TEKTUS CONSULTANTS LIMITED
A • 12 MADDEN ST
AUCKLAND CBD 1010
E • KIAORA@TEKTUS.NZ
W • TEKTUS.NZ

WARWICK & MARION STEFFERT

Infrastructure Report
Private Plan Change 58

INFRASTRUCTURE REPORT • 22 DECEMBER 2022
T21098.221222.R01.AVENUE • REV A

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Document Control

Client	WARWICK & MARION STEFFERT
Title	Private Plan Change 58 – Infrastructure Report
Revision	D
Status	Final
Version date	22 December 2022
Prepared by	Dali Suljic
Reviewed by	Jack Turner
Released by	Jack Turner

Revision History

Revision	Status	Date Issued	Prepared by	Reviewed by	Released by
A	Draft	30/09/2022	Dali Suljic	Jack Turner	Jack Turner
B	Final Draft	12/10/2022	Dali Suljic	Jack Turner	Jack Turner
C	Final Draft v2	28/10/2022	Dali Suljic	Jack Turner	Jack Turner
D	Final	22/12/2022	Dali Suljic	Emily Afoa	Emily Afoa

1 Introduction

Tektus was engaged by WARWICK & MARION STEFFERT to carry out a civil engineering servicing assessment for the proposed rezoning of approximately 13.4 hectares of land from Rural to Industrial. The scope of the assessment includes three waters (stormwater, wastewater, potable water) serviceability and the likely extent of earthworks required to support the proposed Private Plan Change 58 (PPC58).

1.1 Site description and existing environment

PPC58 has an area of approximately 13.4 hectares and is generally covered in pasture, farm access tracks and a network of stormwater drains. The access to site is currently provided from Thames Street (SH26).

Along the eastern boundary the proposed site is bounded by the existing Industrial Zone and includes Bowers Concrete and the Avenue Business Park development, which has been granted a resource consent in early 2022 and is currently under construction. To the north and west lies existing farmland within the Rural Zone, with existing shelterbelt planting along the western boundary. Land to the south consists of small lots which contain dwellings.

The site comprises of a flatter low-lying area in the south and a moderately sloping high-lying area in the north. The low-lying area generally slopes in a west to east direction at an average grade of approximately 0.3% and ground levels ranging between RL 28.0m and RL29.0m. The high-lying area slopes in a west to east direction as well, however the average grades here are at approximately 10% and ground levels range between RL 29.0m and RL51.0m. An existing contour plan and slope analysis plan are included in Attachment A of this report.

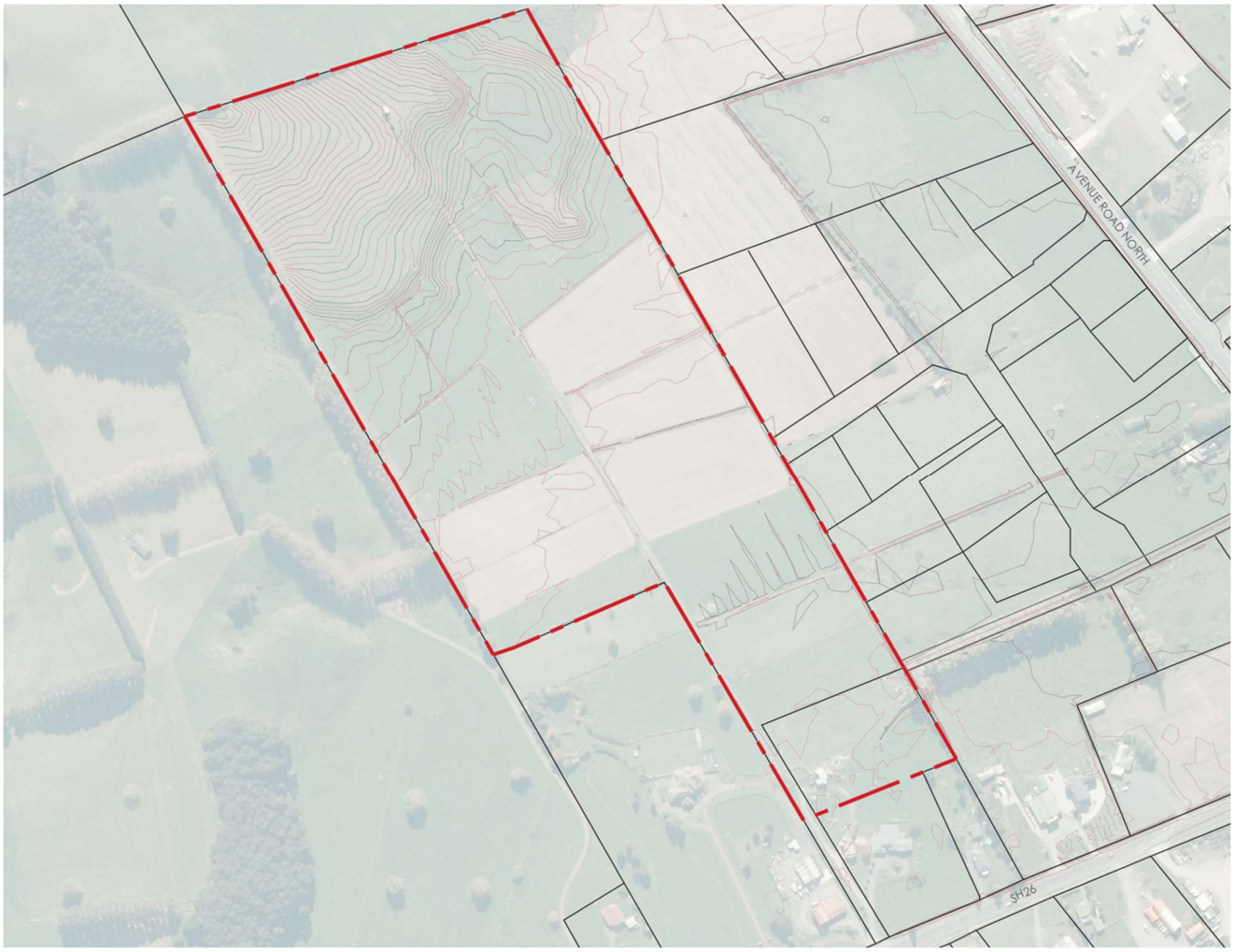

Figure 1 – PPC58 extents and existing contours (0.5m increments).

1.2 Proposed development

A concept plan shown in Figure 2 was prepared by Tektus to demonstrate how the proposed site might be developed under the proposed Industrial Zoning. The minimum adopted concept lot size has a minimum area of 1,000m² and a minimum width of 30m. The concept plan has been used as a basis for the plan change assessments, including the earthworks and three waters assessment contained in this report.

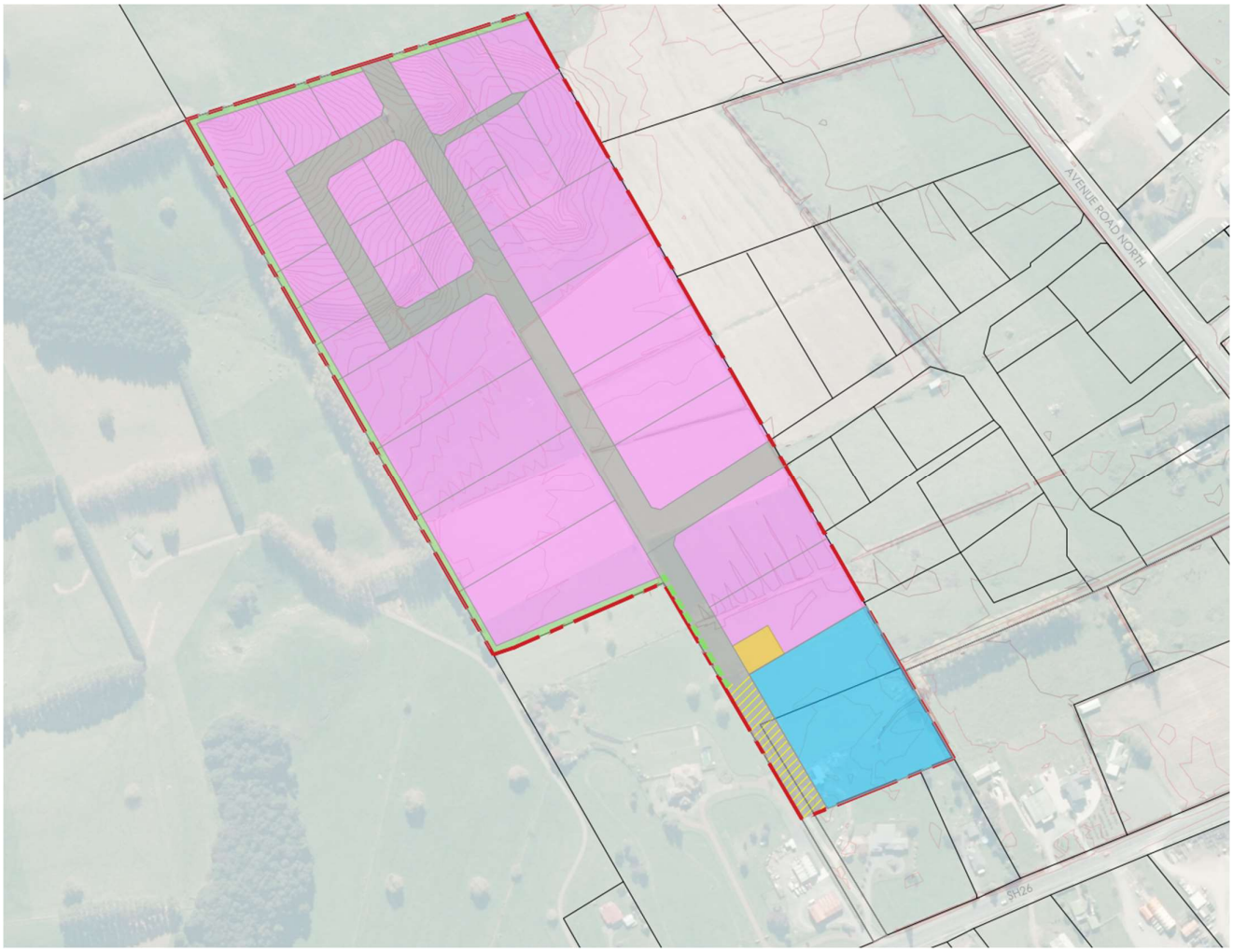

Figure 2 – PPC58 concept plan showing indicative industrial lots (magenta), roads (grey), stormwater management (blue), utility reserve (orange) and proposed landscaping buffer (green).

1.3 Ngāti Hauā Iwi Trust

A Cultural Values Assessment (CVA) was prepared by the Ngāti Hauā Iwi Trust outlined the potential effects on the cultural and environmental values for the PPC58 area and highlighted the opportunities to incorporate iwi values and mitigate these concerns.

A meeting was held with Norm Hill from the Ngāti Hauā Iwi Trust on 28 October 2022 to discuss the proposed development civil infrastructure provisions and ensure that the connections to the cultural and environmental outcomes have been appropriately recognised and captured. Ongoing discussions with Ngāti Hauā Iwi Trust are expected in order to establish a partnership and ensure collaboration through resource consent process and detailed design.

2 Earthworks

Due to the flat topography of the site, bulk cut and fill operations are expected to be required to deliver landform suitable for industrial land uses and lot platforms, provide for the construction of future roads, achieve minimum cover for three waters infrastructure and to form stormwater management devices. The concept plan was developed based on the expectation that smaller landholdings will be located within the high-lying areas of the site to minimise total bulk earthworks and retaining.

Bulk earthworks within the proposed site have the potential to accidentally uncover and disturb areas of cultural significance such as taonga tuku iho or koiwi. Appropriate Accidental Discovery protocols will need to be developed together with Ngāti Hauā Iwi Trust at the resource consent stage to ensure correct procedures are in place once the works commence.

A preliminary earthworks model, based on the concept plan layout, was developed by Tektus to assess the likely scale of future earthworks operations. The purpose of the model was to assess the feasibility of the land for industrial development and provide high-level supporting information for the PPC58 specialist reports. The final development layout and corresponding earthworks will be subject to future resource consent processes and detailed design.

All modelled access road grades were limited to a minimum of 0.4% and a maximum of 8%. Retaining walls were also included to represent the anticipated flat lot platforms. Retaining was limited to the sloping high-lying areas and is expected to be generally between 2-3m high, with a maximum height of 3.5m. The management of elevation differences created by flat platforms could also be addressed using landscaping batters.

The preliminary model has shown that most of the low-lying areas will likely be subject to fill operations. The cut operations will be generally limited to the high-lying areas and the stormwater management reserve. Cut and fill depths are estimated to range up to 3m. The conceptual earthworks (cut to fill) volumes are estimated at approximately 40,000m^3.

A preliminary geotechnical assessment was carried out by HDGEO and has identified that the high-lying areas are subject to low liquefaction and settlement risk, whereas the low-lying areas are subject to an elevated liquefaction and settlement risk. Overall, the report found the land suitable for industrial development subject to further geotechnical investigation, assessment, and design. This will be carried out in conjunction with the detailed earthwork designs at the resource consent stage.

The preliminary earthworks assessment has demonstrated that the proposed site is suitable for industrial development.

3 Erosion and Sediment Control

The erosion and sediment controls (ESCs) supporting the earthworks operations are expected to be in accordance with the Waikato Regional Council Erosion and Sediment Control Guidelines for Soil Disturbing Activities TR2009/02 (2014 Update) or any subsequent updates to these documents. Due to the size and topography of the proposed site, a combination of devices including sediment retention ponds, decanting earth bunds and silt fences will likely be required. The final ESCs will be subject to future resource consent processes and detailed design.

We consider that that the ESCs, that will enable future earthworks can be appropriately and effectively managed through a resource consent process and by implementing best practice industry standards, while not posing significant risks to downstream receiving environments.

4 Stormwater

PPC58 including all upstream catchments, are located completely within the Morrinsville Stream catchment and will be subject to the Morrinsville Stream Catchment Management Plan (CMP) dated October 2020. The majority of the site currently drains to the south-east via a network of farm drains. As part of the Avenue Business Park development, a swale was upgraded in the southern position of the development that improved the conveyance of stormwater runoff to the existing culverts under Avenue Road North. The swale was designed to convey the 100-year ARI peak flows (including the effects of climate change) from the upstream catchments under a rural zoning scenario. The existing culverts under Avenue Road North are recognised to have conveyance capacity constraints. There is a relatively small portion of the site (estimated at approximately 1 hectare) that drains north-east to an existing farm drain that runs along the northern boundary of the Bowers Concrete land.

The proposed development will increase the overall imperviousness and change the type and delivery of freshwater contaminants. The total imperviousness is expected to be up to 90% and the contaminants of concern will reflect

industrial land use that is generally high in total suspended solids (TSS), heavy metals, hydrocarbons, temperature, and gross pollutants.

The stormwater management objectives and design criteria proposed for PPC58 have been developed in accordance with the Morrinsville Stream CMP, Waikato Stormwater Management Guideline (WRC TR2020/07), the Waikato Regional Infrastructure Technical Specifications (RITS) and the recommendations of the Ngāti Hauā Iwi Trust CVA. The proposed stormwater management also considers the nature of industrial land use and the conveyance capacity limitations of the existing stormwater system.

The development within PPC58 is expected to achieve the following objectives and design criteria:

- Water quality treatment
    - Two stage treatment train approach:
        - Primary treatment providing at-source gross pollutant removal and sediment load reduction
        - Secondary treatment providing water quality volume equal to 1/3 of the 2-year ARI rainfall event runoff (including the effects of climate change) or water quality flow equal to 10mm/hr from the contributing catchment
- Stream erosion protection
    - Retention equal to the difference between the pre-development and post-development runoff volume for the 2-year ARI rainfall event runoff (including the effects of climate change) or retention equal to the difference between the pre-development and post development initial abstraction runoff volume where there are geotechnical, geological and groundwater limitations.
    - Detention volume equal to 1.2 times the water quality volume, minus the retention volume achieved, and slow release over 24 hours
- Attenuation of the 2-year, 10-year and 100-year ARI rainfall events (including the effects of climate change) to pre-development peak flows
- Design of primary stormwater systems to convey 10-year ARI rainfall (including the effects of climate change) event peak flows
- Design of secondary stormwater systems to convey 100-year ARI (including the effects of climate change) peak flows
- Discharge of stormwater to the Avenue Business Park development conveyance swale

A concept stormwater management solution was developed to demonstrate the feasibility of the proposed development. The geotechnical assessment carried out by HDGEO has identified groundwater levels between 0.0 and 1.4m below ground within the low-lying areas of the site and 3.9m below ground levels within the high-lying areas. The investigation was carried out in August and is likely reflecting the upper (winter) water table levels. As a result soakage disposal is not expected to be suitable on this site.

Due to the nature of industrial development, it is expected that the access roads will be relatively wide (minimum 20m) and the future private lots relatively large (minimum 1,000m^2). This indicates that at-source gross pollutant, sediment load management and retention can be readily implemented given the spatial flexibility. The selection of at-source stormwater management devices is expected to follow a Water Sensitive Design (WSD) criteria. The implementation of private lot retention via rainwater harvesting tanks is further discussed in Section 6.

A single communal stormwater management area (SMA) located at the inlet to the existing swale draining the site can deliver secondary water quality treatment, detention, and attenuation of rainfall events up to and including the 100-year ARI. Due to the relatively large size of the total site catchment, the device was assumed to be a wetland.

The water quality footprint of the wetland was estimated to 4% of total catchment area, based on TR2020/07. A preliminary HEC-HMS model was developed to estimate the total footprint of the wetland (8% of the catchment area) that included the storage volumes to deliver detention and attenuation requirements. To minimise likely effects of post-development discharges to existing farm drains beyond the property boundary, it was assumed that the wetland would service the entire site, which includes the relatively small portion of the site currently draining to the north-east. The HEC-HMS model was based on the Waikato Stormwater Runoff Modelling Guideline (WRC TR2020/06) and included the effects of climate change using RCP6.0 Scenario from NIWA HIRDS V4 2081-2100. The HIRDS v4 rainfall table outputs

are included in Attachment B. The total footprint of the wetland and the SMA was estimated at approximately 1 hectare and is reflected on the concept plan prepared by Tektus.

The internal stormwater network is envisaged to comprise a piped reticulation and at-surface conveyance swales. The swales can also accommodate retention requirements and achieve water quality improvements for the contributing catchments (e.g. access roads) subject to detailed investigation. The implementation of retention via infiltration to ground will likely be limited within PPC58 due to the presence of high ground water table within the low lying-areas and slope stability limitations within the high-lying areas. This will be subject to detailed design, and it is likely that the provision of retention will be achieved via rainwater harvesting tanks and evapotranspiration practices (landscaping and tree pits).

There is an external catchment that currently drains through the site via farm drains originating from the property to the west. These flows can be accommodated via a network of conveyance swales that can be integrated within the proposed perimeter landscaping buffer. Preliminary sizing has been carried out to demonstrate the feasibility of these swales.

A site-specific Stormwater Management Plan is expected to be provided to support the future resource consent processes and detailed design. The SMP will detail the stormwater management approach and devices that demonstrate compliance with the relevant standards including the Morrinsville Stream CMP.

The preliminary stormwater assessment has demonstrated that stormwater runoff from the proposed site can be managed under industrial land use to achieve the outcomes of the Morrinsville Stream CMP, in accordance with the relevant standards.

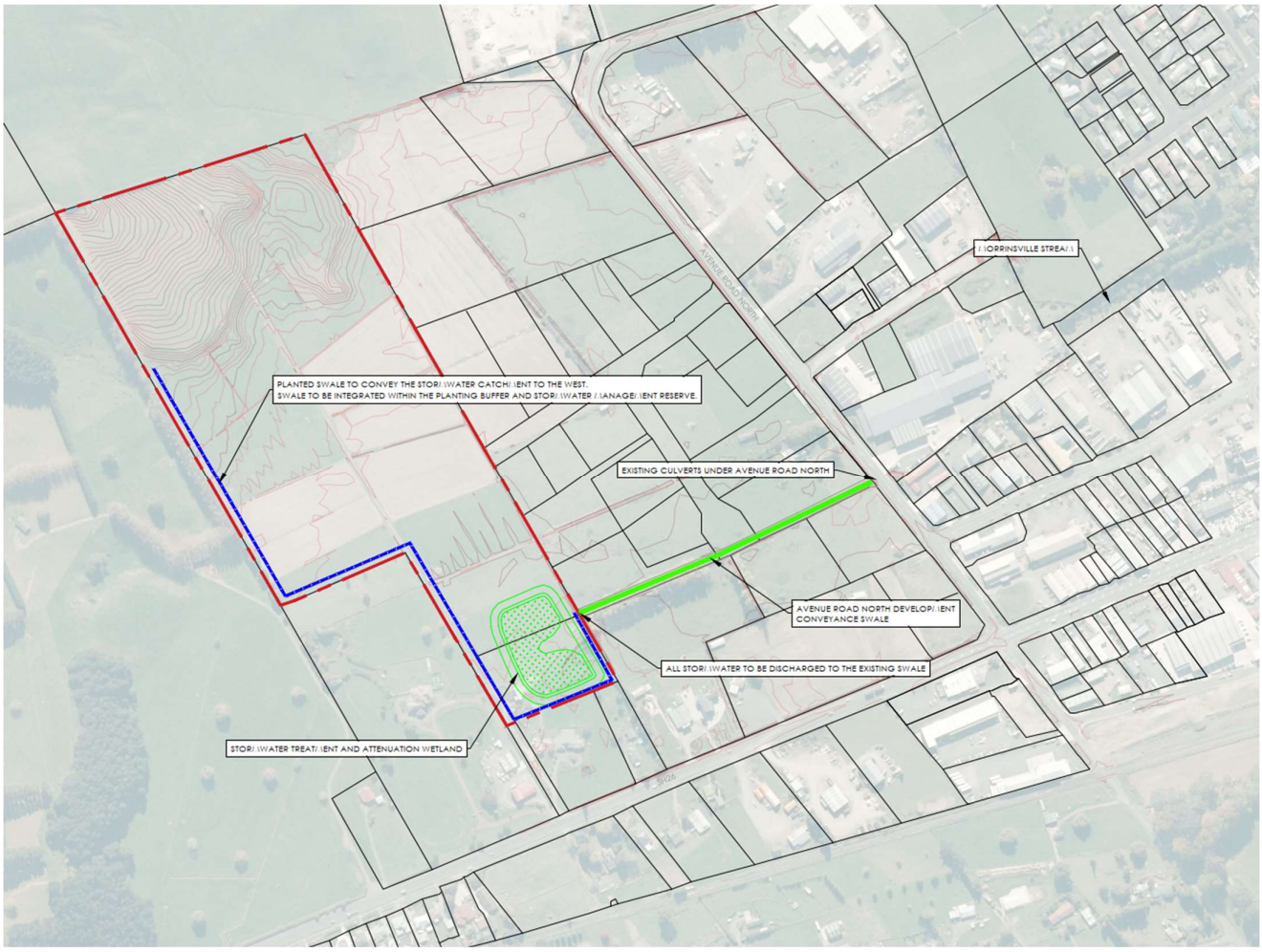

Figure 3 – Concept stormwater management layout

5 Wastewater

There is currently no existing public wastewater network located within the site, or in its immediate vicinity. The nearest existing public wastewater network is located on Avenue Road North. This network ultimately discharges to a transmission wastewater pump station on Allen Street, from where the wastewater is pumped across the Piako River to the Morrinsville Wastewater Treatment Plant (WWTP).

As part of the pre-lodgement engagement which has occurred, MPDC staff advised that a study was carried out by PDP on the existing wastewater network in March 2022 that delivered recommendations on the necessary upgrades to the network to support the future projected growth within the Morrinsville township.

The WWTP does not have the capacity for future growth at present and its consent is due for renewal in 2024. MPDC has advised that there are upgrade works planned on the WWTP for 2025/2026 and 2026/2027 and that the increased capacity will likely be sufficient to accommodate PPC58 subject to the quality of wastewater effluent and the detailed assessment and design of the upgrade works. MPDC has also advised that upgrades are being progressed for the Allen Street wastewater pump station to accommodate future projected growth and minimise the frequency of overflows. These upgrades will also provide additional capacity in the pipe network.

A preliminary capacity assessment of the existing downstream network from the likely connection point on Avenue Road North to the transmission 300mm wastewater main on Marshall Street was carried out. The assessment was based on MPDC GIS data and pipe full flow capacity calculations, which show that the existing network may already be under capacity. MPDC has advised that there are overflow issues reported during high rainfall events due to water infiltration and inflow (I&I) into the piped system and that an I&I management strategy has been prepared to alleviate these effects. MPDC has also advised that wastewater master planning, including existing network hydraulic modelling, is underway and is expected to be completed in second half of 2023. The outcome of this assessment is expected to highlight any required upgrades to the existing network to support PPC58.

It is expected that the proposed development area would be included in the future MPDC development contribution policy to support any required wastewater infrastructure upgrades.

The wastewater flows for PPC58 were estimated in accordance with Waikato Local Authority Regional Infrastructure Technical Specifications May 2018 (RITS) and are shown in Table 1 below.

Table 1 – Estimated wastewater flows for the proposed plan change.

WASTEWATER FLOWS	COMMENTS
Average Daily Flow (ADF) = 137.3m³/day	ADF = (infiltration allowance x catchment area) + (water consumption x population equivalent) = (2,250 l/ha/day x 11.6 ha) + (200 l/person/day x 45 people/ha x 12.2 ha)
Peak Daily Flow (PDF) = 3.9 l/s	PDF = (infiltration allowance x catchment area) + (peaking factor × water consumption × population equivalent) = (2,250 l/ha/day x 11.6 ha) + (2.8 x 200 l/person/day x 45 people/ha x 12.2 ha)
Peak Wet Weather Flow (PWWF) = 6.2 l/s	PWWF = catchment area x (surface water ingress + infiltration allowance) + (peaking factor × water consumption × population equivalent) = 11.6 ha x (16,500 l/ha/day + 2,250 l/ha/day) + (2.8 x 200 l/person/day x 45 people/ha x 12.2 ha)

Based on the available GIS and design information, two possible connection routes have been considered as follows:

1. Connection into the 150mm diameter gravity wastewater network proposed to be constructed as part of the Avenue Business Park development. This network discharges into the wastewater pump station located at the intersection of Avenue Road North and Keith Camp Place. The connection point is expected to be located at approximately IL27.35m.
2. Connection into the 200mm diameter gravity wastewater main located at the intersection of Avenue Road North and Thames Street (SH 26). Based on the available MPDC GIS data, the connection point is located at approximately IL26.14m.

The connection to the future Avenue Business Park development 150mm diameter gravity pipe is constrained by the flat topography of the low-lying area. To connect to this reticulation via a gravity system, and maintain adequate pipe grade and cover, the low-lying area will either require a relatively large depth of fill to be placed or a new pump station to be constructed. The connection to this part of the network is also likely to be constrained by the capacity restrictions of the existing pump station at the intersection of Avenue Road North and Keith Camp Place.

The connection to the existing 200mm diameter gravity pipe is also constrained by the flat topography of the land and will require a new pump station with a rising main along SH26. New Zealand Transport Agency (NZTA) would need to be consulted in the process as the new rising main would be located within state highway land. The connection to this part of the network will bypass the existing pump station.

A concept solution to manage wastewater flows from PPC58 can include a new gravity wastewater network and a pump station that can be designed to manage the effects on the potential downstream network capacity issues. This can be achieved with a storage and off-peak pumping approach and can be supported by the required upgrades to the existing downstream wastewater network that will be based on the wastewater master planning outcomes. A utility reserve that can accommodate the pump station has been included in the concept plan prepared by Tektus. All wastewater network within PPC58 will be designed in accordance with RITS.

It is anticipated that the future land use within PPC58 will be limited to “dry” industry with estimated effluent disposal to the municipal wastewater network limited to 10,000 litres/day. Any potential heavy water use (“wet”) industry will be subject to a resource consent process and will be expected to demonstrate water recycling practices that will meet the maximum daily municipal effluent disposal requirements.

The preliminary wastewater assessment has demonstrated that there are engineering solutions to managing wastewater flows from the proposed site under the proposed industrial land use.

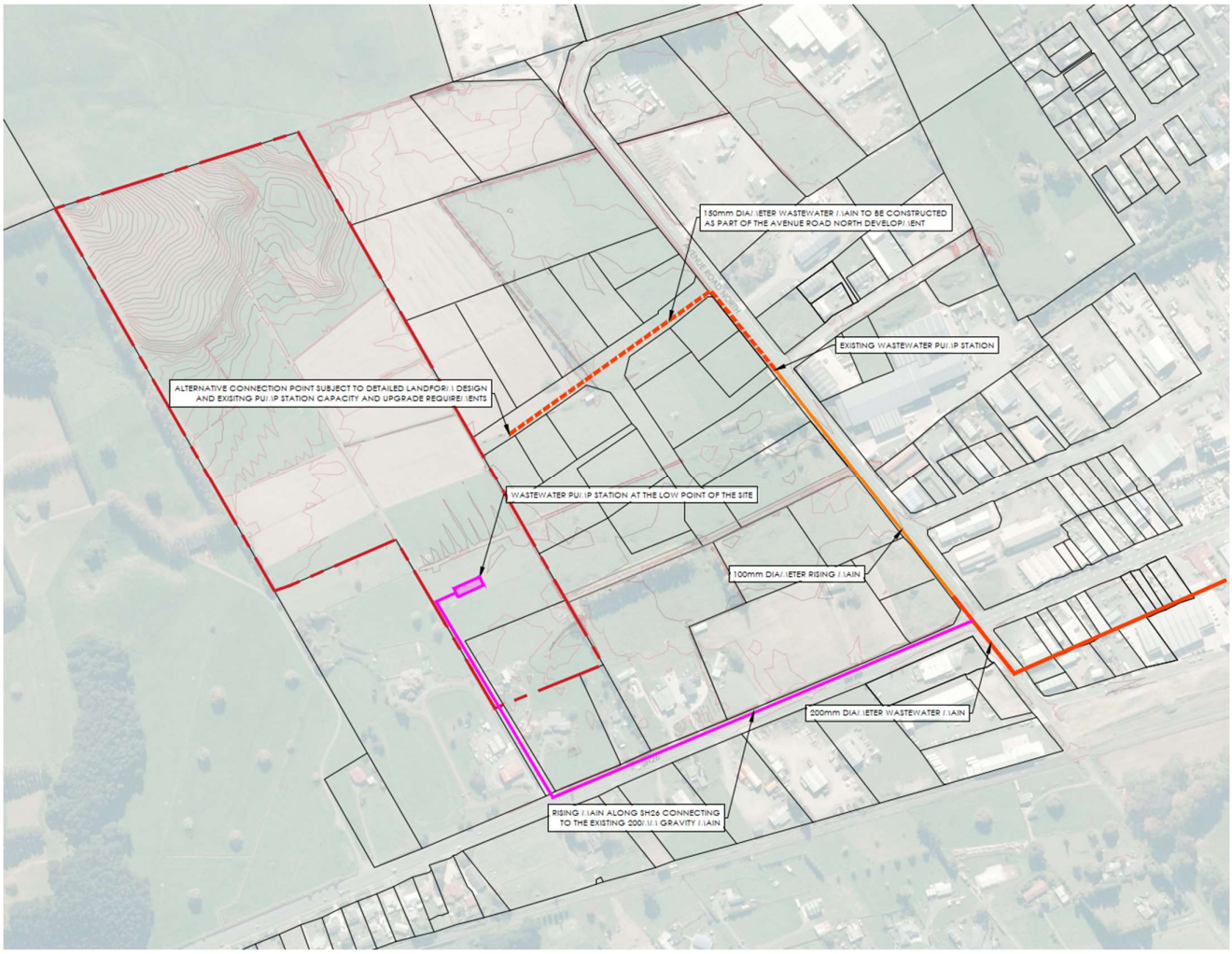

Figure 4 – Concept wastewater management layout.

6 Water Supply

The existing public water supply reticulation is located on Avenue Road North and SH26. At the pre-application meetings, MPDC has advised that a new bore and Water Treatment Plant (WTP) are planned within the Lockerbie development with the construction and connection to the municipal mains due to be completed in the second half of 2023. The new bore and WTP will increase the potential water intake for the Morrinsville township to support projected future growth by 2055. The increased uptake will likely be able to support PPC58. A potable water masterplan is also being developed by MPDC with aimed delivery in 2023.

It is expected that the proposed development area would be included in the future MPDC development contribution policy to support any required water supply infrastructure upgrades.

The water demand for PPC58 was estimated in accordance with RITS and is shown in Table 2 below.

Table 2 – Estimated water supply demands for the proposed plan change.

POTABLE WATER DEMAND	COMMENTS
Average Daily Demand (ADD) = 1.65 l/s	ADD = (water consumption x population equivalent) = (260 l/person/day x 45 people/ha x 12.2 ha)
Peak Daily Demand (PDD) = 8.26 l/s	PDD = (peaking factor x water consumption x population equivalent) = (5 x 260 l/person/day x 45 people/ha x 12.2 ha)

Based on the available GIS information, two potential connection points have been Identified as follows:

1. Connection to the 150mm diameter watermain on Avenue Road North. This would be completed via the proposed potable water supply network extension through the Avenue Business Park development.
2. Connection to the 150mm diameter watermain on SH26.

A concept solution for water supply reticulation can include the extension of the 150mm diameter network (each side of the road) from the Avenue Business Park development with a metered connection for each lot. An additional connection can be made to the SH26 existing 150mm diameter main to improve connectivity and resilience. All water supply network within PPC58 will be designed in accordance with RITS. The RITS firefighting level of service requirement for industrial areas is FW3. The FW3 specific requirements are documented in the SNZ PAS 4509:2008 New Zealand Fire Service firefighting water supplies code of practice.

A preliminary hydraulic model was developed using EPANET to assess whether the water supply pressure within the existing reticulation is adequate to service PPC58. The network was assessed under static and residual (firefighting) scenarios. The model incorporated a single end supply from Avenue Road North and a 150mm diameter network (each side of the road) extending through Avenue Business Park and the proposed site. The peak potable water demands, based on the design criteria as per Table 2, were added to the network for both Avenue Business Park and PPC58. A static pressure of approximately 555 kPa and residual (firefighting) pressure of 460 kPa under FW2 (25l/s hydrant flow) conditions were provided by MPDC as per the Hydrant Flow Analysis Report included in Attachment C. The model has shown that the minimum pressure within PPC58 under a static scenario is approximately 370 kPa and that the minimum residual pressure under FW2 was 185 kPa.

Based on the preliminary EPANET hydraulic model FW3 level of service is unlikely to be achieved for the high-lying areas with the existing available pressure within the Avenue Road water supply network. To achieve FW3, the pressure within the existing system will need to be increased or locally boosted for the high-lying areas via a water supply pump. Alternatively, the high-lying areas could remain at FW2 (RITS dispensation) with site specific fire safety designs for future developments that will comply with SNZ PAS 4509:2008 requirements (sprinklers, fire cell limits, etc.). This can be addressed at resource consent process and detailed design.

The preliminary hydraulic assessment has shown that the minimum water supply pressures can be achieved within PPC58 to service the proposed industrial land use.

The water supply within Morrinsville township is drought prone and subject to water use restrictions throughout the year. Rainwater harvesting is proposed for PPC58 to reduce the stress on the public water supply network. This includes a requirement for each lot to install a rainwater tank that will capture roof water and provide for landscaping and non-potable water use. The minimum tank size will need to comply with the stormwater retention requirements discussed in Section 4 or 10,000 litres, whichever one is greater.

It is anticipated that the future land use within PPC58 will be limited to “dry” industry with estimated demand from the municipal supply limited to 10,000 litres/day. Any potential heavy water use (“wet”) industry will be subject to a resource consent process and will be expected to demonstrate water conservation practices that will meet the maximum daily municipal demand requirements.

The preliminary water supply assessment has demonstrated that there are engineering solutions to managing the projected water supply demands from the proposed site under the proposed industrial land use.

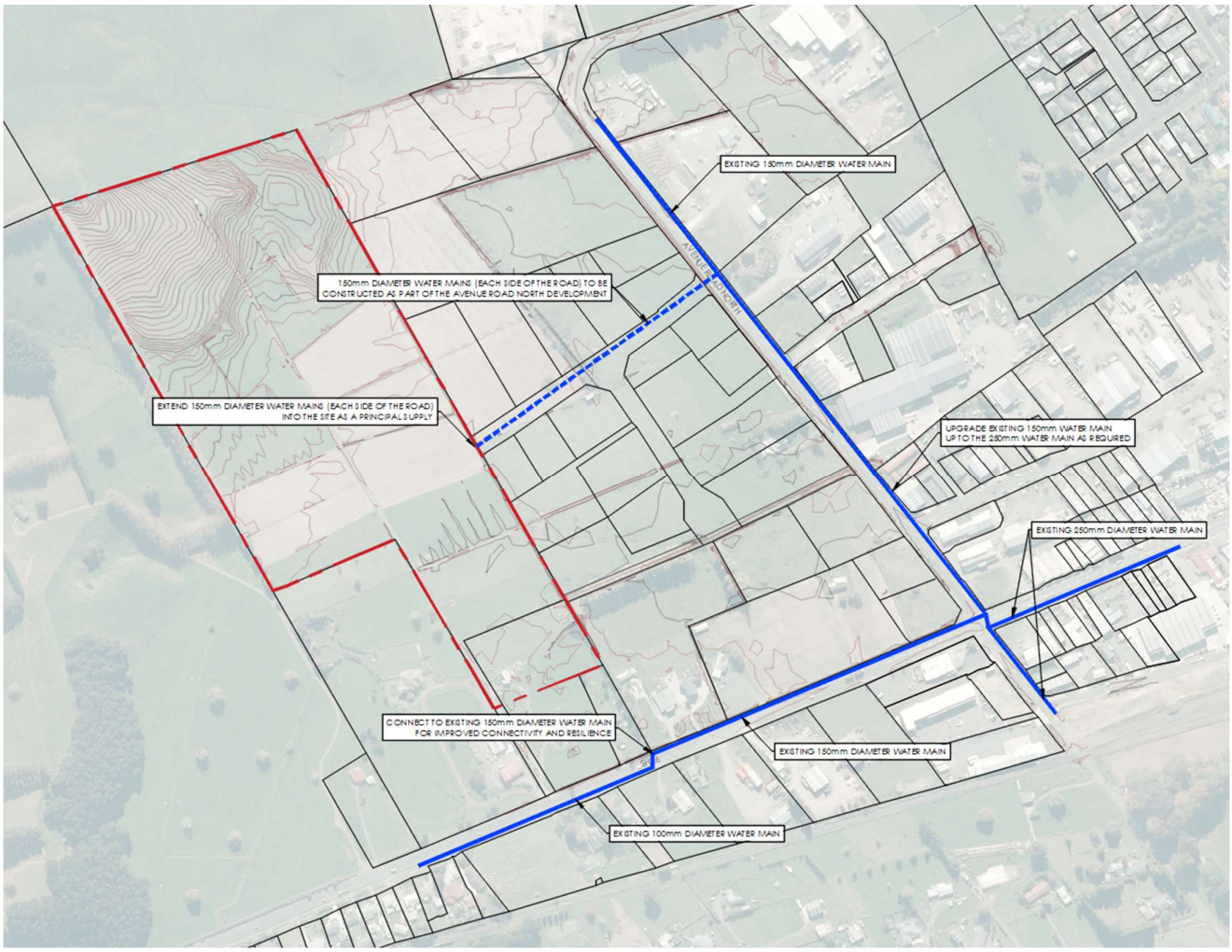

Figure 5 – Concept water supply management layout

7 Conclusion

This infrastructure report has been prepared in support of PPC58 in the context of future anticipated earthworks and three waters (stormwater, wastewater, potable water) serviceability. The assessments carried out have demonstrated that the proposed site is suitable for industrial development and that there are feasible engineering solutions to delivering three waters infrastructure.

ATTACHMENT A

Engineering Plans

#	REFERENCE	REVISION
100	Concept Layout Plan	E
200	Existing Contours Plan	B
250	Existing Slope Analysis Plan	B
300	Existing Features and Infrastructure Plan	B
400	Stormwater Management Concept Plan	C
450	Stormwater Catchment Plan	C
500	Wastewater Network Concept Plan	C
600	Water Supply Network Concept Plan	B

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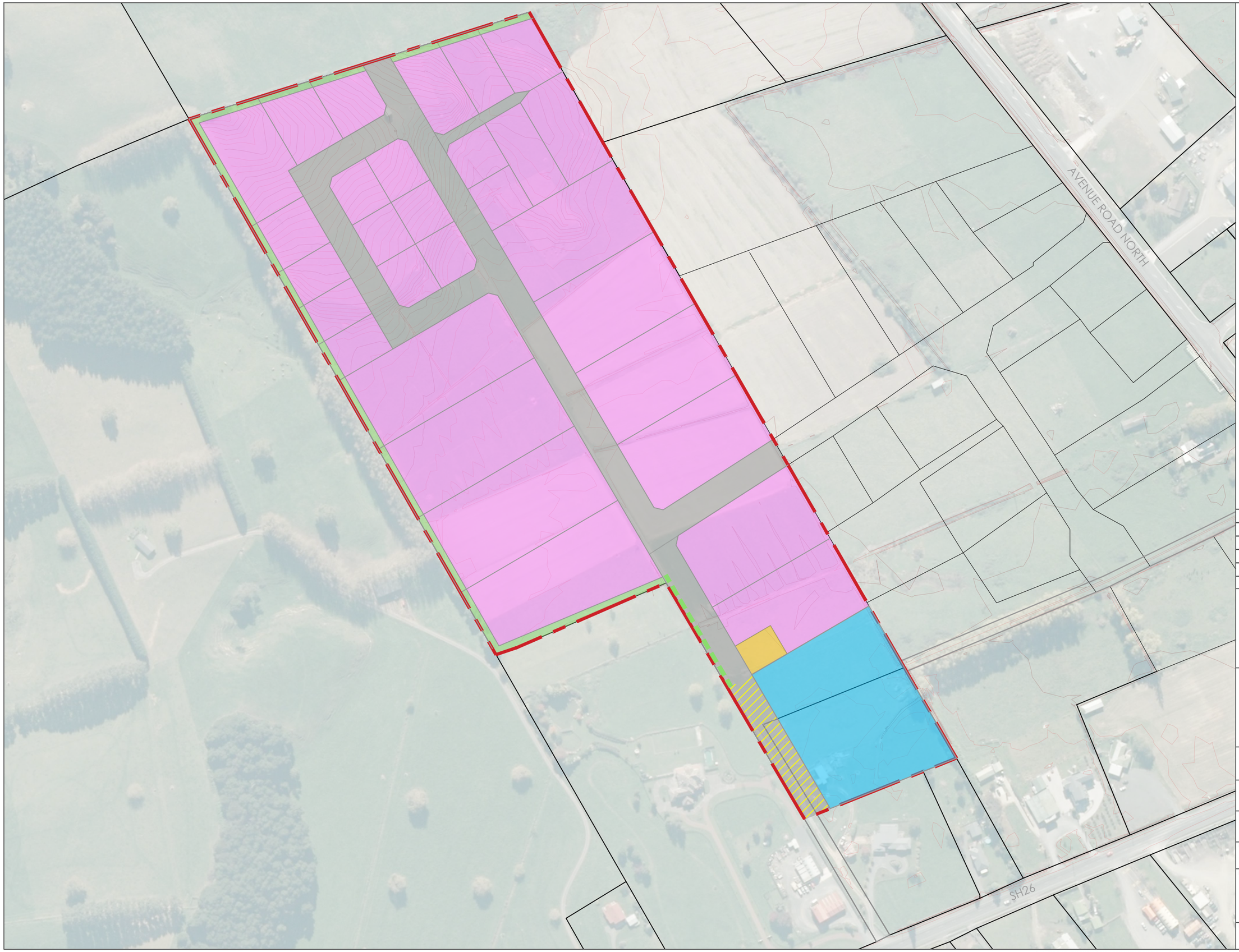

NOTES:

LEGEND

- EXISTING PROPERTY BOUNDARY
- PROPOSED INDUSTRIAL ZONE
- EXISTING MAJOR CONTOUR (2m)
- EXISTING MINOR CONTOUR (0.5m)
- PROPOSED INDUSTRIAL AREA
- ROAD/ACCESS RESERVE
- STORMWATER MANAGEMENT RESERVE
- LANDSCAPE BUFFER (5m)
- LANDSCAPE BUFFER - ROAD BERM (5m)
- UTILITY RESERVE
- ACCESS TO STORMWATER MANAGEMENT RESERVE AND POTENTIAL FUTURE ROAD

E	FOR APPROVAL	DS	22.12.2022
D	FOR APPROVAL	DS	12.10.2022
C	DRAFT	DS	20.09.2022
B	FOR DISCUSSION	DS	31.08.2022
A	FOR DISCUSSION	DS	25.07.2022
REVISION DETAILS:		BY:	DATE:

TEKTUS CONSULTANTS

CLIENT:

WARWICK AND MARION STEFFERT

SITE: AVENUE ROAD PLAN CHANGE

TITLE: CONCEPT LAYOUT PLAN

SUBTITLE:

DRAWN:	REVIEWED:	APPROVED:
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PROJECT NO: T21098	DRAWING NO: 100	REVISION: E

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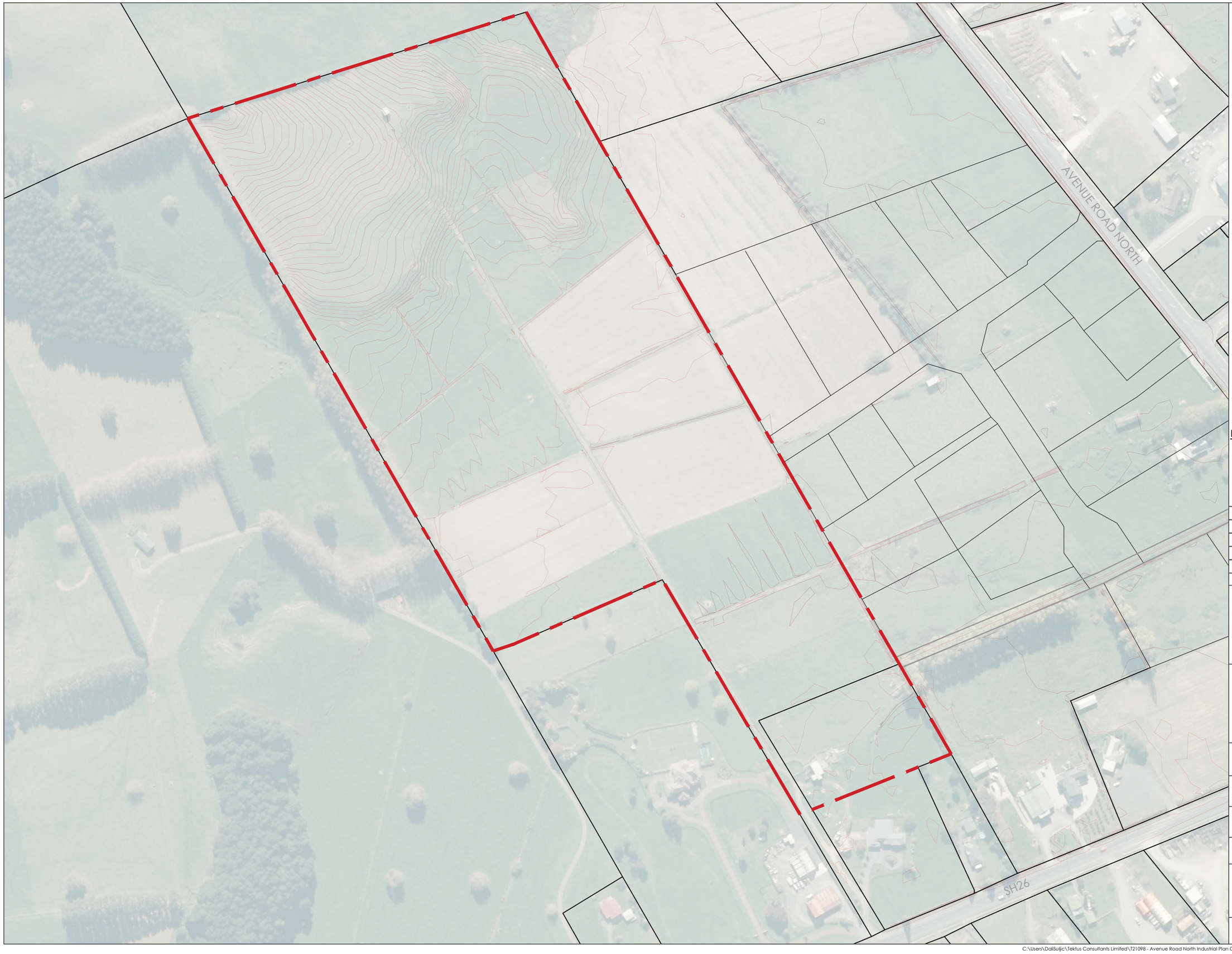

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A	FOR DISCUSSION	DS	25.07.2022
REVISION DETAILS:		BY:	DATE:

TEKTUS CONSULTANTS

CLIENT:

WARWICK AND MARION STEFFERT

SITE: AVENUE ROAD PLAN CHANGE

TITLE: EXISTING CONTOURS PLAN

SUBTITLE:

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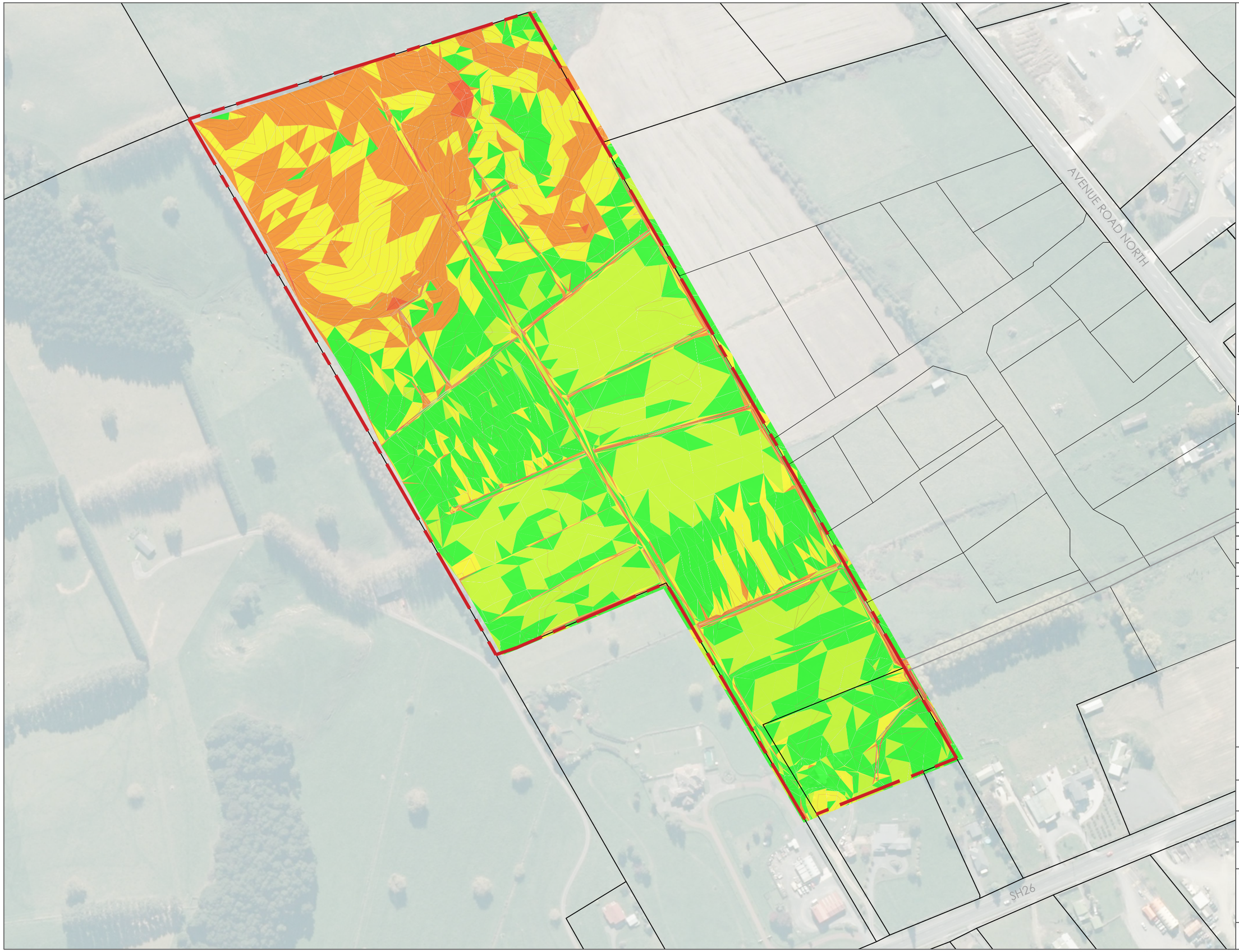

NOTES:

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- EXISTING PROPERTY BOUNDARY
- PROPOSED INDUSTRIAL ZONE
- < 1% SLOPE
- 1% - 5% SLOPE
- 5% - 10% SLOPE
- 10% - 30% SLOPE
- > 30% SLOPE

B	FOR APPROVAL	DS	12.10.2022
A	FOR DISCUSSION	DS	25.07.2022
REVISION DETAILS:		BY:	DATE:

TEKTUS CONSULTANTS

CLIENT:

WARWICK AND MARION STEFFERT

SITE: AVENUE ROAD PLAN CHANGE

TITLE: EXISTING SLOPE ANALYSIS PLAN

SUBTITLE:

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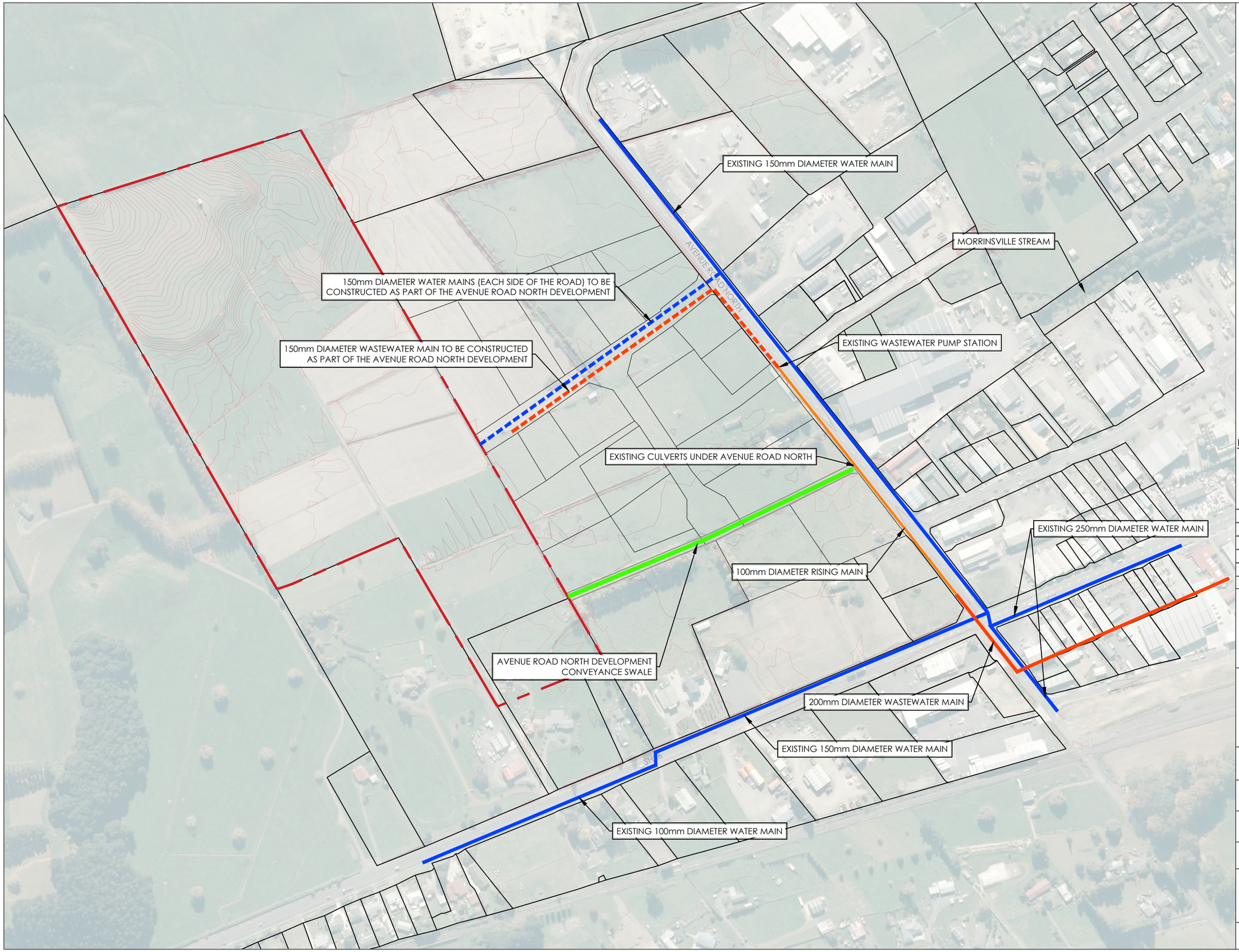

NOTES:

LEGEND

- EXISTING PROPERTY BOUNDARY
- PROPOSED INDUSTRIAL ZONE
- EXISTING MAJOR CONTOUR (2m)
- EXISTING MINOR CONTOUR (0.5m)

B	FOR APPROVAL	DS	12.10.2022
A	FOR DISCUSSION	DS	25.07.2022
REVISION DETAILS:		BY:	DATE:

TEKTUS CONSULTANTS

CLIENT:
WARWICK AND MARION STEFFERT

SITE:
AVENUE ROAD PLAN CHANGE

TITLE:
EXISTING FEATURES AND INFRASTRUCTURE PLAN

SUBTITLE:

DRAWN:	REVIEWED:	APPROVED:
DS	JT	JT
NORTH:	SCALE AT A3: 1:4000	DATE: 12.10.2022
	STATUS: FOR APPROVAL	
PROJECT NO: T21098	DRAWING NO: 300	REVISION: B

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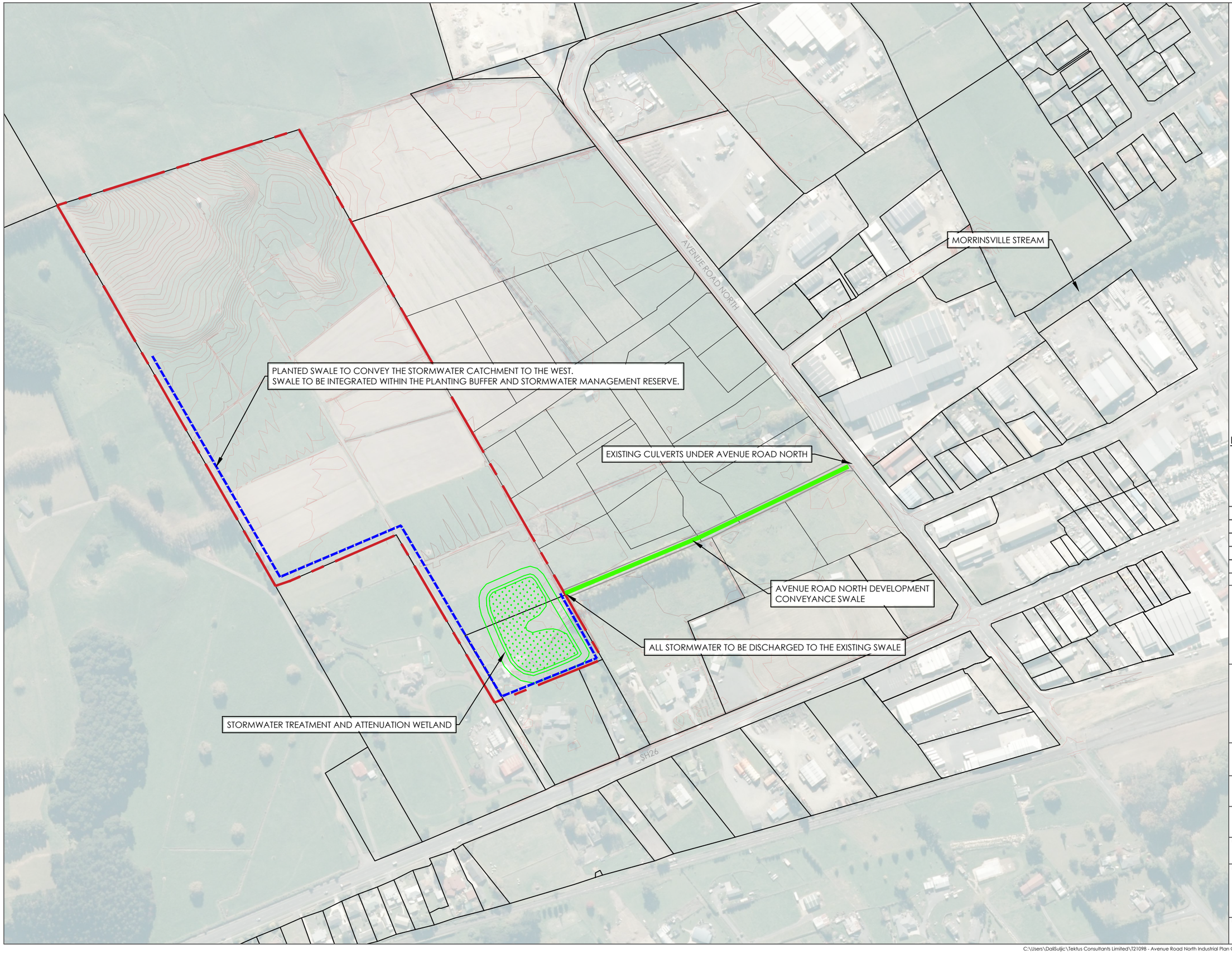


NOTES:

LEGEND

- EXISTING PROPERTY BOUNDARY
- PROPOSED INDUSTRIAL ZONE
- EXISTING MAJOR CONTOUR (2m)
- EXISTING MINOR CONTOUR (0.5m)

C	FOR APPROVAL	DS	22.12.2022
B	FOR APPROVAL	DS	12.10.2022
A	FOR DISCUSSION	DS	25.07.2022
REVISION DETAILS:		BY:	DATE:

TEKTUS CONSULTANTS

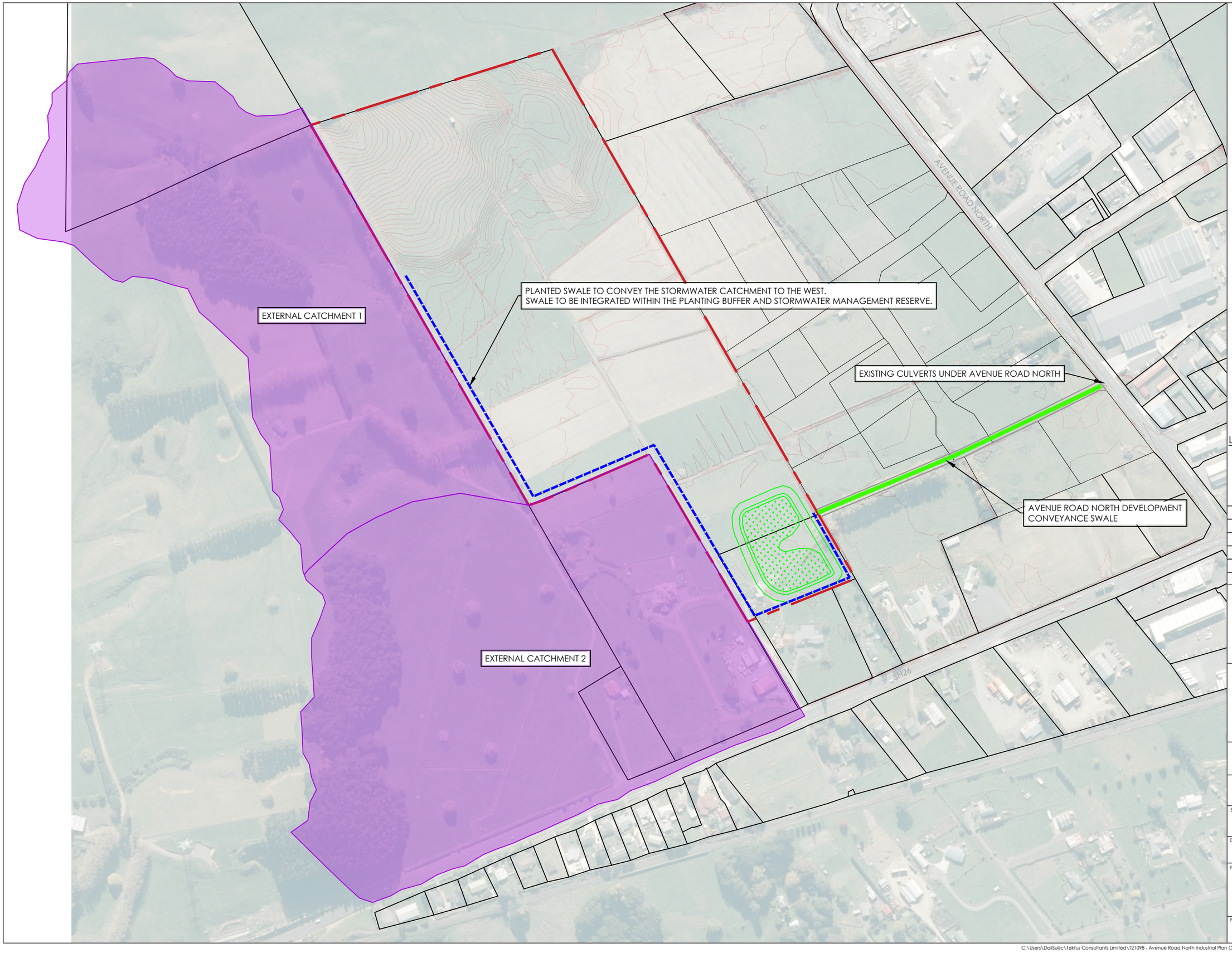
CLIENT:
WARWICK AND MARION STEFFERT

SITE:
AVENUE ROAD PLAN CHANGE

TITLE:
STORMWATER MANAGEMENT CONCEPT PLAN

SUBTITLE:

DRAWN:	REVIEWED:	APPROVED:
DS	JT	JT
NORTH:	SCALE AT A3: 1:4000	DATE: 22.12.2022
	STATUS: FOR APPROVAL	
PROJECT NO: T21098	DRAWING NO: 400	REVISION: C



NOTES:

LEGEND

- EXISTING PROPERTY BOUNDARY
- PROPOSED INDUSTRIAL ZONE
- EXISTING MAJOR CONTOUR (2m)
- EXISTING MINOR CONTOUR (0.5m)

C	FOR APPROVAL	DS	22.12.2022
B	FOR APPROVAL	DS	12.10.2022
A	FOR DISCUSSION	DS	25.07.2022
REVISION DETAILS:		BY:	DATE:

TEKTUS CONSULTANTS

CLIENT:
WARWICK AND MARION STEFFERT

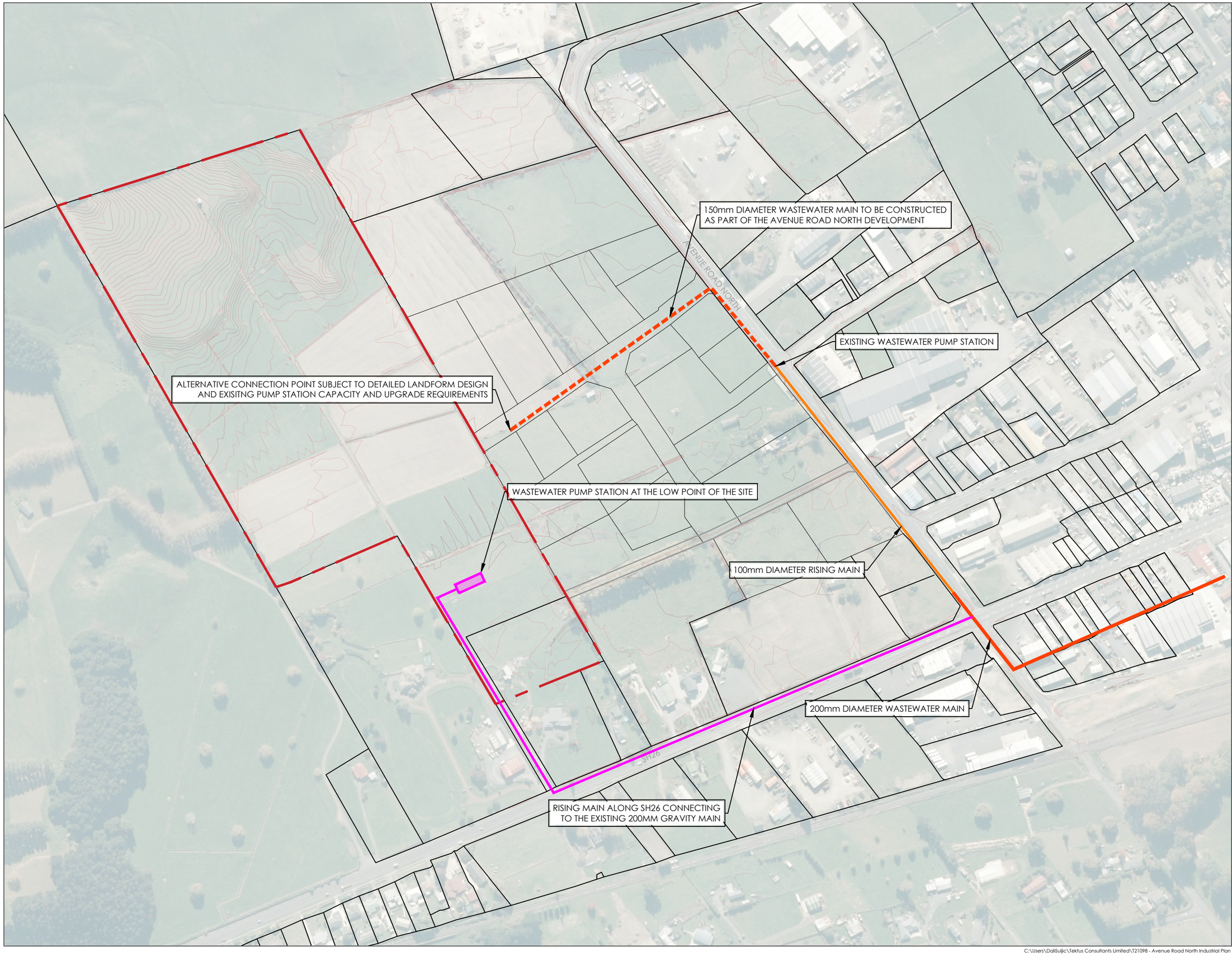
SITE:
AVENUE ROAD PLAN CHANGE

TITLE:
STORMWATER CATCHMENT PLAN

SUBTITLE:

DRAWN:	REVIEWED:	APPROVED:
DS	JT	JT
NORTH:	SCALE AT A3: 1:4000	DATE: 22.12.2022
	STATUS: FOR APPROVAL	
PROJECT NO: T21098	DRAWING NO: 450	REVISION: C

PLOTTED: 21/12/2022 9:00:17 am



NOTES:

LEGEND

- EXISTING PROPERTY BOUNDARY
- PROPOSED INDUSTRIAL ZONE
- EXISTING MAJOR CONTOUR (2m)
- EXISTING MINOR CONTOUR (0.5m)

C	FOR APPROVAL	DS	22.12.2022
B	FOR APPROVAL	DS	12.10.2022
A	FOR DISCUSSION	DS	25.07.2022
REVISION DETAILS:		BY:	DATE:

TEKTUS CONSULTANTS

CLIENT:

WARWICK AND MARION STEFFERT

SITE: AVENUE ROAD PLAN CHANGE

TITLE: WASTEWATER NETWORK CONCEPT PLAN

SUBTITLE:

DRAWN:	REVIEWED:	APPROVED:
DS	JT	JT
NORTH:	SCALE AT A3: 1:4000	DATE: 22.12.2022
	STATUS: FOR APPROVAL	
PROJECT NO: T21098	DRAWING NO: 500	REVISION: C

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PLOTTED: 11/10/2022 2:29:24 pm

EXISTING 150mm DIAMETER WATER MAIN

150mm DIAMETER WATER MAINS (EACH SIDE OF THE ROAD) TO BE CONSTRUCTED AS PART OF THE AVENUE ROAD NORTH DEVELOPMENT

AVENUE ROAD NORTH

EXTEND 150mm DIAMETER WATER MAINS (EACH SIDE OF THE ROAD) INTO THE SITE AS A PRINCIPAL SUPPLY

UPGRADE EXISTING 150mm WATER MAIN UP TO THE 250mm WATER MAIN AS REQUIRED

EXISTING 250mm DIAMETER WATER MAIN

CONNECT TO EXISTING 150mm DIAMETER WATER MAIN FOR IMPROVED CONNECTIVITY AND RESILIENCE

EXISTING 150mm DIAMETER WATER MAIN

EXISTING 100mm DIAMETER WATER MAIN

NOTES:

LEGEND

- EXISTING PROPERTY BOUNDARY
- PROPOSED INDUSTRIAL ZONE
- EXISTING MAJOR CONTOUR (2m)
- EXISTING MINOR CONTOUR (0.5m)

B	FOR APPROVAL	DS	12.10.2022
A	FOR DISCUSSION	DS	25.07.2022
REVISION DETAILS:		BY:	DATE:

TEKTUS CONSULTANTS

CLIENT:

WARWICK AND MARION STEFFERT

SITE: AVENUE ROAD PLAN CHANGE

TITLE: WATER SUPPLY NETWORK CONCEPT PLAN

SUBTITLE:

DRAWN:	REVIEWED:	APPROVED:
DS	JT	JT
NORTH:	SCALE AT A3: 1:4000	DATE: 12.10.2022
	STATUS: FOR APPROVAL	
PROJECT NO: T21098	DRAWING NO: 600	REVISION: B

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ATTACHMENT B

Engineering Calculations

TEKTUS CONSULTANTS LIMITED
A · 12 MADDEN STREET, AUCKLAND CENTRAL 1010
E · KIAORA@TEKTUS.NZ

Warwick & Marion Steffert

Private Plan Change 58
Morrinsville

Introduction

This package has been prepared to support a private plan change application to rezone approximately 13.4 hectares of land from Rural to Industrial, and specifically to assess the three waters (water supply, wastewater, and stormwater) serviceability.

The assessment is based on information made available to us for the area, and utilises current best practice methodologies including Waikato Regional Council RITS, TR2020/06 and TR2020/07.

Project	PPC58
Date	22-Dec-22
Status	FOR APPROVAL
By	DS

HIRDS V4 Depth-Duration-Frequency Results
Sitename: Private Plan Change 58
Coordinate system: WGS84
Longitude: 175.5105
Latitude: -37.6606

Rainfall depths (mm) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	8.36	11.9	14.5	19.8	26.5	39.7	49.6	60.4	71.8	78.4	83.1	86.6
2	0.5	9.24	13.2	16	21.9	29.2	43.7	54.6	66.4	78.8	86.1	91.2	95
5	0.2	12.4	17.6	21.4	29.1	38.7	57.8	72	87.4	103	113	119	124
10	0.1	14.8	21	25.5	34.7	46.1	68.6	85.3	103	122	133	141	146
20	0.05	17.5	24.7	29.9	40.7	53.9	80	99.3	120	142	154	163	170
30	0.033	19.1	27	32.7	44.4	58.8	87	108	130	154	167	177	184
40	0.025	20.3	28.7	34.7	47.1	62.3	92.2	114	138	162	177	186	194
50	0.02	21.2	30	36.3	49.2	65.1	96.2	119	144	169	184	194	202
60	0.017	22	31.1	37.6	51	67.4	99.6	123	149	175	190	201	209
80	0.013	23.3	32.9	39.7	53.9	71.2	105	130	157	184	200	211	219
100	0.01	24.3	34.3	41.4	56.1	74.1	109	135	163	191	208	219	228
250	0.004	28.7	40.3	48.7	65.8	86.7	127	157	189	222	241	253	263

Rainfall depths (mm) :: RCP6.0 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	9.98	14.2	17.3	23.7	31.3	45.8	56.1	67.3	78.6	85	89.5	93
2	0.5	11.1	15.8	19.2	26.2	34.7	50.7	62.1	74.2	86.7	93.8	98.7	102
5	0.2	15	21.3	25.8	35.2	46.5	67.7	82.8	98.5	115	124	130	135
10	0.1	18	25.5	30.9	42.1	55.6	80.7	98.5	117	136	147	154	160
20	0.05	21.2	30.1	36.4	49.5	65.2	94.5	115	136	158	171	179	186
30	0.033	23.2	32.9	39.8	54.1	71.1	103	125	148	172	185	195	201
40	0.025	24.7	34.9	42.2	57.3	75.4	109	133	157	182	196	206	213
50	0.02	25.9	36.6	44.3	60	78.9	114	138	164	190	205	215	222
60	0.017	26.9	37.9	45.9	62.2	81.7	118	143	169	196	212	222	229
80	0.013	28.5	40.2	48.5	65.8	86.3	125	151	178	207	223	233	241
100	0.01	29.7	41.9	50.6	68.6	89.9	130	157	186	215	231	243	251
250	0.004	35	49.3	59.5	80.4	105	151	183	216	249	268	280	289

Rainfall depths (mm) :: RCP8.5 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	10.9	15.6	18.9	25.9	34.1	49.3	59.8	71.3	82.5	88.8	93.2	96.7
2	0.5	12.2	17.3	21	28.8	38	54.8	66.5	78.8	91.2	98.3	103	107
5	0.2	16.5	23.4	28.4	38.8	51	73.4	89	105	121	131	137	142
10	0.1	19.8	28.1	34.1	46.5	61.1	87.7	106	125	144	155	162	168
20	0.05	23.4	33.2	40.2	54.6	71.7	103	124	146	168	181	189	195
30	0.033	25.7	36.3	44	59.7	78.3	112	135	158	183	196	205	212
40	0.025	27.3	38.6	46.7	63.3	83	119	143	168	193	208	217	224
50	0.02	28.6	40.4	48.9	66.3	86.9	124	150	175	202	216	226	233
60	0.017	29.7	41.9	50.7	68.7	90	129	155	181	208	224	234	241
80	0.013	31.5	44.4	53.7	72.8	95.2	136	163	191	220	236	246	254
100	0.01	32.8	46.3	56	75.8	99.2	142	170	199	228	245	256	264
250	0.004	38.7	54.5	65.7	88.9	116	165	198	231	265	283	296	305

HIRDS V4 Intensity-Duration-Frequency Results
Sitename: Private Plan Change 58
Coordinate system: WGS84
Longitude: 175.5105
Latitude: -37.6606

Rainfall intensities (mm/hr) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	50.2	35.7	29	19.8	13.2	6.62	4.13	2.52	1.5	1.09	0.866	0.722
2	0.5	55.5	39.5	32	21.9	14.6	7.28	4.55	2.77	1.64	1.2	0.95	0.792
5	0.2	74.3	52.8	42.7	29.1	19.4	9.63	6	3.64	2.15	1.57	1.24	1.04
10	0.1	89	63.1	51	34.7	23.1	11.4	7.11	4.31	2.54	1.85	1.46	1.22
20	0.05	105	74.1	59.9	40.7	27	13.3	8.28	5.01	2.95	2.14	1.7	1.41
30	0.033	114	81	65.3	44.4	29.4	14.5	8.99	5.44	3.2	2.32	1.84	1.53
40	0.025	122	86	69.3	47.1	31.1	15.4	9.52	5.75	3.38	2.45	1.94	1.62
50	0.02	127	90	72.5	49.2	32.5	16	9.93	6	3.53	2.56	2.02	1.68
60	0.017	132	93.3	75.2	51	33.7	16.6	10.3	6.2	3.65	2.64	2.09	1.74
80	0.013	140	98.6	79.5	53.9	35.6	17.5	10.8	6.53	3.84	2.78	2.2	1.83
100	0.01	146	103	82.9	56.1	37.1	18.2	11.3	6.79	3.99	2.89	2.28	1.9
250	0.004	172	121	97.3	65.8	43.3	21.2	13.1	7.88	4.62	3.34	2.64	2.19

Rainfall intensities (mm/hr) :: RCP6.0 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	59.9	42.7	34.6	23.7	15.7	7.63	4.67	2.81	1.64	1.18	0.932	0.775
2	0.5	66.5	47.3	38.4	26.2	17.4	8.45	5.18	3.09	1.81	1.3	1.03	0.854
5	0.2	89.8	63.8	51.6	35.2	23.3	11.3	6.9	4.1	2.39	1.72	1.36	1.13
10	0.1	108	76.6	61.9	42.1	27.8	13.4	8.21	4.87	2.83	2.04	1.61	1.33
20	0.05	127	90.2	72.8	49.5	32.6	15.7	9.58	5.68	3.3	2.37	1.87	1.55
30	0.033	139	98.6	79.6	54.1	35.6	17.2	10.4	6.17	3.58	2.58	2.03	1.68
40	0.025	148	105	84.5	57.3	37.7	18.2	11.1	6.53	3.79	2.73	2.14	1.77
50	0.02	155	110	88.5	60	39.4	19	11.5	6.82	3.95	2.84	2.24	1.85
60	0.017	161	114	91.7	62.2	40.8	19.7	12	7.06	4.09	2.94	2.31	1.91
80	0.013	171	120	97.1	65.8	43.2	20.8	12.6	7.43	4.31	3.09	2.43	2.01
100	0.01	178	126	101	68.6	45	21.6	13.1	7.74	4.48	3.21	2.53	2.09
250	0.004	210	148	119	80.4	52.6	25.2	15.3	8.98	5.18	3.72	2.92	2.41

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

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	65.6	46.7	37.9	25.9	17.1	8.22	4.99	2.97	1.72	1.23	0.97	0.806
2	0.5	72.9	51.9	42.1	28.8	19	9.13	5.54	3.28	1.9	1.37	1.07	0.89
5	0.2	98.9	70.2	56.8	38.8	25.5	12.2	7.42	4.37	2.53	1.82	1.43	1.18
10	0.1	119	84.4	68.2	46.5	30.5	14.6	8.85	5.21	3	2.16	1.69	1.4
20	0.05	141	99.6	80.4	54.6	35.9	17.2	10.3	6.07	3.5	2.51	1.97	1.62
30	0.033	154	109	87.9	59.7	39.2	18.7	11.3	6.6	3.81	2.72	2.14	1.76
40	0.025	164	116	93.3	63.3	41.5	19.8	11.9	6.99	4.02	2.88	2.26	1.87
50	0.02	172	121	97.8	66.3	43.5	20.7	12.5	7.29	4.2	3.01	2.36	1.94
60	0.017	178	126	101	68.7	45	21.5	12.9	7.56	4.34	3.11	2.44	2.01
80	0.013	189	133	107	72.8	47.6	22.7	13.6	7.96	4.58	3.27	2.56	2.12
100	0.01	197	139	112	75.8	49.6	23.6	14.2	8.29	4.76	3.4	2.67	2.2
250	0.004	232	163	131	88.9	58	27.5	16.5	9.63	5.51	3.94	3.08	2.54

PRE-DEVELOPMENT CATCHMENT

Summary of HEC-HMS inputs using TR2020/06 methodology.

Project	PPC58
Date	22-Dec-22
Status	FOR APPROVAL
By	DS

				m^2	*ha*
		Catchment	**Existing site**	*123970*	*12.40*
Soil group	Surface cover	CurveNumber(CN)	Area, ha (a)	CN * a	*Est. cover*
Group B	Pasture	49	12.40	607.45	*100%*
Group B	Impervious	98	0.00	0.00	*0%*
		Pervious totals	*12.40*	*607.45*	
		Impervious totals	*0.00*	*0.00*	
		Sum totals	*12.40*	*607.45*	
Total pervious area, km^2 (A_p)			*1ha = 0.01km2*	*0.12397*	
Total impervious area, km^2 (A_i)			*1ha = 0.01km3*	*0.00000*	
CN - pervious (CN_p)		*total pervious product / total pervious area*		*49*	
CN - impervious (CN_i)		*total impervious product / total impervious area*		*0*	
CN - weighted (CN_w)		*total product / total area*		*49*	
Initial abstraction - pervious, mm (Ia_p)		*((1000/CNp)-10)*25.4*.05*		*13.2*	
Initial abstraction - impervious, mm (Ia_i)		*((1000/CNi)-10)*25.4*.05*		*0.0*	
Initial abstraction - weighted, mm (Ia_w)		*((1000/CNw)-10)*25.4*.05*		*13.2*	
Storage - pervious (S_p)		*(1000/CN_p-10).25.4*		*264.37*	
Storage - impervious (S_i)		*(1000/CN_i-10).25.4*		*0.00*	
Storage - weighted (S_w)		*(1000/CN_w-10).25.4*		*264.37*	
Sheet and shallow concentrated flow					
Catchment length, m (L)		*GIS measure*		*575.0*	
Catchment slope (S) in %		*GIS measure*		*3.83*	
Mannings n		*Table 7-1*		*0.045*	
ToC, mins		*((100nL)^0.33)/S^0.2*		*28.01*	
Time of concentration, hrs (t_c)				*0.47*	
ARI storm (yr)				10	100
24 hour rainfall depth, mm (P24), NIWA HIRDS v4 RCP 6.0				117.0	186.0

POST-DEVELOPMENT CATCHMENT

Summary of HEC-HMS inputs using TR2020/06 methodology.

Project	PPC58
Date	12-Oct-22
Status	FOR APPROVAL
By	DS

			m^2	*ha*
		Catchment **Post development**	*133970*	*13.40*

Soil group	Surface cover	CurveNumber(CN)	Area, ha (a)	CN * a	*Est. cover*
Group B	Pasture	69	1.34	92.44	*10%*
Group B	Impervious	98	12.06	1,181.62	*90%*
		Pervious totals	*1.34*	*92.44*	
		Impervious totals	*12.06*	*1181.62*	
		Sum totals	*13.40*	*1274.05*	

Total pervious area, km^2 (A_p)	*1ha = 0.01km2*	*0.01340*
Total impervious area, km^2 (A_i)	*1ha = 0.01km3*	*0.12057*
CN - pervious (CN_p)	*total pervious product / total pervious area*	*69*
CN - impervious (CN_i)	*total impervious product / total impervious area*	*98*
CN - weighted (CN_w)	*total product / total area*	*95*
Initial abstraction - pervious, mm (Ia_p)	*((1000/CNp)-10)*25.4*.05*	*5.7*
Initial abstraction - impervious, mm (Ia_i)	*((1000/CNi)-10)*25.4*.05*	*0.3*
Initial abstraction - weighted, mm (Ia_w)	*((1000/CNw)-10)*25.4*.05*	*0.7*
Storage - pervious (S_p)	*(1000/CN_p-10).25.4*	*114.12*
Storage - impervious (S_i)	*(1000/CN_i-10).25.4*	*5.18*
Storage - weighted (S_w)	*(1000/CN_w-10).25.4*	*13.09*

Pipe network flow

Gradient	*Drop down*	*Flat Gradient*
Length	*GIS measure*	*575.00*
ToC, mins		*15.97*
Time of concentration, hrs (t_c)		*0.27*

ARI storm (yr)	10	100
24 hour rainfall depth, mm (P_{24}), NIWA HIRDS v4 RCP 6.0	117.0	186.0

EXTERNAL CATCHMENT 1

Summary of HEC-HMS inputs using TR2020/06 methodology.

Project	PPC58
Date	12-Oct-22
Status	FOR APPROVAL
By	DS

				m^2	*ha*
		Catchment	**Existing site**	*116746*	*11.67*

Soil group	Surface cover	CurveNumber(CN)	Area, ha (a)	CN * a	*Est. cover*
Group B	Pasture	49	11.67	572.06	*100%*
Group B	Impervious	98	0.00	0.00	*0%*
		Pervious totals	*11.67*	*572.06*	
		Impervious totals	*0.00*	*0.00*	
		Sum totals	*11.67*	*572.06*	

Total pervious area, km^2 (A_p)	*1ha = 0.01km2*	*0.11675*
Total impervious area, km^2 (A_i)	*1ha = 0.01km3*	*0.00000*
CN - pervious (CN_p)	*total pervious product / total pervious area*	*49*
CN - impervious (CN_i)	*total impervious product / total impervious area*	*0*
CN - weighted (CN_w)	*total product / total area*	*49*
Initial abstraction - pervious, mm (Ia_p)	*((1000/CNp)-10)*25.4*.05*	*13.2*
Initial abstraction - impervious, mm (Ia_i)	*((1000/CNi)-10)*25.4*.05*	*0.0*
Initial abstraction - weighted, mm (Ia_w)	*((1000/CNw)-10)*25.4*.05*	*13.2*
Storage - pervious (S_p)	*(1000/CN_p-10).25.4*	*264.37*
Storage - impervious (S_i)	*(1000/CN_i-10).25.4*	*0.00*
Storage - weighted (S_w)	*(1000/CN_w-10).25.4*	*264.37*
Sheet and shallow concentrated flow		
Catchment length, m (L)	*GIS measure*	*825.0*
Catchment slope (S) in %	*GIS measure*	*4.97*
Mannings n	*Table 7-1*	*0.045*
ToC, mins	*((100nL)^0.33)/S^0.2*	*29.95*
Time of concentration, hrs (t_c)		*0.50*

ARI storm (yr)	10	100
24 hour rainfall depth, mm (P24), NIWA HIRDS v4 RCP 6.0	117.0	186.0

EXTERNAL CATCHMENT 2

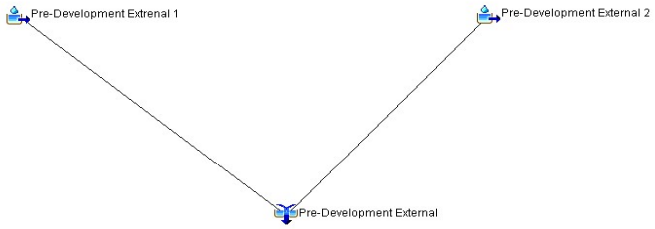
Summary of HEC-HMS inputs using TR2020/06 methodology.

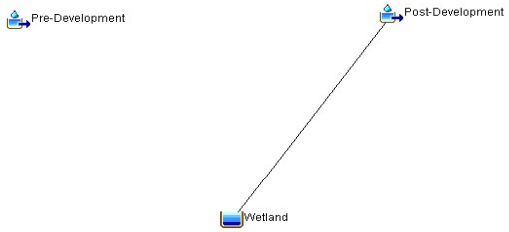
Project	PPC58
Date	12-Oct-22
Status	FOR APPROVAL
By	DS

				m^2	*ha*
		Catchment	**Existing site**	*150999*	*15.10*
Soil group	Surface cover	CurveNumber(CN)	Area, ha (a)	CN * a	*Est. cover*
Group B	Pasture	49	15.10	739.90	*100%*
Group B	Impervious	98	0.00	0.00	*0%*
		Pervious totals	*15.10*	*739.90*	
		Impervious totals	*0.00*	*0.00*	
		Sum totals	*15.10*	*739.90*	
Total pervious area, km^2 (A_p)			*1ha = 0.01km2*	*0.15100*	
Total impervious area, km^2 (A_i)			*1ha = 0.01km3*	*0.00000*	
CN - pervious (CN_p)		*total pervious product / total pervious area*		*49*	
CN - impervious (CN_i)		*total impervious product / total impervious area*		*0*	
CN - weighted (CN_w)		*total product / total area*		*49*	
Initial abstraction - pervious, mm (Ia_p)		*((1000/CNp)-10)*25.4*.05*		*13.2*	
Initial abstraction - impervious, mm (Ia_i)		*((1000/CNi)-10)*25.4*.05*		*0.0*	
Initial abstraction - weighted, mm (Ia_w)		*((1000/CNw)-10)*25.4*.05*		*13.2*	
Storage - pervious (S_p)		*(1000/CN_p-10).25.4*		*264.37*	
Storage - impervious (S_i)		*(1000/CN_i-10).25.4*		*0.00*	
Storage - weighted (S_w)		*(1000/CN_w-10).25.4*		*264.37*	
Sheet and shallow concentrated flow					
Catchment length, m (L)		*GIS measure*		*370.0*	
Catchment slope (S) in %		*GIS measure*		*0.27*	
Mannings n		*Table 7-1*		*0.045*	
ToC, mins		*((100nL)^0.33)/S^0.2*		*41.15*	
Time of concentration, hrs (t_c)				*0.69*	
ARI storm (yr)				10	100
24 hour rainfall depth, mm (P24), NIWA HIRDS v4 RCP 6.0				117.0	186.0

HEC-HMS MODEL LAYOUT

Project	PPC58
Date	12-Oct-22
Status	FOR APPROVAL
By	DS





Project: Avenue_Plan_Change
Simulation Run: 10yr
Simulation Start: 31 December 1999, 24:00
Simulation End: 1 January 2000, 24:00

HMS Version: 4.10
Executed: 20 December 2022, 20:05

Global Parameter Summary - Subbasin

Area (KM2)

Element Name	Area (KM2)
Pre - Development External 2	0.15
Pre - Development Extrenal 1	0.12
Pre - Development	0.12
Post - Development	0.13

Downstream

Element Name	Downstream
Pre - Development External 2	Pre - Development External
Pre - Development Extrenal 1	Pre - Development External
Post - Development	Wetland

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Pre - Development External 2	0	49	13.2
Pre - Development Extrenal 1	0	49	13.2
Pre - Development	0	49	13.2
Post - Development	90	69	5.7

Transform: Scs

Element Name	Lag	Unitgraph Type
Pre - Development External 2	27.57	Standard
Pre - Development Extrenal 1	20.07	Standard
Pre - Development	18.77	Standard
Post - Development	10.7	Standard

Subbasin: Pre-Development External 2

Area (KM2) : 0.15
Downstream : Pre - Development External

Loss Rate: Scs

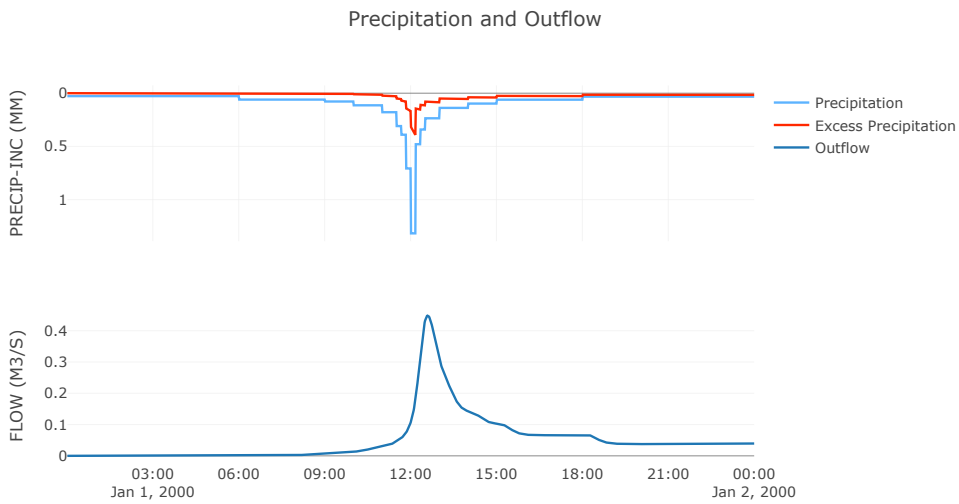
Percent Impervious Area	0
Curve Number	49
Initial Abstraction	13.2

Transform: Scs

Lag	27.57
Unitgraph Type	Standard

Results: Pre-Development External 2

Peak Discharge (M3/S)	0.45
Time of Peak Discharge	01Jan2000, 12:35
Volume (MM)	28.7
Precipitation Volume (M3)	17666.88
Loss Volume (M3)	13247.89
Excess Volume (M3)	4419
Direct Runoff Volume (M3)	4334.37
Baseflow Volume (M3)	0



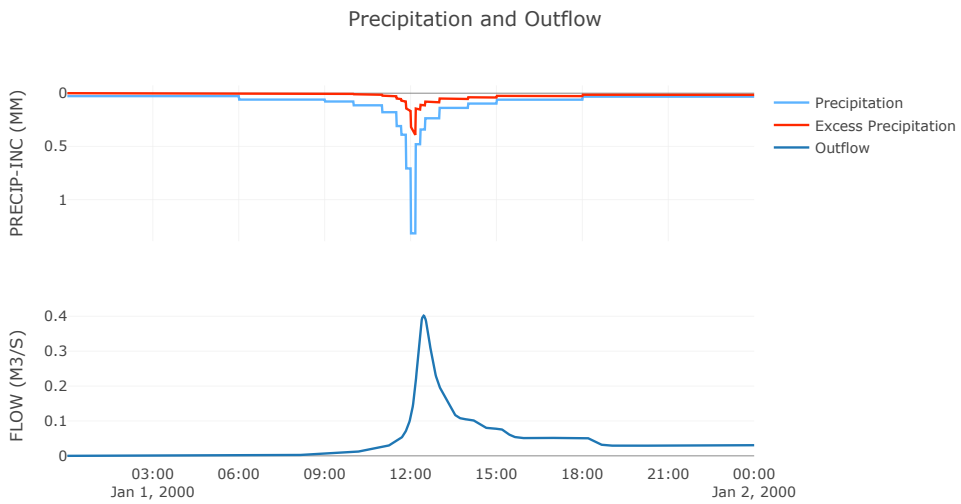
Subbasin: Pre-Development Extrenal 1

Area (KM2) : 0.12
Downstream : Pre - Development External

Loss Rate: Scs	
Percent Impervious Area	0
Curve Number	49
Initial Abstraction	13.2

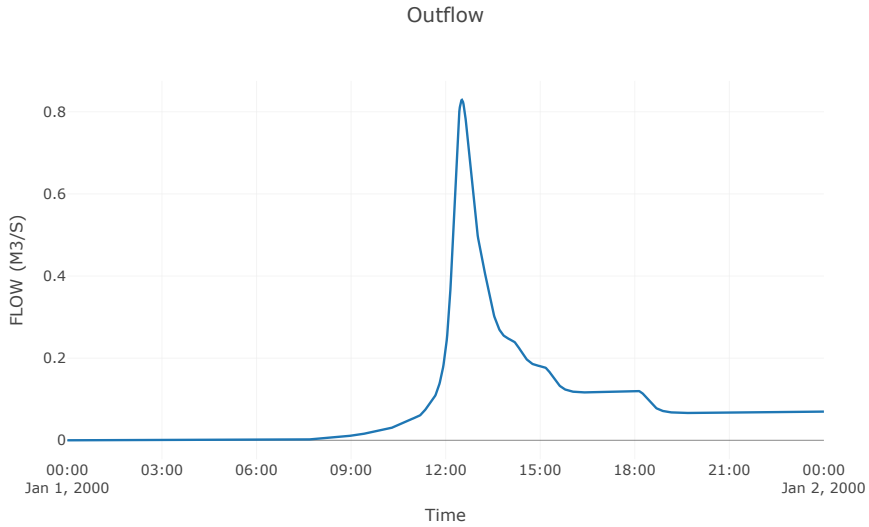
Transform: Scs	
Lag	20.07
Unitgraph Type	Standard

Results: Pre-Development Extrenal 1	
Peak Discharge (M3/S)	0.4
Time of Peak Discharge	01Jan2000, 12:27
Volume (MM)	28.86
Precipitation Volume (M3)	13659.28
Loss Volume (M3)	10242.7
Excess Volume (M3)	3416.58
Direct Runoff Volume (M3)	3368.82
Baseflow Volume (M3)	0



Junction: Pre-Development External

Results: Pre-Development External	
Peak Discharge (M3/S)	0.83
Time of Peak Discharge	01Jan2000, 12:31
Volume (MM)	28.77



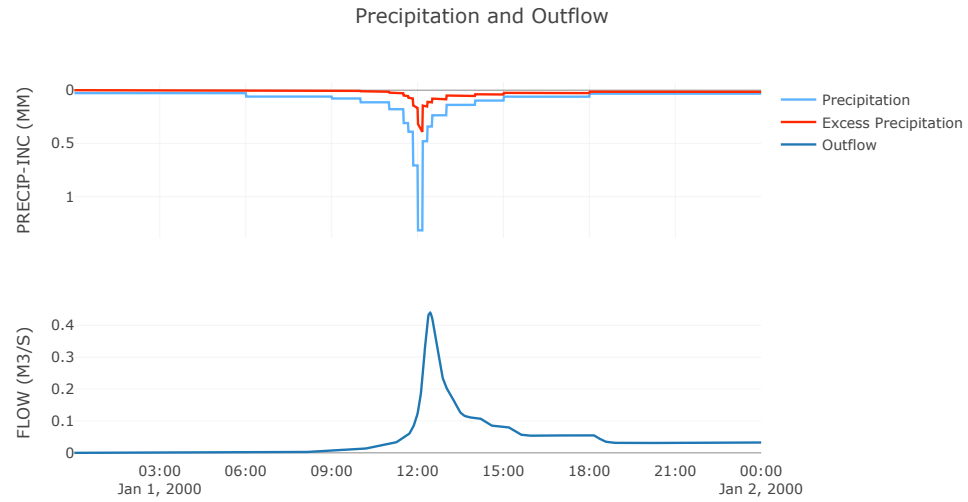
Subbasin: Pre-Development

Area (KM2) : 0.12

Loss Rate: Scs	
Percent Impervious Area	0
Curve Number	49
Initial Abstraction	13.2

Transform: Scs	
Lag	18.77
Unitgraph Type	Standard

Results: Pre-Development	
Peak Discharge (M3/S)	0.44
Time of Peak Discharge	01Jan2000, 12:25
Volume (MM)	28.88
Precipitation Volume (M3)	14504.49
Loss Volume (M3)	10876.5
Excess Volume (M3)	3627.99
Direct Runoff Volume (M3)	3580.54
Baseflow Volume (M3)	0



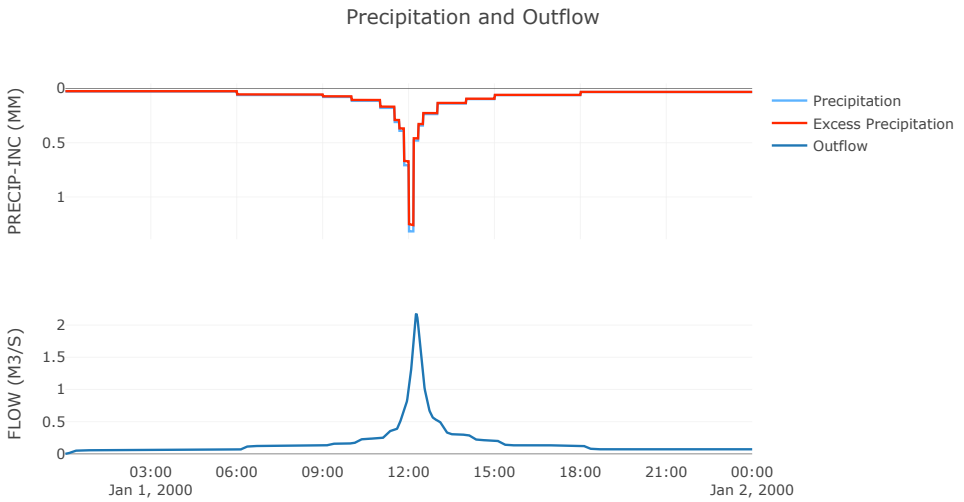
Subbasin: Post-Development

Area (KM2) : 0.13
Downstream : Wetland

Loss Rate: Scs	
Percent Impervious Area	90
Curve Number	69
Initial Abstraction	5.7

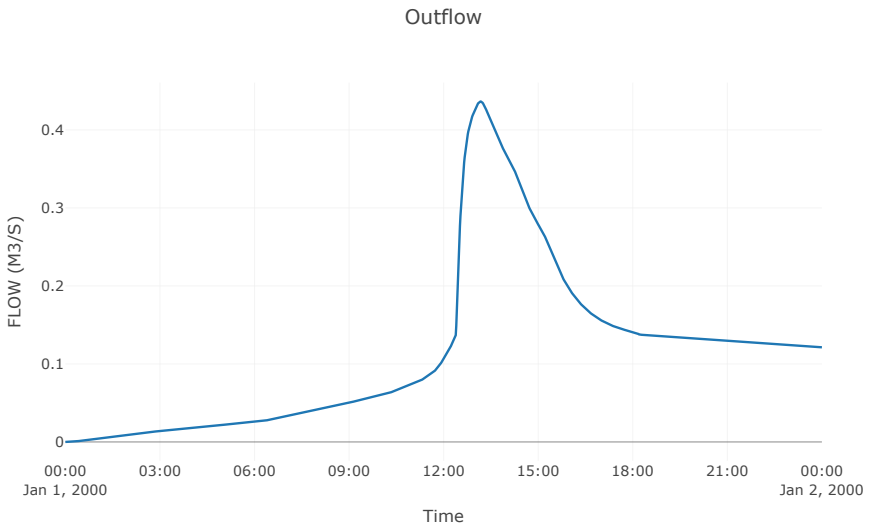
Transform: Scs	
Lag	10.7
Unitgraph Type	Standard

Results: Post-Development	
Peak Discharge (M3/S)	2.18
Time of Peak Discharge	01Jan2000, 12:16
Volume (MM)	110.35
Precipitation Volume (M3)	15674.49
Loss Volume (M3)	831.22
Excess Volume (M3)	14843.27
Direct Runoff Volume (M3)	14784.03
Baseflow Volume (M3)	0



Reservoir: Wetland

Results: Wetland	
Peak Discharge (M3/S)	0.44
Time of Peak Discharge	01Jan2000, 13:10
Volume (MM)	73.14
Peak Inflow (M3/S)	2.18
Time of Peak Inflow	01Jan2000, 12:16
Inflow Volume (M3)	14784.03
Maximum Storage (M3)	7295.17
Discharge Volume (M3)	9798.91



Project: Avenue_Plan_Change
Simulation Run: 100yr
Simulation Start: 31 December 1999, 24:00
Simulation End: 1 January 2000, 24:00

HMS Version: 4.10
Executed: 20 December 2022, 20:06

Global Parameter Summary - Subbasin

Area (KM2)

Element Name	Area (KM2)
Pre - Development External 2	0.15
Pre - Development Extrenal 1	0.12
Pre - Development	0.12
Post - Development	0.13

Downstream

Element Name	Downstream
Pre - Development External 2	Pre - Development External
Pre - Development Extrenal 1	Pre - Development External
Post - Development	Wetland

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Pre - Development External 2	0	49	13.2
Pre - Development Extrenal 1	0	49	13.2
Pre - Development	0	49	13.2
Post - Development	90	69	5.7

Transform: Scs

Element Name	Lag	Unitgraph Type
Pre - Development External 2	27.57	Standard
Pre - Development Extrenal 1	20.07	Standard
Pre - Development	18.77	Standard
Post - Development	10.7	Standard

Subbasin: Pre-Development External 2

Area (KM2) : 0.15
Downstream : Pre - Development External

Loss Rate: Scs

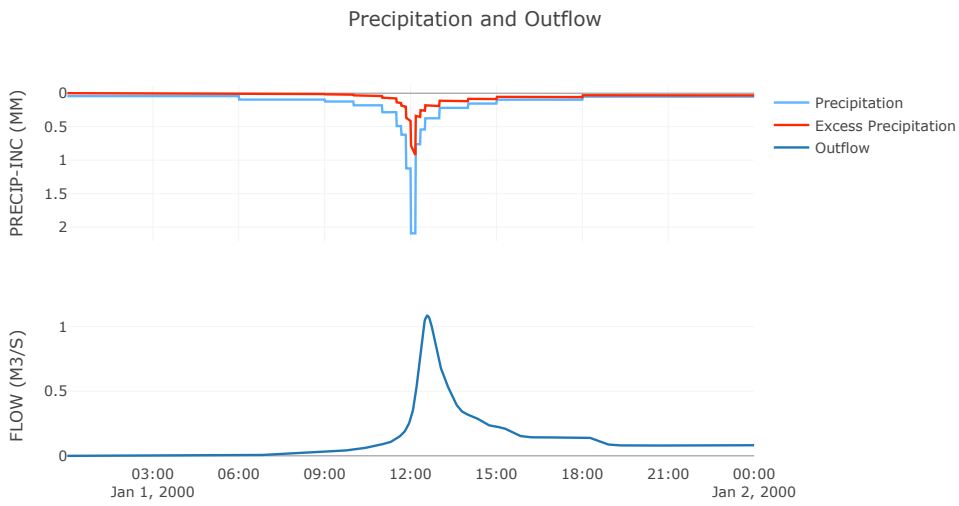
Percent Impervious Area	0
Curve Number	49
Initial Abstraction	13.2

Transform: Scs

Lag	27.57
Unitgraph Type	Standard

Results: Pre-Development External 2

Peak Discharge (M3/S)	1.09
Time of Peak Discharge	01Jan2000, 12:35
Volume (MM)	67.13
Precipitation Volume (M3)	28085.81
Loss Volume (M3)	17772.13
Excess Volume (M3)	10313.68
Direct Runoff Volume (M3)	10137.32
Baseflow Volume (M3)	0



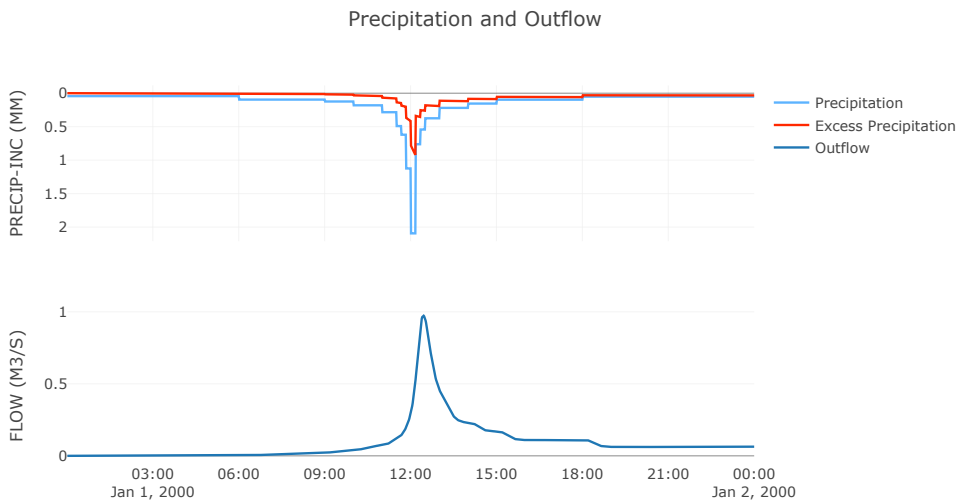
Subbasin: Pre-Development Extrenal 1

Area (KM2) : 0.12
Downstream : Pre - Development External

Loss Rate: Scs	
Percent Impervious Area	0
Curve Number	49
Initial Abstraction	13.2

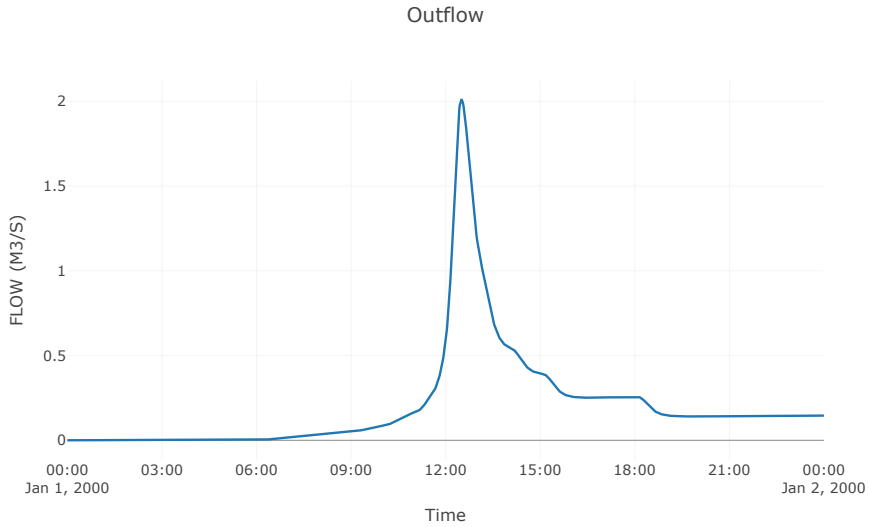
Transform: Scs	
Lag	20.07
Unitgraph Type	Standard

Results: Pre-Development Extrenal 1	
Peak Discharge (M3/S)	0.97
Time of Peak Discharge	01Jan2000, 12:26
Volume (MM)	67.45
Precipitation Volume (M3)	21714.76
Loss Volume (M3)	13740.65
Excess Volume (M3)	7974.1
Direct Runoff Volume (M3)	7874.6
Baseflow Volume (M3)	0



Junction: Pre-Development External

Results: Pre-Development External	
Peak Discharge (M3/S)	2.01
Time of Peak Discharge	01Jan2000, 12:30
Volume (MM)	67.27



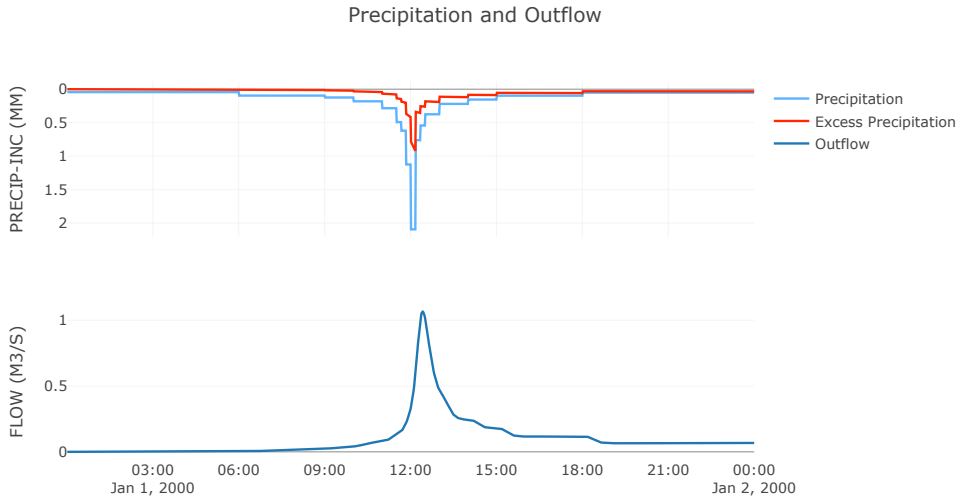
Subbasin: Pre-Development

Area (KM2) : 0.12

Loss Rate: Scs	
Percent Impervious Area	0
Curve Number	49
Initial Abstraction	13.2

Transform: Scs	
Lag	18.77
Unitgraph Type	Standard

Results: Pre-Development	
Peak Discharge (M3/S)	1.06
Time of Peak Discharge	01Jan2000, 12:25
Volume (MM)	67.51
Precipitation Volume (M3)	23058.42
Loss Volume (M3)	14590.9
Excess Volume (M3)	8467.52
Direct Runoff Volume (M3)	8368.65
Baseflow Volume (M3)	0



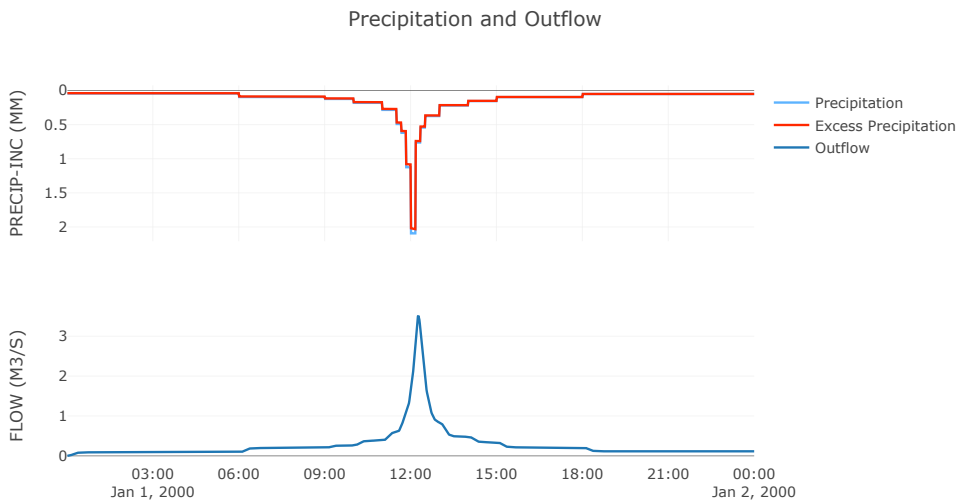
Subbasin: Post-Development

Area (KM2) : 0.13
Downstream : Wetland

Loss Rate: Scs	
Percent Impervious Area	90
Curve Number	69
Initial Abstraction	5.7

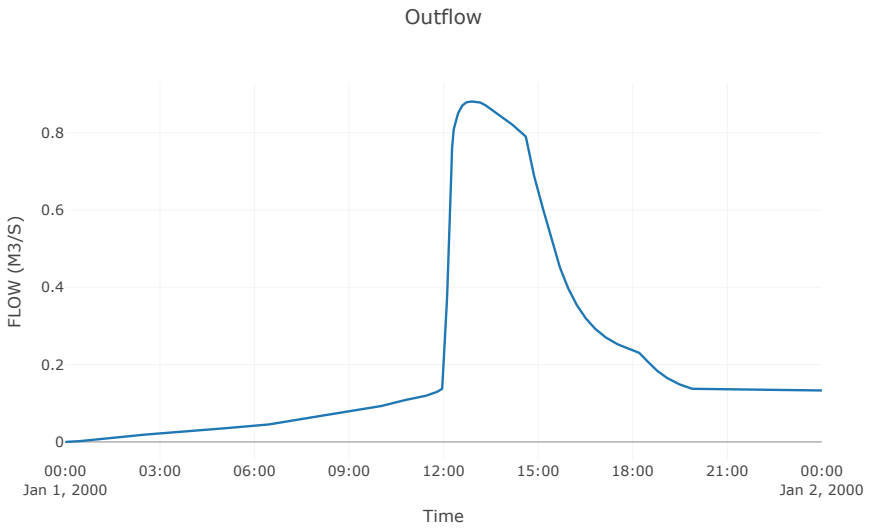
Transform: Scs	
Lag	10.7
Unitgraph Type	Standard

Results: Post-Development	
Peak Discharge (M3/S)	3.52
Time of Peak Discharge	01Jan2000, 12:16
Volume (MM)	177.73
Precipitation Volume (M3)	24918.42
Loss Volume (M3)	1012.61
Excess Volume (M3)	23905.81
Direct Runoff Volume (M3)	23810.61
Baseflow Volume (M3)	0



Reservoir: Wetland

Results: Wetland	
Peak Discharge (M3/S)	0.88
Time of Peak Discharge	01Jan2000, 12:53
Volume (MM)	133.92
Peak Inflow (M3/S)	3.52
Time of Peak Inflow	01Jan2000, 12:16
Inflow Volume (M3)	23810.61
Maximum Storage (M3)	10606.57
Discharge Volume (M3)	17940.62



OVERLAND FLOW PATH SWALE

Assessment uses Manning's open channel formula.

Project	PPC58
Date	12-Oct-22
Status	FOR APPROVAL
By	DS

	EXTERNAL CATCHMENT 1	*EXTERNAL CATCHMENT 1 + 2*	
Flow depth (m)	0.700	0.950	*m*
Base width (m)	0.600	0.600	*m*
LHS slope	3.0000	3.0000	*m*
RHS slope	3.0000	3.0000	*m*
Flow width (m)	4.80	6.30	
Cross-sectional area of channel (m2)	1.89	3.28	m^2
Manning's 'n' value slope	0.060	0.060	
Wetted perimeter of channel (m)	5.03	6.61	*m*
Slope along channel	0.004	0.004	*m / m*
OLFP velocity	**0.549**	**0.660**	***m/s***
OLFP capacity	**1.038**	**2.165**	m^3/s

WETLAND SIZING

Summary of HEC-HMS inputs using TR2020/07 methodology.

Project	PPC58
Date	22-Dec-22
Status	FOR APPROVAL
By	DS

Depth (m)	Volume (m³)	Extended Detention Circular Orifice (m³/s)	Attenuation Circular Orifice (m³/s)	Total (m³/s)
0.00	0	0.000	0.000	0.000
0.30	1831	0.054	0.000	0.054
0.60	3933	0.107	0.000	0.107
0.90	6191	0.138	0.000	0.138
1.20	8601	0.162	0.628	0.790
1.50	11166	0.184	0.722	0.906

DIAMETER (m)	0.27	0.55
INVERT (m)	0.00	0.00

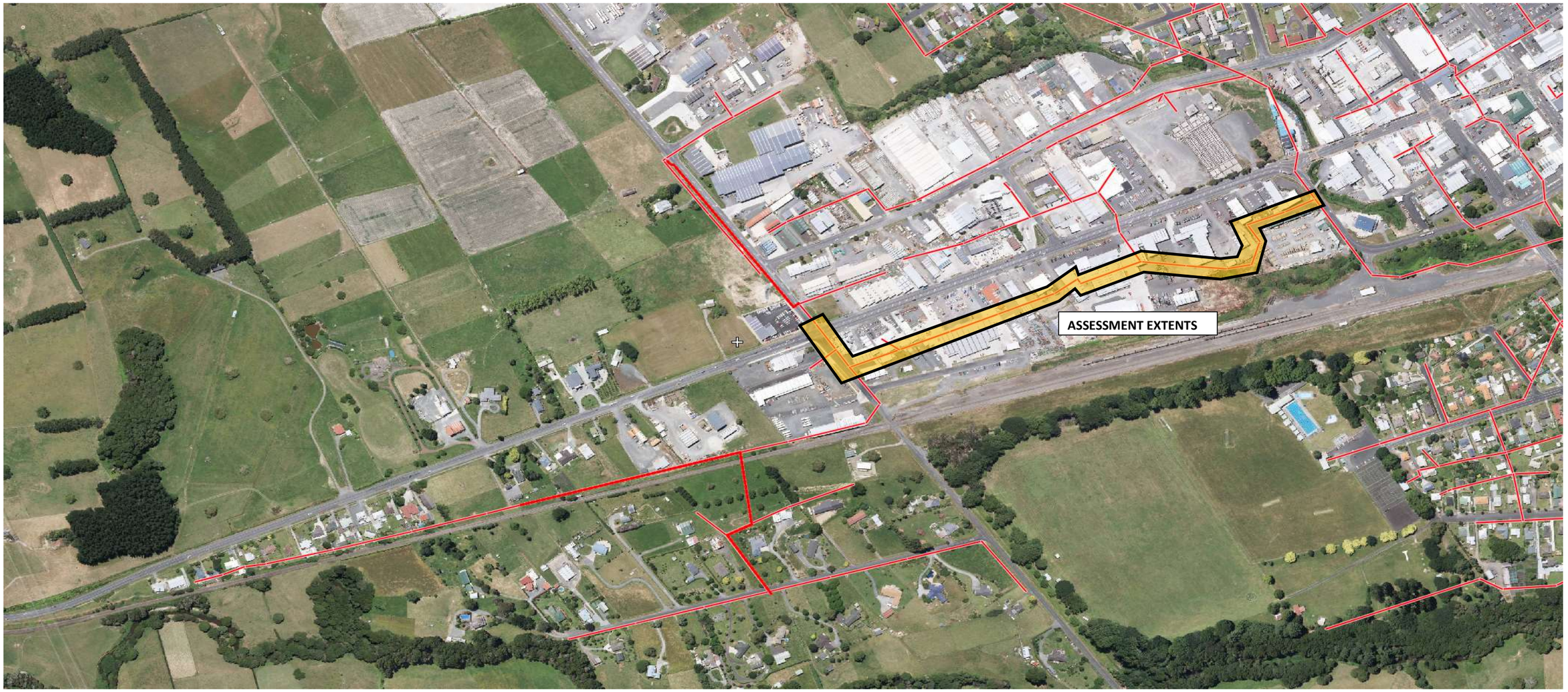
SUMMARY

WATER QUALITY FOOTPRINT (m²)	5359
EXTENDED DETENTION VOLUME (m³)	6431
EXTENDED DETENTION RELEASE (m³/s)	0.149
ATTENUATION VOLUME (m³/s)	4176

WASTEWATER CAPACITY ASSESSMENT

From proposed connection point to 300mm diameter transmission main on Marshall Street

Project	PPC58
Date	12-Oct-22
Status	FOR APPROVAL
By	DS



GIS REFERENCE	MANHOLE IL (mRL)	MANHOLE LL (mRL)	PIPE LENGTH (m)	DIAMETER (mm)	INDUSTRIAL AREA (ha)	COMMERCIAL AREA (ha)	RESIDENTIAL AREA (ha)	INDUSTRIAL AREA POPULATION	COMMERCIAL AREA POPULATION	RESIDENTIAL AREA POPULATION	AVERAGE DAILY FLOW (ADF)			
											INFILTRATION (l/day)	ADF (m^3/day)	CUMMULATIVE ADF (m^3/day)	CUMMULATIVE ADF + PPC58 (m^3/day)
100388	26.14	28.18	0.00	200.00	18.69	5.74	0.00	841	172	0	54968	257.62	257.62	394.87
100599	26.08	28.00	47.45	200.00	0.00	1.34	0.00	0	40	0	3015	11.06	268.67	405.92
100600	26.06	28.60	31.43	200.00	0.00	6.06	24.14	0	182	135	67950	131.31	399.98	537.23
100336	25.66	27.80	70.71	200.00	0.00	0.66	0.00	0	20	0	1485	5.45	405.43	542.68
100368	25.57	27.82	70.78	200.00	0.00	0.61	0.00	0	18	0	1373	5.03	410.46	547.71
100598	25.26	27.41	71.49	200.00	0.00	0.73	0.00	0	22	0	1643	6.02	416.48	553.73
100597	25.10	28.13	80.26	200.00	0.00	1.23	0.00	0	37	0	2768	10.15	426.63	563.88
100595	25.00	27.19	36.29	200.00	0.00	1.61	0.00	0	48	0	3623	13.28	439.91	577.16
100596	24.98	27.17	7.90	200.00	0.00	0.00	0.00	0	0	0	0	0.00	439.91	577.16
100367	24.78	26.89	85.63	200.00	0.00	3.90	0.00	0	117	0	8775	32.18	472.09	609.34
100366	24.60	26.85	61.42	200.00	0.00	1.37	0.00	0	41	0	3083	11.30	483.39	620.64
100592	24.50	26.88	52.00	200.00	0.00	1.05	0.00	0	32	0	2363	8.66	492.05	629.30
100593	24.40	26.79	34.46	200.00	0.00	0.00	0.00	0	0	0	0	0.00	492.05	629.30
100594	24.27	26.50	35.79	200.00	0.00	1.20	0.00	0	36	0	2700	9.90	501.95	639.20
100365	24.19	26.71	29.82	200.00	0.00	0.47	0.00	0	14	0	1058	3.88	505.83	643.08
100634	24.00	26.57	52.10	200.00	0.00	0.00	0.00	0	0	0	0	0.00	505.83	643.08
100362	22.58	24.59	22.58	200.00	0.00	0.00	0.00	0	0	0	0	0.00	505.83	643.08
PPC58					12.2			549	0	0	27450	137.25		

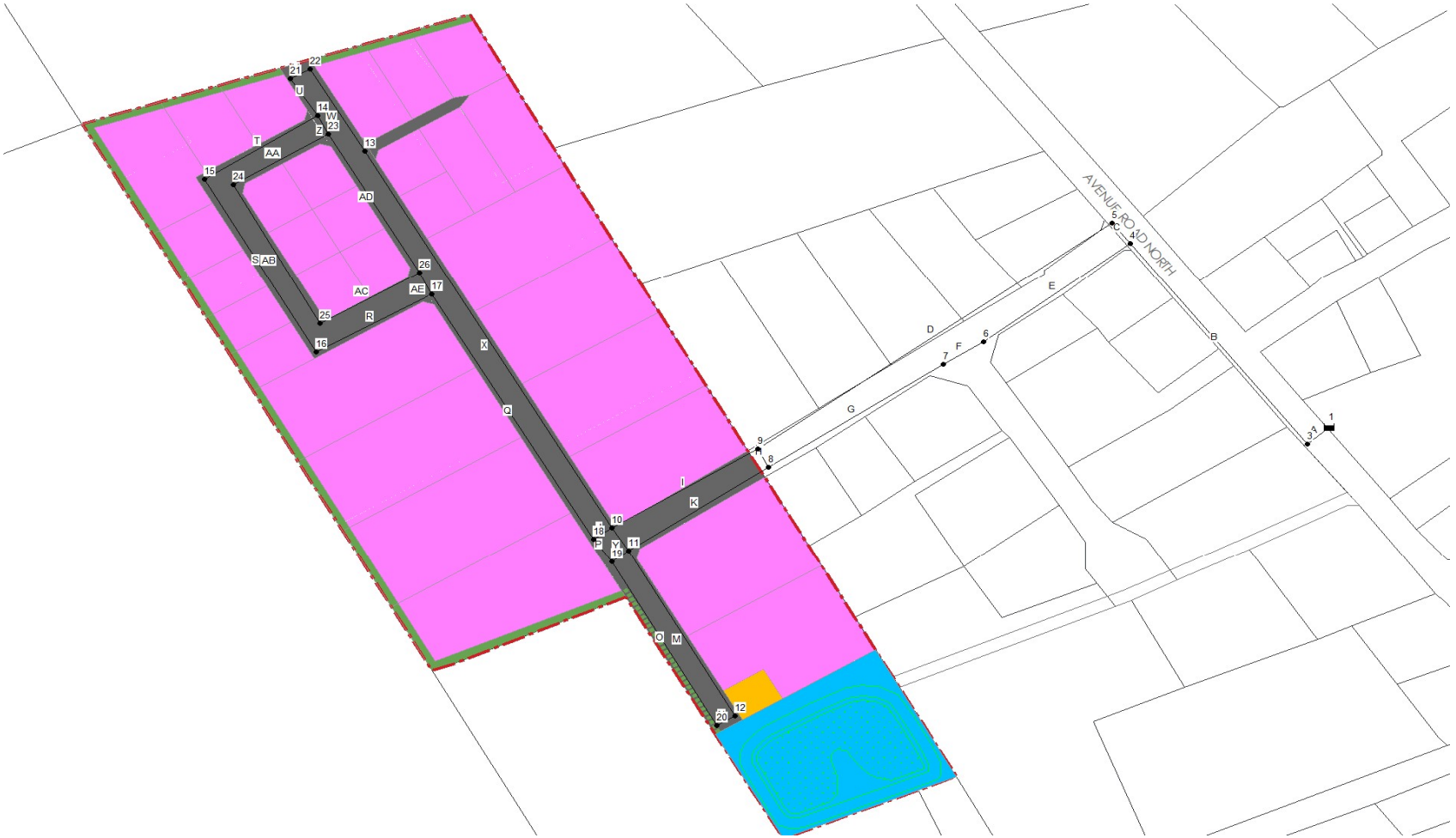
GIS REFERENCE	PEAK DAILY FLOW (PDF)						PEAK WET WEATHER FLOW (PWWF)				PIPE CAPACITY				
	FACTOR OF SAFETY INDUSTRIAL	FACTOR OF SAFETY COMMERCIAL	FACTOR OF SAFETY RESIDENTIAL	PDF (l/s)	CUMMULATIVE PDF (l/s)	CUMMULATIVE PDF + PPC58 (l/s)	INGRESS (l/day)	PWWF (l/s)	CUMMULATIVE PWWF (l/s)	CUMMULATIVE PWWF + PPC58 (l/s)	GRADE (m/m)	VELOCITY (m/s)	CAPACITY (l/s)	CAPACITY RATIO	CAPACITY RATIO + PPC58
100388	2.55	4.00	0.00	7.20	7.20	11.07	403095	11.86	11.86	18.07	0.0013	0.37	11.66	1.02	1.55
100599	0.00	7.20	0.00	0.70	7.90	11.78	22110	0.96	12.82	19.03	0.0006	0.26	8.27	1.55	2.30
100600	0.00	3.80	5.00	3.95	11.85	15.72	498300	9.72	22.54	28.74	0.0057	0.79	24.67	0.91	1.17
100336	0.00	11.00	0.00	0.52	12.37	16.25	10890	0.65	23.18	29.39	0.0013	0.37	11.70	1.98	2.51
100368	0.00	11.00	0.00	0.48	12.85	16.73	10065	0.60	23.78	29.99	0.0043	0.69	21.60	1.10	1.39
100598	0.00	9.50	0.00	0.50	13.35	17.23	12045	0.64	24.42	30.63	0.0020	0.47	14.64	1.67	2.09
100597	0.00	7.50	0.00	0.67	14.02	17.90	20295	0.91	25.33	31.54	0.0028	0.55	17.22	1.47	1.83
100595	0.00	6.90	0.00	0.81	14.84	18.71	26565	1.12	26.45	32.66	0.0025	0.53	16.50	1.60	1.98
100596	0.00	0.00	0.00	0.00	14.84	18.71	0	0.00	26.45	32.66	0.0023	0.50	15.85	1.67	2.06
100367	0.00	4.80	0.00	1.40	16.24	20.12	64350	2.15	28.60	34.80	0.0029	0.57	17.76	1.61	1.96
100366	0.00	7.20	0.00	0.72	16.96	20.84	22605	0.98	29.58	35.79	0.0019	0.46	14.38	2.06	2.49
100592	0.00	8.00	0.00	0.61	17.57	21.45	17325	0.81	30.39	36.60	0.0029	0.56	17.67	1.72	2.07
100593	0.00	0.00	0.00	0.00	17.57	21.45	0	0.00	30.39	36.60	0.0036	0.63	19.77	1.54	1.85
100594	0.00	7.50	0.00	0.66	18.23	22.10	19800	0.89	31.28	37.48	0.0027	0.54	16.99	1.84	2.21
100365	0.00	13.00	0.00	0.44	18.66	22.54	7755	0.53	31.80	38.01	0.0036	0.63	19.81	1.61	1.92
100634	0.00	0.00	0.00	0.00	18.66	22.54	0	0.00	31.80	38.01	0.0629	2.62	82.25	0.39	0.46
100362	0.00	0.00	0.00	0.00	18.66	22.54	0	0.00	31.80	38.01					
PPC58	2.80	0.00	0.00	3.88			201300	6.21							

INPUTS

BUSINESS AREA	30	people/ha
INDUSTRIAL AREA	45	people/ha
RESIDENTIAL AREA	45	dwellings
INFILTRATION	2250	l/ha/day
EFFLUENT	200	l/p/day
INGRESS	16500	l/ha/day
PEOPLE	3	people/dwelling
PEAKING FACTOR		per RITS
COLEBROOK WHITE COEFFICIENT	1.5	mm

EPANET MODEL LAYOUT

Project	PPC58
Date	12-Oct-22
Status	FOR APPROVAL
By	DS



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**************************************************************
*                          E P A N E T                       *
*                  Hydraulic and Water Quality               *
*                  Analysis for Pipe Networks                *
*                        Version 2.2                         *
**************************************************************
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Input File: Avenue Road North Static.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
A	1	3	18.17	150
B	3	4	181.54	150
C	4	5	18.68	150
D	5	9	276.06	150
E	4	6	116.83	150
F	6	7	30.09	150
G	7	8	132.86	150
H	8	9	14.69	150
I	9	10	108.18	150
J	10	18	14.59	150
K	8	11	106.61	150
L	11	19	13.14	150
M	11	12	135.13	150
N	12	20	13.53	150
O	20	19	133.34	150
P	19	18	19.71	150
Q	18	17	202.06	150
R	17	16	84.44	150
S	16	15	141.90	150
T	15	14	84.98	150
U	14	21	31.71	150
V	21	22	14.11	150
W	22	13	67.50	150
X	13	10	309.57	150
Y	10	11	19.50	150
Z	14	23	14.69	150
AA	23	24	70.10	150
AB	24	25	112.97	150
AC	25	26	72.70	150
AD	26	23	113.71	150
AE	26	17	17.05	150

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
3	0.00	83.21	55.41	0.00	
4	1.99	82.34	54.04	0.00	
5	0.37	82.32	54.02	0.00	
6	0.00	82.20	53.90	0.00	
7	2.56	82.17	53.87	0.00	
8	0.41	82.10	53.50	0.00	
9	1.27	82.10	53.50	0.00	
10	1.75	82.05	53.45	0.00	
11	0.00	82.05	53.45	0.00	
12	1.13	82.05	53.75	0.00	
13	0.94	82.03	46.03	0.00	
14	0.70	82.03	43.53	0.00	
15	0.95	82.03	37.03	0.00	
16	0.39	82.03	48.03	0.00	
17	0.00	82.03	52.63	0.00	
18	2.44	82.05	53.45	0.00	
19	0.00	82.05	53.45	0.00	
20	0.00	82.05	53.75	0.00	
21	0.00	82.03	43.53	0.00	
22	0.00	82.03	43.53	0.00	
23	0.00	82.03	43.53	0.00	
24	0.00	82.03	37.03	0.00	
25	0.00	82.03	48.03	0.00	
26	0.00	82.03	52.63	0.00	
1	-14.90	83.30	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
A	14.90	0.84	4.82	Open
B	14.90	0.84	4.82	Open
C	6.00	0.34	0.89	Open
D	5.63	0.32	0.80	Open
E	6.91	0.39	1.16	Open
F	6.91	0.39	1.16	Open
G	4.35	0.25	0.49	Open
H	-0.20	0.01	0.00	Open
I	4.16	0.24	0.45	Open
J	2.34	0.13	0.16	Open
K	4.14	0.23	0.45	Open
L	2.08	0.12	0.13	Open
M	0.74	0.04	0.02	Open
N	-0.39	0.02	0.01	Open
O	-0.39	0.02	0.01	Open
P	1.69	0.10	0.09	Open

Link Results: (continued)

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
Q	1.59	0.09	0.08	Open
R	0.79	0.04	0.02	Open
S	0.40	0.02	0.01	Open
T	-0.55	0.03	0.01	Open
U	-0.45	0.03	0.01	Open
V	-0.45	0.03	0.01	Open
W	-0.45	0.03	0.01	Open
X	-1.39	0.08	0.06	Open
Y	-1.32	0.07	0.05	Open
Z	-0.80	0.05	0.02	Open
AA	-0.31	0.02	0.00	Open
AB	-0.31	0.02	0.00	Open
AC	-0.31	0.02	0.00	Open
AD	0.49	0.03	0.01	Open
AE	-0.80	0.05	0.02	Open

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**************************************************************
*                          E P A N E T                       *
*                  Hydraulic and Water Quality               *
*                  Analysis for Pipe Networks                *
*                        Version 2.2                         *
**************************************************************
```

Input File: Avenue Road North Residual (Firefighting).net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
A	1	3	18.17	150
B	3	4	181.54	150
C	4	5	18.68	150
D	5	9	276.06	150
E	4	6	116.83	150
F	6	7	30.09	150
G	7	8	132.86	150
H	8	9	14.69	150
I	9	10	108.18	150
J	10	18	14.59	150
K	8	11	106.61	150
L	11	19	13.14	150
M	11	12	135.13	150
N	12	20	13.53	150
O	20	19	133.34	150
P	19	18	19.71	150
Q	18	17	202.06	150
R	17	16	84.44	150
S	16	15	141.90	150
T	15	14	84.98	150
U	14	21	31.71	150
V	21	22	14.11	150
W	22	13	67.50	150
X	13	10	309.57	150
Y	10	11	19.50	150
Z	14	23	14.69	150
AA	23	24	70.10	150
AB	24	25	112.97	150
AC	25	26	72.70	150
AD	26	23	113.71	150
AE	26	17	17.05	150

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality	
3	0.00	73.26	45.46	0.00	
4	1.99	67.83	39.53	0.00	
5	0.37	67.70	39.40	0.00	
6	0.00	66.89	38.59	0.00	
7	2.56	66.65	38.35	0.00	
8	0.41	65.82	37.22	0.00	
9	1.27	65.82	37.22	0.00	
10	1.75	65.18	36.58	0.00	
11	0.00	65.20	36.60	0.00	
12	1.13	65.18	36.88	0.00	
13	0.94	64.23	28.23	0.00	
14	0.70	63.93	25.43	0.00	
15	0.95	63.94	18.94	0.00	
16	0.39	63.97	29.97	0.00	
17	0.00	63.99	34.59	0.00	
18	2.44	65.14	36.54	0.00	
19	0.00	65.18	36.58	0.00	
20	0.00	65.18	36.88	0.00	
21	0.00	64.01	25.51	0.00	
22	0.00	64.05	25.55	0.00	
23	0.00	63.88	25.38	0.00	
24	25.00	63.53	18.53	0.00	
25	0.00	63.77	29.77	0.00	
26	0.00	63.92	34.52	0.00	
1	-39.90	73.80	0.00	0.00	Reservoir

Link Results:

Link ID	Flow LPS	Velocity m/s	Unit Headloss m/km	Status
A	39.90	2.26	29.90	Open
B	39.90	2.26	29.90	Open
C	18.28	1.03	7.05	Open
D	17.91	1.01	6.78	Open
E	19.63	1.11	8.04	Open
F	19.63	1.11	8.04	Open
G	17.07	0.97	6.20	Open
H	0.09	0.01	0.00	Open
I	16.73	0.95	5.98	Open
J	10.00	0.57	2.31	Open
K	16.57	0.94	5.87	Open
L	7.88	0.45	1.48	Open
M	2.00	0.11	0.12	Open
N	0.87	0.05	0.03	Open
O	0.87	0.05	0.03	Open
P	8.75	0.50	1.80	Open

Link Results: (continued)

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
Q	16.32	0.92	5.71	Open
R	3.10	0.18	0.26	Open
S	2.71	0.15	0.21	Open
T	1.76	0.10	0.09	Open
U	-10.72	0.61	2.62	Open
V	-10.72	0.61	2.62	Open
W	-10.72	0.61	2.62	Open
X	-11.66	0.66	3.07	Open
Y	-6.68	0.38	1.09	Open
Z	11.79	0.67	3.13	Open
AA	15.38	0.87	5.12	Open
AB	-9.62	0.54	2.14	Open
AC	-9.62	0.54	2.14	Open
AD	3.60	0.20	0.35	Open
AE	-13.21	0.75	3.86	Open

ATTACHMENT C

Hydrant Flow Analysis Report

MATAMATA-PIAKO DISTRICT COUNCIL

Hydrant Flow Analysis – Avenue/Anderson

Introduction

Matamata-Piako District Council (MPDC) wishes to understand the pressure of the hydrant at the intersection of Anderson Road and Avenue Road for the following conditions:

- Static pressure
- Residual pressure reflecting FW2 fire flow condition during average demand
- Residual pressure reflecting FW2 fire flow condition during peak summer demand

The hydrant is shown highlighted in red on Figure 1.

Figure 1: Anderson/Avenue Hydrant

Pressure in Current Model

The current Morrinsville water supply model was updated and calibrated in early 2022. In this calibration three dataloggers were installed near the Anderson/Avenue hydrant. These were at:

- Intersection of West Street and Avenue Road
- Opposite 60 Snell Street
- 6 Lear Street

These locations are shown highlighted in red on Figure 2.

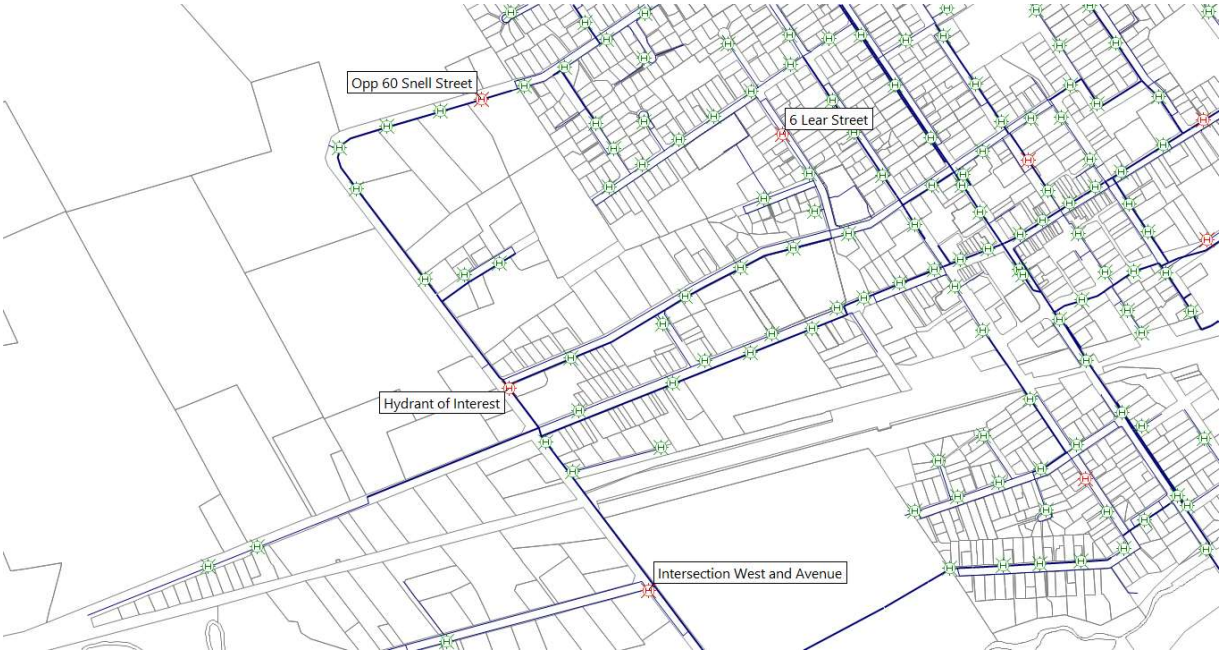


Figure 2: Nearby Datalogging Locations

Data for opposite 60 Snell Street was not available until after the calibration day but the other two sites show a good match between the model results and the live data. The static pressure at these sites is 55 - 56m. **The static pressure in the model at the hydrant at the intersection of Anderson Street and Avenue Road is 55.5m.**

Daily Demand

The model is currently set up with a daily demand of 5,125 m^3/day. Analysis is required for an average day and a peak day. Daily totals for Morrinsville from July 2018 to June 2019 were available and these show that the average daily demand for this period was 4,405 m^3/day and the peak daily demand was 6,135 m^3/day. The demand in the model was scaled and two scenarios were run, one for the average day and one for the peak day.

Fire Flow

An FW2 fire flow was required. This is 12.5 l/s from a hydrant within 135m of the fire and an additional 12.5 l/s from a second hydrant within 270m. For the purposes of this analysis a fire flow of 25 l/s was applied at the hydrant at the intersection of Anderson Street and Avenue Road.

The fire flow was applied for two hours between 2:00pm and 4:00pm.

Results at Average Flow

When a fire flow of 25 l/s is applied at the hydrant at the intersection on Anderson Street and Avenue Road for the average flow day the pressure drops at the hydrant by approximately three metres. This is a very small reduction in pressure during the fire flow and can be seen on Figure 3.

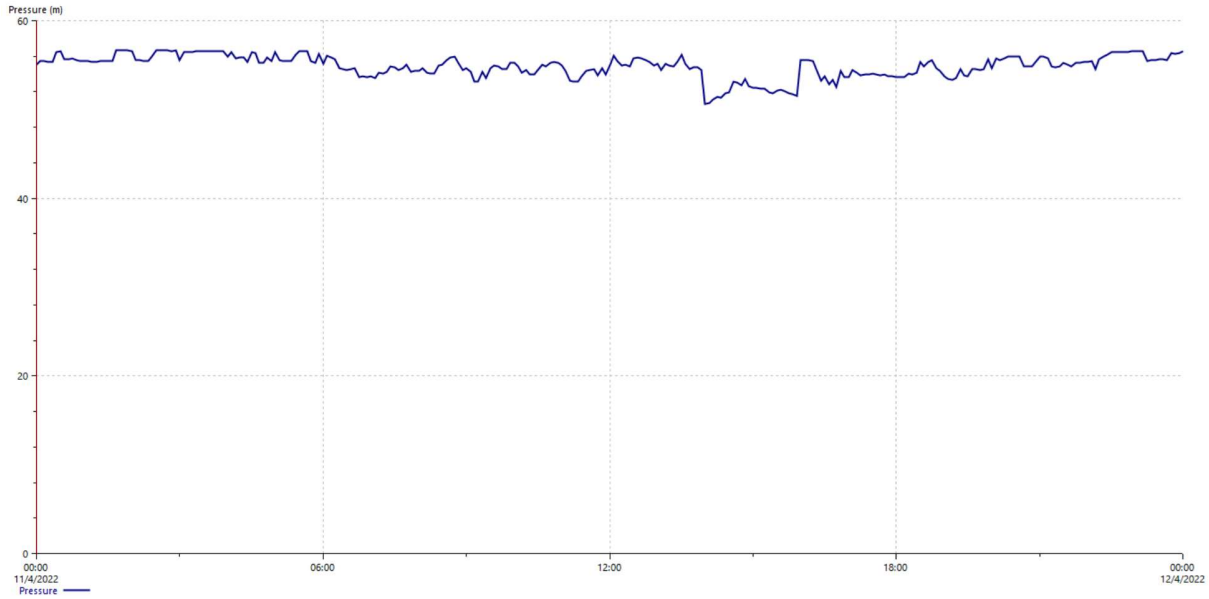


Figure 3: Pressure at Anderson/Avenue Hydrant on Average Demand Day

Results at Peak Flow

When a fire flow of 25 l/s is applied at the hydrant at the intersection on Anderson Street and Avenue Road for the peak flow day the pressure drops at the hydrant by approximately seven metres. Again, this is a very small reduction in pressure during the fire flow. The pressure at the hydrant can be seen on Figure 4.

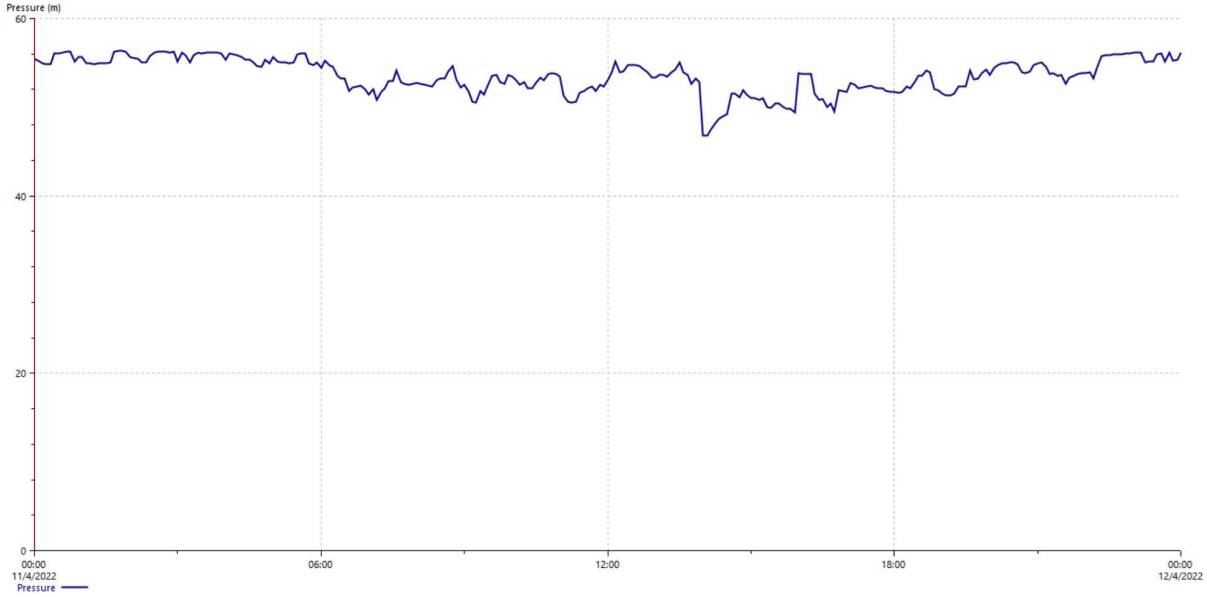


Figure 4: Pressure at Anderson/Avenue Hydrant on Peak Demand Day

Conclusions

The static pressure at the hydrant at the intersection of Anderson Street and Avenue Road is approximately 55.5m.

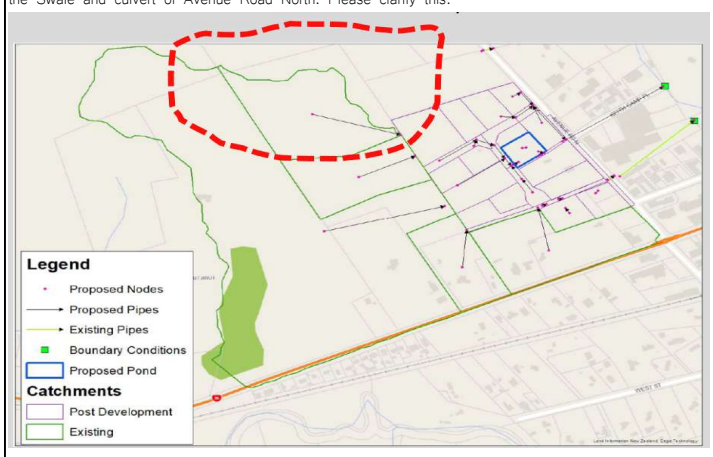
A very small pressure drop can be expected at this hydrant when a 25 l/s fire flow is applied under average daily flow conditions or peak daily flow conditions. The residual pressure is above 46m in both cases.

TEKTUS CONSULTANTS LIMITED
A · 12 MADDEN STREET, AUCKLAND CENTRAL 1010
E · KIAORA@TEKTUS.NZ

AVENUE ROAD PLAN CHANGE (PC58) - FEEDBACK AND RESPONSE ON DRAFT APPLICATION

Response table that addresses the comments raised with regards to the proposed management of stormwater for the plan change area.

Stormwater Comments Response Table

	CKL Comments: 9 December 2022	Tektus Response: 22 December 2022
a)	Please provide the conceptual stormwater layout within site for the primary and secondary systems, including: - Conveyance method (e.g. piped network, open channel), OLFP -Please clarify that the planted swale from the west catchment (refer to drawings# 450) is only designed for the upstream catchment flow. Or is it also part of the proposed stormwater system for this site?	The stormwater layout (primary and secondary systems) within the site is expected to generally follow the future public road corridors and will comply with the relevant engineering standards. The conveyance methodology will be subject to the future resource consent process and may include a combination of piped and overland flow systems. We do not consider the conceptual stormwater layout of primary and secondary systems to be necessary at this point to support a private plan change application. The intent of the planted swale shown on the plans was to highlight the key boundary constraint in the context of stormwater runoff management for the proposed plan change area. The design of the swale will be subject to the future resource consent process and could be utilised as part of the internal site stormwater management system, provided the overall outcomes comply with the proposed stormwater management requirements.
b)	It has stated that the existing culvert under Avenue Rd North is under capacity for the current condition. Please provide an analysis of the impact of the post-development on this culvert. The existing conveyance swale upstream of this culvert is designed for 100-yr with an under-capacity culvert downstream. Does it look like the swale is working as an attenuation system? Please investigate this and clarify this.	As noted in Section 4 of the Infrastructure Report it is proposed to attenuate peak stormwater flows from this plan change area to below pre-development levels. This requirement will ensure that any future development within the plan change area will need to demonstrate through the resource consent process that the pre-development peak flows are not exceeded, and that the hydraulic performance of this culvert is not affected respectively. As such we do not consider the culvert analysis necessary to support the proposed plan change. The attenuation capacity of the existing swale upstream of the culvert has not been assessed and quantified. The swale predominantly functions as a conveyance system for the upstream, catchment and it overtops Avenue Road North once the existing culvert capacity is exceeded. There are no works proposed within this swale and as such the future development of the plan change area is not likely to affect the existing storage volumes. As noted above the overall performance of the future stormwater system will be subject to a detailed assessment at resource consent stage that will need to demonstrate compliance with the proposed attenuation requirements (and ensure there are no adverse effects to downstream properties and infrastructure).
c)	The high groundwater level has been reported for this site (between 0.0 and 1.4m below ground); please advise how to manage the impact of the high groundwater level on the stormwater system.	As noted in Section 4 of the Infrastructure Report, the high groundwater level will likely limit ground infiltration practices and future developments within the plan change area are expected to predominantly rely on the implementation of rainwater harvesting and evapotranspiration (e.g. tree pits) to meet the proposed retention requirements. We consider this an appropriate approach to achieve the proposed stormwater management outcomes. The details of how high groundwater table will be managed to ensure the performance of all elements of the stormwater system is expected to be provided at the resource consent stage. It is important to note that similar high groundwater conditions have been experienced for the Avenue Business Park development and that the overall stormwater management has been developed through the resource consent and engineering plan approval stage to achieve the stormwater management outcomes required by the Morrinsville Stream CMP, TR2020/07 and RITS.
d)	The proposed wetland is proposed water quality and flood attenuation. The proposed 4% of the total catchment to achieve water quality and attenuation up to 100-yr ARI may underestimate. Please clarify this, including the feasible depth of the wetland, storage volume, etc. It is a flat site area, and existing swale levels (invert level and topwater level) will create constraints for the depth of the wetland. Please also provide the tailwater on the existing swale (2-yr, 10-yr, and 100-yr).	As noted in Section 4 of the Infrastructure Report, the 4% is the estimated water quality footprint of the wetland; this reflects the area of the wetland base. The total estimated area for the wetland and the stormwater management reserve is approximately 1 hectare, which is approximately 8% of the projected developable catchment area. The Infrastructure Report has been updated to include this clarification. The sizing is also supported by the conceptual wetland sizing (included in Attachment B) that assumes attenuation volumes will be provided via a live storage depth of up to 1.5m, which includes the extended detention. The invert of the existing swale at the property boundary sits at approximately RL 27.2m, with the estimated 100yr ARI peak flood levels at approximately RL 28.0m (based on the modelling outputs from the resource consent application for the Avenue Business Park development). The existing level across the stormwater management area reserve currently sits at approximately 28.5m. It is also noted in Section 2 of the Infrastructure Report that fill is likely to be placed in this area to accommodate future landform and infrastructure. We consider the level of detail provided in the conceptual sizing assessment to be sufficient to demonstrate that appropriate stormwater management solutions can be delivered for this plan change area. The detailed wetland sizing parameters, including effects of tailwater within the swale and any associated earthworks within the site, are expected to be delivered at the future resource consents, at which stage the size of the stormwater management area reserve will be finalised.
e)	The catchment delineation provided for 91 Ave Rd shows that the upper north of the proposed site is not part of the Swale and culvert of Avenue Road North. Please clarify this. 	Correct. This area is estimated at approximately 1 hectare and currently drains to an existing farm drain to the north. To minimise the likely effects of post-development discharges into an existing farm drain beyond the property boundary it was conceptually assumed that the entire area would drain to the centralised stormwater management area. Noting here that this does not preclude alternative solutions to be delivered at the resource consent stage, which may maintain some discharges to the north-east, provided the stormwater management requirements for this plan change area are met. The HEC-HMS model and outputs in Attachment B have been updated to reflect a smaller pre-development area and the peak flows respectively. This has not changed the overall assessment and the previously estimated wetland/stormwater management reserve size. The Infrastructure Report has also been updated to capture this.
f)	The catchment delineation provided for 91 Ave Rd shows that the upper north of the proposed site is not part of the Swale and culvert of Avenue Road North. Please clarify this.	Same as under item e)
g)	According to the second table in the proposed RITS amendments, a temperature increase of 2.3 degrees Celsius (RCP6.0 2080-2100) shall be used. Please update the calculation on this basis. According to RITS Amendment for Design Rainfall (2020) WRC, the sensitivity test is required for RCP8.5. Please provide the sensitivity test for RCP8.5.	Climate change RCP6.0 (2081-2100) scenario has already been used for the preliminary calculations. This has been noted in Section 4 of the Infrastructure Report and is reflected in the HEC-HMS model and calculations attached in Appendix B. For clarity the 24-hour rainfall depths used for the 10-year and 100-year ARI storm events are 117mm and 186mm. Extracted HIRDS tables have also been included in Appendix B. The key purpose of the conceptual wetland and overland flow swale sizing assessment was to inform the likely size of the stormwater management area reserves and to inform the general practicality in achieving the stormwater management outcomes. The overall stormwater system has not been designed at this point and it would be difficult to assess the effects of the RCP8.5 scenario on the performance of the stormwater infrastructure in this regard. This assessment is expected to be carried out at the resource consent stage in conjunction with the appropriate stormwater system design.
h)	Drawing #450 shows the planted swale conveyed from the west catchment between the proposed site and the wetland. Please clarify the connection method from the proposed site to the wetland over the swale. Also, the access to the wetland? 	It is expected that the overland flow path/swale conveying the flows from the upstream catchment will be integrated within the future stormwater management area reserve and will be hydraulically connected to the existing swale within the Avenue Road Business Park. As noted under a), the intent of the planted swale being shown on the plans was to highlight the key boundary constraint in the context of stormwater runoff management for the proposed plan change area. This concept swale location was diverted along the outside of the future stormwater management reserve to reflect a layout that could better manage the internal stormwater infrastructure connectivity to the wetland. The details of this connection (location, type, etc.) including any wetland access requirements are expected to be designed and delivered at the resource consent stage in accordance with the relevant engineering standards.
i)	The wastewater pump station is located at the lowest level of the site, as stated in the report. Please clarify the wetland position on the site? i.e. is it in the lowest point or engineered as such?	The low lying-areas of the site are very flat, and the area is currently being drained via a network of farm drains to the head of the conveyance swale at the Avenue Business Park development boundary that was considered as the existing low point of the site. This is expected to be the most practicable discharge point for the plan change area and as such the location of the wetland (stormwater management area) has been positioned in that regard.