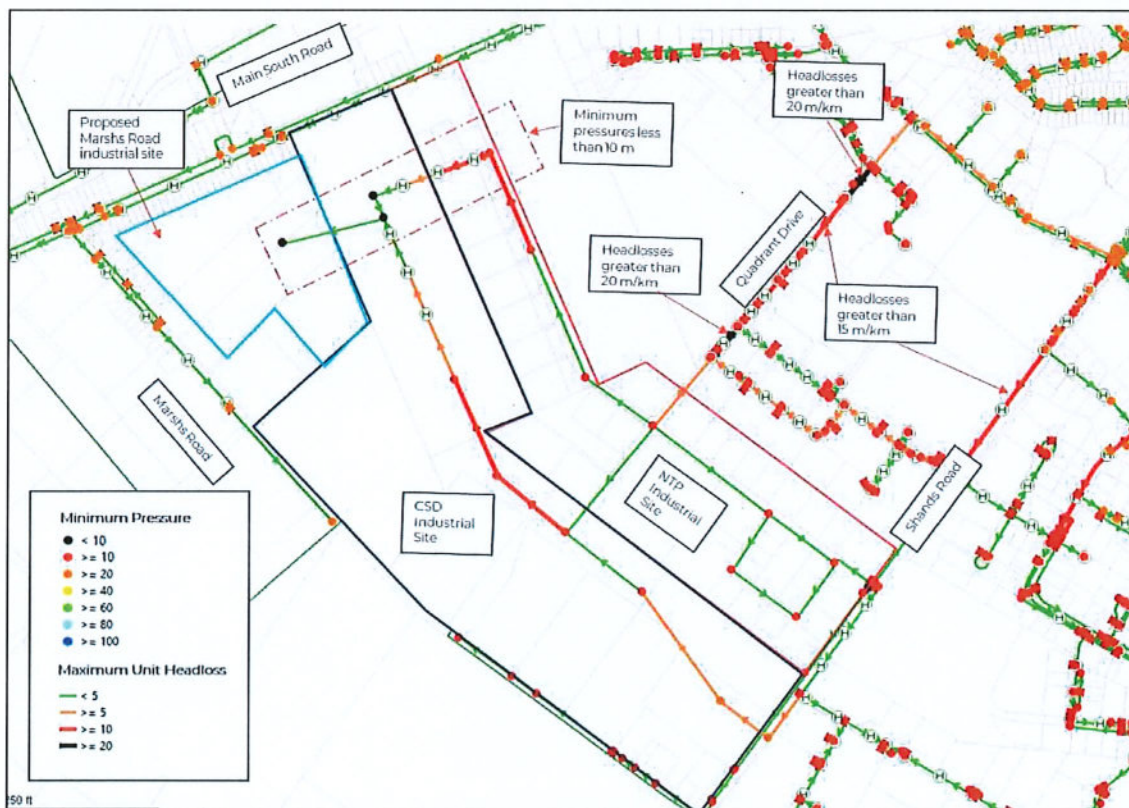


Figure 3-6 : LoS results for the FW4 fire flow scenario

As shown in the figure, the area around the hydrants fails to maintain a minimum network pressure of 10 m during the fire flow event. The rest of the localised network maintains a minimum pressure between 10 – 20 m.

Some of the proposed DN 200 pipe sections within the proposed CSD and NTP industrial sites experience a maximum unit headloss greater than 15 m/km. The maximum unit headlosses of the existing DN 200 pipe sections on Quadrant Drive and Shands Roads are between 10 – 15 m/km for most of the length with some sections exceeding 20 m/km. The velocity in these pipe sections is still meeting the criteria of < 3 m/s for emergency conditions.

As the FW4 fire flow criteria was not met when the Marshs Road development demand was added to the network, the next step was to assess FW3 fire flow criteria. The nearest two fire hydrants to the proposed development were tested for a required fire flow of 50 L/s. Like the previous fire flow scenarios, the testing was conducted at the 60% peak day demand.

The fire flow results are summarised in Table 3-4.

Table 3-4: Summary of fire flow results for FW3 criteria

HYDRANT	FIRE FLOW ACHIEVED (L/S)	RESIDUAL PRESSURE AT REQUIRED FIRE FLOW (M)
1	25	18.02
2	25	17.40

As listed in the table above, the 2 hydrants achieve the required fire flow of 25 L/s (a total of 50 L/s) while maintaining a residual pressure greater than 10 m at required fire flow. Therefore, FW3 fire flow criteria is met. Figure 3-7 shows the LoS results in the nearby network during the fire flow simulation.

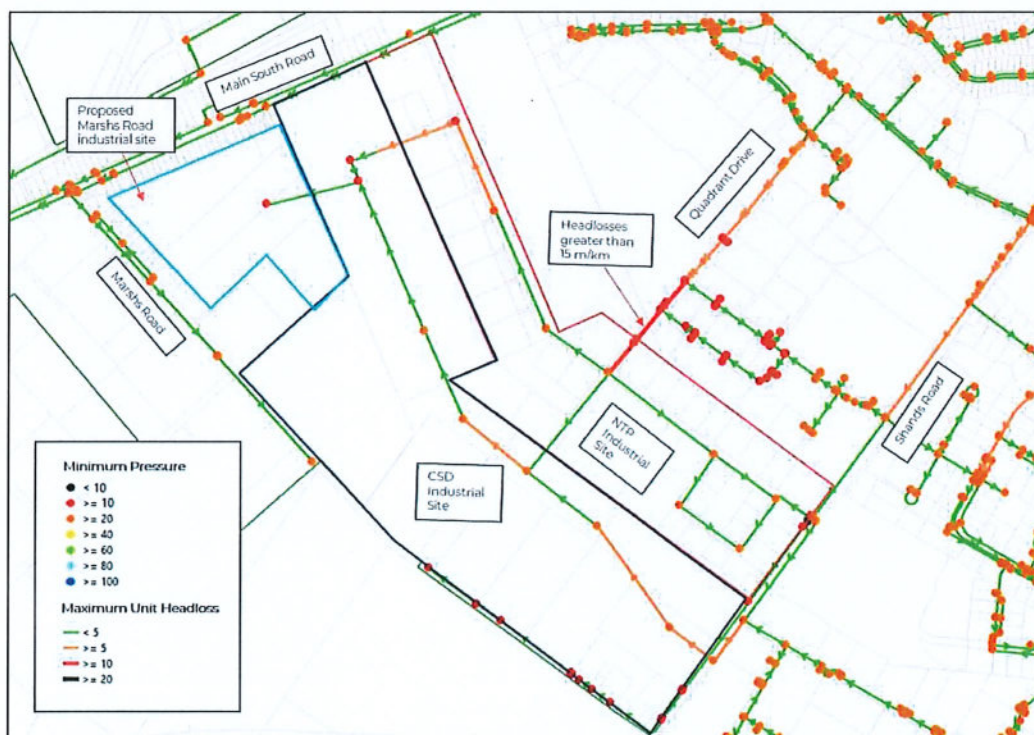


Figure 3-7 : LoS results for the FW3 fire flow scenario

As shown in the figure, all three proposed developments and the localised area maintain a minimum pressure greater than 10 m during the fire flow event.

The only noticeable maximum pipe headloss is on an approx. 93 m of existing DN 200 pipe section and on approx. 200 m of proposed DN 300 pipe section on Quadrant Drive. The headloss of these pipe sections exceed 15 m/km during the simulated fire event. The velocity in these pipe sections is still meeting the criteria of < 3 m/s for emergency conditions.

A summary of the overall modelling assessment is captured below:

- The base scenario with CSD and NTP industrial demands meets minimum pressure and maximum unit headloss criteria.
- The base scenario did not meet FW5 fire flow criteria, as there is not sufficient pipe capacity to maintain a residual pressure of 10 m to provide the required fire flow of 150 L/s.
- The base scenario met FW4 fire flow criteria as the network can provide a fire flow of 25 L/s at four hydrants and maintain a residual pressure greater than 10 m.
- The maximum headloss of the DN 200 pipe sections on Quadrant Drive (North of Depot St) and Shands Roads reduces with FW3 criteria from 10-15 m/km to 6-8 m/km.
- The minimum pressure and maximum unit headloss criteria are still met when the proposed Marshs Road development demand is added to the base model.
- The proposed Marshs Road development does not meet the FW4 fire flow criteria.
- Marshs Road can meet FW3 fire flow criteria as the network can provide a fire flow of 25 L/s at two hydrants and maintain a residual pressure greater than 10 m.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

Council engaged WSP on behalf of the plan change applicant to carry out a modelling assessment for the proposed Marshs Road industrial development at the corner of Marshs Road and Main South Road. The key findings from this modelling assessment are summarised below.

- The base scenario (current peak day demand) was carried out including the CSD and NTP industrial site demands and internal pipe network in the model. The industrial sites meet the minimum pressure and maximum headloss criteria. The rest of the zone supplied by Denton Station will also maintain a minimum pressure range between 20 – 40 m. The maximum headlosses of the DN 200 supply pipe sections on Quadrant Drive and Shands Road exceeds 5 m/km but are considered acceptable as they are within performance criteria.
- Fire flow models runs were carried out to determine the available fire flow to the proposed Marshs Road industrial development.
- FW5 fire flow criteria was not met, as all six hydrants failed to maintain a residual pressure of 10 m at the required fire flow. The minimum pressure of the area closer to the hydrants was less than 10 m. The network (i.e., the existing DN 200 supply pipes on Quadrant Drive and Shands Road) also experienced higher unit headlosses (greater than 20 m/km) in this scenario.
- Pipe upgrades will be required to achieve FW5 fire flow to the site. This include upgrading the existing DN 200 supply pipes on Quadrant Drive and Shands Road.
- The hydrants were then tested for FW4 fire flow criteria. All four hydrants maintained a residual pressure greater than 10 m at the required fire flow of 100 L/s. The headlosses of the existing supply pipes decreased between 10 – 15 m/km with a velocity around 2 m/s.
- The maximum headlosses of the existing DN 200 Quadrant Drive and Shands Road supply pipes are further reduced when the fire flow is tested against FW3 criteria.
- The network still maintained a minimum pressure above 20 m when Marshs Road demand was added. The maximum headloss on the existing DN 200 PVC pipe section on Quadrant has slightly increased compared to the base scenario.
- However, the proposed Marshs Road development was not able to meet the FW4 fire flow criteria, as the hydrants failed to maintain a residual pressure greater than 10m at required fire flow. The maximum unit headloss exceeded 15 m/km in some pipe sections within the proposed CSD and NTP sites. The maximum unit headlosses of the existing DN 200 pipe sections on Quadrant Drive and Shands Roads are between 10 – 15 m/km for most of the length with some sections exceeding 20 m/km.
- The proposed Marshs Rd development can meet FW3 criteria, as the required fire flow of 50 L/s was achieved while maintaining a residual pressure of 10 m at each hydrant.

4.2 RECOMMENDATIONS

WSP recommends that the existing DN 200 PVC supply pipe sections on Quadrant Drive and the existing DN 200 AC supply pipe on Shands Road are upgraded in the future to a minimum DN 300 to align with the new DN300 sections on Quadrant Drive that service the industrial areas.

FW4 can be achieved for the Marshs Road development site by upgrading the existing DN 200 PVC section on Quadrant Drive.

Further modelling is recommended to verify pipe sizes, this is to reduce high headlosses, and to ensure there is sufficient capacity to support future growth and meet fire flow requirements for the industrial area.

5 LIMITATIONS

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for Christchurch City Council ('Client') in relation to Marshs Road Industrial Development – Modelling Assessment ('Purpose') and in accordance with the WS Model Query Request – Plan Change Marshs Road Industrial Extension with the Client dated 10/08/2023 ('Agreement'). The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any use or reliance on this Report, in whole or in part, for any purpose other than the Purpose or for any use or reliance on this Report by any third party.

In preparing this Report, WSP has relied upon data, surveys, analyses, designs, plans and other information ('Client Data') provided by or on behalf of the Client. Except as otherwise stated in this Report, WSP has not verified the accuracy or completeness of the Client Data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this Report are based in whole or part on the Client Data, those conclusions are contingent upon the accuracy and completeness of the Client Data. WSP will not be liable for any incorrect conclusions or findings in the Report should any Client Data be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

Appendix G – Sewer Catchment Modelling



Memorandum

To	Michele McDonald
Copy	Sue Harrison (WSP)
From	Lyndsey Foster / David Ripley
Office	Christchurch
Date	20 September 2023
File	3-CHCH3.42/0016 - Wastewater Hydraulic Modelling
Subject	Wastewater Model Query Request – Marshs Road Industrial Extension
Ref	\\corp.pbwan.net\ANZ\Projects\NZ\3c\3-CHCH3.42 WW Network Modelling for Capital Works\Home\600 Queries\0016 – Marshs Road Industrial Extension

1 Introduction

Christchurch City Council (Council) engaged WSP to model the effect of a proposed industrial development at the corner of Main South Road and Marshs Road on the wastewater network. Council provided the following information for this investigation:

- A restricted average flow of 0.09 L/s/ha (Industrial Heavy) from the development was applied.
- The development will be serviced by a local pressure sewer network.
- Four potential discharge points were identified.
- Network change - The amendment of the discharge point of growth area Southwest Hornby CB2 site 3 to PS82 catchment.

2 Modelling

2.1 Assumptions, Uncertainties, and Limitations

General

- This assessment was performed using InfoWorks ICM v9.0.7, using the existing 2020 wastewater model¹. Only the existing model (Version 612) was used. It was assumed that this model is suitable for this assessment. More details on this model can be found in the **Christchurch City Wastewater Model: Model Update and Calibration Report** (WSP, 17 July 2020).
- This model is predominately a trunk main model. Hence, pipes smaller than DN 225 are generally not included in the model unless this would cause connectivity issues. Additionally, subcatchments in this model can be quite large and are not split up by

¹ WSP model reference: dcapa500app57:40000/CCC 2019 InfoNet

each manhole. If required during development inquiries, pipes smaller than DN 225 can be added to the model and large subcatchments can be split up to better reflect the flow distributions in the area.

- Pump stations are modelled using a "screw pump". The modelled pump operates continuously with the discharge rate matching the incoming flow up to the maximum possible pump rate, as opposed to start-stop operation. This method reduces model run times but may lead to under predictions of peak flows downstream.
- For wet weather flow (WWF), there are two design events available for this model. The first is the compliance design event, which was provided by Council in September 2020 and is assumed suitable for compliance assessments. The second is the planning design event, which is the same as the compliance event but shifted by three days and 13 hours such that the peak rainfall aligns with peak growth trade flows. The planning design event was used for this assessment. For more details on the planning design storm, refer to *Design Storm Modification – May 2021 Update Memorandum* (WSP, 25 May 2021).
- The impact of this development during WWF was assessed using the planning design event. However, a variety of storm events would be necessary to fully understand the impact of WWF on the network. Variables to consider include the annual exceedance probability (AEP), intensity, duration, and timing of the event with respect to flow patterns in the network.
- The wastewater network model has both a Base Model and a Growth Model. The base model represents the current network and flow inputs. The Growth Model has committed network and growth changes included in addition to the Base Model.

More information on the creation of the Growth Model can be found in *Christchurch City Wastewater Model-Updated Growth Model Report* (WSP, 17 June 2020, Council ref CPMS#51866). In summary, the Growth Model differs from the Base Model through the inclusion of the following:

- City wide population uplift using Stats NZ 2013 Meshblocks with Council calculated 2041 populations.
- Identified population growth areas from 2016 with either lot density or number of lots.
- Large industrial / commercial areas:
 - Christchurch Airport
 - Dakota Park, Memorial Avenue Investments Ltd (MAIL) and North West Review Area 3 (NWRA3)
 - Ravensdown
 - East Frame (mixed use)
 - Riccarton Park (mixed use)
- Additional industrial / commercial areas modelling using *IDS Part 6* (CCC, December 2018)

Scenario Specific

- The nearest flow monitor is Annex, a long-term flow monitor installed in manhole WwAccess6455. A good level of calibration was achieved against data between February 2018 and June 2019 (WSP, 2020), although the model in this area can over-predict slow response for large summer rainfall events.
- The planned growth areas Southwest Hornby CB2, Southwest Hornby CB2 site 3 (to PS82 catchment), and West Hornby CB7 were included in both the Base Model and Growth Model as requested by Council.

- The following planned growth areas, additional to those listed above, were added to the Growth Model:
 - Southwest Hornby CB2 site 2
 - Hornby South
 - Hornby South Heavy
 - Templeton
 - Islington Park
 - Islington Park A
- The development's private infrastructure was not modelled explicitly. It was assumed the private infrastructure has capacity for the development flows.
- Development flows were calculated using the following information provided by Council:
 - The proposed plan change is for an area currently zoned as Rural Urban Fringe to be rezoned Industrial Heavy.
 - As the site is within a limited sewer discharge area, an average flow of 0.09 L/s/ha was applied to represent the additional flow from the proposed development.

2.2 Methodology

The following methodology was undertaken:

- 1 The Growth Model was updated to reflect one network change in the area. This was Council's requested amendment of the discharge point of the Southwest Hornby CB2 site 3 to WwAccess43671, in the PS82 catchment.
- 2 Growth areas were added to the Base and Growth model, as discussed in section 2.1.
- 3 Two new scenarios were created to include the new development, one from the Base Model and one from the Growth Model (WWF).
- 4 In these two new scenarios, the expected Marshs Road development flow was applied as a trade flow to a new subcatchment covering both the existing residential properties and the currently undeveloped greenfield area.

The new subcatchment was assigned to WwAccess30451 on the DN 225 line on Main South Road. This manhole was chosen as the most appropriate given the predicted surcharge in the downstream line on Waterloo Road. Assigning the development to this manhole means that the increased flow arriving at Waterloo Road can be mitigated to some extent by the operation of pump station PS87 (though at the expense of increased pumping costs). Figure 2-1 shows the site location and relevant features.

The development land parcel is 22.6 ha, which gives an average flow (ASF) of 2.03 L/s and a peak flow (MF) of 10.2 L/s. The peak flow has been applied to the development scenarios.

- 5 Simulations were run with the Base Model, the Growth Model, and both development scenarios to assess the impact of the development on the network during DWF and WWF, using the planning design storm for the latter.

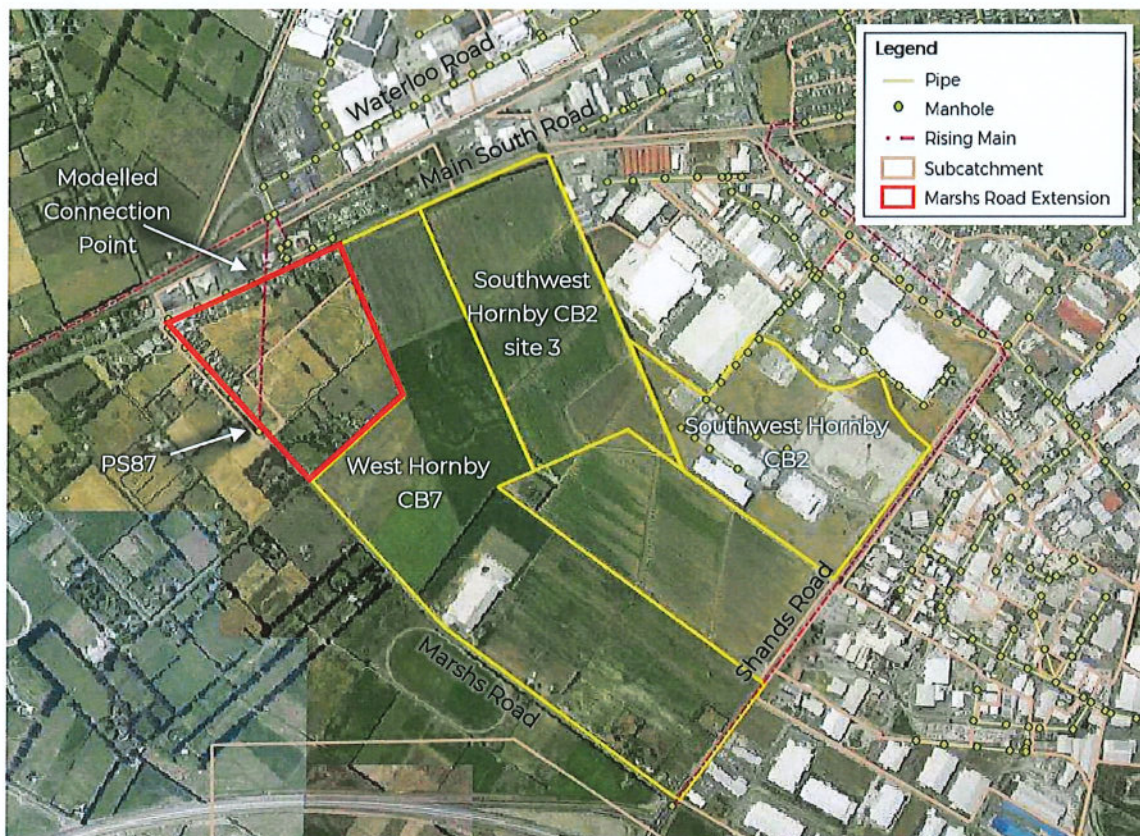


Figure 2-1: Plan of the development area and surrounding important features.

3 DWF Results

The DWF results show that there are predicted capacity issues on Waterloo Road with the added development flows in the Growth Model, however no overflows are predicted.

Flows within the Marshs Road / Main South Road line to PS87 increase with the addition of the new industrial area. No surcharge is predicted when compared to the Base Model or Growth Model. Long sections of the Marshs Road line are presented in Figure 3-1 and Figure 3-2.

Peak DWF in the Marshs Road line (approximately 11 L/s) are considerably lower than the PS87 duty pump rate of 21 L/s (calculated from a drop test in 2003). The pump start level in the model (provided by Council in 2019) is above the invert of the incoming pipe to the wet well; this causes the minor backing up of flows at PS87.

There is a small difference in flows in the Waterloo Road line with the addition of the new industrial area for the Base Model, see Figure 3-3.

Surcharge is predicted on Waterloo Road in the Growth Model, see Figure 3-4. Although the line is surcharged in DWF, no manhole overflows are predicted due to the depth of the pipes. Therefore, the existing infrastructure does not have capacity to accommodate both zoned growth and new zoned/new growth areas.

It should be noted that the pipes in Waterloo Road have a minimum pipe full capacity of 81 L/s. This is less than the combined peak pump rates of the three upstream pump stations, which is 150 L/s (PS79 at 99 L/s, PS87 at 26 L/s and PS146 at 25 L/s). It is recommended that Council investigate the potential for limiting peak rates at these pump stations, or upgrading telemetry to allow for their synchronisation (i.e. not having all three operating simultaneously) to reduce the predicted surcharge.

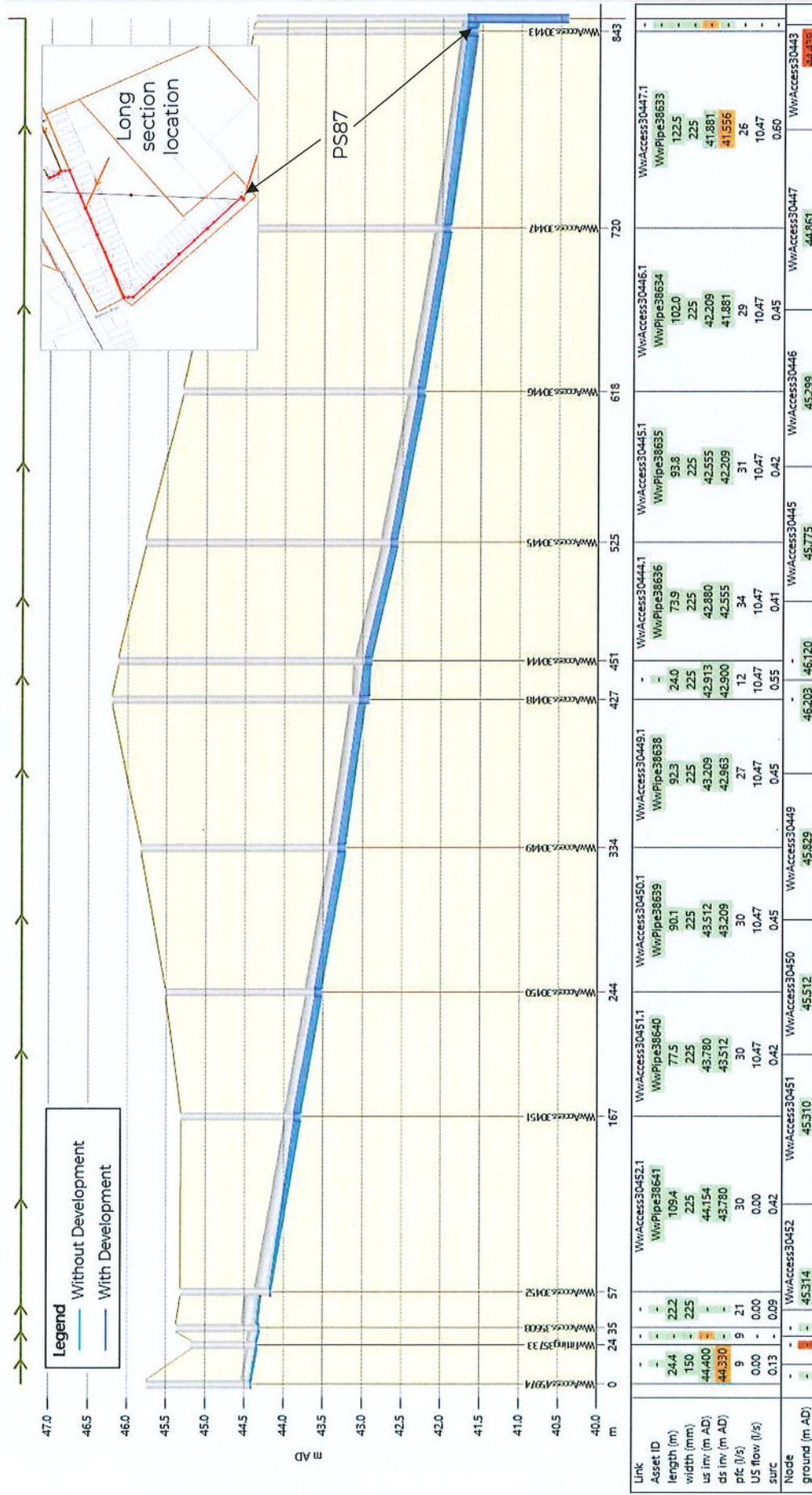


Figure 3-1: Long section of the Marshes Road / Main South Road line - Base Model with and without development at peak DWF.

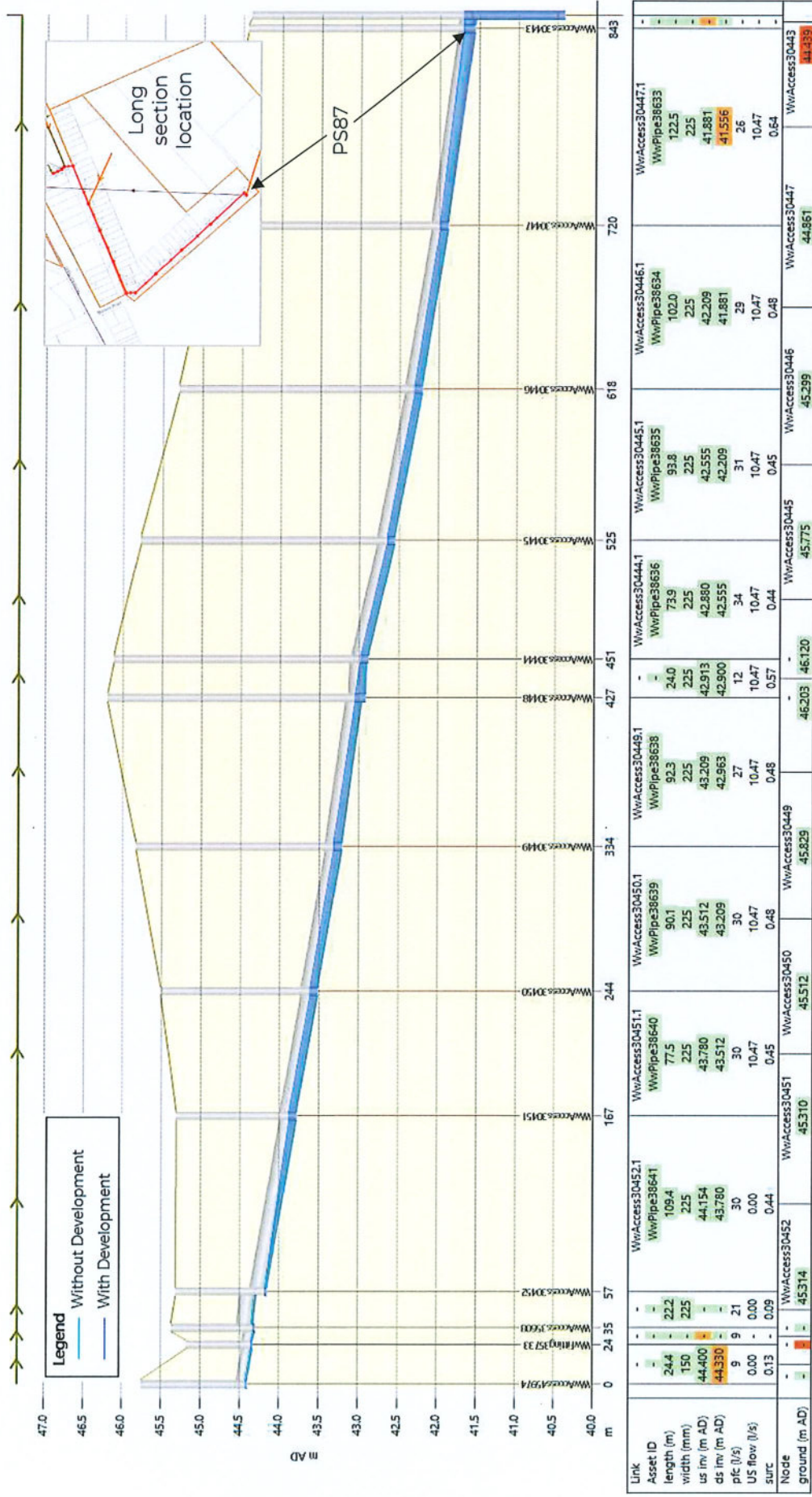


Figure 3-2: Long section of the Marshes Road / Main South Road line – Growth Model with and without development at peak DWF.

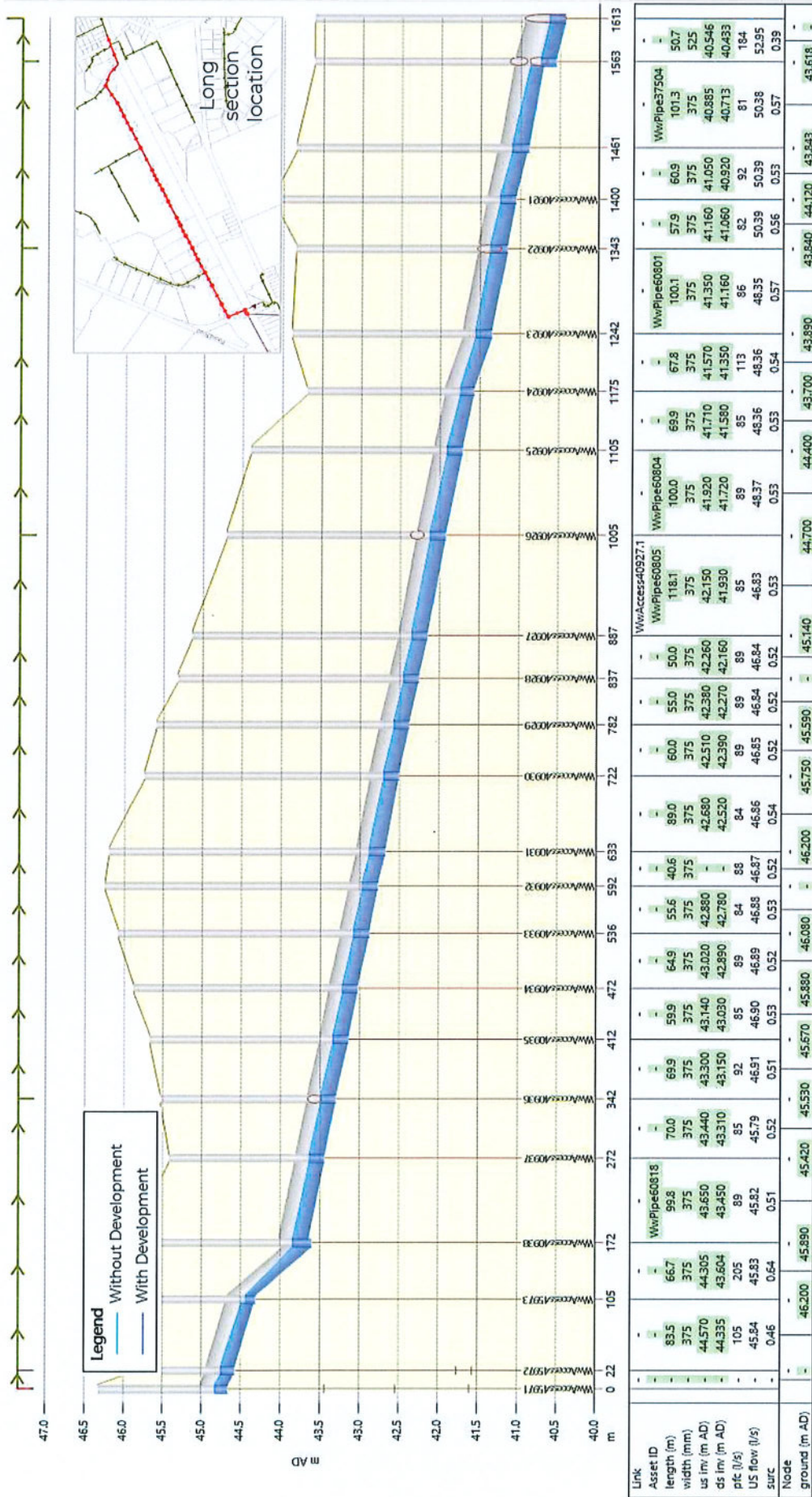
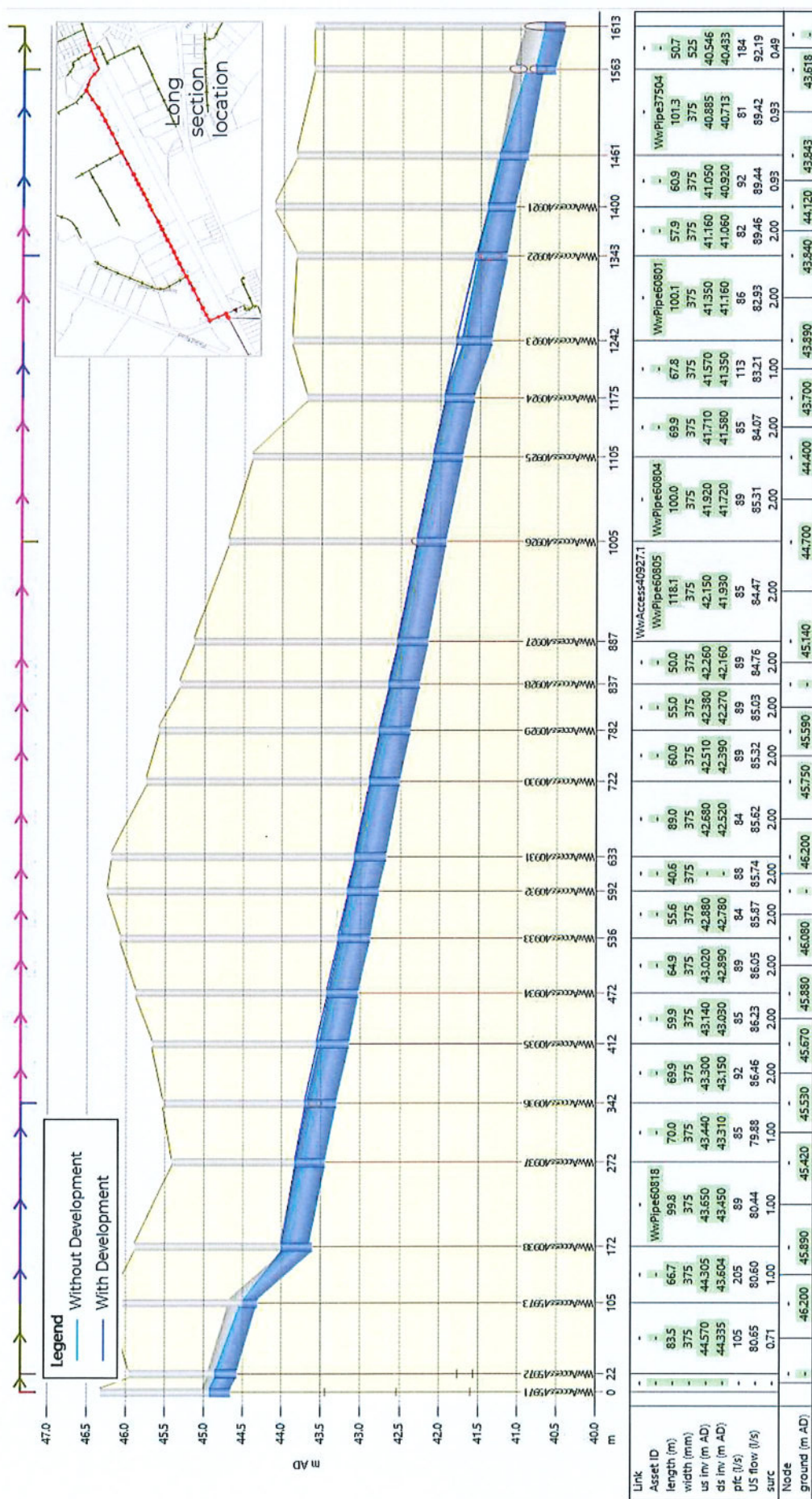


Figure 3-3: Long section of the Waterloo Road line – Base Model with and without development at peak DWF.



4 WWF Results

The WWF results show similar issues to the DWF results in the Growth Model, with increased surcharging on Waterloo Road but no new or increased overflows.

As there is little modelled storm response connected to Marshs Road, there is little difference on Marshs Road between DWF and WWF. Peak flows arriving at PS87 do not exceed the modelled maximum duty-assist pump rate of 26 L/s.

However, there is a significant difference in predicted peak levels on Waterloo Road with the addition of the development, although no manhole overflows are predicted. Surge on Waterloo Road is already predicted for the Growth Model without the development, so only a small increase in flows due to the new development is required to cause a significant increase in surcharge levels.

As previously noted, the pipes on Waterloo Road have a pipe full capacity less than the combined peak pump rates of the three pump stations upstream. These peak pump rates are not achieved during the planning rainfall event, indicating that some flow could be held back temporarily to reduce predicted surcharge levels.

Predicted results on Waterloo Road are shown in the long sections in Figure 4-1 and Figure 4-2.

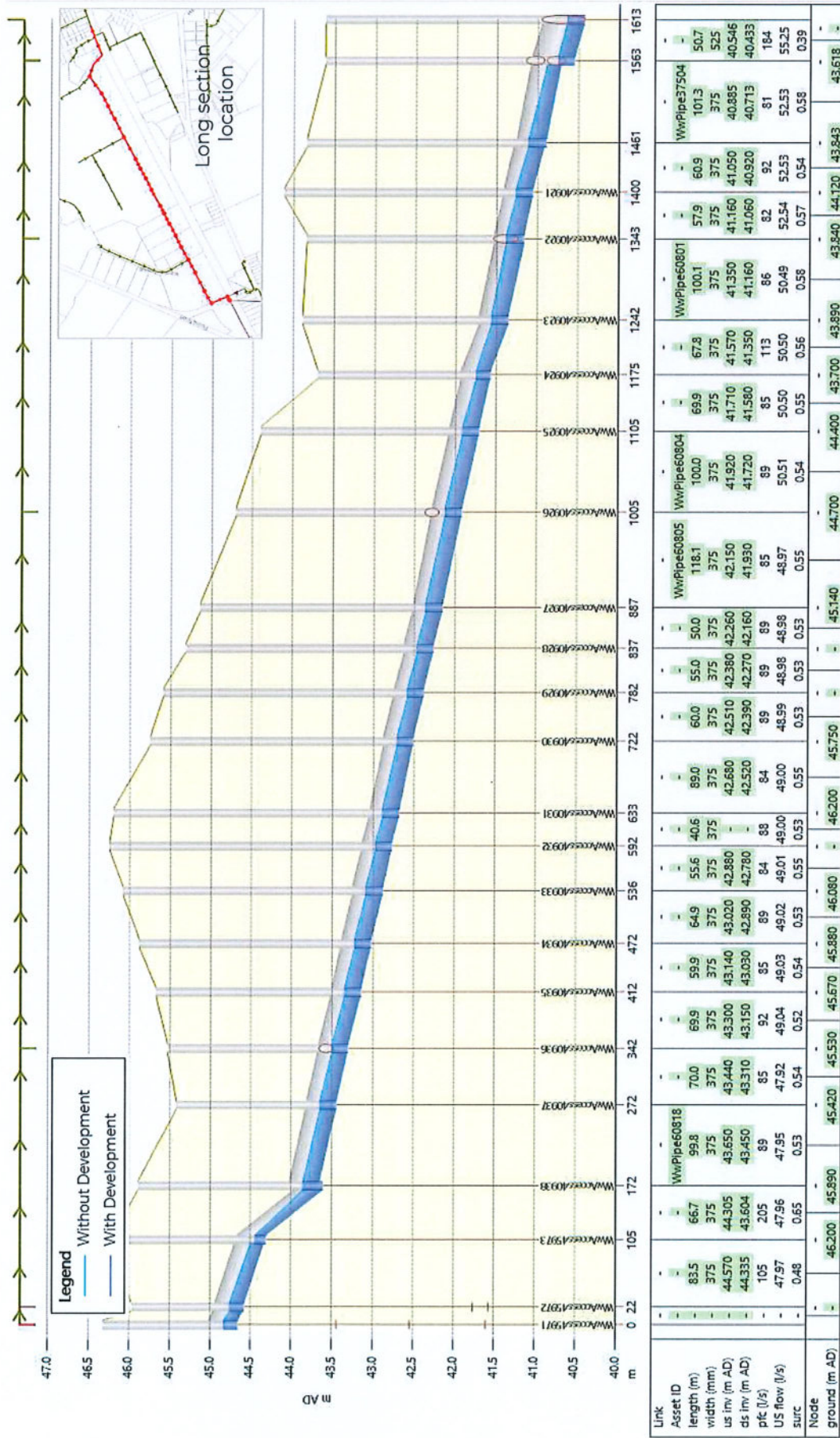
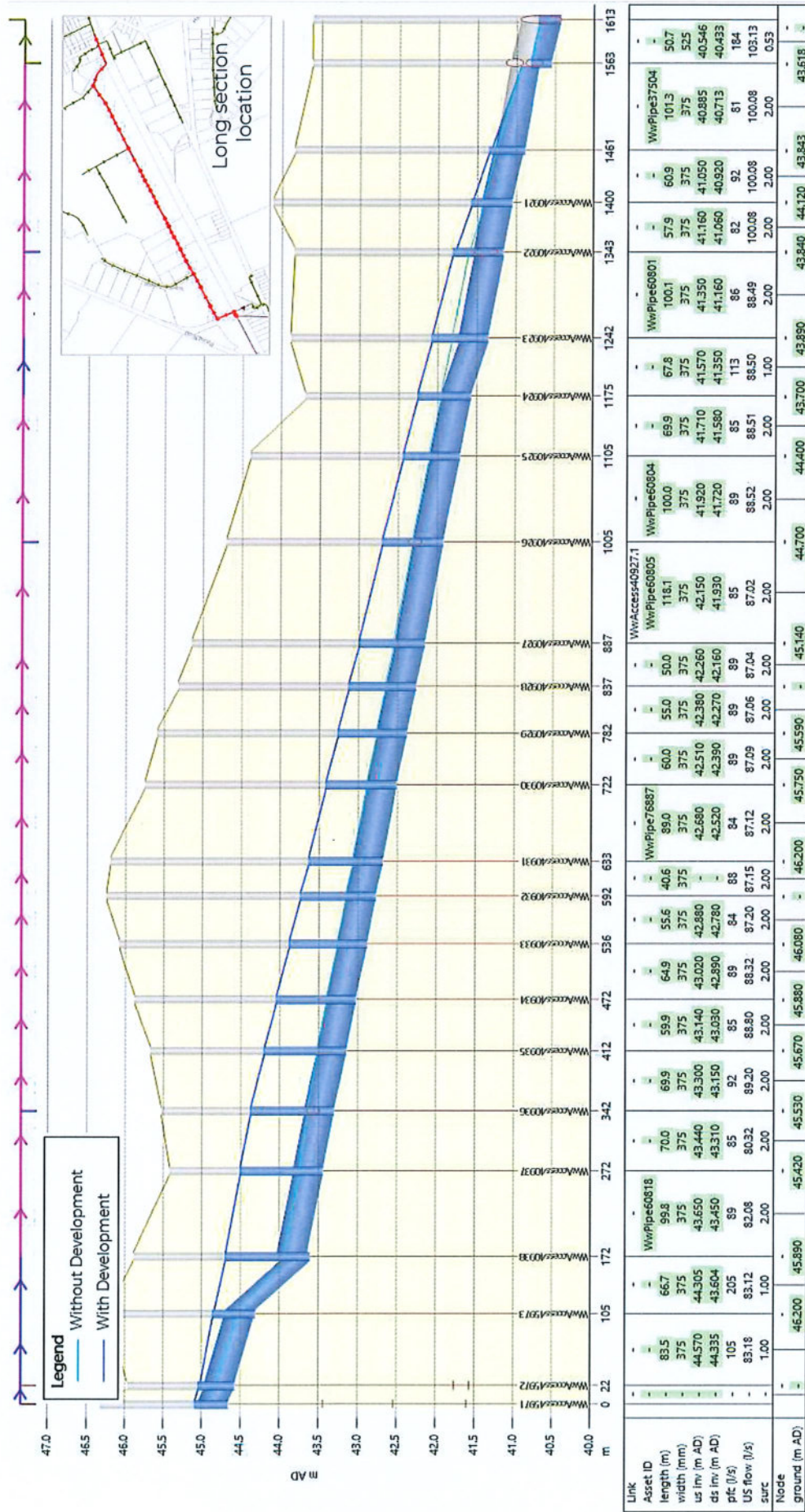


Figure 4-1: Long section of the Waterloo Road line – Base Model with and without development at peak WWF.



5 Conclusions

Surcharge is predicted on the Waterloo Road line in the Growth Model during dry weather. This would suggest that there will be insufficient capacity in the existing infrastructure to accommodate any new zoned/new growth areas in addition to the current zoned growth.

There are no capacity issues predicted during wet weather flow, with no overflows predicted.

It is recommended that Council investigate the potential for limiting peak rates at PS79, PS87 and PS146, or upgrading telemetry to allow for their synchronisation i.e. not having all three operating simultaneously. There are no capacity issues predicted for the Base Model for either DWF or WWF, with or without the Marshs Road development.

Appendix H – Stormwater Catchment and Basin Calculations

Refer to Subdivision Concept Plan attached

Assumptions:

1. Critical storm is 50 year event - any duration
2. Onsite soak rate measured to be 3500mm/hr, testing completed by Landform Projects. A factor of safety of 5 was applied to give a design rate of 700mm/hr
3. First flush treatment to be provided for the first 25mm of rainfall with a design soakage rate of 20mm per hour as per WWDG 6.5.4
4. Rainfall based on HIRDS RCP 8.5 2081-2100
5. All roof runoff is discharged to ground with lots. An assumption of 40% of site coverage by buildings has been applied
6. Stormwater basins to be sized to contain a minimum volume of 50% of the 10 year 18 hour event
7. Rapid soakage soakpit designed to be 50% of detention basin area to allow two soakpits to be constructed to prevent failure
8. Depth of first flush basin 1.2m
9. Depth of storage basin 1.5m

Site area contributing to basins

Total site Area	28.89 Ha
Total Lot Area	25.39
60% of Total Lot Area	15.23
Total road area	3.5
Contributing Catchment Area	18.73

Area (Ha)	C _{ff}	D _{ff} (mm)	C _{50yr}	C _{10yr}
18.73	0.81	25	0.82	0.77

C_{ff} From WWDG Table 6.10

C_{50yr}, C_{10yr} From WWDG table 21.5

HIRDS V4 Intensity-Duration-Frequency Results

Sitename: Calder Stuart Marshs Road

Rainfall intensities (mm/hr) :: RCP8.5 for the period 2081-2100

Coordinate system: WGS84

Longitude: 172.495

Latitude: -43.5548

ARI	1h	2h	3h	6h	9h	12h	18h	24h
10	24.6	17.1	13.2	9.22	7.6	6.07	4.98	3.88
50	37.9	26	19.9	13.7	11.3	8.88	7.23	5.58

Values linearly interpolated from HIRDS RCP 8.5 2081-2100 results

First Flush Volume

$$V_{ff} = C_{ff} \times A \times D_{ff} \times 10$$

$$V_{ff} = 3794 \text{ cu.m}$$

$$Aff = V_{ff}/Y_{ff} + 8 \times (V_{ff} \times Y_{ff})^{0.5}$$

$$FFB \text{ Depth} = 1.2 \text{ m}$$

$$\text{First Flush Soakage Rate} = 20 \text{ mm/hr}$$

WWDG 6.8.1

WWDG 6.5.4

WWDG EQN (6-7)

$$\text{Area First Flush Basin} = 3701 \text{ sq.m}$$

$$\text{Base Area First Flush Basin} = 3000 \text{ m}^2$$

Rapid Soakage

Rapid Soakage area under basin

1250 m²

Rapid Soakage Rate

700 mm/hr

Rapid Soakage depth

0.6 m

Minimum Basin Volume 50% of 10 year AEP 18 hour event

$$Q = 2.78 C I A$$

$$Q = 199.51 \text{ l/s}$$

$$V = Q \times 60 \times 1080 / 1000 \times 0.5$$

$$V = 6464 \text{ cu.m}$$

$$V = 2670 \text{ cu.m}$$

50% of Total Storm Volume to be contained by basins

Minimum Basin Volume 50% of Total Storm Volume minus First Flush Volume

Full Flood Flow calculation = 2.78CI A

Soakage Basin Sizing Table

Duration (min)	Unit	60	120	180	360	540	720	1080
Q (l/s)	l/s	1619	1110	848	585	482	379	309
V (m ³)	cu.m	5827	7995	9155	12638	15622	16383	20008
V _{ff} (m ³)	cu.m	3794	3794	3794	3794	3794	3794	3794
V over FFB	cu.m	2033	4201	5362	8844	11828	12589	16214
FFB Soakage	cu.m	60	120	180	360	540	720	1080
Rapid Soakage	cu.m	875	1750	2625	5250	7875	10500	15750
Soakpit Storage	cu.m	225	225	225	225	225	225	225
V _{balance}	cu.m	873	2106	2332	3009	3188	1144	-841

Storage Volume Exceeds Storm volume

Critical Event

Soakage exceeds inflow

Basin Area

Basin depth

1.5 m

$$A = V/Y + 8 \times (V \times Y)^{0.5}$$

$$A = 2679 \text{ sq.m}$$

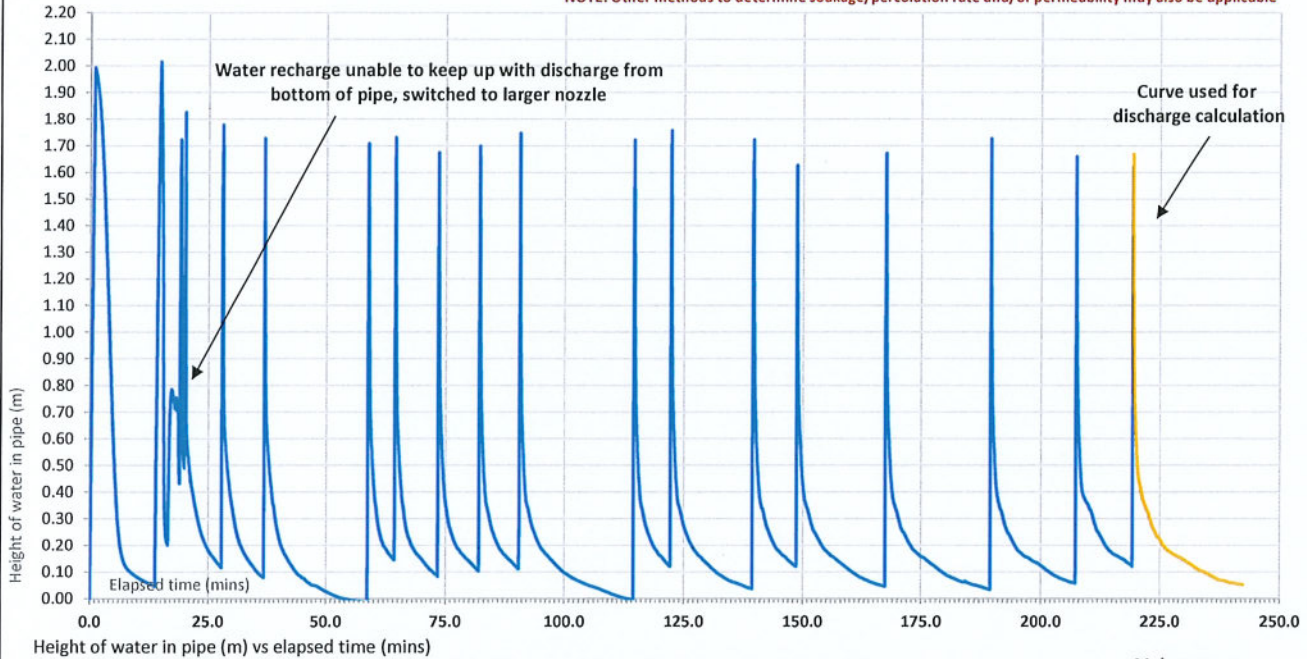
$$\text{Total Basin Area} = 6380 \text{ sq.m}$$

FALLING HEAD PERCOLATION TEST REPORT

ST01

Test to determine Percolation Rate (P_r)

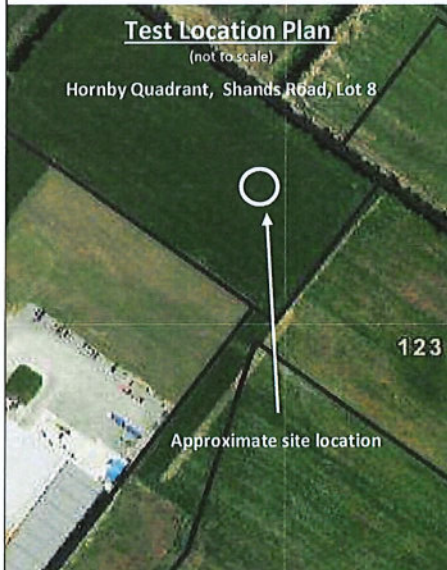
NOTE: Other methods to determine soakage/percolation rate and/or permeability may also be applicable



H_1 (m)	H_2 (m)	Δh (m)	t_1 (min)	t_2 (min)	Δt (min)	Volume (m^3)	Volume (L)	mld H (d) (m)	Percolation Rate ($L/m^2/min$)
1.648	0.592	1.056	219.367	220.050	0.683	0.00897	8.97313	1.120	1545.880
0.592	0.183	0.408	220.050	226.583	6.533	0.00347	3.46845	0.388	62.495
0.183	0.052	0.132	226.583	242.433	15.850	0.00112	1.11877	0.118	8.309
1.648	0.052	1.596	219.367	242.433	23.066	0.01356	13.55781	0.850	69.192

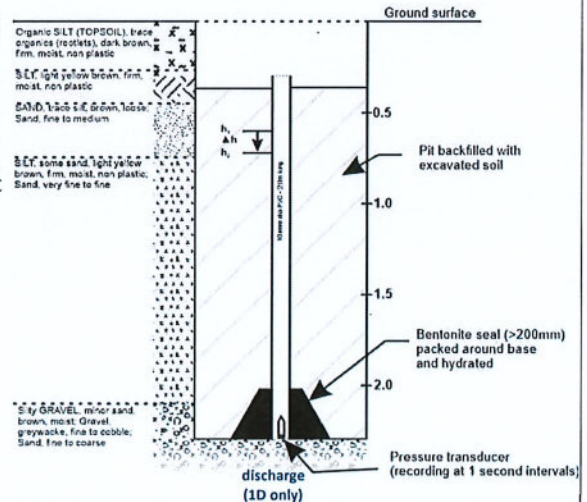
$$P_r (L/m^2/min) = \frac{\text{Volume (L)}}{\text{Area}_{\text{discharge}} (m^2) \times \Delta t (min)}$$

(Percolation rate at given head 'd')



This test is cased (to below g.l.) with PVC pipe and allows 1 dimensional discharge (only) at the base discharge area of base = 0.008495m². Various Council guidelines were used to prepare calculations of percolation rate using this test method.

Pipe Diameter: 104mm I.D. (PVC Pipe)
 Pipe length: 2.0m
 t.o.p below ground: 0.3m
 Pipe Base Depth: 2.3m.b.g.l.
 Hole Diameter: Test pit (>1m)
 Geology at discharge (base of pipe): Silty Gravel, minor sand, fine to cobble
 Groundwater: 12m approx.
 Bentonite seal: (2 bags) placed around base of pipe (in pit), hydrated, then backfilled over up to ground level, prior to testing.



Test Construction

landform
projects

Project: Hornby Quadrant, Shands Road, Lot 8
 Client: Davie Lovell-Smith
 Client Ref #: Lots 8 & 12 - Soakage Testing
 Co-ordinates: 1559595.202, 5177346.904 (NZTM2000 E,N)
 Max depth: Test at 2.3m.b.g.l.
 Equipment: Excavator

Contractor: LFP
 Drill method: Excavated Test Pit

Test #: ST01

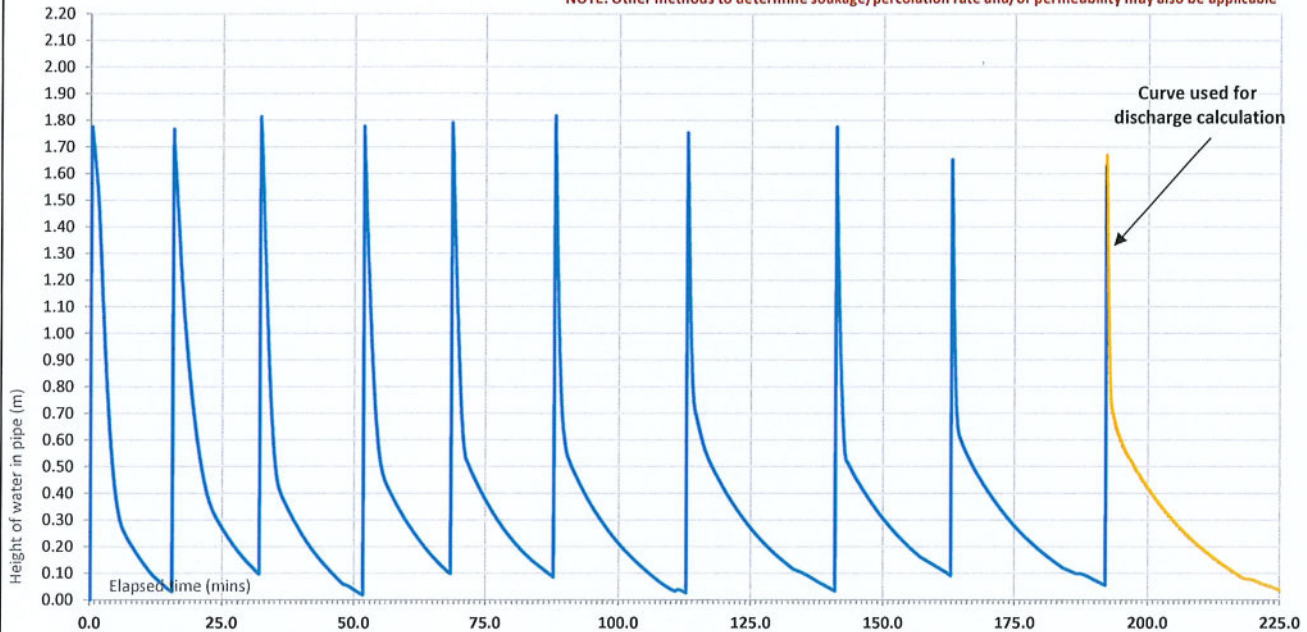
Job #: 1730
 Date tested: 06/03/2023
 R.L.: 32.5 (NZVD '16)
 Logged by: CLS
 Driller: Higgins

FALLING HEAD PERCOLATION TEST REPORT

ST02

Test to determine Percolation Rate (P_r)

NOTE: Other methods to determine soakage/percolation rate and/or permeability may also be applicable



H_1 (m)	H_2 (m)	Δh (m)	t_1 (min)	t_2 (min)	Δt (min)	Volume (m ³)	Volume (L)	mid H (d) (m)	Percolation Rate (L/m ² /min)
1.668	0.727	0.942	192.220	193.220	1.000	0.00800	7.99792	1.197	941.500
0.727	0.281	0.445	193.220	205.650	12.430	0.00378	3.78276	0.504	35.825
0.281	0.021	0.261	205.650	226.533	20.883	0.00221	2.21461	0.151	12.484
1.668	0.021	1.648	192.220	226.533	34.313	0.01400	13.99529	0.844	48.014

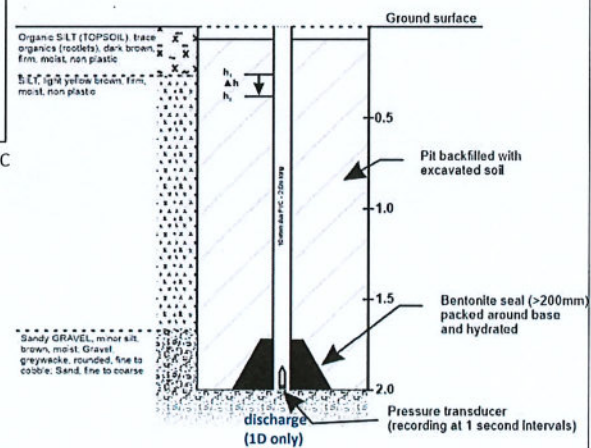
$$P_r \text{ (L/m}^2\text{/min)} = \frac{\text{Volume (L)}}{\text{Area}_{\text{discharge}} \text{ (m}^2\text{)} \times \Delta t \text{ (min)}}$$

(Percolation rate at given head 'd')



This test is cased (to above g.l.) with PVC pipe and allows 1 dimensional discharge (only) at the base discharge area of base = 0.008495m². Various Council guidelines were used to prepare calculations of percolation rate using this test method.

Pipe Diameter: 104mm I.D. (PVC Pipe)
Pipe length: 2.0m
t.o.p. above ground: 0.0m
Pipe Base Depth: 2.0m.b.g.l.
Hole Diameter: Test pit (>1m)
Geology at discharge (base of pipe): Sandy Gravel, minor silt, fine to cobble
Groundwater: 12m approx.
Bentonite seal: (2 bags) placed around base of pipe (in pit), hydrated, then backfilled over up to ground level, prior to testing.



Test Construction

landform
projects

Project: Hornby Quadrant, Shands Road. Lot 12
Client: Davie Lovell-Smith
Client Ref #: Lots 8 & 12 - Soakage Testing
Co-ordinates: 1559511.595, 5177408.182 (NZTM2000 E,N)
Max depth: Test at 2.0m.b.g.l.
Equipment: Excavator

Contractor: LFP
Drill method: Excavated Test Pit

Test #: ST02

Job #: 1730
Date tested: 06/03/2023
R.L: 33.0 (NZVD '16)
Logged by: CLS
Driller: Higgins



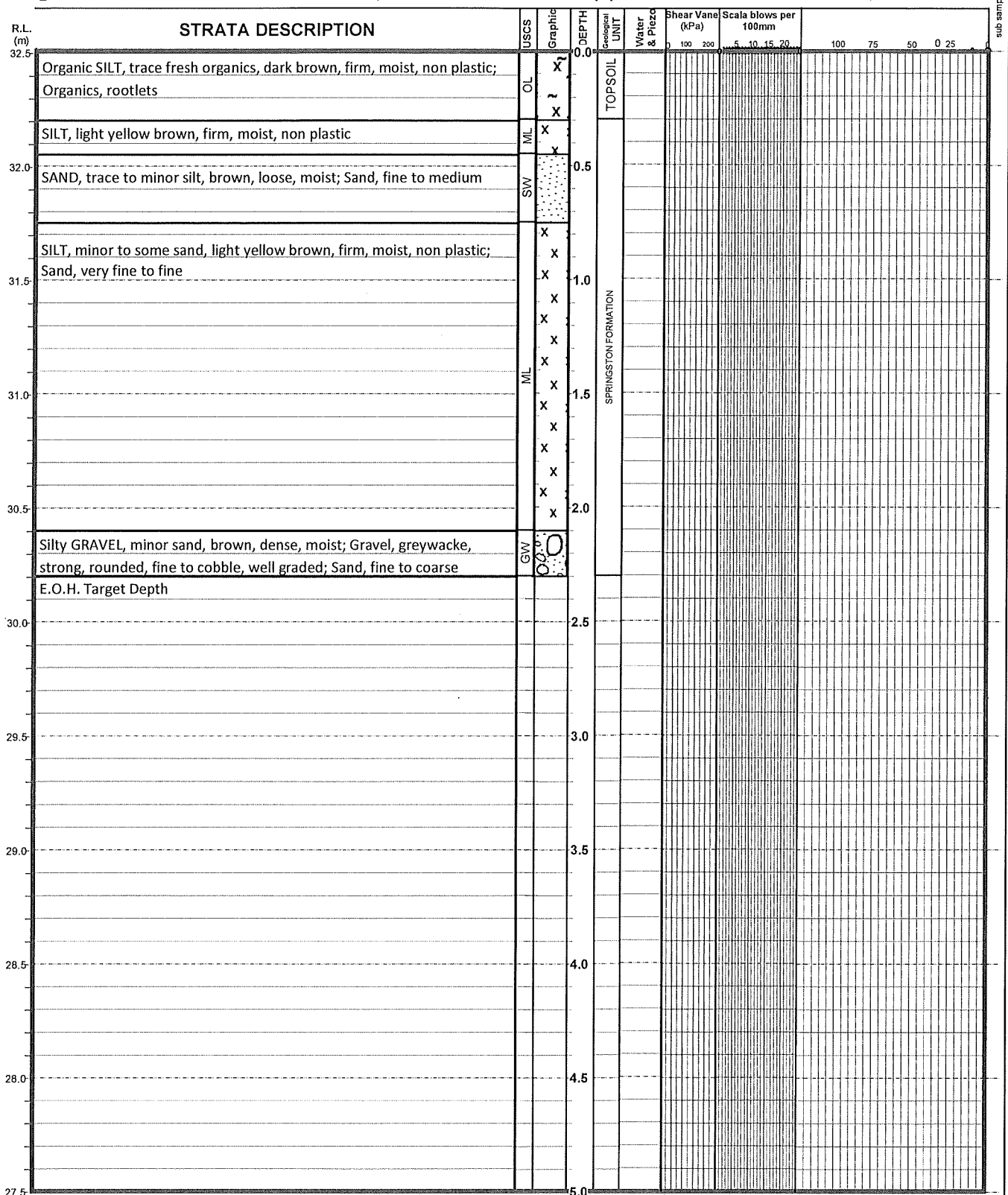
BOREHOLE LOG

Hole # **STP01**

Project: Hornby Quadrant, Shands Rd
For: Calder Stewart Ltd.
Project #:
Co-ordinates: 1559595.202, 5177346.904
Drill method: Excavator
Hole depth: 2.30

Grid system: NZTM2000 (E, N)
Contractor: LFP
Equipment: Excavator

LFP Ref #: 1730
Date started: 6/03/2023
Date finished: 6/03/2023
R.L.: 32.5 m NZVD(2016)
Logged by: CLS
Checked By: RBW

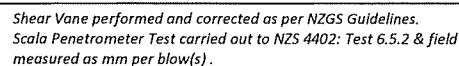


Notes: R.L. Approximate only
No Scala Penetrometer test taken

0 25 50
X peak
(kPa)
Residual
(kPa)
Size: mm
#:
blows/100mm
are calculated
from mm/blow as
recorded

Borehole logged in accordance with the "Guidelines for the Classification and Description of Soil and Rock for Engineering Purposes" Dec 2005 NZGS.
R.L. is inferred and/or interpolated unless otherwise stated.

Shear Vane performed and corrected as per NZGS Guidelines.
Scala Penetrometer Test carried out to NZS 4402: Test 6.5.2 & field measured as mm per blow(s).



Mia

Subject: FW: Plan Change 19

From: Andy Hall [mailto:Andy.Hall@dls.co.nz]
Sent: Friday, 27 June 2025 4:18 p.m.
To: 'office@rgmc.co.nz'
Subject: RE: Plan Change 19

RFI 8.

There has not been consultation with the Canterbury Regional Council. Consultation has been undertaken with the City Council to use their Global Stormwater Discharge Consent CRC252424 as per Phase 1 of the Hornby Quadrant Project. City Council has confirmed that the applicant can use the City's Global Consent on the basis that the flows other than roof water are treated through a forebay, first flush basin and infiltration bed. Please refer to the council advice below.

RFI 12.

The applicant is accepting of a Council Water Supply that will provide a maximum fire water classification of FW3. That is a flow of 25l/s from hydrants within 135m of the site and a further 25l/s from 270m. Subject to design approval at building stage, the individual future land uses may revert to Appendix B of SNZ PAS 4509:2008 New Zealand Fire Service Firefighting Supplies Code of Practice. This Appendix details alternative firefighting water sources. A full s.32 evaluation of the potential fire protection outcomes cannot be fully assessed at this time as the future buildings are yet to be designed, suffice to say that acceptance of the FW3 classification and adherence to SNZ PAS 4509 should provide satisfaction for the purposes of a Plan Change.

RFI 13.

The restriction of the wastewater discharge to 0.09l/s/ha is accepted by the applicant and is expected. This same restriction has been applied to the adjacent Phase 1 of Hornby Quadrant under Resource Consent RMA2020/2032 Condition 8.8a. This flow rate is sufficient for a wide variety of industry types as is evident in the existing development. Wet industry such as food processing, laundries etc would not be suitable businesses in this area.

RFI 14.

Consultation has been undertaken with the City Council with regard to this existing discharge. Please refer to the council response below that details that they would not expect to provide any contribution to the reworking of this discharge to a proper treatment and storage facility. At this stage the pipes and discharge will be maintained but this may be further reviewed at the time of subdivision.

Cheers

Andy Hall | Engineering Director



116 Wrights Road, Addington, Christchurch | P (03) 379 0793 | M 021 663 856 | www.dls.co.nz

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From: Norton, Brian [mailto:Brian.Norton@ccc.govt.nz]
Sent: Thursday, 12 June 2025 11:20 a.m.
To: Andy Hall
Cc: Mark Weaver; Kim McCracken - office@rgmc.co.nz; Martin Hayes
Subject: RE: Plan Change 19

Hi Andy,

We will be able to operate under the CSNDC as long as all hardstand runoff goes through the CCC network (a public treatment and disposal system). Otherwise, you will need ECan consents to treat and dispose of individual lot stormwater. Council are not going to monitor private treatment systems on industrial lots.

Council currently has right to drain and infrastructure in place to dispose of stormwater on #689 Main South Road. The infrastructure, while older, works fine as I understand it. Off the top of my head I don't think Council would be compelled to contribute to any reworking of its infrastructure to accommodate development, but I'm happy to continue discussions.

Kind Regards,

Brian Norton

Senior Stormwater Planning Engineer
Asset Planning – Stormwater & Waterways
Three Waters

 03 941 8394
 Brian.Norton@ccc.govt.nz
 Te Hononga Civic Offices, 53 Hereford Street, Christchurch
 PO Box 73014, Christchurch 8154
 ccc.govt.nz



From: Andy Hall <Andy.Hall@dls.co.nz>
Sent: Thursday, 12 June 2025 10:45 am
To: Norton, Brian <Brian.Norton@ccc.govt.nz>
Cc: Mark Weaver <mark.weaver@calstewart.co.nz>; Kim McCracken - office@rgmc.co.nz <office@rgmc.co.nz>; Martin Hayes <Martin.Hayes@dls.co.nz>
Subject: Plan Change 19

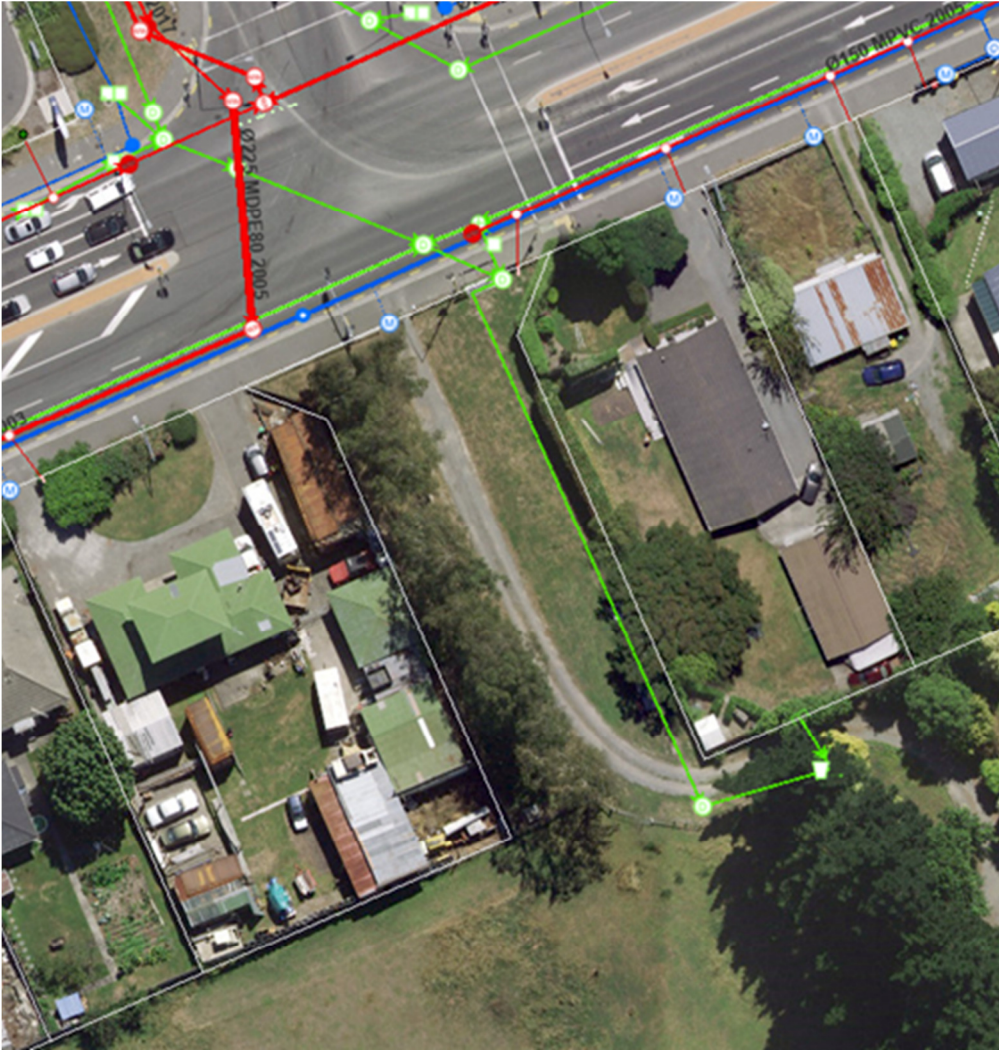
Dear Brian

We have received the attached RFI for the Plan Change 19 Application.
Please refer to Item 8 in the attached document.
Plan of the ODP also attached

I was expecting to undertake the stormwater disposal on this plan change area under the CCC Global rather than consult with ECan.

Are you able to confirm that this area can be covered in the global?

Also please note item 14.



The stormwater and other infrastructure from Main South Road will be tidied up and incorporated into the design to bring it up to modern standards and particularly in regard to the SW – to be compliant with the CCC Global Discharge Consent.

It is expected that the CCC will surrender those easements at the appropriate time and also contribute to the SW facility by way of a PDA where costs are shared pro-rata based on flows. Does this sound fair enough?



Andy Hall | Engineering Director



116 Wrights Road, Addington, Christchurch | P (03) 379 0793 | M 021 663 856 | www.dls.co.nz

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