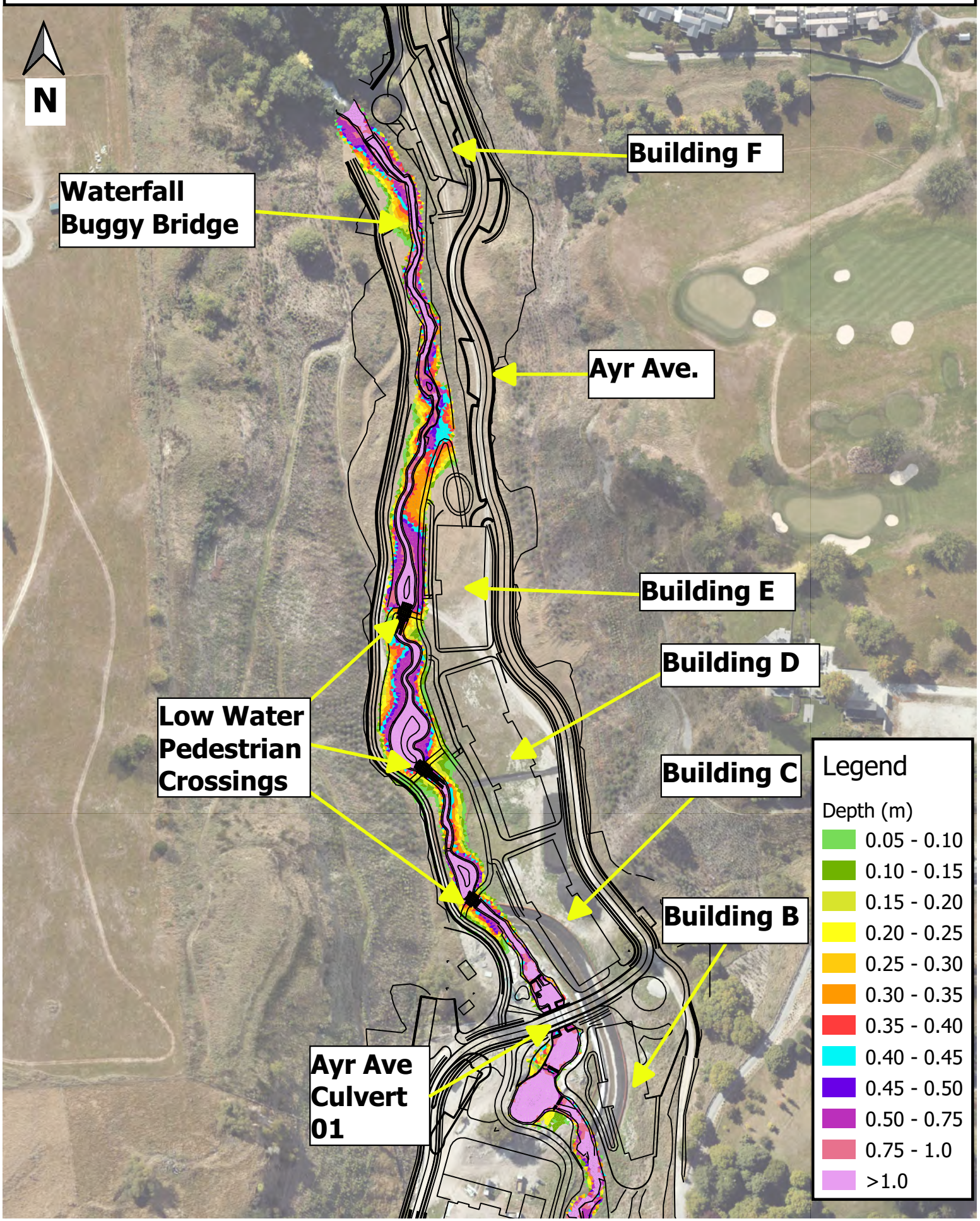
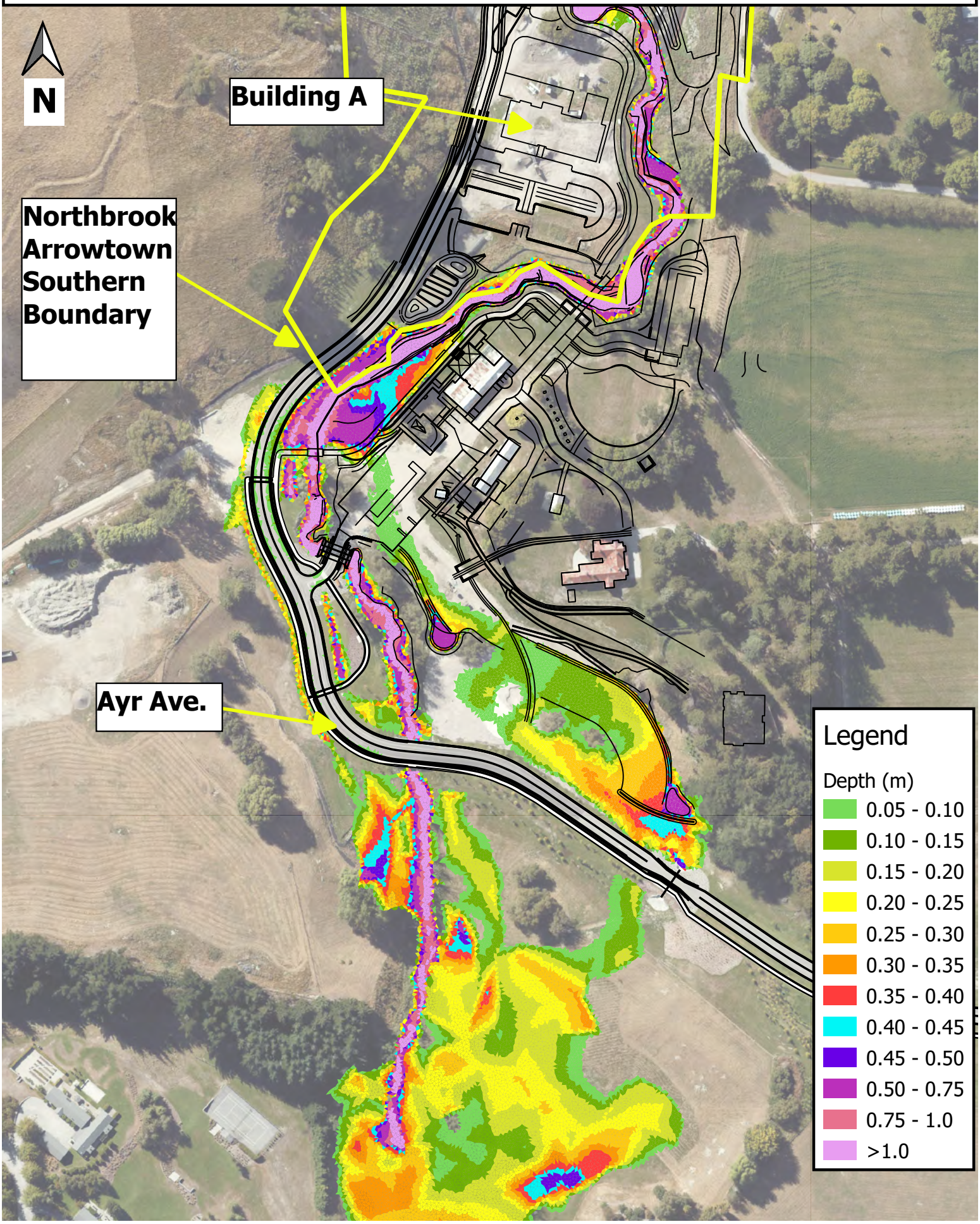
Post-Development 20yr ARI (8.5 m3/s) Mill Creek Peak Flow
Flood Depths - Upper
29/09/2022

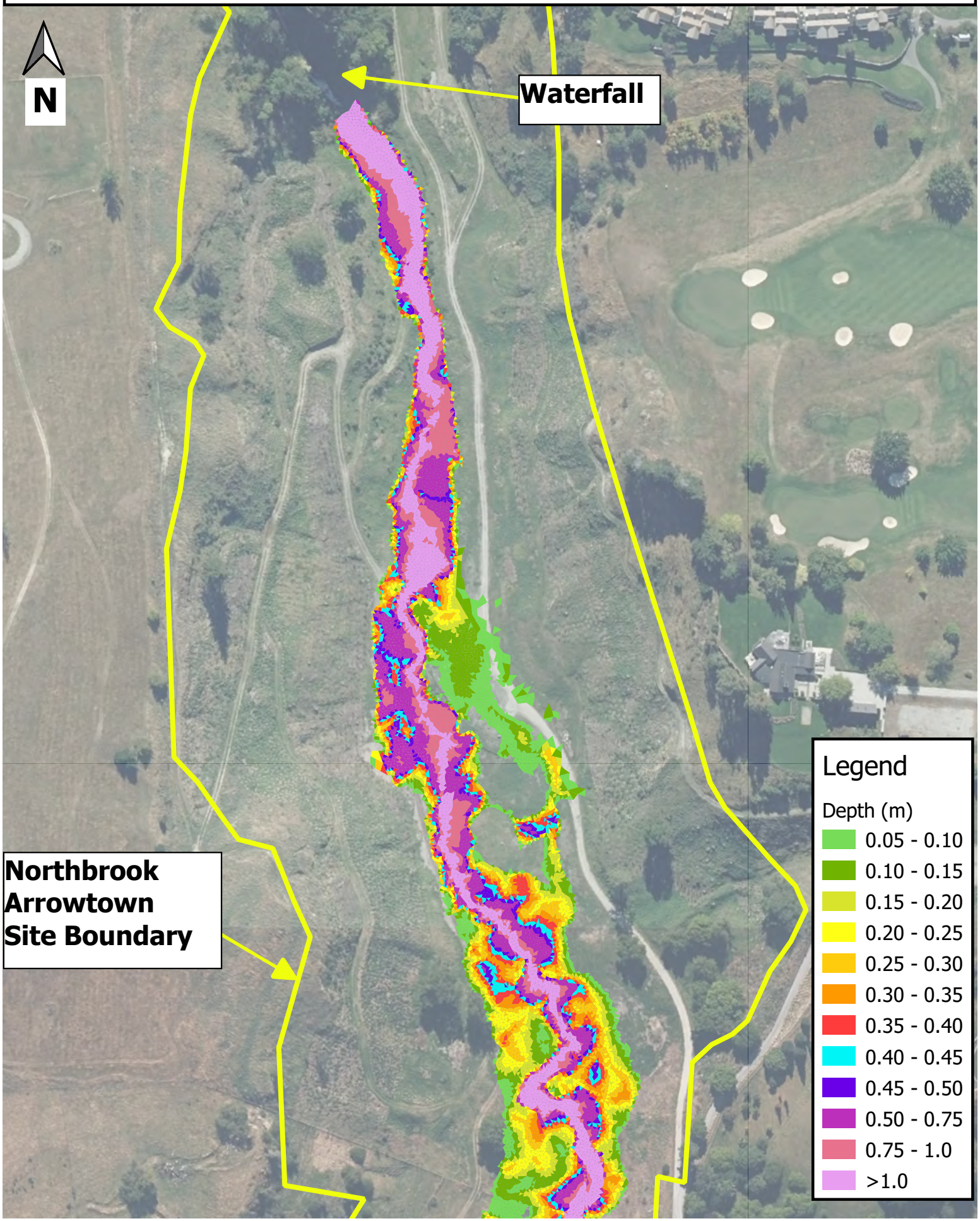


Post-Development 20yr ARI (8.5 m3/s) Mill Creek Peak Flow
Flood Depths - Lower
29/09/2022

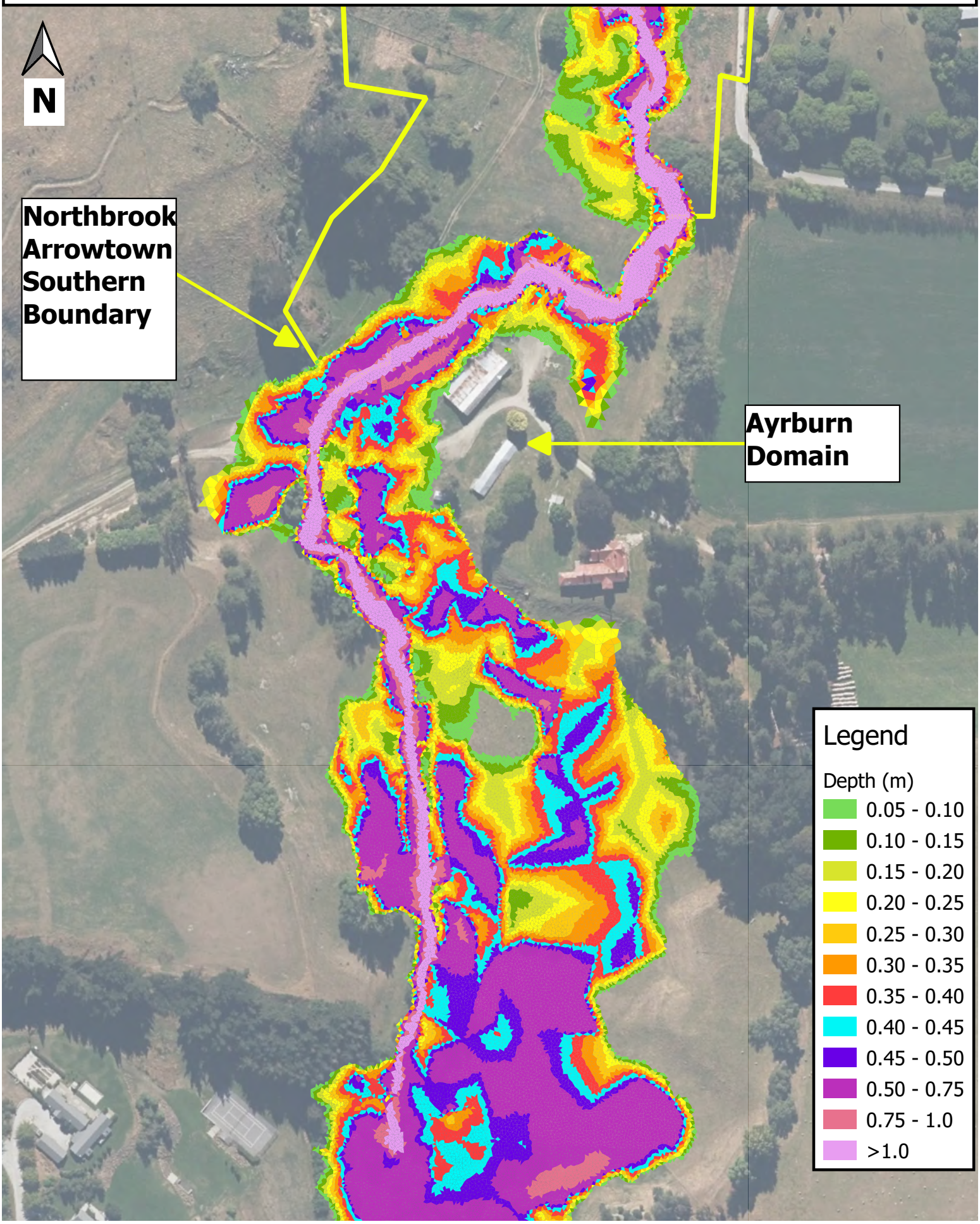


RUN 220905 POST Upper R9 T19-10mm 2 0yr

Pre-Development 100yr ARI (33.0 m3/s) Mill Creek Peak Flow
Flood Depths - Upper
29/09/2022

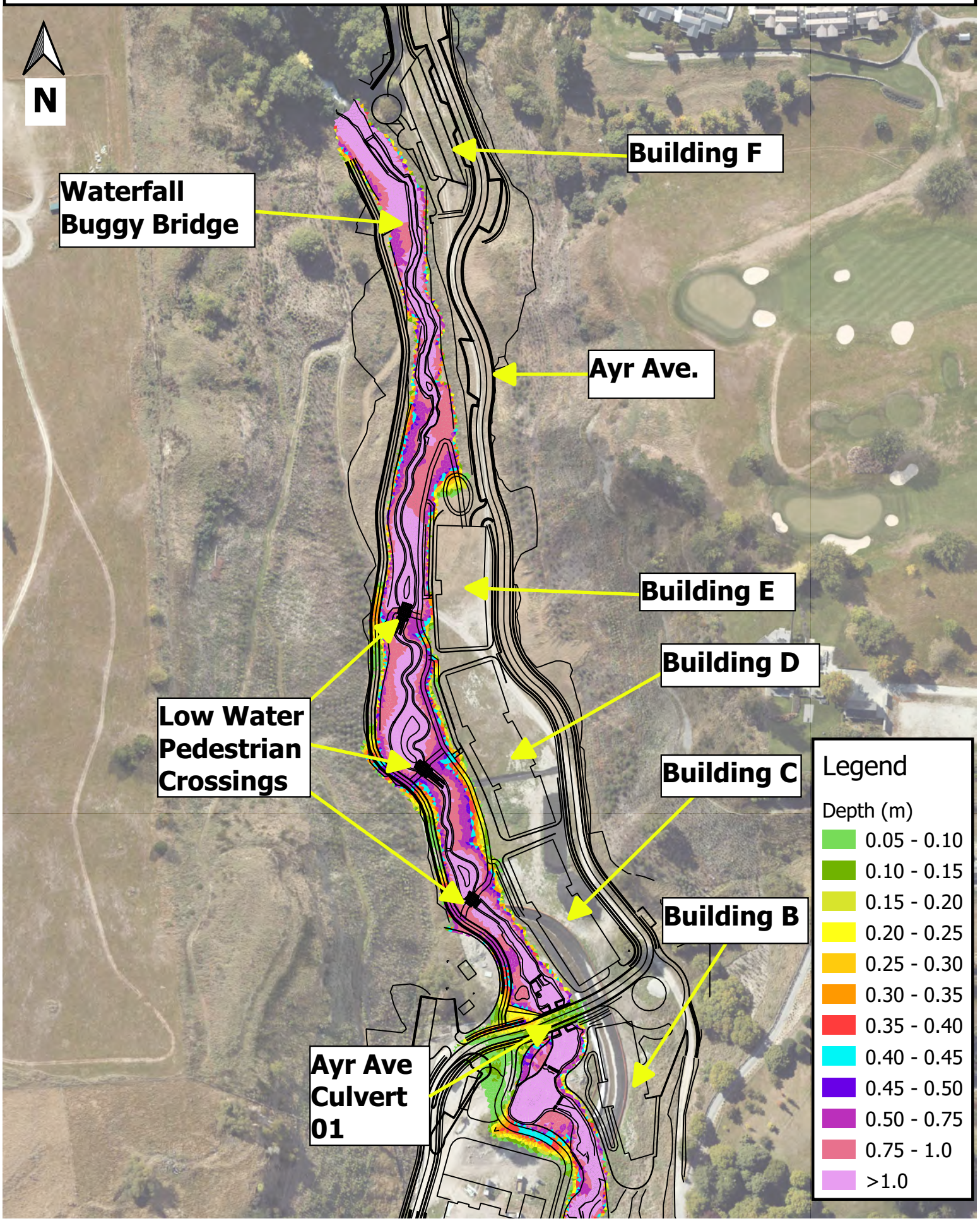


Pre-Development 100yr ARI (33.0 m3/s) Mill Creek Peak Flow
Flood Depths - Lower
29/09/2022

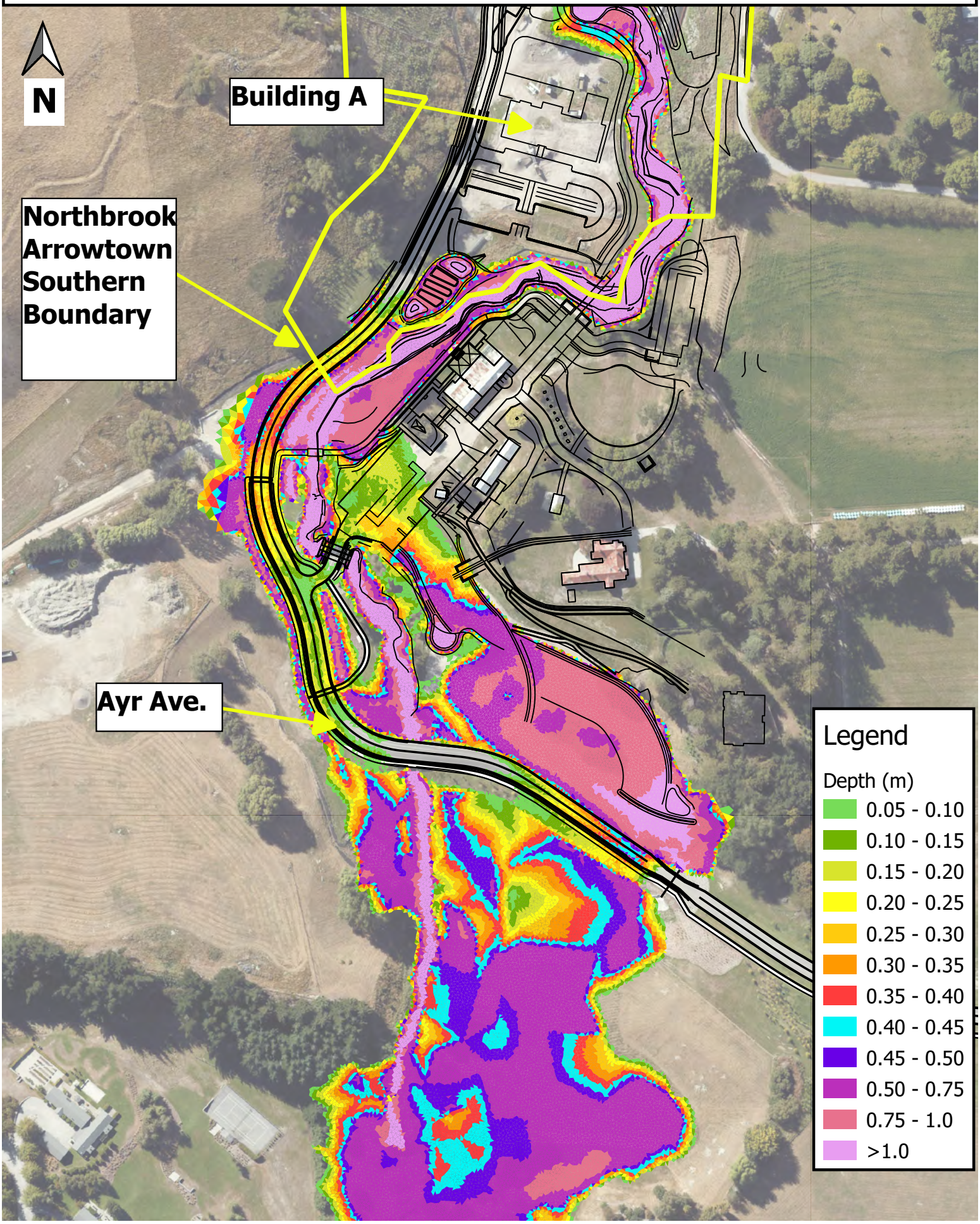


RUN 220905 PRE Upper S6_T2-10mm 100yr

Post-Development 100yr ARI (33.0 m3/s) Mill Creek Peak Flow
Flood Depths - Upper
29/09/2022



Post-Development 100yr ARI (33.0 m3/s) Mill Creek Peak Flow
Flood Depths - Lower
29/09/2022

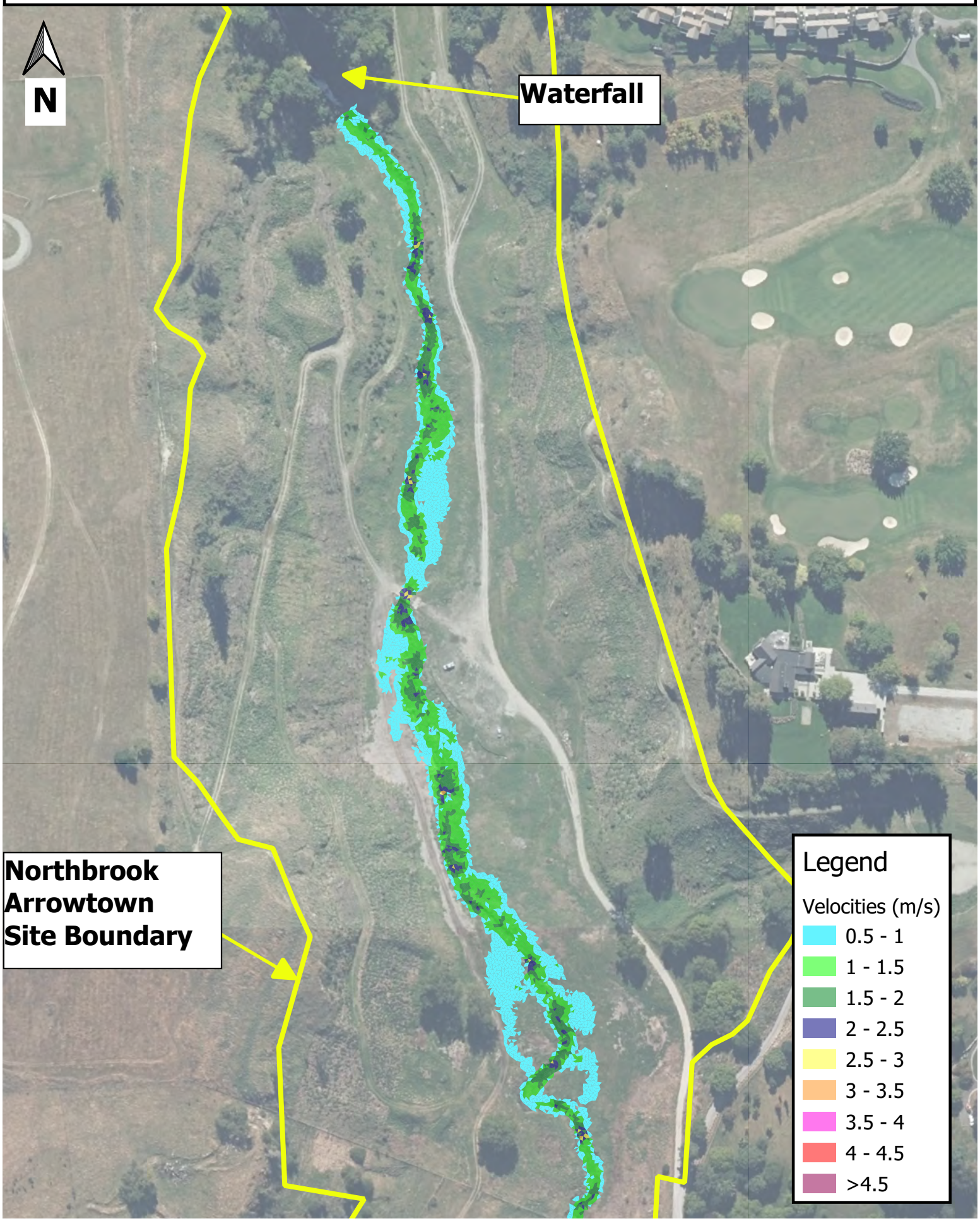


RUN 220905 POST Upper R9_T19-10mm 100yr

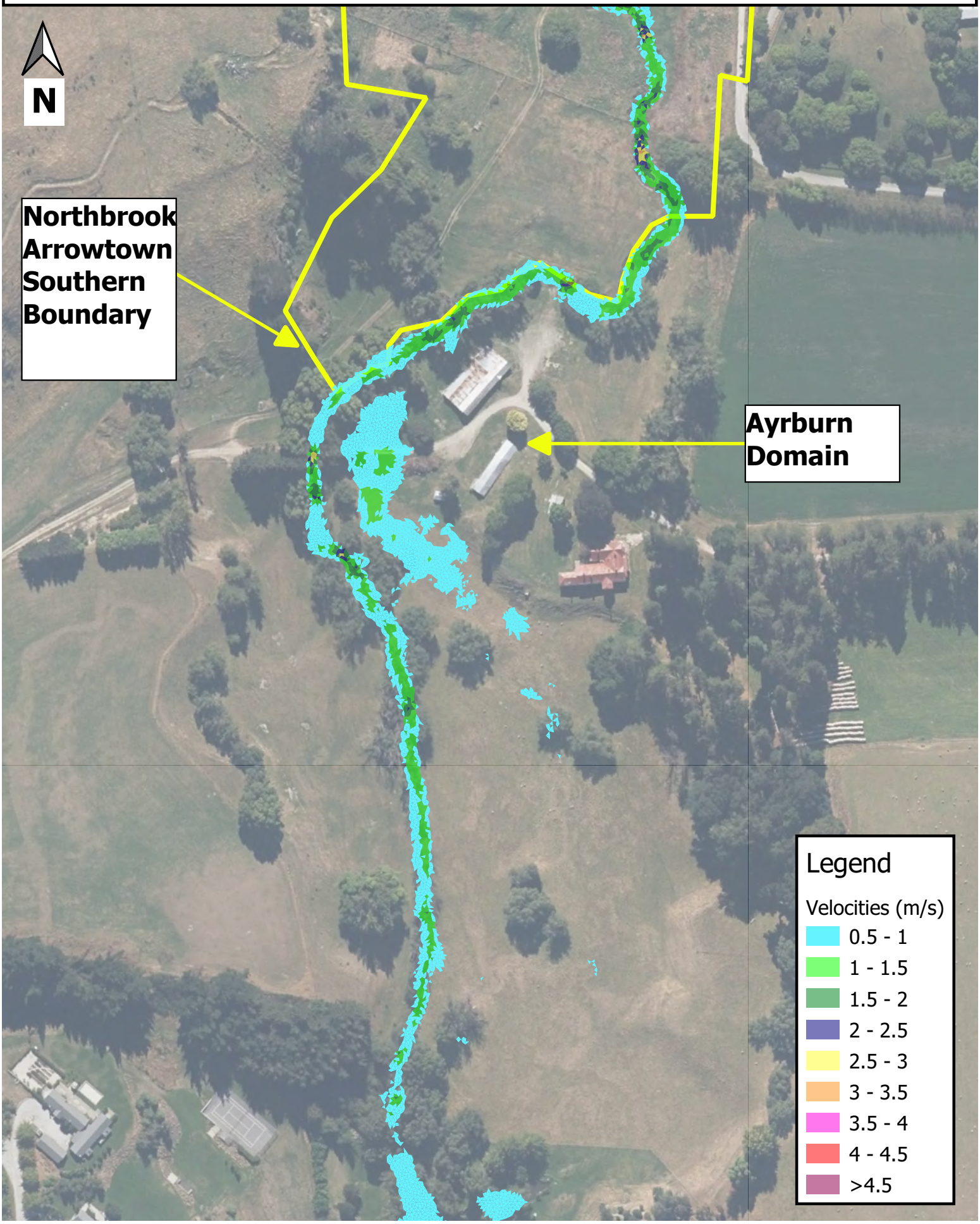
APPENDIX B

Maximum Flood Velocity Maps – 20-year and 100-year ARI Events

Pre-Development 20yr ARI (8.5 m3/s) Mill Creek Peak Flow
Flood Velocities - Upper
29/09/2022

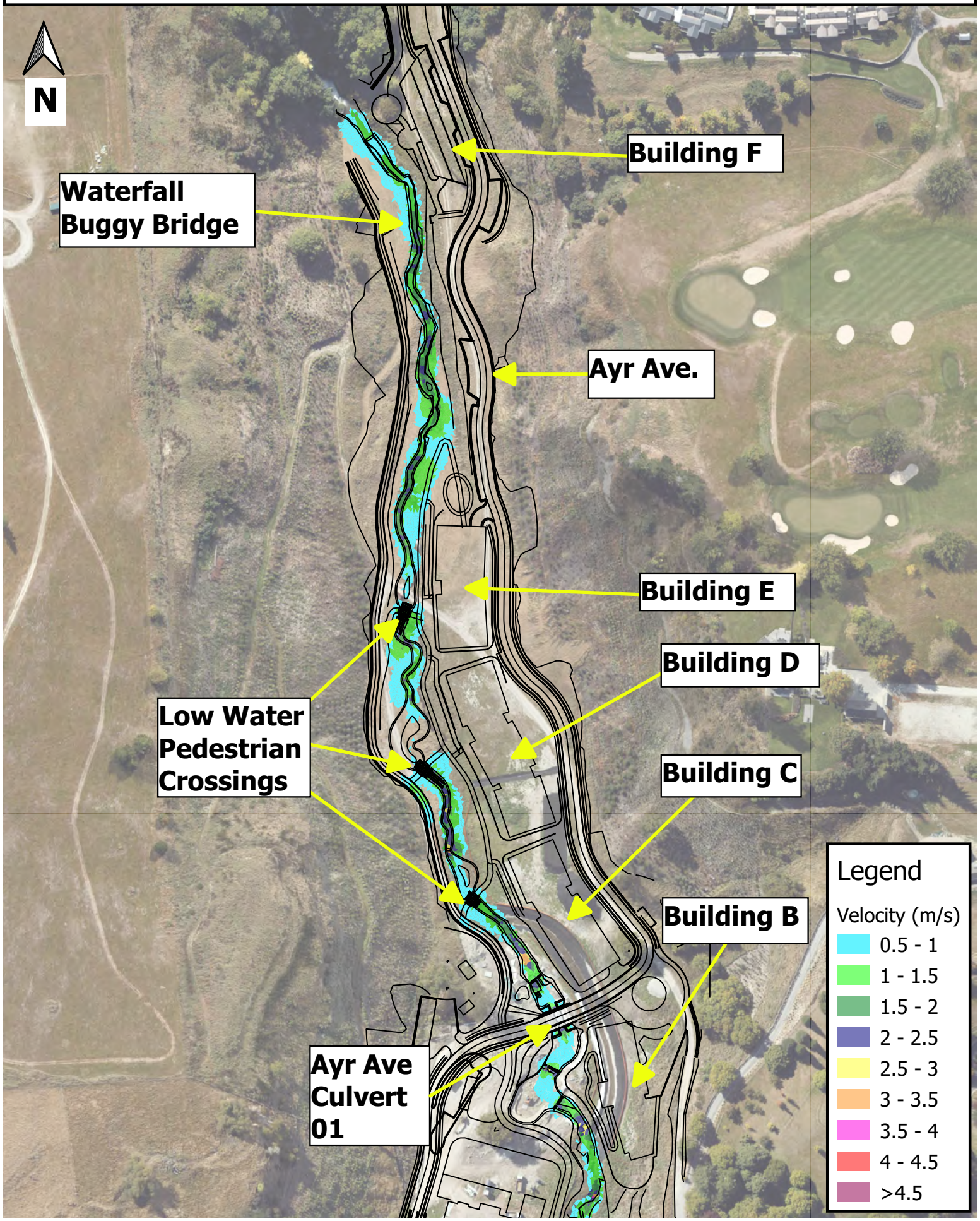


Pre-Development 20yr ARI (8.5 m3/s) Mill Creek Peak Flow
Flood Velocities - Lower
29/09/2022

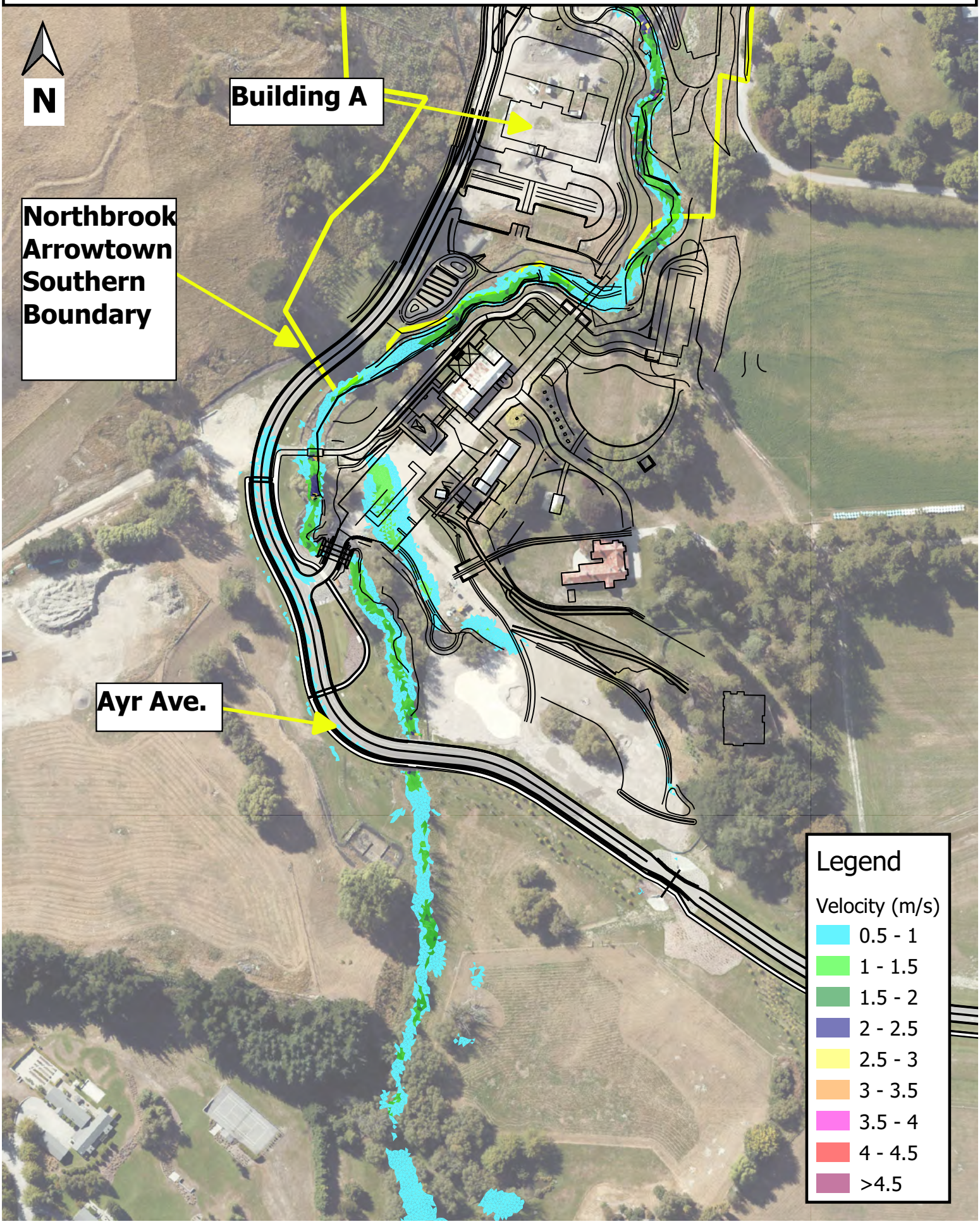


RUN 220905 PRE Upper S6_T2-10mm 20yr

Post-Development 20yr ARI (8.5 m3/s) Mill Creek Peak Flow
Flood Velocities - Upper
29/09/2022

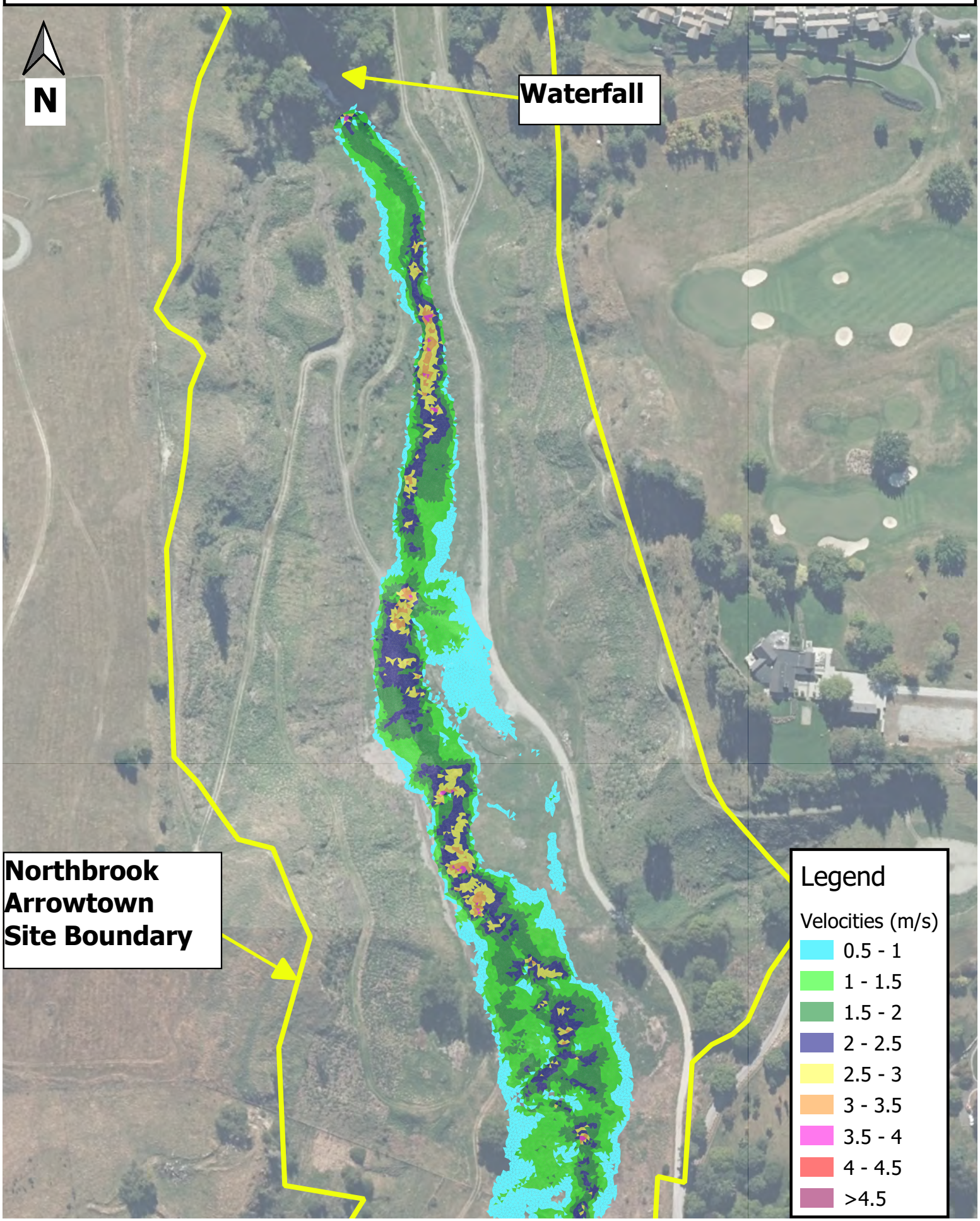


Post-Development 20yr ARI (8.5 m3/s) Mill Creek Peak Flow
Flood Velocities - Lower
29/09/2022



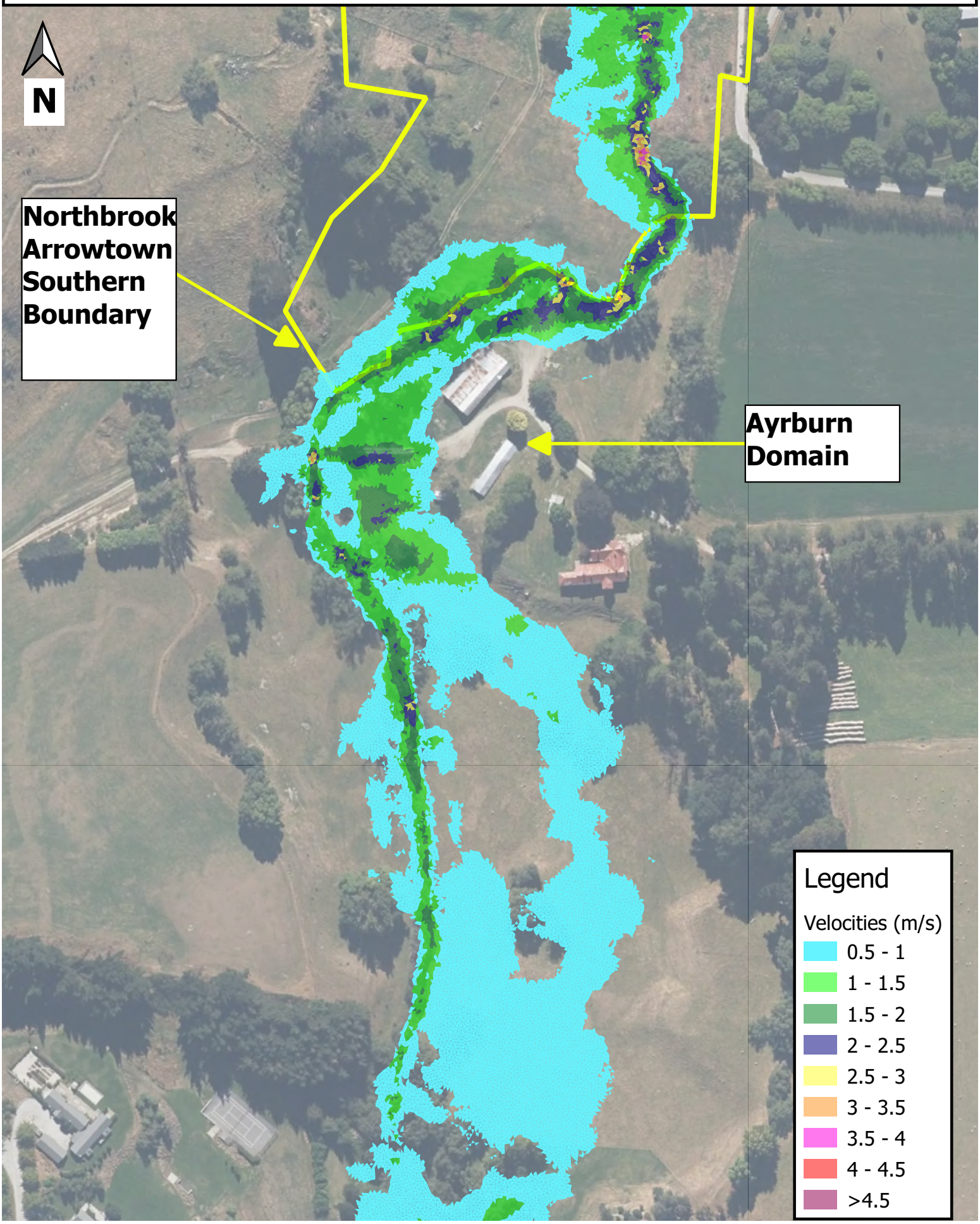
RUN 220905 POST Upper R9 T19-10mm 2 0yr

Pre-Development 100yr ARI (33.0 m3/s) Mill Creek Peak Flow
Flood Velocities - Upper
29/09/2022



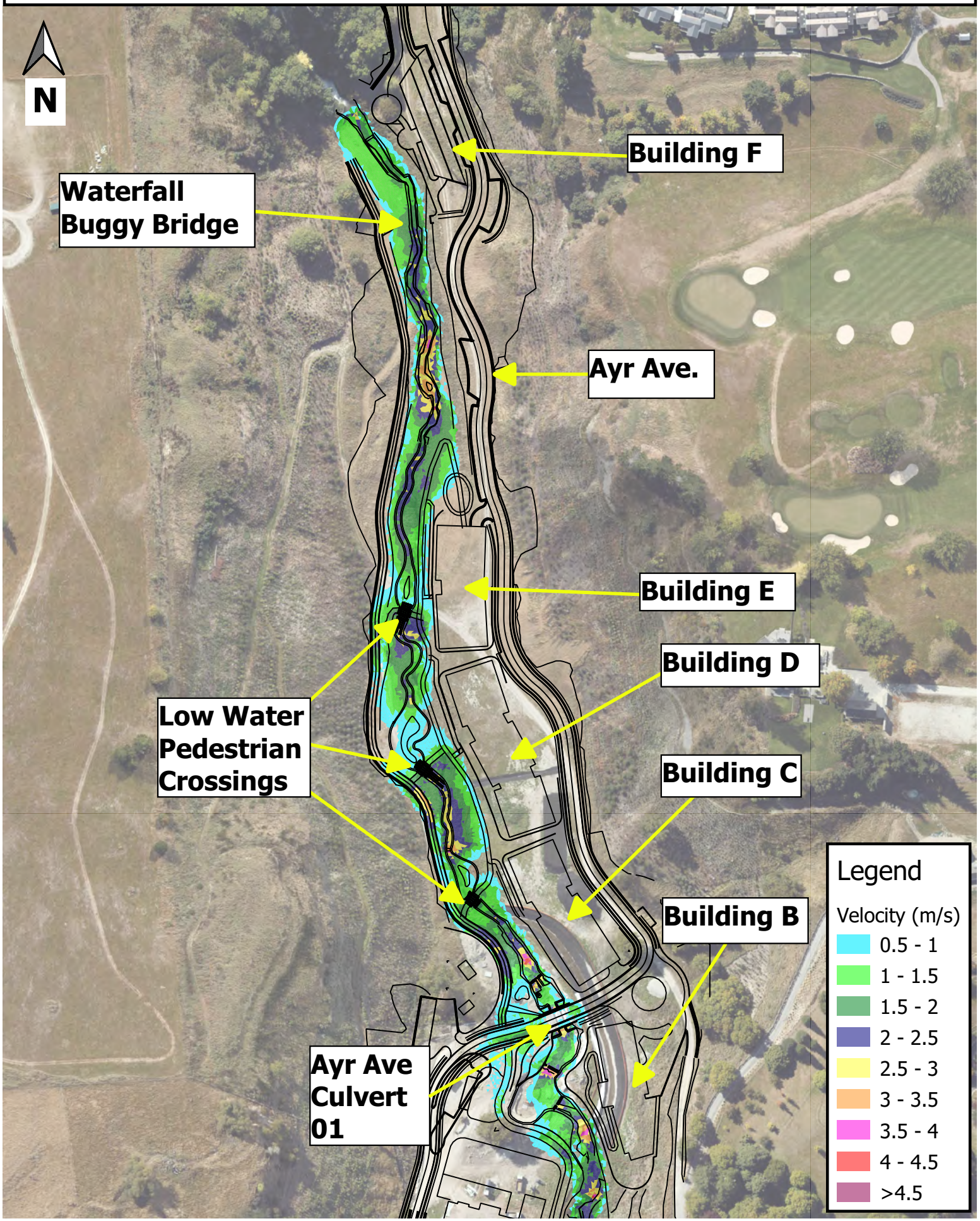
RUN 220905 PRE Upper S6_T2 10mm 100yr

Pre-Development 100yr ARI (33.0 m3/s) Mill Creek Peak Flow
Flood Velocities - Lower
29/09/2022

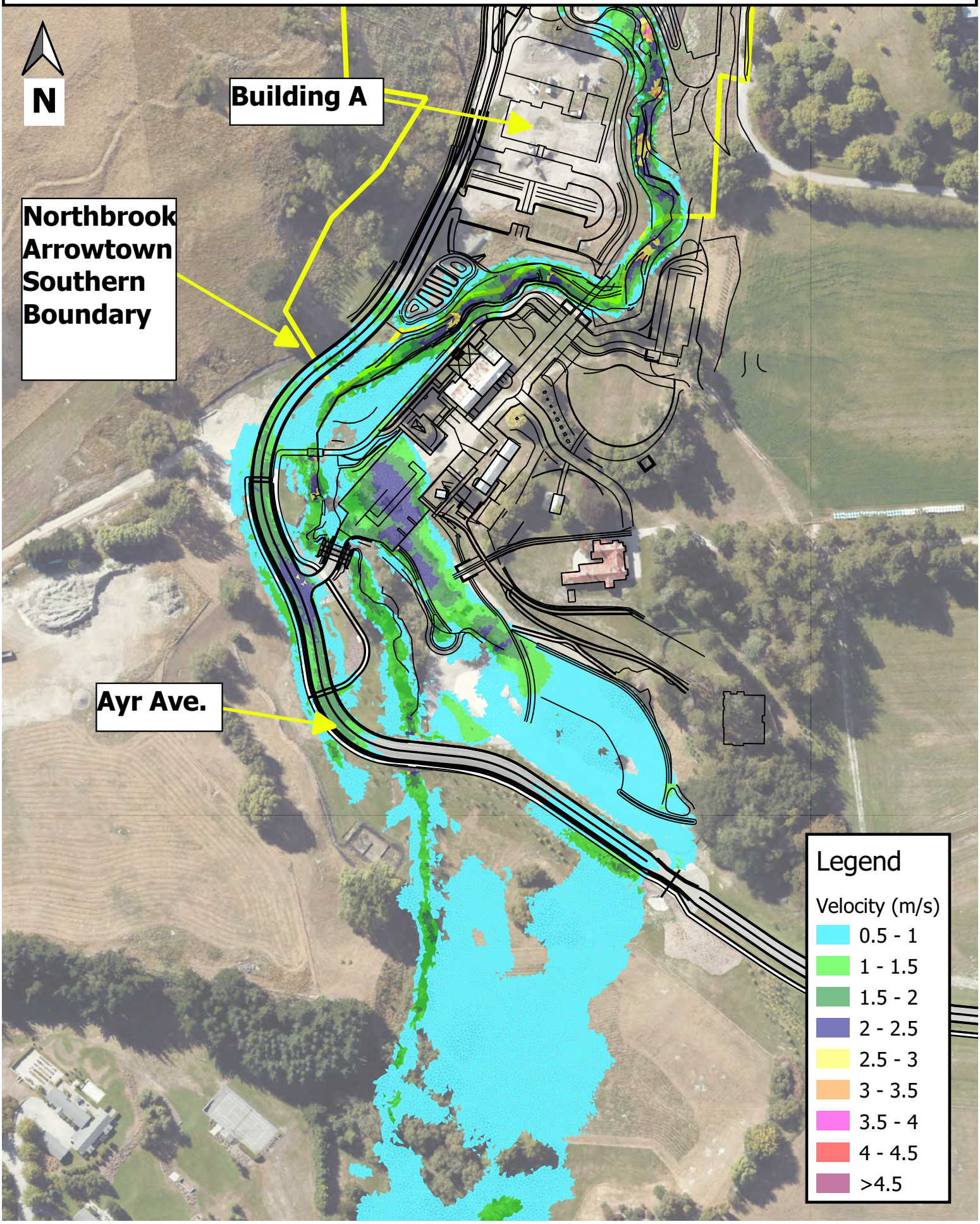


RUN 220905 PRE Upper S6_T2-10mm 100yr

Post-Development 100yr ARI (33.0 m3/s) Mill Creek Peak Flow
Flood Velocities - Upper
29/09/2022



Post-Development 100yr ARI (33.0 m3/s) Mill Creek Peak Flow
Flood Velocities - Lower
29/09/2022



RUN 220905 POST Upper R9 T19-10mm 100yr

APPENDIX C

Flood Model Parameter Summary

FILE RECORD

SUBJECT:	Northbrook Arrowtown Flood Model – Parameters Summary	Job No.:	Q000491
Prepared By:	Fluent Solutions	Date:	03/10/2022
		Page 1 of 16	
		Reference:	*FR-22-10-03 AWF 000491 Parameters Summary.Docx*

1.0 Introduction

This document sets out a summary of flood modeling parameters proposed for use in the design of flood mitigation processes in relation to Mill Creek and the Northbrook Arrowtown Development area.

The purpose of the flood model is to provide a detailed analysis of pre development vs. post development flows, flood affected developed areas, flood velocities, potential erosion/ scour from flooding, flow paths, and flooding extents. The model incorporates data for the entire upstream Mill Creek catchment. The area of focus for the flood assessment model is the Northbrook Arrowtown Development area. The developed model has been used to inform decisions regarding potential flood impacts affecting the development, as well as proposed design decisions meeting Queenstown Lakes District Councils Land Development and Subdivision Code of Practice (COP) requirements.

2.0 Flood Flow Assessment

2.1 Analysis Methodology

The hydraulic and hydrological modelling software Infoworks ICM (Version 2021.9) (ICM) was used to derive the flood and stormwater flow patterns and estimated flood depths and velocities within the development site and the downstream environment. LiDAR and survey data were used for the pre-development 2D runoff calculations. A combination of LiDAR and a developed design ground model were used for the post-development 2D runoff calculations.

Flow estimates for Mill Creek at the Northbrook Arrowtown development have been developed using two methods as described in Section 2.2 below.

2.2 Mill Creek Design Flow Estimates

The Northbrook Arrowtown design flows were developed using two methods, the Generalised Extreme Value method and an ICM 2D catchment model as described in more detail below.

2.2.1 Generalised Extreme Value Flow Estimates

The Mill Creek catchment area at Waterfall Park is approximately 35km^2 while the catchment area at the “Fish Trap” gauging station on Mill Creek is 55km^2. The additional catchment

area is largely that of the Speargrass Flat area which includes Mooneys swamp. The Speargrass sub-catchment has a similar catchment shape but shorter time of concentration than Mill Creek at Waterfall Park and therefore the peak flow at the Fish Trap gauging station would generally be marginally higher than the peak flow at Waterfall Park. The flow estimates provided by the Otago Regional Council (ORC) using the Generalised Extreme Value (GEV) analysis of annual maximum flows from the Fish Trap flow records have been used as the basis of the hydraulic analysis of conditions at Waterfall Park.

A 30% increase to the varying ARI flows at the Fish Trap was added to account for climate change.

From these peak flow estimates, flow triangular hydrographs were created with the peak flow occurring at 0.7 times the duration each ARI storm event. The hydrograph was used to represent the storage routing.

The GEV method was used to develop the 2-year through the 50-year ARI design flows reported in Table 2.4 below. The triangular hydrographs were developed from these peak flows and applied to the model at the waterfall located at the top of the Waterfall Park valley.

2.2.2 Mill Creek Upper Catchment Model – 100-year and 500-year ARI Flow Estimates

The 100-year ARI peak flows were developed using a comprehensive ICM model for Mill Creeks “Upstream Catchment” upstream of the Waterfall. A 2D “rain on grid” model assessment was completed to visualise the flow paths through the catchment and assess the potential increases in flood flow magnitude for a range of storm durations and various climatic considerations.

The following sections provide a summary of the model parameters used in developing the Upper Catchment flows ICM model to generate the 100-year ARI design flow.

2.2.2.1 Ground Model Surface

The model is based on LiDAR data captured for Otago Regional Council by Aerial Surveys in March and April 2016.

2.2.2.2 Soil Infiltration Characteristics

The Horton methodology was used for estimating infiltration losses to the soil using a “rain on grid” surface created from the 3D LiDAR data. This document goes into further description regarding the Horton methodology in Section 2.3 below. The specific infiltration values were based on a dry silty loam soil with little to no vegetation, an initial infiltration (f0) of 101.6mm/hr, and ultimate infiltration (fc) of 7.6mm/hr, and a decay rate of 4.1/hr.

As a sensitivity analysis Horton infiltration rates of an initial infiltration (f0) of 50mm/hr, and ultimate infiltration (fc) of 7.6mm/hr, and a decay rate of 2/hr and a further decay rate of 0.05/hr were also trialed. Results from both trials gave similar results.

2.2.2.3 Roughness Considerations

Additional to the soil characteristics, the Manning's roughness of the ground surface was also considered. Figure 2.1 shows the roughness scenario for the hill catchment above the upper Mill Creek flood plain (upstream of the waterfall at Waterfall Park), the upper flood plain and the main Mill Creek flow path within the flood plain considered as part of the analysis.

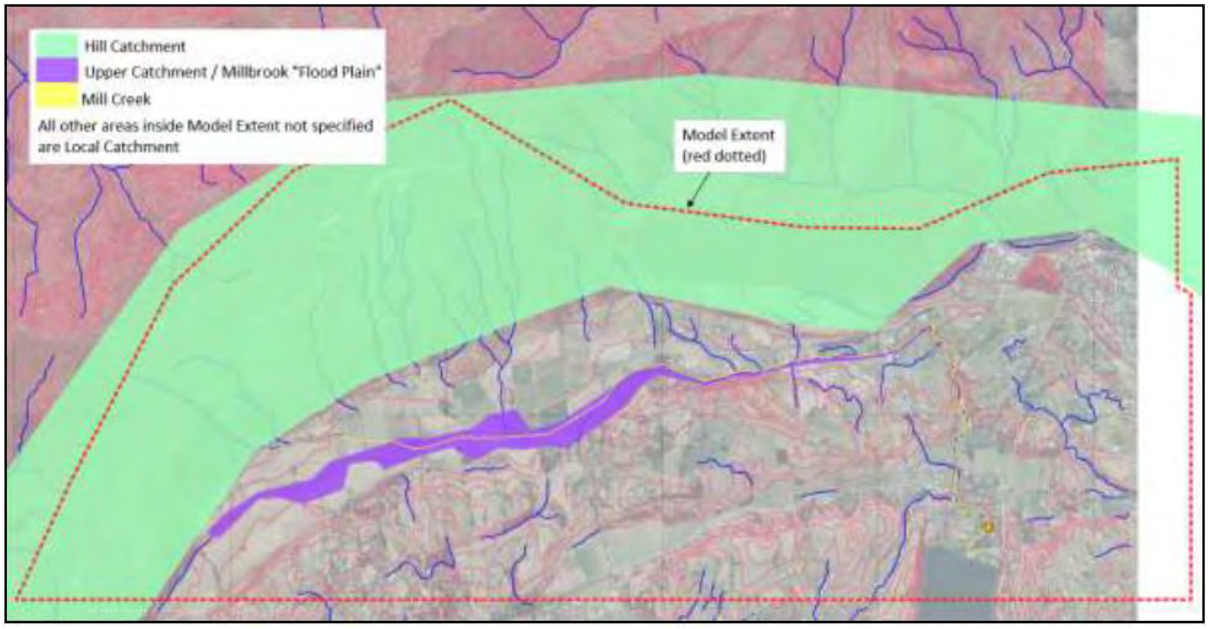


Figure 2.1: Upper Catchment Mannings Roughness Area Map

A variety of roughness allowances were made in the model as part of a sensitivity study. A summary of the varying roughness conditions and the effect on estimated flows at the Fish Trap site are presented below. Note that the information in Table 2.1 only represents the estimated historic flow (no climate change allowance) at the Fish Trap flow station.

Table 2.1: Roughness Area Scenarios

Scenario	Hill Catchment Manning's	Upper Catchment / Millbrook "Flood Plain" Manning's	Mill Creek Manning's	Local Catchment Manning's	100yr ARI Estimated Flow at Fish Trap (Historical Data HIRDS V4, no climate change) – assumed 9hr critical storm – (large scale mesh)	6hr for reference only
1	0.2	0.03	0.03	0.03		6.54
2	0.2	0.1	0.06	0.1		3.49
3	0.16	0.075	0.04	0.075	4.30	4.18
4	0.16	0.075	0.06	0.075		4.14
5	0.16	0.035	0.06	0.075	4.25	4.14

After consideration of the results in Table 2.1 as well as a review of the catchment characteristics, "Scenario 5" was selected as it closely reflected measured flows at the Fish Trap gauging site. "Scenario 5" includes a roughness Manning's n (n) of 0.16 was chosen to represent the sheet and shallow flow, which delays the flow of water through the steep mountainous catchments. A Manning's n of 0.035 was chosen to represent the flow over the "flood plain" in the flat area of the catchment. The Mannings n for the local hill catchments were estimated to be 0.075. Finally, a roughness of 0.06 was allowed for within the Mill Creek margins.

2.2.2.4 Rainfall and Climate Change

A series of triangular rainfall hyetographs (rainfall depth versus time graph) were developed for a range of storm durations and used in the model. The triangular hyetograph methodology, which has been adopted by the Christchurch City Council "Advanced Analysis" method provided in the *"Waterways, Wetlands and Drainage Guideline,"* was applied to this model. The rainfall used in this analysis was taken at a location which represented the upstream catchment area as a whole.

The NIWA High Intensity Rainfall Distribution System (HIRDS) Version 4 was used to generate the rainfall hyetographs. The design rainfall hyetographs utilised in the model included an allowance for an assumed increase in average annual temperature following the RCP8.5 climate change projection scenario for the period 2081-2100 (published by NIWA in HIRDS Version 4) as required by the Queenstown Lakes District Council (QLDC) Land Development and Subdivision Code of Practice (COP).

2.2.2.5 Critical Flow Duration

The initial model was run with triangular rainfall hyetographs for a range of rainfall event durations from 0.5hr to 12hr and the flow at Waterfall Park and at the Fish Trap were reviewed. The purpose of the review was to identify the critical maximum duration 100-year ARI flood flow event at Waterfall Park.

Table 2.2 below shows the maximum peak flows for the various durations for the historical rainfall and the more conservative RCP8.5 climate change allowance. Note that the 6hr duration had the peak inflow from the upper hill catchment, yet the 9hr duration consistently produced the highest flows at the Waterfall and Fish Trap. This is thought to be due to the storage component in the upper catchment area, which is expanded upon in the following sections. Therefore, the 9hr duration event was adopted as the critical design scenario for the flows at Waterfall Park.

Table 2.2: Peak 100-year ARI Critical Duration Analysis

Storm Event	Historic			RCP8.5		
	Peak Flow from Hill (m3/s)	Peak Flow at Waterfall (m3/s)	Peak Flow at Fish Trap (m3/s)	Peak Flow from Hill (m3/s)	Peak Flow at Waterfall (m3/s)	Peak Flow at Fish Trap (m3/s)
100yr, 2hr	2.50	0.02	0.01	34.72	3.17	6.65
100yr, 6hr	20.52	0.33	4.14	48.05	39.63	36.17
100yr, 9hr	17.41	2.97	4.25	35.57	42.08	39.34
100yr, 12hr	11.98	0.18	2.76	25.77	34.90	32.51

2.2.2.6 Model Limitations

- The model is based on LiDAR data as described in the previous sections. From a cross section analysis, the LiDAR data frequently provides a relatively coarse representation of the Mill Creek channel in difference to that available from a detailed survey assessment.
- The mesh size for the initial run iterations has a maximum triangle area of 20m^2. Subsequent runs reduced the mesh size for the area immediately around Mill Creek. Model flow results were similar.
- No culverts have been included in the model to date. It is considered that the culverts would be undersized for the 100-year ARI event and/or may become blocked in large flood events. The exclusion of the culverts from the model would cause additional flooding/overtopping of roads in the model but because culverts carry a small portion of the 100-year ARI flood flow the effect on the results was considered to be relatively minor.
- The model results are based on the HIRDS Version 4 rainfall data from the hills approximately 2km west of the waterfall. Additionally, rainfall data from HIRDS was taken at different points within the catchment to test variations around the upper catchment. Comparisons of the HIRDS rainfall data at points around the catchment showed that spatial variation in the rainfall data is minor and would have minimal affect the magnitude of the flow results from the model.
- In the model, flows around the Fish Trap site show water breaking out from the Mill Creek banks. However, cross sections of the channel taken on site show that there is additional capacity in Mill Creek than what is represented by the LiDAR. To account for this in the model, estimated flows at the Fish Trap included the overspill from the banks.

2.2.2.7 Flow Results

The modelled flow results are presented in Figure 2.2 and Table 2.3 below. Further commentary is provided below.

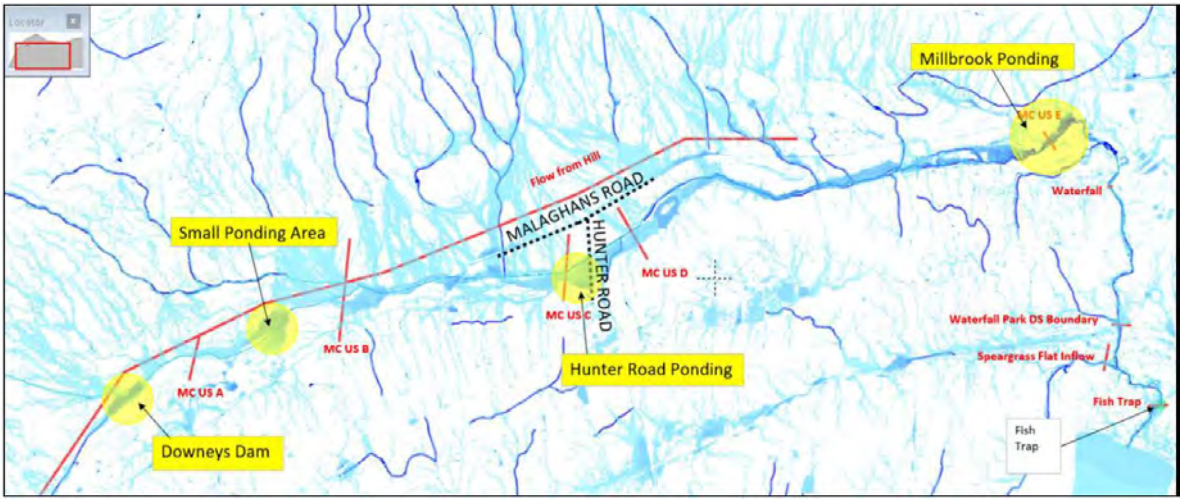


Figure 2.2: 100-year ARI RCP 8.5 Rainfall Scenario – Flood Map Extents

Table 2.3: 100-year ARI Flood Flow Results – Historic and with Climate Change by Rainfall Duration (2hr to 12hr)

Storm Event	Historic					RCP8.5				
	Rainfall Total Depth (mm)	Peak Flow from Hill (m3/s)	Peak Flow at Waterfall (m3/s)	Peak Flow at WP DS Boundary (m3/s)	Peak Flow at Fish Trap (m3/s)	Rainfall Total Depth (mm)	Peak Flow from Hill (m3/s)	Peak Flow at Waterfall (m3/s)	Peak Flow at WP DS Boundary (m3/s)	Peak Flow at Fish Trap (m3/s)
100yr, 2hr	39	2.50	0.02	0.37	0.01	52.2	34.72	3.17	3.94	6.65
100yr, 6hr	66.3	20.52	0.33	1.89	4.14	86	48.05	39.63	37.71	36.17
100yr, 9hr	80	17.41	2.97	2.31	4.25	102	35.57	42.08	40.29	39.34
100yr, 12hr	89.3	11.98	0.18	0.97	2.76	113	25.77	34.90	33.59	32.51

Figure 2.2 shows an example of the flow paths through the catchment and selected flow measure points for the 100-year ARI RCP8.5 climate change scenario. The yellow highlighted areas signify significant storage areas identified in the upper catchment. In the case of the high flow events with climate change included the storage areas overflow, particularly at Hunter Road/Malaghans Road and in Millbrook, and create an amplified peak flow at Waterfall Park. In the historic rainfall scenario, the storages only experience minimal overflows, which corresponds to the muted observed peak flow for the 100-year ARI event in the case excluding climate change.

The results from the model assessment suggest the following:

- The increase in rainfall depth for climate change produces a major increase in peak flow.
- Modelling of the catchment shows signs consistent with the assumption that flood plain storage modifies flood flows upstream of the Millbrook area. For the historical rainfall data (i.e. no climate change), the storage capacity on the floodplain absorbs the runoff flow from the upper mountain catchments with minimal discharge down Mill Creek.
- The "with climate change" rainfall storms have a greater rainfall depth and higher rainfall intensity. For a 100-year ARI event, the rainfall depths across the range of durations modelled is predicted to increase by 30% on average (based on HIRDS data), with the rainfall intensity, at the peak of the storm, increasing by around 80%.
- The combined effect of the increase in rainfall depth, intensity and saturated soil leads to a much larger response down Mill Creek. **At the waterfall location at Waterfall Park the 100-year ARI flow with climate change based on the model results is estimated to be 42m^3/s.**

2.2.3 Updated Flow Results Peer Reviewed by Multiple Engineering Consultants

After the 100-year ARI flood model assessment described in Section 2.2.2 was completed, the model and results were initially peer reviewed by CKL (Auckland) and Stantec (Dunedin) engineering consultants. Additionally, AWA (Auckland) also undertook a peer review of the flood model assessment. The following points are summaries from the peer reviewer comments:

- The CKL review concluded that the flood estimations presented in the memo (42m^3/s peak flow for the 100-year ARI) seemed reasonable.
- Stantec undertook a review and based on a sensitivity study looking into the infiltration characteristics of the catchment, Stantec found it reasonable to reduce the 100-year ARI peak flow to 33m^3/s. However, even with the reduction in peak flow estimates, the Stantec review concluded that "the future modelled peak flows may be a conservatively high extrapolation."
- Lastly, AWA undertook a peer review and commented as below.

  "A high-level review of the model was undertaken based on documentation received. AWA is in agreement with previous reviewer comments (Stantec) suggesting the future flow at Waterfall is conservatively high."

After the peer reviewer comments and inputs from a diverse range of engineering consultant firms, a 100-year ARI design flow of 33m^3/s was adopted. Table 2.4 outlines the 100-year ARI design flows for the Northbrook Arrowtown Development.

The 500-year ARI design flow has been extrapolated from the 100-year ARI design flow, as rainfall records for the 500-year ARI were not available. The extrapolated 500-year ARI design flow is presented in Table 2.4.

2.2.4 Flow Result Summary

Table 2.4 provides a summary of the design input peak flows for the 2-year through the 500-year ARI storm events. The triangular hydrographs were developed from these peak flows and applied to the model at the Waterfall, which is located at the head of the Waterfall Park valley, shown in Figure 2.3.

Table 2.4: Adopted Design Peak Flows for 2-year through 500-year ARI Events

Storm Event	Design Input Peak Flow (m^3/s)
2 Year ARI	4.4
10 Year ARI	7.6
20 Year ARI	8.5
50 Year ARI	9.6
100 Year ARI	33.0
500 Year ARI	86.0

2.2.5 Sensitivity Analysis – Sustained Peak Flow

For the design, the peak flows as referenced the section above were used for the flow hydrograph input at the waterfall. These design flows included a hydrograph shape with a sharp rise and fall.

As a further sensitivity analysis, a long period (12hr) sustained peak flow hydrograph was developed for each ARI storm event and run in the model to assess the effects of a sustained peak flow, which applies a larger volume to the model.

The sustained peak flow hydrograph has an artificial 1-hour ramp up, from 0m^3/s to the peak flow value (depending on the ARI), which is maintained for 10 hours, and another 1 hour artificial ramp down.

2.3 Northbrook Arrowtown Flood Model

An ICM flood model was also developed for the Northbrook Arrowtown Development area. The design flows developed in Section 2.2 were applied at an inflow point to the developed ICM model. This flood model focused on the proposed development area with the intention of assessing flood flow patterns, flood affected developed areas, flood velocities, potential erosion/scour from flooding, flow paths, and flooding extents for the proposed development site and the downstream environment. Figure 2.3 shows the Northbrook Arrowtown Development area boundary, the Mill Creek upstream catchment inflow point, and ICM flood model extents.

The entire model had 3D ground surface information available where 2D hydraulic calculation algorithms were utilised to estimate runoff flows and overland flow pathways.

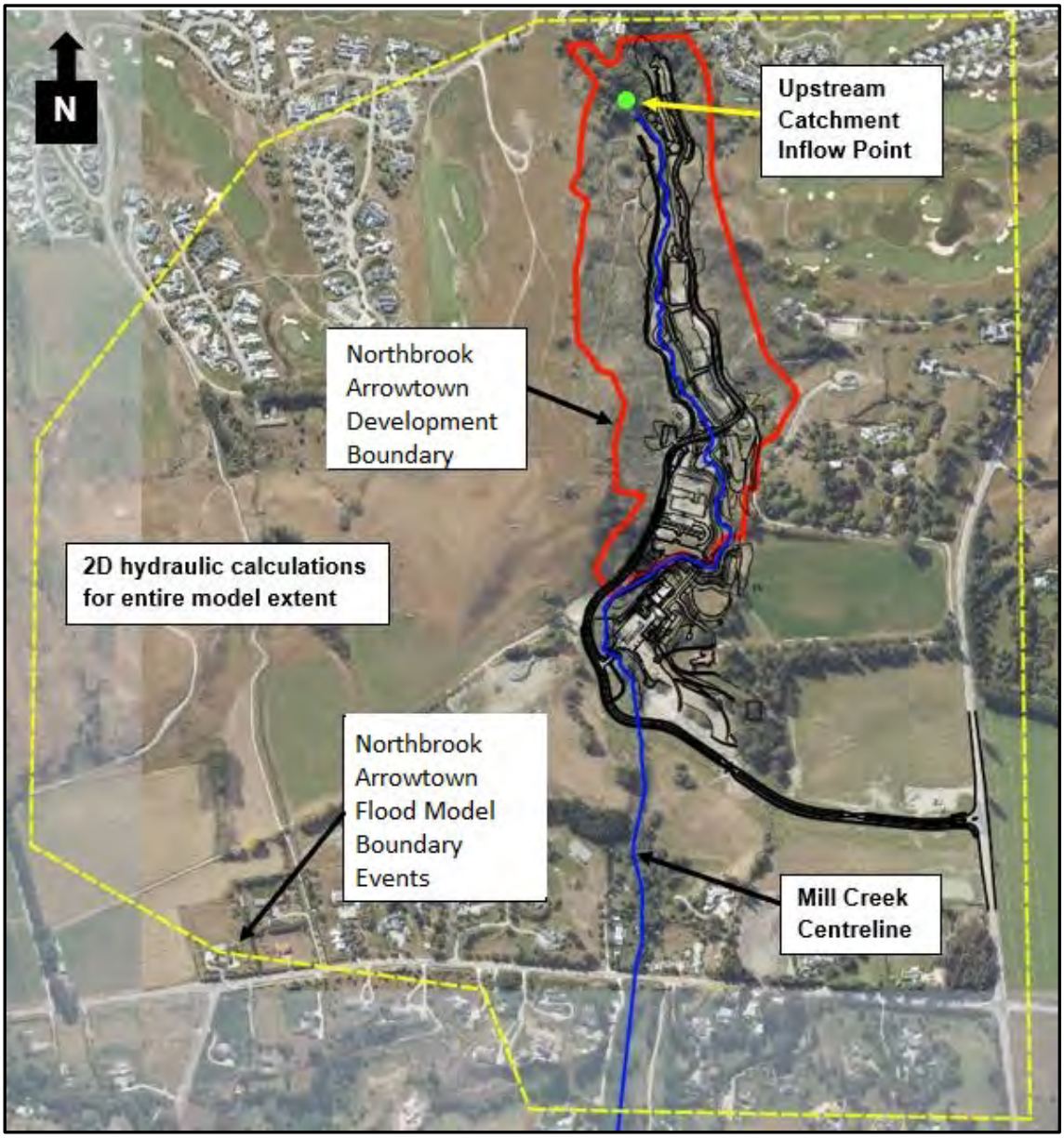


Figure 2.3: Northbrook Arrowtown Model Extent

2.3.1 Ground Model Data

The model was based on a combination of LiDAR data (circa 2016), survey data, and a design surface for the post-development scenario.

The LiDAR for the area surrounding the Northbrook Arrowtown development was captured for Otago Regional Council by Aerial Surveys in March and April 2016. The information is available as a 1m Digital Elevation Model (DEM) from Land Information New Zealand (LINZ). The survey and design surface were provided by the Patterson Pitts Group (PPG).

2.3.2 Soil Characteristics

The sections below set out the assumptions for the pre- and post-development soil and land use characteristics. The pre- and post-development scenarios were modelled using different

methods as described below. Therefore, it was necessary to use a soil / land use characteristics specific for each area based on land use and available topographical data.

The Horton infiltration methodology was used for estimating infiltration losses to the soil surface created from the ground surface data. The infiltration and decay rate selections are described in more detail in Section 2.3.3.3 below.

2.3.2.1 Pre-development Soil Characteristics

The pre-development flow was modelled using a 2D surface based on 3D LiDAR information. Figure 2.4 below gives the breakdown of soil areas. Table 2.5 provides Horton infiltration rates based on the type of soil present in the area within the model.

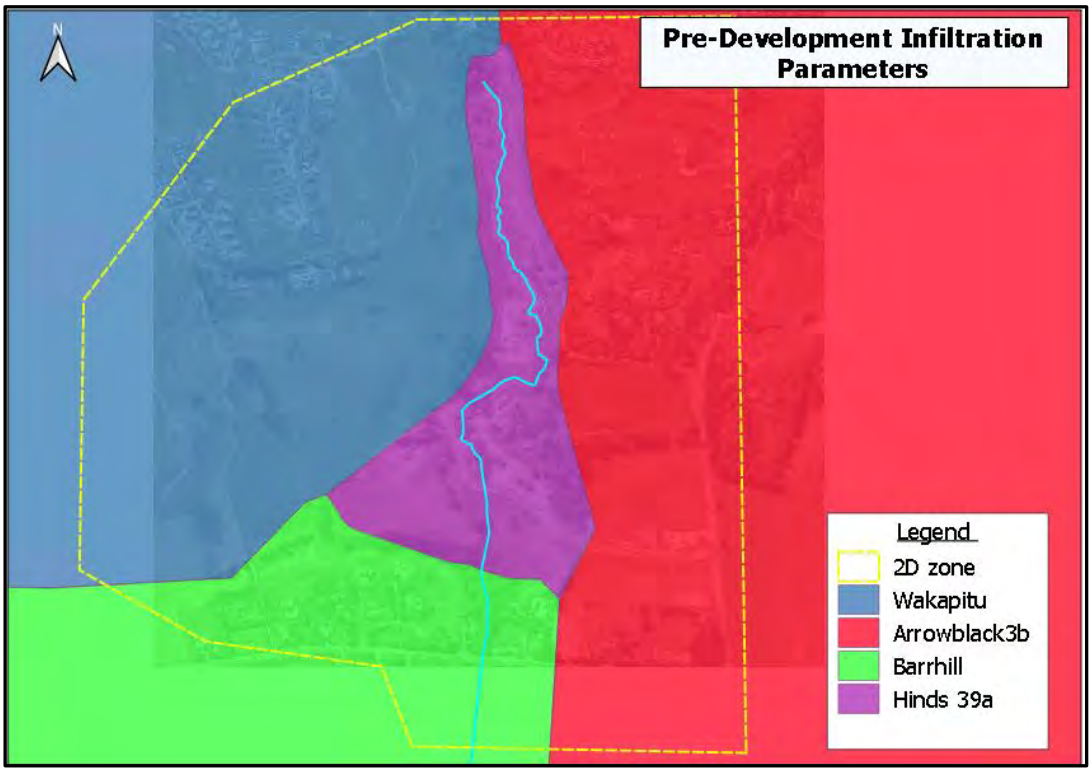


Figure 2.4: Pre-Development Soil Areas and Infiltration Parameters

Table 2.5: Soil Types and Corresponding Infiltration Parameters

S-Map Report	Texture Profile	Permeability Profile	Waterlogging Vulnerability	Initial Infiltration (mm/hr) (F0)	Ultimate Infiltration (mm/hr) (Fc)
Wakapitu 1a	Loam	Moderate over slow	Moderate	101.6	7.6
Barrhill 36a	Silt	Moderate	Very Low	101.6	7.6
ArrowBlack 3b	Loam	Slow	Moderate	101.6	7.6
Hinds 39a	Silt	Moderate	Moderate	63.5	6.0

Note: The selected Horton infiltration values were based on the data available from Akan 1993, which is described in more detail in the section below.

2.3.2.2 Post-development Soil Characteristics

The post-development model incorporates a combination of the 3D LiDAR surface, survey data, and a 3D design surface. The soil characteristics applied for the post-development scenario differed from the pre-development assumptions only with the addition of impervious surfaces in the form of roads and buildings. Figure 2.5 below gives the breakdown of soil areas (similar as the pre-development scenario). Table 2.6 provides Horton infiltration rates based on the type of soil present in the area within the model.

The 3D design surface was used to model the roads and overland flow path features in the development area using fixed runoff and Horton infiltration values on the 2D design surface. For the roads, all flood water was assumed to run off using a fixed 100% runoff allowance.

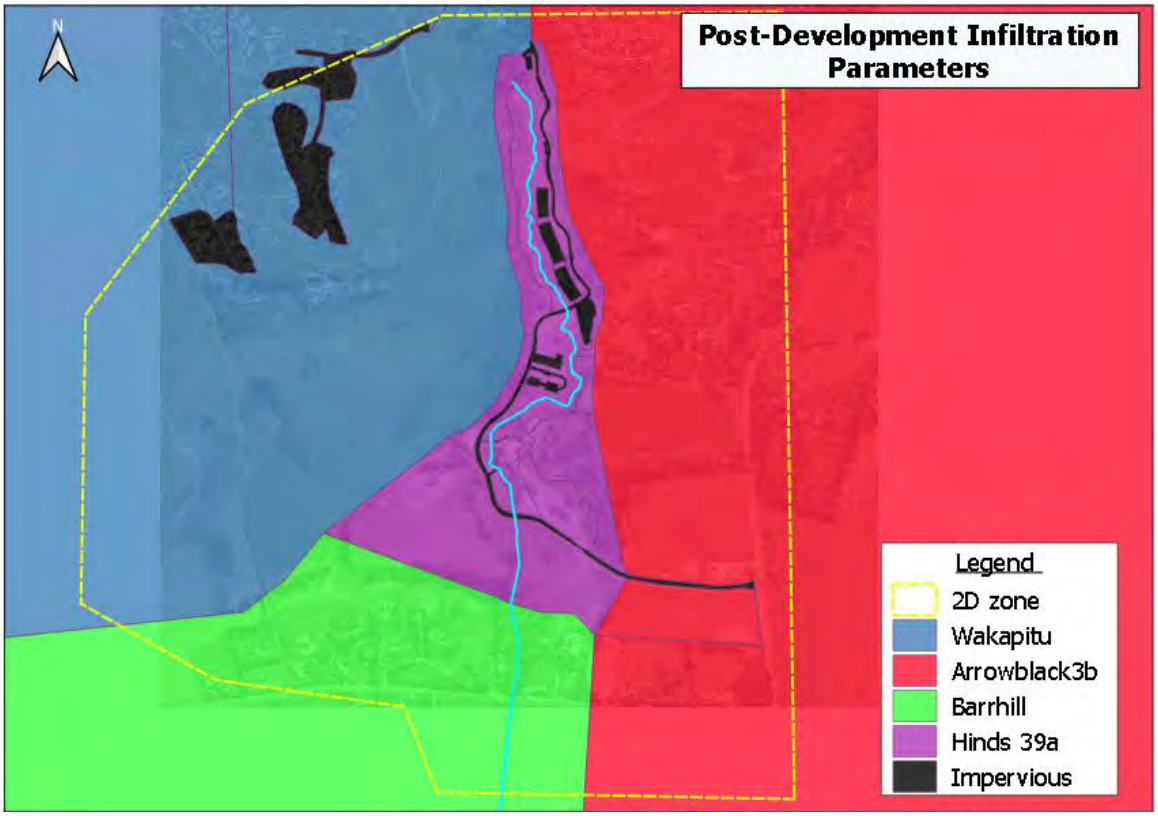


Figure 2.5: Post Development Soil Areas and Infiltration Parameters

2.3.2.3 Horton Infiltration Methodology

Initial Infiltration

The selected Horton infiltration values were based on the data available from Akan 1993 which includes initial infiltration values ranging from 7.6 to 254mm/hr based on differing vegetation covers, soil types, and soil moisture antecedent conditions (based on published scientific study and data) as shown in Figure 2.6.

These values are copied below for reference. The ICM manual also references use of the Akan 1993 data. The assumptions have been based on dry soil conditions considering that the peak flow of the multiple durations was used in the design. Multiple storms in series may occur, but these are likely to be individually less than the 100-year ARI event. The combination of rainstorm on rainstorm on rainstorm, creating wet antecedent conditions, could have a similar effect to the 100-year ARI event, but individual storms would likely be less.

Table 2.6: Akan 1993 Horton Infiltration Values

	Initial infiltration capacity	
Soil Type	in/hr	mm/hr
Dry sandy soils with little to no vegetation	5	127
Dry loam soils with little to no vegetation	3	76.2
Dry clay soils with little to no vegetation	1	25.4
Dry sandy soils with dense vegetation	10	254
Dry loam soils with dense vegetation	6	152.4
Dry clay soils with dense vegetation	2	50.8
Moist sandy soils with little to no vegetation	1.7	43.18
Moist loam soils with little to no vegetation	1	25.4
Moist clay soils with little to no vegetation	0.3	7.62
Moist sandy soils with dense vegetation	3.3	83.82
Moist loam soils with dense vegetation	2	50.8
Moist clay soils with dense vegetation	0.7	17.78

Ultimate Infiltration (Fc)

It should be noted that ultimate infiltration values as determined by infiltrometer studies are highly variable and can show an order of magnitude variation on seemingly similar soil types.

Additionally, the ultimate infiltration rate has been suggested to be driven by the saturated hydraulic conductivity (McLaren, Cameron 1996).

Akan 1993 also provides a table of ultimate infiltration rates based on various soil types, which is shown in Table 2.7. An ultimate infiltration value was selected for the design based on the soil type.

Table 2.7: Horton Ultimate Infiltration Values (Akan 1993)

Soil Type	f_c mm/hr (in/hr)	
Clay loam, silty clay loams	0–1.3	(0–0.05)
Sandy clay loam	1.3–3.8	(0.05–0.15)
Silt loam, loam	3.8–7.6	(0.15–0.30)
Sand, loamy sand, sandy loams	7.6–11.4	(0.30–0.45)

Decay (k)

The rate of decay selected drives how fast the initial or maximum infiltration decreases to the ultimate infiltration rate. A larger decay rate means that the soils become saturated faster and it takes less time to go from the initial to the ultimate infiltration rate. Akan 1993 suggests a decay rate equivalent to 4.14 hr^{-1} ($1.15x10^{-3}$ s^{-1}) for all soil types. The ICM manual also references us of a decay rate of 2.0 hr^{-1} ($5.56x10^{-4}$ s^{-1}).

For this assessment, a decay rate of 4.14 hr^{-1} ($1.15x10^{-3}$ s^{-1}) was utilised for the design.

2.3.3 Pre and Post Development Roughness

Additional to the soil characteristics, the roughness characteristics of the surface for the pre and post development scenarios were analysed. Various Manning's (n) roughness values were applied based on specific ground characteristics for each area, in each scenario.

The Pre and Post Development model roughness values are displayed in Figure 2.6 and Figure 2.7. The polygon values range from 0.0125 to 0.10 which were chosen to represent the roughness based on existing land-use. The values used for all roughness areas are derived from the Christchurch City Council *"Waterways, Wetlands and Drainage Guide – Part B: Design, Section 22 – Hydraulics"*. The roughness values are presented in Figure 2.8. The remaining areas of the 2D model extent have a roughness value of 0.075. These estimates are considered conservative in relation to estimating the flood extent.

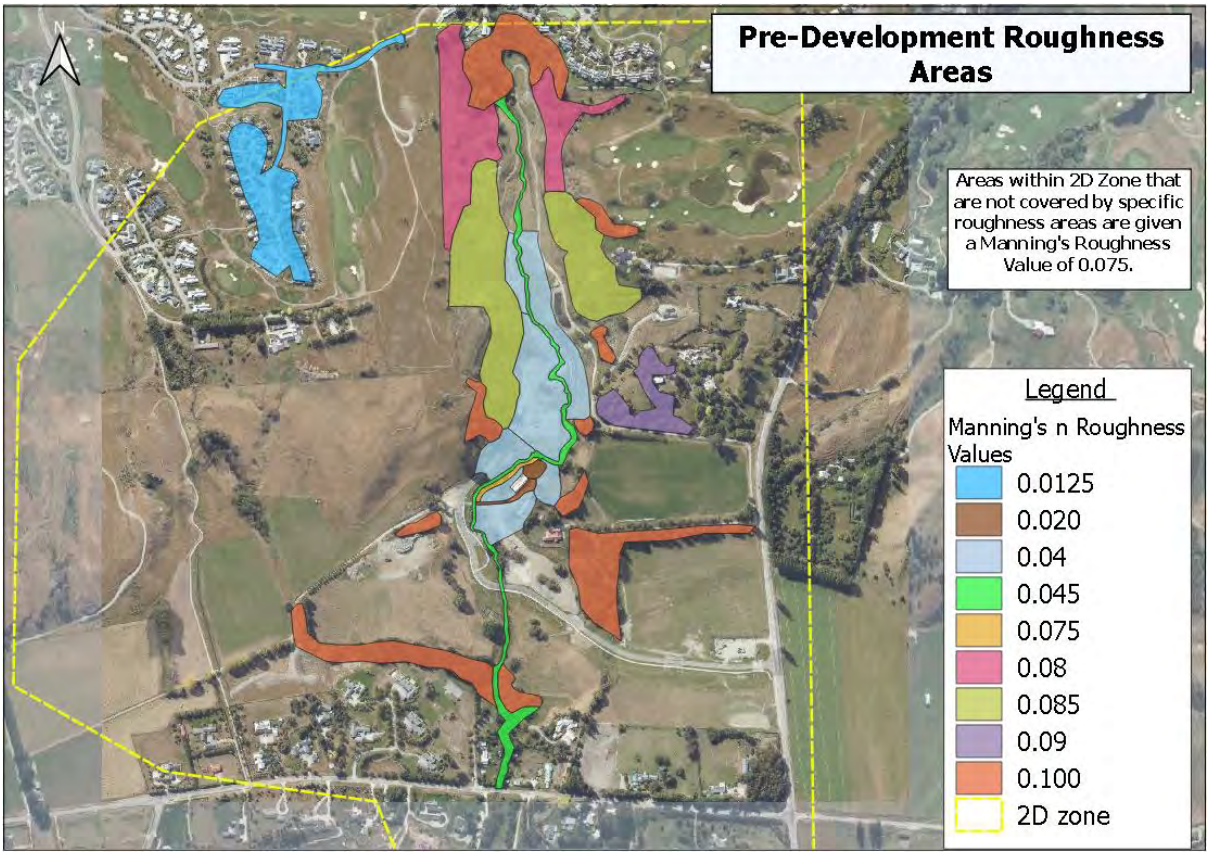


Figure 2.6: Manning's n Roughness Areas – Pre-development

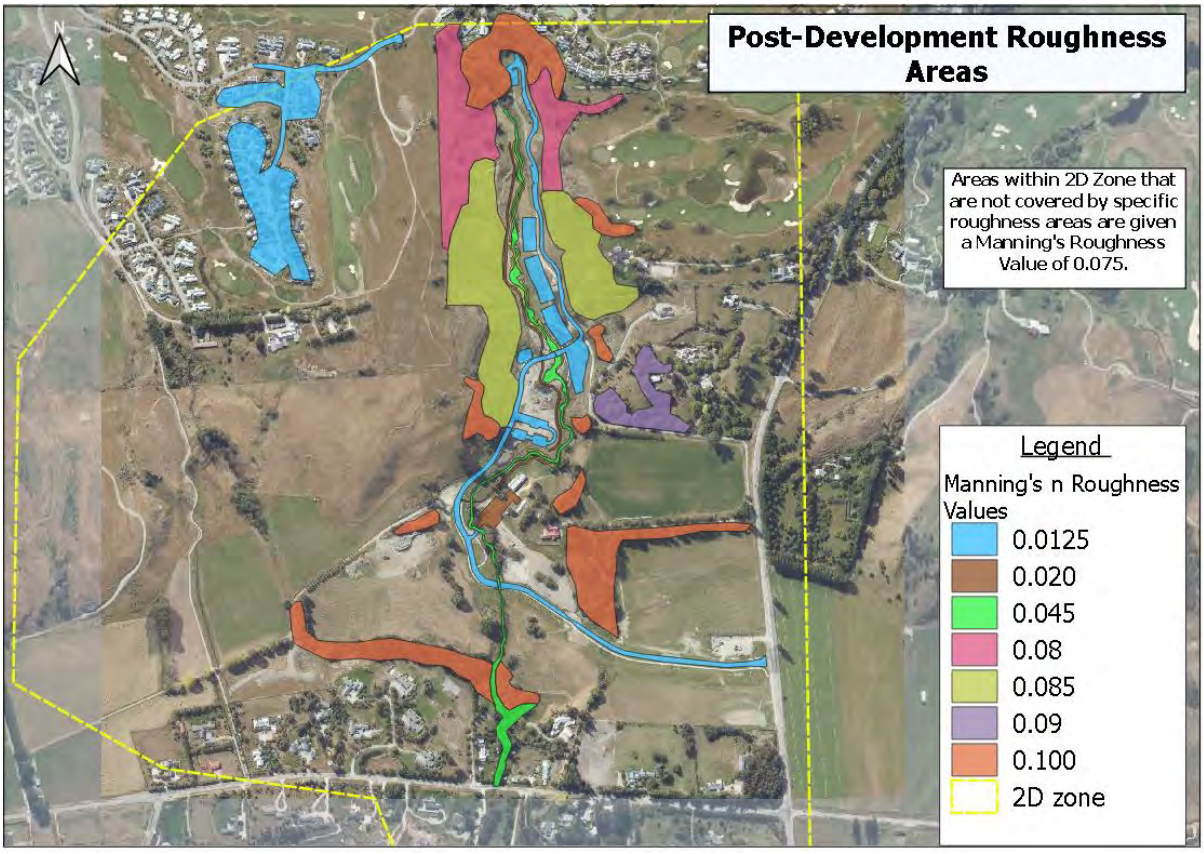


Figure 2.7: Manning's n Roughness Areas – Post-development

Table 22-1: Manning's Roughness Coefficients.

Manning's Roughness Coefficients

I. Closed Conduits:

A. Concrete pipe	0.011 - 0.013
B. Corrugated metal pipe or pipe arch:	
1. 68 mm by 13 mm corrugation	0.024
2. 150 mm by 50 mm corrugation (field bolted)	0.030
C. Vitrified clay pipe	0.012 - 0.014
D. Cast iron pipe, uncoated	0.013
E. Steel pipe	0.009 - 0.011
F. Brick	0.014 - 0.017
G. Monolithic concrete:	
1. Wood forms, rough	0.015 - 0.017
2. Wood forms, smooth	0.012 - 0.014
3. Steel forms	0.012 - 0.013

II. Open Channels, Lined (straight alignment):

A. Concrete, with surfaces as indicated:	
1. Formed, no finish	0.013 - 0.017
2. Float finish	0.013 - 0.015
3. Float finish, some gravel on bottom	0.015 - 0.017
4. Sprayed concrete, good section	0.016 - 0.019
5. Sprayed concrete, wavy section	0.018 - 0.022
B. Concrete, bottom flat finished, sides as indicated:	
1. Random stone in mortar	0.017 - 0.020
2. Dry rubble (riprap)	0.020 - 0.030
C. Gravel bottom, sides as indicated:	
1. Formed concrete	0.017 - 0.020
2. Random stone in mortar	0.020 - 0.023
3. Dry rubble (riprap)	0.023 - 0.033
D. Brick	0.014 - 0.017

III. Open Channels, Excavated (straight alignment, natural lining):

A. Earth, uniform section:	
1. Clean, after weathering	0.018 - 0.020
2. With short grass, few weeds	0.022 - 0.027
3. In gravelly soil, uniform section, clean	0.022 - 0.025
B. Earth, fairly uniform section:	
1. No vegetation	0.022 - 0.025
2. Grass, some weeds	0.025 - 0.030
3. Dense aquatic plants in deep channels	0.030 - 0.035
4. Sides clean, gravel bottom	0.025 - 0.030
5. Sides clean, cobble bottom	0.030 - 0.040
C. Dragline excavated or dredged:	
1. No vegetation	0.028 - 0.033
2. Light shrubbery on banks	0.035 - 0.050
D. Rock:	
1. Smooth and uniform	0.035 - 0.040
2. Jagged and irregular	0.040 - 0.045
E. Channels not maintained:	
1. Dense weeds, high as flow depth	0.080 - 0.120
2. Clean bottom, shrubbery on sides	0.050 - 0.080
3. Clean bottom, shrubbery on sides, highest stage of flow	0.070 - 0.110
4. Dense shrubbery, high stage	0.100 - 0.140

Note: the value of 'n' for natural channels must be increased to allow for the additional energy loss caused by bends. The increase may be in the range of perhaps 3 to 15 %

IV. Roadside Channels and Swales with Maintained Vegetation (for velocities of 0.6 m/s to 1.8 m/s):

A. Depth of flow up to 210 mm:	
1. Good stand, any grass:	
a. Mowed to 50 mm	0.070 - 0.045
b. Length 100 mm to 150 mm	0.090 - 0.050
2. Fair stand, any grass:	
a. Length about 300 mm	0.140 - 0.080
b. Length about 600 mm	0.250 - 0.120
B. Depth of flow 210 mm to 460 mm:	
1. Good stand, any grass:	
a. Mowed to 50 mm	0.120 - 0.070
b. Length 100 mm to 150 mm	0.200 - 0.100
2. Fair stand, any grass:	
a. Length about 300 mm	0.100 - 0.060
b. Length about 600 mm	0.170 - 0.090

V. Roadside Concrete Side-Channels:

A. Concrete channel, trowelled finish	0.012
B. Asphalt pavement:	
1. Smooth texture	0.013
2. Rough texture	0.016
C. Concrete side-channel with asphalt pavement:	
1. Smooth	0.012
2. Rough	0.013
D. Concrete pavement:	
1. Float finish	0.014
2. Broom finish	0.016
E. For side-channels with small slope, where sediment may accumulate, increase above values of n by	0.002

VI. Natural Stream Channels:

A. Streams:	
1. Fairly regular section:	
a. Some grass & weeds, little/no shrubs	0.030 - 0.035
b. Dense growth of weeds, depth of flow greater than weed height	0.035 - 0.050
c. Light shrubbery on banks	0.035 - 0.060
d. Heavy shrubbery on banks	0.050 - 0.070
e. Some weeds, dense willow on banks	0.060 - 0.080
f. For trees within channel & branches submerged at high stage, increase above values by	0.010 - 0.020
2. Irregular sections, with pools, slight channel meander: Increase values given in 1a. to 1e. by	0.010 - 0.020
3. Mountain streams, no channel vegetation, banks usually steep, trees & shrubs on banks submerged at high stage:	
a. Gravel, cobble, few boulders on bed	0.040 - 0.050
b. Cobbles and large boulders on bed	0.050 - 0.070
B. Flood plains, adjacent to natural streams:	
1. Pasture, no shrubs:	
a. Short grass	0.030 - 0.035
b. High grass	0.035 - 0.050
2. Cultivated areas:	
a. No crop	0.030 - 0.040
b. Mature row crops	0.035 - 0.045
c. Mature field crops	0.040 - 0.050
3. Heavy weeds, scattered shrubbery	0.050 - 0.070
4. Light shrubbery and trees:	
a. Winter	0.050 - 0.060
b. Summer	0.060 - 0.080
5. Medium to dense shrubbery:	
a. Winter	0.070 - 0.110
b. Summer	0.100 - 0.160
6. Dense willows	0.150 - 0.200

Figure 2.8: Manning's n Roughness Values

APPENDIX D

Scour Estimate Assessment Summary

SUBJECT:	Scour Estimations and Management Concepts – Northbrook Arrowtown	Job No.:	Q000491
Prepared By:	Fluent Solutions	Date:	30/09/2022
		Page 1 of 7	
		Reference:	*FR-22-09-30 AWF Q000491 Waterfall Park Rc Scour Analysis.Docx*

1.0 Introduction

The purpose of this document is to present a summary of the scour analysis work undertaken to date and summarise the concept options for management of scour and limitations from a hydraulic perspective in Mill Creek within Northbrook Arrowtown.

The information summarised in this memo concerning scour estimations is provided to the design team for consideration in order to inform the structural, geotechnical, and other design considerations and safety factors for the design.

The design concepts presented and background are intended to facilitate development of a multi-disciplinary approach to scour management in Northbrook Arrowtown.

2.0 Design Storms

In terms of flood management, the building finished floor levels (FFL) have been set based on the 100yr ARI flood level plus an allowance for freeboard as per the Code of Practice requirements. Other structures, such as bridge deck elevations, have been set in accordance with the Code of Practice requirements.

The New Zealand Transport Agency Bridge Manual outlines design criteria for bridges and structures based on the Serviceability Limit State (SLS) flood event and Ultimate Limit State (ULS) flood event. It is understood that the flood flow and erosion / scour assessment design criteria for items such as bridges needs to reflect the 500-year ARI event.

3.0 Estimation of Potential Scour Depths and Extents

A preliminary estimation of potential scour depths and extents was undertaken based on hydraulic model results and hand calculation estimations.

This memo presents the different methods used for the scour analysis, variability of the scour depths, and conservativism built into the selected scour depth estimate.

It is noted that scour would most likely occur during flood events. Scour is progressive and would occur naturally during all flood events but would likely occur at greater depths proportionate to larger flood flows.

However, the mechanism and estimation of scour is a complex process that is highly sensitive to local soil properties and multi-dimensional flow characteristics. It is noted that "physical modelling or careful 3D/CFD modelling paired with extensive soil data collection are the only way to predict local scour depth with any confidence, and even these approaches can have significant uncertainty if they are not calibrated" (HEC RAS Manual).

Note that scour and erosion has been observed recently in Mill Creek – see Figures 3.1 and 3.2 below.

Figure 3.1: Mill Creek Erosion / Scour – Photo 1

Figure 3.2: Mill Creek Erosion / Scour – Photo 2

3.1 Substate and Bed Material Assumptions

3.1.1 Test Pit Information

Test pits TP13a, TP24a, and TP51d lie within the vicinity of the Ayrburn Domain area (refer to Geosolve May 2018 investigation report). At depth, the material likely to form the bedding under Mill Creek is understood to be a combination of alluvial gravels, alluvial sand, and pond sediment (silt).

A borehole (#3) was also undertaken in the vicinity of the Domain area up to a depth of 25m. No bedrock was found at this depth.

Updates to the scour analysis have been based on a D_{50} of 0.2mm to represent the underlying soils in Mill Creek where applicable (Refer to Figure 3.3 below). It is understood that this is a conservative estimate.

Name				Size range (mm)	Size range (approx. in)
Very coarse soil		Large boulder	LBo	>630	>24.8031
		Boulder	Bo	200–630	7.8740–24.803
		Cobble	Co	63–200	2.4803–7.8740
Coarse soil	Gravel	Coarse gravel	CGr	20–63	0.78740–2.4803
		Medium gravel	MGr	6.3–20	0.24803–0.78740
		Fine gravel	FGr	2.0–6.3	0.078740–0.24803
	Sand	Coarse sand	CSa	0.63–2.0	0.024803–0.078740
		Medium sand	MSa	0.2–0.63	0.0078740–0.024803
		Fine sand	FSa	0.063–0.2	0.0024803–0.0078740
Fine soil	Silt	Coarse silt	CSi	0.02–0.063	0.00078740–0.0024803
		Medium silt	MSi	0.0063–0.02	0.00024803–0.00078740
		Fine silt	FSi	0.002–0.0063	0.000078740–0.00024803
	Clay		Cl	≤0.002	≤0.000078740

Figure 3.3: Particle Size Fractions, Adopted from ISO 14688-1:2017 – *Geotechnical investigation and testing – Identification and classification of soil – Part 1: Identification and description*

3.2 General Bed and Bend Scour

General scour is understood to refer to scour which occurs naturally, i.e. not near hydraulic structures. The process would occur slowly over time for general flows, but would rapidly increase during flood flows.

A scour estimation analysis has been completed using the HEC RAS scour calculator which applies the most widely used local and bend scour equations to the riprap design cross section, to provide the range of scour depths expected from these empirical approaches. The suite of results should be used with engineering judgement, field observations, expert elicitation, geologic controls, and other quantitative and qualitative metrics to determine a maximum, likely, scour depth.

A velocity assessment was also completed since velocity is a key indicator to establishing context for scour depth estimates.

The results and methodologies are described below.

3.2.1 HEC-RAS General Scour Estimations

The HEC RAS cross sections used in the analysis are shown in Figure 3.4 below. The equations are summarised in Figures 3.5 and 3.6. The Mill Creek scour depth estimations based on the equations below and output by the developed HEC-RAS model were provided to the design team in order to inform the structural, geotechnical, and other design considerations and safety factors for the design. These estimations were provided as a guide for the structural and geotechnical detailed design plans. Erosion protection and armouring of the stream banks to mitigate impacts from scour were also developed with the scour estimates developed. See structural and geotechnical design plans within the overall Northbrook Arrowtown development resource consent.

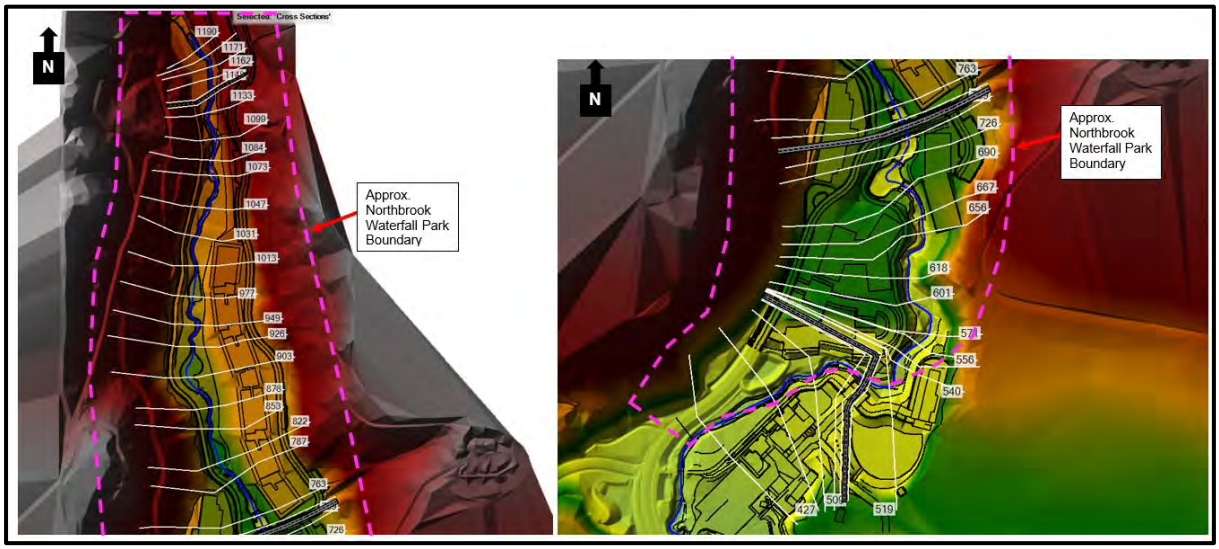


Figure 3.4: HEC-RAS Simulation Cross Sections

Method	Equation	Parameters	Assumptions and Conditions
Neil◊	$\Delta y = Z \cdot \bar{D}_{bf}\left(\frac{Q_d/W}{Q_{bf}/W_{bf}}\right)^m$	$Z = \begin{cases} 0.5\ if\ Straight \\ 0.6\ if\ Moderate \\ 0.7\ if\ Severe \blacksquare \end{cases}$ $m = \begin{cases} 0.67\ for\ sand * \\ 0.85\ for\ gravel \end{cases}$	See Table 2 for quantitative metrics for Z categories Valid for reaches with channel constrictions
Lacey◊	$\Delta y = Z \cdot 0.47\left(\frac{Q_d}{1.76\sqrt{d_m}}\right)^{\frac{1}{3}}$	$Z = \begin{cases} 0.25\ if\ Straight \\ 0.5\ if\ Moderate \\ 0.75\ if\ Severe \blacksquare \end{cases}$	Silt bed rivers. Zero bedload conditions.
USBR Mean Velocity (Pemberton and Lara, 1984)	$\Delta y = Z\bar{D}$	$Z = \begin{cases} 0.25\ if\ Straight \\ 0.5\ if\ Moderate \\ 0.75\ if\ Severe \end{cases}$	
Blench◊	$\Delta y = Z \cdot \frac{\left(Q_d/W\right)^{\frac{2}{3}}}{(F_{B0})^{\frac{1}{3}}}$	$Z = 0.6$ $F_{B0} = f(d_m)$ $F_{B0}\ from\ chart$	Clear water flow
USBR Envelope Curve	$\Delta y = \begin{cases} 2.47 + \frac{0.937\left(Q_d/W\right)}{3.45} \\ K\left(Q_d/W\right)^{0.24} \end{cases}$	$If\ \left(Q_d/W\right) < 3.45$ $If\ \left(Q_d/W\right) \geq 3.45$	$K = \begin{cases} 2.45\ US\ Cust \\ 1.32\ SI \end{cases}$ Valid for: Relatively steep slopes $0.004 < S < 0.008$ MS-CS bedload $0.5 < d_m < 0.7$ $\left(Q_d/W\right) < 3.45$

■Both Neil and Lacey have higher values of Z (1-1.25) for right angle bends or vertical rock banks.

◊Neil, Lacey and Blench in this document are from Peberton and Lara, 1984, which have been modified from the original documents.

* This equation applies a smaller power for sand than gravel, which tends to predict more scour for gravel than sand. This emerged from the data in this study but may not be broadly applicable

Figure 3.5: General Scour Equations

Method	Equation	Assumptions and Conditions
Maynord*	$\Delta y = \bar{D}_{US}\left(1.8 - 0.051\left(\frac{Rc}{W_{US}}\right) + 0.0084\left(\frac{W_{US}}{D_{US}}\right)\right) - \bar{D}_{US}$	Sand bed $S \leq 2\%$, $1.5 < \frac{Rc}{W_{US}} < 10$** Recommends a safety factor of 1.0 to 1.19
USACE EM 1110-2-1601	$\Delta y = \begin{cases} \bar{D}_{US}\left(-1.51\log_{10}\left(\frac{Rc}{W}\right) + 3.37\right) - D_{Max}\ for\ sand \\ \bar{D}_{US}\left(-1.62\log_{10}\left(\frac{Rc}{W}\right) + 3.375\right) - D_{Max}\ for\ gravel \end{cases}$	This method uses much of the same data as Thorne
Zeller†	$\Delta y = \frac{0.0685 \cdot D_{US\_Max} V_{US}^{0.8}}{D_{h\_US}^{0.4} S_{US}^{0.3}} + \left(2.1\left(\frac{W}{4Rc}\right)^{0.2} - 1\right)$	Sand bed channels.
Thorne	$\Delta y = \bar{D}_{US}\left(2.07 - 0.19\ln\left(\frac{Rc}{W_{US}} - 2\right)\right) - \bar{D}_{US}$	Includes data from large sand bed rivers and smaller gravel-cobble systems $\frac{Rc}{W_{US}} < 2$

* For a factor of safety of 1. The method recommends a factor of safety between 1.0 and 1.19 based on the percentage of "significantly unconservative data".

**The algorithm has alternate forms for $\frac{Rc}{W_{US}} < 10$ and $\frac{Rc}{W_{US}} < 1.5$

†This form replaces $\frac{\sin^2\frac{\alpha}{2}}{\cos\alpha}$ with the equivalent $\frac{W}{4Rc}$.

Figure 3.6: Bend Scour Equations

3.2.2 Discussion

As noted above, estimating the likely depth of scour is difficult to do with accuracy, as the many equations provide varying estimates, as seen in the results above. Many different equations have been developed based on specific scenarios and rely on observed data. The worst-case scenario results (maximum estimate) from the equations shown above were presented to the structural and geotechnical designers to be adopted as basis of being conservative.

This is a complex project, where the scour depth estimations can be highly variable due to the nature of the morphology of an alluvial stream and unpredictability of the stream reaction during a high flow event. Please be aware that no Factor of Safety (FOS) has been applied to the provided scour depth estimations. Discussions with the structural and geotechnical engineer have resulted in the appropriate FOS being applied to the overall project design for each situation.

The scour depth selected for design is calculated conservatively based on the worse case parameters, but given the nature of the stream as described, further scour may occur in localised pockets, such as at a rigid structure such as a sheet pile toe wall, which requires additional consideration.

It is important to note that the scour depth estimates presented in this document and used for design are based on the current Mill Creek channel conditions (Bed levels, bank toes, etc.). Maintaining these benchmark bed levels through regular surveying and maintenance is critical for the basis of the scour estimates used to assist with design decisions. Maintenance practices are outlined in Section 4 of this document and the Operations and Maintenance plan document.

This is the limit of the information which can be provided for the design by others for critical infrastructure throughout the site. The design assumptions for the geotechnical and structural considerations have approached detailed design with these limitations in mind.

4.0 Maintenance

A Floodway Maintenance Plan has been developed "*to monitor the condition of the Mill Creek waterway and provide a mechanism for identifying channel conditions that could adversely affect flood levels and channel stability*."

Monitoring of the bed after flow events larger than 3.2m^3/s will need to be undertaken under the Floodway Maintenance Plan. While this would not stop the creek bed from eroding/scouring during the storm event, after the storm event any issues will require the maintenance/repair to maintain the floodway. Therefore scour/erosion effects would not necessarily be compounding, thus creating a more stable creek bed margin by maintaining the bed profile.

A system for assessment of scour within Mill Creek at critical structures such as bridges or riverbank slopes near buildings would be adopted in the revised version of the Floodway Maintenance Plan. This would include methods for identifying structures most at risk of being impacted by a flood event, inspection methods, and provide guidance on measures that can be used following the assessment to manage the risks of scour.

Additionally, the resource consent requires that the Mill Creek channel long section be surveyed 5 years after the development becomes operational. An initial long section of Mill Creek was completed in April 2018 for use as a reference point.

*Note: Any recommendations, opinions or findings stated in this memo are based on circumstances, facts and assessment criteria as they existed at the time that the work was performed, and on data obtained from the investigations and site observations as detailed. There are no calculation methods that are reliable enough to accurately predict the scour depths, since there are a number of unknown stream processes and the creek bed is in constant flux. Section 5.2 Page 5/1 of *The Assessment of Scour and Other Hydraulic Actions at Highway Structures* (UK) states "It is important to recognise that the calculated scour depth is a theoretical estimate of the potential scour depth."

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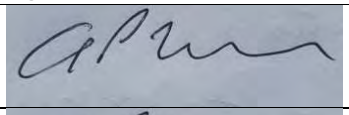
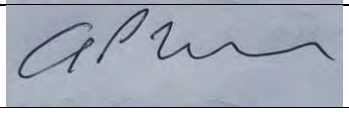
ENVIRONMENTAL MANAGEMENT PLAN

(CONSENT DRAFT)

PROJECT	NORTHBROOK ARROWTOWN
PRINCIPAL	WATERFALL PARK DEVELOPMENTS LTD
OUR REF	Q6388/F
DATE	28 February 2023

Rev:	Date:	Prepared By:	Reviewed By:	Comments:	Signature
0	6/10/2022	SB	AN(CPESC 7510)	Issued as draft	
1	30/11/2022	SB	AN(CPESC 7510)	Issued as draft for consent	

CONTENTS:

1. INTRODUCTION

1.1. BACKGROUND

The project is a further stage of development within the Waterfall Park valley associated with the proposed Northbrook Arrowtown later living development. Previous stages within the wider site have included the construction of Ayr Avenue off the Arrowtown Lake Hayes Road, development of a hospitality precinct as a repurposing of existing heritage stone buildings, associated landscaping, and diversions of the Mill Creek channel to enable crossings, accessways and creek bank stabilisation. The approximate location of the project is shown by the red area in **Figure 1**.

Figure 1 - Project Location Plan

1.2. PURPOSE OF DOCUMENT

This Earthworks Management Plan (EMP) has been prepared for the earthworks as shown on Paterson Pitts Group drawing set "*Waterfall Park Developments Ltd – Northbrook Arrowtown Resource Consent Drawings Q6388-82-01*", sheets 001 - 503.

It is a high-level draft document prepared for the purposes of informing the Queenstown Lakes District Council and Otago Regional Council in the consenting process that appropriate measures have been designed and located to address the environmental risks of what is classified as "High Risk' project under the QLDC Guidelines and a Restricted Discretionary Activity under the Operative Plan Change 8 of the Otago Regional Plan. As such it does not contain the detailed design or calculations that would be expected in am EMP ready for construction.

Prior to ground disturbance associated with works specific to the Northbrook Arrowtown resource consent, a final EMP for Waterfall Park will be submitted with the Engineering Acceptance, containing landform and full designs for all ESC measures suitable to inform construction plans will be submitted for review and acceptance by Otago Regional Council (ORC) and Queenstown Lakes District Council (QLDC).

1.3. GUIDELINE DOCUMENTS

This EMP has been prepared according to the requirements of

- *QLDC Guidelines for Environmental Management Plans* - June 2019
- *Erosion and sediment control guide for land disturbing activities in the Auckland region* – Gdo5 2018; and
- IECA 2008 – *Best Practice Erosion & Sediment Control - for building and construction sites* IECA (Australasia)

2. LEGAL CONTEXT

The discharges of sediment laden water and dust from a construction site are subject to the provisions of the RMA and National Policy Statements as expressed in the policies and rules of the relevant regional council and district council.

2.1. OTAGO REGIONAL COUNCIL

In Otago Clause 14.5.1 in the now operative Plan Change 8 of the Otago Regional Plan effectively sets a risk threshold by establishing the permitted activity criteria for use of land, and the associated discharge of sediment into water or onto or into land where it may enter water, for earthworks for residential development. This sets a permitted activity threshold where either

- the area of disturbed soil must not exceed 2500m^2; or
- the activity occurs within 10 m of a drain

If either of these is breached, the activity becomes effectively "high risk" as a restricted discretionary activity where the matters considered by the ORC in its decision whether to grant consent are restricted to the following range of matters

(a) Any erosion, land instability, sedimentation or property damage resulting from the activities; and
(b) Effectiveness of the proposed erosion and sediment control measures in reducing discharges of sediment to water or to land where it may enter water; and
(c) The extent to which the activity complies with the Erosion and Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region 2016 (Auckland Council Guideline Document GD2016/005); and
(d) Any adverse effect on water quality, including cumulative effects, and consideration of trends in the quality of the receiving water body; and
(e) Any adverse effect on:
i. Kāi Tahu cultural and spiritual beliefs, values and uses.
ii. Any natural or human use value.
iii. Use of water bodies or the coastal marine area for contact recreation and food gathering.
and measures to avoid, remedy or mitigate these adverse effects.

2.2. QUEENSTOWN LAKES DISTRICT COUNCIL

The Queenstown Lakes District Council "QLDC" defines the following 3 levels of risk that add to but are not inconsistent with the ORC rule of Plan Change 8

- Low
  - Less than 2500 m^2 disturbed surface area open at any one time
  - Less than 15% (6.6 degrees) slope ; and
  - Earthworks not located within 50 m of a Sensitive Environmental Receptor: and
  - Controls installed and maintained in accordance with Template EMP including measures to ensure sediment does not enter the stormwater network.
- Medium
  - Greater than 2500 m^2 disturbed surface area open at any one time; or
  - Where a Sensitive Environmental Receptor within 50 m of the site or specific environmental adverse effect has been identified. All projects not meeting the characteristics of "Low Risk" (above) and "High Risk" (below)
- High
  - Projects which have greater than one hectare of land exposed, or
  - Projects which have greater than 2500m^2 of disturbed surface open at any one time and include any of the following characteristics:
    - Project working within or discharging to Sensitive; or Environmental Receptors such as a water body or stormwater network
    - Topography where any slope is greater than 15% (6.6 degrees)
    - Soils with high erodibility (e.g. silts or other soil types with high silt content) as determined by geotechnical advice.

EMP for Medium and High-risk projects are to be prepared by a Suitably Qualified and Experienced Person (SQEP).

2.3. ASSESSMENT OF RISK STATUS

Under these criteria this Project has been defined as a Restricted Discretionary Activity under the ORC Regional Plan and a High Risk project under the criteria of the QLDC.

3. DESCRIPTION OF THE PROPOSED WORKS

3.1. SCOPE OF THE PROJECT

As shown by Sheet 300 in Appendix A, the works comprise

- Building A – Welcome and amenities
- Building B – Care and serviced apartments
- Buildings C-E – Residential Apartments
- Building F – Boutique hotel accommodation and day spa
- Roading network including, carparks, retaining walls, culverts, and pedestrian/cycle paths.
- Drainage and utility reticulation for all buildings.
- Associated landscaping works, including construction of rock weirs, stormwater treatment ponds, and swales.

3.2. STAGING

The civil component of the project is anticipated to be complete within 12 months, commencing in early 2024, dependent upon the conclusion of the consenting process. Within this the following staging of earthworks is currently proposed, though this may change as the project advances. They are based on internal construction stormwater catchments. Works complete during each stage will comprise of; earthworks, preparation of building foundations, preparation of road and carpark pavements, and landscaping works including stabilising the catchments.

Stage 1:

- Building A,
- Buildings C-E, basement excavation will likely start at the northern end of building E with construction working south so the existing construction ponds created as part of the stream alignment works can remain in place for as long as possible. Once the basement is installed and backfilled civil components adjacent to the building can progress and landscape areas (particularly on the creek side) can be stabilised to reduce open area.

Stage 2

- Building B

Stage 3

- Building F and associated accessway.

Final staging will be submitted as part of the final EMP at EA.

3.3. EARTHWORKS AND QUANTITIES

Figure 2 is the overall cut and fill plan within the indicative stage boundaries.

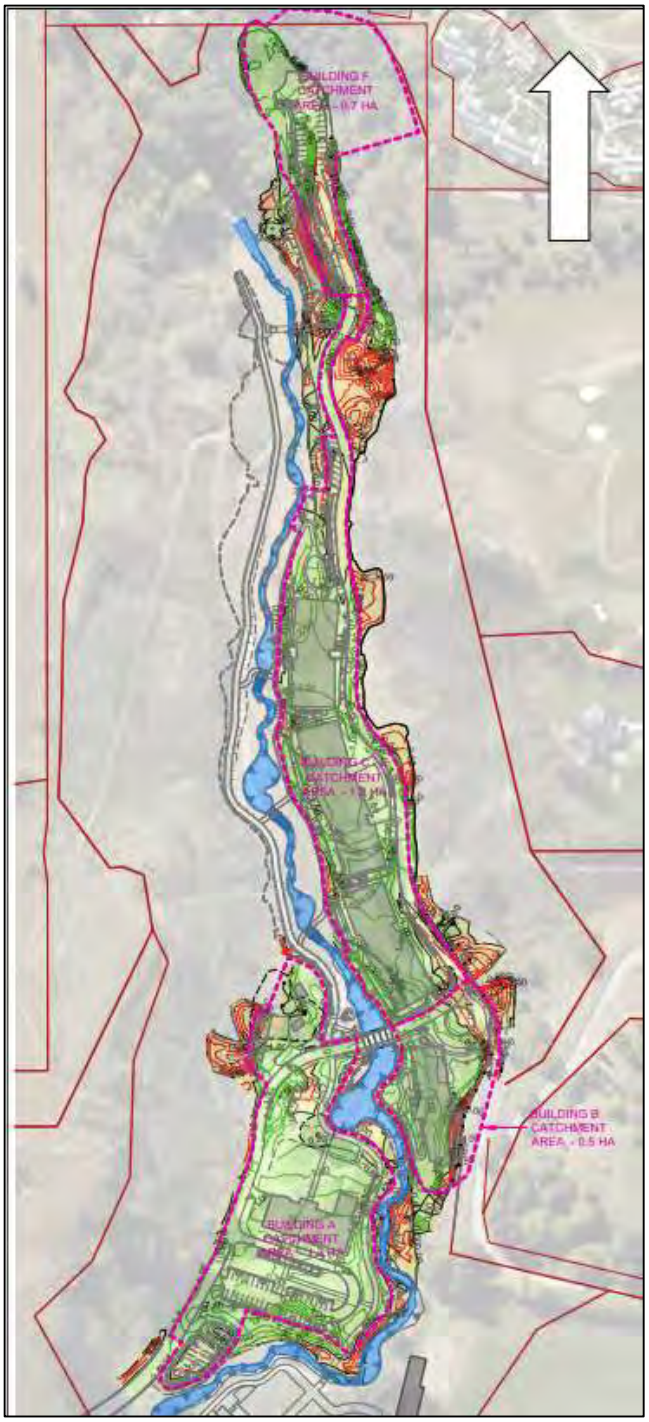


Figure 2- Cut and Fill Plan by catchment

The earthworks will generate an excess of topsoil and loess subsoil, unsuitable for engineering fill under the pavement layers and building platforms. Where these soils are surplus to the requirements of project non-structural purposes such as landscaping, they will be carted offsite to a location appropriate to receive such material. To enable the construction of pavement layers, paths, and building foundations, various aggregate materials will be imported from an offsite location. The source location/destination for material to be carted to and from site will be determined nearer to the time of construction.

The proposed approximate earthworks volumes and quantities are shown in the table below. Final quantities will be determined and submitted with the final EMP at EA which will be representative of the landform at the time.

Table 1 - Earthworks Volumes

Topsoil	**Approximate Volume**
Strip topsoil	10,000m³
Respread Topsoil	5,000m³
Excess	**5,000m³**
Earthworks	
Cut - Fill	5,000m³
Cut - Waste	7,000m³
Imported Material	
Engineered fill spec	25,000m³
Roading/path spec	4,000m³
Total area to be exposed	6.5Ha
Maximum cut depth	6.0m
Maximum fill depth	4m

4. SITE DESCRIPTION

4.1. SITE CONTEXT

The site is located in rural land surrounded by permanent and holiday residential development blocks to the east and west at the top end and Millbrook Resort and its associated golf course to the north. The land to the south is occupied by vineyards and remaining drystock farming land in an area of almost continuous development. The residents of the dwellings and the users of the resort can be considered potential sensitive receptors to noise, vibration, dust and traffic movements.

4.2. TOPOGRAPHY

The site is approximately 500 m long in a north south aligned gorge of 3% approximate grade from an altitude of 359 m ASL at a waterfall to 349 m ASL at the mouth of the gorge. The footprint of the proposed earthworks occupies the true left eastern bank of the relocated stream on the gorge floor

that increases in width from approximately 30 m to 90 m over the same distance. The steep sides of the gorge vary between 25% – 40%+ in grade and rise an average 50 m above the gorge floor.

4.3. SOIL CHARACTERISTICS

The NIWA S-map shows the site is underlain by a silty slightly loess valley floor Hinds_39a.1 soil over Otago Schist. Hinds soil is described by Landcare Research as poorly drained.

4.4. GROUND AND SURFACE WATER

4.4.1. Groundwater

Consistent with the location adjacent an active waterway there is a persistent watertable

4.4.2. Surface water

As shown by **Figure 3**, the site is located next to Mill Creek (bold light blue line), which is a significant tributary of Lake Hayes. Mill Creek enters the gorge over a waterfall. It is a recognised high-quality habitat of trout.

Figure 3- Existing Drainage and Water Bodies

Principal surface water quality risks from the Project to the Mill Creek/ Lake Hayes catchment come from

- Sediment in the runoff, generated during site clearing and stripping, subsoil cutting and filling, and topsoil replacement activities; and

- Spillages and leaks from vehicles and earthmoving equipment including sediment deposited in roads outside the project getting into the stormwater drainage of the public road.
- Effects on traditional Maori values and principally those of Mahika kai or food gathering. Nonetheless, unlike the Arrow River, Mill Creek is not listed as a culturally significant waterway in the Queenstown Lakes District Plan nor by Kai Tahu Ki Otago[1].

4.5. GROUND COVER

Vegetation on the earthworks footprint is a mix of a variable quality dryland pasture grass and exotic weeds. Indigenous plantings have recently been established on the slopes of the gorge. These are unaffected by the earthworks project.

4.6. WEATHER

4.6.1. Precipitation

Table 2 indicates the levels of rainfall expected in each month at the Arrowtown Rain gauge which is the nearest climate record to the site. Although rainfall in Arrowtown is relatively evenly distributed throughout the year there are minima in February- March and in July. Although it is preferable for earthworks to be conducted during periods of lower rainfall erosion risk, the project will be carried out over a full 12-month period. It is proposed in mitigation that all reasonable and practicable steps are to be taken to minimise the amount of exposed earth at any one time and to apply appropriate best practice erosion and sediment control.

Table 2- Monthly Rainfall– Arrowtown (Station 48981)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
64	48	53	56	70	72	49	69	67	66	68	76

Prior to anticipated rainfall, all erosion and sediment control measures on the site are to be inspected to ensure they are complete and fully operational, prior to, and after the event.

HIRDS was used to generate **Table 3** which shows the intensity, duration, and frequency of rainfall events at the site.

Table 3 - HIRDS4 Rainfall Intensity-Duration-Frequency for Northbrook Arrowtown

Annual Exceedance Probability	10	20	30	1h	2h	6h	12h	24h
0.633	16.5	12.8	11.0	8.4	6.3	3.8	2.7	1.8
0.5	18.5	14.3	12.3	9.3	7.0	4.2	3.0	2.0
0.2	26.2	20.0	17.0	12.8	9.5	5.6	3.9	2.6
0.1	32.5	24.6	20.8	15.6	11.5	6.8	4.7	3.1
0.05	39.4	29.7	25.2	18.7	13.7	7.9	5.4	3.6
0.02	50.0	37.5	31.4	23.2	16.8	9.7	6.6	4.3

Intensity is an indication of the erosive force of a rainfall event. While short duration storms have the highest intensity and thus erosive power, long duration events can saturate the ground and mobilise

[1] *Kai Tahu ki Otago -Natural Resource Management Plan 2005*

sediment in runoff. It shows the importance of maintaining groundcover by minimising the amount of exposed earth at any time and the prompt stabilisation of disturbed surfaces. Prior to anticipated rainfall, all erosion and sediment control measures on the site are to be inspected to ensure they are complete and fully operational, prior to, and after the event.

It is anticipated that some of the rain will be received as snow during the project. In the aftermath of snow, frost can disrupt the soil surface and make it more prone to rainfall and wind erosion.

4.6.2. Wind

An analysis of airflow from Queenstown Airport (**Table 4**) gives an indication of the risk of dust generation at the site and consequent air quality issues for adjacent downwind residents (sensitive receptors).

Table 4 – Mean monthly and annual wind speed (km/hr) for Queenstown Airport

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
13.9	13.3	12.2	11.0	10.2	10.0	9.7	10.2	11.8	13.2	14.1	13.6	11.9

Windrose data from the same location show the predominant airflow is from the SW quarter and the NE with another peak in frequency from the south. Topographic channelling will be a factor in this.

Although the risk of generation is low given the even rainfall throughout the year, management of dust shall be conducted by

- Monitoring the weather
- Proactive application of water on earthworks surface and haul road and
- The setting and enforcement of internal speed limits.

5. SITE MANAGEMENT PERSONNEL

5.1. KEY CONTACT DETAILS

Role	Name	Phone	Email
Principal	Lauren Christie	+64 21 910 981	lauren.christie@winton.nz
Contract Engineer	Sam Ballam	+64 27 427 4557	Sam.ballam@ppgroup.co.nz
Contractor	Isaac Harrison	+64 27 292 9010	isaac@wilsoncontractors.co.nz
Environmental Manager	Darren Willis	+64 29 122 3770	dwillis@wilsoncontractors.co.nz
Environmental Consultant (SQEP)	Andrew Nichols	+64 21 082 20573	Andrew.nichols@ppgroup.co.nz
Otago Regional Council Monitoring	Melanie Heather (TBC)	+64 27 564 1758	Melanie.heather@orc.co.nz

ORC Pollution Hotline (Pollution of air water and land)		0800 800 033	
Heritage New Zealand – Pouhere Taonga (Cultural Finds/Koiwi Tangata)	TBC		

6. EROSION AND SEDIMENT CONTROL

6.1. EARTHWORKS CATCHMENTS AND OVERLAND FLOWS

With Mill Creek in the base of the valley the site is split into two main catchments (eastern and western). Overlaying the proposed construction features the site is separated into the following sub-catchments:

- Building A catchment
- Building B catchment
- Buildings C – E catchment
- Building F catchment

6.1.1. Building A catchment

This catchment sits on the western edge of Mill Creek and comprises an area of approx. 1.3ha. Proposed works within this catchment include:

- The extension of the existing Ayr Avenue formation (Road 01)
- The construction of a carpark and circulation road (Road 02)
- The construction of Building A foundations and associated landscape features.

Some works have been completed in this area of site previously as part of the RM180584 consent. This included the establishment of a sediment retention pond (SRP) at the southern extent of the catchment. This SPR will be used during construction within this catchment, earth bunds or silt fences will be installed around the perimeter of the works to convey runoff to the pond and prevent any sediment laden water discharging directly to Mill Creek.

There is a steep hillside catchment to the west, upslope of the proposed works. To minimise the volume of water that requires treatment, a clean water cut off drain will be established at the base of the slope. This will divert runoff from this area around the work site into the existing Ayr Avenue swales.

6.1.2. Building C - E catchment

This catchment sits on the eastern edge of Mill Creek and comprises an area of approx. 1.3ha. It is separated from the Building B catchment by the proposed Road 01 formation. Proposed works within this catchment include:

- The construction of Buildings C – E basement, retaining walls, and associated landscape features.
- Installation of services
- The extension of the existing Ayr Avenue formation (Road 01)

Works have been completed within this catchment previously as part of the recently completed upstream works under RM180584. SRP 02 was established as part of these works and will remain in place for the initial construction phases until the basement excavation commences. When the basement excavation gets underway the first two bays of the pond will need to be removed, the remaining two bays within the Building B catchment will remain in place, to allow for treatment of any ground water pumped during construction.

There is a steep hillside catchment upslope of the proposed works to the east. To minimise the volume of water that requires treatment a clean water cut off drain will be established at the base of the slope, this runoff will be collected at intervals along the channel and piped to Mill Creek. Runoff from within the works extent will be contained by perimeter bunds or silt fence which will convey it to the pond and prevent any sediment laden water discharging directly to Mill Creek.

6.1.1. Building B catchment

This 0.5 Ha catchment is adjacent to the building C – E catchment on the southern side of the road 01 alignment. Like the C -E catchment clean water cut off drains will be installed on the upslope extent with dirty water drains installed on the downslope extent to contain runoff from the works area.

There are two existing SRP bays within this catchment which will remain in place until the basements for buildings C – E have been completed and no further ground water pumping is required. At this point a new decanting earth bund (DEB) will be installed at the southern extent for treatment of the building B catchment in isolation. Once installed the remaining SRP bays can be removed and construction for building B foundations and associated civil works can commence.

6.1.2. Building F catchment

The building F catchment comprises a 0.7Ha area at the northern extent of the valley and is generally isolated from the other catchments due to the narrow track that connects it. The catchment is steep and narrow so will need to be split to manage the runoff. A contour drain will be installed through the centre of the catchment to divert to majority of the flow north to a DEB or similar treatment device. The small, isolated section of catchment that can't be diverted to this device will be contained by silt fence. The cut off drain to divert runoff will need to be adjusted as the building works progress and the levels change.

6.1.3. Silt Fence Catchments

As catchments change during construction it is expected there will be small areas where runoff is unable to be directed back to a treatment device. Catchment areas contained by silt fence will be kept to a minimum and monitored regularly throughout the construction duration.

6.2. EROSION AND SEDIMENT CONTROL MEASURES

Appendix A shows how the following measures will be applied overall and to the individual site catchments. Note that the location of any or all these measures is indicative only and may be changed as the earthworks design changes and and/or site conditions dictate. All changes will be shown on revised plans, and it is recognised that significant deviation is likely to require approval of the consent authority.

6.2.1. Site Access

The existing Ayr Avenue formation will provide all weather access to the site. A stabilised site entrance will be installed at the end of the asphalt formation; as works progress, and the road is constructed to its finished form the stabilised site entrance will be relocated further into the site.

Facilities will be in place to washdown vehicles. Vehicles entering and exiting the site will be inspected for cleanliness and if necessary, washed down. In addition, 'shake down' grids will be installed at the haul road entry and the access point to the Site Compound as works progress to prevent deposition of debris on surrounding roads.

6.2.2. Runoff Diversion Channel / Bund

Runoff diversion channels or bunds will be installed on the upslope extent of the works area. These will be considered as clean water diversion and be lined with fabric or sown in grass to prevent the transportation of sediment. These diversions will convey water around the perimeter of the development and discharge to the existing watercourse on the downstream extent, this will limit the volume of runoff within the site requiring treatment and protect the work areas. Additional diversions will be installed within the work site to manage flow path lengths and direct sediment laden water to an appropriate sediment pond or alternate treatment device. These will be considered as dirty water diversions. Figures 4 and 5 show a conceptual design for a diversion bund and channel respectively.

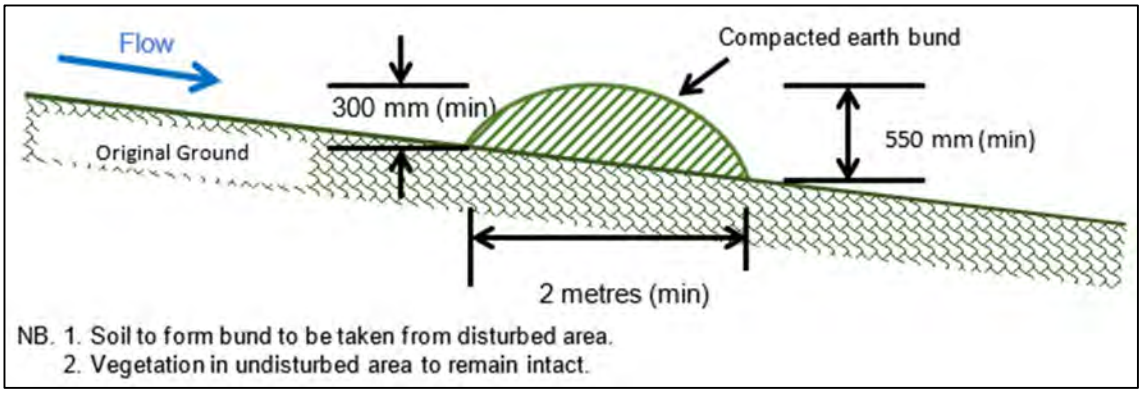


Figure 4 - Diversion Bund Section

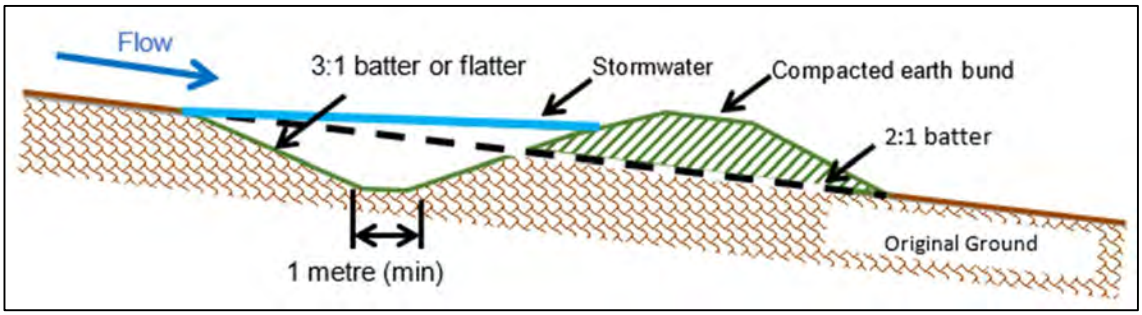


Figure 5 - Diversion Channel Section

All diversion channels and bunds constructed for the proposed works will be regularly inspected by the contractor. Any damage or sediment build up will be repaired or removed immediately. No site works will recommence after a significant rain event before all diversion channels and bunds are inspected.

6.2.3. Silt Fences and Super Silt Fences

Silt fences and super silt fences can be used on slopes to intercept sheet flows whereby the flow is detained to allow sediment to drop out of the runoff. Silt fences will be used in several areas during the proposed works. Multiple rows of silt fence will form the final system of barriers for overland flow from the proposed earthworks before discharging into the natural watercourses. By the time overland flow reaches this point it will already have passed through the sediment detention ponds. Silt fences will also be used at the toe of fill batters where the runoff catchment only consists of the batter itself. This will prevent any sediment from the batter from entering the wider network of overland flow. Silt fences are to be constructed from geotextile, a minimum of 600mm in height and 200mm into the ground. Silt fences are to be installed along the contours to reduce the velocity of flow behind them. Figure 6 is a conceptual design for the installation of a silt fence.

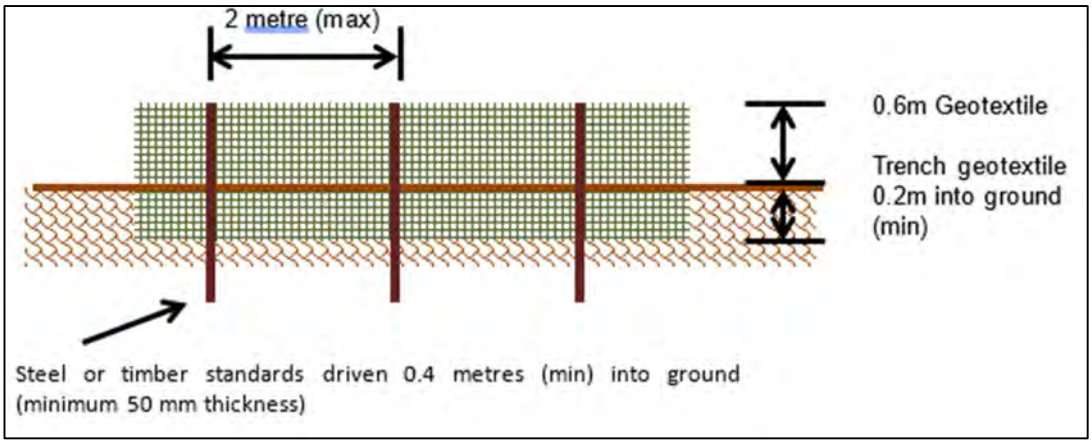


Figure 6 - Indicative Silt Fence Design

Silt fences should be installed so that:

- There are no gaps between joins in the fabric
- The geotextile is appropriate as per manufacturers specifications
- The geotextile is buried so that water cannot pass under the fence
- Returns are installed as support at right angles to main fence as required (minimum 2 metre length)

Table 5 summarises the design features of a silt fence according to the slope of the earthworks surface

Table 5 - Silt fence design layout

Slope (%)	Slope spacing per fence (m) (maximum)	Return spacing (m)	Silt Fence length (m) (max)
<2%	Unlimited	None required	Unlimited
2-10%	40	60	300
10-20%	30	50	230
20-33%	20	40	150
33-50%	15	30	75
>50%	6	20	40

All silt fences will be inspected regularly by the contractor. Sediment deposited behind the silt fence will be removed and any damaged sections of silt fence will be replaced.

6.2.4. Rock Check Dams

A rock check dam is a small temporary dam constructed across a channel (i.e., a concentrated flow), usually in series, to reduce flow velocity and may also help to retain sediment. A reduction in the flow velocity helps to reduce erosion of the channel. Rock check dams will be used in the diversion channels on steeper slopes. Figures 7 and 8 show conceptual designs for the section and profile of a check dam.

Rock check dams will be inspected regularly by the contractor and any sediment build up will be removed.

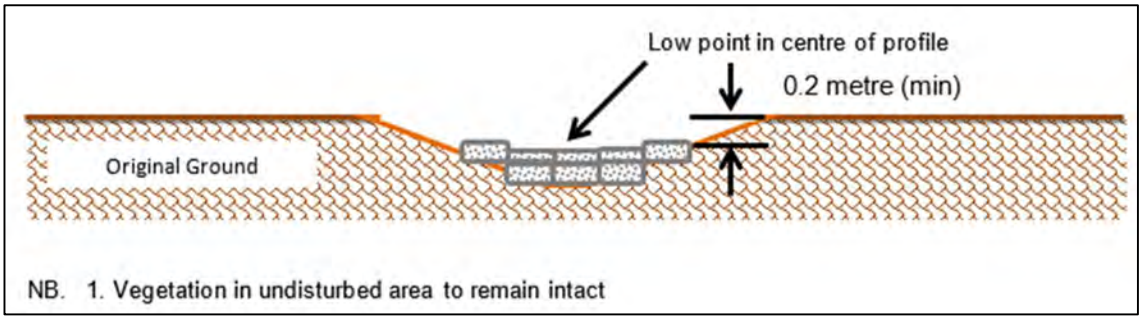


Figure 7– Rock Check Dam Section

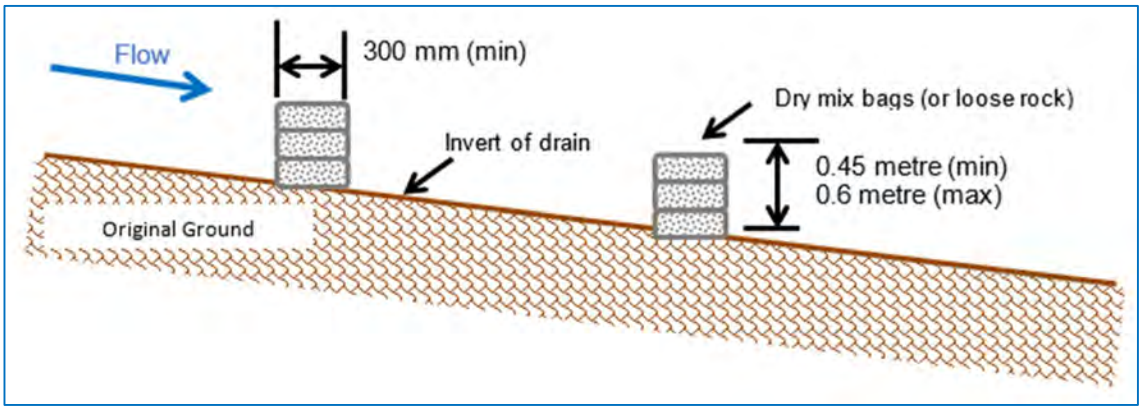


Figure 8 - Rock Check Dam Profile

Table 6 summarises the spacing of check dams according to the channel slope.

Table 6 -Check Dam Design

Slope of channel	Spacing between dams (metres)	
	450 mm height	600 mm height
<2%	24	30
2% - 4%	12	15
4% - 7%	8	11
7% - 10%	5	6
>10%	Stabilised channel	

6.2.5. Drop Structures (Pipe and Flume)

A pipe drop structure or flume will be used for any areas where water from channels and drains must rapidly descend to a lower level. The inlet of the pipe or flumed section should be flared and sufficiently protected to prevent undermining and scour. A plastic or other impervious membrane should be considered at the inlet to prevent undermining and outflanking of the structure. The drop structure must extend beyond the toe of the slope and dissipate with adequate protection (such as rip rap) to minimise erosion and undermining of the slope. Figure 9 shows the schematic for a drop structure/flume

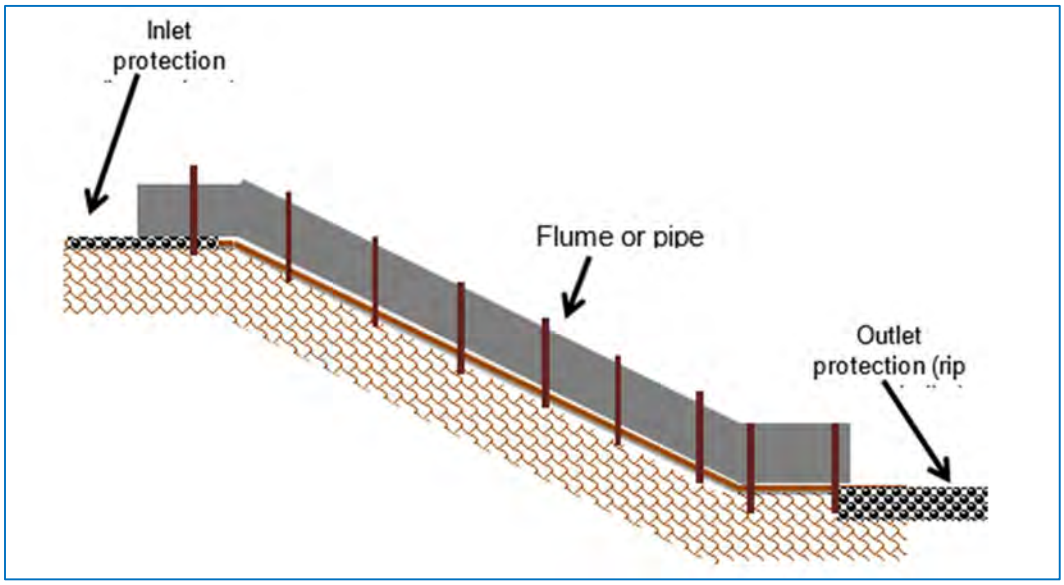


Figure 9 - Drop Structure/flume Schematic

6.2.1. Rock Lined Swales

Due to the steep nature of the site, there are areas where runoff flows will need to be conveyed down steep banks. As indicated in the drawings it is proposed to install rock 'waterfall' features around the site where this occurs. These permanent features will be set up in the early stages to convey concentrated runoff from the works, preventing scour of the banks and discharge of sediment laden water.

6.2.2. Sediment Retention Ponds

Applied Pond design

A sediment retention pond will treat sediment laden runoff from any exposed area and prevent water quality degradation. The proposed sediment retention ponds as shown for the locations in Appendix A will be designed and constructed in accordance with the Auckland Council Erosion and Sediment Control Guide GD05 as shown in Figure 10.

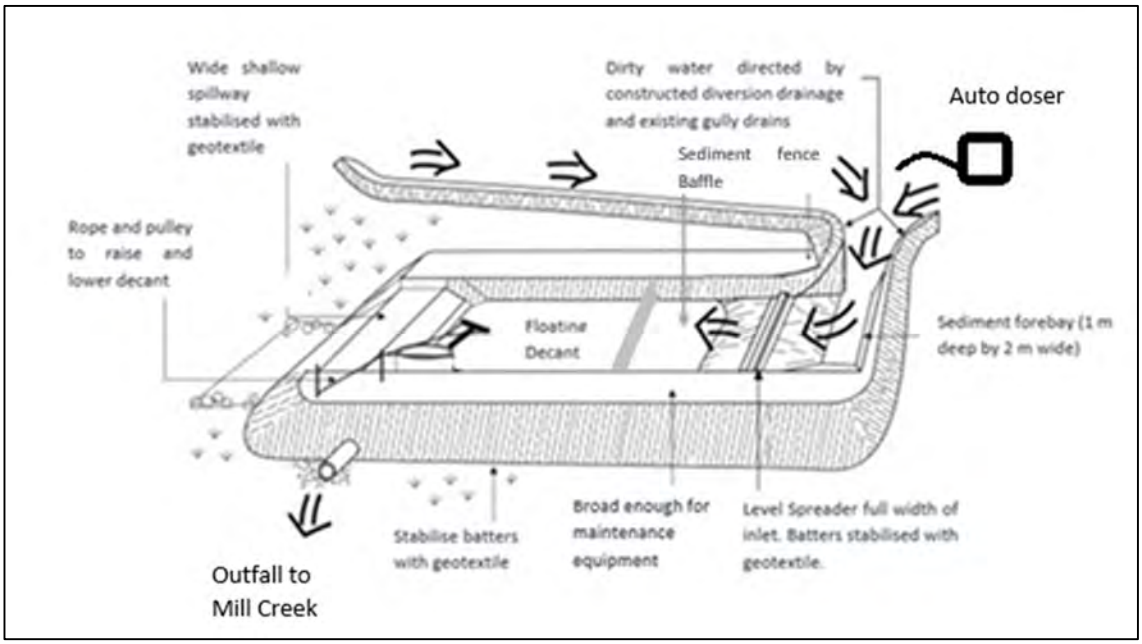


Figure 10 - Plan schematic of a sediment pond

Trapezoidal basins will be the preferred design but where topography does not allow this, a turkey nest configuration to achieve the required storage and 3:1 flow length to width ratio will be designed and built as per the concepts shown in Figure 11

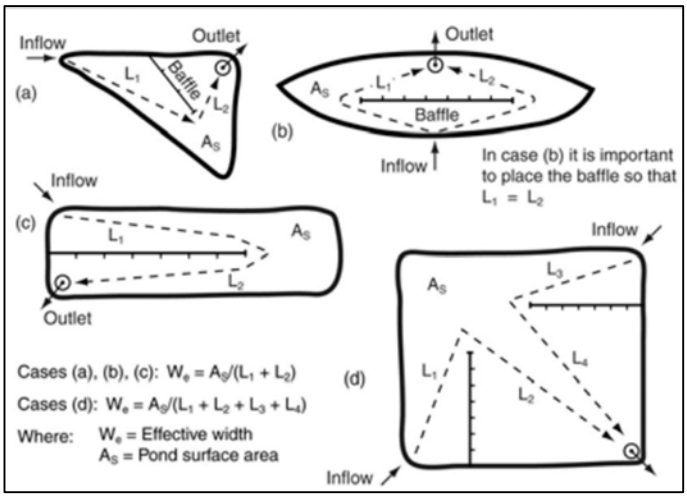


Figure 11 - Irregular sediment retention pond configurations

For catchments with

- slopes < 18% and < 200 m length Volume = 2% of catchment area
- slopes>18% or > 200 m in length Volume= 3% of catchment area

Decants will be restricted to 3L/second/ha of catchment During the construction of the ponds, silt fencing will be installed on the downslope side of the SRP.

Like the permanent Stormwater Treatment Ponds that will be a feature of this development, the SRPs will have compacted batters and be stabilised on completion.

Detailed designs including calculations will be presented in the final ESC plan to be approved prior to construction commencing

Flocculant

Prior to commencing works soil samples will be taken to assess the reactive properties with flocculant solution. A decision regarding installation of flocculant sheds/boxes will made on receipt of these results. All aspects of the sediment ponds and discharge points will be regularly inspected, maintained, and cleaned out by the contractor. Any damage will be repaired immediately.

6.3. DUST MANAGEMENT

The soils within this development have potential to generate dust. The methods used to eliminate/reduce the creation of dust and its subsequent effects will include but are not limited to the following:

- Keep stripped areas as small as possible – cut and cover method;
- Re-spread topsoil and establish grass (or alternative measures if outside the grassing season) over finished areas as soon as practicable;
- Monitor weather forecasts and manage daily tasks to suit expected wind speeds;
- Reduce or suspend work that has the potential to produce dust during times of high wind;
- Roll/compact stripped surfaces, stockpiles and completed surfaces;
- Prior to leaving site at days end, undertake site inspection with respect to potential causes of dust and remediate if necessary;
- Water stripped surfaces with a water cart;
- Establish K-lines.

Water carts shall refill from the mains within Ayr Avenue. All necessary QLDC approvals shall be sought prior and approved filling methods including back flow prevention used.

6.4. STOCKPILE MANAGEMENT

Stockpile location within the working area will be carefully selected to suit the current activity. Locations will ensure they are readily accessible, not within flow paths, and do not impede the construction operation. All stockpiles will be contained within the catchment of a sediment pond. Silt fences, earth bunds, and diversion channels will be installed as required to ensure runoff from stockpiles is directed to the associated pond.

Stockpiles will be segregated into different fill classifications as follows:

- Excess topsoil for offsite transport - due to the volumes, will typically be loaded out in phases on a backload basis due to cost and sustainability considerations. A portion of this material will be loaded out at the end of the project once the final landscaping of the project is completed.

- Unsuitable fill material for offsite transport - again, this material will likely be stockpiled and removed on a backload basis. If sequencing allows for this material to be carted directly off site via backload it will be done to prevent the double handling of material.
- Site won cut material for future use on site - this material will typically be carted directly to fill, when sequencing doesn't allow, it will be placed in stockpile and later carted to fill when programme allows.
- Imported construction materials (pavement layers, building and foundation hardfill, and engineered fill) - these materials are likely to be directly transported to work areas and spread/compacted immediately. Certain site constraints may mean some imported construction materials are stockpiled for short durations.

All stockpiled material shall be shaped, compacted, and maintained in a tidy manner and suitably covered/suppressed if they are not active in the day-to-day operation. Where stockpiling is occurring under dry, windy conditions (typically the summer months), this activity will be monitored for potential dust suppression requirements. Dust suppression techniques could include wetting down of stockpiles with a watercart or covering of stockpiles on completion of loading.

6.5. CONTAMINATED SOIL MANAGEMENT

Detailed site wide testing suggests there are no ground contaminants which are likely to be encountered as part of the works. If any potentially contaminated materials are discovered whilst undertaking construction work, works shall cease immediately within a 20m radius of the area and the Principal and Engineer to the Contractor shall be notified. No work shall recommence until an agreement has been reached between the parties regarding appropriate protection measures. Testing may be undertaken on the material and the waste classified accordingly. If necessary, the material will be transported off site to the relevant disposal facility.

6.6. STABILISATION

As per section 4.5 above, re-grassing and/or planting of cut and fill batters outside of the building and parking areas will occur as soon as possible to minimise the time any area is susceptible to erosion.

Depending on the time of year and staging of works, re-grassing of disturbed areas and areas of earthworks will occur as soon as practicable as the construction sequence allows and once the risk of disturbance from further works is sufficiently reduced. To minimise the time open areas are susceptible to erosion, hydroseeding will be used rather than applying ordinary drill seeding to help promote quicker establishment of the grass and provide some protection from rain drop impact.

If the season and sequencing of works does not allow for re-grassing immediately, other measures, such as erosion protection matting, or temporary surface stabilisation will be applied.

As the development is progressively completed and areas stabilised, the temporary silt and sediment control measures will be progressively removed.

7. SITE MANAGEMENT

7.1. SITE OFFICE AND SIGNON

There are two existing site offices within the wider Waterfall Park Development: the building contractors' compound on the western side of Ayr Avenue (opposite Ayrburn Domain) and the civil contractor's compound at the end of the existing Ayr Avenue formation. Subject to staging of the construction works, it is intended to use these facilities for the proposed works. These locations allow good visibility of incoming vehicle movements as well as act as a logical control point for the bulk of the construction activity further up the valley. A sign-in register will be located at the end of the existing Ayr Avenue formation and must be signed prior to entering the construction site. Only site inducted personnel will be allowed access to the site. As construction works progress the compounds will be disestablished and relocated as required.

Ablutions will be provided in the form of 'portaloos' or connection to the mains system once installed and operational. Portaloos will be emptied as necessary, and the waste removed from site via sucker truck.

7.2. PARKING AND LAYDOWN

Light vehicle parking for the contractor, sub-contractors, and site visitors will be provided at the site office/laydown area. Heavy plant will park in the construction work areas to minimise the hazards of interactions between people and plant near the site compound and reduce contaminants being spread across access roads.

If space is a constraint within the works area, the upper paddocks within Lot 4 can be used for additional material laydown. These paddocks have all weather access in the form of a gravel farm track.

7.3. SERVICING

No specific workshop facility will be setup on site. It is anticipated breakdowns/machine servicing will be attended to by offsite service personnel. Contractors' equipment storage will generally be containerised, and materials generally placed in the nearby laydown area.

Refuelling and the storage of contaminants will be restricted to the laydown areas and away from any watercourses or floodplains. The refuelling area will be delineated with perimeter bunding to prevent any runoff of contaminants. Spill kits will be available nearby for the clean-up of fuels, lubricants, or other contaminants.

Laydown and stockpile areas will be formed with aggregate to provide all weather access. It is intended that vehicles delivering materials to site will always remain on all weather surfaces to prevent debris and detritus being carted off site.

Where required, Ayr Avenue and internal roads will be cleaned using a road sweeper to prevent dirt and mud build up on the public road.

7.4. WASTE MANAGEMENT

On-site skip bins shall be used for the disposal of general waste. These shall be located at each construction zone and shall be emptied as necessary. Should any hazardous waste be generated on site, this will be segregated accordingly and disposed to the appropriate facility. Preliminary testing and investigation of contaminants on site suggests no contaminated earth material will be encountered. At no point shall waste from site be allowed to migrate beyond the site boundaries and onto public road or private property adjacent to the site.

7.5. NOISE VIBRATION AND TRAFFIC CONTROL

Due to the distances to the nearest sensitive stakeholders, it is not expected that noise and vibration from heavy machinery will become problematic. If complaints are received, monitoring could be setup at perimeter locations to determine the extent of ground velocities and peak acceleration and to determine if noise and vibration from construction equipment is within an acceptable range.

As the construction will be staged, the balance of material to be removed from/transported to site will be staggered over the duration of the project. This will limit the impact of truck movements causing noticeable congestion on site and on the surrounding transport network.

8. INDUCTIONS, MONITORING, INSPECTIONS AND RECORDING

8.1. INDUCTION

All workers, including subcontractors, will complete a site induction upon arrival at site. As part of their site induction, they shall be fully informed of the details of this Earthworks Management Plan.

The induction shall include but not be limited to:

- Roles and responsibilities for environmental management
- Specific locations within the site of environmental significance or risks, including exclusion zones and sensitive receptors
- Scope and conditions of resource consent conditions
- Explanation of the erosion and sedimentation control measures in place and how they work
- Erosion and sedimentation control maintenance and monitoring requirements
- Requirements and procedures for preparing for an imminent rain and/or wind event
- Procedures to reduce and mitigate dust
- Areas where access is not permitted
- Parking and material storage areas including refuelling areas and spill management protocol
- Expectations for specific work
- Archaeological protocols
- Procedures for notifying of potential environmental incidents and complaints

An up-to-date register shall be maintained on site recording all persons that have completed the induction. All workers and subcontractors shall sign the register upon completion of the induction, this record will be kept on site and be made available to the consent authority on request.

All personnel working on site will be made aware of, and always have access to:

- ORC Land Use & Discharge Permit (RM20.296.01);
- Construction Management Plan; and
- Earthworks Management Plan.

These documents will be available at the site office.

8.2. INSPECTIONS AND WATER QUALITY MONITORING

The following inspections are to be completed routinely throughout the project works:

8.2.1. Inspection of Controls During Implementation

Prior to breaking ground for construction of control devices, a Suitably Qualified and Experienced Person (SQEP) is to review the downslope barrier to ensure it has been installed correctly and is suitable to contain the runoff from the exposed area. Following acceptance by the SQEP the Contractor can proceed with construction of sediment control devices. On completion of construction the SQEP is to be provided with as-built information including but not limited to:

- capacity of the device
- invert levels for device inlets/outlet
- a survey extent of the catchment where diversion channels/cut off drains will be installed.

Only when the as-builts have been accepted by the SQEP can works commence, as-built documentation is to be provided to the Consent Authority.

8.2.2. Daily Inspections

The daily inspections will include a walk over the site to view all sediment controls, make sure that all temporary bunds/diversion have been reinstated to function correctly, culverts are clear to prevent blockages and ensure treatment devices have sufficient capacity. During dryer/windier months regular assessment of airborne contaminants and dust it to be undertaken, dust suppression is to be implemented when required. Conversely, during wetter months adjoining roads are to be monitored regularly for debris and detritus, roads are to be swept as required to remove contaminants. These walkovers will be particularly important as works transition between phases and the management plan changes. Regular review of the controls will help identify any amendments required.

8.2.3. Weekly Inspections

These inspections are to be conducted by the Environmental Representative and documented in accordance with the weekly inspection checklist included in Appendix B. Completed checklists are to be included in the Monthly Environment Report.

8.2.4. Monthly Inspections

A Suitably Qualified and Experienced Person (SQEP) shall monitor the site monthly and ensure it is being managed in accordance with the EMP. The SQEP is to identify any new risks that could have an effect of the receiving environment and suggest solutions to improve the controls in place.

8.2.5. Pre-storm Event Inspection

When rain and wind events are forecast, all work considered at risk from adverse weather is to cease with enough time to carry out all necessary site management works to protect the site and adjoining

property (as applicable). Review of controls is to be carried out to ensure everything is functioning correctly. Particular attention is to be paid to the perimeter controls to ensure no weak points.

8.2.6. Storm Event Monitoring

The Environmental Representative and Construction Project Manager is to ensure that sufficient resource is on call during a storm event so that emergency works can be undertaken if required. The capacity of sediment retention devices is to be monitored.

When devices are in operation, the Environmental Representative is to conduct a visual inspection of the water being discharged before it reaches the receiving environment (Mill Creek and the ephemeral stream). They are to ensure there are no:

- suspended materials present.
- signs of an oil/grease film.
- change in the clarity of water contained in the runoff.
- increase in Total Suspended Sediments (TSS) in the waterbody when compared to the flow upstream of the site. TSS are not to exceed 50mg/L.

If any of the items above are present in the discharge the representative must:

- Immediately identify and remediate the source of the contamination, and
- Following remediation undertake one off sampling at the upstream and downstream extents of the watercourse. Water samples are to be assessed for total percentage change in clarity, all records of water quality monitoring must be kept and provided to the Consent Authority on request.

Visual inspections must be recorded and documented with photos/videos, evidence of the inspection is to be kept on file and provided to the Consent Authority on request.

The contractor shall ensure no works recommence after any rain event significant enough to generate overland flow until a thorough inspection of all erosion and sediment controls has been undertaken and any remedial works that are required are completed. Inspection details and remedial works undertaken shall be recorded in the site diary.

8.3. RECORDING

The site office will be the principal point for all site management. A site diary and all necessary records shall be always kept on site. The Construction Project Manager shall be responsible for maintaining all records and shall make this information available to suitably authorised persons upon request.

The Construction Project Manager shall make a written record of employees or sub-contractors who do not follow the guidelines set out in this plan. As applicable, the sub-contractor's employer shall also be notified of each infringement. Any employee or sub-contractor who repeatedly ignores the requirements of this Plan shall be banned from site.

Pre-start meetings and tail-gate meetings shall include discussion on specific works required for site management, dust, erosion, and sediment control, with details of the discussion recorded in the site diary. The site diary shall also record details of end-of-day stabilisation inspections, including sub-contractor areas, plus any additional works carried out in anticipation of adverse weather.

Site environmental records may be requested by QLDC or ORC. The records to be managed on site will include the following:

- Environmental induction attendance register
- Environmental Incident reports and associated corrective actions undertaken
- Complaints register and associated corrective actions undertaken
- Daily diary entries (including pre-start inspection observations)
- Post-Rain event inspection observations and corrective actions
- Weekly Site Inspection checklists
- Monitoring results for water quality
- EMP Non-conformance register (based on weekly inspection results or otherwise identified) and associated corrective actions taken

A SQEP is to monitor the site monthly to ensure it is complying with the EMP and identify any new environmental risks arising which could cause an environmental effect and suggest alternative solutions which will result in more effective and efficient management. The outcome of these inspections will be reported and included in the Monthly Environmental Report. The Monthly Environment Report is to be provided to the Consent Authority within 5 working days of the end of the month and include the following detail:

- Updates to the EMP and erosion sediment controls
- Weekly Site Inspections – number of inspections completed, and summary of corrective actions and/or maintenance work undertaken
- Summary of monitoring (including Pre- and Post-Rainfall Events and water quality sampling) and whether non-conforming results were obtained
- Positive environmental outcomes achieved, and opportunities identified.

9. RISK MANAGEMENT

9.1. EVENT AND INCIDENT MANAGEMENT

The Site Environmental Representative will notify QLDC and ORC of details of any Environmental Incident where the EMP has failed leading to any adverse environmental effects offsite. All Environmental Incidents will be notified to QLDC and ORC monitoring officers within 12 hours of becoming aware of the incident.

For any environmental incidents, the Environmental Representative will ensure that remedial actions to mitigate adverse environmental effects are undertaken immediately. On site contractors will be the first point of assistance for carrying out remedial works.

Once the immediate risk of the environmental incident is managed, an incident investigation will take place to identify and implement corrective actions as soon as practicable. An Environmental Incident Report will be prepared for QLDC and ORC within 10 working days of the incident occurring and detail the following:

- The nature of the Environmental Incident
- What management measures were in place to prevent the incident from occurring
- Probable causes of the incident

- Corrective actions that have been undertaken to prevent incidents reoccurring

Refer to the attached checklist at Appendix C and Failure Assessment Form at Appendix D.

9.2. COMPLAINTS ACTION PROCESS

On commencement of the project, site signage shall be installed detailing first points of contact (including phone numbers).

All employees of the main contractor will be trained to immediately report and feedback to the Site Supervisor issues raised (be it complaints and or praise) from site visitors or neighbouring properties.

All complaints will be followed up and an appropriate course of action taken by the Site Supervisor in the following manner:

1. Ensure Complaints Register is completed.
2. Record complaint.
3. Facilitate open discussion with affected parties.
4. Discuss appropriate solutions.
5. Implement solutions and monitor both nuisance and complainant.

Any complaint received from any person about activities on the site associated with earthworks must be reported to the ORC within 24 hours.

All feedback will be recorded in a feedback record, which will be maintained by the Construction Project Manager.

The feedback record will cover the following points:

1. Date of Complaint
2. Complainants Name
3. Complaint Recipients Name
4. Summary of Complaint
5. Action Taken
6. Details of Report back to Complainant
7. Conclusion

Refer to the Complaints Form at Appendix E.

9.3. REVIEW

This plan will be updated when:

- Resource Consent has been approved and an application for EA is submitted
- The construction programme moves from one Stage to another: or
- Any significant changes have been made to the construction methodology since the original plan was accepted for that Stage; or
- There has been an Environmental Incident and investigations have found that the management measures are inadequate; or
- There are changes to the site conditions or natural environment.

Any updated version of this plan will be submitted to the QLDC and ORC immediately for review and acceptance.

Consultation with the QLDC and ORC, and potentially affected landowners, may be required for any relevant revisions of a material nature. Reasons for making changes to the plan will be documented.

A copy of the original document and subsequent versions will be kept for the Project records and marked as obsolete. Each new/updated version of the plan documentation will be issued with a version number and date to eliminate obsolete documentation being used.

10. ARCHAEOLOGICAL AND HERITAGE PROTOCOLS

10.1. KOIWI ACCIDENTAL DISCOVERY

If Koiwi (human skeletal remains) are discovered whilst undertaking construction work, then the following shall be undertaken:

- Construction work within a 20m radius of the site shall cease immediately and indefinitely until Te Ao Marama Inc and/or New Zealand Police advise that it can recommence.
- Advice of the discovery shall be reported, as soon as practicable, to Te Ao Marama Inc (Ngai Tahu Murihiku Resource Management Consultants), the New Zealand Police, the Project Liaison Advisor and the Grantor.
- No work shall recommence until an agreement has been reached between the parties regarding appropriate protection measures for the artefact or material found.

10.2. TAONGA OR ARTEFACT DISCOVERY

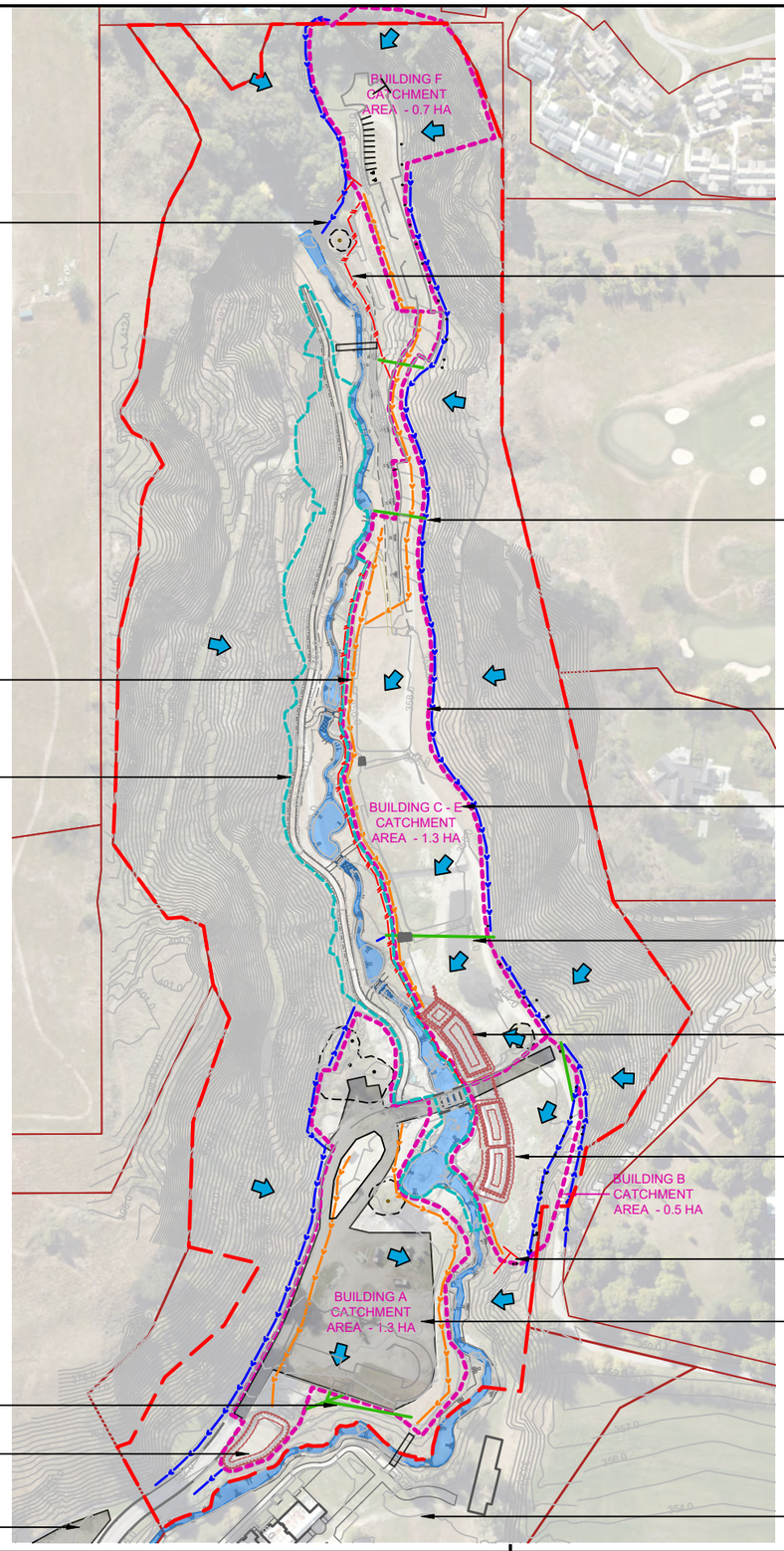
Taonga or artefact material other than Koiwi will be treated in a similar manner so that their importance can be determined, and the environment recorded by qualified archaeologists alongside the appropriate Tangata Whenua.

10.3. ARCHAEOLOGICAL AUTHORITY

The conditions contained within the Archaeological Authority (no. 2018/123: F41/578 Ayrburn Farm, Lake Hayes Road, Arrowtown) will be adhered to as specified in the authority and as detailed in the archaeological assessment prepared by the approved archaeologist in October 2018.

APPENDICES

APPENDIX A – DRAFT ESC PLANS



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
A	ORIGINAL ISSUE	30/03/22
B	FOR RESOURCE CONSENT	27/09/22
C	RFI RESPONSE	28/02/23

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Queenstown 9349.
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E queenstown@ppgroup.co.nz

Client/Location:
WATERFALL PARK DEVELOPMENT LTD
LOT 1 DP 540788

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

Surveyed by:		Original Size: A3	Scale: 1:3000
Designed by:	SB		
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

PLOT DATE: 03 March, 2023 - 11:53 AM BY: Sb

C:\12DS\DATA\QTSVR01\Q6388F - NORTHBROOK WATERFALL PARK_10662\5 - DRAWINGS\1 - DWG\RETIREMENT RC\Q6388-82-01_200 EARTHWORKS PLANS.DWG

APPENDIX B – WEEKLY SITE INSPECTION CHECKLIST

ENVIRONMENTAL MANAGEMENT RECORD

To be completed by the Environmental Representative: [INSERT]

	[example]	[insert date]
Time completed	7.45am	
Erosion & sediment controls - walk site and confirm that required controls are in place and working effectively	Y	
Visual check of the clarity of creeks. Check that no noticeable discolouration occuring after 50m downstream from all discharge points. Refer ORC and implement conditions 9-12 if any discharge is occurring.	No discolouration noted	
Vehicles & plant - parked outside of overland flow paths (& contained within designated areas)	Y	
Stockpiled material - outside of overland flow paths, located within designated areas, contained to prevent run-off, no more than 2.5m in height, covered if in place for >6-weeks.	Y	
Dust control - exposed areas properly stabilised as per the methods outlined in the EMP. Inspect site for visual evidence of dust travelling beyond the boundaries and remedy as required. Reduce or suspend works if dust is seen moving across the boundary.	Y	
Check no unnecessary excavation occuring or left unnecssarily exposed (e.g. could be premanently stablised)	Okay	
Debris - not tracking onto surrounding roads; roads kept clean	Okay	
Site kept clean and free of rubbish. No rubbish tracking across boundaries.	Okay	
Weather:		
Observations on-site	overcast with light showers in the afternoon	
Mill Creek flow rate (https://www.orc.govt.nz/managing-our-environment/water/water-monitoring-and-alerts/kawarau/mill-creek at-fish-trap-arrow-basin-area)	record flow rate /observations	
Weather forecast - check forecast (Metservice) for rainfall events (20mm/12hrs) and wind speeds for overnight, next day (or weekend), and week ahead. Check controls, implement measures, and alert others as required.	Y	
Weekly pre- and post rain event site inspections and maintenance recorded	Y	
Latest version of EMP available on site	Y	
Confirm all staff working onsite have attended an Environmental Site Induction and record of attendance updated.	Y	
Suitably Qualified Person kept informed and on-site at least monthly to monitor site. Records maintained.	Y	
Advise to the distribution list if any changes or updates required to the EMP (e.g. due to changes in construction methodology, measures not working as intended, or incident occured).	No updates to report	
Confirm no work occuring in the stream bed when flows are negligible and not connected to Mill Creek	No work	
Check and confirm no erosion, scouring, land instability or property damage occuring through the site & on neighbouring boundaries.	Okay	
Completed by:		
Name		
Signature		

APPENDIX C – EVENT CHECKLIST

EVENT CHECKLIST

To be completed by the Environmental Representative:[INSERT]

	EXAMPLE	[insert date]	[insert date]	[insert date]
BEFORE EVENT (= forecast 20mm/12hrs):				
Remove all plant from ephemeral bed (if applicable) and all machinery/vehicles from the overland flow path.				
Check all site measures are stable. Undertake further checks as required.				
DURING EVENT (= forecast 20mm/12hrs):				
Remove all plant from ephemeral bed (if applicable) and all machinery/vehicles from the overland flow path.				
Check all site measures are stable and undertake regular checks throughout the day and evening. Undertake further checks as required.				
AFTER EVENT:				
Check all erosion and sediment controls are still in place and effective. Any fixes or remedial measures to be undertaken before works in that area can recommence.				

STEPS IF FAILURE

Fix any problems immediately

Complete Failure Assessment Form and Contractor's Incident Form within 24 hours of the incident occuring and copy provided to distribution list.

Advise Suitably Qualified Person of failure and discuss and implement corrective measures to prevent it from occurring again.

APPENDIX D – FAILURE ASSESSMENT FORM

Sediment Control Failure Assessment Form

Date	

Recorded by	

Failure (what failed)

What management measures were in place to prevent the incident from occurring and what are the likely causes of the failure?

Outcome (what was affected)

Action (how does the Contractor propose to mitigate the issue and prevent re-occurrence)

Signed	

Reviewed by	

APPENDIX E – COMPLAINTS FORM

Complaints Form

Date received	

Received by	

Complaint (Write Description)

Cause of Issue

Outcome

Action – How does the Contractor propose to mitigate the issue and prevent re-occurrence

Signed	

Reviewed by	

Assessment of the provisions of the relevant planning instruments

1. Objectives and policies of the Operative District Plan

1.1. Section 4 - District Wide

Provision	Detail	Assessment
Natural Environment 4.1.4 Objectives and Policies		
Objective 1 - Nature Conservation Values	The protection and enhancement of indigenous ecosystem functioning and sufficient viable habitats to maintain the communities and the diversity of indigenous flora and fauna within the District. Improved opportunity for linkages between the habitat communities. The preservation of the remaining natural character of the District's lakes, rivers, wetlands and their margins. The protection of outstanding natural features and natural landscapes. The management of the land resources of the District in such a way as to maintain and, where possible, enhance the quality and quantity of water in the lakes, rivers and wetlands. The protection of the habitat of trout and salmon.	This objective is met by the development. Mill Creek will be improved by extensive replanting and extensive controls on construction effects will ensure the water quality is not affected. There are no outstanding natural features and natural landscapes as part of the development. The habitat of trout will be maintained and enhanced as a result of the proposed works. The proposal achieves this objective.
Policy 1.1	To encourage the long-term protection of indigenous ecosystems and geological features.	There is little indigenous vegetation naturally present on the site and the indigenous vegetation present has been planted by the applicant under previous consents. The proposal includes further extensive planting to support the creation of future ecosystems. The proposal achieves this policy.
Policy 1.7	To avoid any adverse effects of activities on the natural character of the District's environment and on indigenous ecosystems; by ensuring that opportunities are taken to promote the protection of indigenous ecosystems, including at the time of resource consents.	The development of Northbrook Arrowtown supports the development and enhancement of the of Waterfall Park environment though extensive planting and stormwater treatment to support the water quality of Mill Creek. The proposal achieves this policy.
Policy 1.12	To maintain the site-specific, geological and geomorphological features that are of scientific importance.	The waterfall at the end of the valley is unique in the District, and the development provides for access to and appreciation of this natural landform. The proposal achieves this policy.

Provision	Detail	Assessment
Policy 1.13	To maintain or enhance the natural character and nature conservation values of the beds and margins of the lakes, rivers and wetlands.	The nature conservation values will be enhanced by the riparian planting enhancements. The natural character of Mill Creek has already been affected by consented works to provide flood protection, but the comprehensive development of Northbrook Arrowtown will support the integration of the creek with the amenity planting and built form of the proposal. ~~The proposal achieves this policy.~~
Policy 1.16	To encourage and promote the regeneration and reinstatement of indigenous ecosystems on the margins of lakes, rivers and wetlands	The proposal includes extensive onsite planting, including of indigenous species. The proposal achieves this policy.
Policy 1.17	To encourage the retention and planting of trees, and their appropriate maintenance.	Retention of specimen trees forms part of the proposal, while extensive replanting of both exotic and natives is also proposed. The comprehensive development of the site for later living will support the ongoing maintenance of planting onsite. The proposal achieves this policy.
Objective 2 - Air Quality	Maintenance and improvement of air quality	Site works will be managed by good practice construction measures and environmental management plans and controls. The proposal achieves this objective.
Policy 2.1	To ensure that land uses in both rural and urban areas are undertaken in a way which does not cause noxious, dangerous, offensive or objectionable emissions to air.	Site works will be managed by good practice construction measures and environmental management plans and controls to ensure no noxious, dangerous, offensive or objectionable emissions to air. The proposal achieves this policy.
Landscape and Visual Amenity 4.2.5 Objective and Policies		
Objective	Subdivision, use and development being undertaken in the District in a manner which avoids, remedies or mitigates adverse effects on landscape and visual amenity values.	The methodology for the location, design and shape of the proposed buildings ensures that the landscape and visual amenity values can be avoided or mitigated. The visual assessment ensures that the development will not be visible outside of the site from public places and will be comparable with zoned and consented development from private views. The proposal achieves this objective.
Policy 1 – Future Development	(a) To avoid, remedy or mitigate the adverse effects of development and/or subdivision in those areas of the District where the landscape and visual amenity values are vulnerable to degradation. (b) To encourage development and/or subdivision to occur in those areas of the District with greater potential to absorb	The built form has been comprehensively designed to ensure any adverse effects on landscape and visual amenity values are mitigated through the careful location within the existing landscape. The development is contained within the valley landscape to consolidate built form within the site. The site can absorb the

Provision	Detail	Assessment
	change without detraction from landscape and visual amenity values. (c) To ensure subdivision and/or development harmonises with local topography and ecological systems and other nature conservation values as far as possible.	proposed change without detracting from landscape and visual amenity values. The proposal achieves this policy.
Policy 8 – Avoiding Cumulative Degradation	In applying the policies above the Council's policy is: (a) to ensure that the density of subdivision and development does not increase to a point where the benefits of further planting and building are outweighed by the adverse effect on landscape values of over domestication of the landscape. (b) to encourage comprehensive and sympathetic development of rural areas.	The development will not result in adverse effects on the landscape and will not result in a cumulative domestication of the landscape. The proposal achieves this policy.
Policy 9 – Structures	To preserve the visual coherence of: (a) outstanding natural landscapes and features and visual amenity landscapes by: • encouraging structures which are in harmony with the line and form of the landscape; • avoiding, remedying or mitigating any adverse effects of structures on the skyline, ridges and prominent slopes and hilltops; • encouraging the colour of buildings and structures to complement the dominant colours in the landscape; • encouraging placement of structures in locations where they are in harmony with the landscape; • promoting the use of local, natural materials in construction. (b) visual amenity landscapes • by screening structures from roads and other public places by vegetation whenever possible to maintain and enhance the naturalness of the environment; and (c) All rural landscapes by • limiting the size of signs, corporate images and logos • providing for greater development setbacks from public roads to maintain and enhance amenity values associated with the views from public roads.	The site is within a visual amenity landscape. The development is already screened from public places by the topography and landscaping. The location and design of Northbrook Arrowtown, being consistent with the consented Hotel built form, will ensure that the development is integrated into the landscape. The built form is well set back from Arrowtown-Lakes Hayes Road and will not be seen from this road. It will also not be seen from the nearby Speargrass Flat Road. The proposal achieves this policy.

Provision	Detail	Assessment
Policy 15 - Retention of Existing Vegetation	To maintain the visual coherence of the landscape and to protect the existing levels of natural character by: (a) Encouraging the retention of existing indigenous vegetation in gullies and along watercourses; (b) Encouraging maintenance of tussock grass-lands and other nature ecosystems in outstanding natural landscapes.	Additional significant landscaping and planting will be undertaken in conjunction with the proposal to ensure integration with the landscape. There is no indigenous vegetation or tussock grasslands within the site beyond what has been consented and implemented. The proposal achieves this policy.
Policy 17 – Land Use	To encourage land use in a manner which minimises adverse effects on the open character and visual coherence of the landscape.	The proposed buildings are located in a part of the site which is by its nature contained and not open. The proposal achieves this policy.
Takata Whenua 4.3.4 Objective and Policies		
Objective 5 - Wai (Water)	The management of the land resource and associated waste discharges in such a way as to protect the quality and quantity of water in the District to a standard consistent with the human consumption of fish, swimming and protects the mauri (life force) of the lakes and rivers.	Stormwater will be treated before discharge to Mill Creek, and the proposal includes treatment train approach for hardstanding areas to reduce the levels of contaminants and therefore contribute to the management of land in a manner that protects the quality of the water within Mill Creek. The proposal achieves this objective.
Policy 5.1	To recognise the importance of the concept of mauri (life force) as it applies to lakes and rivers	The importance of water quality of Mill Creek has been recognised in the high levels of onsite treatment proposed for stormwater. The proposal achieves this policy.
Policy 5.2	In the development and upgrading of public sewage treatment and disposal systems and in the development of new and extended settlements	All sewage will be discharged to the reticulated network. The proposal achieves this policy.
Policy 5.3	To adopt performance standards or require resource consents for land use activities, including mining, in order to minimise the adverse effects on the quality of the District's water resources and associated habitat.	Comprehensive monitoring of Mill Creek is required to be undertaken as a condition of existing consent RM180584 and it is proposed that this continue under the current application. To the extent that it is relevant, the proposal achieves this policy.

1.2. Section 5 - Rural Zones (Building A only)

Provision	Detail	Assessment
Objective 1 - Character and Landscape Value	To protect the character and landscape value of the rural area by promoting sustainable management of natural and physical resources and the control of	The land that is subject to the activity in this application is not used for rural activities and the development is in keeping with zoned

Provision	Detail	Assessment
	adverse effects caused through inappropriate activities.	and consented activities. Any adverse effects can be mitigated. The proposal achieves this objective.
Policy 1.3	Ensure land with potential value for rural productive activities is not compromised by the inappropriate location of other developments and buildings	No parts of the site have value for rural productive activities.
Policy 1.4	Ensure activities not based on the rural resources of the area occur only where the character of the rural area will not be adversely impacted.	The character of the surrounding area will not be adversely impacted. The proposed building is located in at the entrance to and valley (which does not support the rural resources of the Wakatipu Basin) and in an area which can be absorbed by the landscape. The proposal achieves this policy.
Policy 1.6	Avoid, remedy or mitigate adverse effects of development on the landscape values of the District.	The landscape values of the site will not be adversely affected by the proposal as identified in the Landscape Assessment in **Attachment I.** The proposal achieves this policy.
Policy 1.7	Preserve the visual coherence of the landscape by ensuring all structures are to be located in areas with the potential to absorb change.	The development is contained within the valley landscape to consolidate built form within the site. The site can absorb the proposed change without detracting from landscape and visual amenity values. The proposal achieves this policy.
Policy 1.8	Avoid remedy or mitigate the adverse effects of the location of structures and water tanks on skylines, ridges, hills and prominent slopes.	The proposed building is not on skylines, ridges, hills and prominent slopes. The proposal achieves this policy.
Objective 2 - Life Supporting Capacity of Soils	Retention of the life supporting capacity of soils and/or vegetation in the rural area so that they are safeguarded to meet the reasonably foreseeable needs of future generations.	The proposal will not have a significant impact of the life supporting capacity of soil, notwithstanding the very limited extent to which any soils on the site would go towards safeguarding the needs of future generations is limited. The proposal achieves this objective.
Policy 2.1	Avoid, remedy or mitigate adverse effects of subdivision and development on the life-supporting capacity of the soils	There will be no adverse effect of the life supporting capacity of soils. The proposal achieves this policy.
Objective 3 - Rural Amenity	Avoiding, remedying or mitigating adverse effects of activities on rural amenity	The activities proposed for Building A will have some impact on rural amenity due to the potential for noise and traffic effects however these will be no more than minor particularly when considered within the context of the consented commercial and hospitality hub of the wider Ayrburn Domain and Hotel consent activities. Any adverse

Provision	Detail	Assessment
		effects from the proposed activities can be managed to avoid adverse effects on the amenity of neighbouring properties. There is no impact on any persons' privacy or outlook. The proposal achieves this objective.
Policy 3.3	To avoid, remedy or mitigate adverse effects of activities located in rural areas.	Any adverse effects from the proposed activities can be avoided through appropriate management, and the physical effects have been mitigated through thoughtful location and design. The proposal achieves this policy.
Objective 4 - Life Supporting Capacity of Water	To safeguard the life supporting capacity of water through the integrated management of the effects of activities	The effects of the activities themselves will not impact the life supporting capacity of Mill Creek. The proposal includes a comprehensive onsite stormwater management system that utilises a treatment train approach to support a reduction in contaminants within the stormwater being discharged. The proposal achieves this objective.

2. Objectives and policies of the Proposed District Plan

2.1. Chapter 3 – Strategic Direction

Provision	Detail	Assessment
SO 3.2.1.	The development of a prosperous, resilient and equitable economy in the District.	The Northbrook Arrowtown proposal is not reliant on the visitor industry and hence is not adversely affected by the Covid-19 pandemic that has drastically reduced visitor numbers to the District. The baby boomer wave of retirees will continue, so providing for demand for retirement living options assists in developing an equitable economy, regardless of the economic environment, and the project will generate significant construction employment during the development phase as well as ongoing local employment and spending in the local community once Northbrook Arrowtown is operational. The project will contribute to the District's economic diversity, at a time when such diversity is needed. The proposal achieves this objective.
SO 3.2.1.1	The significant socioeconomic benefits of well designed and appropriately located visitor industry places, facilities and services are realised across the District.	Not relevant except to the extent that the proposal can integrate with the hospitality precinct proposed and underway in Ayrburn Domain.

Provision	Detail	Assessment
		The proposal achieves this objective.
SO 3.2.1.5	Local service and employment functions served by commercial centres and industrial areas outside of the Queenstown and Wanaka town centres, Frankton and Three Parks, are sustained.	The Arrowtown town centre will not be affected by the proposal other than in a positive way by the increased local patronage from the residents of and visitors to Northbrook Arrowtown. The proposal achieves this objective.
SO 3.2.1.6	Diversification of the District's economic base and creation of employment opportunities through the development of innovative and sustainable enterprises.	The proposal will enable employment through job creation in a sustainable business, that contributes to diversifying the economy – see assessment of SO 3.2.1 above. The proposal achieves this objective.
SO 3.2.1.8	Diversification of land use in rural areas beyond traditional activities, including farming, provided that: a. the landscape values of Outstanding Natural Features and Outstanding Natural Landscapes are protected; b. the landscape character of Rural Character Landscapes is maintained and their visual amenity values are maintained or enhanced; and c. significant nature conservation values and Ngāi Tahu values, interests and customary resources, are maintained.	The site is not in an ONL, ONF, or RCL. The nature conservation values of Mill Creek will be maintained as a result of the proposal through the treatment of stormwater runoff to maintain water quality entering the creek, and the significant planting proposed onsite.
SO 3.2.2.1	Urban development occurs in a logical manner so as to: a. promote a compact, well designed and integrated urban form; b. build on historical urban settlement patterns; c. achieve a built environment that provides desirable, healthy and safe places to live, work and play; d. minimise the natural hazard risk, taking into account the predicted effects of climate change; e. protect the District's rural landscapes from sporadic and sprawling urban development; f. ensure a mix of housing opportunities including access to housing that is more affordable for residents to live in; g. contain a high quality network of open spaces and community facilities; and h. be integrated with existing, and proposed infrastructure and appropriately manage effects on that infrastructure.	Clauses (a), (c) and (g) are achieved through the master-planned design and layout of Northbrook Arrowtown. Clause (b) is achieved by the development's proximity to Millbrook and Arrowtown. Clause (d) is achieved through the proposed mitigation measures proposed, including that all buildings will meet the minimum freeboard specifications in accordance with the Subdivision and Development Code of Practice. Clause (e) is achieved as development not "sporadic" as it is located within Waterfall Park Zone and integrates with services, roading, open spaces and trail linkages. It is not "sprawling" as it is a compact built form that is clustered within the wider site. Clause (f) is achieved through a mix of residential / care typologies that will enable choice for future residents. Clause (h) is achieved through the connection to existing reticulated services and existing roading infrastructure. The proposal achieves Strategic Objective 3.2.2.1.

Provision	Detail	Assessment
SO 3.2.3	A quality built environment taking into account the character of individual communities.	The proposal provides for a quality-built environment that takes into account the character of the wider area. The proposal achieves this objective.
SO 3.2.3.1	The District's important historic heritage values are protected by ensuring development is sympathetic to those values.	The buildings adjoining the site in Ayrburn Domain have historic heritage values. The proposal will not affect those values. The proposal achieves this objective.
SO 3.2.4	The distinctive natural environments and ecosystems of the District are protected.	The development is comprehensive and does not result in any adverse effects on the natural environments and ecosystems that exist on site. The proposal achieves this objective.
SO 3.2.4.1	Development and land uses that sustain or enhance the life-supporting capacity of air, water, soil and ecosystems, and maintain indigenous biodiversity.	Water, soil and their associated ecosystems will be safeguarded by the proposed planting and stormwater treatment strategies. The proposal achieves this objective.
SO 3.2.4.3	The natural character of the beds and margins of the District's lakes, rivers and wetlands is preserved, or enhanced where possible, and protected from inappropriate subdivision, use and development.	The proposal includes built form and associated servicing and activities in the vicinity of Mill Creek, however the building materials and landscaping strategy will ensure integration with and support of the natural character of the stream. The proposal achieves this objective.
SO 3.2.4.4	The water quality and functions of the District's lakes, rivers and wetlands are maintained or enhanced.	The water quality of the existing waterbodies on site will be maintained through the significant planting and the stormwater treatment strategies proposed. The proposal achieves this objective.
SO 3.2.4.5	Public access to the natural environment is maintained or enhanced.	Mill Creek is a feature of the design of the open space within Northbrook Arrowtown and the development will result in the public gaining access to this waterway through connections to public walkways. The proposal achieves this objective.
SO 3.2.5	The retention of the District's distinctive landscapes.	The proposal is in a location that can absorb the development in the form proposed. Distinctive landscapes, in particular the landscape and visual amenity of the Wakatipu Basin Rural Amenity Zone and the Waterfall Park Zone, will be maintained. The proposal achieves this objective.
SO 3.2.6	The District's residents and communities are able to provide for their social, cultural and economic wellbeing and their health and safety.	The proposal will contribute to peoples' and the community's social, cultural and economic wellbeing by providing housing and related amenities for older persons in an area where the landscape can absorb development and in

Provision	Detail	Assessment
		a manner that protects and enhances the natural conservation values of the site and wider area. The proposal achieves this objective.
SO 3.2.6.1	The accessibility needs of the District's residents and communities to places, services and facilities are met.	The development has been designed to respond to the accessibility requirements of its residents, including the community and recreational facilities provided within the site. The proposal achieves this objective.
SO 3.2.6.2	A diverse, resilient and well-functioning community where opportunities for arts, culture, recreation and events are integrated into the built and natural environment.	The proposal includes opportunities for arts, culture and recreation through the inclusion of facilities such as community recreation activities (featuring a gym and pool), community and potting sheds, and outdoor open spaces. These facilities have been integrated into both the built form and the natural environment. The proposal achieves this objective.
SO 3.2.6.3	The contribution that community social, recreational and cultural facilities and activities make to identity and sense of place for the residents of the District is recognised and provided for through appropriate location and sound design.	The inclusion of social and recreational facilities contribute to creating a sense of community within Northbrook Arrowtown by enabling residents to meet these needs onsite. The proposal achieves this objective.
SP 3.3.17	Identify heritage items and ensure they are protected from inappropriate development.	The heritage items on the site have been identified and are protected by the proposal, through sympathetic location and design of the new development. The proposal achieves this policy.
SP 3.3.20	Manage subdivision and / or development that may have adverse effects on the natural character and nature conservation values of the District's lakes, rivers, wetlands and their beds and margins so that their life-supporting capacity is safeguarded; and natural character is maintained or enhanced as far as practicable.	Water and its associated ecosystems will be safeguarded by the proposal through treatment of contaminants and sediment in stormwater. The natural character of Mill Creek is maintained by the proposal through sympathetic design, including landscaping. The proposal achieves this policy.
SP 3.3.25	That subdivision and / or development be designed in accordance with best practice land use management so as to avoid or minimise adverse effects on the water quality of lakes, rivers and wetlands in the District.	The proposal will comply with all best practice techniques for land development (including sediment control and erosion measures) to avoid adverse effects on the water quality of Mill Creek, being the nearest sensitive receiver. The proposal achieves this policy.
SP 3.3.27	Seek opportunities to provide public access to the natural environment at the time of plan change, subdivision or development.	Mill Creek is a feature of the design of the open space of Northbrook Arrowtown and the proposal will result in the public being able to gain access to this natural feature of the environment.

Provision	Detail	Assessment
		The proposal achieves this policy.

2.2. Chapter 6 – Landscapes and Rural Character

Provision	Detail	Assessment
Policy 6.3.1.3	Provide a separate regulatory regime for the Gibbston Valley (identified as the Gibbston Character Zone), Rural Residential Zone, Rural Lifestyle Zone, Resort Zones and the Special Zones within which the Outstanding Natural Feature, Outstanding Natural Landscape and Rural Character Landscape categories and the policies of this chapter related to those categories do not apply unless otherwise stated.	The PDP provides a separate regulatory regime for the Waterfall Park in Chapter 42 and which is assessed in detail below.
Policy 6.3.1.4	Provide a separate regulatory regime for the Wakatipu Basin Rural Amenity Zone, within which the Outstanding Natural Feature, Outstanding Natural Landscape and Rural Character Landscape categories and the policies of this Chapter related to those categories do not apply.	The PDP provides a separate regulatory regime for the Wakatipu Basin Rural Amenity Zone, which is the Landscape Character Units detailed in Chapter 24 and which is assessed in detail below.

2.3. Chapter 24 – Wakatipu Basin

Provision	Detail	Assessment
Objective 24.2.1*	Landscape character and visual amenity values in the Wakatipu Basin are maintained or enhanced.	The Landscape Assessment (**Attachment I**) concludes that the proposal will only be visible from within the confines of the site but impossible to see from public viewpoints due to being tucked into the surrounding landforms and mature trees. As such, the landscape character and visual amenity values of the basin will be maintained. The proposal achieves this objective.
Policy 24.2.1.2*	Ensure subdivision and development is designed (including accessways, services, utilities and building platforms) to minimise inappropriate modification to the natural landform.	The proposal has been comprehensively designed to complement both the existing established landforms, landscape, and existing development on the site. The proposal achieves this policy.
Policy 24.2.1.3*	Ensure that subdivision and development maintains or enhances the landscape character and visual amenity values identified in Schedule 24.8 - Landscape Character Units.	The proposal maintains the landscape character and visual amenity values of the Speargrass Flat LCU23 for the reasons discussed in the Landscape Assessment (**Attachment I**). The proposal achieves this policy.

Provision	Detail	Assessment
Policy 24.2.1.4*	Maintain or enhance the landscape character and visual amenity values of the Rural Amenity Zone including the Precinct and surrounding landscape context by: a. controlling the colour, scale, form, coverage, location (including setbacks) and height of buildings and associated infrastructure, vegetation and landscape elements.	The proposed building (Building A) has been sympathetically designed and located to ensure that it will maintain the landscape character and visual amenity values of the area. The proposal achieves this policy.
Policy 24.2.1.6*	Provide for farming, commercial, community, recreation, tourism and other non-residential related activities that rely on the rural land resource, subject to maintaining or enhancing landscape character and visual amenity values.	The application site does not rely on the rural land resource, except to the extent that the spacious location and the amenities of Mill Creek enable a high quality living environment for the Northbrook Arrowtown residents. Landscape character and visual amenity values are maintained, both in the local sense and the wider values of the Wakatipu Basin. ~~The proposal achieves this policy.~~
Policy 24.2.1.9	Control earthworks and vegetation clearance to minimise adverse effects on landscape character and visual amenity values.	The proposed earthworks are required to establish the built form. The total volume is not excessive for the level of built form proposed and will not result in adverse effects on landscape character and amenity values. The proposal achieves this policy.
Policy 24.2.1.11	Provide for activities that maintain a sense of spaciousness in which buildings are subservient to natural landscape elements.	There is no sense of openness or spaciousness as the development is proposed for a natural valley. However buildings will be subservient to the natural landscape elements. The proposal achieves this policy.
Policy 24.2.1.12	Manage lighting so that it does not cause adverse glare to other properties, roads or public places or degrade views of the night sky.	All lighting associated with the development will be for wayfinding purposes, with limited up-lighting of some features but which will not result in glare beyond the site or in lightspill on the night sky. The proposal achieves this policy.
Objective 24.2.2	Non-residential activities maintain or enhance amenity values.	The proposal maintains the amenity values through sympathetic design and location of built form and consistency with the existing consented activities at Ayrburn Domain. The proposal achieves this objective.
Policy 24.2.2.1*	Ensure traffic, noise and the scale and intensity of non-residential activities do not have an adverse impact on landscape character and amenity values, or affect the safe and efficient operation of the roading and trail network or access to public places.	The proposed non-residential components of Northbrook Arrowtown are of a small scale and will not have adverse effects on landscape character and amenity values, or affect the safe and efficient operation of the roading and trail network. The proposal achieves this policy.
Policy 24.2.2.2	Ensure the effects generated by non-residential activities (e.g. traffic, noise, and	As discussed in the Transportation Assessment (**Attachment K**) the proposal does not give rise to adverse traffic effects that

Provision	Detail	Assessment
	hours of operation) are compatible with surrounding uses.	are more than minor, and likewise noise effects will not extend beyond the site. The proposal achieves this policy.
Policy 24.2.2.3	Ensure non-residential activities other than farming, with the potential for nuisance effects from dust, visual, noise or odour effects, are located a sufficient distance from formed roads, neighbouring properties, waterbodies and any residential activity.	The proposal includes non-residential activities, however these activities are located away from neighbouring properties and public roads and will be managed to not give rise to adverse effects. The proposal achieves this policy.
Objective 24.2.3	Reverse sensitivity effects are avoided or mitigated where rural living opportunities, visitor and tourism activities, community and recreation activities occur.	The discreet location of the site, and the substantial setbacks and landscaping, means that any reverse sensitivity effects are avoided. The proposal achieves this objective.
Objective 24.2.4	Subdivision and development, and use of land, maintains or enhances water quality, ecological quality, and recreation values while ensuring the efficient provision of infrastructure.	Water and its associated ecosystems will be safeguarded through treatment of stormwater which will reduce contaminants in runoff. The life supporting values of Mill Creek will be protected during development. The development opens up access to Mill Creek and the ephemeral stream to residents. The proposal achieves this objective.
Policy 24.2.4.1	Avoid adverse cumulative impacts on ecosystem services and nature conservation values.	No adverse cumulative impacts on ecosystems will arise. There will be a reduction in the levels of contaminants through treatment. There will therefore be no adverse cumulative impacts on ecosystem services. The proposal achieves this policy.
Policy 24.2.4.2	Restrict subdivision, development and use of land in the Lake Hayes catchment, unless it can contribute to water quality improvement in the catchment commensurate with the nature, scale and location of the proposal.	The proposal includes significant planting onsite, including riparian planting of Mill Creek, and a treatment train approach to provide a high level of treatment of contaminants in stormwater runoff prior to entering Mill Creek to maintain the water quality of Lake Hayes. The proposal achieves this policy, taking into account the small part of the site which is subject to Chapter 24.
Policy 24.2.4.4*	Provide adequate firefighting water and fire service vehicle access to ensure an efficient and effective emergency response.	There is adequate water supply and vehicle access to ensure an efficient and effective response by the fire service if required. The proposal achieves this policy.
Policy 24.2.4.5	Ensure development has regard to servicing and infrastructure costs that are not met by the developer.	There will be no costs on the community, all servicing and infrastructure costs will be met by the developer. The proposal achieves this policy.
Policy 24.2.4.6	Facilitate the provision of walkway and cycleway networks and consider opportunities for the provision of bridle path networks.	Walkway and cycleway networks have been provided for in the consented Ayrburn Domain development. The proposal includes

Provision	Detail	Assessment
		additional pedestrian accessways to connect the waterfall and the proposed development with the consented Ayrburn development. The proposal is consistent with this policy.
Policy 24.2.4.7	Ensure traffic generated by non-residential development does not individually or cumulatively compromise road safety or efficiency.	As discussed in the Transportation Memorandum (**Attachment K**), the proposal (cumulative with other consented and potential future development) will not compromise road safety or efficiency. The proposal achieves this policy.
Policy 24.2.4.9	Encourage the planting, retention and enhancement of indigenous vegetation that is appropriate to the area and planted at a scale, density, pattern and composition that enhances indigenous biodiversity values, particularly in locations such as gullies and riparian areas, or to provide stability.	The proposal includes a comprehensive landscape design which complements the character of the area. Extensive riparian planting has been implemented already and will not be amended or affected by the proposal, which proposes additional planting in addition to this. The proposal achieves this policy.

2.4. Chapter 25 – Earthworks

Provision	Detail	Assessment
Objective 25.2.1	Earthworks are undertaken in a manner that minimises adverse effects on the environment, including through mitigation or remediation, and protects people and communities.	The proposed earthworks can be managed adequately through best practice measures (in accordance with Auckland Councils *GD05*). The earthworks will be undertaken in a manner which ensures any effects on the natural environment are mitigated, including through the use of industry best practice. The draft Environmental Management Plan included as **Attachment P** sets out the measures to be implemented. The proposal achieves this objective.
Policy 25.2.1.1	Ensure earthworks minimise erosion, land instability, and sediment generation and offsite discharge during construction activities associated with subdivision and development.	Environmental protection measures, consistent with those existing at the site already, will avoid adverse effects from earthworks, particularly on water quality, from arising. The proposal achieves this policy.
Policy 25.2.1.2	Manage the adverse effects of earthworks to avoid inappropriate adverse effects and avoid, remedy or mitigate other adverse effects, in a way that to the extent practicable: a. Outstanding Natural Features and Landscapes; b. the amenity values of Rural Landscapes and other identified amenity landscapes;	Environmental protection measures will ensure that the proposed earthworks do not result in inappropriate adverse effects on Mill Creek and, downstream, Lake Hayes. The proposal achieves this policy.

Provision	Detail	Assessment
	c. significant Natural Areas and the margins of lakes, rivers and wetlands; d. the exposure of aquifers, in particular the Wakatipu Basin, Hāwea Basin, Wanaka Basin and Cardrona alluvial ribbon aquifers; Advice note: These aquifers are identified in the Otago Regional Plan: Water for Otago 2004. e. the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other taonga; f. heritage sites, precincts and landscape overlays; and g. public access to and along lakes and rivers.	
Policy 25.2.1.3	Avoid, where practicable, or remedy or mitigate adverse visual effects of earthworks on visually prominent slopes, natural landforms and ridgelines.	The design of the cuts and batters are necessary for the development of the zone. They will be sympathetic to the landscape and retaining will also provide for design contributing to the development. The proposal achieves this policy.
Policy 25.2.1.4	Manage the scale and extent of earthworks to maintain the amenity values and quality of rural and urban areas.	The scale and extent of the proposed earthworks are consistent with the proposal and will maintain the amenity values and quality of the area. The proposal achieves this policy.
Policy 25.2.1.5	Design earthworks to recognise the constraints and opportunities of the site and environment.	The design of the cuts and batters are necessary for the development of the zone. They will be sympathetic to the landscape and retaining will also provide for design contributing to the development. The proposal achieves this policy.
Policy 25.2.1.6	Ensure that earthworks are designed and undertaken in a manner that does not adversely affect infrastructure, buildings and the stability of adjoining sites.	The earthworks have been designed to ensure the earthworks do not adversely affect surrounding infrastructure, buildings and stability of the land. The proposal achieves this policy.
Policy 25.2.1.7	Encourage limiting the area and volume of earthworks being undertaken on a site at any one time to minimise adverse effects on water bodies and nuisance effects of adverse construction noise, vibration, odour, dust and traffic effects.	The nature and scale of the earthworks is consistent with the built form proposed and have been designed to avoid adverse effects on waterbodies and neighbouring sites. Any potential nuisance effects can be adequately avoided through conditions of consent. The proposal achieves this policy.
Policy 25.2.1.8	Undertake processes to avoid adverse effects on cultural heritage, including wāhi tapu, wāhi tūpuna and other taonga, and archaeological	The proposed earthworks must be undertaken in accordance with the conditions of the existing Archaeological Authority to ensure

Provision	Detail	Assessment
	sites, or where these cannot be avoided, effects are remedied or mitigated.	adverse effects on cultural heritage are avoided. The proposal achieves this policy.
Policy 25.2.1.10	Ensure that earthworks that generate traffic movements maintain the safety of roads and accesses, and do not degrade the amenity and quality of surrounding land.	The nature and scale of the earthworks is consistent with the built form proposed and have been designed to avoid adverse effects on waterbodies and neighbouring sites. Traffic generation associated with the earthworks is commensurate and will maintain the safety of roads and accesses and will not degrade the surrounding amenity. The proposal achieves this policy.
Policy 25.2.1.11	Ensure that earthworks minimise natural hazard risk to people, communities and property, in particular earthworks undertaken to facilitate land development or natural hazard mitigation.	The design of the earthworks has taken into account the site's flood risk and stormwater management. The proposal achieves this policy.
Objective 25.2.2	The social, cultural and economic wellbeing of people and communities benefits from earthworks	The earthworks will enable the development to be undertaken, which will provide later living facilities that the community requires. The proposal achieves this policy.
Policy 25.2.2.1	Enable earthworks that are necessary to provide for people and communities wellbeing, having particular regard to the importance of: a. Nationally and Regionally Significant Infrastructure; b. tourism infrastructure and activities, including the continued operation, and provision for future sensitive development of recreation and tourism activities within the Ski Area Sub Zones and the vehicle testing facility within the Waiorau Ski Area Sub Zone; c. minimising the risk of natural hazards; d. enhancing the operational efficiency of farming including maintenance and improvement of track access and fencing; and e. the use and enjoyment of land for recreation, including public walkways and trails; and f. maintaining or enhancing the operational efficiency of existing infrastructure.	The earthworks will enable the development to be undertaken, which will provide later living facilities that the community requires. The design of the earthworks has taken into account the site's flood risk and stormwater management. The proposal achieves Clause (c) and (e) of the policy (Clauses (a), (b), (d) and (f) are not relevant.

2.5. Chapter 26 – Historic Heritage

Provision	Detail	Assessment
Objective 26.3.1	The District's historic heritage is recognised, protected, maintained and enhanced.	A Heritage Impact Assessment (**Attachment J**) has been prepared to assess effects on the

Provision	Detail	Assessment
		heritage values of the buildings on Lot 1 Overall, the proposal will have no more than minor effects on the identified heritage values as the buildings' context relationship to one another will be retained and the new buildings within the setting will be of sympathetic design, particularly that of the closest building (Building A). The proposal achieves this objective.
Policy 26.3.1.3	Protect historic heritage values while managing the adverse effects of land use, subdivision and development, including cumulative effects, taking into account the significance of the heritage feature, area or precinct.	The proposal must comply with the Archaeological Authority as issued, which includes measures to protect heritage values during development. The proposal achieves this policy.
Policy 26.3.1.4	Where activities are proposed within the setting or extent of place of a listed heritage feature, to protect the heritage significance of that feature by ensuring that: a. the form, scale and proportion of the development, and the proposed materials, do not detract from the listed heritage feature located within the setting or extent of place; b. the location of development does not detract from the relationship that exists between the listed heritage feature and the setting or extent of place, in terms of the values identified for that feature; c. existing views of the listed heritage feature from adjoining public places, or publicly accessible places within the setting or extent of place, are maintained as far as is practicable; d. hazard mitigation activities and network utilities are located, designed, or screened to be as unobtrusive as possible.	The proposal includes the construction of a building and other development (carparking areas, landscaping and earthworks) within the setting of the historic heritage buildings. Overall, the proposal will have no more than minor effects on the identified heritage values as the buildings' context and relationship to one another will be retained and the new buildings will be of sympathetic design. The proposal achieves this policy.
Policy 26.3.1.7	Protect archaeological and historic heritage values of listed archaeological sites while managing the adverse effects of land use and development, including cumulative effects.	The proposal must comply with the Archaeological Authority as issued, which includes measures to protect heritage values during development. The proposal achieves this policy.

2.6. Chapter 28 – Natural Hazards

Provision	Detail	Assessment
Objective 28.3.1B	Development on land subject to natural hazards only occurs where the risks to the community and the built environment are appropriately managed.	Considerable testing has been undertaken of the geotechnical nature of the Zone and the assessment of flood flows of Mill Creek, resulting in the development occurring in areas

Provision	Detail	Assessment
		to ensure buildings are located in suitable positions and are not affected by natural hazards. The proposal achieves the objective.
Policy 28.3.1.4	Avoid activities that result in significant risk from natural hazard.	The proposal is supported by extensive reports and engineering specifications to ensure that the hazard risk is avoided or mitigated. The proposal achieves the policy.
Policy 28.3.1.6	Not preclude subdivision and development of land subject to natural hazards which do not: a. accelerate or worsen the natural hazard risk to an intolerable level; b. expose vulnerable activities to intolerable natural hazard risk; c. create an intolerable risk to human life; d. increase the natural hazard risk to other properties to an intolerable level; e. require additional works and costs including remedial and maintenance works, that would be borne by the public.	The proposal is supported by extensive reports and engineering specifications to ensure that the hazard risk is avoided or mitigated. The proposal achieves the policy.

2.7. Chapter 29 – Transport

Provision	Detail	Assessment
Objective 29.2.1*	**Objective - An integrated, safe, and efficient transport network that:** **a. provides for all transport modes and the transportation of freight;** **b. provides for future growth needs and facilitates continued economic development;** **c. reduces dependency on private motor vehicles and promotes the use of shared, public, and active transport;** **d. contributes towards addressing the effects on climate change;** **e. reduces the dominance and congestion of vehicles, particularly in the Town Centre zones; and** **Enables the significant benefits arising from public walking and cycling trails.**	Arrowtown-Lake Hayes Road is an arterial road. Ayr Avenue has been engineered to enable the traffic levels associated with the development. The Transportation Assessment (**Attachment K**) addresses the effects of the proposal on the traffic environment and concludes that the traffic generated by the development can be accommodated without capacity or efficiency issues arising. Pedestrian and cyclist movements will be enhanced through the linkages within and outside the site. The existing public transport services link Arrowtown with Frankton and Queenstown. Older persons can benefit from this service and the proposal will add to the likely usage and sustainability of the service. The proposal achieves the objective.
Policy 29.2.1.1	Require that transport networks including active transport networks, are well-connected and specifically designed to: a. enable an efficient public transport system;	The proposal will not adversely affect the safety of the existing transportation network as set out in **Attachment K,** and all new roads will be constructed to Council standards.

Provision	Detail	Assessment
	b. reduce travel distances and improve safety and convenience through discouraging single connection streets; and c. provide safe, attractive, and practical walking and cycling routes between and within residential areas, public facilities and amenities, and employment centres, and to existing and planned public transport.	Pedestrian and cyclist movements will be enhanced through the linkages within and outside the site. The existing public transport services link Arrowtown with Frankton and Queenstown. Older persons can benefit from this service and the proposal will add to the likely usage and sustainability of the service. The proposal achieves the policy.
Objective 29.2.2	Parking, loading, access, and onsite manoeuvring that are consistent with the character, scale, intensity, and location of the zone and contributes toward: a. providing a safe and efficient transport network; b. compact urban growth; c. economic development; d. facilitating an increase in walking and cycling and the use of public transport; and e. achieving the level of residential amenity and quality of urban design anticipated in the zone.	The development will include parking, loading, access and manoeuvring onsite generally in accordance with Council standards. While there are some instances of small non-compliances with some standards, the effects of these have been considered in the Transportation Assessment in **Attachment K** and are not expected to give rise to any adverse effects on road safety or efficiency that are more than minor. The proposal achieves the objective.
Policy 29.2.2.1	Manage the number, pricing, location, type, and design of parking spaces, queuing space, access, and loading space in a manner that: a. is safe and efficient for all transport modes and users, including those with restricted mobility, and particularly in relation to facilities such as hospitals, educational facilities, and day care facilities; b. is compatible with the classification of the road by: (i) ensuring that accesses and new intersections are appropriately located and designed and do not discourage walking and cycling or result in unsafe conditions for pedestrians or cyclists; (ii) avoiding heavy vehicles reversing off or onto any roads; and (iii) ensuring that sufficient manoeuvring space, or an alternative solution such as a turntable or car stacker, is provided to avoid reversing on or off roads in situations where it will compromise the effective, efficient, and safe operation of roads. c. contributes to an increased uptake in public transport, cycling, and walking in locations where such alternative travel modes either exist; are identified on any Council active transport network plan or public transport network plan; or are proposed as part of the subdivision, use, or development;	The development includes off street parking for both the residential and commercial components of the retirement village. The design of the development has specifically considered the needs of those residents that may have reduced mobility. Pedestrian and cyclist movements will be enhanced through the linkages within and outside the site. The existing public transport services link Arrowtown with Frankton and Queenstown. Older persons can benefit from this service and the proposal will add to the likely usage and sustainability of the service. Landscaping is proposed to mitigate the effects of additional hardstanding on landscape and visual amenity values. There will be occasional instances where heavy vehicles will be required to reverse onto Ayr Avenue. As set out in the Transportation Assessment in **Attachment K**, adverse effects are very unlikely to arise due to the low use this area will receive. The proposal achieves the policy.

Provision	Detail	Assessment
	d. provides sufficient parking spaces to meet demand in areas that are not well connected by public or active transport networks and are not identified on any Council active or public transport network plans; e. provides sufficient onsite loading space to minimise congestion and adverse visual amenity effects that arise from unmanaged parking and loading on road reserves and other public land; f. is compatible with the character and amenity of the surrounding environment, noting that exceptions to the design standards may be acceptable in special character areas and historic management areas; g. avoids or mitigates adverse effects on the amenity of the streetscape and adjoining sites; and h. provides adequate vehicle access width and manoeuvring for all emergency vehicles.	
Objective 29.2.4	An integrated approach to managing subdivision, land use, and the transport network in a manner that: a. supports improvements to active and public transport networks; b. promotes an increase in the use of active and public transport networks and shared transport; c. reduces traffic generation; and d. d. manages the effects of the transport network on adjoining land uses and the effects of adjoining land-uses on the transport network.	The existing public transport services link Arrowtown with Frankton and Queenstown. Older persons can benefit from this service and the proposal will add to the likely usage and sustainability of the service. Pedestrian and cyclist movements will be enhanced through the linkages within and outside the site. The consented and constructed Ayr Avenue provides adequately for the traffic levels associated with the development. The proposal achieves Objective 29.2.4.
Policy 29.2.4.4*	Avoid or mitigate the adverse effects of high traffic generating activities on the transport network and the amenity of the environment by taking into account the location and design of the activity and the effectiveness of the methods proposed to limit increases in traffic generation and to encourage people to walk, cycle, or travel by public transport.	The proposal constitutes a high traffic generating activity however this will not give rise to adverse effects on the safe or efficient operation of the transportation networks as set out in **Attachment K**. The proposal achieves the policy.

2.8. Chapter 42 – Waterfall Park Zone

Provision	Detail	Assessment
Objective 42.2.1	Visitor, residential and recreation facilities and activities developed in an integrated manner	The proposal is for residential accommodation and facilities, for older persons, within the WPZ.

Provision	Detail	Assessment
	with particular regard for the natural and scenic values of the setting.	The masterplan for the development utilises the natural and scenic values associated with the zone while providing for public access in the valley. Extensive planting is proposed in the zone in association with the development. Servicing can be undertaken without adverse effects. Mill Creek and ecological values will be improved through extensive riparian planting. The proposal achieves the objective.
Policy 42.2.1.1	Ensure that the external appearance of buildings and other structures are appropriate to the location with particular regard to the site's natural and scenic values.	The architectural drawings for Northbrook Arrowtown (including the renders) show how the buildings will be accommodated into the natural environment of the zone. The colours and materials proposed for the development are appropriate for this zone. The proposal achieves the policy.
Policy 42.2.1.2	Require all development to be located in accordance with the Structure Plan.	The Structure Plan requires development in locations unsuitable from a geotechnical and hazard perspective. Effects on Mill Creek would also result from development in accordance with the Structure Plan. This proposal seeks development to be located in the most appropriate locations within the Zone. The proposal does not achieve the policy.
Policy 42.2.1.3	Protect and enhance the important natural features on the site.	The waterfall will be protected and the surrounding area improved and enhanced so it can be enjoyed by residents of, and visitors to, the site. The proposal achieves the policy.
Objective 42.2.2	Development avoids adverse effects on Mill Creek and ecological values.	The proposal includes significant planting onsite, including riparian planting of Mill Creek, and a treatment train approach to provide a high level of treatment of contaminants in stormwater runoff prior to entering Mill Creek to maintain the water quality of Lake Hayes. The proposal achieves this objective.
Policy 42.2.2.1	Ensure sewage disposal, water supply and refuse disposal services are provided so as not to adversely impact on water or other environmental qualities on or off the site.	Reticulated wastewater and water supply are available to service the site, and refuse disposal services will ensure that there will be no adverse effects on water or other environmental qualities as a result of these services. The proposal achieves the policy.
Policy 42.2.2.2	Protect and enhance Mill creek as an important brown trout spawning habitat.	The proposed riparian planting within the margins of Mill Creek will protect and enhance its function as an important brown trout spawning habitat.

Provision	Detail	Assessment
		The proposal achieves the policy.

3. Partially Operative Regional Policy Statement 2019

3.1. Chapter 1 – Resource management in Otago is integrated

Provision	Detail of Provision	Assessment
Objective 1.1	Otago's resources are used sustainably to promote economic, social, and cultural wellbeing for its people and communities	The proposal will promote economic, social and cultural wellbeing by responding to the demand for retirement living in the District and contributes to meeting the housing needs of the District's older residents. The proposal achieves this objective.
Policy 1.1.1	*Economic wellbeing* Provide for the economic wellbeing of Otago's people and communities by enabling the use and development of natural and physical resources only if the adverse effects of those activities on the environment can be managed to give effect to the objectives and policies of the Regional Policy Statement.	Given the demand growth for retirement living and the current global uncertainties regarding tourism, the development of the site for Northbrook Arrowtown is a sustainable use of the land for economic well-being, and a resilience for the current and future generations. The proposal achieves this policy.
Policy 1.1.2	Social and cultural wellbeing and health and safety – provide for the social and cultural wellbeing and health and safety of Otago's people and communities when undertaking subdivision, use, development and protection of natural and physical resources by all of the following: a) Recognising and providing for Kāi Tahu values; b) Taking into account the values of other cultures; c) Taking into account the diverse needs of Otago's people and communities' d) Avoiding significant adverse effects of activities on human health; e) Promoting community resilience and the need to secure resources for the reasonable needs for human wellbeing; f) Promoting good quality and accessible infrastructure and public services.	Clauses (c) to (f) of this policy are most relevant. The proposal recognises the needs of the District's older residents – as part of the diversity of the District's demographics – by providing for a residential units (of varying levels of independence) and associated facilities. The development will not result in adverse effects on human health. The proposal will contribute to and promote community resilience in relation to land supply for retirement living, in a manner which is resilient by recognising and appropriately managing potential adverse effects on the environment. The proposal contributes to fulfilling the need to secure land resources for the reasonable needs for human wellbeing, i.e. for retirement living land supply. The proposal achieves the policy.
Objective 1.2	**Recognise and provide for the integrated management of natural and physical resources to support the wellbeing of people and communities in Otago**	The land is close or adjacent to the urban settlement of Arrowtown. Integration with surrounding natural and physical resources and activities is managed

Provision	Detail of Provision	Assessment
		through the location and design of the development, including setbacks, landscaping and ecological restoration through planting. Within the site, there is significant interconnectedness and integration through the internal network of roads, walkways and cycleways, and the central location of the facilities will reduce the number of vehicle trips outside the site. The proposal achieves this objective.
Policy 1.2.1	*Integrated resource management* Achieve integrated management of Otago's natural and physical resources, by all of the following: a) Coordinating the management of interconnected natural and physical resources; b) Taking into account the impacts of management of one resource on the values of another, or on the environment; c) Recognising that resource may extend beyond the immediate, or directly adjacent, area of interest; d) Ensuring that resource management approaches across administrative boundaries are consistent and complementary; e) Ensuring that effects of activities on the whole of a resource are considered when that resource is managed as subunits.	The proposal coordinates the resources of the site by the integration of the natural features, including existing and proposed vegetation, open spaces, landforms and waterbodies, into the location, design and layout of the development. The development is not out of character with the level of development enabled in the WPZ and any adverse effects on the surrounding rural and rural residential land uses are avoided or adequately mitigated by the location, design and landscaping. The actual and potential adverse effects of the proposal have been recognised and addressed in the design and layout of the development and will be effectively managed and will give effect to the relevant objectives and policies of the Regional Policy Statement. The proposal will result in positive effects on the health of ecosystems associated with the waterbodies on site through the enhancement of riparian areas through extensive planting and the treatment of stormwater for contaminants. Sustainable resource limits will not be challenged by the development. The proposal achieves the policy.

3.2. Chapter 3 – Otago has high quality natural resources and ecosystems

Provision	Detail of Provision	Assessment
Objective 3	**The values (including intrinsic values) of ecosystems and natural resources are recognised and maintained, or enhanced where degraded**	The proposal will maintain the ecosystems and natural values of Mill Creek and Lake Hayes through the treatment of stormwater runoff and the offsite works to maintain water quality of Lake Hayes. The proposal achieves this objective.

Provision	Detail of Provision	Assessment
Policy 3.1.13	*Environmental enhancement* Encourage, facilitate and support activities that contribute to the resilience and enhancement of the natural environment, by where applicable: a) Improving water quality and quantity; b) Protecting or restoring habitat for indigenous species; c) Regenerating indigenous species; d) Mitigating natural hazards; e) Protecting or restoring wetlands; f) Improving the health and resilience of: i. Ecosystems supporting indigenous biological diversity; ii. Important ecosystem services, including pollination; g) Improving access to rivers, lakes, wetlands and their margins, and the coast; h) Buffering or linking ecosystems, habitats and areas of significance that contribute to ecological corridors; i) Controlling pest species.	The proposal will contribute to the resilience of the natural environment as follows: a) Providing treatment of stormwater runoff to maintain water quality outcomes and offsite works to maintain water quality of Lakes Hayes as enabled by the voluntary contribution; b) Increased indigenous planting on the riparian margins will support the restoration of Mill Creek as habitat for indigenous species; c) Increased indigenous planting on the riparian margins will support the restoration of Mill Creek as habitat for indigenous species; d) Mitigation of geotechnical risk through design; e) A new wetland is proposed as part of the stormwater management of the site; f) Supporting the health and resilience of the water catchment through stormwater runoff treatment; g) Increased access to Mill Creek and the waterfall to residents and their visitors; h) Not relevant, except to the extent that the restoration of Mill Creek will support it as a habitat and ecological corridor for fish species; i) Not relevant. The proposal achieves this policy.

4. Proposed Regional Policy Statement 2021

4.1. Integrated Management

Provision	Detail of Provision	Assessment
Objective IM-O1	**Long term vision** **The management of *natural and physical resources* in Otago, by and for the people of Otago, including Kāi Tahu, and as expressed in all resource management plans and decision making, achieves healthy, resilient, and safeguarded natural systems, and the ecosystem services they offer, and supports the well-being of present and future generations, mō tātou, ā, mō kā uri ā muri ake nei.**	The proposal provides for the integrated and comprehensive development of the WPZ. The wellbeing of present and future generations has been considered in the design of the proposal, including through the health of waters in the catchment through contaminant treatment and riparian planting. The proposal achieves this objective.

Provision	Detail of Provision	Assessment
Objective IM-O2	**Ki uta ki tai** ***Natural and physical* resource management and decision making in Otago embraces ki uta ki tai, recognising that the *environment* is an interconnected system, which depends on its connections to flourish, and must be considered as an interdependent whole.**	The proposal has recognised ki uta ki tai through the treatment provided for stormwater and riparian planting, and the role that maintenance of water quality of Mill Creek plays in the wider catchment. The proposal achieves this objective.
Objective IM-O3	**Environmentally sustainable impact** **Otago's communities carry out their activities in a way that preserves environmental integrity, form, function, and *resilience*, so that the life-supporting capacities of air, *water*, soil, ecosystems, and indigenous *biodiversity* endure for future generations.**	The proposal has been designed to ensure that the life supporting capacities of water ecosystems will not be reduced and will provide for indigenous species planting. The proposal achieves this objective.
Policy IM-P13	**Managing cumulative *effects*** Otago's environmental integrity, form, function, and *resilience*, and opportunities for future generations, are protected by recognising and specifically managing the cumulative effects of activities on natural and physical resources in plans and explicitly accounting for these effects in other resource management decisions.	The proposal provides for the integrated and comprehensive development of the WPZ. The overall effects of the current proposal, when considered in conjunction with the consented development and also potential future development (where these effects cannot reasonably be mitigated such as through upgrades to infrastructure) will be no more than minor. The proposal achieves this policy.

4.2. Land and Freshwater – Te Mana o te Wai

Provision	Detail of Provision	Assessment
Objective LF–WAI–O1	**Te Mana o te Wai** **The mauri of Otago's water bodies and their health and well-being is protected, and restored where it is degraded, and the management of land and water recognises and reflects that:** (1) **water is the foundation and source of all life – na te wai ko te hauora o ngā mea katoa,** (2) **there is an integral kinship relationship between water and Kāi Tahu whānui, and this relationship endures through time, connecting past, present and future,** (3) **each water body has a unique whakapapa and characteristics,** (4) **water and land have a connectedness that supports and perpetuates life, and** (5) **Kāi Tahu exercise rakatirataka, manaakitaka and their kaitiakitaka**	The proposal is consistent with upholding Te Mana o te Wai by prioritising the health and wellbeing of waterbodies and freshwater ecosystems through stormwater treatment and riparian planting, and the role that maintenance of water quality of Mill Creek plays in the wider catchment. The proposal achieves this objective.

Provision	Detail of Provision	Assessment
	duty of care and attention over wai and all the life it supports.	
Policy LF-WAI-P1	**Prioritisation** In all management of fresh water in Otago, prioritise: (1) first, the health and well-being of water bodies and freshwater ecosystems, te hauora o te wai and te hauora o te taiao, and the exercise of mana whenua to uphold these, (2) second, the health and well-being needs of people, te hauora o te tangata; interacting with water through ingestion (such as drinking water and consuming harvested resources) and immersive activities (such as harvesting resources and bathing), and (3) third, the ability of people and communities to provide for their social, economic, and cultural well- being, now and in the future.	The proposal prioritises freshwater by proposing a comprehensive onsite stormwater management system that includes a treatment train approach for reduction of contaminants in stormwater entering waterbodies. The proposal achieves this policy.
Policy LF-WAI-P4	**Giving effect to Te Mana o te Wai** All persons exercising functions and powers under this RPS and all persons who use, develop or protect resources to which this RPS applies must recognise that LF-WAI-O1, LF-WAI-P1, LF-WAI-P2 and LF-WAI-P3 are fundamental to upholding Te Mana o te Wai, and must be given effect to when making decisions affecting fresh water, including when interpreting and applying the provisions of the LF chapter.	The proposal is consistent with upholding Te Mana o te Wai by prioritising the health and wellbeing of waterbodies as discussed above. The proposal achieves this policy.

4.3. Freshwater

Provision	Detail of Provision	Assessment
Objective LF-FW-O8	**In Otago's water bodies and their catchments**: (1) **the health of the wai supports the health of the people and thriving mahika kai,** (2) **water flow is continuous throughout the whole system,** (3) **the interconnection of fresh water (including groundwater) and coastal waters is recognised,** (4) **native fish can migrate easily and as naturally as possible and taoka species and their habitats are protected, and**	The proposal does not adversely affect the water quality and function of Mill Creek or Lake Hayes. The proposal prioritises freshwater by proposing a comprehensive onsite stormwater management system that includes a treatment train approach for reduction of contaminants in stormwater entering waterbodies and extensive riparian planting of the Mill Creek margin, recognising the importance of the waterbodies and waters to Kāi Tahu and the wider community for the range of roles it plays (including for mahika kai and as habitats for indigenous species).

Provision	Detail of Provision	Assessment
	(5) **the significant and outstanding values of Otago's outstanding water bodies are identified and protected.**	
Objective LF-FW-O10	**Natural character** **The natural character of wetlands, lakes and rivers and their margins is preserved and protected from inappropriate subdivision, use and development.**	The proposal does not affect the natural character of wetlands, lakes and river and their margins. Northbrook Arrowtown has been comprehensively located and designed to be consistent with the nature and character of the site, including the role that Mill Creek plays in that. The proposal achieves this policy.
Policy LF-FW-P15	**Stormwater and wastewater discharges** Minimise the adverse effects of direct and indirect discharges of stormwater and wastewater to fresh water by: (1) requiring: (a) all sewage, industrial or trade waste to be discharged into a reticulated wastewater system, where one is available, (b) all stormwater to be discharged into a reticulated system, where one is available, … (2) promoting the reticulation of stormwater and wastewater in urban areas.	There is no reticulated stormwater available to connect the development to. The proposal provides for high level of treatment and reduction of contaminants through a comprehensive onsite stormwater management system that includes a treatment train approach for reduction of contaminants in stormwater entering waterbodies, and with significant riparian planting. The proposal achieves this policy.

4.4. Historical and Cultural Values

Provision	Detail of Provision	Assessment
Objective HCV-HH-O3	**Historic heritage resources** **Otago's unique historic heritage contributes to the region's character, sense of identity, and social, cultural and economic well-being, and is preserved for future generations.**	The Stone Farm Buildings are a Category 2 listed heritage feature in the Queenstown Lakes District Plan and the proposal will support the ongoing use, repair and maintenance of these buildings and their associated social and cultural value will be available to be appreciated for the residents as well as the wider public and preserved for future generations. The proposal achieves this objective.

4.5. Natural Features and Landscapes

Provision	Detail of Provision	Assessment
Objective NFL-O1	**Outstanding and highly valued natural features and landscapes**	The proposal maintains the values if the area is within a "highly valued natural landscape". It avoids adverse effects on

Provision	Detail of Provision	Assessment
	The areas and values of Otago's outstanding and highly valued natural features and landscapes are identified, and the use and development of Otago's natural and physical resources results in: (1) **the protection of outstanding natural features and landscapes, and** (2) **the maintenance or enhancement of highly valued natural features and landscapes.**	the values of the landscape as detailed in the Landscape Assessment (**Attachment I**)**,** by carefully locating and designing new development. The proposal achieves this objective.
Policy NFL-P3	Maintenance of highly valued natural features and landscapes Maintain or enhance highly valued natural features and landscapes by: (1) avoiding significant adverse effects on the values of the natural feature or landscape, and (2) avoiding, remedying or mitigating other adverse effects.	As discussed above, the proposal maintains the values if the area is within a "highly valued natural landscape". It avoids adverse effects on the values of the landscape as detailed in the Landscape Assessment (**Attachment I**), by carefully locating and designing new development. The proposal achieves this policy.

5. National Policy Statement – Freshwater Management 2020

Provision	Detail of Provision	Assessment
Objective 1	**The objective of this National Policy Statement is to ensure that natural and physical resources are managed in a way that prioritises:** **(a) first, the health and well-being of water bodies and freshwater ecosystems** **(b) second, the health needs of people (such as drinking water)** (c) **third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.**	The proposal prioritises the health and wellbeing of waterbodies and freshwater ecosystems through the maintenance of water quality in the catchment. The proposal also provides for people's social, economic and cultural wellbeing by creating jobs through new commercial activities. The proposal achieves this objective.
Policy 1	Freshwater is managed in a way that gives effect to Te Mana o te Wai.	The proposal is consistent with upholding Te Mana o te Wai by prioritising the health and wellbeing of waterbodies and freshwater ecosystems through the treatment of stormwater runoff by proposing a comprehensive onsite stormwater management system that includes a treatment train approach for reduction of contaminants in stormwater entering waterbodies and by proposing extensive riparian planting of the Mill Creek margins, therefore maintaining the quality of water entering the wider freshwater system. The proposal achieves this policy.

Provision	Detail of Provision	Assessment
Policy 3	Freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchment basis, including the effects on receiving environments.	The proposal includes the treatment of stormwater runoff via a comprehensive onsite stormwater management system that includes a treatment train approach for reduction of contaminants in stormwater entering waterbodies and by proposing extensive riparian planting of the Mill Creek margins, therefore maintaining the quality of water entering the wider freshwater system. The proposal achieves this policy.
Policy 5	Freshwater is managed through a National Objectives Framework to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained and (if communities choose) improved.	The proposal includes the treatment of stormwater runoff via a comprehensive onsite stormwater management system that includes a treatment train approach for reduction of contaminants in stormwater entering waterbodies and by proposing extensive riparian planting of the Mill Creek margins, therefore maintaining the quality of water entering the wider freshwater system. The proposal achieves this policy.
Policy 8	The significant values of outstanding water bodies are protected.	The proposal includes the treatment of stormwater runoff via a comprehensive onsite stormwater management system that includes a treatment train approach for reduction of contaminants in stormwater entering waterbodies and by proposing extensive riparian planting of the Mill Creek margins, therefore maintaining the quality of water entering the wider freshwater system and assisting in protecting the significant values of the outstanding waterbody that is Lake Hayes. The proposal achieves this policy.
Policy 15	Communities are enabled to provide for their social, economic, and cultural well- being in a way that is consistent with this National Policy Statement.	The proposal will allow people and the community to provide for their social, economic and cultural wellbeing in a way that is consistent with the NPS due to the proposed comprehensive onsite stormwater management system that includes a treatment train approach for reduction of contaminants in stormwater entering waterbodies and by proposing extensive riparian planting of the Mill Creek margins, therefore maintaining the quality of water entering the wider freshwater system. The proposal achieves this policy.

Internet Banking for Business

Direct Credit Payment

Account	Waterfall Park Chq / 02-0108-0379403-000		
Due Date	10/10/2022	Total Amount	$3,300.00
Status	PROCESSED	Total Items	1
Authorised By	JEANMC, SIMONASH	Hash Total	9480002000

To appear on your statement | *To appear on other party's statement*

One bulk transaction

Transaction Name	WPDL - RC	Name	Waterfall Park Dev
Particulars	WPDL		
Code	RC		
Reference	Waterfall Pa		

Name	Account Number	Amount	Particulars	Code	Reference
QUEENSTOWN LAKES DIS	02-0948-0002000-000	$3,300.00 CR	P13472	RMWPDL 10/10	Waterfall Pa

End of Report

From: "David Dwight"
Sent: Fri, 3 Mar 2023 15:52:09 +1300
To: "Christine Edgley" <Christine@brownandcompany.co.nz>
Cc: "Morgan@brownandcompany.co.nz" <Morgan@brownandcompany.co.nz>
Subject: RE: RM220926 Waterfall Park Developments Limited

Thanks Christine

I'll update the description and resend the EMP request to Louis, a quote should be back by next week.

Cheers

David Dwight| Senior Planner | Planning & Development
Queenstown Lakes District Council
P: +64 3 450 1790
david.dwight@qldc.govt.nz

QUEENSTOWN LAKES DISTRICT COUNCIL

From: Christine Edgley <Christine@brownandcompany.co.nz>
Sent: Friday, March 3, 2023 3:36 PM
To: David Dwight <David.Dwight@qldc.govt.nz>
Cc: Morgan Shepherd <Morgan@brownandcompany.co.nz>
Subject: RE: RM220926 Waterfall Park Developments Limited

Hi David,

Further to your email below and our subsequent discussions, this email addresses the following:

1. Partial response to some of the initial queries raised below;
2. Updated application package for notification;
3. Peer review of draft EMP; and
4. Feedback on the draft public notice description.

1. **Partial response to queries received 28 November 2022**

Initial responses to some of the queries are provided in red text in the email below. The remaining responses will be addressed during the notification / post-notification period.

2. **Updated application package for notification**

Please find at the link below an updated application package for public notification.

RM220926

The updated application package incorporates the following changes (when compared to the application as lodged in October 2022):

a. All documentation has been updated to reflect a renaming of the proposal to "Northbrook Arrowtown";
b. Minor increases to the overall height of Buildings B, C and D by between 100mm and 300mm, with a maximum building height of RL377.925m (21.7m (Building D), as opposed to 21.5m as lodged) and the architectural drawings updated to make this clear. There has been one revision to the finished floor level (Building C, of 100mm) to provide a greater structural zone and achieve 2.5m clearance in the basement, which has resulted in the increase to the overall height of that building. The changes to the heights of Buildings B and D are a result of the comprehensive review of the plan set;
c. Updates to the architectural drawing and engineering drawing sets to as indicated in response to the initial queries addressed under (1) above, including:
    a. Tapers to the Building A parallel parks;
    b. Showing of additional RL levels and measurements to demonstrate clearances of ramps and porte cochere.
d. Updates to the traffic assessment to reflect the slight amendments to the parking areas;
e. Updates to the AEE to reflect where the proposal has been slightly amended;
f. Revised dates on documents to reflect that they have been updated, and revised cross-referencing to other documentation in the package (excluding Attachments H, L and M), which have not required any updates).

We acknowledge that the updates have resulted in some changes that may require additional consideration by the Council's experts. In particular, the building heights have slightly increased (maximum increase of 300mm (Building B – maximum height of 18.4m above ground level and overall maximum height of 21.7m (Building D)) and we anticipate that this will need to be brought to the Council's landscape peer reviewer's attention to enable her to consider this during the application's notification period. The landscape architect that authored the landscape assessment has reviewed the amended building heights and is comfortable that the assessment remains accurate.

3. **Updated draft EMP**

The draft EMP in the updated package in (2) above has now been reviewed by a SQEP. Can you please arrange a quote for the peer review of this draft EMP for review and acceptance by the applicant.

4. **Feedback on draft public notice description**

Thank you for providing the opportunity to review the draft wording for the public notice. Preferred wording to describe the proposal is set out below:

"Establish and operate a later living retirement development and related commercial/residential activities and includes associated buildings and works such as earthworks, roading, landscaping and carparking."

We trust that the above is clear, and that the information provided enables Council to move forward with public notification on 9 March 2023. The applicant has paid the public notification fee.

Kind regards,
Christine

Christine Edgley
Senior Planner
03 409 2258 | 027 588 8824
BROWN&COMPANY PLANNING GROUP

From: David Dwight <David.Dwight@qldc.govt.nz>
Sent: Monday, November 28, 2022 12:30 PM
To: Christine Edgley <Christine@brownandcompany.co.nz>
Subject: FW: Engineering Referral - RM220926 Ayrburn Precinct Limited (Engineering RFI)

Hi Christine,

As discussed. Still have to filter this one before an RFI.

Cheers

David Dwight| Senior Planner | Planning & Development
Queenstown Lakes District Council
P: +64 3 450 1790
david.dwight@qldc.govt.nz
QUEENSTOWN LAKES DISTRICT COUNCIL

From: Alan Hopkins <Alan.hopkins@qldc.govt.nz>
Sent: Monday, November 28, 2022 11:34 AM
To: David Dwight <David.Dwight@qldc.govt.nz>
Subject: FW: Engineering Referral - RM220926 Ayrburn Precinct Limited (Engineering RFI)

Morning David,

Please include the following engineering matters in your RFI for this consent-

- Applicant/planner to confirm if this application is being processed as a variation to RM180584 or a whole new consent?
  As per previous discussions with the processing planner, this is to be processed as a new application and not as a variation to RM180584.
- Section 4.4 of the CKL water and wastewater infrastructure assessment states –
  '*It should be noted that, according to the modelling undertaken by Mott MacDonald, the domes tic demand was not added to the FW2 and sprinkler flow. The fire flow consisted only of FW2 an d sprinkler flow. This is on the assumption that during a fire event, residents,*

staff or visitors will not be making use of the building's facilities during emergency/evacuation p rocedures.'

This approach does not align with Section 6.3.5.5 of the QLDC COP which requires both peak demand and firefighting to be combined. Applicant to provide amended water supply modelling and if required solution for the scenario described in Section 6.3.5.5 that confirms minimum flows and pressures can be provided/maintained.

- Applicant's traffic engineer to justify the number of mobility spaces proposed. Given the nature of the proposed activity (aged care) the mobility parking requirement will likely be significantly greater than the minimum requirements under the district plan. Applicant to provide further assessment and comment in this regard. Ideally this would align with national best practice for similar facilities.

The accessible parking provisions in the District Plan have recently been through a Council-led variation, becoming operative in mid-June 2022. As this was instigated by the Council and so recently approved, it is assumed that this variation considered the appropriate minimum provision for this type of activity at that time and that these minimums can be relied upon. The proposed development is for 161 units for independent living plus 12 serviced apartments and 23 specialist care beds. The District Plan provisions require:

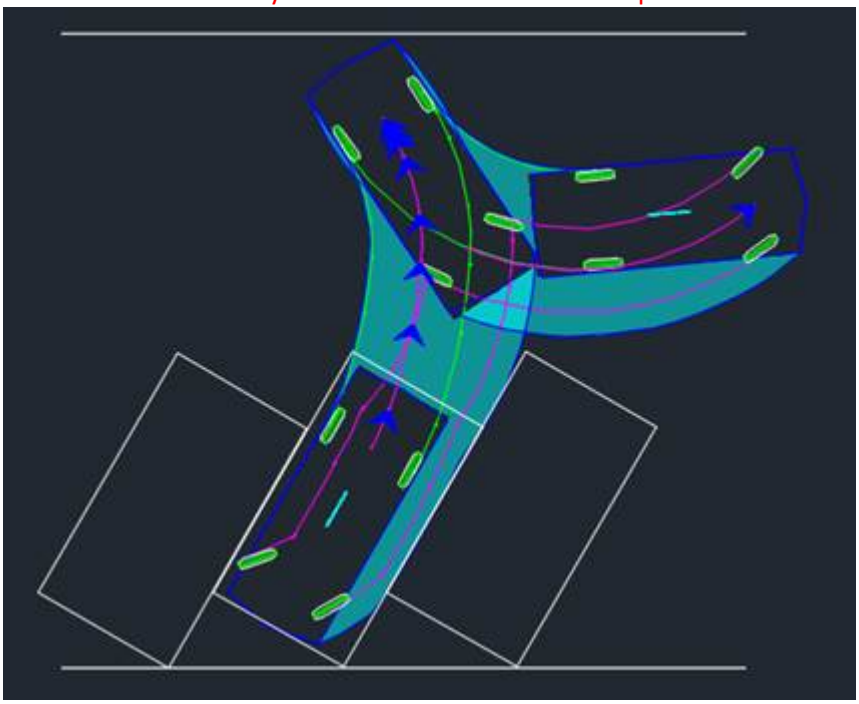
- Four accessible spaces for independent living for residents. There are two formally marked accessible spaces in the basement car park plus a further three spaces that can be used for accessible parking. The latter are not marked – spaces will be allocated to residents and thus a person with mobility impairments can be allocated one of these spaces if needed.
- One accessible is required for residents occupying a specialist care bed and/or a serviced apartment. In practice it is highly unlikely that a resident requiring a high level of specialist care will hold a driving license, but if necessary, one of the pick-up/drop-off spaces north of Building B could be repurposed as a accessible space. Alternatively, the fifth 'spare' space in the basement can be used.
- No accessible spaces are required for staff/guests associated with the independent living units.
- For the specialist care beds and serviced apartments, one accessible space is required for staff/guests. Four such spaces are shown within the car park near Building A.

The level of provision of accessible parking is therefore greater than required under the Building Act or Standard NZS4121, which are the two overarching documents.

- Applicant to update plans to include traffic flow direction arrows within the basement parking and associated access ramps.

  The architectural drawings have been updated (Sheet 10.01) to include traffic flow direction arrows within the basement parking within Buildings C-E.
- Applicant to confirm basement parking and associated access ramp floor to ceiling clearance and confirm that this will take into account need to provide for mobility parks.

  The architectural drawings have been updated (Sheets 10.02 and 10.03) to demonstrate a minimum 2.5m clearance.
- Parallel parks and set down areas fronting Building A to be updated to include entry and exit tappers. For obvious reasons parallel parks and set down within age care facilities require entry/exit tappers.
- The engineering drawings have been updated (Sheet 301) to provide tapers to the Building A parallel parking spaces (loading and accessible).

- Applicant's traffic engineer to confirm any bus set down/parking/manoeuvring requirements for activities within the site. Both age care and hotel type activities generally result in bus requirements and this should be accounted for.
  Aged care facilities do not result in demand for coaches, although minibuses can be used. At such time that a minibus is due (of which the facility will have advance notice of) the drop-off spaces at the Building A carpark can be coned off / reserved for the use of the minibus, noting that these spaces have not been counted as part of the parking supply / demand and therefore the use of these spaces for this purpose will not affect the assessed parking provision overall. Notwithstanding that a coach is not likely to be utilised, the Building A carpark layout / loop can accommodate coach tracking, and the clearance of the Building A porte cochere achieves the 3.5m necessary to enable coach clearance (see updated architectural drawings Sheet 07.09).
  With regard to the proposed hotel (Building F), this has 16 rooms – the District Plan only requires coach parking where more than 30 rooms are provided for visitor accommodation. This rule acknowledges that a hotel of a scale smaller than 30 rooms cannot accommodate demand from even one tour coach (which would be carrying 50+ people) and tour parties do not book the same groups into multiple locations. In the event minibuses are used there are two parking spaces that are oversized for this purpose. In the unlikely event that the entire hotel was book by one tour party, then the parking provision for the hotel rooms (14 spaces) would be available to be utilised.
- 8 angled car parks north of building E preferred to be at 90 degrees to the carriageway. The current 60 degrees proposed makes exit manoeuvring difficult and will require users to travel north on exit and/or perform multiple manoeuvres.
  The angled spaces have been retained as vehicles can exit these spaces without heading north to exit and without having to perform multiple manoeuvres – see the vehicle tracking below that demonstrates only one reverse manoeuvre is required.
- 
- Given number of users the current Y or T type turning head at the end of Road 1 is not deemed acceptable. While this was previous accepted under the hotel consent, this is not deemed

acceptable for an aged care type facility. QLDC require full turning head to limit manoeuvres and associated potential conflict. Applicant to amend design to include full minimum 19m diameter turning head (possibly larger if basses to be accommodated).
The turning head is located next to the hotel, and therefore it is not likely to function as a part of an aged care facility. In addition, there is a turning area provided near Building B where larger vehicles can turn, removing the need for all vehicles to progress to the end of the road before turning. As discussed above, the use of the site for "buses" (i.e. tour coaches) is unlikely. The location of this turning head is unlikely to cause conflict with pedestrians (being the main concern with regards to reversing large vehicles).

- Applicant to confirm if the s/w modelling and flood protection solution provided from Fluent has undergone any independent peer review to date. If the current assumed event flows and design solution has not been independently peer reviewed in full, Council will require a consent level peer review of flood control solution and flows under section 92.2.
- The proposed Fluent flood management solution clearly departs from Section 4.3.4.2 of the COP with regards to the depth of flows under the 1% AEP event at road centrelines being greater than 100mm. Applicant therefore to provide specific approval from QLDC P&I (Richard Powell) for proposed departure from COP for 100yr flood flows greater that 0.1m on road centrelines.
- Applicant to confirm freeboard between the 1% AEP flood event and entry ramps to the basement car parking area. Specifically what level of freeboard is provided to ramp entries?
The freeboard provided for the Building C ramp is 600mm, and the Building E ramp is 800mm.

Regards

Alan Hopkins | Consulting Engineer | Planning & Development
Queenstown Lakes District Council
Mobile : 021 02209678
E: alan.hopkins@qldc.govt.nz

QUEENSTOWN LAKES DISTRICT COUNCIL

From: QLDC RMEngineering <RMEngineering@qldc.govt.nz>
Sent: Tuesday, 8 November 2022 2:40 PM
To: Alan Hopkins <Alan.hopkins@qldc.govt.nz>
Cc: David Dwight <David.Dwight@qldc.govt.nz>
Subject: RE: Engineering Referral - RM220926 Ayrburn Precinct Limited

HI Alan
Please provide comment to David for this substitute retirement village over/near the hotel site previously reported
Ngā Mihi | Kind regards,
Mike

Michael Wardill | Team Leader - Resource Management
Engineering, Subdivision and Development Contributions

Planning & Development
Queenstown Lakes District Council
DD: +64 3 450 0359 | P: +64 3 441 0499 | M: +64 27 600 8807 E: michael.wardill@qldc.govt.nz

QUEENSTOWN LAKES DISTRICT COUNCIL

From: David Dwight <David.Dwight@qldc.govt.nz>
Sent: Monday, 7 November 2022 7:05 PM
To: QLDC RMEngineering <RMEngineering@qldc.govt.nz>
Subject: Engineering Referral - RM220926 Ayrburn Precinct Limited

Hi Team

Below is an Engineering request for:

APPLICATION DETAILS	
REFERENCE	**RM220926**
APPLICANT	Waterfall Park Development Limited
APPLICATION TYPE & DESCRIPTION	Use and Development of a Resort for later living, including Hotel and associated buildings, earthworks, roading, landscaping, and carparking.
ADDRESS	Lot 1, 2 & 4 DP 540788, Arrowtown
ZONING	Waterfall Park Zone Wakatipu Basin Rural Amenity Zone/ Rural General Zone
SITE AREA	
ACTIVITY STATUS	Non-Compliant
VALUATION NUMBER	

REQUEST DETAILS	
FROM (PROCESSING PLANNER)	David Dwight
DATE OF REQUEST	7th November 2022
WORKING DAYS AT TIME OF REQUEST	17
FINAL DATE FOR FURTHER	Standard timeframe

INFORMATION REQUESTS	
DATE REPORT REQUIRED BY:	Standard timeframe
INDICATION OF NOTIFICATION	Notified
TYPE OF COMMENT REQUIRED	- Comment or **Engineering Report**
REQUESTED AREAS OF COMMENT	Seeking Engineering advice on; • **Attachment K -Transportation Assessment**: From Hotel to Retirement Village/Resort; 1 of consents for the same site which have implications – RM220829 & RM220874. Public transport opportunities (Line 2). Status of new road. • **Attachment G - Stormwater Management Plan**; Some changes from previous stormwater report RM180584. • **Attachment N - Geotech Report**: Earthworks – Stability/Location to Waterway • **Attachment O - Natural Hazards** - Shotover-Arrow-Mill Creek Flood Hazard Zones. Previous Consent RM180584 is subject to a Flood Management Plan. Are there any issues. • **Car Parking –** Numbers & Design. • **Waste Management**

Cheers,

David Dwight| Senior Planner | Planning & Development
Queenstown Lakes District Council
P: +64 3 441 0499
david.dwight@qldc.govt.nz

QUEENSTOWN LAKES DISTRICT COUNCIL