Figure 14: Current peak wet weather outflow from Lake Hayes #2 PS

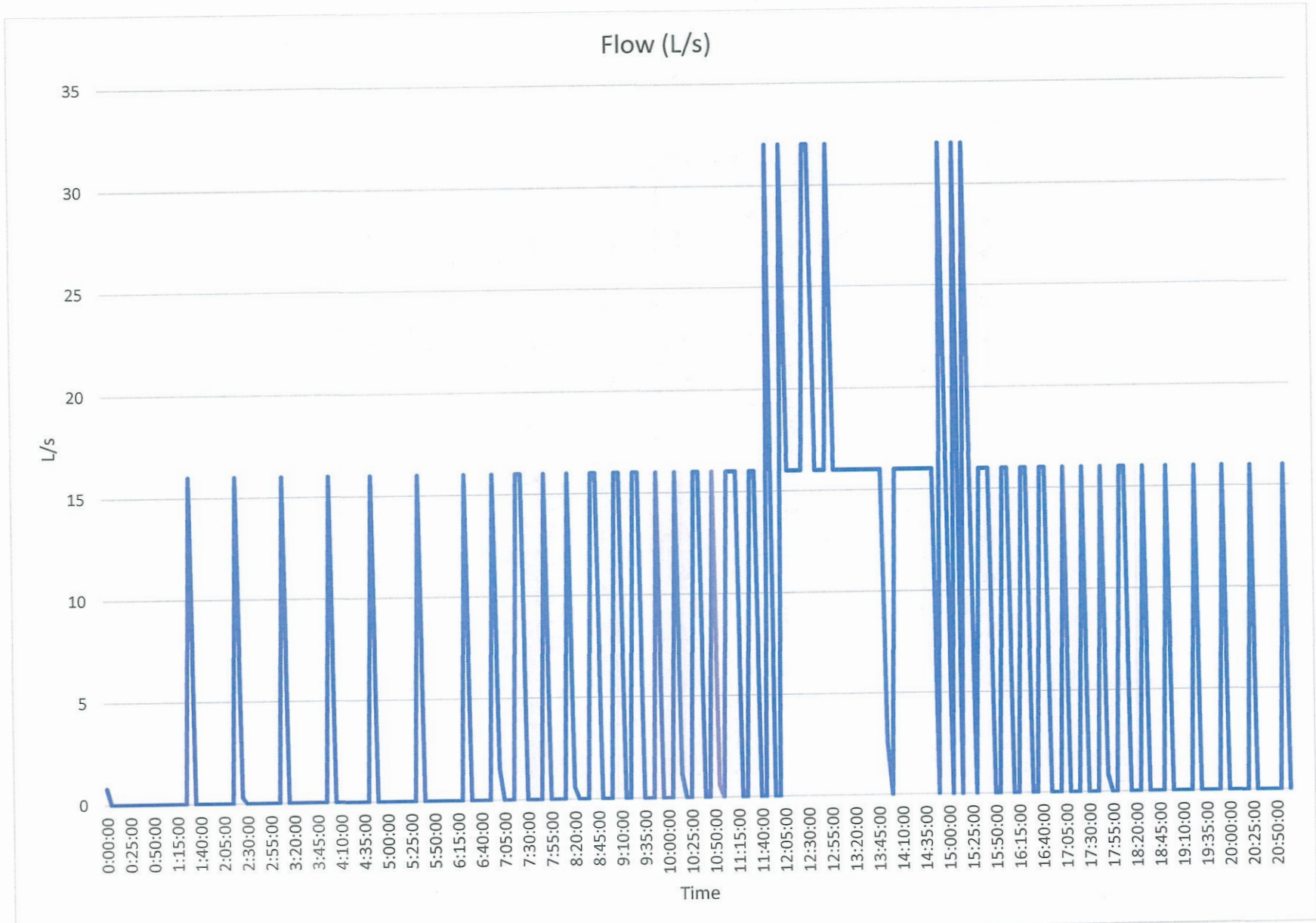


Figure 15: Peak wet weather outflow from Lake Hayes #2 PS using 2028 Growth Model (No Waterfall Park Development)

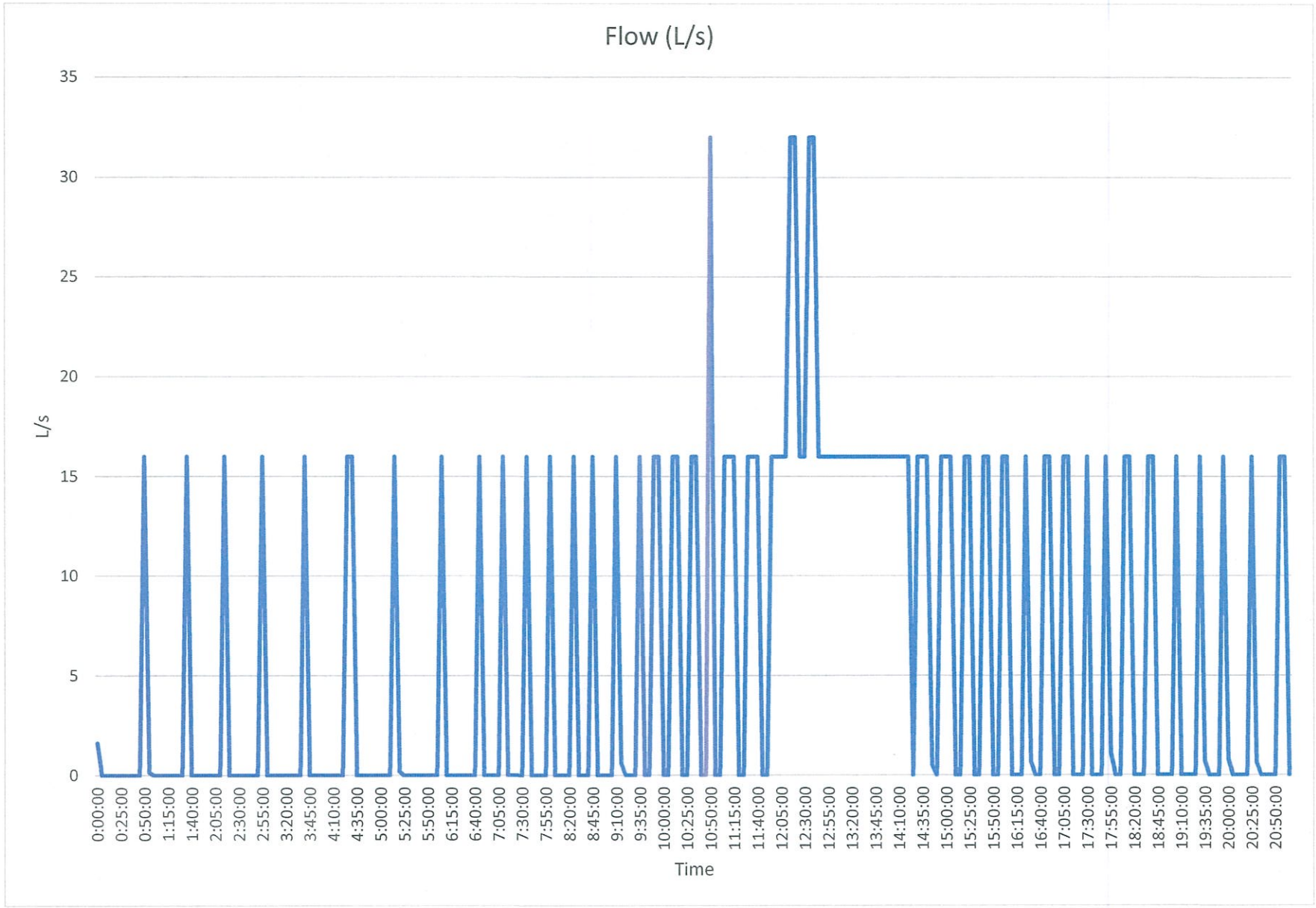


Figure 16: Peak wet weather outflow from Lake Hayes #2 PS using 2028 Growth Model, and including Waterfall Park Development

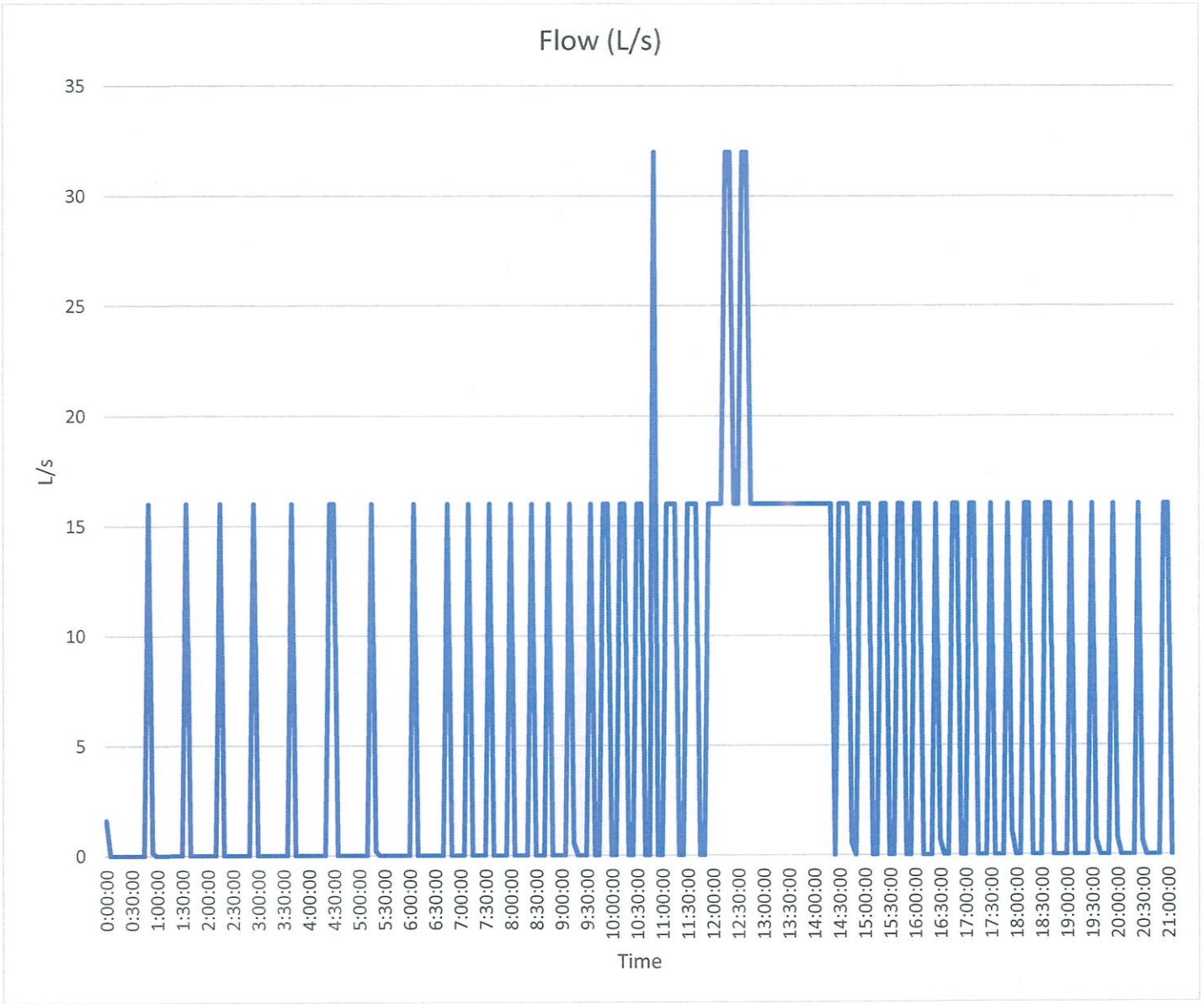


Figure 17: Current peak wet weather outflow from Bendemeer PS

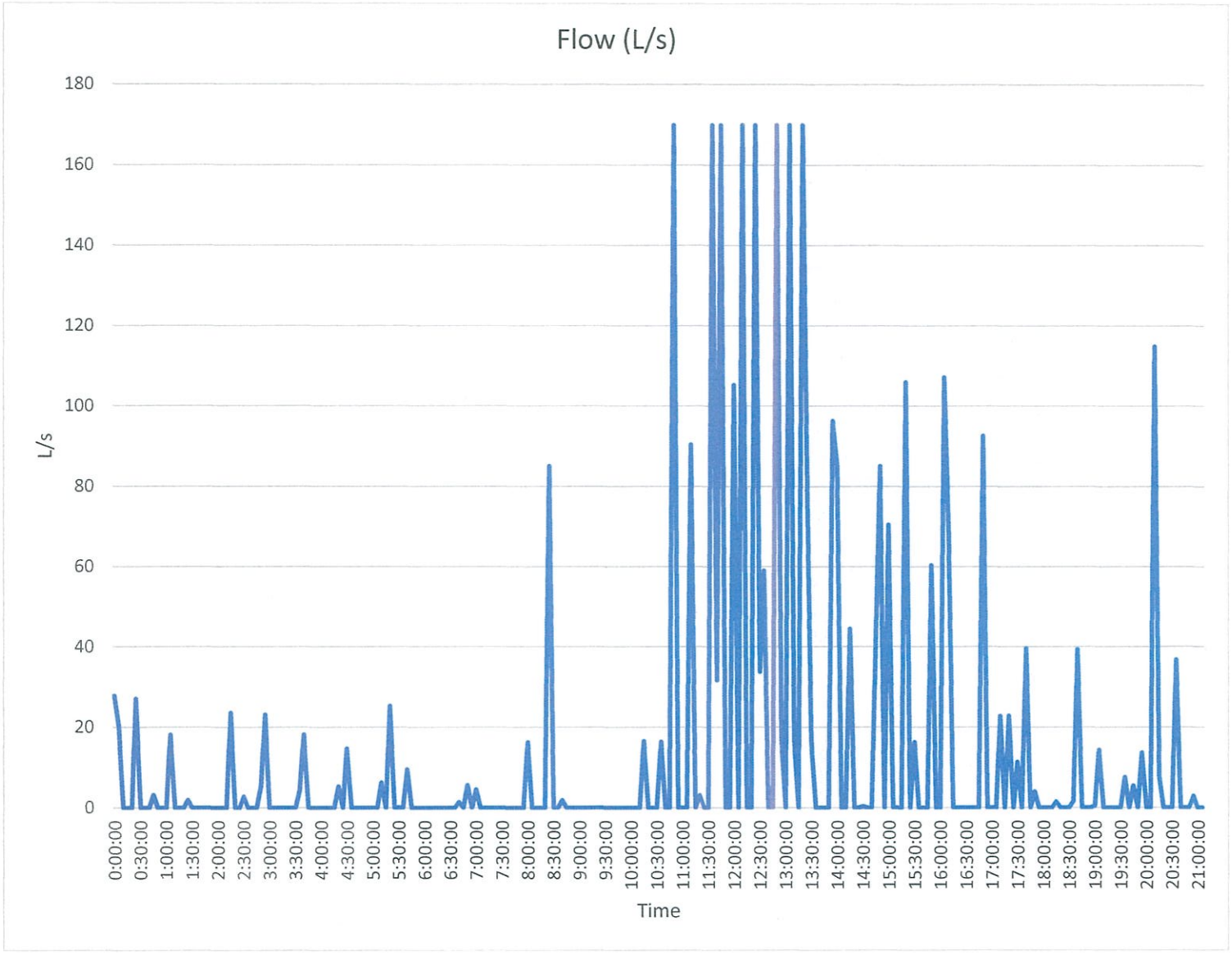


Figure 18: Peak wet weather outflow from Bendemeer PS using 2028 Growth Model (No Waterfall Park Development)

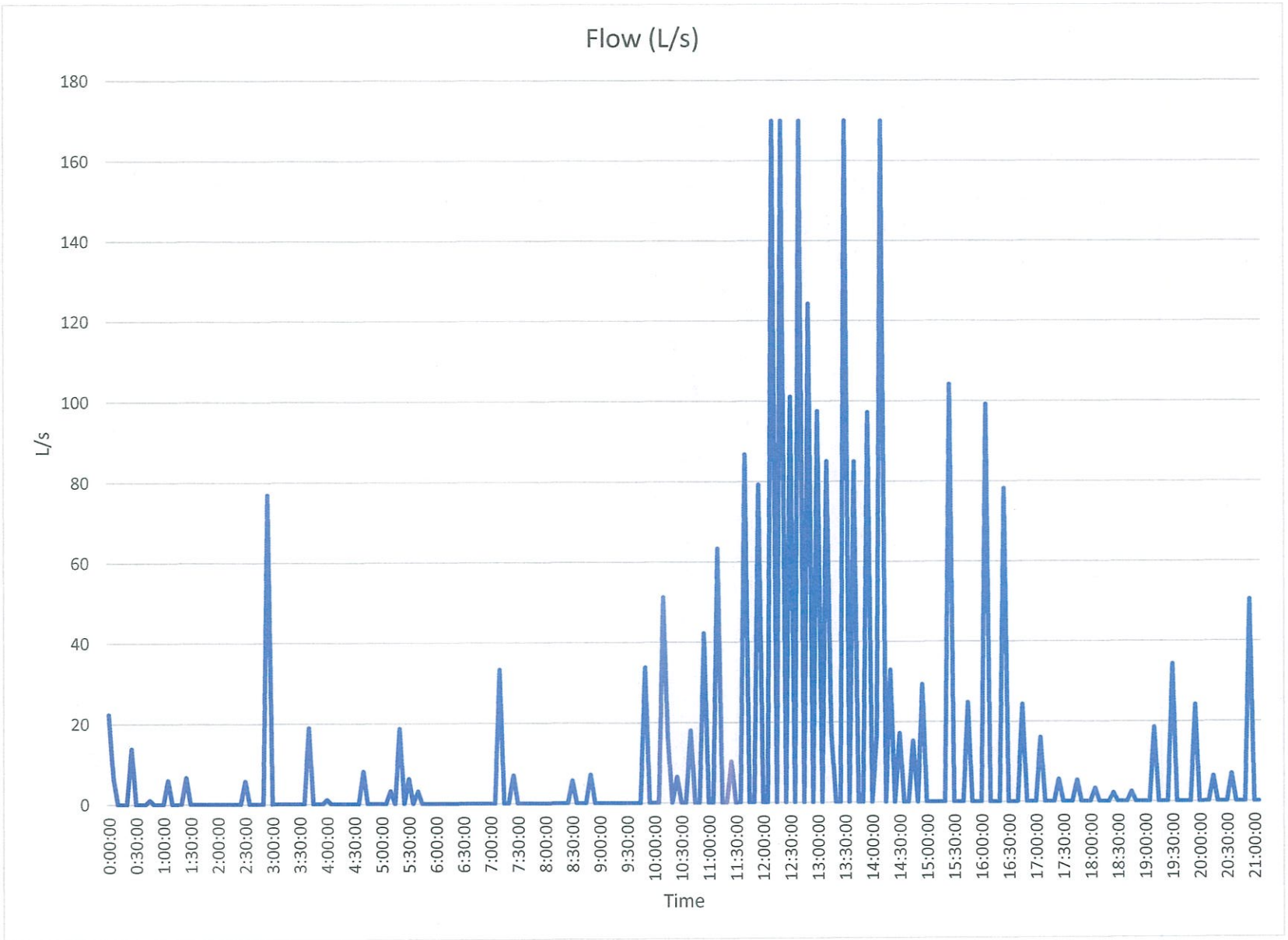
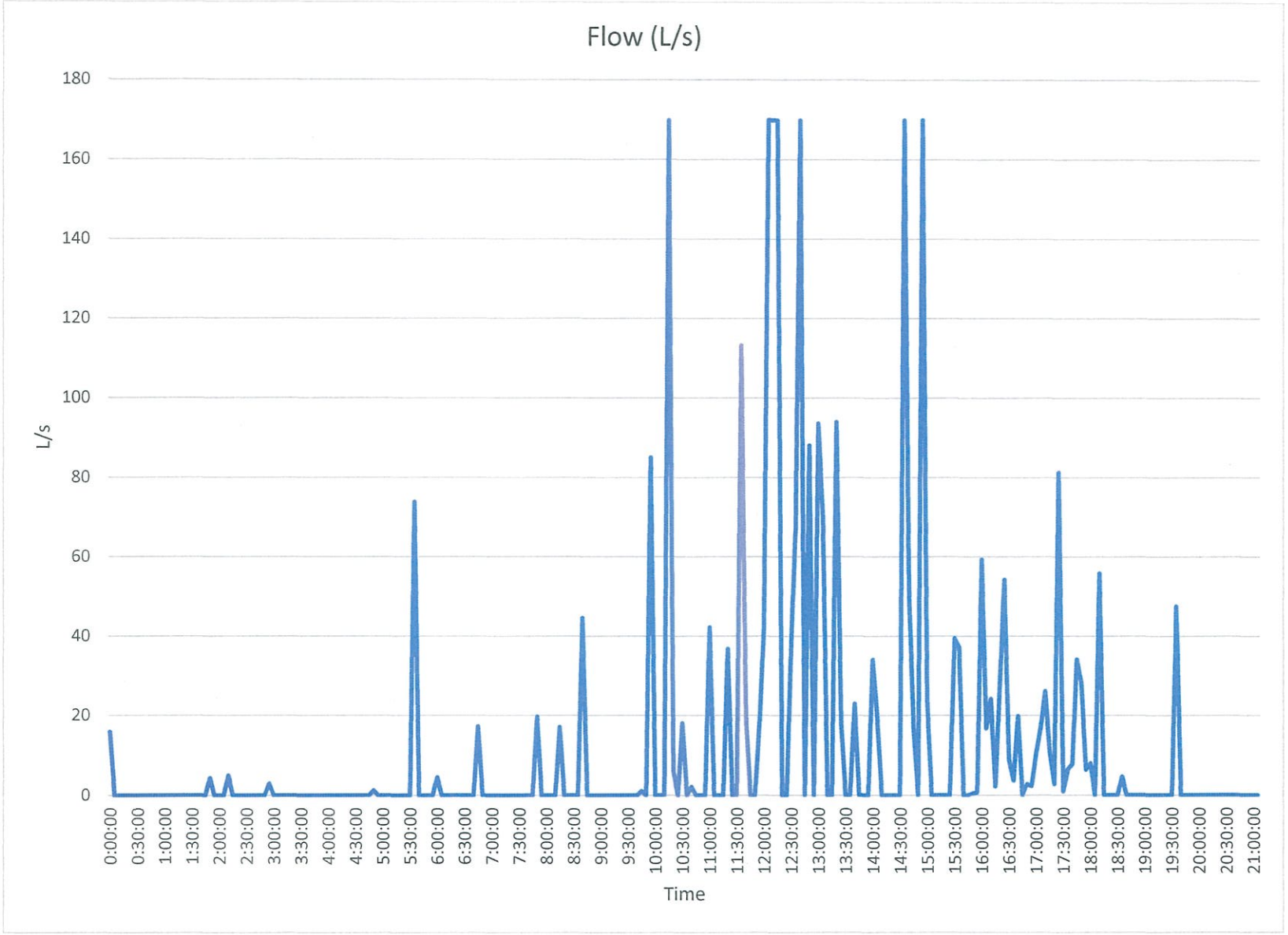


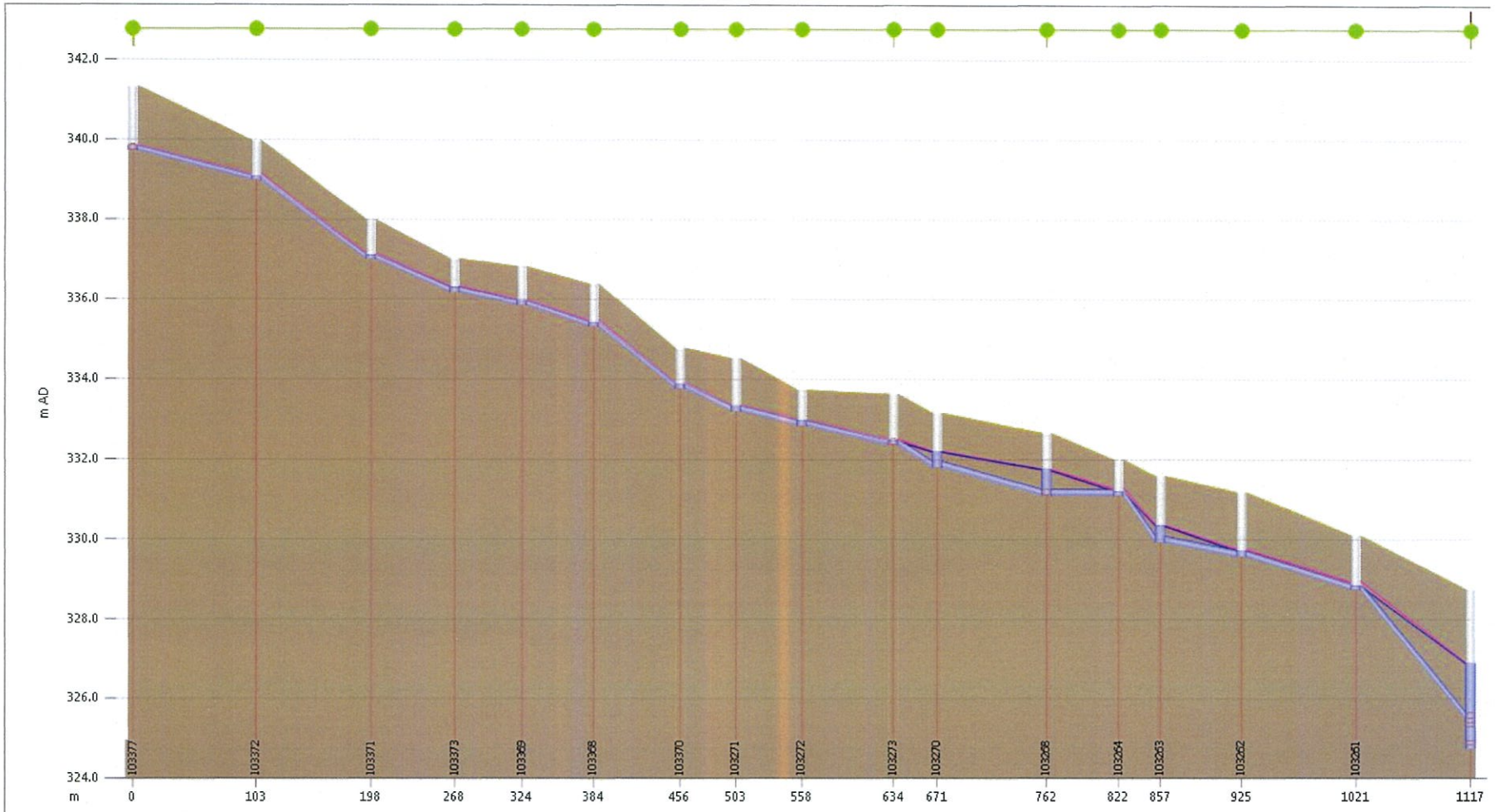
Figure 19: Peak wet weather outflow from Bendemeer PS using 2028 Growth Model, and Including Waterfall Park Development



Appendix D

Long Sections

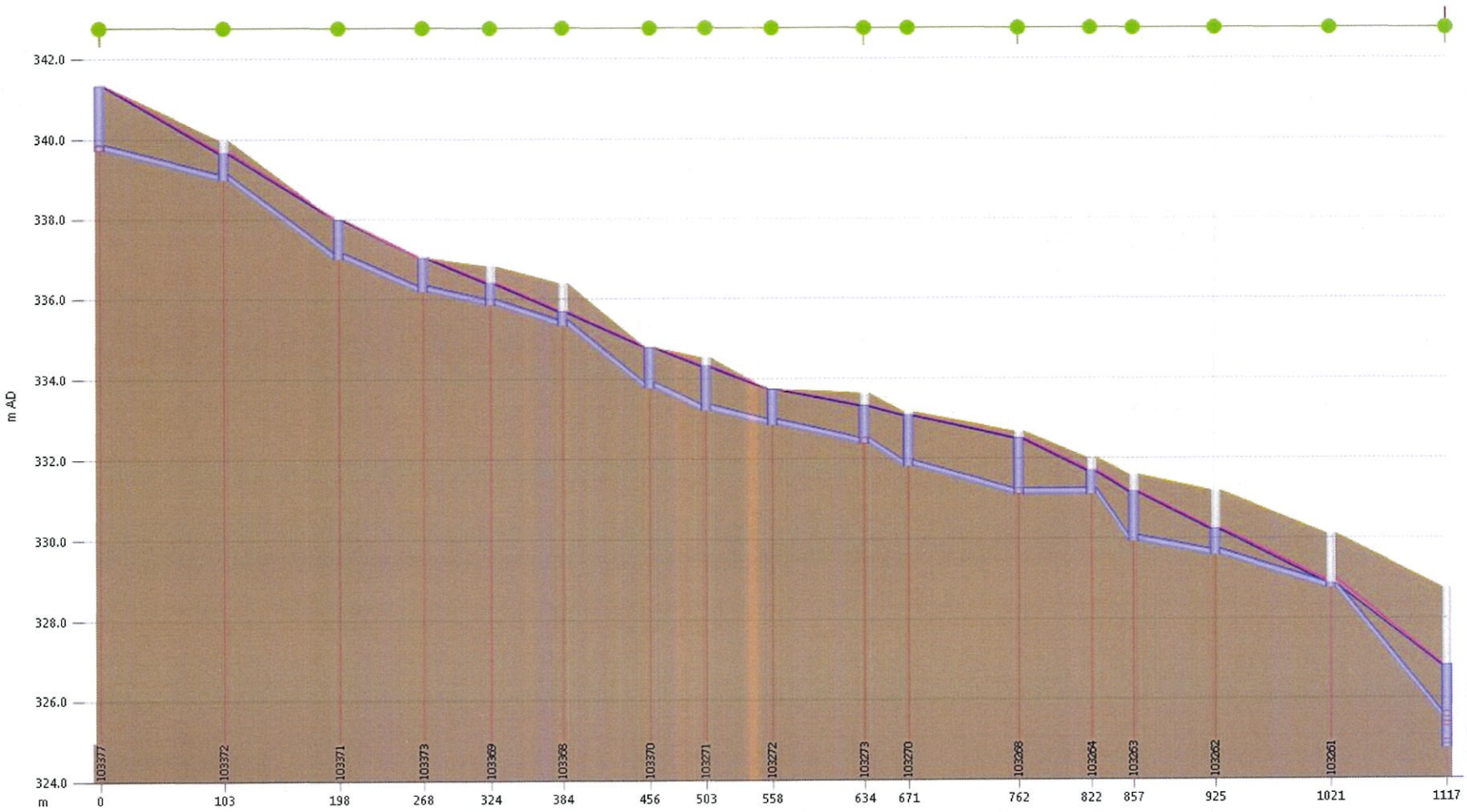
Figure 20: Long Section Upstream of Lake Hayes #1 PS without Development



Link	103377.1	103372.1	103371.1	103373.1	103369.1	103368.1	-	103271.1	103272.1	-	103270.1	103268.1	-	103263.1	103262.1	103261.1
width (mm)	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
us inv (m AD)	339.720	338.990	337.010	336.190	335.860	335.340	333.780	333.220	332.850	-	331.810	331.100	-	329.930	329.580	328.760
ds inv (m AD)	338.990	337.010	336.190	335.860	335.340	333.780	333.220	332.850	332.370	-	331.100	331.100	-	329.580	328.760	325.500

Node	103377	103372	103371	103373	103369	103368	103370	103271	103272	103273	103270	103268	103264	103263	103262	103261	107909
ground (m AD)	341.330	339.970	337.990	337.020	336.820	336.390	334.780	334.520	333.730	333.630	333.160	332.660	-	331.580	331.180	330.100	-
level (m AD)	339.831	339.063	337.103	336.303	335.962	335.414	333.870	333.335	332.966	332.466	332.194	331.749	-	330.344	329.718	328.841	-

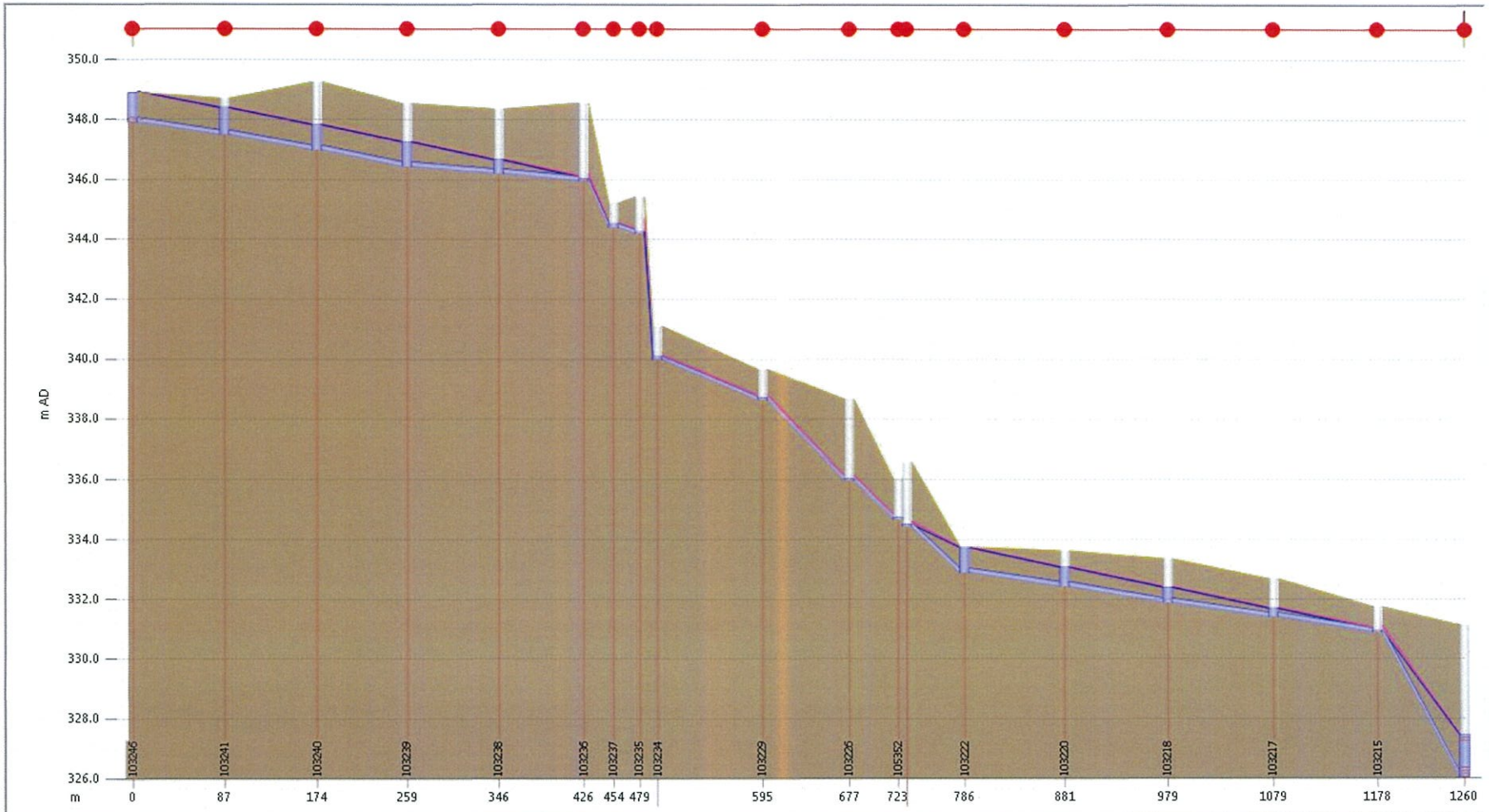
Figure 21: Long Section Upstream of Lake Hayes #1 PS with Maximum Development



Link	103377.1	103372.1	103371.1	103373.1	103369.1	103368.1	-	103271.1	103272.1	-	103270.1	103268.1	-	103263.1	103262.1	103261.1
width (mm)	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
us inv (m AD)	339.720	338.990	337.010	336.190	335.860	335.340	333.780	333.220	332.850	-	331.810	331.100	-	329.930	329.580	328.760
ds inv (m AD)	338.990	337.010	336.190	335.860	335.340	333.780	333.220	332.850	332.370	-	331.100	331.100	-	329.580	328.760	325.500

Node	103377	103372	103371	103373	103369	103368	103370	103271	103272	103273	103270	103268	103264	103263	103262	103261	107909
ground (m AD)	341.330	339.970	337.990	337.020	336.820	336.390	334.780	334.520	333.730	333.630	333.160	332.660	-	331.580	331.180	330.100	-
level (m AD)	341.330	339.652	337.990	337.020	336.400	335.689	334.780	334.314	333.730	333.326	333.076	332.500	-	331.157	330.226	328.854	-

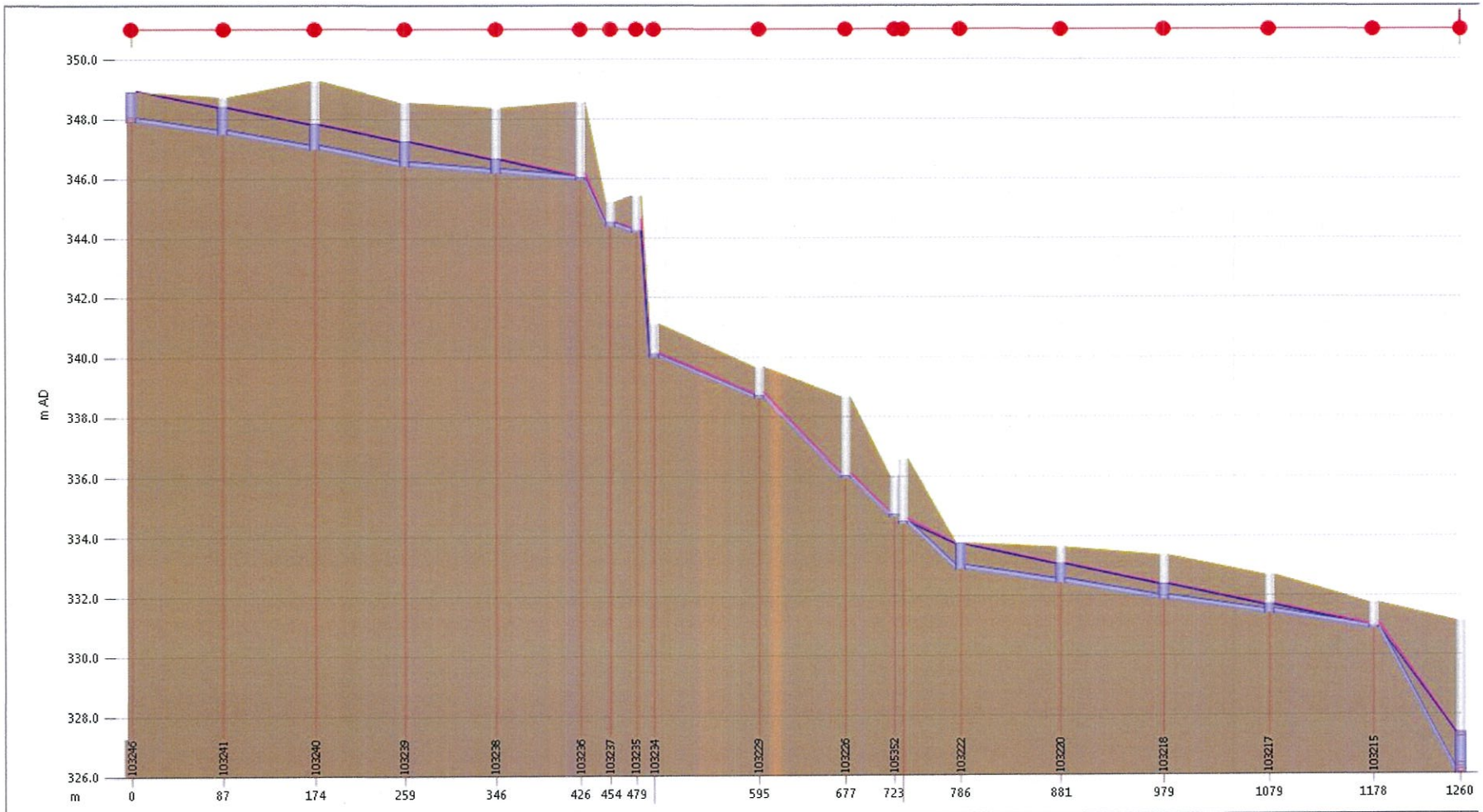
Figure 22: Long Section Upstream of Lake Hayes #2 PS without Development



Link	103246.1	103241.1	103240.1	103239.1	103238.1	-	-	-	103234.1	103229.1	-	105353.1	103222.1	103220.1	103218.1	103217.1	103215.1
width (mm)	150	150	150	150	150	150	150	-	150	150	150	150	150	150	150	150	150
us inv (m AD)	347.910	347.500	346.990	346.440	346.200	-	-	-	340.000	338.650	-	334.420	332.890	332.440	331.880	331.400	330.890
ds inv (m AD)	347.500	346.990	346.440	346.200	345.976	-	-	-	338.650	335.950	-	332.890	332.440	331.880	331.400	330.890	326.030

Node	-	103241	103240	103239	103238	103236	-	-	-	103234	103229	103226	-	-	103222	103220	103218	103217	103215	-
ground (m AD)	-	348.710	349.260	348.540	348.360	-	-	-	-	341.110	339.670	338.670	-	-	333.750	333.620	333.350	332.680	331.750	-
level (m AD)	-	348.398	347.831	347.254	346.657	-	-	-	-	340.110	338.725	336.031	-	-	333.733	333.076	332.393	331.690	330.953	-

Figure 23: Long Section Upstream of Lake Hayes #2 PS with Maximum Development



Link	103246.1	103241.1	103240.1	103239.1	103238.1	-	-	-	103234.1	103229.1	-	105353.1	103222.1	103220.1	103218.1	103217.1	103215.1
width (mm)	150	150	150	150	150	150	150	-	150	150	150	150	150	150	150	150	150
us inv (m AD)	347.910	347.500	346.990	346.440	346.200	-	-	-	340.000	338.650	-	334.420	332.890	332.440	331.880	331.400	330.890
ds inv (m AD)	347.500	346.990	346.440	346.200	345.976	-	-	-	338.650	335.950	-	332.890	332.440	331.880	331.400	330.890	326.030

Node	-	103241	103240	103239	103238	103236	-	-	103234	103229	103226	-	-	103222	103220	103218	103217	103215	-
ground (m AD)	-	348.710	349.260	348.540	348.360	-	-	-	341.110	339.670	338.670	-	-	333.750	333.620	333.350	332.680	331.750	-
level (m AD)	-	348.399	347.831	347.254	346.657	-	-	-	340.110	338.725	336.031	-	-	333.735	333.078	332.394	331.691	330.953	-

APPENDIX B

Wastewater Modelling Report Addendum

WATERFALL PARK DEVELOPMENT: WASTEWATER NETWORK ASSESSMENT

To:	Richard Powell	Queenstown Lakes District Council (QLDC)
Distribution:	Jayne Richards	Fluent Solutions (FS)
From:	Brian Robinson; Rebecca Ellmers (HAL)	
Subject:	Waterfall Park Development – Wastewater Network Assessment	
Date:	16 January 2019	

1 Introduction

1.1 Objective

The objective of this study is to utilise the existing hydraulic model (Wakatipu Wastewater Model with HAL updates, 2018) of the Queenstown, Arrowtown and Lake Hayes wastewater network to assess the impact of the proposed Waterfall Park development on the wastewater network.

1.2 Background

The Waterfall Park development proposal seeks to discharge a maximum flow rate of 23.4 l/s to the existing network. The initial hydraulic modelling carried out by BECA (Waterfall Park Development Wastewater Modelling, 2018) considered a number of private pump station scenarios at various connection points to the existing network. The development consultant has since requested further assessment of the Waterfall Park development impact.

2 Waterfall Park Development

2.1 Overview

The Waterfall Park development seeks to discharge a maximum PWWF of 23.4 l/s and has considered two potential network connection points as summarized below:

1. Connection to the existing local 150mm network to the south discharging to Lake Hayes #1 Pump Station, and eventually to the Arrowtown-Lake Hayes Pump Station
2. Connection to the existing transmission 300mm gravity/pressure main connecting Norfolk Street Pump Station to the Arrowtown-Lake Hayes Pump Station

The connection point to the existing 150mm network to the south was shown in the assessment undertaken by Beca to result in overflows from the local network upstream of the Lake Hayes #1 pump station. This assessment has focused on the connection point to the existing 300mm gravity/pressure main with a proposed pump rate of 23.4 l/s (i.e. matching expected design flows for the full development.

The location of the development and proposed connection points is shown in Figure 1 below.

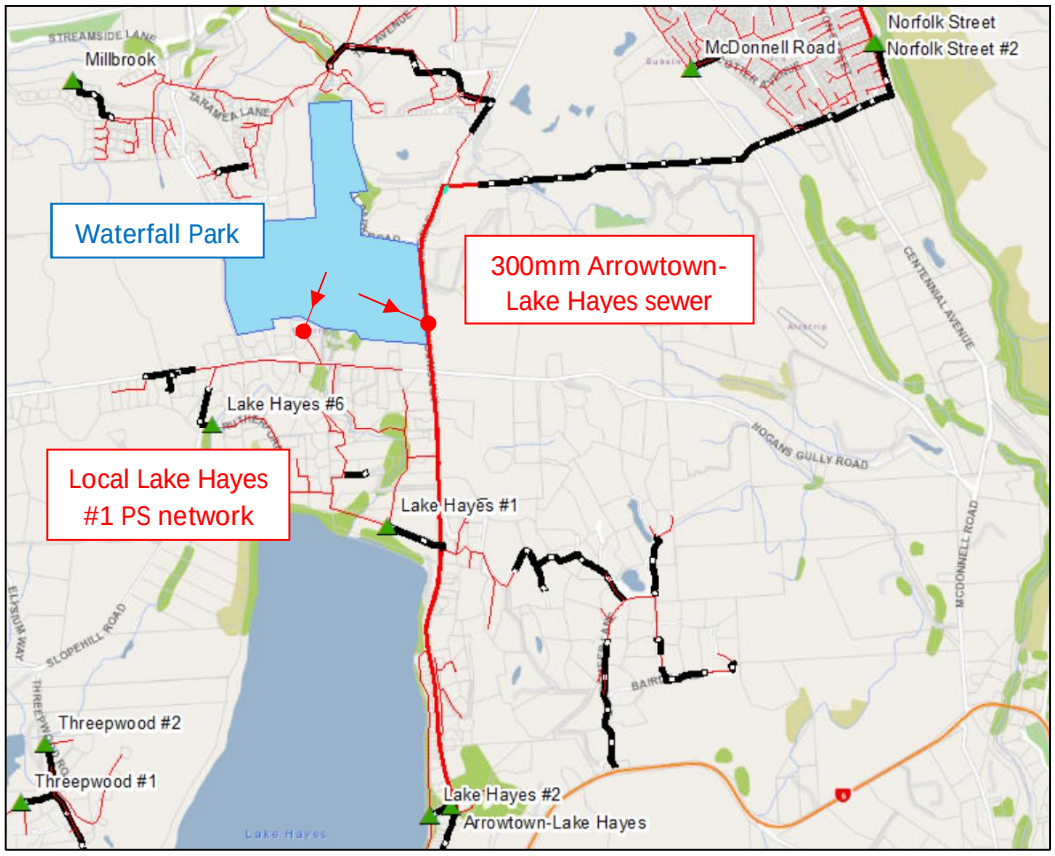


Figure 1: Waterfall Park Development Wastewater Connection

3 Waterfall Park Development Impact

3.1 Proposed Modelling Scenarios

The development consultant Fluent Solutions have since requested further assessment of the Waterfall Park development impact. The initial hydraulic modelling carried out by BECA (Waterfall Park Development Wastewater Modelling, 2018) considered a private pump station with storage and off-peak pumping (assumed to lessen the effect of the development load on the network), with an arbitrary pumped rate of 15 l/s. Fluent Solutions have requested modelling of the maximum proposed development discharge of 23.4 l/s at the Arrowtown-Lake Hayes 300mm connection point (identified as Scenario 3 in the BECA report).

3.2 Scenario 3: Waterfall Park (23.4 l/s) to Arrowtown-Lake Hayes 300mm line

The Wakatipu wastewater model (with 2018 HAL updates included update of pump station capacities) was run under the current (2015) scenario, with and without the proposed Waterfall Park development. The network was assessed against a 5-year ARI design storm to understand the system performance. As shown in the Figure 2 long-section below, the existing network has sufficient capacity in the 300mm Arrowtown-Lake Hayes Wastewater line, discharging to the Arrowtown-Lake Hayes Pump Station.

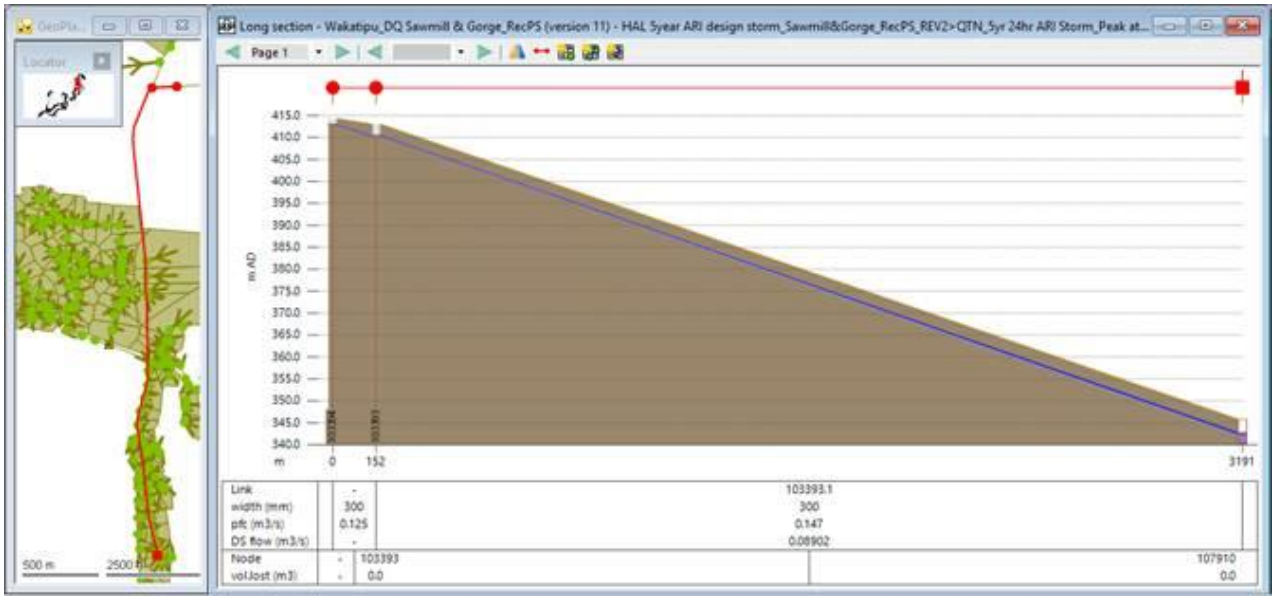


Figure 2: Existing (2015) Long Section (300mm Arrowtown WW line) – 5 year ARI design storm

The additional peak wet weather flows of 23.4 l/s from the Waterfall Park development were added in to the model, with connection to the 300mm Arrowtown-Lake Hayes wastewater line. As shown in the Figure 3 long-section below, the post-development network has adequate capacity within the 300mm line to receive the full peak wet weather flows from the proposed development.

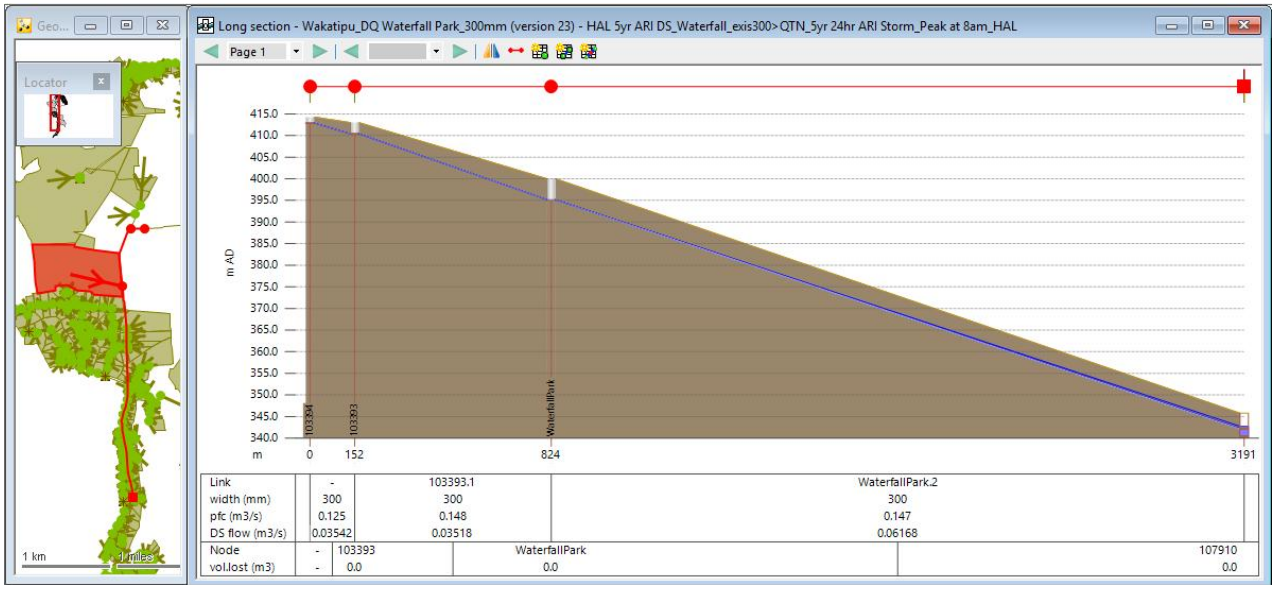


Figure 3: Post Development (2015) Long Section (300mm Arrowtown WW line) with additional Waterfall Park Flows (23.4 l/s) – 5 year ARI design storm

It should be noted that limited information has been made available to date regarding the levels of this 300mm wastewater pipe, with modelled levels taken from QLDC's GIS which just provides invert and ground levels at the upstream end of the pipe (at the confluence with the Norfolk St and Millbrook rising mains) and at the downstream end (at the Arrowtown-Lake Hayes pump station), with no information provided regarding levels at intermediate points along its length. It is understood that this pipeline, whilst generally operating as a gravity pipe, is designed to operate under pressure if flows exceed the on-grade capacity of the pipeline

3.3 Pump Station Assessment – Current Scenario (2015)

The 300mm Arrowtown-Lake Hayes wastewater line conveys flow from the Norfolk Road Pump Station (maximum capacity 70 l/s) and the Millbrook pump station (maximum capacity 24 l/s) to the Arrowtown-Lake Hayes Pump Station. The modelled inflows and outflows for the Arrowtown-Lake Hayes PS post-development scenario are shown in Figure 4 below.

The Arrowtown-Lake Hayes Pump Station has a maximum capacity of 85 l/s with one pump operating (based on QLDC records). In the post-development scenario (with the 23.4 l/s from Waterfall Park connected), the peak modelled inflow to the pump station is 81 l/s in the 5-year ARI design storm (as shown by the red trace). As shown by the yellow trace, the majority of flows entering the pump station are received from the 300mm line and the Waterfall Park development.

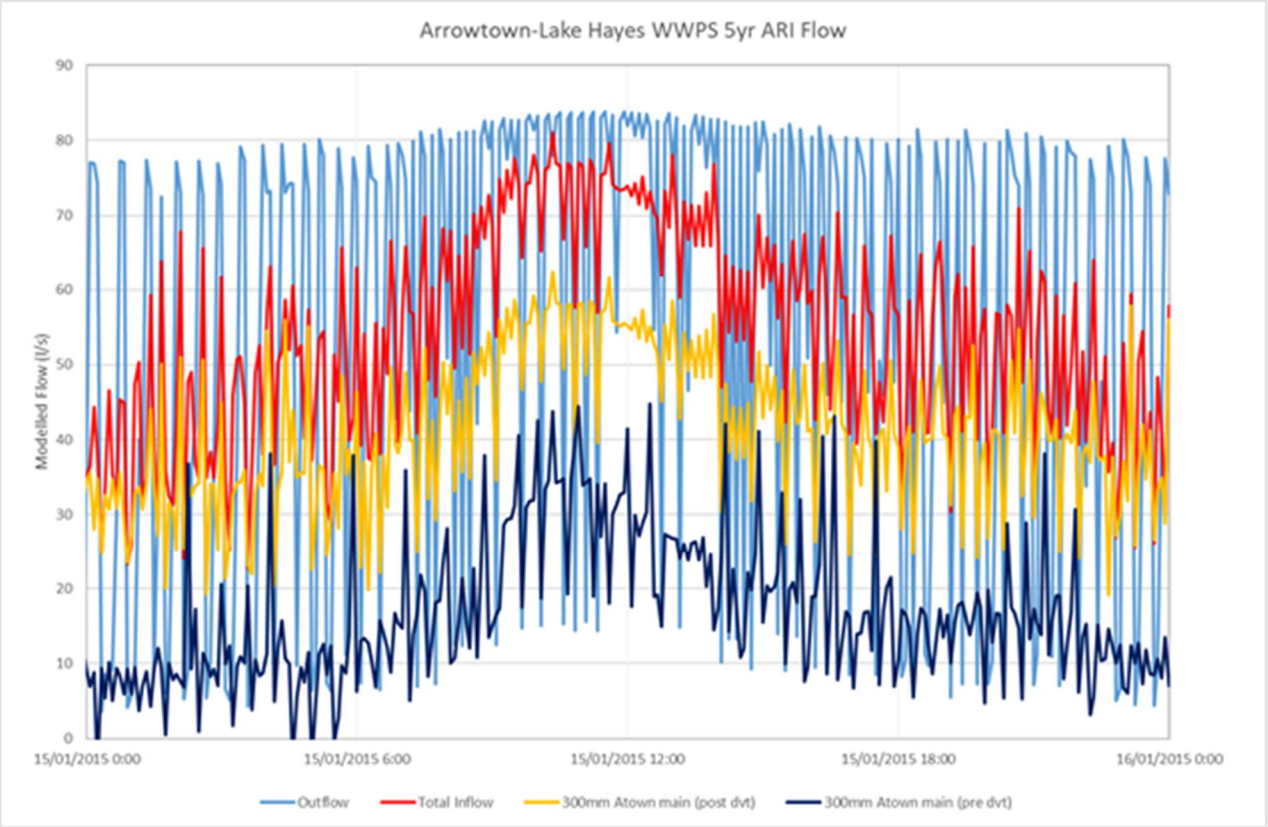


Figure 4: Modelled Arrowtown-Lake Hayes Pump Station flows – 5 year ARI design storm

3.4 Pump Station Assessment – Future Scenario (2055)

Based on a future (2055) population scenario, an assessment was made of the capacities of the relevant pump stations discharging to the Arrowtown-Lake Hayes Pump Station, and can be summarised in the Figure 5 schematic below.

While there is current (2015) capacity in the Arrowtown-Lake Hayes Pump Station for the proposed development, future significant growth in the remainder of the contributing catchment (in addition to the proposed Waterfall Park flow of 23.4 l/s) will likely trigger pump station upgrade requirements.

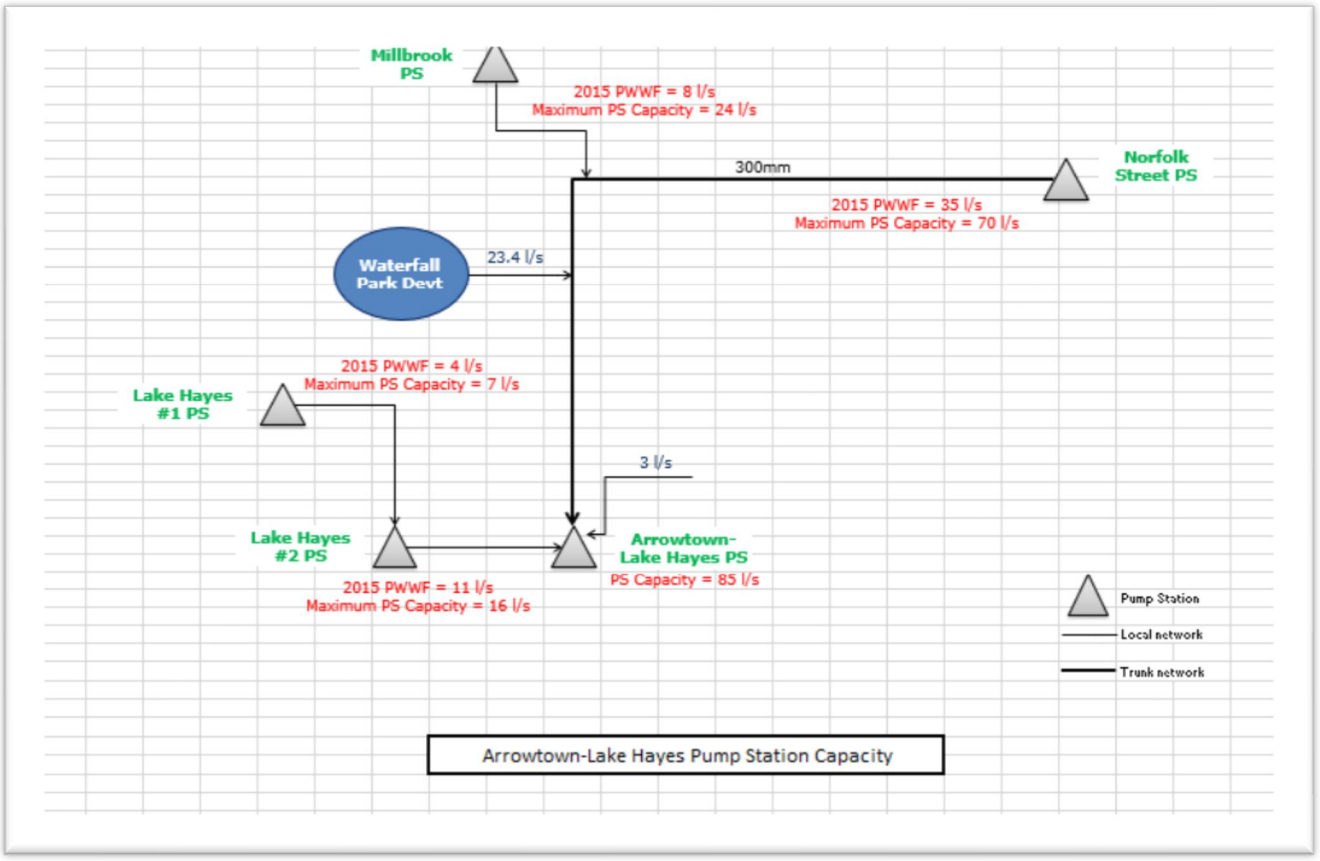


Figure 5: Pump station capacity current (2015) scenario versus theoretical maximum flows

3.5 Pressure at Arrowtown-Lake Hayes 300mm line connection point

In both the current (2015) and future (2055) scenarios, there is sufficient capacity within the 300mm line to receive the additional flows from the Waterfall Park development. Based on the GIS data available, the wastewater line appears to discharges as free flow via gravity (i.e. not pressurized) to the Arrowtown-Lake Hayes Pump Station.

The proposed connection point of the Waterfall Park development to the Arrowtown-Lake Hayes 300mm line has been constructed in the model with an estimated ground and invert level based on existing data. Insufficient level data is available to determine whether there are sections of this pipeline that don't operate under gravity conditions (and hence may operate under pressure), and is recommended as part of the design process for the Waterfall Park development, an assessment is made of actual levels at the proposed connection point to determine whether the pipeline is expected to operate under pressure, and to determine the head that the proposed Waterfall pump station will operate at.

APPENDIX C

Water Modelling Report

MOTT MACDONALD

Queenstown Lakes District Council
Private Bag 50072
Queenstown 9348,
New Zealand

Waterfall Park Development – Water Impact Assessment

19 March 2018

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This letter summarises the results of the assessment undertaken for a proposed development consisting of mixed land use, including a hotel (380 rooms) and a residential development of 125 units (double dwelling). The project is located on the northwest side of Arrowtown-Lake Hayes Rd and Speargrass Flat Rd.

1 Background

In January 2018 Mott MacDonald was commissioned by Queenstown Lakes District Council (QLDC) to assess the system performance in terms of Level of Service (LOS) and firefighting capacity in the proposed development.

In this analysis, the latest Lake Hayes water supply model was used. Three scenarios were investigated, with and without additional demand from the proposed development for existing and future conditions. These are further detailed in the scenarios investigation section of this letter.

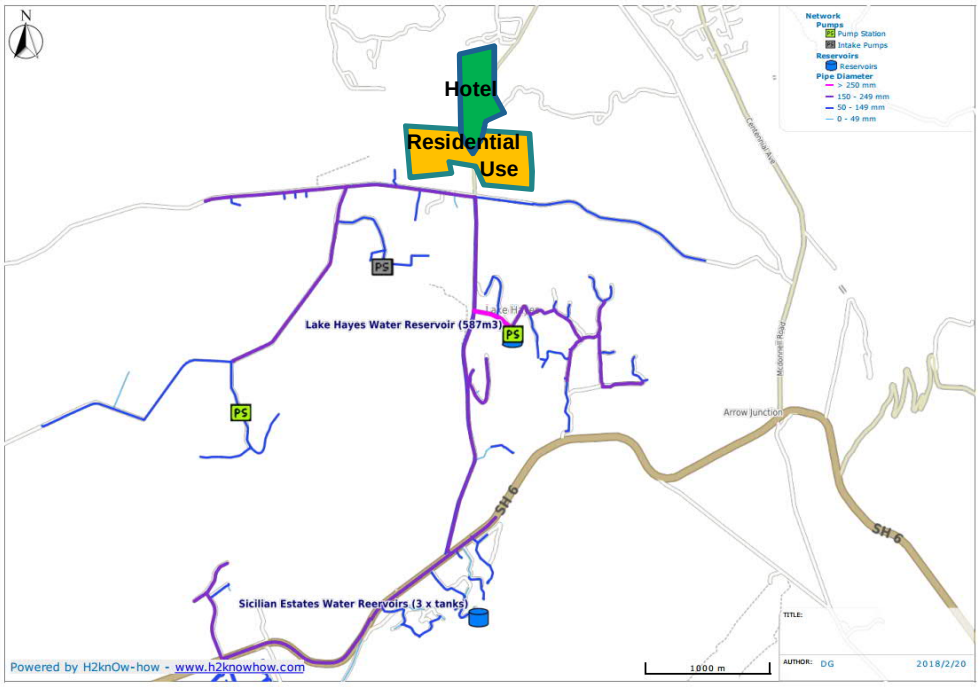

Figure 1 - Proposed Development Location

Mott MacDonald New Zealand
Limited Registered in New Zealand
no. 3338812

MOTT MACDONALD

2 Assumptions

2.1 Demand Calculations

A demand assessment was provided by the client as summarised in Table 1 below. The detailed calculation is attached in appendix.

Table 1 - Demand Calculation

Hotel Facility (Elevation: RL 368m)	
No. Hotel rooms	380
Maximum people per room	2
Peak daily consumption (l/day/room)	440
Peak water demand (m^3/day) - room	167.2
Additional demand (conference centre, restaurant, irrigation, etc) (m^3/day)	205.2
Instantaneous Peak Flow (l/s)	**18.9**

Residential Development (Elevation: RL 367m)	
No. Primary Dwelling (3 people)	125
No. Secondary Dwelling (2 people)	125
Peak consumption Primary Dwelling (l/day/property)	2,100
Peak consumption Secondary Dwelling (l/day/property)	700
Peak water demand (m^3/day)	350
Instantaneous Peak Flow (l/s)	**26.7**

The calculated demand seems conservative when compared to the observed consumption in Queenstown (2000l/property/day) and Lake Hayes (see table below).

Table 2 - Lake Hayes Demands

DMA Zone	Total demand (m^3/day)	Number of connections	Average demand per connection (l/prop/day)
Shotover Country	374	495	756
Lake Hayes Estate	822	596	1379
Lake Hayes	928	421	2204
Bendeemer	17	13	1308
Terraces	25	9	2778
DMAs Combined	**2,166**	**1,534**	**1,412**

As shown in the table above, the proposed development peak day demand is equivalent to a third of the current peak day demand in the entire service area.

2.2 Proposed Connection Point

The minimum and maximum elevations within the proposed development areas of the lots are shown in the table below:

Table 3 - Proposed Development Elevations

	Min elevation in proposed development area	Max elevation in proposed development area
Hotel Development	347.5m (with 4 story hotel building ~12.8m height)	368m (with single story building only)
Residential Development	342m	367m

Overall, the maximum elevation within the lot proposed for the residential development is 423m.

As suggested by the developer, it was assumed that the proposed development would be connected to the 235 mm ID main at the Arrowtown-Lake Hayes Rd and Speargrass Flat Rd junction. Figure 2 below shows the development location, and the proposed network and connection point considered in this study.

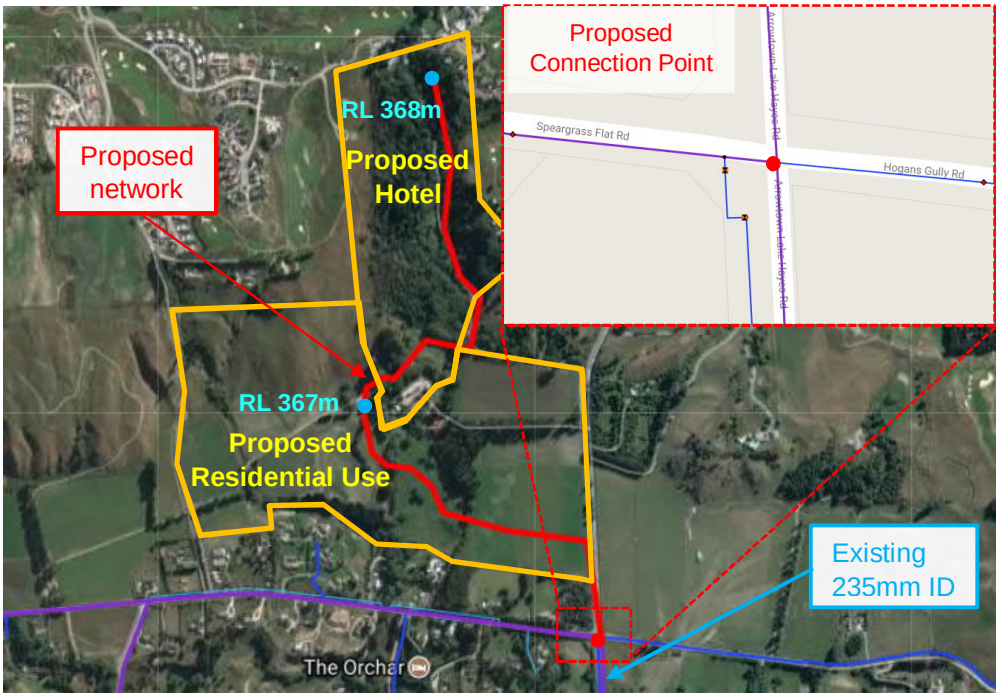

Figure 2 – Proposed Development Location, Network and Connection Point

3 Scenario Investigated

Three scenarios were investigated, including the above demand and the current network operations:

- Existing peak day scenario.
- 2028 peak day scenario.
- 2058 peak day scenario.

Planned upgrades along Frankton Ladies Mile Highway were included in the future 2028 and 2058 scenarios.

To ensure head losses in the proposed network remain between 1 and 3 m/km (recommended head losses for pipeline design), it was assumed that the proposed development would be serviced through a 260mm (ID) pipe connected to the supply point. The proposed network layout was provided by the client and is attached in appendix.

Two elevation points were included, one for the hotel (max. elevation:368m) and one for the residential development (max. elevation:367m). Respective demands were assigned to each point.

Fire flow capacity was assessed based on FW2 requirement plus sprinklers flow of 16.6l/s, as defined by the client.

4 Model Results

4.1 System Performance Analysis in the Proposed Development

This section describes the results of the system performance analysis undertaken for the above scenarios after including the proposed development demands. Results have been analysed to verify whether levels of service can be met in the proposed development without any network modification. The table below summarises the results in terms of minimum and maximum pressure, maximum head losses in the proposed network (260mm pipe) and fire flow capacity.

Table 4 - Minimum Pressure and Maximum Head Losses in Proposed Development

Scenario	Minimum Pressure (m)	Maximum Pressure (m)	Maximum Head Losses (m/km)	Fire Flow
Existing	60.9	97.1	3.0	Can meet residential fire flow (FW2 –25 l/s + 16.6l/s sprinklers flow)
2028	59.9	97.1		
2058	58.0	97.0		

The normal operating pressure set by QLDC addendum to NZS4404:2004 (Development ad Subdivision Engineering Standards) is 30 to 90m. As shown in the table above, minimum pressure in the proposed development is predicted to meet the recommended LOS for all scenarios. However, pressures higher than the recommended LOS are predicted in areas below 349m.

FW2 fire flow was tested at the end of the proposed 260mm (ID) line. The model predicts that residential fireflow (FW2 – 25l/s) plus the sprinkler flow required can be provided with a residual pressure of 47m at RL 368m.

The highest elevation that would be serviceable for the residential development is 395m. Recommended LOS in terms of pressure and fire flow are predicted to be met up to this point.

4.2 System Performance Analysis in the Remaining of the Network

The section below describes the results of the system performance in the remaining of the Lake Hayes network. Results have been analysed to assess the effect of the proposed development for each scenario.

Figure 3 to Figure 8 below show the system performance for current operational conditions, including current, 2028 and 2058 peak demand.

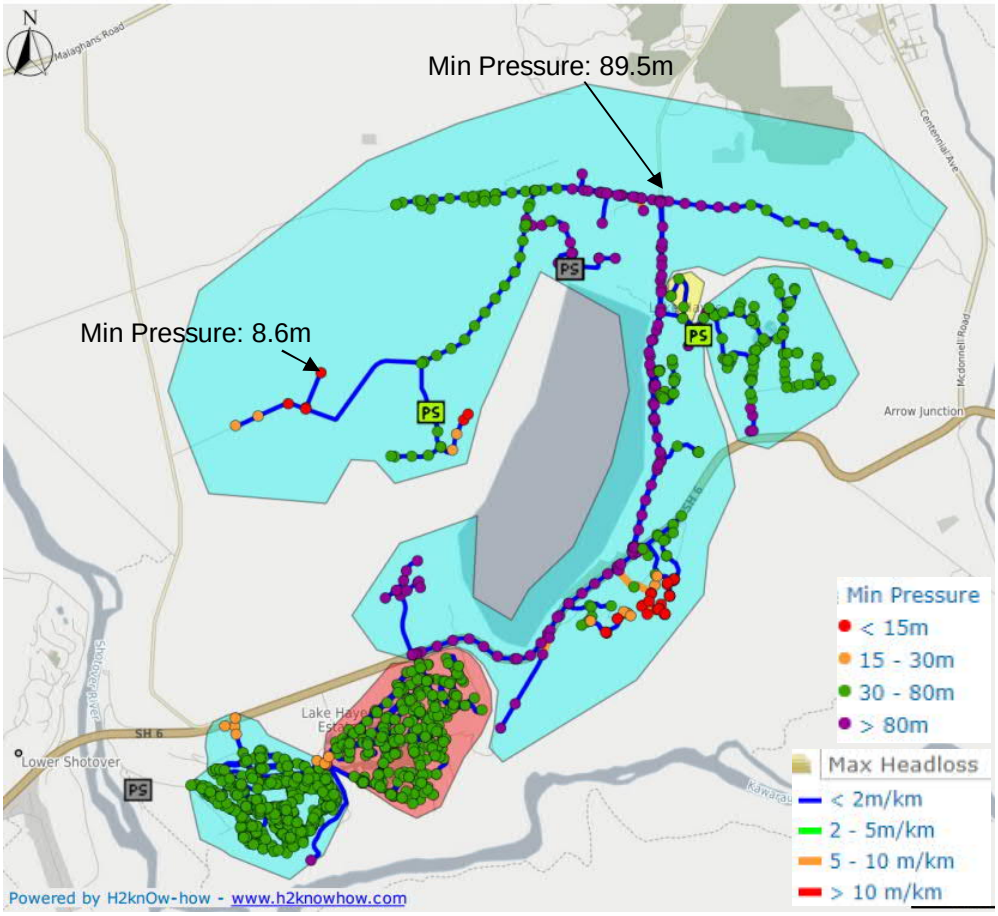

Figure 3 – Current Peak Day System Performance – Prior Development

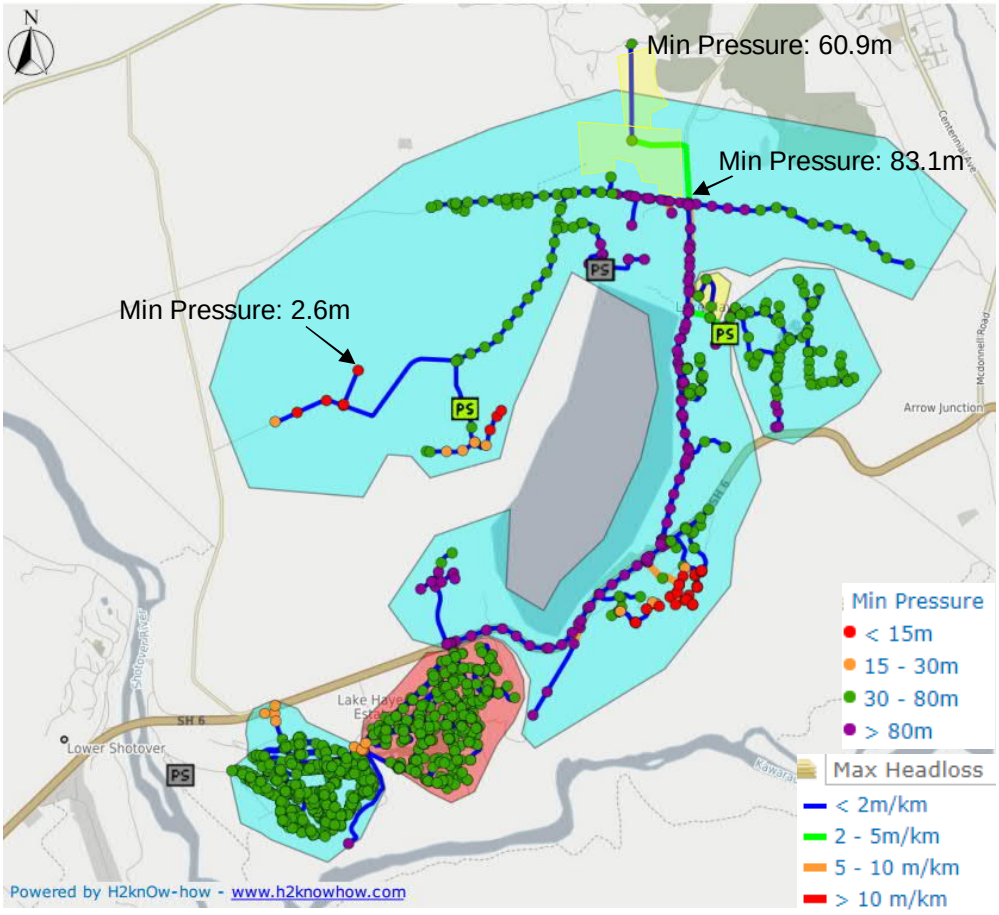

Figure 4 – Current Peak Day System Performance - Post Development

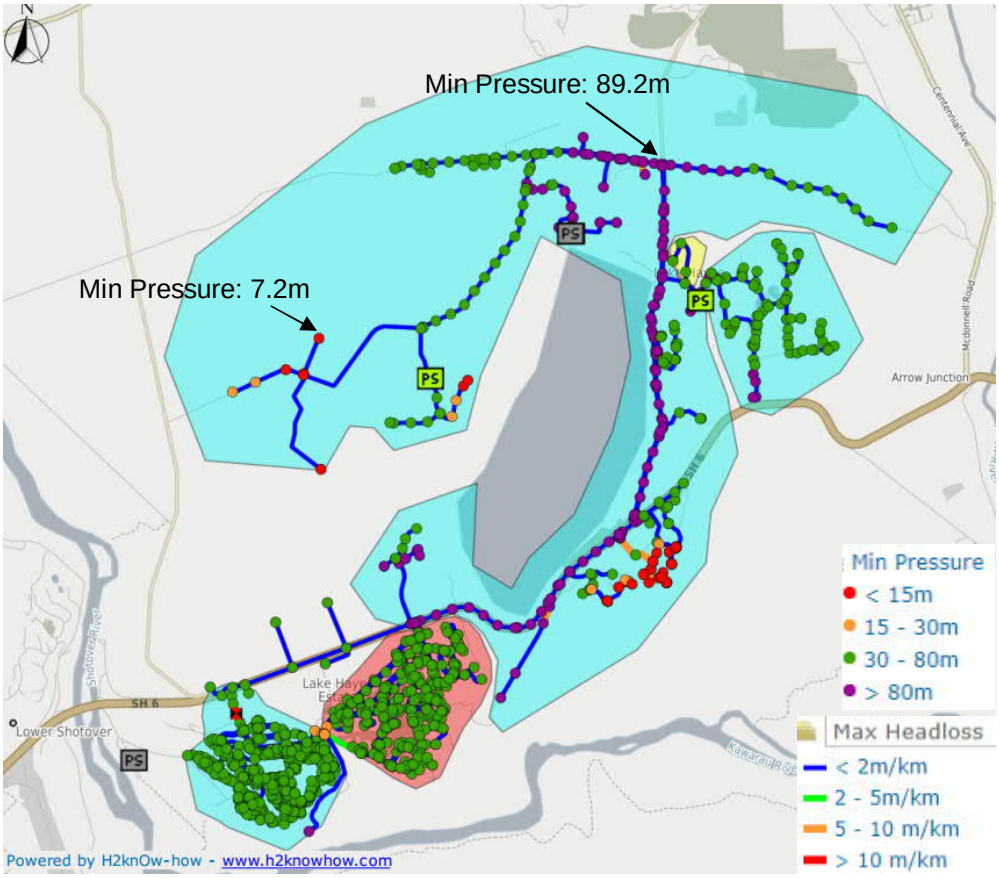

Figure 5 - 2028 Peak Day System Performance - Prior Development

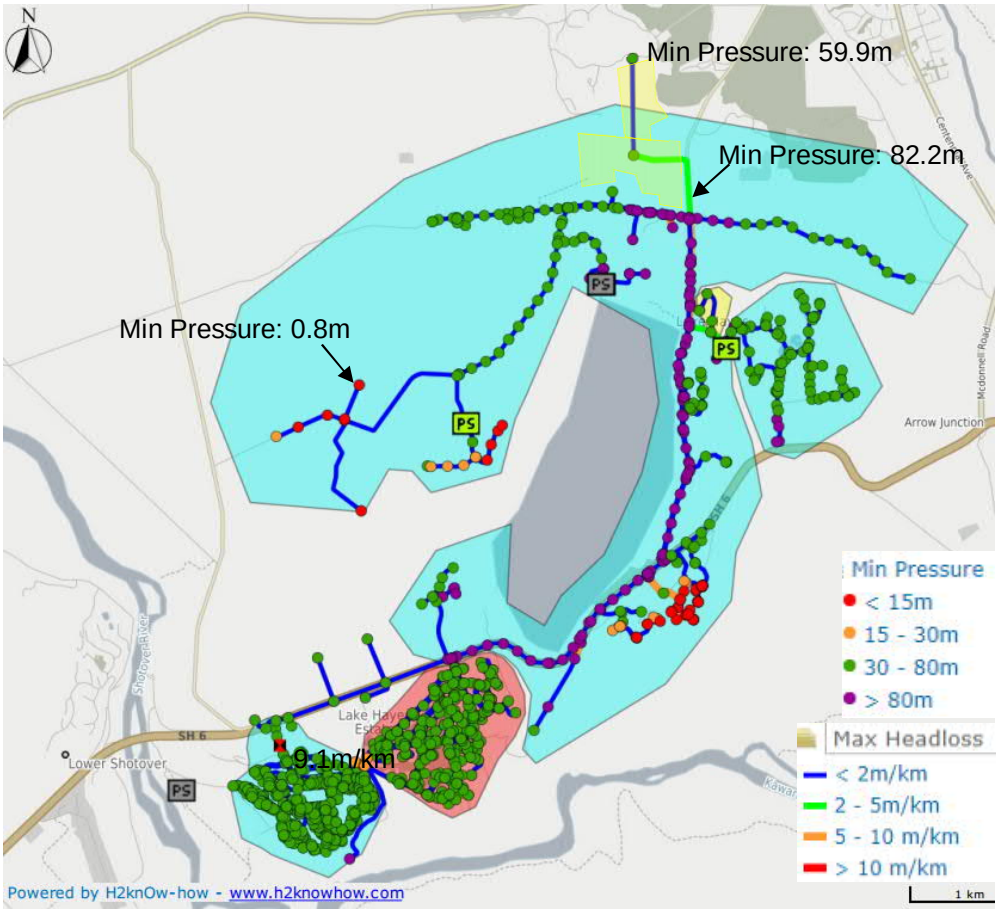

Figure 6 - 2028 Peak Day System Performance - Post Development

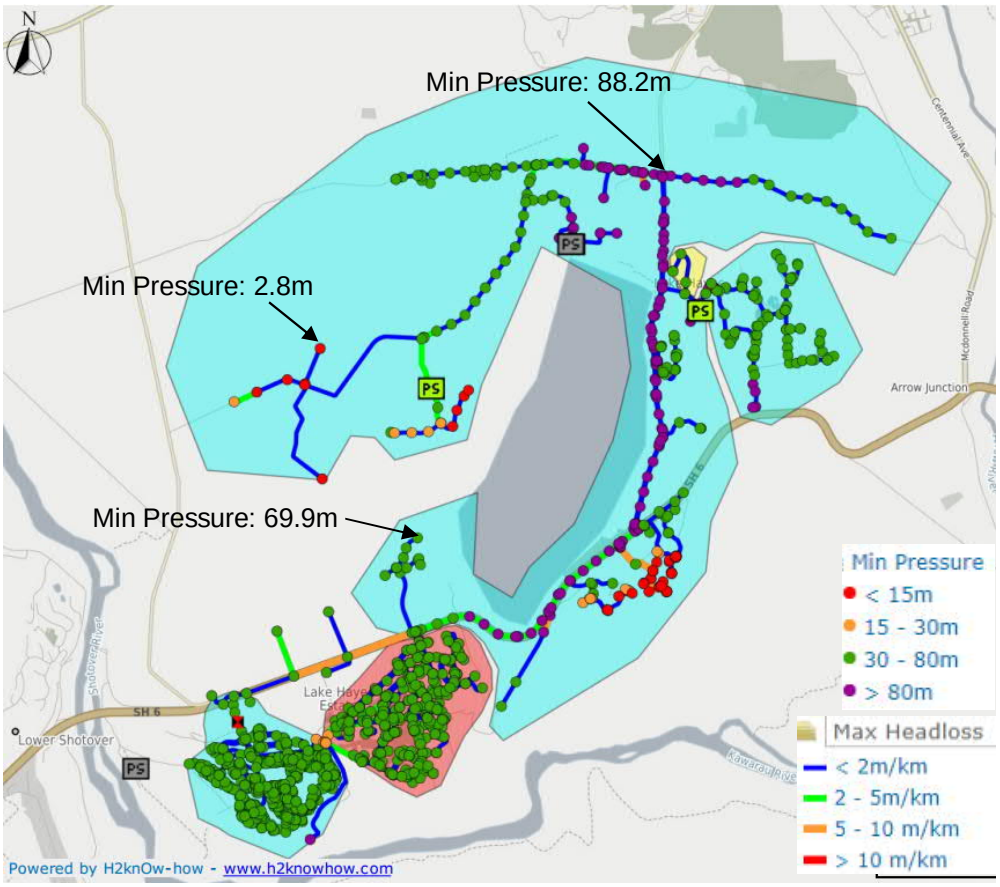

Figure 7 - 2058 Peak Day System Performance - Prior Development

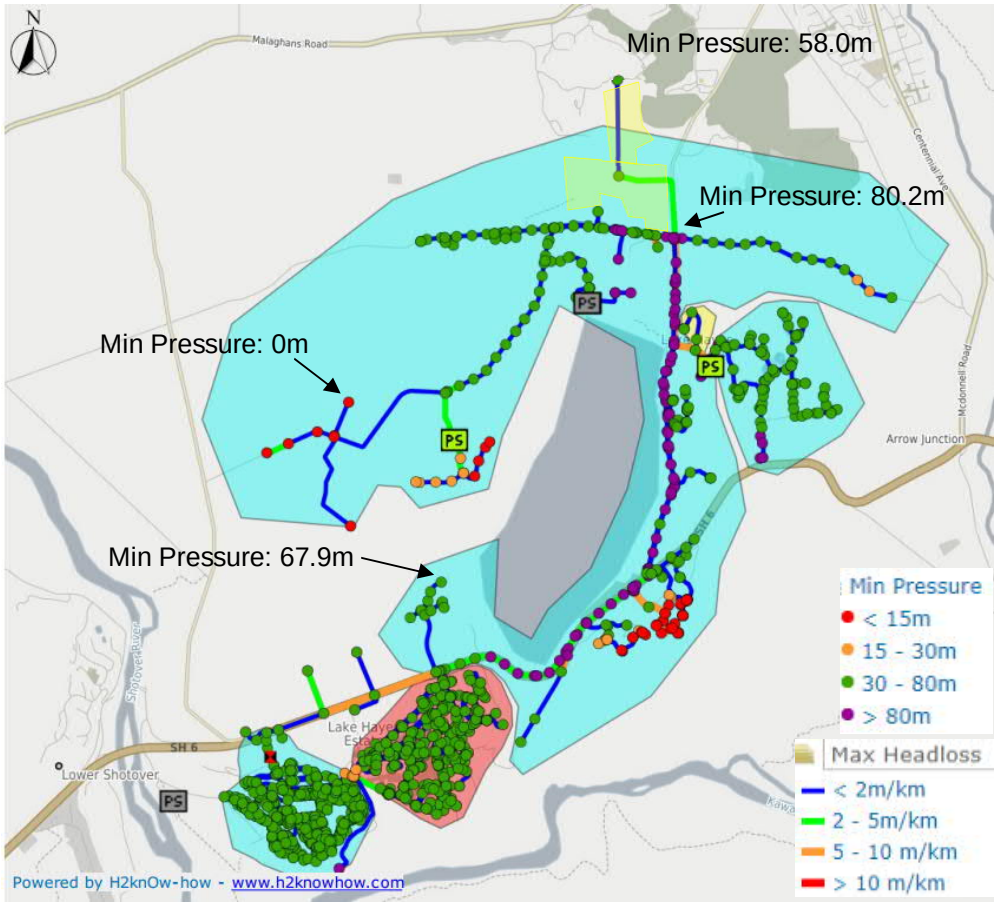

Figure 8 - 2058 Peak Day System Performance - Post Development

The table below summarises the maximum head losses in the existing 235mm ID pipe along Arrowtown Lake Hayes Rd and the minimum pressure forecasted at the supply point, before and after the proposed development:

Table 5 - Minimum Pressure at Supply Point

Demand	Min pressure before development (m)	Min pressure after development (m)	Pressure drop (m)
Current Peak Day	89.5	83.1	6.4
2028 Peak Day	89.2	82.2	7.0
2058 Peak Day	88.2	80.2	8.0

Table 6 - Maximum Head Losses in 235mm ID Pipe

Demand	Max head losses before development (m/km)	Max head losses after development (m/km)	Head losses increase (m/km)
Current Peak Day	0.4	6.0	5.6
2028 Peak Day	0.6	6.6	6.0
2058 Peak Day	1.1	7.8	6.7

As shown in the pictures and above tables, the proposed development is predicted to have a noticeable impact on the remaining of the water network with a maximum pressure drop of 8.0m. Pressures are generally high along Arrowtown Lake Hayes Rd and Speargrass Flat Rd, so pressure remains well above the recommended LOS in this area, for current and future scenarios. However, pressures below the recommended LOS are predicted in the properties located in the elevated areas of Slope Hill Rd and Threewood Rd. This is an existing LOS issue that needs to be addressed.

Head losses are predicted to increase by up to 6.7m/km reaching 7.8m/km in the 235mm (ID) along Arrowtown Lake Hayes Rd due to the additional demand. The predicted head losses exceed the recommended LOS, 5m/km. This LOS issue needs to be addressed.

5 Conclusions and Recommendations

Demand from the proposed Waterfall Park development has been added to the network for the current, future 2028 and 2058 peak day models to determine if suitable levels of service could be obtained.

Levels of service are expected to be met in terms of minimum pressure and head losses in the proposed development, however pressures higher than the recommended LOS are predicted in areas below 349m. The model predicts that fireflow requirements (FW2 – 25l/s and 16.6l/s sprinklers flow) can be provided with a residual pressure of 47m at RL 368m, for current and future scenarios. The highest elevation that would be serviceable for the residential development is 395m.

The system performance in the remaining of the network has been verified. The proposed development is predicted to cause a maximum pressure drop of 8m at the connection point. Since pressures are high in this area recommended LOS can still be met in terms of pressure. However, pressures dropping to zero are predicted in 2058 in properties located in the elevated areas of Slope Hill Rd and Threewood Rd due to the additional demand. These areas already experience pressures below the recommended LOS, the additional demand causes the pressure to deteriorate even further.

Maximum head losses greater than 5 m/km are predicted along Arrowtown Lake Hayes Rd for all scenarios. This system performance issue is related to the additional demand, the proposed development impact needs to be mitigated.

Diana Galindo
Hydraulic Engineer
diana.galindo@mottmac.com

Revision	Date	Originator	Checker	Approver	Description
A	23/02/2018	Diana Galindo	Julie Plessis	Julie Plessis	Draft for client review
B	19/03/2018	Diana Galindo	Julie Plessis	Julie Plessis	Draft for client review
C	30/05/2018	Diana Galindo	Nasrine Tomasi	Nasrine Tomasi	Final

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6 Appendix - Demand Calculation and proposed Pipe Layout

Waterfall Park Water Demand Estimate Summary

Table 1: Waterfall Park Hotel Complex - Water Demand Estimate

Hotel facility	No. Facilities	Max no. People / Facility	Average Daily Water Demand (L/p/d)	Average Daily Water Demand (m3/day)	Average Daily Water Demand (L/s)	Peak Hour Peaking Factor	Peak Hour Demand (L/s)	Peak Day Peaking Factor	Peak Day Demand (L/s)	Comment / Reference
Hotel Room	380	2	220	167.2	1.94	6.6	12.77	3.30	6.39	*AS/NZS 1547:2012, Table H4.*
Conference Centre	1	600	30	18	0.21	6.6	1.38	3.30	0.69	*Metcalfe and Eddy, Table 3-2. Wedding can occur at same time as conference*
Restaurants	1	1520	30	45.6	0.53	6.6	3.48	3.30	1.74	*AS/NZS 1547:2012, Table H4. Restaurants can seat 270 people. Assume hotel full (760 people) asssume each person eats two meals at hotel, total no. diners = 1520 over a day*
Lounge Bar and bar	1	250	20	5	0.06	6.6	0.38	3.30	0.19	*AS/NZS 1547:2012, Table H4. Lounge and bar can accommodate 115 people, assume 250 people max over a day*
Chapel / wedding venue	1	100	40	4	0.05	6.6	0.31	3.30	0.15	*Assume 40L/guest. Wedding can occur at same time as conference.*
Wellness centre - pool, gym, spa	1	100	40	4	0.05	6.6	0.31	3.30	0.15	*Metcalfe and Eddy Table 3-4 for swimming pools. Assume pool is filled overnight when irrigation is not running.*
Non residential staff	1	120	30	3.6	0.04	6.6	0.28	3.30	0.14	*AS/NZS 1547:2012, Table H4.*
Irrigation demand	1	n/a	n/a	125	1.45	n/a	n/a	n/a	4.35	*Based on calculated irrigation requirements with irrigation over an eight hour period overnight*
Total				**372.59**	**4.31**		**18.90**		**13.80**	

Table 2: Waterfall Park Residential Development - Water Demand Estimate

Hotel facility	No. Dwellings	No. people/ dwelling	Average Daily Water Demand (L/p/d)	Average Daily Water Demand (m3/day)	Average Daily Water Demand (L/s)	Peak Hour Peaking Factor	Peak Hour Demand (L/s)	Peak Day Peaking Factor	Peak Day Demand (L/s)	Comment / Reference
Primary Dwelling	125	3	700	262.5	3.04	6.6	20.05	3.30	10.03	*Total of 125 lots*
Secondary Dwelling	125	2	350	87.5	1.01	6.6	6.68	3.30	3.34	*Assume each lot may also have a secondary dwelling. Assume average of 2 person occupancy per secondary dwelling, assume no irrigation requirements for secondary dwelling*
Total				**350.00**	**4.05**		**26.74**		**13.37**	

Notes:

- Average day to peak hour peaking factor of 6.6 has been applied as per QLDC CoP Section 6.3.5.6
- The average day to peak day peaking factor is assumed to be 50% of average day to peak hour peaking factor
- It is assumed that each residential lot may have a primary dwelling and a secondary dwelling

References:

Metcalfe and Eddy, 2003, Wastewater Engineering: Treatment and Reuse, McGraw-Hill
AS/NZS 1547:2012 - Onsite wastewater management
QLDC Land Development and Subdivision Code of Practice, 2015

APPENDIX D

Email Correspondence on Fire Fighting Requirements

Louise Clarke

From: Sam Ballam <sam.ballam@ppgroup.co.nz>
Sent: Thursday, 24 June 2021 1:59 pm
To: Louise Clarke; Lauren Christie; Jayne Richards
Cc: Tim Allan; damien@oceaniafireprotection.co.nz; David Chenery
Subject: RE: [PPG-Q6388D] Ayrburn - Fire Engineering and Water Demands

Hi Louise,

Below is previous correspondence I found from David, noting the this is for the heritage buildings and doesn't account for the future homestead and hay barn buildings.

"I just spoke with Cam Stewart at GHD. They have done the sprinkler design for Oceania.
Flow rate required is 800 l/min at 300 Kpa"

Jayne – Can you confirm your understanding, I haven't been back through all the correspondence but from memory the haybarn had the biggest fire cell demand and you were going to take an estimate at what the peak demand would be.

Regards,

Sam Ballam
Licensed Cadastral Surveyor, MS+SNZ
Queenstown Office
M 027 427 4557
E sam.ballam@ppgroup.co.nz

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From: Louise Clarke <louise@fluentsolutions.co.nz>
Sent: Thursday, 24 June 2021 11:47 am
To: Sam Ballam <sam.ballam@ppgroup.co.nz>; Lauren Christie <Lauren.Christie@winton.nz>
Cc: Tim Allan <t.allan@brynmartin.co.nz>; damien@oceaniafireprotection.co.nz
Subject: RE: [PPG-Q6388D] Ayrburn - Fire Engineering and Water Demands

Hi Sam,

Had the sprinkler demand been confirmed?
I know the backflow prevention was resolved, but I cant identify a confirmation on the flows for sprinklers.

Regards,
Louise

APPENDIX E

Hydraulic Calculations

Fluent SOLUTIONS

Title	**Hydraulic Calculations to assess maximum headlosses in 235mm ID pipe**
Job No.	**Q000492**
Job Title:	**Ayrburn Domain**
Engineer:	**Louise Clarke**
Checked:	**Jayne Richards**
Date:	**1/11/2021**

Pre-development flows - estimated from Mott MacDonald Headloss/km in Table 6 (to match headloss in m/km)

Pipe Dia (ID)	Flow Q (l/s)	Area A (m^2)	Pipe diameter m	Roughness Coefficient k (mm)	Length L (m)	Kinematic Viscosity ν (10^{-6} m^2/s)	Mean Velocity V (m/s)	Hydraulic diameter D (m)	Reynolds Number Re	Friction Coefficient f	Total Head loss ΔH (m)	m/1000 m	Velocity Head	Description
235 mm	12.7	0.04338	0.235	0.015	1	1.5	0.29	0.235	45867	0.0214	0.00	0.40	0.004368623	**Estimated flow before development- current peak day**
235 mm	16	0.04338	0.235	0.015	1	1.5	0.37	0.235	57785	0.0204	0.00	0.60	0.006933893	**Estimated flow before development- 2028 peak day**
235 mm	22.4	0.04338	0.235	0.015	1	1.5	0.52	0.235	80899	0.0190	0.00	1.10	0.01359043	**Estimated flow before development- 2058 peak day**

Post-development flows - estimated from Mott MacDonald Headloss/km in Table 6 (to match headloss in m/km)

Pipe Dia (ID)	Flow Q (l/s)	Area A (m^2)	Pipe diameter m	Roughness Coefficient k (mm)	Length L (m)	Kinematic Viscosity ν (10^{-6} m^2/s)	Mean Velocity V (m/s)	Hydraulic diameter D (m)	Reynolds Number Re	Friction Coefficient f	Total Head loss ΔH (m)	m/1000 m	Velocity Head	Description
235 mm	57	0.04338	0.235	0.015	1	1.5	1.31	0.235	205859	0.0160	0.01	6.00	0.088000853	**Estimated flow post development- current peak day**
235 mm	60	0.04338	0.235	0.015	1	1.5	1.38	0.235	216694	0.0159	0.01	6.59	0.09750787	**Estimated flow post development- 2028 peak day**
235 mm	65.8	0.04338	0.235	0.015	1	1.5	1.52	0.235	237641	0.0156	0.01	7.81	0.117270548	**Estimated flow post development- 2058 peak day**

Approximate flows allocated to Waterfall Park development in Mott Macdonal Model:

Current peak day:	44.3	L/s
2028 peak day:	44	L/s
2058 peak day:	43.4	L/s

New flow (Waterfall Park Hotel plus Northbrook Retirement Village):

Current peak day:	29.8	L/s
2028 peak day:	29.8	L/s
2058 peak day:	29.8	L/s

New post-development flows (Mott Macdonald Pre-Development Flows plus Waterfall Park Hotel plus Northbrook Retirement Village):

Current peak day:	42.5	L/s
2028 peak day:	45.8	L/s
2058 peak day:	52.2	L/s

New post-development flows (Mott Macdonald Pre-Development Flows plus Waterfall Park Hotel plus Northbrook Retirement Village):

Pipe Dia (ID)	Flow Q (l/s)	Area A (m^2)	Pipe diameter m	Roughness Coefficient k (mm)	Length L (m)	Kinematic Viscosity ν (10^{-6} m^2/s)	Mean Velocity V (m/s)	Hydraulic diameter D (m)	Reynolds Number Re	Friction Coefficient f	Total Head loss ΔH (m)	m/1000 m	Velocity Head	Description
235 mm	42.5	0.04338	0.235	0.015	1	1.5	0.98	0.235	153491	0.0169	0.00	3.51	0.04892322	**Estimated flow post development- current peak day**
235 mm	45.8	0.04338	0.235	0.015	1	1.5	1.06	0.235	165409	0.0166	0.00	4.02	0.056815669	**Estimated flow post development- 2028 peak day**
235 mm	52.2	0.04338	0.235	0.015	1	1.5	1.20	0.235	188523	0.0163	0.01	5.11	0.073803707	**Estimated flow post development- 2058 peak day**

Extract from Mott Macdonald Report:

The table below summarises the maximum head losses in the existing 235mm ID pipe along Arrowtown Lake Hayes Rd and the minimum pressure forecasted at the supply point, before and after the proposed development:

Table 5 - Minimum Pressure at Supply Point

Demand	Min pressure before development (m)	Min pressure after development (m)	Pressure drop (m)
Current Peak Day	89.5	83.1	6.4
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Table 6 - Maximum Head Losses in 235mm ID Pipe

Demand	Max head losses before development (m/km)	Max head losses after development (m/km)	Head losses increase (m/km)
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2058 Peak Day	1.1	7.8	6.7

As shown in the pictures and above tables, the proposed development is predicted to have a noticeable impact on the remaining of the water network with a maximum pressure drop of 8.0m. Pressures are generally high along Arrowtown Lake Hayes Rd and Speargrass Flat Rd, so pressure remains well above the recommended LOS in this area, for current and future scenarios. However, pressures below the recommended LOS are predicted in the properties located in the elevated areas of Slope Hill Rd and Threewood Rd. This is an existing LOS issue that needs to be addressed.

Head losses are predicted to increase by up to 6.7m/km reaching 7.8m/km in the 235mm (ID) along Arrowtown Lake Hayes Rd due to the additional demand. The predicted head losses exceed the recommended LOS, 5m/km. This LOS issue needs to be addressed.

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RESOURCE CONSENT DRAWINGS

PLAN INDEX

SHEET	CONTENTS	REV	DATE
INDEX			
001	INDEX SHEET	C	28/02/2023
GENERAL			
100	SITE PLAN	C	28/02/2023
101	RM180584 CONSENT OVERLAY	C	28/02/2023
EARTHWORKS			
200	EARTHWORKS OVERVIEW	C	28/02/2023
210-212	DEPTH CONTOURS	C	28/02/2023
250	SEDIMENT AND EROSION CONTROL PLAN	C	28/02/2023
ROADING			
300	ROADING OVERALL PLAN	C	28/02/2023
301-306	ROADING LAYOUTS	C	28/02/2023
310	ACCESSIBLE PATHS LAYOUT	C	28/02/2023
315	PARKING OVERVIEW	C	28/02/2023
320-322	ROAD 01 LONGSECTION	C	28/02/2023
325	ROAD 02 LONGSECTION	C	28/02/2023
326	WATERFALL PARK ROAD LONGSECTION	C	28/02/2023
330-331	TYPICAL CROSS SECTIONS	C	28/02/2023
340	BRIDGE 01 LONGSECTION	C	28/02/2023
STORMWATER			
400	STORMWATER OVERVIEW	C	28/02/2023
401-406	STORMWATER LAYOUT	C	28/02/2023
410	WETLAND SECTIONS	C	28/02/2023
WASTEWATER/WATER			
500	WASTEWATER/WATER OVERVIEW	C	28/02/2023
501-503	WASTEWATER/WATER DETAIL	C	28/02/2023

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REV.	REVISION DETAILS	DATE
A	DRAFT ISSUE	30/03/22
B	FOR RESOURCE CONSENT	27/09/22
C	RFI RESPONSE	28/02/23

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E queenstown@ppgroup.co.nz

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Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN
INDEX SHEET

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Checked by:	SP		DO NOT SCALE
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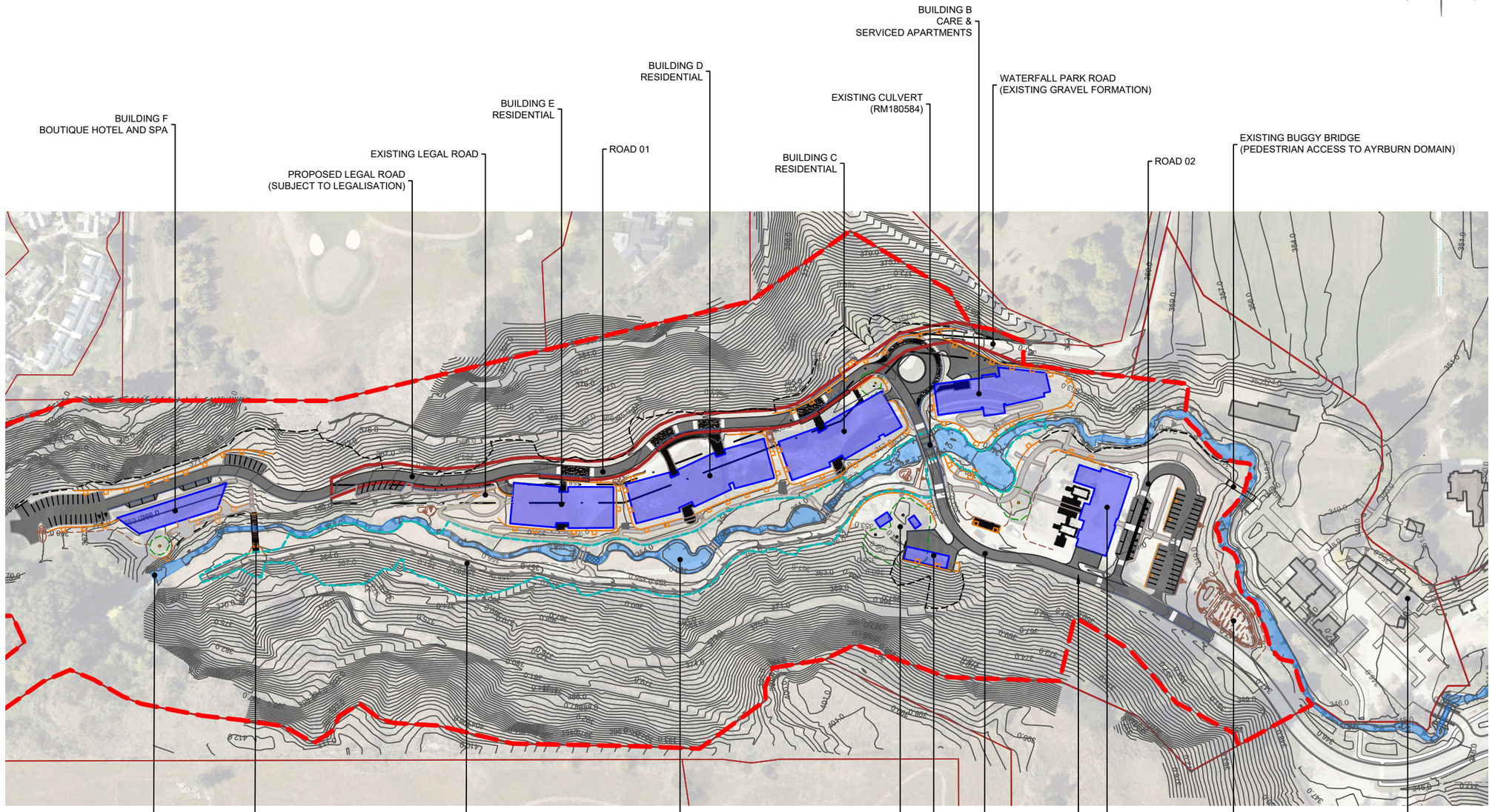
			Date Issued: 28/02/2023



NOTES

1. EXISTING WATERFALL PARK ROAD BOUNDARY TO BE REALIGNED TO SUIT PROPOSED ROAD ALIGNMENT. PROPOSED LEGAL BOUNDARIES SHOWN RELATE TO AN EXISTING ROAD STOPPING APPLICATION LODGED WITH QLDC WHICH IS STILL SUBJECT TO APPROVAL.

FOR RESOURCE CONSENT

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- UNDERLYING BOUNDARY (ROAD TO BE REALIGNED)
- MILL CREEK
- SITE EXTENTS
- PROPOSED BUILDING
- AYRBURN BUILDINGS (UNDER CONSTRUCTION)
- GRASS SWALE
- CONCRETE CHANNEL / KERB
- CUT / FILL INTERFACE
- EARTH BATTER EXTENT
- RETAINING WALL
- ROAD CARRIAGEWAY
- CYCLE / PEDESTRIAN PATH
- CONCRETE THRESHOLD / PARKING AREA
- STONE THRESHOLD
- STABILISED GRASS (EMERGENCY SERVICES PARKIN
- PAVING AREA
- STREAM WORKS UNDER CONSTRUCTION RM180584
- EXISTING TREE
- POND / RAINGARDEN
- 366.0 — PROPOSED CONTOUR (1m INTERVAL)

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
B	FOR RESOURCE CONSENT	27/09/22
C	RFI RESPONSE	28/02/23

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Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN SITE PLAN

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Checked by:	SP		DO NOT SCALE
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 100	Revision No: C / Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:33 PM BY: Sb

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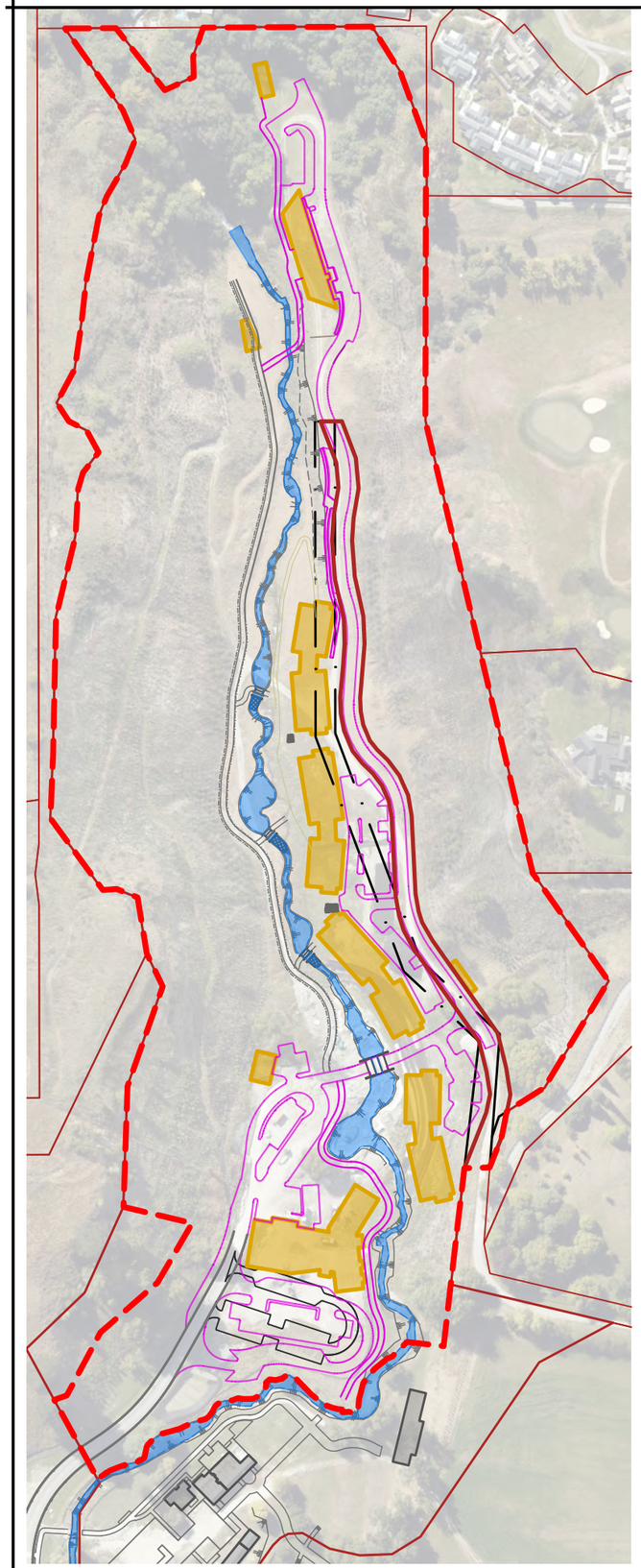
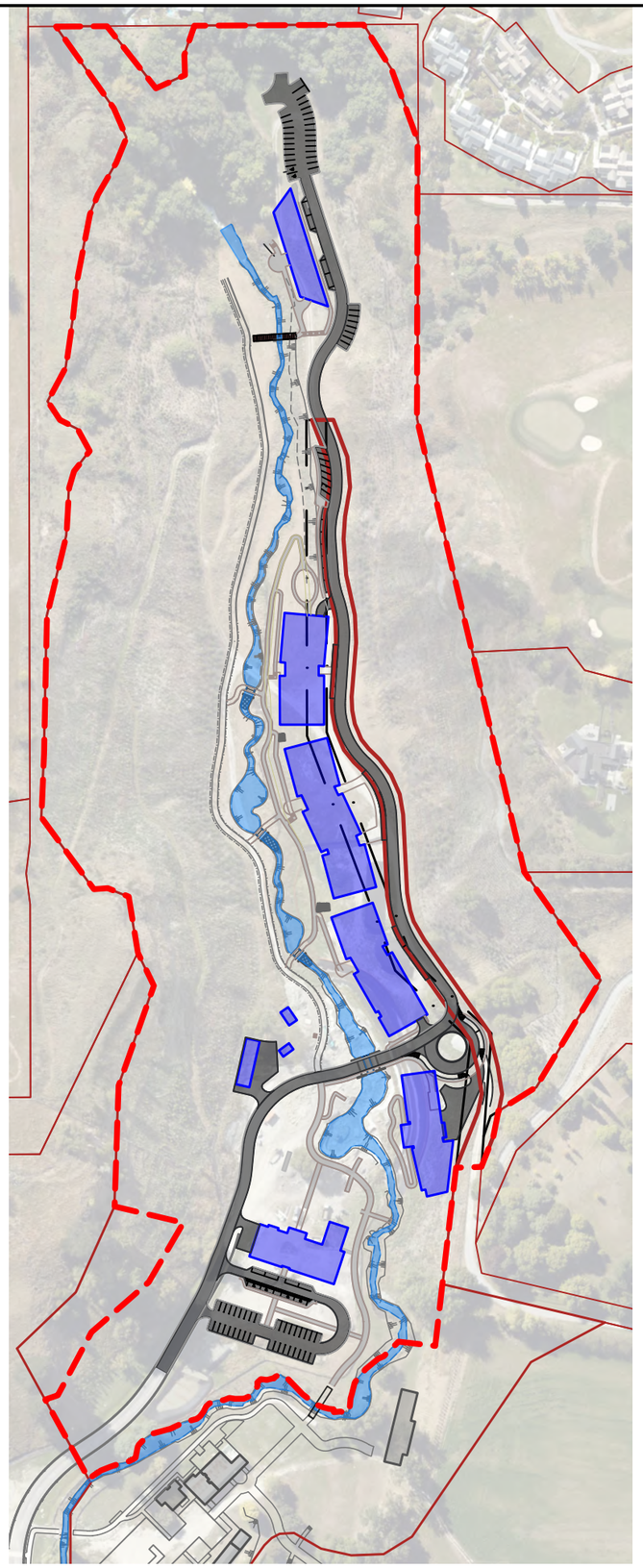
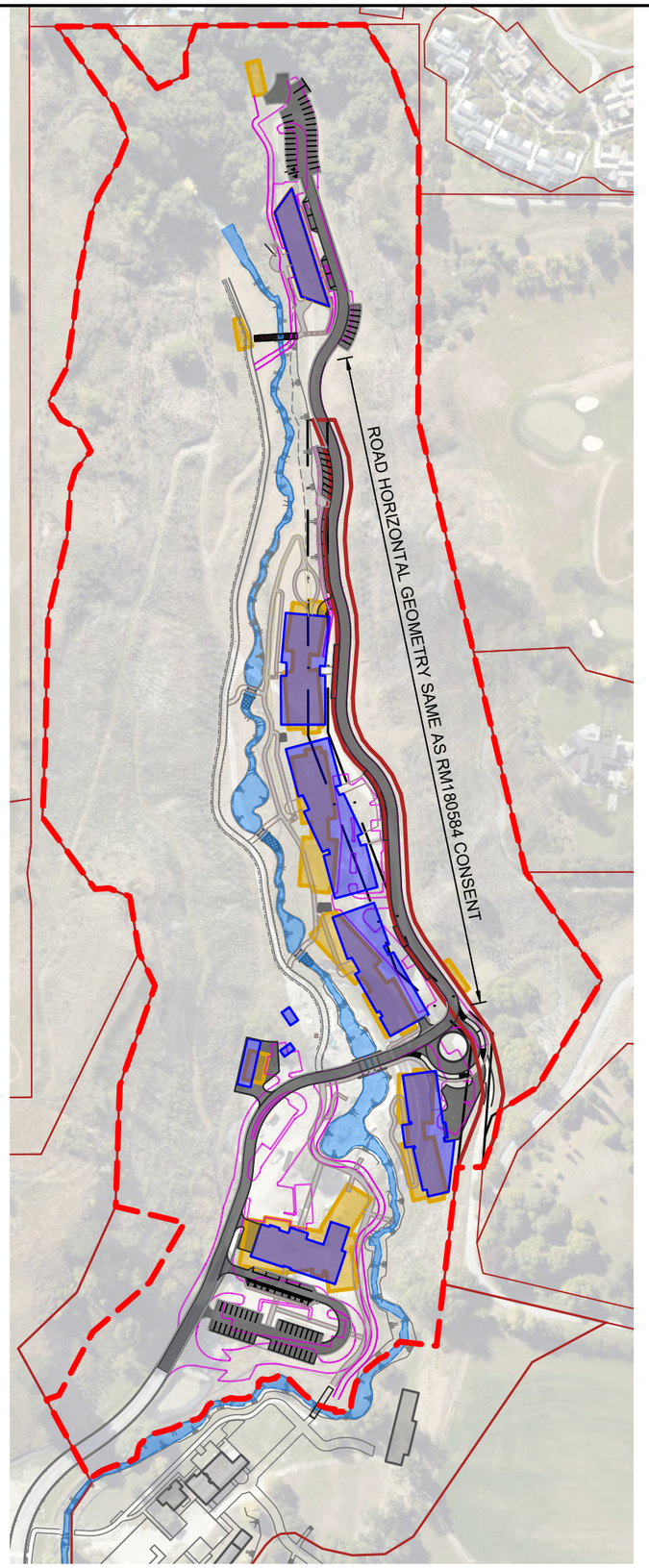


CONSENTED UNDER RM180584



PROPOSED FEATURES



CONSENTED vs' PROPOSED OVERLAY

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- UNDERLYING BOUNDARY (ROAD TO BE REALIGNED)
- MILL CREEK
- SITE EXTENTS
- PROPOSED ROAD
- PROPOSED PATH
- CONSENTED HOTEL BUILDING (RM180584)
- PROPOSED BUILDING
- AYRBURN BUILDINGS (UNDER CONSTRUCTION)
- CONSENTED ROAD / PATH (RM180584)
- EXISTING ROAD / PATH

NOTES

1. EXISTING WATERFALL PARK ROAD BOUNDARY TO BE REALIGNED TO SUIT PROPOSED ROAD ALIGNMENT. PROPOSED LEGAL BOUNDARIES SHOWN RELATE TO AN EXISTING ROAD STOPPING APPLICATION LODGED WITH QLDC WHICH IS STILL SUBJECT TO APPROVAL.

N

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REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
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LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN
RM180584 CONSENT OVERLAY

Surveyed by:		Original Size: A3	Scale: 1:3000
Designed by:	SB		
Drawn by:	SB		
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Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 101	Revision No: C / Date Issued: 28/02/23

PLOT DATE: 03 March, 2023 - 2:33 PM BY: Sb

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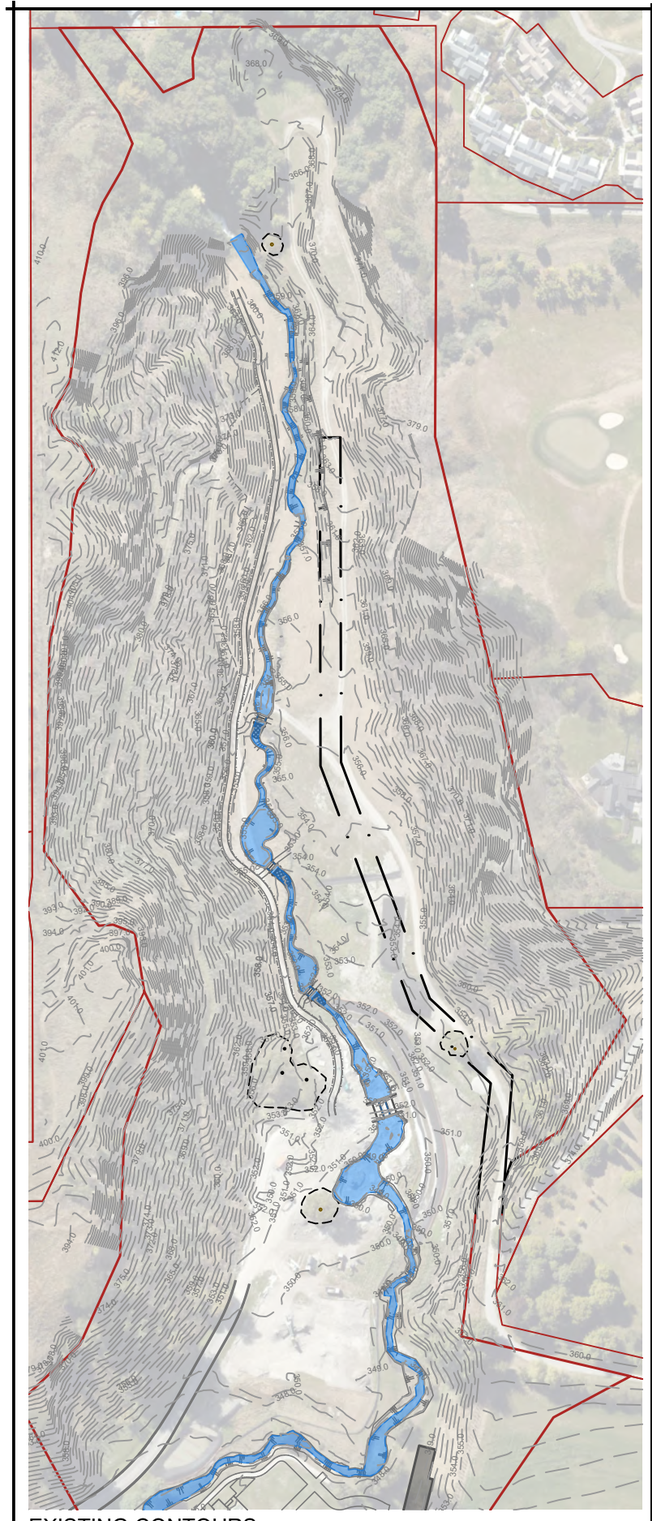
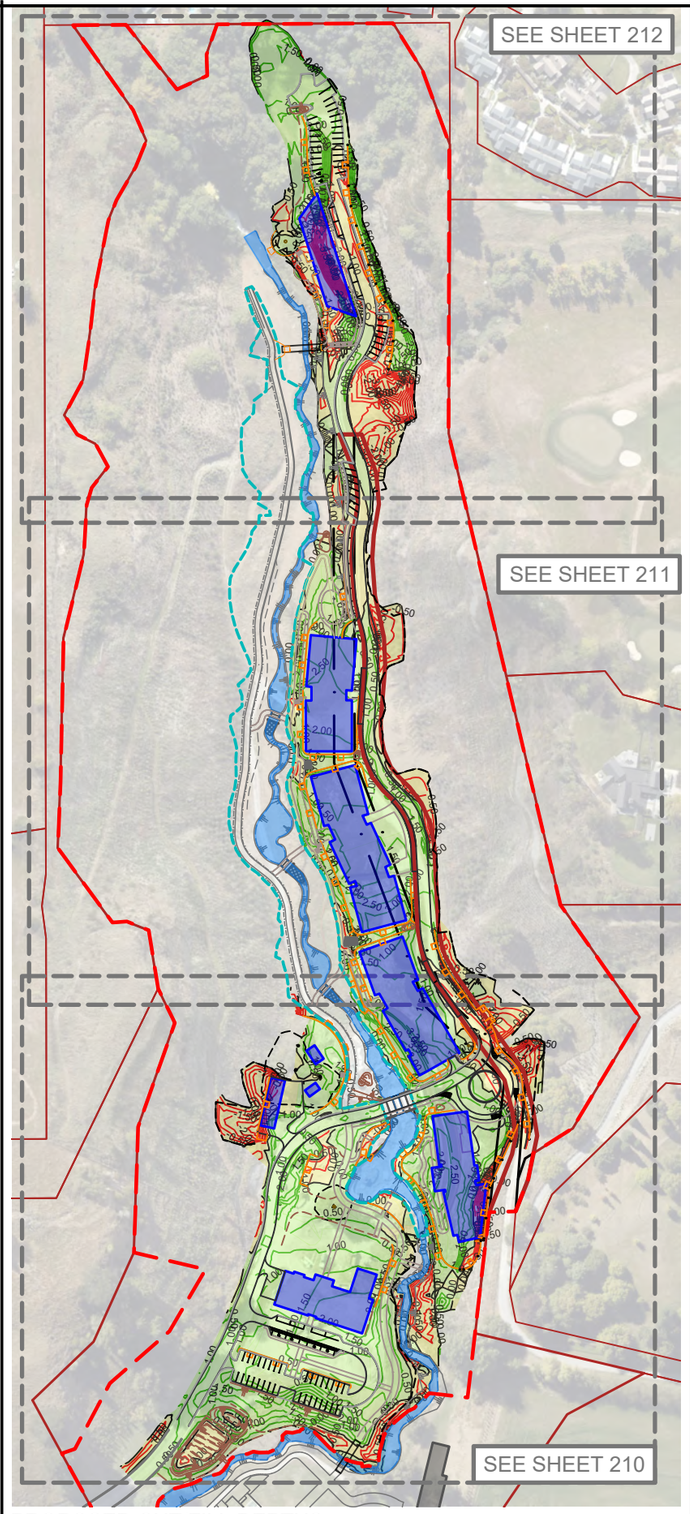
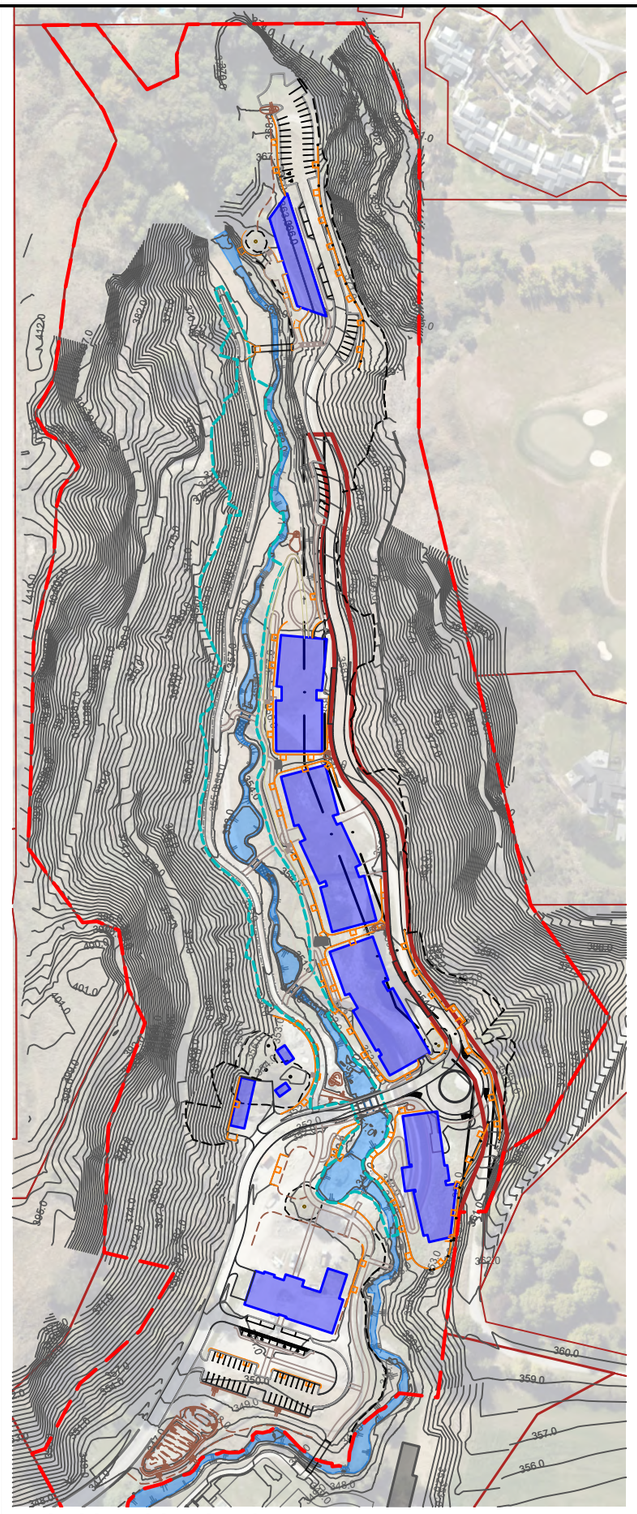


EXISTING CONTOURS



PROPOSED CUT/FILL DEPTHS



PROPOSED CONTOURS

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- UNDERLYING TITLE BOUNDARY (ROAD TO BE REALIGNED)
- MILL CREEK
- 0.50 CUT AREA / CONTOUR (0.5m INTERVAL)
- -0.50 FILL AREA / CONTOUR (0.5m INTERVAL)
- 0.00 ZERO CUT / FILL CONTOUR
- 357.0 DESIGN CONTOURS (1m INTERVAL)
- 357.0 EXISTING CONTOURS (1m INTERVAL)
- RETAINING WALL
- EXTENT RM180584 WORKS UNDER CONSTRUCTION
- SITE EXTENTS

NOTES

1. SEE ROADING SHEETS (300 - 306) FURTHER DETAIL OF PROPOSED CONTOURS.
2. REFER SHEETS 211-212 FOR FURTHER DETAIL OF DEPTH CONTOURS
3. FOR CLARITY DEPTH CONTOURS HAVE BEEN SHOWN TO GROUND LEVEL, ADDITIONAL DEPTH WILL BE REQUIRED FOR EXCAVATION OF BASEMENT
4. EARTHWORKS QUANTITIES SHOWN ARE REPRESENTATIVE OF DESIGN DEVELOPED TO CONSENT LEVEL DETAIL. QUANTITIES WILL BE SUBJECT TO FLUCUATION AS DESIGN IS DETAILED FOLLOWING CONSENT, VOLUMES WILL BE REPRESENTATIVE OF THE LANDFORM AT THE TIME.

EARTHWORKS

5.	TOPSOIL	
	5.1 STRIP	10,000m³
	5.2 RESPREAD	5,000m³
	5.3 EXCESS	5,000m³
6.	EARTHWORKS	
	6.1 CUT - FILL	5,000m³
	6.2 CUT - WASTE	7,000m³
7.	IMPORTED MATERIAL	
	7.1 ENGINEERED FILL SPEC	25,000m³
	7.2 ROADING / PATH AGGREGATES	4,000m³
8.	MAX CUT DEPTH, MAX FILL DEPTH	6.0m
9.	AREA OF EARTHWORKS	6.5 Ha

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
B	FOR RESOURCE CONSENT	27/09/22
C	RFI RESPONSE	28/02/23

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E queenstown@ppgroup.co.nz

Client/Location:

WATERFALL PARK DEVELOPMENT LTD
LOT 1 DP 540788

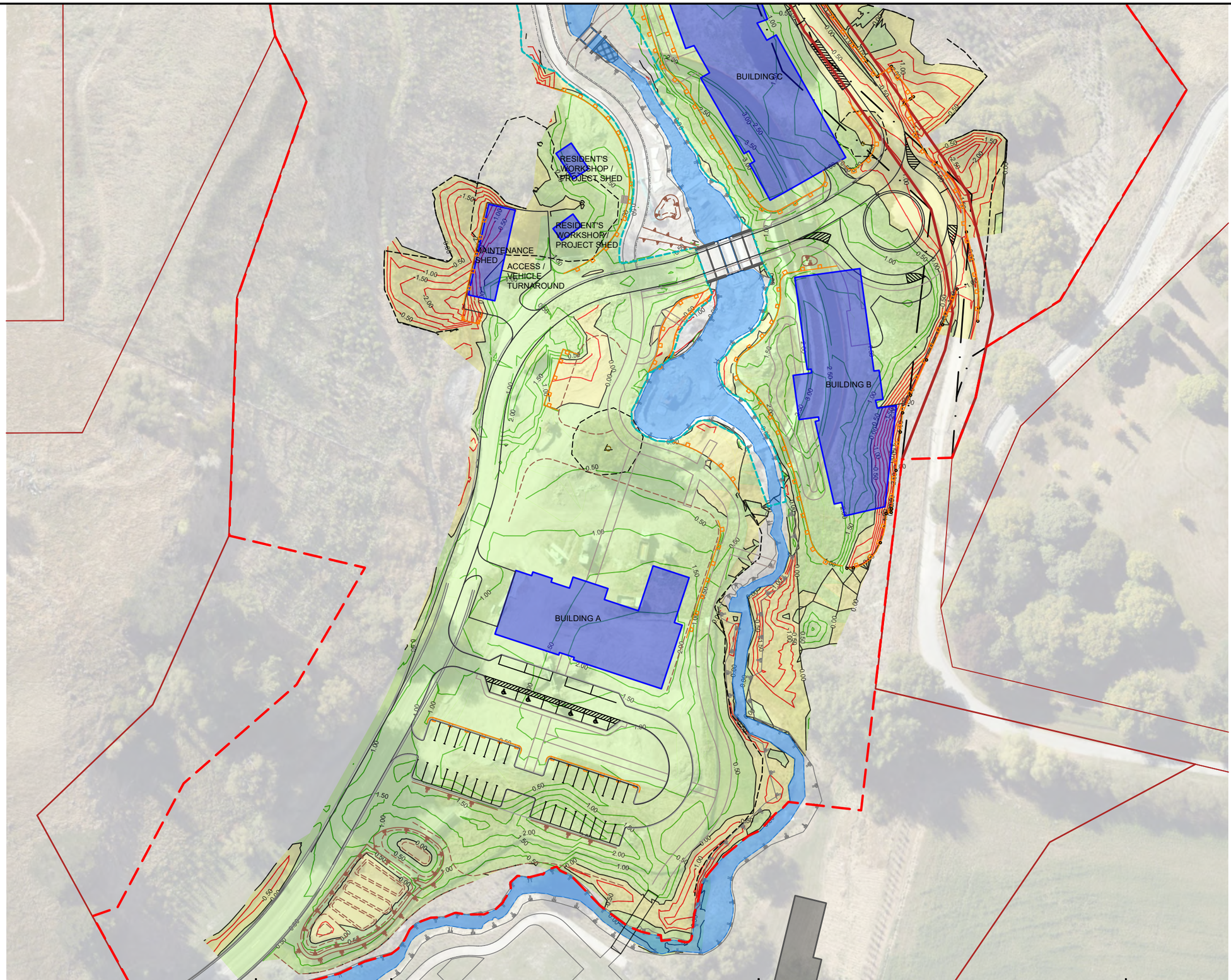
Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN
EARTHWORKS OVERVIEW

Surveyed by:		Original Size:	Scale:
Designed by:	SB	A3	1:3000
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 200	Revision No: C
			Date Created: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:33 PM BY: Sb

C:\12DS\DATA\QTSVR01\Q6388F - NORTHBROOK WATERFALL PARK_1066\5 - DRAWINGS\1 - DWG\RETIREMENT RC\Q6388-82-01_200 EARTHWORKS PLANS.DWG



N

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- UNDERLYING TITLE BOUNDARY (ROAD TO BE REALIGNED)
- MILL CREEK
- 0.50 CUT AREA / CONTOUR (0.5m INTERVAL)
- -0.50 FILL AREA / CONTOUR (0.5m INTERVAL)
- 0.00 ZERO CUT / FILL CONTOUR
- 357.0 DESIGN CONTOURS (1m INTERVAL)
- 357.0 EXISTING CONTOURS (1m INTERVAL)
- RETAINING WALL
- EXTENT RM180584 WORKS UNDER CONSTRUCTION
- SITE EXTENTS

NOTES

1. SEE ROADING SHEETS (300 - 306) FURTHER DETAIL OF PROPOSED CONTOURS.
2. REFER SHEETS 211-212 FOR FURTHER DETAIL OF DEPTH CONTOURS
3. FOR CLARITY DEPTH CONTOURS HAVE BEEN SHOWN TO GROUND LEVEL, ADDITIONAL DEPTH WILL BE REQUIRED FOR EXCAVATION OF BASEMENT
4. EARTHWORKS QUANTITIES SHOWN ARE REPRESENTATIVE OF DESIGN DEVELOPED TO CONSENT LEVEL DETAIL. QUANTITIES WILL BE SUBJECT TO FLUCUATION AS DESIGN IS DETAILED FOLLOWING CONSENT, VOLUMES WILL BE REPRESENTATIVE OF THE LANDFORM AT THE TIME.

FOR RESOURCE CONSENT

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A	ORIGINAL ISSUE	30/03/22
B	FOR RESOURCE CONSENT	27/09/22
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LOT 1 DP 540788

Purpose/Drawing Title:
NORTHBROOK - ARROWTOWN
DEPTH CONTOURS

Surveyed by:		Original Size:	Scale:
Designed by:	SB	A3	1:1000
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 210	Revision No: C
			Date Created: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:33 PM BY: Sb

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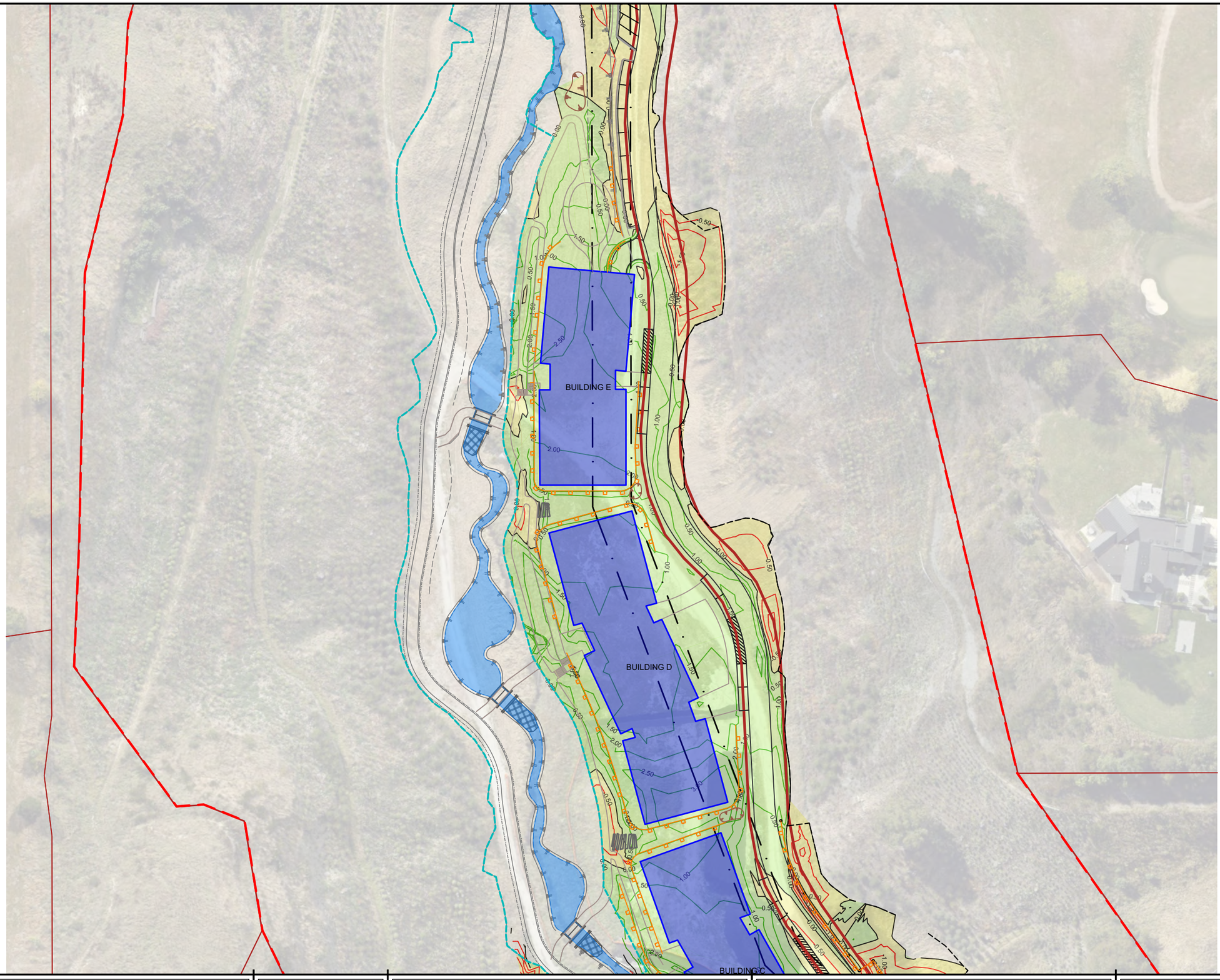

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- UNDERLYING TITLE BOUNDARY (ROAD TO BE REALIGNED)
- MILL CREEK
- 0.50 CUT AREA / CONTOUR (0.5m INTERVAL)
- -0.50 FILL AREA / CONTOUR (0.5m INTERVAL)
- 0.00 ZERO CUT / FILL CONTOUR
- 357.0 DESIGN CONTOURS (1m INTERVAL)
- 357.0 EXISTING CONTOURS (1m INTERVAL)
- RETAINING WALL
- EXTENT RM180584 WORKS UNDER CONSTRUCTION
- SITE EXTENTS

NOTES

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Purpose/Drawing Title:
NORTHBROOK - ARROWTOWN
DEPTH CONTOURS

Surveyed by:		Original Size: A3	Scale: 1:1000
Designed by:	SB		
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 211	Revision No: C
			Date Created: 28/02/2023

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LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- UNDERLYING TITLE BOUNDARY (ROAD TO BE REALIGNED)
- MILL CREEK
- 0.50 CUT AREA / CONTOUR (0.5m INTERVAL)
- -0.50 FILL AREA / CONTOUR (0.5m INTERVAL)
- 0.00 ZERO CUT / FILL CONTOUR
- 357.0 DESIGN CONTOURS (1m INTERVAL)
- 357.0 EXISTING CONTOURS (1m INTERVAL)
- RETAINING WALL
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- SITE EXTENTS

NOTES

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LOT 1 DP 540788

Purpose/Drawing Title:
NORTHBROOK - ARROWTOWN
DEPTH CONTOURS

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Designed by:	SB		
Drawn by:	SB		DO NOT SCALE
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Job Ref: Q6388 - 82 - 01		Sheet No: 212	Revision No: C
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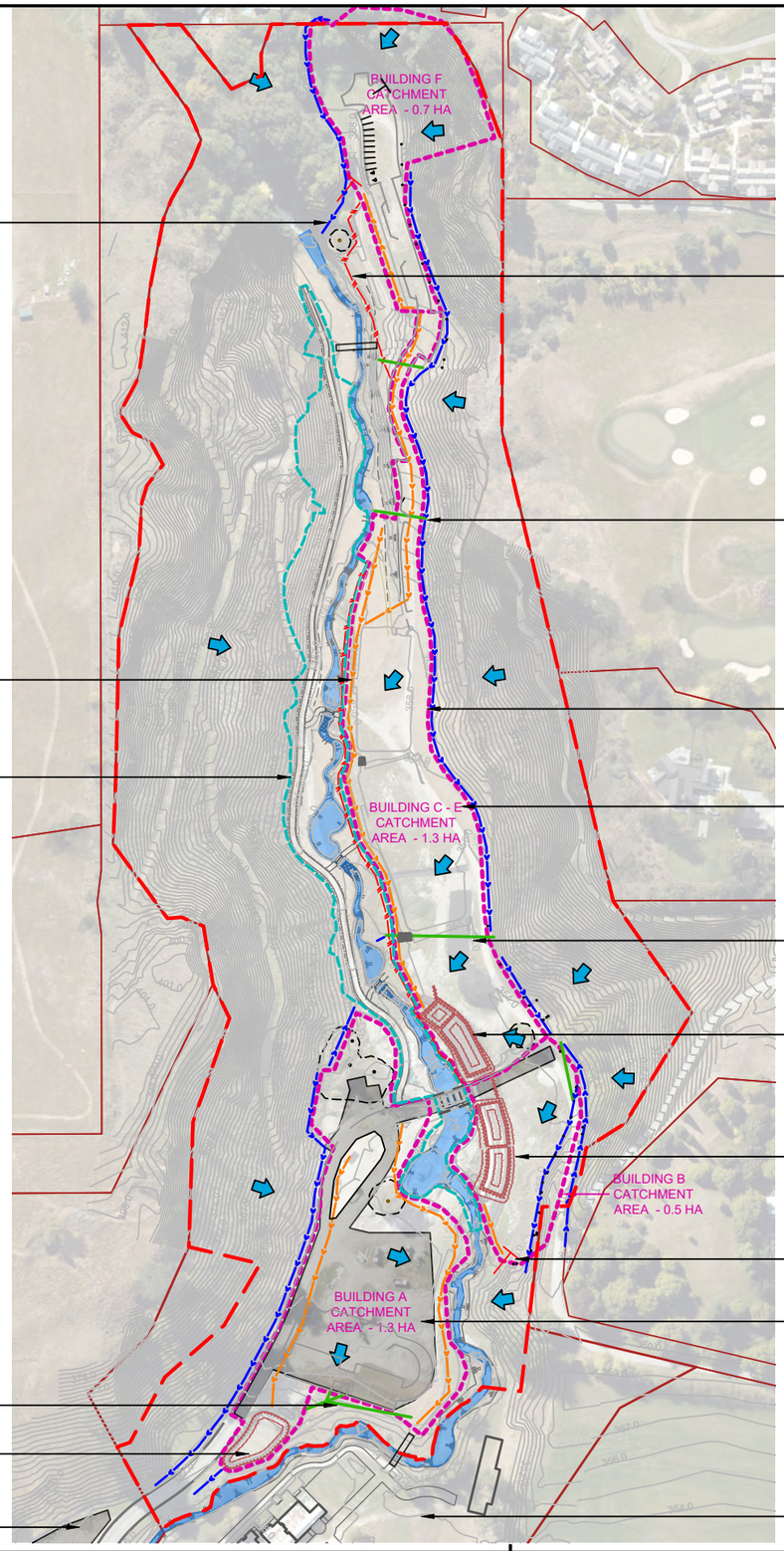

ROCK ARMOUR FEATURE TO BE ESTABLISHED DOWN BANK TO PREVENT SCOUR

DIRTY WATER CHANNEL TO CONVEY RUNOFF TO SRP

EXTENT OF CURRENT CONSTRUCTION WORKS UNDER RM180584

EXISTING SW PIPE THROUGH STABILISED BANK TO CONVEY DIRTY FLOWS TO SRP

EXISTING SRP 01 (DISCHARGE TO EXISTING AYR AVENUE SWALE)

TEMPORARY SITE COMPOUND (BUILDING CONTRACTOR)

SILT FENCE TO CONTAIN RUNOFF FROM AREA THAT CAN'T BE CONVEYED TO DECANT

TEMPORARY PIPE TO CONVEY FLOWS FROM CLEAN WATER CUT OFF CHANNEL THROUGH SITE

CLEAN WATER CUT OFF DRAIN TO DIVERT RUNOFF FROM UPSLOPE

FORMATION OF ROAD SUBGRADE IMPROVEMENT TO PROVIDE ALL WEATHER ACCESS

TEMPORARY PIPE TO CONVEY FLOWS FROM CLEAN WATER CUT OFF CHANNEL THROUGH SITE

EXISTING SRP 02 (2 BAYS TO REMOVE FOR BASEMENT)

EXISTING SRP 02 (2 BAYS TO REMAIN FOR BASEMENT CONSTRUCTION)

DECANT TO INSTALL PRIOR TO DECOMMISSION OF SRP

TEMPORARY SITE COMPOUND (CIVIL CONTRACTOR)

AYRBURN DOMAIN

LEGEND

- LEGAL BOUNDARY
- SITE BOUNDARY
- MILL CREEK
- UPSTREAM WORKS EXTENT (UNDER CONSTRUCTION RM180584)
- PROPOSED BUILDING
- STORMWATER CATCHMENT
- 357.0 DESIGN CONTOURS (1m INTERVAL)
- SEDIMENT RETENTION POND (SRP)
- GRAVEL LAYDOWN / HAUL ROAD (EXISTING)
- CLEAN WATER DIVERSION CHANNEL
- DIRTY WATER DIVERSION CHANNEL
- TEE BAR DECANT
- SW PIPE
- SILT FENCE
- OVERLAND FLOW DIRECTION

NOTES

1. SEDIMENT AND EROSION CONTROLS TO BE ESTABLISHED PRIOR TO COMMENCING WORKS.
2. ALL SEDIMENT AND EROSION CONTROLS TO BE ESTABLISHED IN ACCORDANCE WITH AUCKLAND COUNCIL GD05
3. PERIMETER OF ALL WORK AREAS TO BE PROTECTED BY EITHER EARTH BUND OR SILT FENCE TO PREVENT DISCHARGE OF ANY SEDIMENT LADEN RUNOFF TO MILL CREEK
4. THIS PLAN IS A DRAFT CONCEPT TO BE USED FOR RESOURCE CONSENT APPLICATION ONLY, FURTHER DETAIL TO BE ADDED PRIOR TO SUBMISSION FOR CONSTRUCTION APPROVAL OR IMPLEMENTATION. CATCHMENTS SHOWN WILL BE SUBJECT TO CHANGE AS THE DETAILED DESIGN DEVELOPS AND TO REPRESENT THE LANDFORM AT THE TIME.

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
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B	FOR RESOURCE CONSENT	27/09/22
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Client/Location:
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LOT 1 DP 540788

Purpose/Drawing Title:
NORTHBROOK - ARROWTOWN
SEDIMENT & EROSION CONTROL PLAN

Surveyed by:		Original Size:	Scale:
Designed by:	SB	A3	1:3000
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 250	Revision No: C
			Date Created: 28/02/2023

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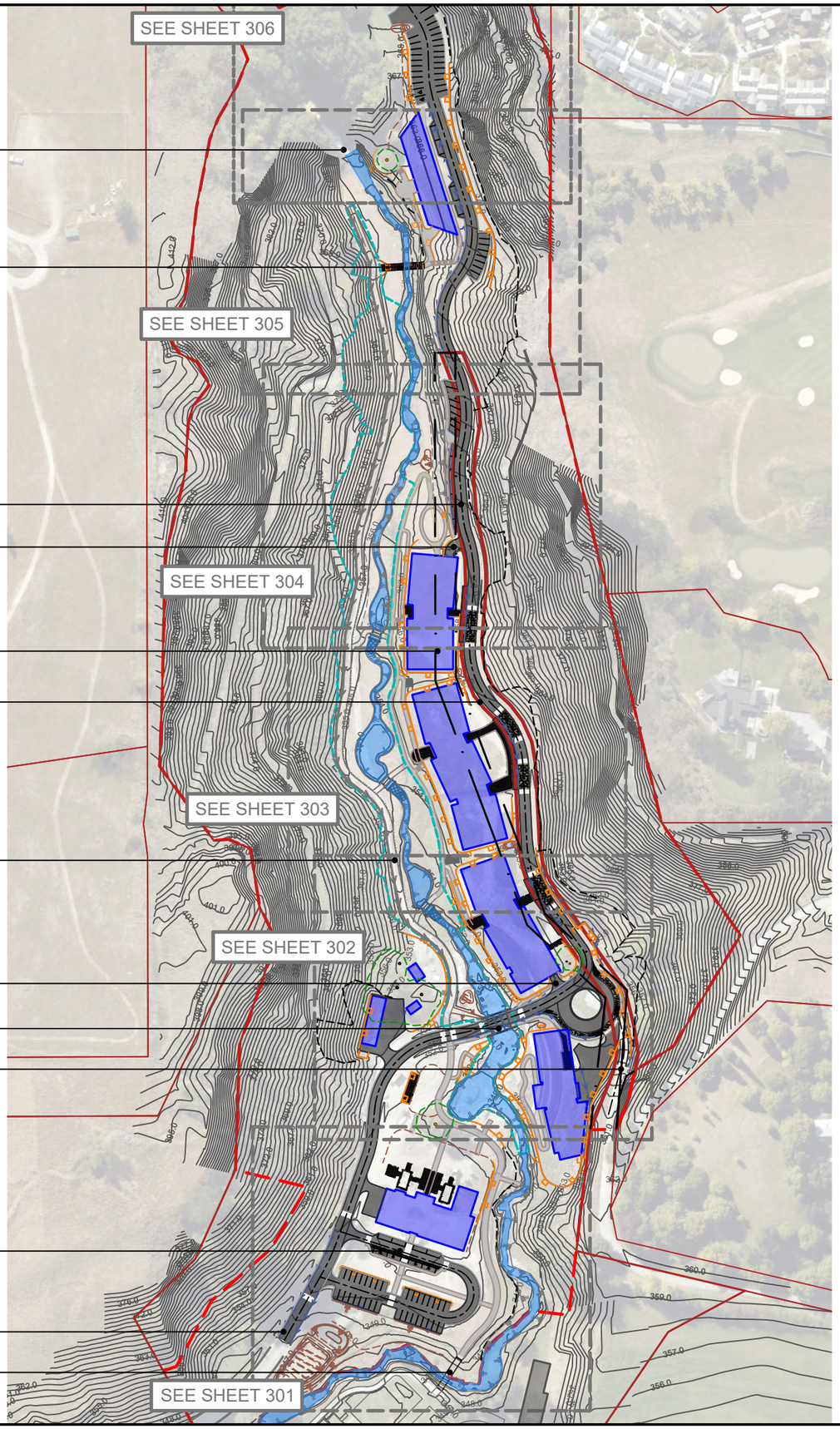

NOTES

1. EXISTING WATERFALL PARK ROAD BOUNDARY TO BE REALIGNED TO SUIT PROPOSED ROAD ALIGNMENT. PROPOSED LEGAL BOUNDARIES SHOWN RELATE TO AN EXISTING ROAD STOPPING APPLICATION LODGED WITH QLDC WHICH IS STILL SUBJECT TO APPROVAL.
2. NO CHANGE TO HORIZONTAL GEOMETRY OF ROAD 01 FROM RM180584 BETWEEN CH1040 AND CH1360.
3. ROAD WIDENING MAY BE REQUIRED TO ACCOMMODATE VEHICLE SWEPT PATHS, EXTENT OF WIDENING WILL BE ASSESSED AT DETAILED DESIGN.
4. WATERFALL PARK ROAD ALIGNMENT WILL BE BLOCKED TO PREVENT EVERYDAY ACCESS. THIS SECTION OF ROAD WILL ONLY BE ACCESSIBLE AS OPERATIONS REQUIRE.
5. PARKING FOR THE RESIDENTIAL LTO BUILDINGS IS PROVIDED IN THE BASEMENT, REFER TO WOODS BAGOT DRAWINGS FOR DETAILS.
6. ALL RETAINING WALLS ARE MAX 1m HIGH UNLESS NOTED OTHERWISE.
7. RETAINING WALL HIGHS SHOWN ARE FOR INDICATION PURPOSES ONLY, FINAL STRUCTURES WILL BE SUBJECT TO DETAILED DESIGN.
8. PATHS SHOWN ON THESE DRAWINGS ARE LIMITED TO MAIN LINKAGES, REFER TO LANDSCAPE AND ARCHITECTURAL DRAWINGS FOR MORE DETAIL OF PATHS / PATIOS IN CLOSE PROXIMITY TO BUILDINGS.
9. HANDRAILS TO BE PROVIDED ADJACENT TO PATHS AND ON RETAINING WALLS IN ACCORDANCE WITH NZBC

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- UNDERLYING BOUNDARY (ROAD TO BE REALIGNED)
- MILL CREEK
- SITE EXTENTS
- PROPOSED BUILDING
- GRASS SWALE
- CONCRETE CHANNEL / KERB
- CUT / FILL INTERFACE
- EARTH BATTER EXTENT
- RETAINING WALL
- ROAD CARRIAGEWAY
- CYCLE / PEDESTRIAN PATH
- CONCRETE THRESHOLD / PARKING AREA
- STONE THRESHOLD
- STABILISED GRASS (EMERGENCY PARKING)
- PAVING AREA
- WORKS COMPLETED UNDER RM180584
- EXISTING TREE
- POND / RAINGARDEN
- 366.0 — PROPOSED CONTOUR (0.5m INTERVAL)

FOR RESOURCE CONSENT

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Client/Location:

WATERFALL PARK DEVELOPMENTS LTD
LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN ROADING OVERVIEW

Surveyed by:		Original Size: A3	Scale: 1:2500
Designed by:	SB		
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 300	Revision No: C
			Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb

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SERVICE AREA (SMALL VEHICLES ONLY)
RUBBISH WILL BE KERB SIDE COLLECTION

END OF EXISTING AYR AVENUE FORMATION ROAD TO BE ADJUSTED TO ALIGNMENT SHOWN

ROAD WIDTH NARROWS TO ENCOURAGE TRAFFIC TO MAIN ENTRANCE

EXTENT OF EXISTING ROAD FORMATION TO BE REALIGNED

ROAD 01

ROAD 02

FGL AT EDGE OF CARRIAGEWAY UNDER PORTE COCHERE (MIN 3.5 BELOW SOFFIT)

BUILDING A
FFL - 351.59m

ONE WAY CIRCULATION ROAD (SIGNAGE TO BE INDICATED AT DETAILED DESIGN)

4 CARPARKS
2.5m x 7.0m WITH 4.0m AISLE
4 ACCESSIBLE CARPARKS
3.5m x 7.0m WITH 4.0m AISLE

45.00 (SIGHT LINE)

ACCESS TO CARPARK NOT ACCESSIBLE

ONE WAY CIRCULATION ROAD (SIGNAGE TO BE INDICATED AT DETAILED DESIGN)

36 CARPARKS
5m x 2.7m WITH 6m AISLE

PUBLIC TRAIL FOR ACCESS TO WATERFALL

CONNECTION TO AYRBURN DOMAIN VIA EXISTING BUGGY BRIDGE

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- UNDERLYING BOUNDARY (ROAD TO BE REALIGNED)
- MILL CREEK
- SITE EXTENTS
- PROPOSED BUILDING
- GRASS SWALE
- CONCRETE CHANNEL / KERB
- CUT / FILL INTERFACE
- EARTH BATTER EXTENT
- RETAINING WALL
- ROAD CARRIAGEWAY
- CYCLE / PEDESTRIAN PATH
- CONCRETE THRESHOLD / PARKING AREA
- STONE THRESHOLD
- STABILISED GRASS (EMERGENCY PARKING)
- PAVING AREA
- STREAM WORKS UNDER CONSTRUCTION RM180584
- EXISTING TREE
- POND / RAINGARDEN
- 366.0 — PROPOSED CONTOUR (1m INTERVAL)

FOR RESOURCE CONSENT

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Client/Location:

WATERFALL PARK DEVELOPMENTS LTD LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN ROADING LAYOUT

Surveyed by:		Original Size: A3	Scale: 1:500
Designed by:	SB		
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 301	Revision No: C
			Date Issued: 28/02/2023

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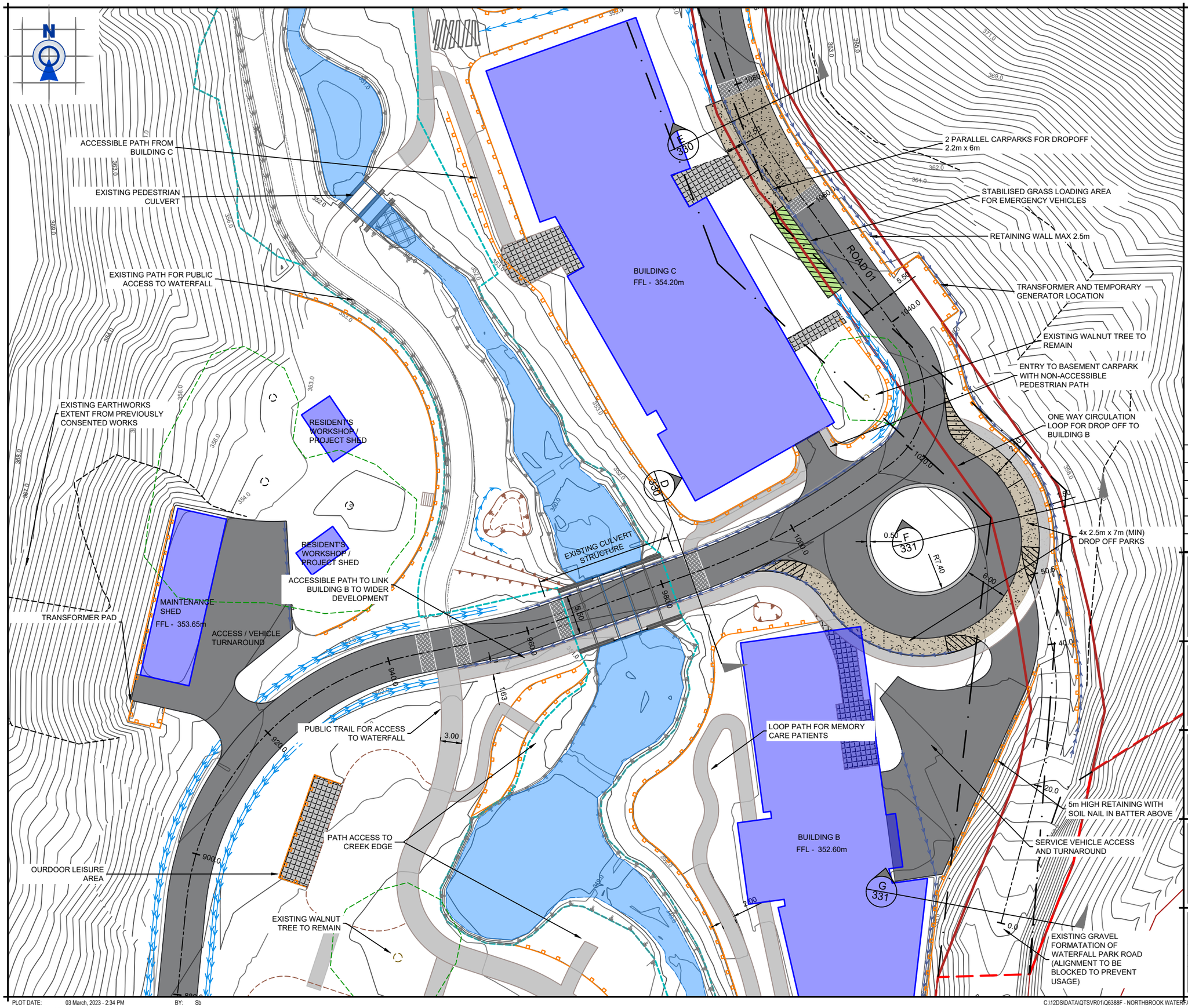

LEGEND

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NORTHBROOK - ARROWTOWN ROADING LAYOUT

Surveyed by:		Original Size: A3	Scale: 1:500
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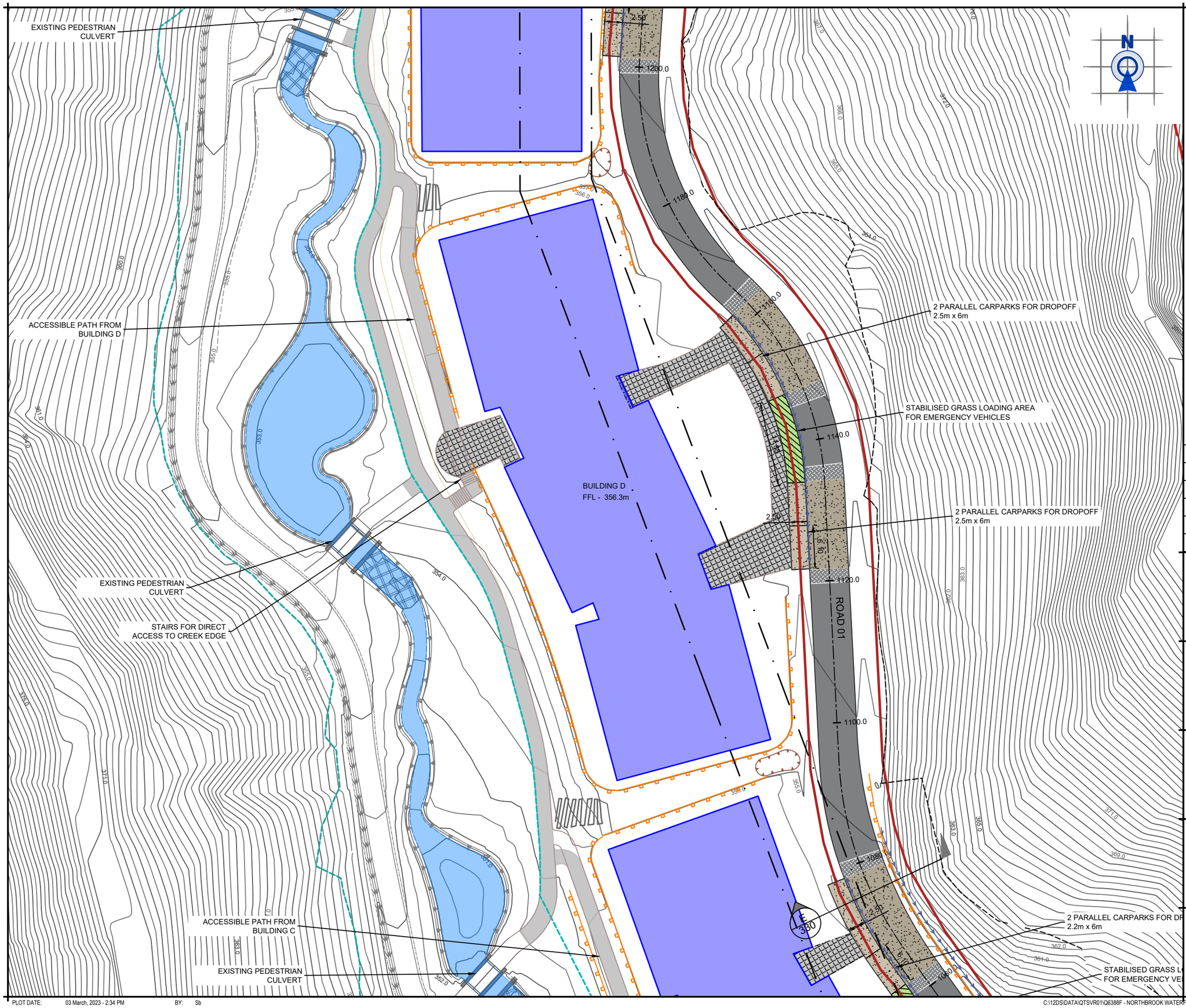

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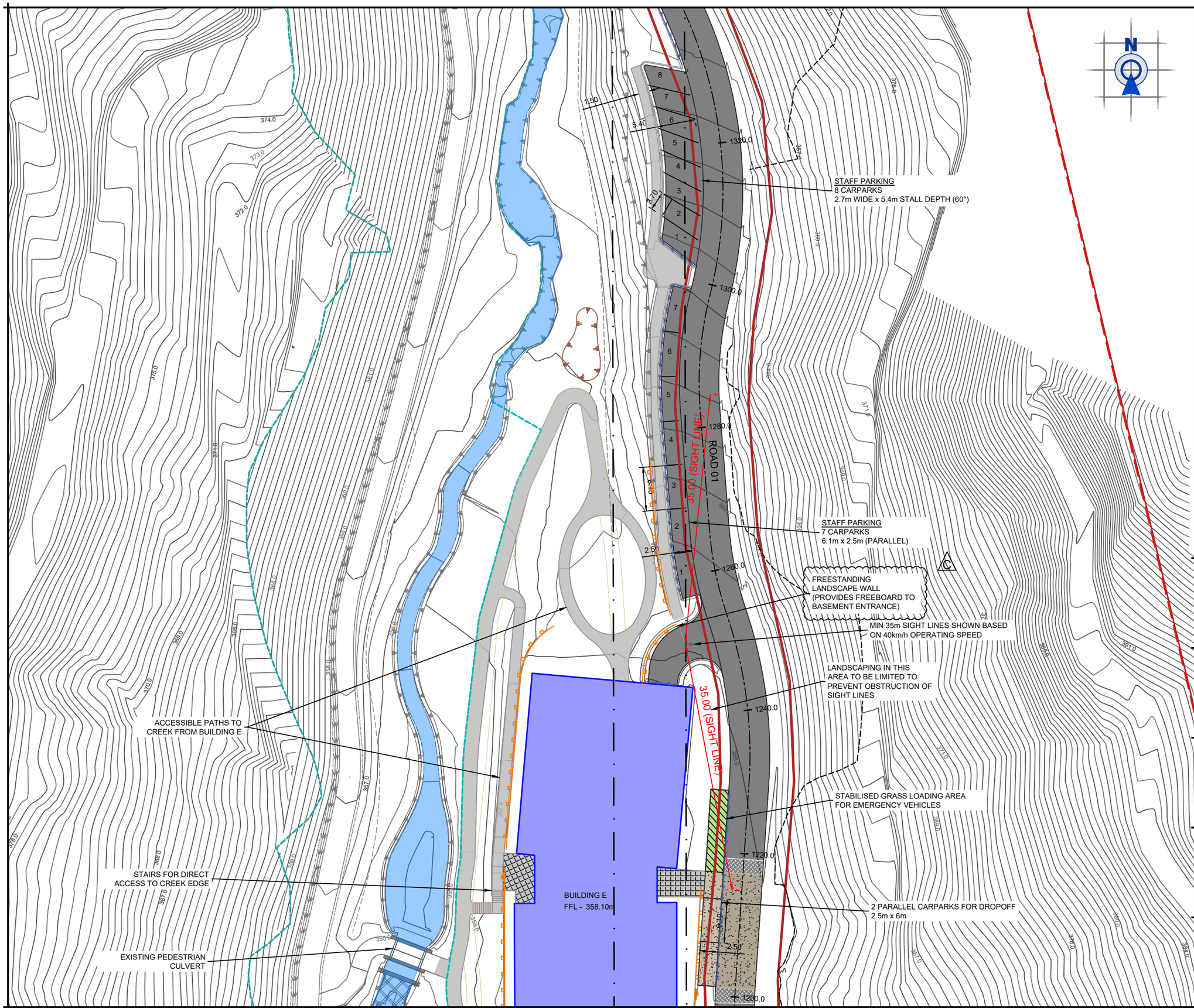
NORTHBROOK - ARROWTOWN ROADING LAYOUT

Surveyed by:		Original Size: A3	Scale: 1:500
Designed by:	SB		
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 303	Revision No: C
			Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb

C:\12DS\DATA\QTSVR01\Q6388F - NORTHBROOK WATERFALL PARK_10662\5 - DRAWINGS\1 - DWG\RETIREMENT RC\Q6388-82-01_300 ROADING PLANS.DWG



LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- UNDERLYING BOUNDARY (ROAD TO BE REALIGNED)
- MILL CREEK
- SITE EXTENTS
- PROPOSED BUILDING
- GRASS SWALE
- CONCRETE CHANNEL / KERB
- CUT / FILL INTERFACE
- EARTH BATTER EXTENT
- RETAINING WALL
- ROAD CARRIAGEWAY
- CYCLE / PEDESTRIAN PATH
- CONCRETE THRESHOLD / PARKING AREA
- STONE THRESHOLD
- STABILISED GRASS (EMERGENCY PARKING)
- PAVING AREA
- STREAM WORKS UNDER CONSTRUCTION RM180584
- EXISTING TREE
- POND / RAINGARDEN
- 366.0 — PROPOSED CONTOUR (1m INTERVAL)

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
B	FOR RESOURCE CONSENT	27/09/22
C	RFI RESPONSE	28/02/23

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E queenstown@ppgroup.co.nz

Client/Location:

WATERFALL PARK DEVELOPMENTS LTD LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN ROADING LAYOUT

Surveyed by:		Original Size: A3	Scale: 1:500
Designed by:	SB		
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 304	Revision No: C
			Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb

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EXISTING CHERRY TREE TO REMAIN

WATERFALL

LEVEL LAWN AREA AROUND EXISTING CHERRY TREE NON ACCESSIBLE (STAIRS) FROM BASEMENT LEVEL

ACCESSIBLE LINK FROM BASEMENT OF BUILDING F TO PUBLIC TRAIL

BUILDING F
FFL - 362.55m (BASEMENT)
FFL - 366.15m (LEVEL 01)
FFL - 369.75m (LEVEL 02)

0.6m RETAINING FOR RAISED GARDENS

1.0m HIGH WALL WITH BATTER ABOVE, BATTER TIES IN WITH BUILDING

BUGGY BRIDGE 01

4 CARPARKS
2.5m WIDE x 7.2m STALL DEPTH (PARALLEL)

RETAINING WALL UP TO 5m WITH SOIL NAILS IN BATTER ABOVE

STAIRS TO PROVIDE NON ACCESSIBLE LINKAGE FOR SPA GUESTS TO WATERFALL

8 CARPARKS
2.7m WIDE x 5.0m STALL DEPTH (90 DEG)

ROAD 01

CH 1460.0
CH 1440.0
CH 1420.0
CH 1400.0
CH 1380.0
1360.0
1340.0

340

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- UNDERLYING BOUNDARY (ROAD TO BE REALIGNED)
- MILL CREEK
- SITE EXTENTS
- PROPOSED BUILDING
- GRASS SWALE
- CONCRETE CHANNEL / KERB
- CUT / FILL INTERFACE
- EARTH BATTER EXTENT
- RETAINING WALL
- ROAD CARRIAGEWAY
- CYCLE / PEDESTRIAN PATH
- CONCRETE THRESHOLD / PARKING AREA
- STONE THRESHOLD
- STABILISED GRASS (EMERGENCY PARKING)
- PAVING AREA
- STREAM WORKS UNDER CONSTRUCTION RM180584
- EXISTING TREE
- POND / RAINGARDEN
- 366.0 — PROPOSED CONTOUR (1m INTERVAL)

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
B	FOR RESOURCE CONSENT	27/09/22
C	RFI RESPONSE	28/02/23

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Client/Location:

WATERFALL PARK DEVELOPMENTS LTD
LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN ROADING LAYOUT

Surveyed by:		Original Size: A3	Scale: 1:500
Designed by:	SB		
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 305	Revision No: C / Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb

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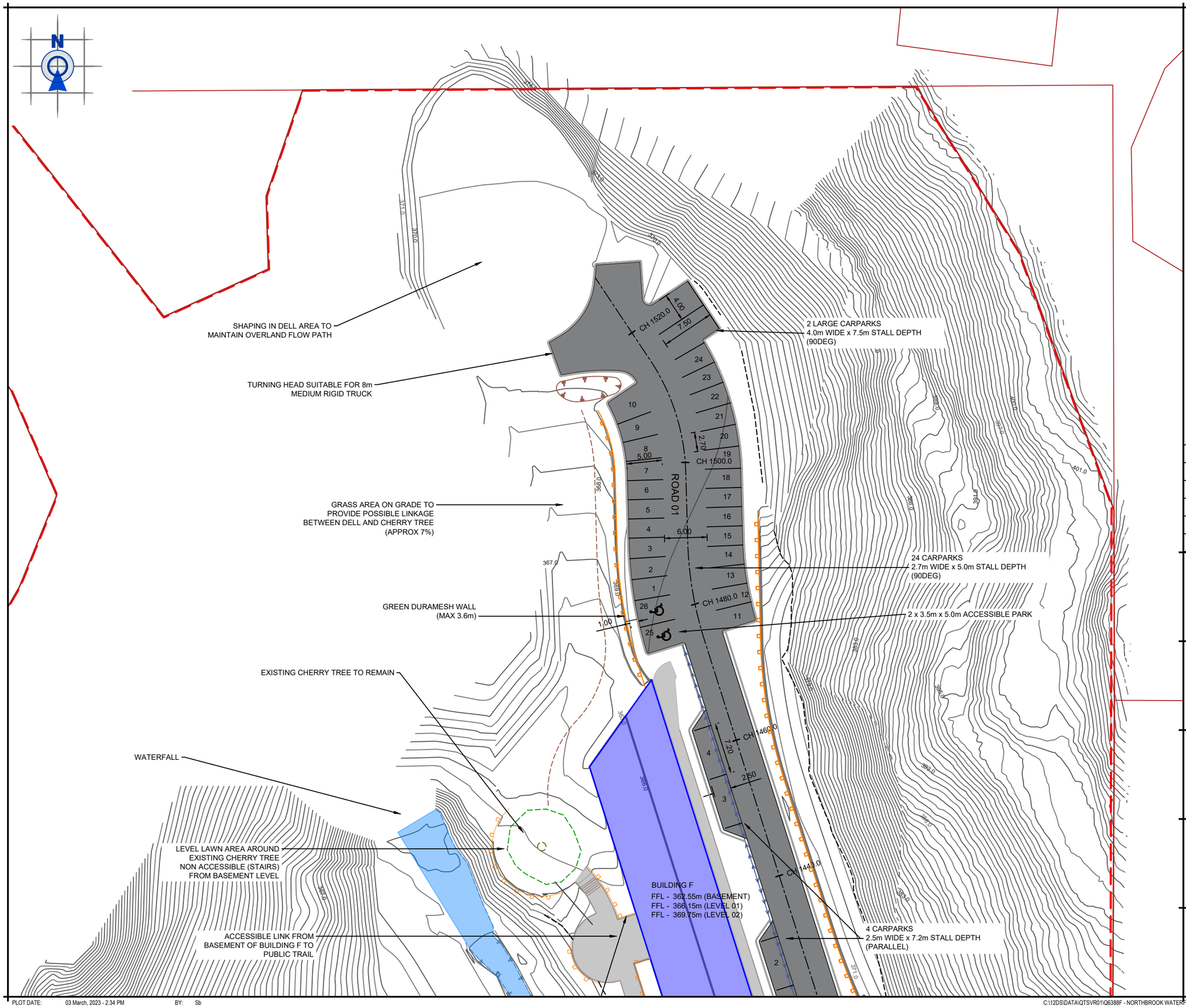

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- UNDERLYING BOUNDARY (ROAD TO BE REALIGNED)
- MILL CREEK
- SITE EXTENTS
- PROPOSED BUILDING
- GRASS SWALE
- CONCRETE CHANNEL / KERB
- CUT / FILL INTERFACE
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FOR RESOURCE CONSENT

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Client/Location:

WATERFALL PARK DEVELOPMENTS LTD LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN ROADING LAYOUT

Surveyed by:		Original Size: A3	Scale: 1:500
Designed by:	SB		
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 306	Revision No: C
			Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb

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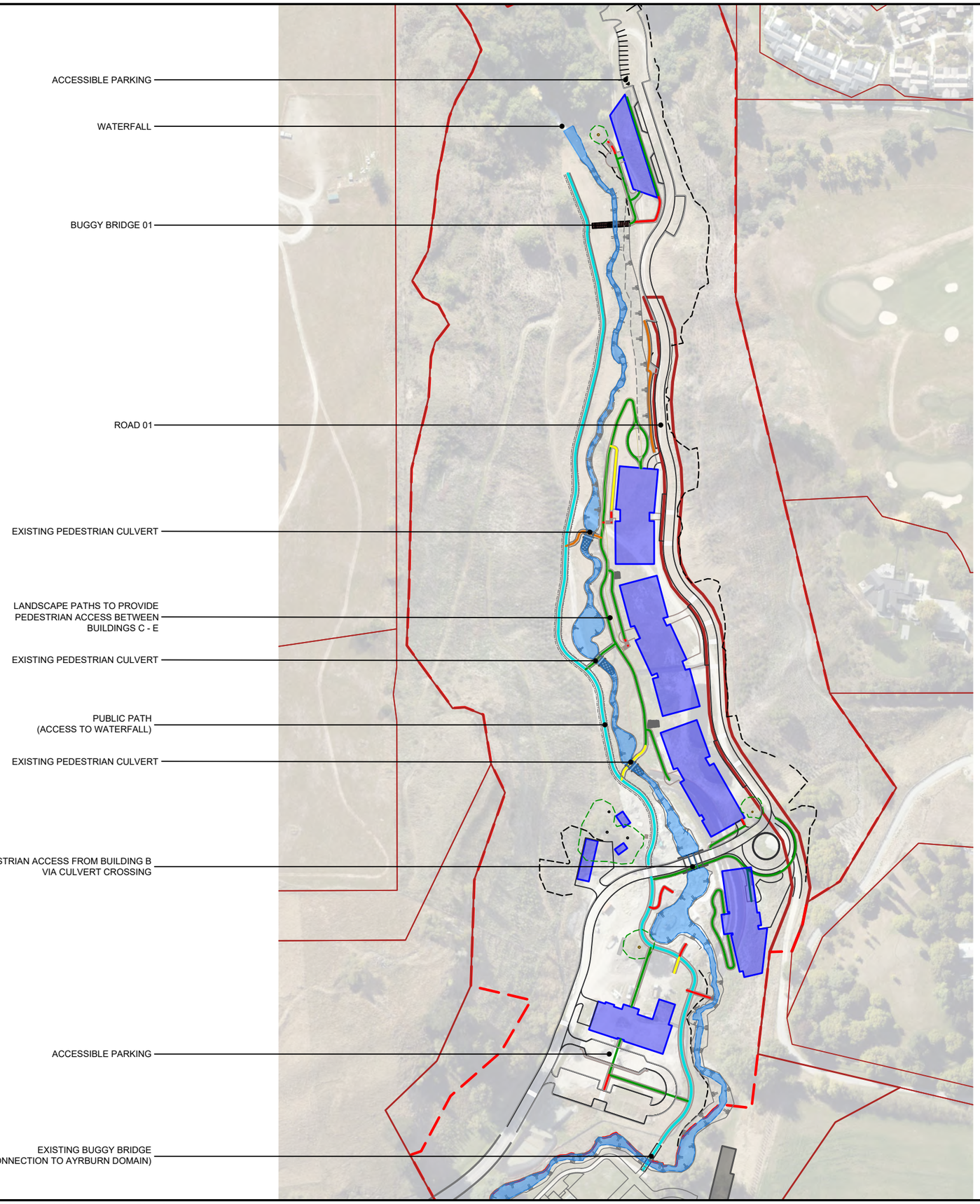

LEGEND

- PUBLIC PATH (2.5 - 3.0m WIDE), ACCESSIBLE (MAX 3%)
- ACCESSIBLE PATH (MAX 3%)
- ACCESSIBLE PATH (MAX 5% WITH LANDINGS)
- ACCESSIBLE PATH (MAX 8% WITH LANDINGS & HANDRAIL)
- NOT ACCESSIBLE (MAX 12% OR STAIRS)

N

FOR RESOURCE CONSENT

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Client/Location:

WATERFALL PARK DEVELOPMENTS LTD
LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN ACCESSIBLE PATHS LAYOUT

Surveyed by:		Original Size: A3	Scale: 1:2500
Designed by:	SB		
Drawn by:	SB		
Checked by:	SP		DO NOT SCALE
Approved by:			
Job Ref: Q6388 - 82 - 01	Sheet No: 310	Revision No: C	Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb

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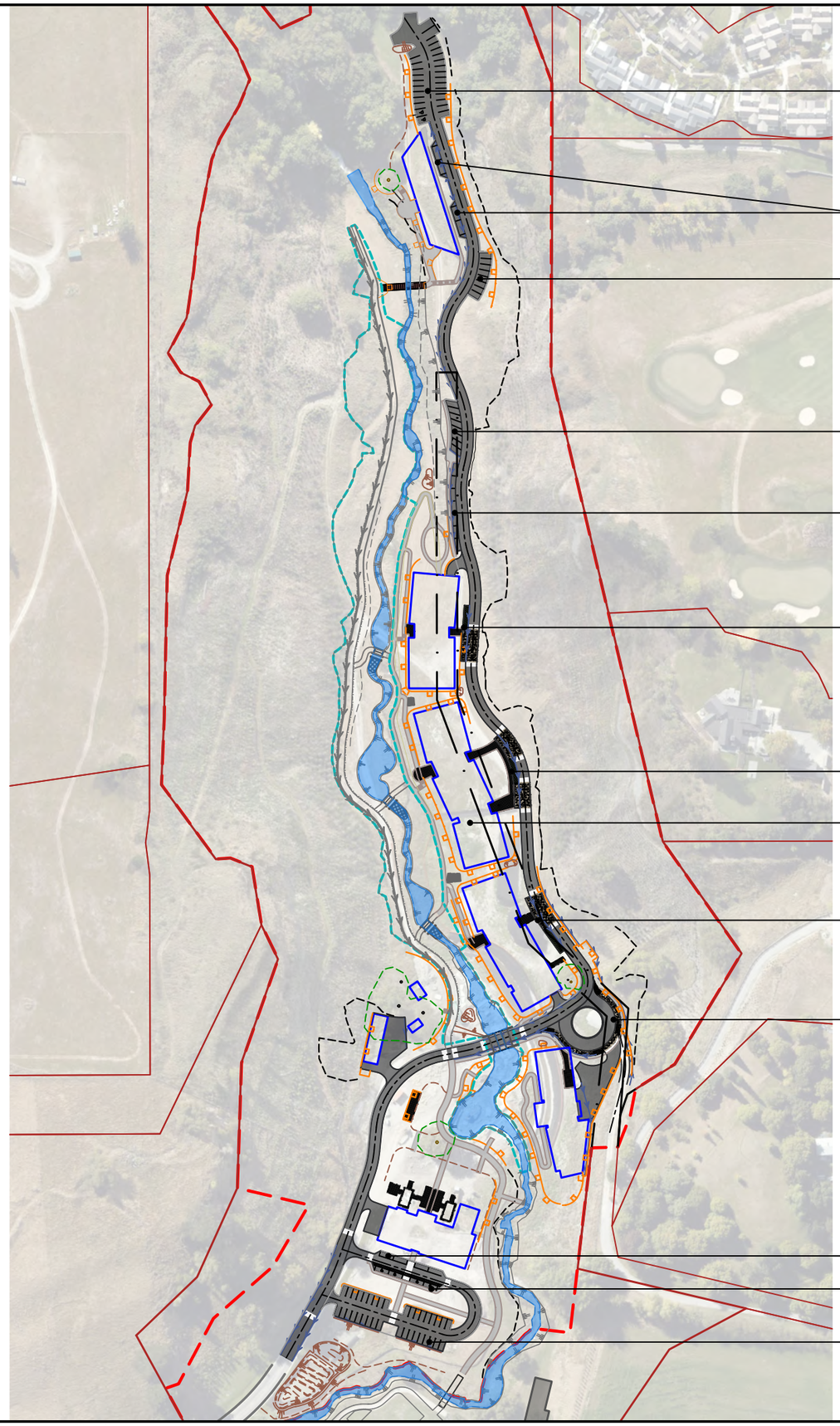

28 90° CARPARKS WITH 6m AISLE
- 2x 3.5m (W) x 5.0m (D) ACCESSIBLE
- 24x 2.7m (W) x 5.0m (D)
- 2x 4.0m (W) x 7.5m (D) MINI VAN PARKS

4 PARALLEL CARPARKS
- 4x 2.5m (W) x 7.0m (D)

8 90° CARPARKS WITH 6m AISLE
- 8x 2.7m (W) x 5.0m (D)

8 60° CARPARKS WITH 6.0m AISLE (STAFF ONLY)
- 9x 2.7m (W) x 5.4m (D)

7 PARALLEL CARPARKS (STAFF ONLY)
- 7x 2.5m (W) x 6.1m (D)

2 PARALLEL CARPARKS (LOADING ONLY)
- 2x 2.5m (W) x 6.1m (D)

4 PARALLEL CARPARKS (LOADING ONLY)
- 4x 2.5m (W) x 6.1m (D)

94 BASEMENT CARPARKS
(REFER TO WOODS BAGOT DRAWINGS FOR DETAILS)

2 PARALLEL CARPARKS (LOADING ONLY)
- 2x 2.5m (W) x 6.1m (D)

4 PARALLEL CARPARKS (LOADING ONLY)
- 4x 2.5m (W) x 7.0m MIN (D)

C

4 PARALLEL CARPARKS (LOADING ONLY)
- 4x 2.5m (W) x 7.0m (D) (3.5m CLEAR HEIGHT TO ACCOMMODATE MINI BUSES)

4 PARALLEL CARPARKS (ACCESSIBLE)
- 4x 3.6m (W) x 7.0m (D)

36 90° CARPARKS WITH 6.0m AISLE
- 36x 2.7m (W) x 5.0m (D)

LEGEND

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- STONE THRESHOLD
- STABILISED GRASS (EMERGENCY PARKING)
- PAVING AREA
- WORKS COMPLETED UNDER RM180584
- EXISTING TREE
- POND / RAINGARDEN
- 366.0 PROPOSED CONTOUR (0.5m INTERVAL)

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
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Client/Location:

WATERFALL PARK DEVELOPMENTS LTD LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN PARKING OVERVIEW

Surveyed by:		Original Size: A3	Scale: 1:2500
Designed by:	SB		
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 315	Revision No: C / Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb

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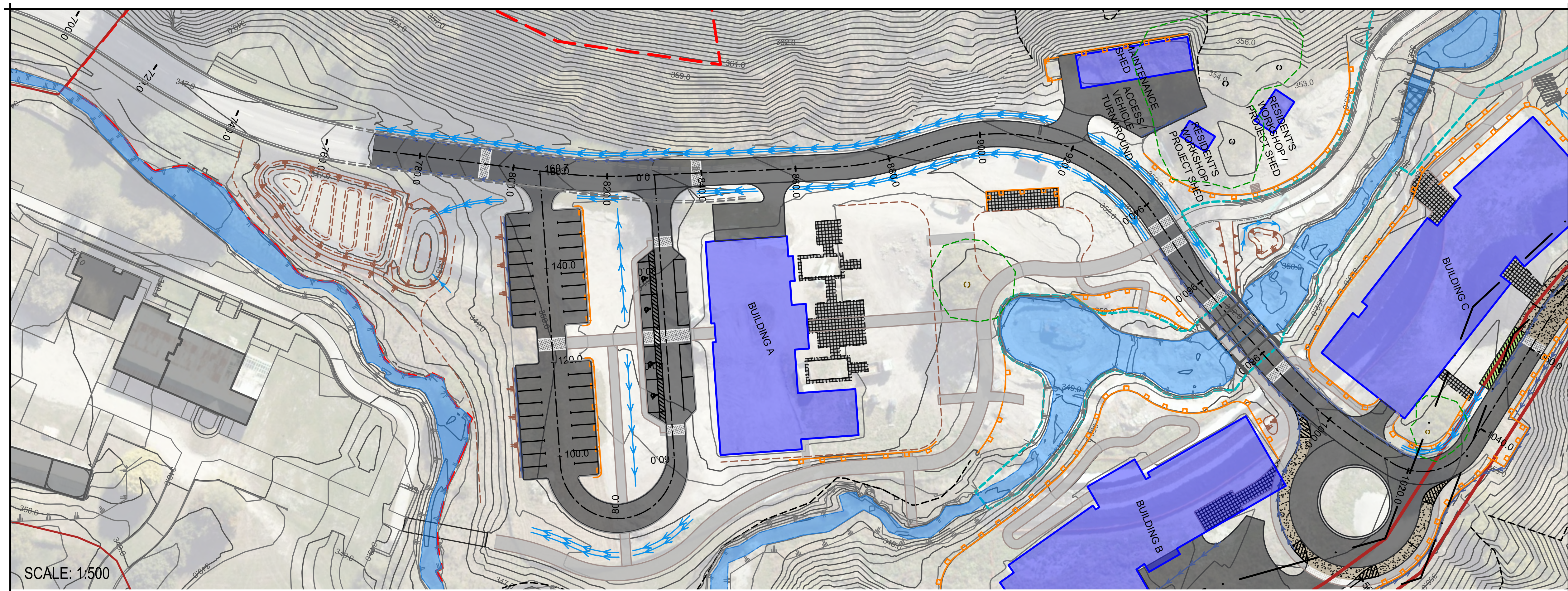

LEGEND

DESIGN SURFACE

EXISTING SURFACE

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
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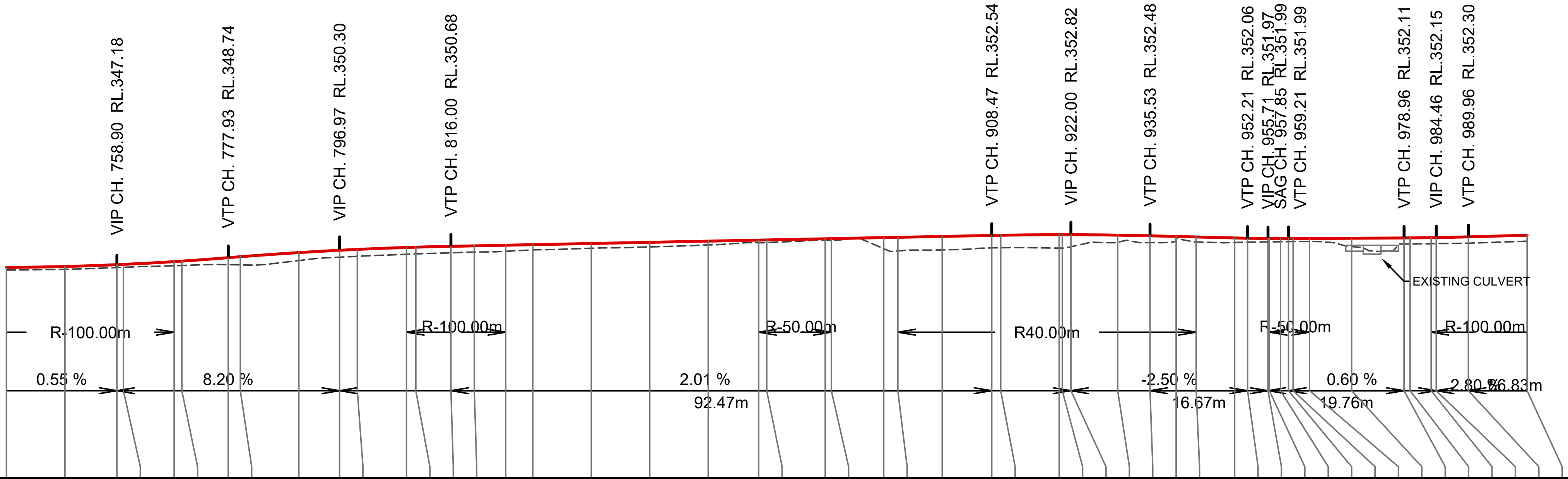

DATUM R.L.311.00

CHAINAGE	EXISTING GROUND LEVEL	+ FILL DEPTH - CUT DEPTH	DESIGN LEVEL
740.00	346.63	0.44	347.07
750.00	346.75	0.48	347.23
758.90	347.05	0.49	347.54
760.00	347.10	0.50	347.59
768.68	347.36	0.71	348.07
770.00	347.41	0.75	348.15
777.93	347.55	1.20	348.74
780.00	347.51	1.40	348.91
790.00	348.25	1.36	349.61
796.97	348.82	1.18	350.01
800.00	348.98	1.18	350.15
808.41	349.32	1.17	350.48
810.00	349.38	1.15	350.53
816.00	349.57	1.11	350.68
820.00	349.69	1.08	350.76
825.36	349.84	1.04	350.87
830.00	350.07	0.90	350.97
840.00	350.35	0.81	351.17
850.00	350.58	0.79	351.37
860.00	350.93	0.64	351.57
868.62	351.30	0.45	351.74
870.00	351.32	0.45	351.77
880.00	351.75	0.22	351.97
881.04	351.70	0.29	351.99
890.00	350.28	1.89	352.17
892.42	349.90	2.32	352.22
900.00	350.07	2.31	352.37
908.47	350.42	2.12	352.54
910.00	350.44	2.13	352.57
920.00	350.38	2.28	352.66
920.53	350.39	2.28	352.66
922.00	350.59	2.07	352.66
930.00	351.37	1.22	352.59
935.53	351.31	1.17	352.48
940.00	352.08	0.29	352.37
943.42	351.42	0.86	352.28
950.00	351.34	0.78	352.12
952.21	351.39	0.67	352.06
955.71	351.43	0.57	352.00
955.94	351.43	0.56	352.00
957.85	351.46	0.53	351.99
959.21	351.48	0.51	351.99
960.00	351.50	0.50	352.00
962.80	351.51	0.51	352.02
970.00	350.64	1.42	352.06
978.96	351.08	1.04	352.11
980.00	351.09	1.03	352.12
983.60	351.13	1.03	352.16
984.46	351.15	1.03	352.18
989.96	351.22	1.08	352.30
1000.00	351.56	1.02	352.58

SCALE 1:1000 HORIZONTAL
1:1000 VERTICAL

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Client/Location:

WATERFALL PARK DEVELOPMENTS LTD
LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN ROAD 01 LONGSECTION

Surveyed by:		Original Size: A3	Scale: AS SHOWN
Designed by:	SB		
Drawn by:	SB		
Checked by:	SP		
Approved by:			DO NOT SCALE
Job Ref: Q6388 - 82 - 01	Sheet No: 320	Revision No: C	Date Issued: 28/02/23

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb
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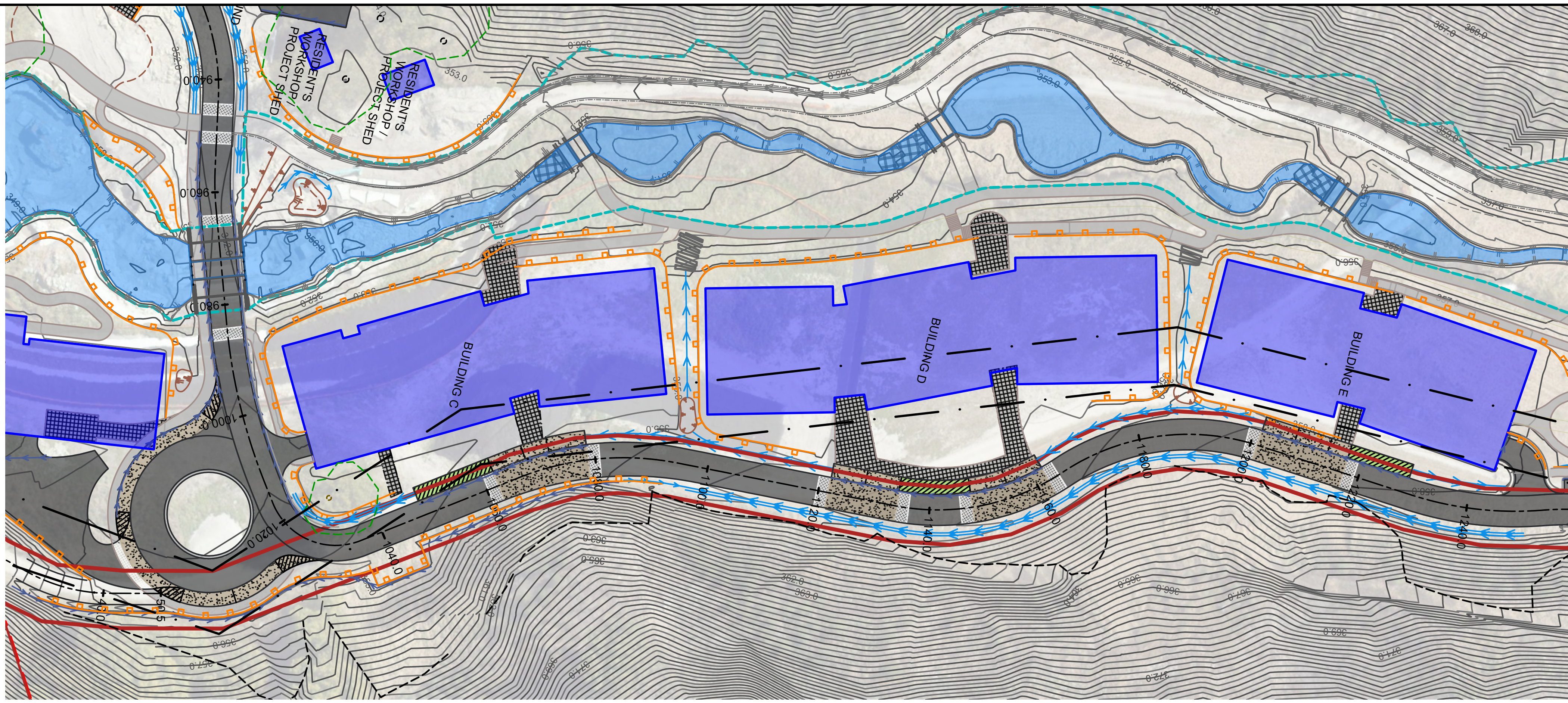

SCALE: 1:500

LEGEND

DESIGN SURFACE

EXISTING SURFACE

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
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VTP CH. 1076.79 RL.354.73

VIP CH. 1091.79 RL.355.15

VTP CH. 1106.79 RL.355.45

VTP CH. 1179.25 RL.356.90

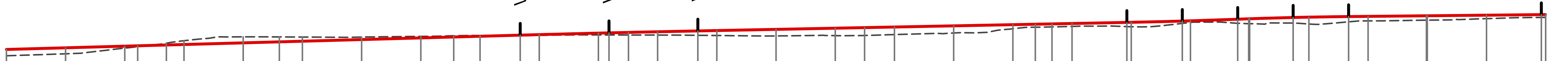
VIP CH. 1188.62 RL.357.09

VTP CH. 1197.98 RL.357.44

VIP CH. 1207.35 RL.357.80

VTP CH. 1216.71 RL.357.90

VTP CH. 1249.26 RL.358.22



HORIZ CURVE DATA: R-100.00m; R-12.00m; R50.00m; R-40.00m; R40.00m; R-60.00m

VERTICAL GRADE: 2.80 %; 2.00 %; 3.82 %; 1.00 %

VERTICAL LENGTH: 86.83m; 72.46m; 32.55m

DATUM R.L.316.00

CHAINAGE	EXISTING GROUND LEVEL	+ FILL DEPTH / - CUT DEPTH	DESIGN LEVEL
990.00	351.22	1.08	352.30
1000.00	351.56	1.02	352.58
1010.00	352.52	0.34	352.86
1012.17	352.77	0.15	352.92
1017.03	353.37	-0.31	353.06
1020.00	353.79	-0.65	353.14
1030.00	354.44	-1.02	353.42
1036.10	354.43	-0.84	353.59
1040.00	354.41	-0.71	353.70
1050.00	354.41	-0.43	353.98
1060.00	354.52	-0.26	354.26
1065.55	354.63	-0.21	354.42
1070.00	354.66	-0.12	354.54
1076.79	354.65	0.08	354.73
1080.00	354.71	0.11	354.82
1090.00	354.77	0.31	355.08
1091.79	354.76	0.36	355.12
1095.08	354.75	0.44	355.20
1100.00	354.75	0.56	355.31
1106.79	354.70	0.75	355.45
1110.00	354.67	0.84	355.51
1120.00	354.60	1.11	355.71
1130.00	354.65	1.26	355.91
1134.95	354.67	1.34	356.01
1140.00	354.83	1.29	356.11
1150.00	355.10	1.21	356.31
1160.00	355.82	0.69	356.51
1163.80	356.08	0.51	356.59
1166.61	356.14	0.51	356.65
1170.00	356.21	0.50	356.71
1179.25	356.18	0.72	356.90
1180.00	356.16	0.76	356.92
1188.62	356.71	0.41	357.13
1190.00	356.88	0.29	357.17
1197.98	356.71	0.73	357.44
1199.83	356.68	0.83	357.51
1200.00	356.68	0.84	357.52
1207.35	356.79	0.95	357.74
1210.00	356.63	1.16	357.79
1216.71	357.00	0.90	357.90
1220.00	357.16	0.77	357.93
1229.86	357.29	0.74	358.03
1230.00	357.29	0.74	358.03
1240.00	357.55	0.58	358.13
1249.26	357.76	0.47	358.22
1250.00	357.76	0.47	358.23

SCALE 1:1000 HORIZONTAL
1:1000 VERTICAL

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Client/Location:

WATERFALL PARK DEVELOPMENTS LTD LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN ROAD 01 LONGSECTION

Surveyed by:		Original Size: A3	Scale: AS SHOWN
Designed by:	SB		
Drawn by:	SB		
Checked by:	SP		
Approved by:			DO NOT SCALE
Job Ref: Q6388 - 82 - 01	Sheet No: 321	Revision No: C	Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb
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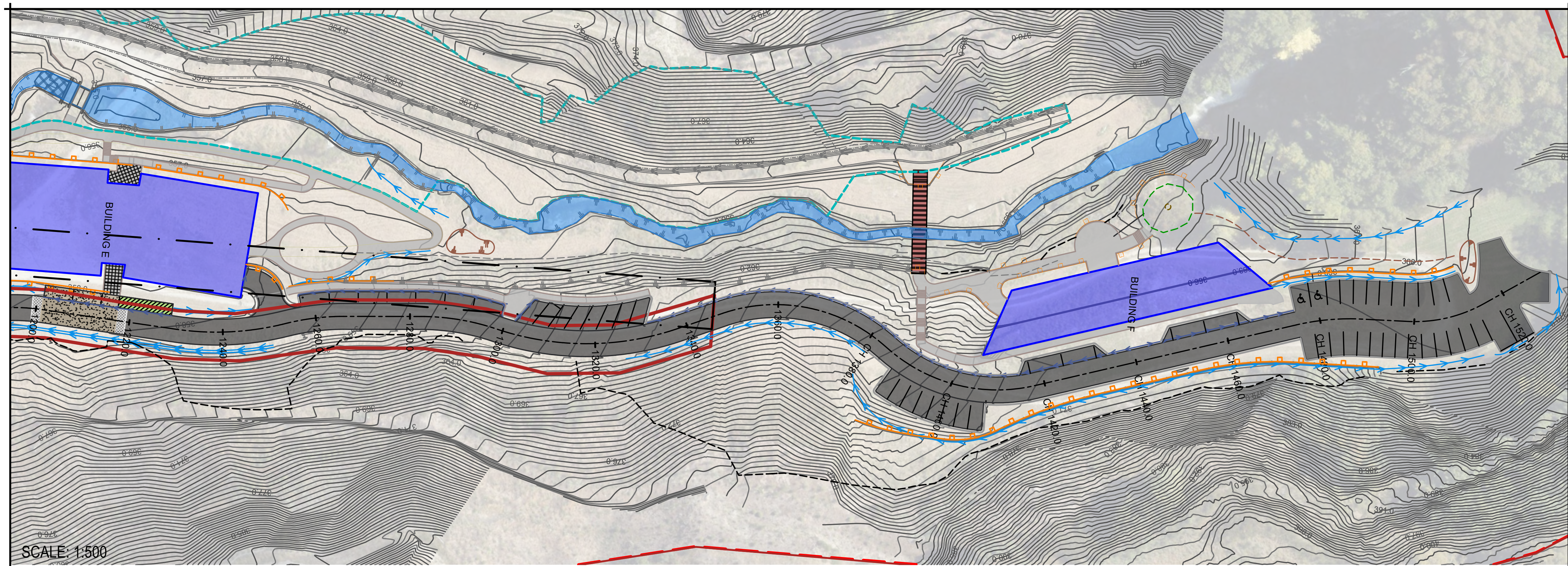
Version: 1, Version Date: 07/03/2023



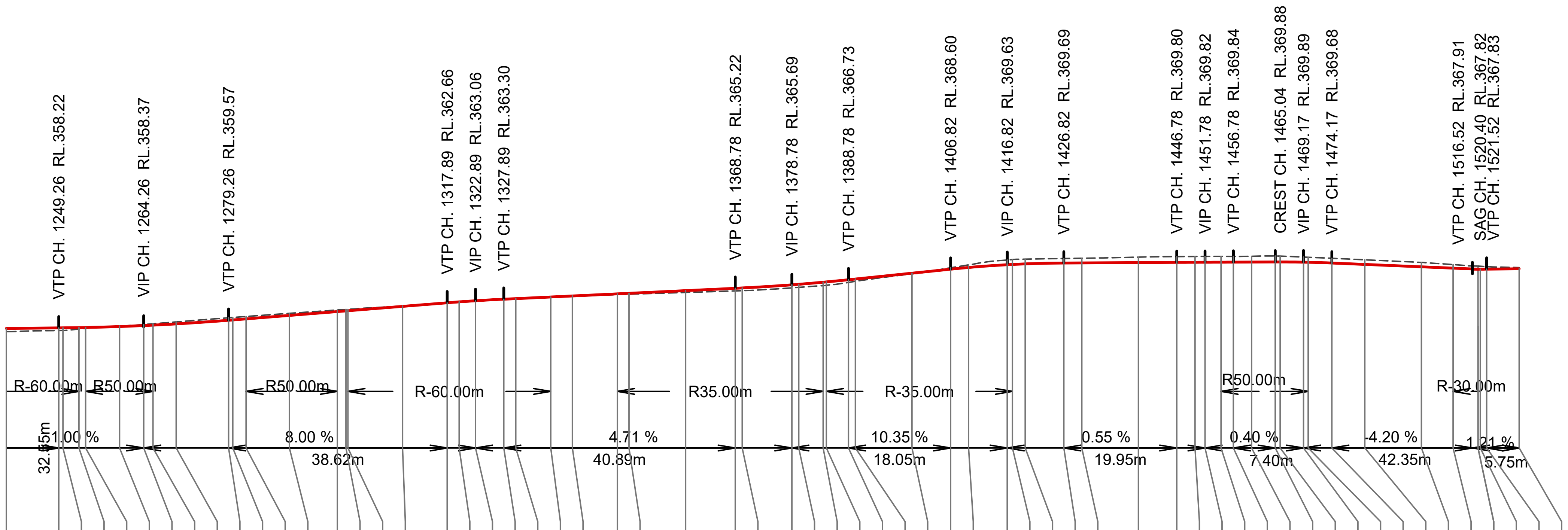
LEGEND

DESIGN SURFACE

EXISTING SURFACE

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
B	FOR RESOURCE CONSENT	27/09/22
C	RFI RESPONSE	28/02/23



HORIZ CURVE DATA

VERTICAL GRADE
VERTICAL LENGTH

DATUM R.L.322.00

CHAINAGE	EXISTING GROUND LEVEL	+ FILL DEPTH / - CUT DEPTH	DESIGN LEVEL
1240.00	357.55	0.58	358.13
1249.26	357.76	0.47	358.22
1250.00	357.76	0.47	358.23
1252.82	358.01	0.26	358.27
1254.00	358.14	0.15	358.29
1260.00	358.54	-0.08	358.46
1264.26	358.82	-0.18	358.63
1265.90	358.95	-0.24	358.71
1270.00	359.28	-0.35	358.93
1279.26	360.01	-0.44	359.57
1280.00	360.06	-0.43	359.63
1282.35	360.24	-0.43	359.82
1290.00	360.79	-0.36	360.43
1298.49	361.40	-0.29	361.11
1300.00	361.48	-0.25	361.23
1300.34	361.49	-0.24	361.26
1310.00	362.09	-0.06	362.03
1317.89	362.58	0.08	362.66
1320.00	362.73	0.10	362.82
1322.89	362.93	0.09	363.02
1327.89	363.24	0.05	363.30
1330.00	363.35	0.05	363.40
1336.18	363.62	0.06	363.69
1340.00	363.79	0.08	363.87
1347.96	364.10	0.14	364.24
1350.00	364.18	0.16	364.34
1360.00	364.48	0.33	364.81
1368.78	364.76	0.46	365.22
1370.00	364.80	0.48	365.28
1378.78	365.29	0.54	365.83
1380.00	365.39	0.54	365.93
1384.31	365.68	0.62	366.29
1384.88	365.75	0.60	366.35
1388.78	366.26	0.47	366.73
1390.00	366.46	0.40	366.86
1400.00	367.78	0.12	367.89
1406.82	368.86	-0.26	368.60
1410.00	369.36	-0.46	368.90
1416.82	370.22	-0.84	369.39
1417.75	370.30	-0.86	369.44
1420.00	370.37	-0.84	369.54
1426.82	370.49	-0.80	369.69
1430.00	370.53	-0.83	369.70
1440.00	370.73	-0.97	369.76
1446.78	370.82	-1.02	369.80
1450.00	370.84	-1.03	369.81
1451.78	370.85	-1.03	369.82
1454.60	370.86	-1.02	369.83
1456.78	370.84	-1.00	369.84
1460.00	370.88	-1.02	369.86
1464.17	370.93	-1.06	369.87
1465.04	370.91	-1.03	369.88
1469.17	370.74	-0.90	369.84
1470.00	370.70	-0.88	369.82
1474.17	370.52	-0.84	369.68
1480.00	370.25	-0.82	369.44
1490.00	369.79	-0.77	369.02
1495.60	369.41	-0.62	368.78
1500.00	369.15	-0.55	368.60
1520.40	368.45	-0.62	367.82
1521.52	368.33	-0.50	367.83
1527.27	368.11	-0.21	367.90

SCALE 1:1000 HORIZONTAL
1:1000 VERTICAL

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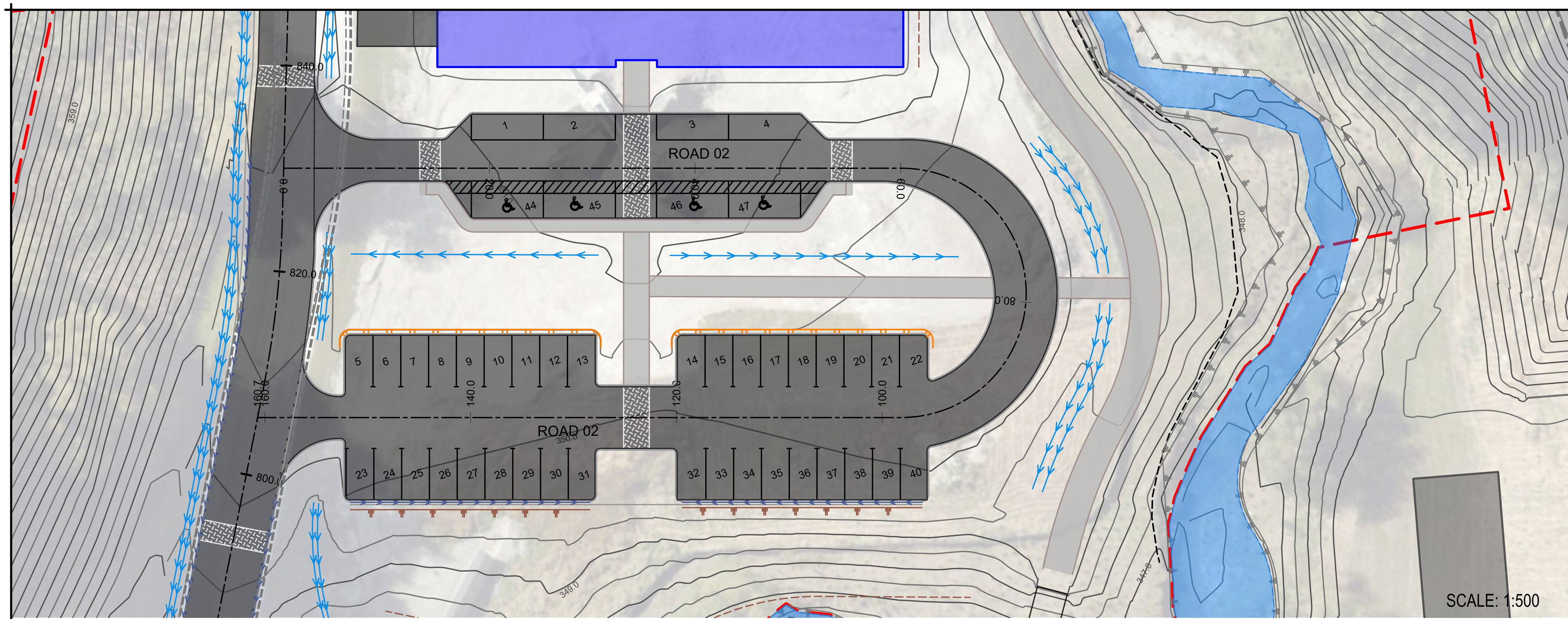
Client/Location:

WATERFALL PARK DEVELOPMENTS LTD
LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN ROAD 01 LONGSECTION

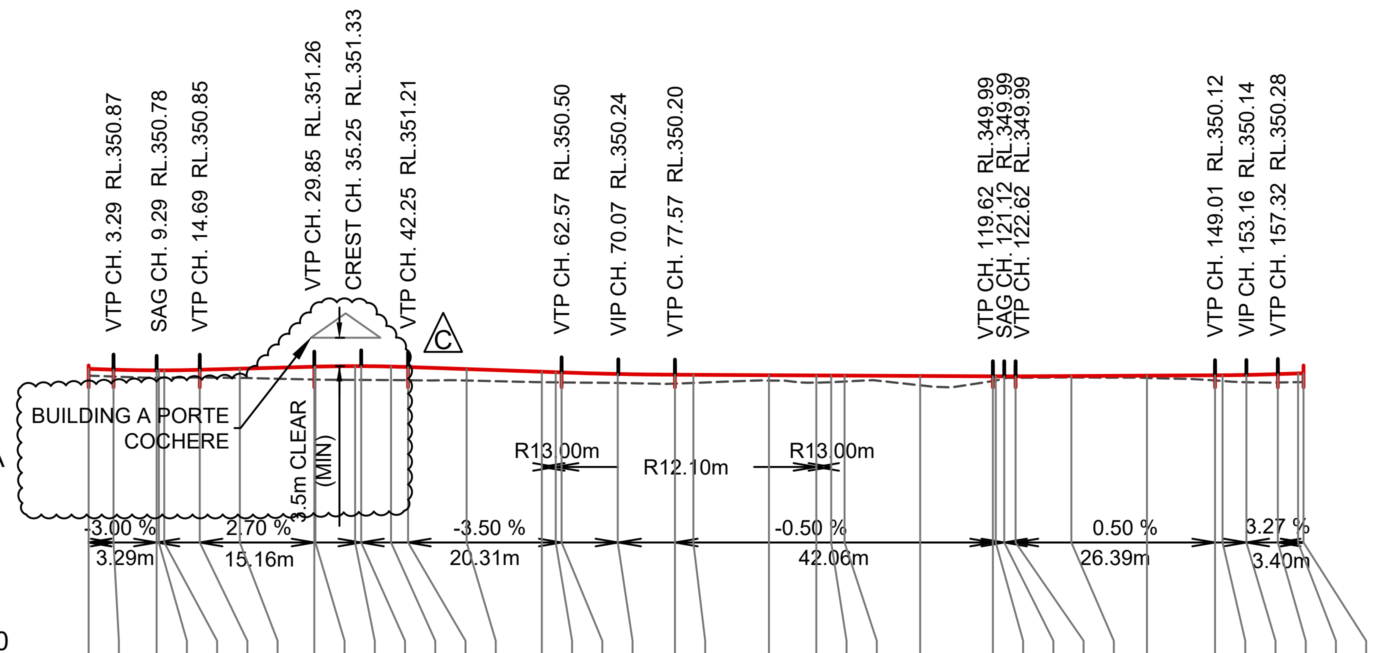
Surveyed by:		Original Size: A3	Scale: 1:500
Designed by:	SB		
Drawn by:	SB		
Checked by:	SP		
Approved by:			DO NOT SCALE
Job Ref: Q6388 - 82 - 01	Sheet No: 322	Revision No: C	Date Issued: 28/02/2023



LEGEND

DESIGN SURFACE

EXISTING SURFACE



DATUM R.L.313.00

EXISTING GROUND LEVEL	350.07	349.96	349.81	349.81	349.81	349.82	349.78	349.56	349.56	349.51	349.51	349.49	349.47	349.43
+ FILL DEPTH - CUT DEPTH	0.90	0.91	0.97	0.97	0.97	1.03	1.21	1.70	1.71	1.82	1.82	1.79	1.74	1.51
DESIGN LEVEL	350.97	350.87	350.78	350.78	350.78	350.85	350.99	351.26	351.26	351.33	351.33	351.28	351.21	350.94
CHAINAGE	0.00	3.29	8.99	9.29	10.00	14.69	20.00	29.85	30.00	35.25	36.05	40.00	42.25	50.00

EXISTING GROUND LEVEL	349.21	349.19	349.18	349.11	349.02	349.11	349.43	349.15	349.21	349.30	348.80	349.36
+ FILL DEPTH - CUT DEPTH	1.38	1.34	1.32	1.18	1.18	1.08	0.71	0.96	0.89	0.79	1.24	0.63
DESIGN LEVEL	350.59	350.53	350.50	350.29	350.20	350.19	350.14	350.11	350.10	350.09	350.04	349.99
CHAINAGE	59.95	61.79	62.57	70.00	77.57	80.00	90.00	96.26	98.23	100.00	110.00	119.62

EXISTING GROUND LEVEL	349.43	349.69	349.79	349.84	349.77	349.44	349.37	349.20	349.17	349.21	349.21
+ FILL DEPTH - CUT DEPTH	0.56	0.29	0.20	0.19	0.30	0.68	0.76	0.97	1.11	1.16	1.18
DESIGN LEVEL	349.99	349.99	349.99	350.03	350.08	350.12	350.13	350.17	350.28	350.37	350.39
CHAINAGE	120.00	121.12	122.62	130.00	140.00	149.01	150.00	153.16	157.32	160.00	160.71

SCALE 1:1000 HORIZONTAL
1:1000 VERTICAL

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
B	FOR RESOURCE CONSENT	27/09/22
C	RFI RESPONSE	28/02/23

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LOT 1 DP 540788

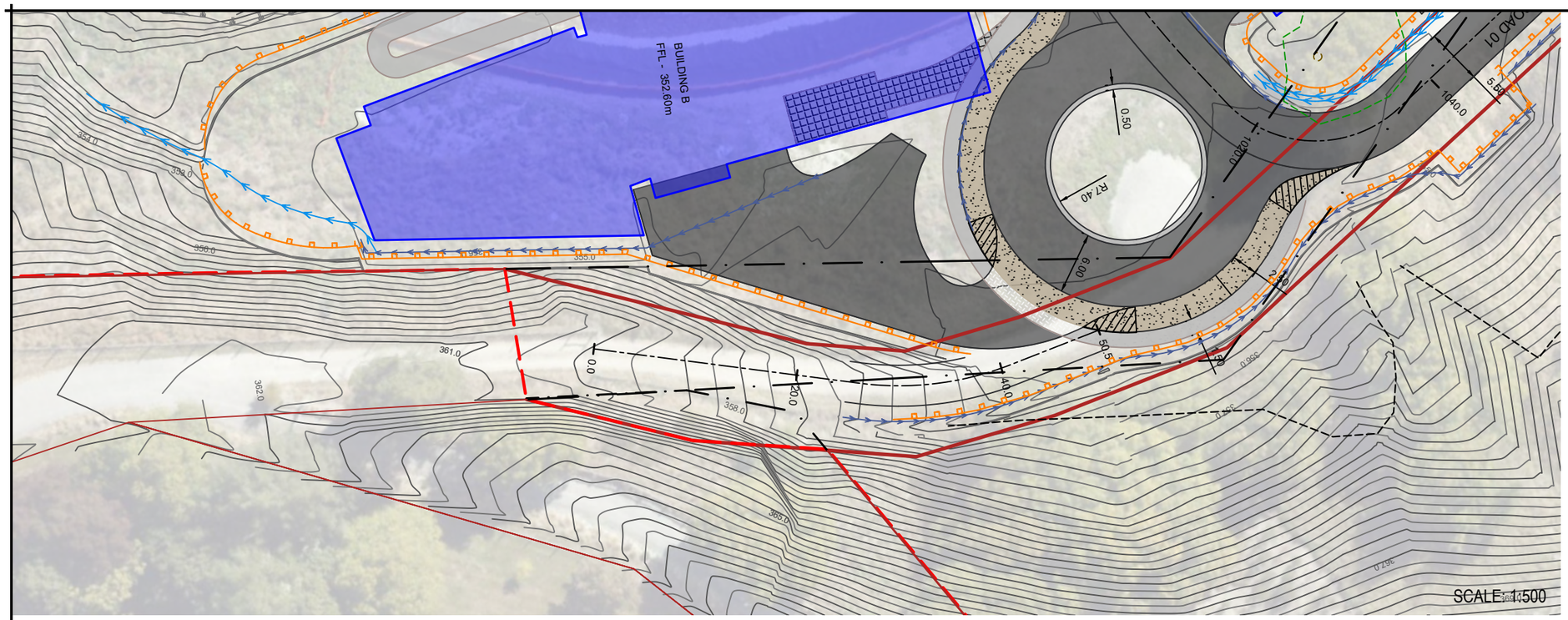
Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN ROAD 02 LONGSECTION

Surveyed by:		Original Size: A3	Scale: AS SHOWN
Designed by:	SB		
Drawn by:	SB		
Checked by:	SP		
Approved by:			DO NOT SCALE
Job Ref: Q6388 - 82 - 01	Sheet No: 325	Revision No: C	Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb

C:\12DS\DATA\QTSVR01\Q6388F - NORTHBROOK WATERFALL PARK_10662\5 - DRAWINGS\1 - DWG\RETIREMENT RC\Q6388-82-01_300 ROADING PLANS.DWG



PROPOSED TRACK GRADE TO MATCH EXISTING AT LOWER ELEVATION

VTP CH. 29.09 RL.355.61
VIP CH. 34.42 RL.354.75
VTP CH. 39.75 RL.354.09
VIP CH. 45.08 RL.353.42
VTP CH. 50.41 RL.353.26

TRACK LEVEL TO TIE IN WITH CIRCULATION LANE

TRACK GRADE EXTENDED DOWN HIGH SIDE TO BE RETAINED

R-30.00m

HORIZ CURVE DATA

VERTICAL GRADE -16.15 % -12.45 % -3.00 %

VERTICAL LENGTH 29.09m 0.10m

DATUM R.L.335.00

EXISTING GROUND LEVEL	359.83	358.85	357.04	356.29	355.92	355.80	355.17	355.07	355.06	355.03	354.93	354.81	354.79	354.79
+ FILL DEPTH - CUT DEPTH	0.48	-0.16	0.03	-0.21	-0.31	-0.34	-0.36	-0.98	-1.00	-1.12	-1.38	-1.53	-1.53	-1.53
DESIGN LEVEL	360.31	358.69	357.08	356.08	355.61	355.47	354.80	354.09	354.06	353.91	353.55	353.28	353.26	353.26
CHAINAGE	0.00	10.00	20.00	26.19	29.09	30.00	34.42	39.75	40.00	41.25	45.08	50.00	50.41	50.51

SCALE 1:500 HORIZONTAL
1:500 VERTICAL

LEGEND

DESIGN SURFACE

EXISTING SURFACE

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
B	FOR RESOURCE CONSENT	27/09/22
C	RFI RESPONSE	28/02/23

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Client/Location:

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LOT 1 DP 540788

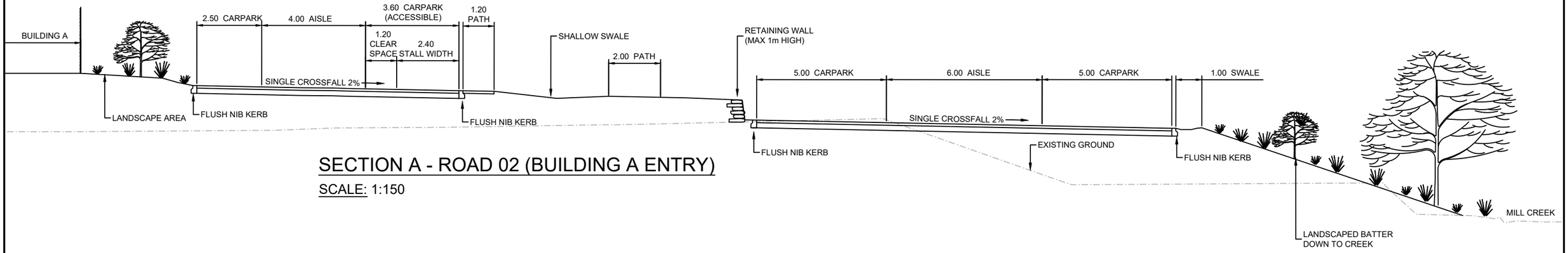
Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN WP ROAD LONGSECTION

Surveyed by:		Original Size: A3	Scale: AS SHOWN
Designed by:	SB		
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 326	Revision No: C / Date Issued: 28/02/2023

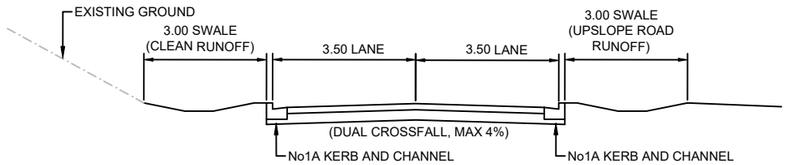
PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb

C:\12DS\DATA\QTSVR01\Q6388F - NORTHBROOK WATERFALL PARK_1066\2\5 - DRAWINGS\1 - DWG\RETIREMENT RC\Q6388-82-01_300 ROADING PLANS.DWG



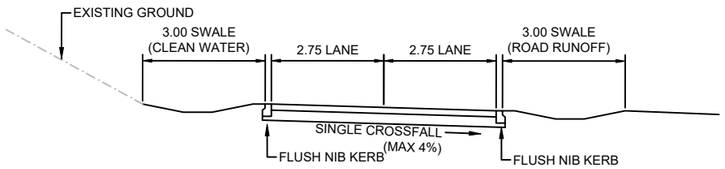
SECTION A - ROAD 02 (BUILDING A ENTRY)

SCALE: 1:150



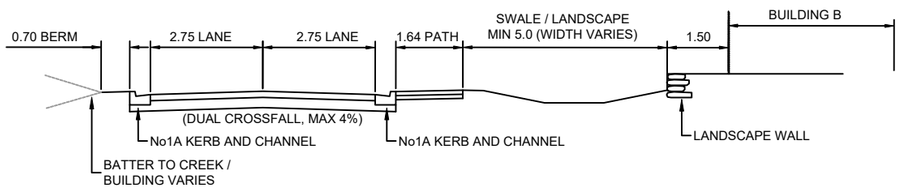
SECTION B - ROAD 01, CH760 - 830

SCALE: 1:150



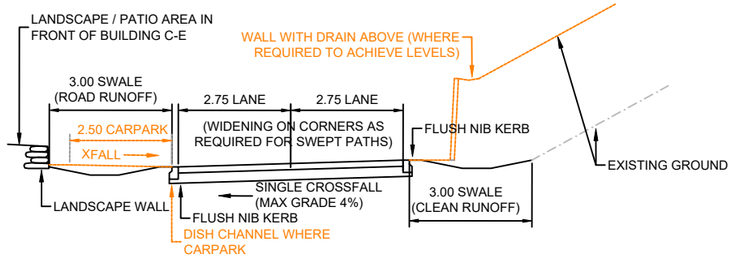
SECTION C - ROAD 01, CH830 - 950

SCALE: 1:150



SECTION D - ROAD 01, CH950 - 1020

SCALE: 1:150



SECTION E - ROAD 01, CH1020 - 1250

SCALE: 1:150

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
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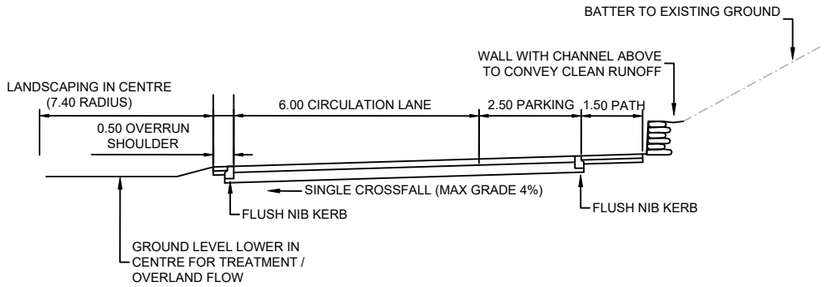
LOT 1 DP 540788

Purpose/Drawing Title:

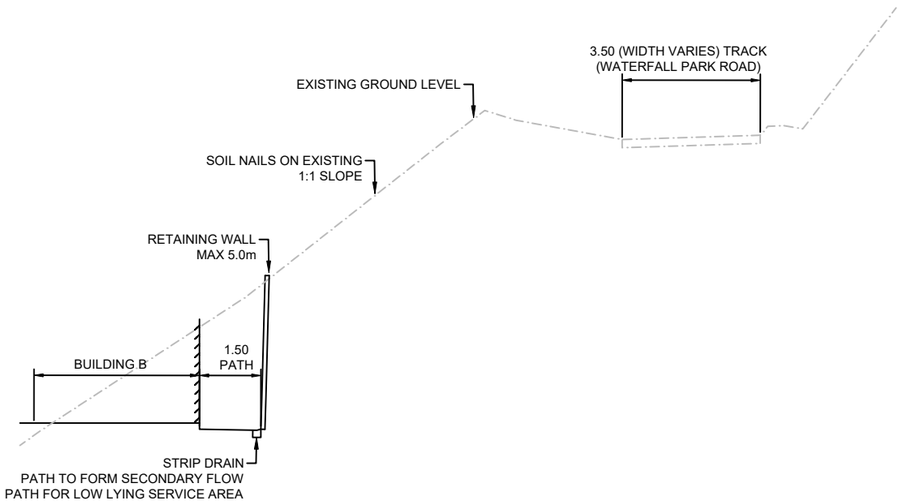
NORTHBROOK - ARROWTOWN
TYPICAL ROAD SECTIONS

Surveyed by:		Original Size: A3	Scale: AS SHOWN
Designed by:	SB		
Drawn by:	SB		
Checked by:	SP		DO NOT SCALE
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 330	Revision No: C
			Date Issued: 28/02/2023



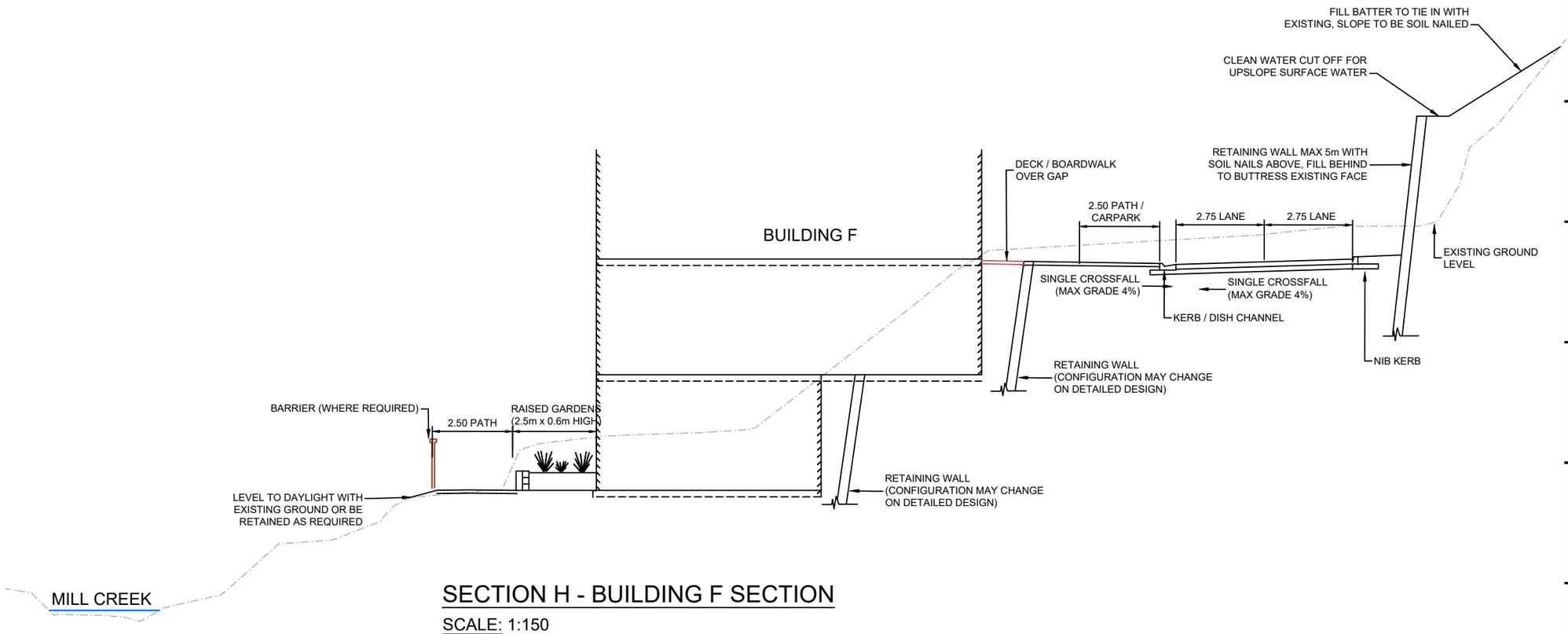
SECTION F - BUILDING B, CIRCULATION LANE

SCALE: 1:150



SECTION G - WATERFALL PARK ROAD (BEHIND BUILDING B)

SCALE: 1:150



SECTION H - BUILDING F SECTION

SCALE: 1:150

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
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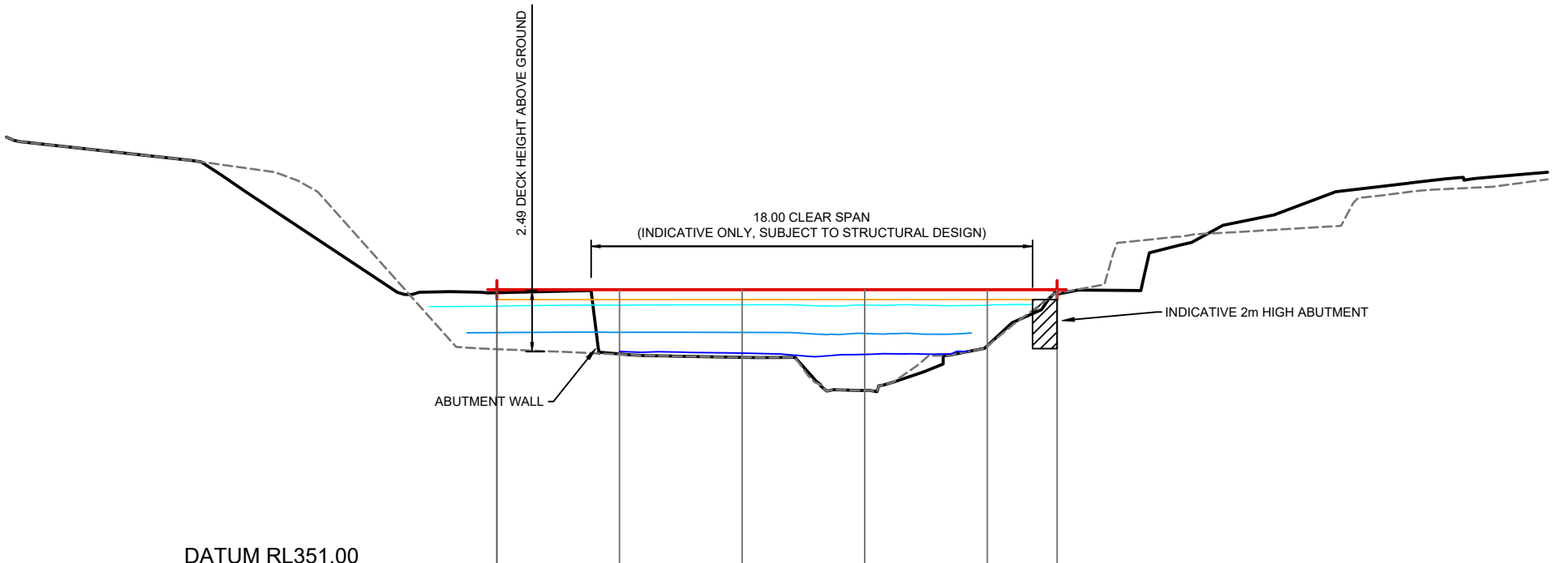
LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN
TYPICAL ROAD SECTIONS

Surveyed by:		Original Size:	Scale:
Designed by:	SB	A3	AS SHOWN
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 331	Revision No: C / Date Issued: 28/02/2023



DATUM RL351.00

BRIDGE DECK LEVEL	362.35	362.35	362.35	362.35	362.35	362.35
BRIDGE SOFFIT	361.95	361.95	361.95	361.95	361.95	
500yr ARI FLOOD LEVEL	361.68	361.72	361.73	361.73	361.72	
100yr ARI FLOOD LEVEL	360.60	360.61	360.61	360.57		
50yr ARI FLOOD LEVEL		359.83	359.77	359.71		
GROUND LEVEL	362.23	359.71	359.59	358.25	360.07	362.18
BRIDGE HEIGHT	0.12	2.64	2.76	4.10	2.28	0.17
CHAINAGE	0.00	5.00	10.00	15.00	20.00	22.84

SCALE: 1:250 HORIZONTAL
1:250 VERTICAL

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
B	FOR RESOURCE CONSENT	27/09/22
C	RFI RESPONSE	28/02/23

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Client/Location:
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LOT 1 DP 540788

Purpose/Drawing Title:
NORTHBROOK - ARROWTOWN BRIDGE 01 LONGSECTION

Surveyed by:		Original Size: A3	Scale: 1:250
Designed by:	SB		
Drawn by:	SB		
Checked by:	SP		DO NOT SCALE
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 340	Revision No: C
			Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb

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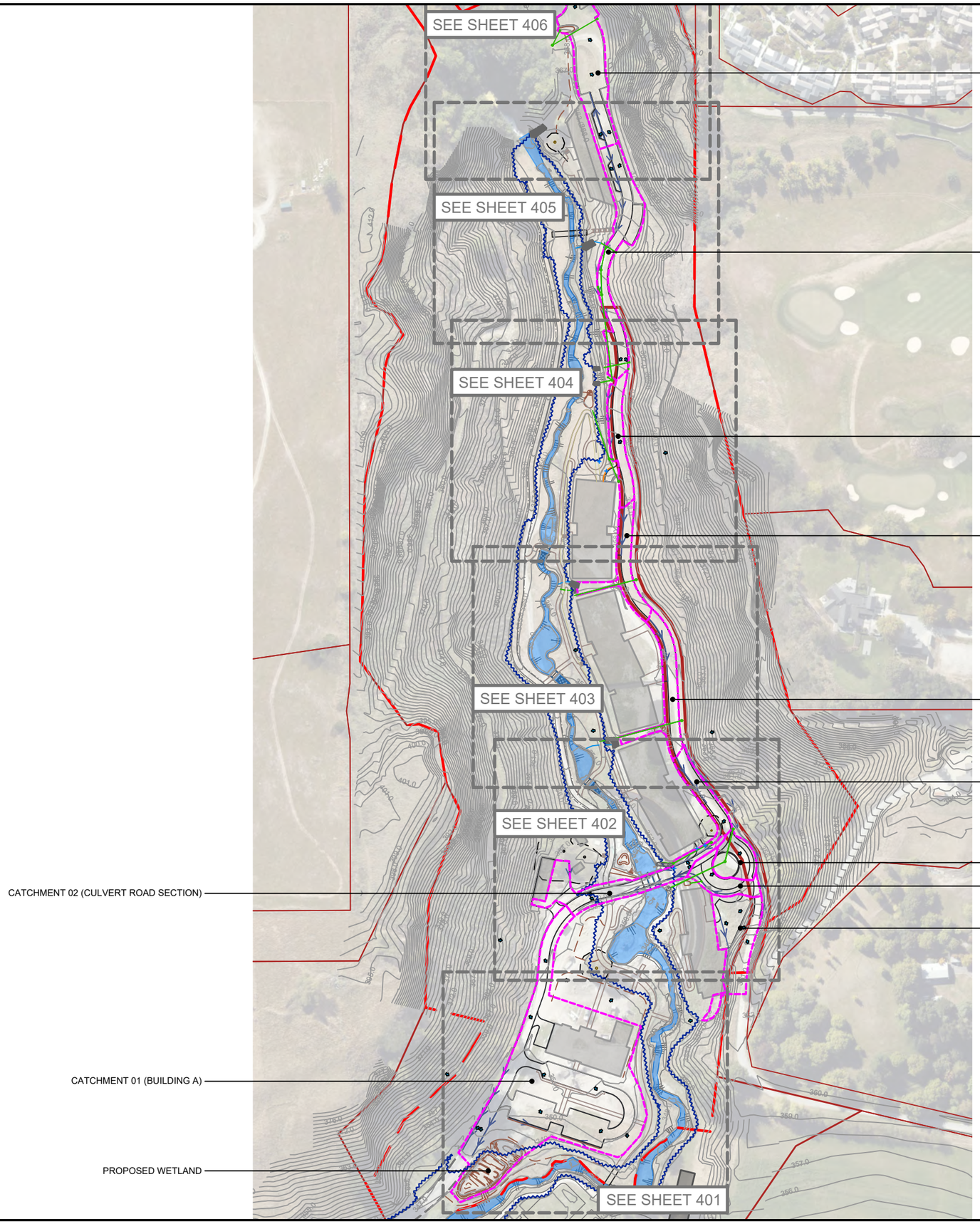

N

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- MILL CREEK
- SITE EXTENT
- CATCHMENT EXTENT (PRIMARY NETWORK)
- RAIN GARDEN
- OPEN SWALE
- KERB / CONCRETE CHANNEL
- SHEET FLOW DIRECTION
- STORMWATER PIPE / CULVERT
- MUDTANK / MANHOLE
- FLOOD EXTENT 100y ARI
- PROPOSED BUILDING
- PROPOSED CONTOUR (1m INTERVAL)
- FLOOD EXTENT/FREEBOARD RL

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
B	FOR RESOURCE CONSENT	12/06/22
C	RFI RESPONSE	28/02/23

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Client/Location:

WATERFALL PARK DEVELOPMENTS LTD
LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN STORMWATER OVERVIEW

Surveyed by:		Original Size: A3	Scale: 1:2500
Designed by:	SB		
Drawn by:	SB		DO NOT SCALE
Checked by:	XXX		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 400	Revision No: C
			Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb

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RUNOFF FROM LAWN AREAS AND PATHS TO SHEET FLOW TO CREEK

ROAD 01

ROAD TRANSITIONS TO SINGLE CROSSFALL, RUNOFF FROM UPSLOPE AND ROAD TO BE TREATED SEPARATELY

EXTENT OF KERB AND CHANNEL, RUNOFF CONVEYED TO EXISTING MUDTANK

PIPE NETWORK TO COLLECT ROOF RUNOFF, DISCHARGE TO SWALE

BUILDING A
FFL - 351.59m

ROAD 02

SECONDARY FLOW PATH TO CONVEY RUNOFF FROM BEHIND BUILDING B THAT CAN'T DRAIN TO THE NORTH

SWALE TO CATCH RUNOFF FROM UPSLOPE AND CONVEY TO MILL CREEK VIA EXISTING AYR AVENUE FLOW PATHS

SHALLOW SWALES SHAPED INTO LAWN TO CONVEY RUNOFF FROM PARKING AREA TO MUDTANK

EXTENT OF KERB AND CHANNEL, RUNOFF CONVEYED TO EXISTING MUDTANK

DISH CHANNEL TO CONVEY RUNOFF TO MUDTANK BEFORE DISCHARGE TO WETLAND

ROAD 02

B 4/10

A 4/10

PIPE DISCHARGE TO PROPOSED WETLAND

CULVERT TO LINK SWALES

MUDTANK TO PICK UP SWALE FLOW AND PIPE TO WETLAND

PROPOSED WETLAND DISCHARGES TO EXISTING AYR AVENUE TREATMENT FLOWPATH

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- MILL CREEK
- SITE EXTENT
- CATCHMENT EXTENT (PRIMARY NETWORK)
- RAIN GARDEN
- OPEN SWALE
- KERB / CONCRETE CHANNEL
- SHEET FLOW DIRECTION
- STORMWATER PIPE / CULVERT
- MUDTANK / MANHOLE
- FLOOD EXTENT 100y ARI
- PROPOSED BUILDING
- 357.0 PROPOSED CONTOUR (1m INTERVAL)
- FLOOD EXTENT/FREEBOARD RL

NOTES

1. REFER TO CKL REPORT FOR DETAILS OF SW TREATMENT
2. ROOF RUNOFF WILL BE PIPED DIRECTLY TO OPEN SWALES AND BE CONVEYED TO MILL CREEK,
3. ALL CATCHMENT EXTENTS SHOWN ARE INDICATIVE ONLY, AREA MAY CHANGE DURING DETAILED DESIGN.

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
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Client/Location:

WATERFALL PARK DEVELOPMENTS LTD
LOT 1 DP 540788

Purpose/Drawing Title:

NORTHBROOK - ARROWTOWN STORMWATER LAYOUT

Surveyed by:		Original Size:	Scale:
Designed by:	SB	A3	1:500
Drawn by:	SB		DO NOT SCALE
Checked by:	SP		
Approved by:			
Job Ref: Q6388 - 82 - 01		Sheet No: 401	Revision No: C
			Date Issued: 28/02/2023

PLOT DATE: 03 March, 2023 - 2:34 PM BY: Sb

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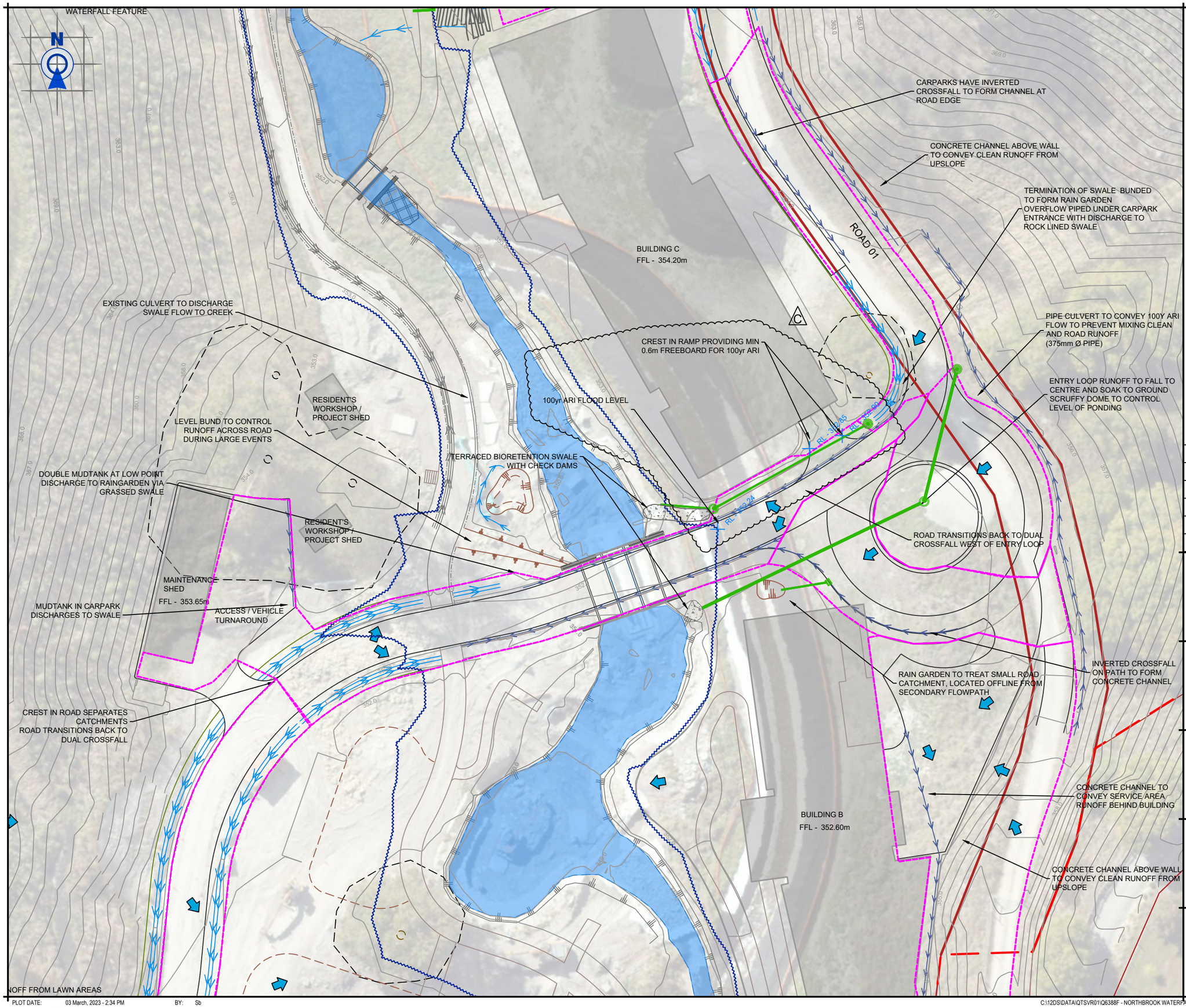

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- MILL CREEK
- SITE EXTENT
- CATCHMENT EXTENT (PRIMARY NETWORK)
- RAIN GARDEN
- OPEN SWALE
- KERB / CONCRETE CHANNEL
- SHEET FLOW DIRECTION
- STORMWATER PIPE / CULVERT
- MUDTANK / MANHOLE
- FLOOD EXTENT 100y ARI
- PROPOSED BUILDING
- 357.0 PROPOSED CONTOUR (1m INTERVAL)
- FLOOD EXTENT/FREEBOARD RL

NOTES

1. REFER TO CKL REPORT FOR DETAILS OF SW TREATMENT
2. ROOF RUNOFF WILL BE PIPED DIRECTLY TO OPEN SWALES AND BE CONVEYED TO MILL CREEK,
3. ALL CATCHMENT EXTENTS SHOWN ARE INDICATIVE ONLY, AREA MAY CHANGE DURING DETAILED DESIGN.

FOR RESOURCE CONSENT

REV.	REVISION DETAILS	DATE
A	ORIGINAL ISSUE	30/03/22
B	FOR RESOURCE CONSENT	12/06/22
C	RFI RESPONSE	28/02/23

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EXISTING PEDESTRIAN CULVERT

RAINGARDEN FOR TREATMENT, DISCHARGE OVERLAND VIA WATERFALL FEATURE

CARPARK HAVE INVERTED CROSSFALL TO FORM CHANNEL AT ROAD EDGE

PIPE CULVERT TO CONVEY RUNOFF FROM UPSLOPE AND DISCHARGE TO LANDSCAPE AREA. SIZED TO CONVEY 100Y ARI

BUILDING D
FFL - 356.3m

CARPARK HAVE INVERTED CROSSFALL TO FORM CHANNEL AT ROAD EDGE

ROAD 01

EXISTING PEDESTRIAN CULVERT

RAINGARDEN FOR TREATMENT, DISCHARGE OVERLAND VIA WATERFALL FEATURE

PIPE CULVERT TO CONVEY RUNOFF FROM UPSLOPE AND DISCHARGE TO LANDSCAPE AREA. SIZED TO CONVEY 100Y ARI

CARPARKS HAVE INVERTED CROSSFALL TO FORM CHANNEL AT ROAD EDGE

CONCRETE CHANNEL ABOVE WALL TO CONVEY CLEAN RUNOFF FROM UPSLOPE

TERMINATI

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- MILL CREEK
- SITE EXTENT
- CATCHMENT EXTENT (PRIMARY NETWORK)
- RAIN GARDEN
- OPEN SWALE
- KERB / CONCRETE CHANNEL
- SHEET FLOW DIRECTION
- STORMWATER PIPE / CULVERT
- MUDTANK / MANHOLE
- FLOOD EXTENT 100y ARI
- PROPOSED BUILDING
- PROPOSED CONTOUR (1m INTERVAL)
- FLOOD EXTENT/FREEBOARD RL

NOTES

1. REFER TO CKL REPORT FOR DETAILS OF SW TREATMENT
2. ROOF RUNOFF WILL BE PIPED DIRECTLY TO OPEN SWALES AND BE CONVEYED TO MILL CREEK,
3. ALL CATCHMENT EXTENTS SHOWN ARE INDICATIVE ONLY, AREA MAY CHANGE DURING DETAILED DESIGN.

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PIPE NETWORK TO COLLECT MUDTANKS THROUGH SECTION WHERE SWALES CAN'T BE FORMED

PIPE CULVERT FOR DISCHARGE OF CLEAN RUNOFF

PIPE OUTLET TO ROCK LINED WATERFALL FEATURE

MUDTANKS DISCHARGE TO RAINGARDEN

ROAD 01

MUDTANK IN CARPARK WITH DISCHARGE TO SWALE

LANDSCAPE WALL, TOP OF WALL SET MIN 0.6m ABOVE 100yr ARI WATER LEVEL

SWALE RUNS AGAINST THE GRADE OF ROAD, PIPE CULVERT UNDER CARPARK ENTRANCE TO DISCHARGE

BUILDING E
FFL - 358.10m

CARPARK HAVE INVERTED CROSSFALL TO FORM CHANNEL AT ROAD EDGE

RL - 357.0

RL - 358.32 (100)

C

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- MILL CREEK
- SITE EXTENT
- CATCHMENT EXTENT (PRIMARY NETWORK)
- RAIN GARDEN
- OPEN SWALE
- KERB / CONCRETE CHANNEL
- SHEET FLOW DIRECTION
- STORMWATER PIPE / CULVERT
- MUDTANK / MANHOLE
- FLOOD EXTENT 100y ARI
- PROPOSED BUILDING
- 357.0 PROPOSED CONTOUR (1m INTERVAL)
- RL - 358.88 FLOOD EXTENT/FREEBOARD RL

NOTES

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2. ROOF RUNOFF WILL BE PIPED DIRECTLY TO OPEN SWALES AND BE CONVEYED TO MILL CREEK,
3. ALL CATCHMENT EXTENTS SHOWN ARE INDICATIVE ONLY, AREA MAY CHANGE DURING DETAILED DESIGN.

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ROCK SWALE / WATERFALL FEATURE TO CONVEY SWALE RUNOFF DOWN THE BANK

WATERFALL

BUILDING F
FFL - 362.55m (BASEMENT)
FFL - 366.15m (LEVEL 01)
FFL - 369.75m (LEVEL 02)

DRY CREEK BED / WATERFALL FEATURE TO CONVEY RUNOFF

ROAD 01

PIPE CULVERT FOR DISCHARGE OF CLEAN RUNOFF

MUDTANKS TO COLLECT ROAD RUNOFF AND CONVEY TO RAINGARDEN

DOUBLE MUDTANK TO COLLECT ROAD RUNOFF ON STEEP VERTICAL ALIGNMENT

PIPE NETWORK TO COLLECT MUDTANKS THROUGH SECTION WHERE SWALES CAN'T BE FORMED

LEGEND

- LEGAL BOUNDARY (SUBJECT PROPERTY)
- LEGAL BOUNDARY (ABUTTALS)
- MILL CREEK
- SITE EXTENT
- CATCHMENT EXTENT (PRIMARY NETWORK)
- RAIN GARDEN
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- STORMWATER PIPE / CULVERT
- MUDTANK / MANHOLE
- FLOOD EXTENT 100y ARI
- PROPOSED BUILDING
- 357.0 PROPOSED CONTOUR (1m INTERVAL)
- RL 360.85 FLOOD EXTENT/FREEBOARD RL

NOTES

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