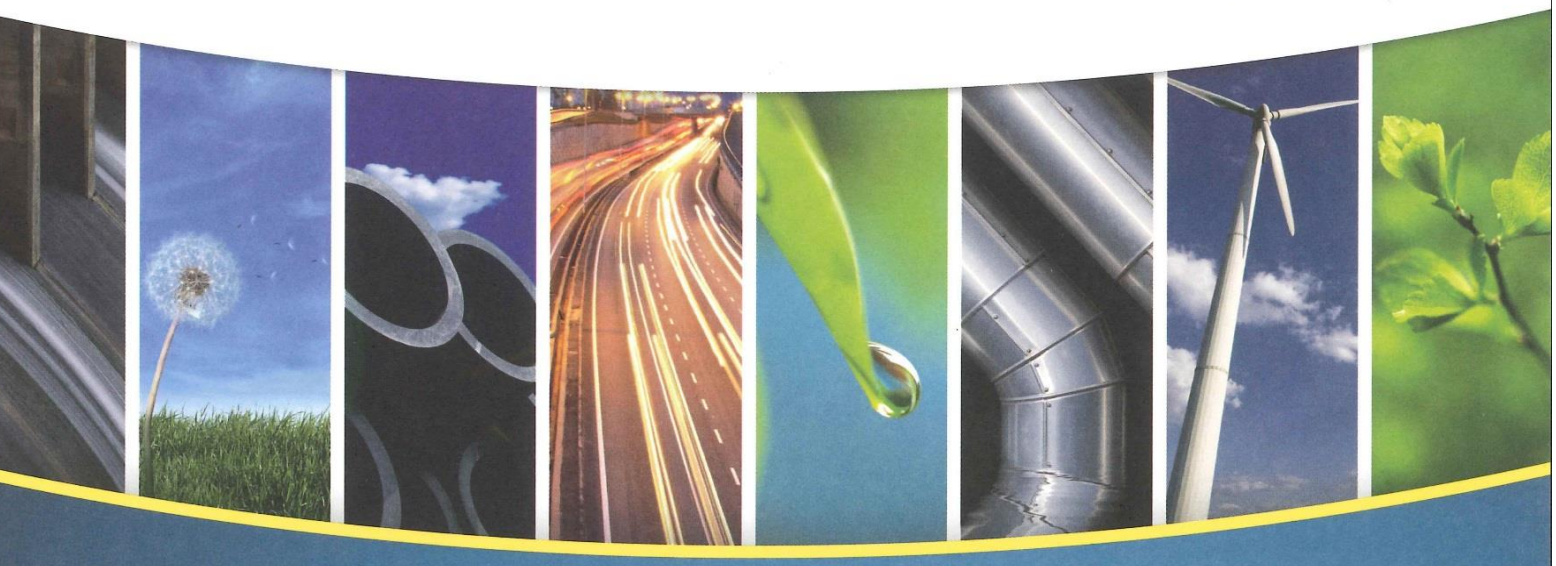
Waterfall Park Special Housing Area Water Services Review

Prepared for the Queenstown Lakes District Council

July 2016



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BUILDING A BETTER WORLD

Waterfall Park Special Housing Area (SHA) Review

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Executive Summary

Water Supply

The information currently available indicates that there is sufficient capacity in the existing water supply system to supply potable water and firefighting flows to the proposed development from the Lake Hayes Water Supply Scheme. The Lake Hayes Estate area has recently been disconnected from the Lake Hayes Water Supply Scheme and is now supplied from the Shotover Country Water Supply Scheme. This change provides surplus capacity in the Lake Hayes Water Supply Scheme to provide both potable water and firefighting flows to the proposed Waterfall Park SHA development.

A detailed water supply model for the currently proposed development is required.

Wastewater Drainage

MWH concurs with the finding in the expression of interest document that it is feasible to drain wastewater from the proposed development into the Lake Hayes Wastewater Scheme with some modifications.

The expression of interest document identifies the following upgrades to the existing Lake Hayes Wastewater Scheme as being necessary:

- Upgrade of the pumps in the Lake Hayes Pump Station #1 (located at the Lake Hayes Recreation Reserve at the north end of the lake) to increase capacity
- Install additional emergency storage at the Lake Hayes Pump Station #1 or provide emergency power by means of a generator or supplemental power feed from the Lake Hayes bore site.

The issues with the wastewater drainage from the proposed development identified by MWH, which are not necessarily the same as in the expression of interest document, are the following:

1. Feasibility of gravity drainage to the existing Lake Hayes Wastewater Scheme at an unspecified point upstream of PS1.
2. Capacity and power supply problems at PS1
3. Capacity of the existing wastewater drainage system between PS1 and PS2

Issue 1:
It is noted that a gravity connection between the new development and the Lake Hayes Wastewater Scheme is the preferred option for the development. However, the connection point to the Scheme is not specified in the expression of interest document. We conclude the most likely route for drainage of the wastewater is the discharge into the existing gravity main that runs alongside Mill Creek to Pump Station #1. The feasibility of this discharge in terms of pipe levels and capacity has not been assessed as part of this review. However, wastewater may also be pumped from the development to Pump Station #1 should this be necessary.

Issue 2:
The existing pump station is supplied with power and emergency power by a cable from the transformer and emergency generator at the borefield site in Rutherford Road. It is understood that the cable capacity limits the current that can be supplied to the pumps at the pump station. If the pumps are up sized there is concern that the cable may not be adequate to supply the power demand. Further work is required to specifically identify this and possible solutions should this prove an issue. Options may involve supplementing the cable or providing soft starters or variable speed drives to limit starting current. Providing either storage or generation capacity on site may not solve the issue of supply of power to the site.

Issue 3:
Further modelling is to be undertaken to determine whether an upgrade of the gravity main along the Lake Hayes walking track between the entrance to the Lake Hayes Recreation Reserve at the north end of the lake and the Lake Hayes Pump Station #2 located at the Bendemeer Bay Reserve is required. An upgrade of the gravity main may be required to avoid overflows. Alternatively, we consider it to be a more practical option to

extend the rising main from the Lake Hayes Pump Station #1 directly along the Arrowtown Lake Hayes Road to the pump station at the Bendemeer Reserve.

The infrastructure review report included in the expression of interest document notes that a pressure sewer solution may be a potential solution for the dispersed lots to the north of the development. No further detail about this solution is provided.

Stormwater Drainage within the Site

The expression of interest document does not include a description or layout of the proposed stormwater management system for an assessment by MWH.

MWH carried out a concept design of a feasible stormwater management system based on the components mentioned in the expression of interest document, namely, the use of stormwater detention ponds for flow control to Mill Creek.

The following criteria for the feasibility assessment in respect to stormwater drainage within the site was checked by MWH:

- The grade across the site available for the stormwater reticulation pipework
- The depth available for stormwater detention in the proposed stormwater attenuation ponds
- The available freeboard between the pond invert and the recorded flood levels for Mill Creek.

This analysis identified that the proposed stormwater system may not be a feasible solution. In particular our preliminary assessment indicates that the low lying, southernmost area of the development on either side of Mill Creek governs the invert level of the stormwater detention structure to be below possible flood levels in Mill Creek. However, this assessment was carried out using the information currently available which is both imprecise and incomplete. A more detailed survey, river level data and detailed long sections of the reticulation system will be required to specifically confirm the practicality of a gravity stormwater system. A further study and a stormwater management system concept design by the developer is required.

Flooding of the Site

The following flood mitigation works are required for the new development in order to protect habitable floors against a 100 year return period flood event with a 0.5m freeboard:

- Widening of the existing channel and providing scour protection in the upstream reach of the floodway; and
- Formation of flood protection banks to confine flood flows in the lower middle reach within the residential area.

Assuming that the mitigation measures as specified in the expression of interest document are implemented as part of the new development, MWH considers the flood risks for buildings and damage to infrastructure adequately addressed.

Table of Contents

1 Introduction

MWH was engaged by the Queenstown Lakes District Council to undertake a high level review of the "Waterfall Park SHA – Expression of Interest: Special Housing Area (16 June 2016)" document by Winton Partners. The purpose of the review is to assess the feasibility of options proposed in the report for:

- Domestic and commercial potable and firefighting water supply from the existing Lake Hayes Water Supply Scheme
- Domestic and commercial wastewater drainage from the proposed development into the existing Lake Hayes Wastewater Scheme
- Reticulated stormwater drainage
- Flooding Risk

The expression of interest document includes appendices addressing the infrastructure review, flood hazards and geotechnical issues. In regard to the infrastructure elements above we have reviewed the following documents that form part of the proposal;

1. Holmes Consulting Group – Infrastructure assessment (dated 15 June 2016)
2. GeoSolve – Geotechnical Report for Resource Consent (dated June 2016)
3. Fluent Solutions – Flood Hazard Review (dated 14 June 2016)

The Holmes Consulting Group infrastructure assessment report refers to reports prepared by Clark Fortune McDonalds & Associates (CFMA), Rationale and Tonkin and Taylor (T+T). It is noted that these reports are not part of the expression of interest documentation and were not reviewed as part of this report. The Holmes Consulting Group report states that the previous reports by CFMA, Rationale and T+T addressed the stormwater management, water demand and wastewater generation of a 150 lot residential development within the 45 Ha block at the southern end of the Waterfall Park site. The current proposal for the Waterfall Park SHA is based on a 140 lot development covering an area of 60 Ha.

The report by Holmes Consulting Group makes an assessment of the wastewater flow, water demand and stormwater run-off and management for the Waterfall Park SHA and checks the applicability of the results from the previous infrastructure assessment reports by CFMA, Rationale and T+T.

2 Background

Waterfall Park SHA is a proposed development on a 60 ha farm site at 341 – 343 Arrowtown – Lake Hayes Road. The proposal is for the development of a 140 lot special housing area including the provision for a restaurant/café and public cycle and walk ways.

Mill Creek runs through the middle of the proposed site.

Figure 1 shows the location of the proposed Waterfall Park SHA development.

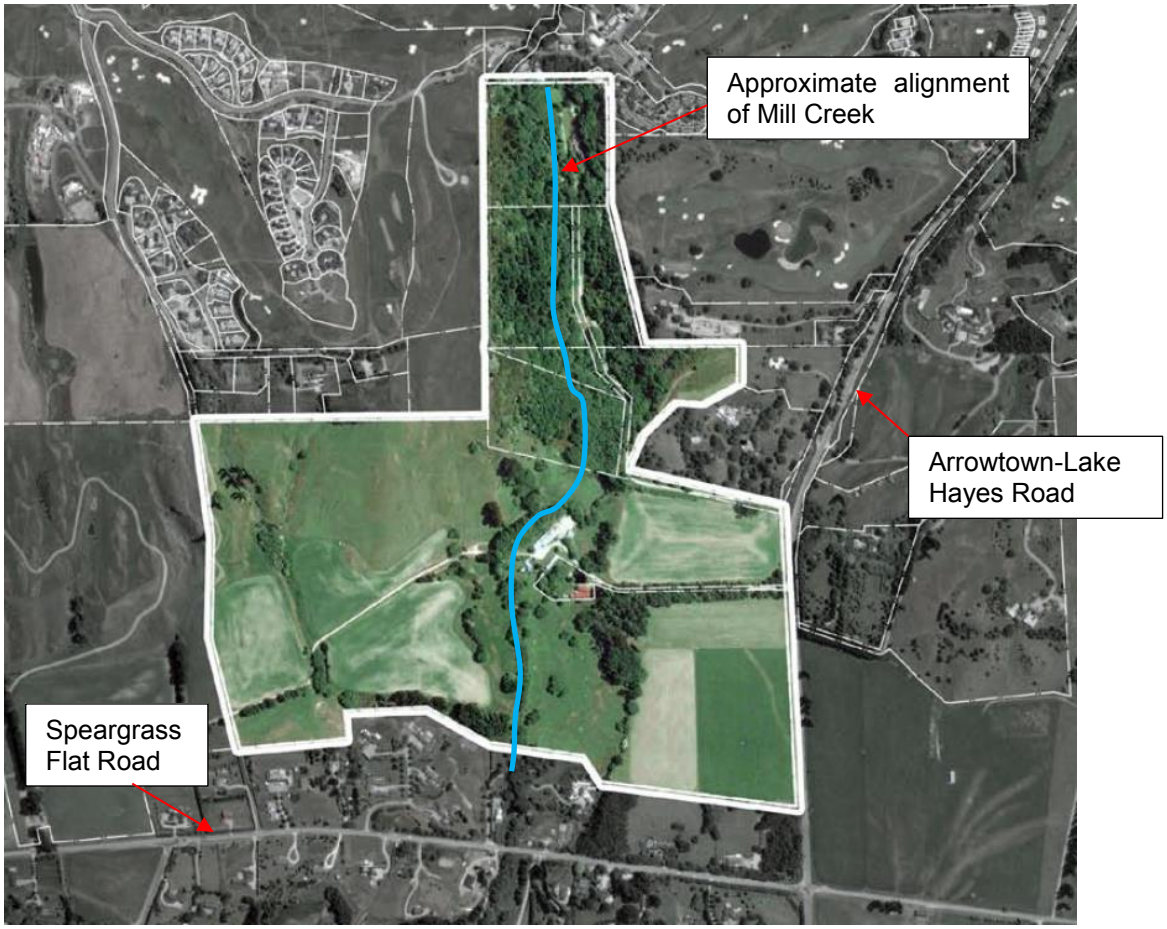


Figure 1: Location of the proposed Waterfall Park SHA development (Source: Expression of interest document)

Figure 2 shows the master plan of the proposed Waterfall Park SHA development.

Figure 2: Master plan of the proposed Waterfall Park SHA development (Source: Expression of interest document)

The extent of the developed area is approximately 500m in east-west direction and 1000m in north-south direction.

3 Specific Review of the Three Waters Infrastructure

3.1 Population Review

For the assessment of the infrastructure demands the expression of interest document assumes a design occupancy of 3 people lot. These assumptions are in line with the Queenstown Lakes District Council Land Development and Subdivision Code of Practice. A total resident number of 420 people has been calculated for the Waterfall Park SHA development.

The Holmes Consulting Group report states that the reports prepared by CFMA, Rationale and T+T for the assessment of the water supply, wastewater generation and stormwater management are based on a 150 lot development with a total of 450 residents. It is noted that the water demand and wastewater generation from a proposed restaurant/café is not accounted for in the stated calculations.

AS/NZS 1547:2012 recommends a wastewater generation figure of 25 l/p/day for tearooms and 30 l/p/d for restaurants.

Based on the flow figures from AS/NZS 1547:2012, we anticipate that the omitted water demand and wastewater generation from the restaurant/café of the Waterfall Park SHA will be somewhat less than the estimated figures by Rationale based on a 150 lot development and thus the wastewater generation and water demand figures used in the infrastructure assessments by Rationale and T+T appear to be adequately conservative.

3.2 Water Supply and Fire Fighting Design Review

The Queenstown Lakes District Council Land Development and Subdivision Code of Practice has been used for the assessment of the water demand. The specific design standards to be applied for the assessment of the water supply demand are included in Appendix 1.

The Holmes Consulting Group report refers to a T+T model of the water supply to the initially proposed 150 lot development. The expression of interest document does not state which water reticulation modelling software has been used.

The T+T specified the Lake Hayes water supply network as the potential water source for the new development. The water supply calculations have been based on the assumption that the Lake Hayes Estate water supply is no longer supplied by the Lake Hayes scheme but through the Shotover Country bores.

MWH confirmed that the Lake Hayes Estate water supply is now covered through the Shotover Country water supply scheme and is disconnected from the Lake Hayes Water Supply Scheme. Therefore, the design assumption about the water supply scheme in this report are verified. Lake Hayes Estate consists of approximately 600 lots. Consequently, the Lake Hayes Estate water demand is deemed higher than the water demand for the proposed 140 lot Waterfall Park SHA development.

In regards to firefighting requirements, T+T have assumed a fire hazard category FW2 fire and also assessed whether a FW3 supply can be provided. However, the Holmes Consulting Group report does not include any results from this assessment.

Based on SNZ PAS 4509:2008 (refer to Appendix 1.2), MWH assessed the fire hazard category as FW3 based on the assumption that a restaurant with a capacity >100 people will be part of the Waterfall Park SHA development.

MWH calculated design flows for proposed 140 lot Waterfall Park SHA. The figures are presented in Table 1 below. Table 1 also presents the MWH assumptions for the required firefighting flow and calculations of the reticulation design flow and the borefield capacity.

Table 1: Calculated design water flows for the proposed 140 lot Waterfall Park SHA development

	Proposed 140 lot development
Average daily flow (l/s)	3.4
Peak day flow (l/s) [2.35 times average day flow]	11.2
Peak hour flow (l/s) [6.6 times average day flow]	22.5
Peak hour (l/s)	22.5
Peak day flow (l/s)	11.2
Firefighting flow	25 (FW3)
Reticulation design flow (l/s)	**36.2**
Borefield capacity equals peak day flow rate (l/s)	11.2

The design flows calculated by T+T for the 150 lot development exceed the calculated design flows for the currently proposed 140 lot development. Therefore, the design assumptions from T+T are considered conservative for the current development and the water supply modelling results are still applicable for the proposed development.

The Holmes Consulting Group report states that an extension of the existing water supply network with a 150mm internal diameter main along the Arrowtown-Lake Hayes Road (approximately 300m long) would be required to connect the internal reticulation network within the development to the existing Lake Hayes Water Supply Scheme.

The Holmes Consulting Group refers to the installation of a 150mm ID main through the proposed Waterfall Park SHA development to provide for fire flows which should cater for a FW3 fire flow. To confirm this statement, a detailed water supply model for the currently proposed development is required.

MWH considers the water supply from the Lake Hayes Water Supply Scheme a feasible option for the proposed Waterfall Park development. The internal reticulation network within the development should be designed to cater for FW3 fire flow to the proposed restaurant.

3.3 Wastewater Design Review

The Queenstown Lakes District Council Land Development and Subdivision Code of Practice has been used for the infrastructure review of the generated wastewater volumes by the Holmes Consulting Group in the expression of interest document.

The design flows calculated by Rationale for the 150 lot development exceed the calculated design flows from Holmes Consulting Group for the currently proposed development. The calculated design flows for both developments are presented in Table 2 below:

Table 2: Design wastewater flows for the previously and currently proposed developments

	150 lot development (Rationale figures)	140 lot Waterfall Peak SHA development (Holmes Consulting figures)
Average dry weather flow (l/s)	Not stated	1.2
Peak wet weather flow (l/s)	8.5	6.1

The Holmes Consulting Group report concludes that the design assumptions from Rationale report are conservative for the current development and the wastewater discharge modelling results are still applicable for the new development.

Assuming that the omitted wastewater generation from the restaurant/bar does not exceed a peak wet weather flow of 2.4 l/s (the difference between the Rationale modelled peak wet weather flow and the estimated wet weather flow for the Waterfall Park SHA development), the results from the Rationale report are applicable.

3.3.1 Wastewater Discharge to the Council System

The proposed solution for the wastewater discharge from the new development is a gravity connection to the Lake Hayes Scheme. The specific connection point from the proposed development to the existing scheme are not stated. Modelling of the wastewater discharge from the previously proposed 150 lot development has been undertaken by Rationale. The modelling is based on the Wakatipu dynamic wastewater model. This model is the commonly used model for the Queenstown Lakes District.

Table 3 below compares the future day maximum inflow to Lake Hayes Pump Station 1 (PS1) between the assessment carried out by Rationale based on a 150 lot development and the proposed 140 lot Waterfall Park SHA development.

Table 3: Future day maximum inflow for the previously and currently proposed developments

	Rationale estimated flows with proposed 150 lots development	Holmes estimated flows with Waterfall Park SHA development
Future day maximum inflow (without new development) (l/s)	6	6
Future day maximum inflow (with new development) (l/s)	14.5	12.1

The Rationale modelling of the network downstream of PS1 has been based on a flow of 16 l/s

The Rationale report concluded that the existing infrastructure has adequate capacity for the formerly proposed 150 lot subdivision, with the exception of:

- Lake Hayes Pump Station 1 (PS1),
- the rising main from this pump station; and
- portions of the 150mm gravity network between PS1 and Lake Hayes Pump Station 2 (PS2).

The Holmes Consulting Group states that following modifications to the existing scheme are required to allow for the wastewater discharge into the Lake Hayes Wastewater Scheme:

- Upgrade of the pumps in the Lake Hayes Pump Station #1 located at the Lake Hayes Recreation Reserve at the north end of the lake
- Install additional emergency storage at the Lake Hayes Pump Station #1 or provide emergency power by means of a generator or supplemental power feed from the Lake Hayes bore site. MWH believe that this approach may not recognize the underlying issue that the cable may be too small to supply power (emergency or otherwise) to an upsized pump station. Thus, more work is required to specifically confirm the suitability or otherwise of the cable. Emergency storage or emergency generation will not address the issue of the cable capacity

To determine whether an upgrade of the rising main from PS1 and the gravity network between PS1 and PS2 as recommended by Rationale is required, the Holmes Consulting Group suggests that further modelling is undertaken with the calculated wastewater figures from the proposed 140 lot Waterfall Park SHA development (as presented in Table 3 above).

We note that the gravity network between PS1 and PS2 includes a gravity main along the Lake Hayes walking track between the entrance to the Lake Hayes Recreation Reserve at the north end of the lake and the Lake Hayes Pump Station #2 located at the Bendemeer Bay Reserve. An upgrade of the gravity main would be required to avoid overflows predicted by Rationale based on a PS1 pump flow of 16 l/s. Alternatively, we consider a more practical option is extending the rising main from the Lake Hayes Pump Station #1 directly along the Arrowtown Lake Hayes Road to the pump station at Bendemeer Reserve.

The Holmes Consulting Group notes that a pressure sewer solution may be a potential solution for the dispersed lots to the north of the development. No further detail about this solution is provided.

3.3.2 Wastewater Drainage within the Site

There is no detailed information on sizing and depth of the wastewater pipe system.

For the purpose of this review, the following assumptions have been made for the feasibility assessment of the wastewater reticulation system:

- DN150 wastewater discharge pipe
- 1:100 fall
- Longest part of discharge pipe on western side of Mill Creek is 400m
- Longest part of discharge pipe north-south direction is 800m
- Pipe cover of 1m

Applying the above assumptions indicates that there is sufficient fall along the proposed development to allow the implementation of the proposed wastewater management system.

It is noted that the connection point into the Council network has not been specified in the expression of interest document. Therefore, the feasibility of a gravity discharge to the connection point into the Council network could not be assessed. However, this section of pipe can be realised with a pump station within the development and a rising main to PS1 should any problems with this section arise in the further design.

Therefore, the proposed option for wastewater management is deemed feasible.

3.4 Stormwater Runoff Generated within the Development Area

Stormwater runoff generated within the development area has not been modelled as part of the expression of interest document. The information provided on the proposed stormwater management system is very limited. CFMA proposed in their report to install detention ponds at the southern end of the site to capture and treat stormwater before discharging into Mill Creek. Neither location nor design details for these ponds have been provided.

It is noted that a resource consent from the Otago Regional Council is required for the stormwater discharge into Mill Creek.

The expression of interest document does not include a site survey.

The requirements of the relevant documents for the design of the stormwater system are summarised in Appendix 2.

MWH have used the Queenstown Lakes District Council Land Development and Subdivision Code of Practice to undertake an 'order of magnitude' review of the stormwater run-off figures in the expression of interest document.

The Holmes Consulting Group report has used the Rational Method for the calculation of stormwater run-off from the area proposed to be developed.

Table 4 presents the results of the two run-off calculations:

Table 4: Stormwater run-off calculations pre- and post-development

	Developed area	Pre-development flow	Post-development flow
Calculated stormwater run-off by Holmes Consulting Group	14.2 ha	**323 l/s** 1 in 20 year return 20 min period	**923 l/s** 1 in 20 year return 10 min period

Holmes Consulting Group have undertaken a stormwater runoff calculation using a methodology consistent with current practice, although, no conclusions are drawn from the runoff results.

3.4.1 Stormwater Reticulation

The expression of interest document does not include any specific information on the stormwater collection and treatment system. The Holmes Consulting Group report refers to proposed detention ponds at the southern end of the site for stormwater treatment and discharge control into Mill Creek.

MWH has assumed that two separate stormwater systems on either side of Mill Creek will be implemented. The hypothetic system consists of piped stormwater collection with dedicated detention ponds at the southern end of the development side.

For the purpose of this review, the following assumptions have been made for the feasibility assessment by MWH:

- DN200 stormwater discharge pipe
- 1:100 fall
- Critical length of discharge pipe to pond on western side of Mill Creek is 100m
- Critical length of discharge pipe to pond on eastern side of Mill Creek is 200m
- Pipe cover of 1m
- Level of Mill Creek flow channel during flood at 341.5m at the pond locations

- Depth of pond structure is 1m

After analysis of preliminary and imprecise topographical maps of the site, MWH is not satisfied that stormwater management by means of a piped gravity system and detention pond is feasible.

Fall available on either side of Mill Creek within the most southern development area is minimal. The initial assessment has shown that the invert level of the detention ponds is located below the flood level of Mill Creek. Discharge through a reticulated gravity network to detention ponds at the southern end of the site *may* be possible but the expression of interest document does not include any detailed information to confirm this. A detailed survey of the site including the mean water level within Mill Creek and the proposed earthworks are required to confirm this.

If discharge into Mill Creek during flood levels is not possible, the detention ponds are required to be sized to provide further storage capacity. Moreover, the design of the detention pond need to consider the impact from surface flooding from Mill Creek and potential lateral subsoil flow during times of Mill Creek flood levels and address them adequately.

3.4.2 Stormwater Detention

On the basis of clause 4.3.5 of the Queenstown Lakes District Council Land Development and Subdivision Code of Practice and the Rational Method, the Holmes Consulting Group have calculated the pre- and post-development stormwater run-off. The difference between these two figures being the detention volume required to ensure that the post-development flow does not exceed pre-development flow. For the calculation of the post-development flow a return period of 1 in 20 was chosen. This is applicable for the design of primary system.

MWH notes that where there is no secondary flow path, the primary system shall cater for the worst case 1 in 100 year return period with no surface flooding.

The Holmes Consulting Group does not specify the required storage volume in the detention ponds nor does it provide any more detail on the pond design and construction. Therefore, MWH cannot carry out any further assessment of the stormwater detention system feasibility. A concept design of the stormwater reticulation and detention system is required.

3.5 Flooding Protection Review

The Fluent Solutions report on flood hazard mitigation states that part of the proposed Waterfall Park SHA development lies within an area of two flood related natural hazards identified in the Queenstown Lakes District Council GIS based Hazard Register data. These are:

- “Flood Hazard due to rainfall” resulting from flows that pass down Mill Stream; and
- Alluvial fan hazard – “Active Debris Dominant Fan” areas.

The report presents alluvial debris and flood risk mitigation measures. Fluent Solutions conclude that “the flood hazard assessment has not identified significant flood issues that cannot be resolved in a practical manner”.

The proposed alluvial debris mitigation measure by Fluent Solutions is the establishment of a 15m wide “No Build Zone” through the affected development area.

In terms of flood risk mitigation, Fluent Solutions states that the following flood mitigation works are required for the new development in order to protect habitable floors against a 100 year return period flood event with a 0.5m freeboard:

- Widening of the existing channel and providing scour protection in the upstream reach of the floodway; and
- Formation of flood protection banks to confine flood flows in the lower middle reach within the residential area.

Based on a 1 in 100 year return period, Fluent Solutions calculates the flow through Mill Creek to the order of 100 m^3/s with a depth of the flow estimated to approximately 1.8m at a confined stream section. No reduced level of the mean water level within Mill Creek is provided in the expression of interest document.

The Fluent Solutions report does not include the calculation details which were used to derive the flow through Mill Creek and the resulting flow depth. However, MWH compared the results with the flow data from the Otago Regional Council at the measuring point Mill Creek at Fish Trap. The results of the Fluent Solutions report are consistent with the reviewed Otago Regional Council data consider these to be credible.

Assuming that the mitigation measures as specified by Fluent Solutions are implemented as part of the new development, MWH considers the flood risks for buildings and damage to infrastructure adequately addressed.

3.5.1 Separation of Flooding and Wastewater Drainage

The potential for contamination of surface water with wastewater has not been addressed in the Fluent Solutions report. For this purpose, we have assumed that stormwater and wastewater drainage pipelines will be laid along similar alignments. This assessment indicates that there is a significant risk of the wastewater system becoming infiltrated with flood water from Mill Creek on the low lying areas of the development around Mill Creek.

It is noted that this is an initial assessment, and should be checked as part of detailed design.

The gravity discharge pipe to the connection point into the Council network has not been assessed.

Appendix 1 – Water Supply Guidelines

A.1.1 Water Supply Guidelines Clarification

MWH Ref: Z15707

20 November 2007

Queenstown Lakes District Council
Private Bag 50072
QUEENSTOWN

Attention: John Porter
Water Services Manager

Dear Sir

QLDC 07/02 Water Services Network Management
Notice To Engineer No. 042
Water Supply Peaking Factor Clarifications

The purpose of this notice is to clarify elements of the Queenstown District Councils amendments to NZS 4404:2004 that relate to water supply.

Background

QLDC produced a document of amendments to NZS 4404:2004 in September 2005. This document included Council's specific requirements for section 6.11.5 of NZS 4404:2002 relating to water supply.

It has been noted that Councils amendments to NZS 4404:2004 and the requirements in Councils Asset Management Plans (AMP) have been applied inconsistently by various parties. In some cases the extent of the variation of application of these guidelines has been significant.

This document is intended to clarify the use of the AMP and amendments to NZS 4404:2004 and to obtain consistency in approach between those using these documents.

The preparation of this document follows a meeting attended by the following organisations:

- Connell Wagner (Martin Dasler)
- GHD (Graham Robinson)
- Tonkin and Taylor (Robert Frost)
- Rationale (Tom Lucas)
- Hadley Consultants (John McCartney)
- MWH (Derek Chinn)

Recommendations

Basic Factors

The basic factors are as follows:

1. Average Daily domestic flow rate = 700 litres / person / day
2. Occupancy per residence = 3 people
3. High density accommodation Average Daily Flow rate = 350 litres / person / day; occupancy 2 people per bedroom.
4. Queenstown Peak Day Flow rate = 2.35 times Average Day Flow rate
5. All other places Peak Day Flow rate = 3.3 times Average Day Flow rate

6. Queenstown Peak Hour Flow rate = 4.0 times the Average Day Flow rate
7. All other places Peak Hour Flow rate = 6.6 times the Average Day Flow rate

High Density accommodation is defined as including three of the following:

- Gross floor area less than 202 m^2
- Development must be at least 4 units
- Units must be joined
- Overall site building coverage > 30%

Borefield and Intake Designs
It was agreed on the following interpretation would be used when designing new intakes or bores supplying systems including a reservoir designed in accordance with Councils AMP:

1. Bore/intake capacity = Peak Day Flow rate

Where the intake or bore pumps directly into a reticulation network without a reservoir, the bore or intake is to be designed to supply the design capacity of the reticulation network.

Reticulation Network Design
It was agreed that the following interpretation would be used when designing new water reticulation systems:
The reticulation system shall be designed to convey the greater of:

1. Peak Hour Flow rate
2. Fire fighting flows plus Peak Day Flow rate

The pressure requirements are:

1. At Peak Hour minimum 300 kPa at each service connection
2. Maximum of 900 kPa at every point in the reticulation network at any time
3. All hydrants have residual pressure of 100 kPa while fire flow is being abstracted under the Peak Day Demand

Reservoir Design
It was agreed that reservoirs shall be designed with minimum available storage volume comprising of the sum of the following:

1. Fire fighting reserve (W5 - 540m^3, W4 - 180m^3, W3 - 45 m^3) plus;
2. Emergency Storage of 4 hours of the Peak Day Flow rate + 1 hour of indirect peak flow rate (flow to other reservoirs and flow to other than the reticulation network) plus;
3. Working Storage of 8 hours of Average Daily Flow rate to the network

Where standby generators, standby pumps and duplicate rising mains are provided, the AMP does not require emergency storage.

Resource Consent & Level of Service Issues
Council has adopted the amendments to NZS 4404:2003 and these amendments plus the requirements of Councils AMP's are a requirement for Engineering Approval of Subdivision Plans.

If the QLDC is to operate an 'on demand' system it is necessary to have capacity to match the intake maximum daily capacity the peak day demand. The QLDC has adopted the above figures for calculating this peak.

The Otago Regional Council will not necessarily issue a water permit based on the QLDC's amendments to NZS 4404:2003. A new development may have to have a bore of a certain capacity to satisfy the QLDC's amendments and the Otago Regional Council may not issue a resource consent for this Peak Day abstraction rate.

Council is currently undertaking a Water Demand Management Strategy to develop approaches to minimising water demand. This document will go some way to identifying demands in specific locations and Average Day to Peak Day factors for those locations. The Demand Management Strategy will identify measures for minimising water demand in different areas. This work may recommend different demand and peaking factors for different communities.

In the interim the QLDC has adopted the above figures and generally, but not always, applies these figures. We note that neither Arrowtown nor Lake Hayes schemes have a peaking factor applied to the bore capacity.

Until other factors are adopted by the QLDC Scoping reports and designs for new schemes should use the figures in this notice unless specific justification for a variation is accepted by Council.

Yours sincerely
MWH New Zealand Limited

Derek Chinn
Engineer

A.1.2 Applicable Standards for Firefighting Flows

SNZ PAS 4509:2008 shall be applied to assess the firefighting flow.

Table 1 – Method for determining required water supply classification

Sprinklered structures															
Category	**Water supply classification (see table 2)**														
Single family homes with a sprinkler system installed to an approved Standard	FW1														
All other structures (apart from single family homes) with a sprinkler system installed to an approved Standard	FW2														
Non-sprinklered structures															
Category	**Water supply classification (see table 2)**														
Housing; includes single family dwellings, multi-unit dwellings, but excludes multi-storey apartment blocks	FW2														
All other structures (characterised by fire hazard category[1]), examples of which are given below	**Water supply classification (see table 2)**														
	Floor area of largest firecell of the building (m^2)														
	0-199[10]	200-399	400-599	600-799	800-999	1000-1199	1200-1399	1400-1599	1600-1799	1800-1999	2000-2199	2200-2399	2400-2599	2600-2799	> 2800
FHC 1[2]	FW3	FW3	FW3	FW4	FW4	FW4	FW5	FW5	FW5	FW5	FW5	FW5	FW5	FW5	FW6
FHC 2[3]	FW3	FW3	FW4	FW5	FW5	FW5	FW6	FW6	FW6	FW7	FW7	FW7	FW7	FW7	FW7
FHC 3[4]	FW3	FW4	FW5	FW5	FW6	FW6	FW7	FW7	FW7	FW7	FW7	FW7	FW7	FW7	FW7
FHC 4[5]	FW4	FW6	FW6	FW6	FW6	FW7	FW7	FW7	FW7	FW7	FW7	FW7	FW7	FW7	FW7
For special or isolated hazards not covered in above categories [9]	FW7														

NOTE –
(1) Fire hazard category as defined in the compliance documents for the New Zealand Building Code, Acceptable Solution C/AS1.
(2) FHC 1 is sleeping activities including care facilities, motels, hotels, hostels; crowd activities of <100 people including cinemas, art galleries, community halls, lecture halls, churches; working/business/storage activities processing non-combustible materials such as wineries, cattle yards, horticultural products; multistorey apartment blocks.
(3) FHC 2 is crowd activities of >100 people, libraries, book storage, night clubs, restaurants; working/business/storage activities with low fire load such as hairdressers, banks, medical consulting rooms, offices.
(4) FHC 3 is working/business/storage activities with medium fire load such as manufacturing, processing, bulk storage up to 3 metres.
(5) FHC 4 is working/business/storage activities with high fire load such as chemical manufacturing, feed mills, plastics manufacturing, supermarkets or other stores with bulk display over 3 metres.
(6) For special or isolated fire hazards in an area with a lower water supply classification, an assessment should be carried out to determine measures to mitigate the hazard or increase the water supply (see 4.4).
(7) The values in the table were determined by heat release rate modelling for fully developed fires.
(8) All non-sprinkler protected structures, except houses, have an entry level of FW3.
(9) Examples of special or isolated hazards may include bulk fuel installations, timber yards, tyre dumps, wood chip stock piles, recycle depots, and marinas.
(10) For non-sprinkler protected fire hazard category 1 structures less than 50 m^2 in floor area, the FW3 requirement may be reduced by up to 50% with the agreement of the Fire Region Manager. Examples of the sorts of structures intended to be covered by this comment are predominantly garages, sheds, and outbuildings.

SNZ PAS 4509:2008

Figure A-1: Method for determining required water supply classification

Table 2 – Method for determining firefighting water supply

	Reticulated water supply			**Non-reticulated water supply**	
Fire water classification	**Required water flow within a distance of 135 m**	**Additional water flow within a distance of 270 m**	**Maximum number of fire hydrants to provide flow**	**Minimum water storage within a distance of 90 m** (see Note 8)	
				Time (firefighting) (min)	**Volume** (m^3)
FW1	450 L/min (7.5 L/s) (See Note 3)	–	1	15	7
FW2	750 L/min (12.5 L/s)	750 L/min (12.5 L/s)	2	30	45
FW3	1500 L/min (25 L/s)	1500 L/min (25 L/s)	3	60	180
FW4	3000 L/min (50 L/s)	3000 L/min (50 L/s)	4	90	540
FW5	4500 L/min (75 L/s)	4500 L/min (75 L/s)	6	120	1080
FW6	6000 L/min (100 L/s)	6000 L/min (100 L/s)	8	180	2160
FW7	As calculated (see Note 7)				

Figure A-2: Method for determining firefighting water supply

Appendix 2 – Applicable Standards for Stormwater Management

A.2.1 Clause E1 Surface Water of the New Zealand Building Code

Clause E1 'Surface Water' of the New Zealand Building Code has the following requirements regarding surface water entering buildings;

FUNCTIONAL REQUIREMENT

E1.2 *Buildings* and *sitework* shall be constructed in a way that protects people and *other property* from the adverse effects of *surface water.*

PERFORMANCE

E1.3.1 Except as otherwise required under the Resource Management Act 1991 for the protection of *other property*, *surface water*, resulting from an event having a 10% probability of occurring annually and which is collected or concentrated by *buildings* or *sitework*, shall be disposed of in a way that avoids the likelihood of damage or nuisance to *other property.*

E1.3.2 *Surface water*, resulting from an event having a 2% probability of occurring annually, shall not enter *buildings.*

Figure A-3: Relevant sections of Clause E1 of the NZBC relating to stormwater return period

A.2.2 NZS 4404 2010

The requirements in NZS 4404:2010 New Zealand Standard for Land Development and Subdivision Infrastructure are reproduced in the table from the standard below.

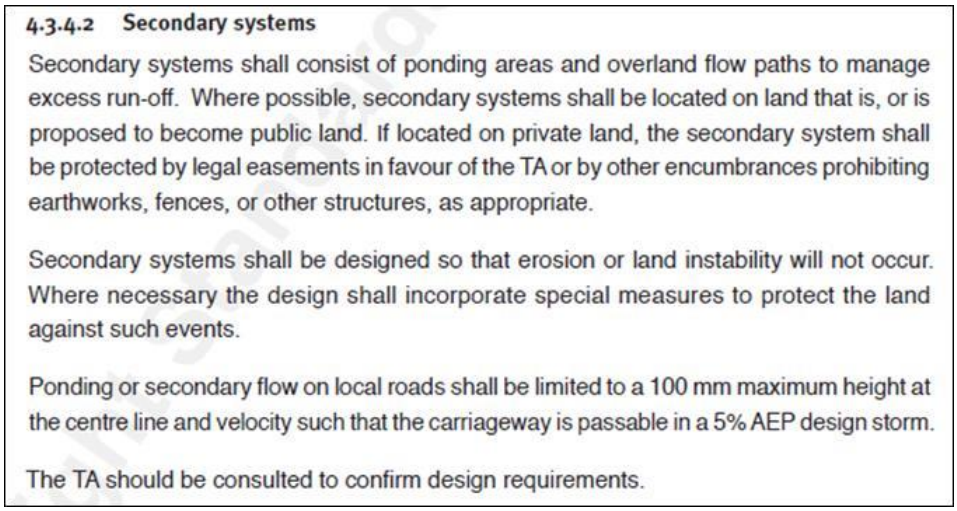
Table 4.1 – Recommended AEP for design storms

Function	AEP (%)	Return period (years)
Primary systems –		
Rural	20	5
Residential and rural residential areas	10	10
Commercial and industrial areas	10	10
All areas where no secondary flow path is available	1	100
Secondary systems	1	100

Figure A-4: Relevant sections of NZS 4404 relating to stormwater return period

NZS 4404 2010 also makes the following recommendations regarding secondary flow systems.

MWH®



4.3.4.2 Secondary systems

Secondary systems shall consist of ponding areas and overland flow paths to manage excess run-off. Where possible, secondary systems shall be located on land that is, or is proposed to become public land. If located on private land, the secondary system shall be protected by legal easements in favour of the TA or by other encumbrances prohibiting earthworks, fences, or other structures, as appropriate.

Secondary systems shall be designed so that erosion or land instability will not occur. Where necessary the design shall incorporate special measures to protect the land against such events.

Ponding or secondary flow on local roads shall be limited to a 100 mm maximum height at the centre line and velocity such that the carriageway is passable in a 5% AEP design storm.

The TA should be consulted to confirm design requirements.

Figure A-5: Relevant sections of NZS 4404 relating to stormwater secondary flow

A.2.3 Queenstown Lakes District Council Land Development and Subdivision Code of Practice

The Queenstown Lakes District Council Land Development and Subdivision Code of Practice are reproduced in the table from the code below.

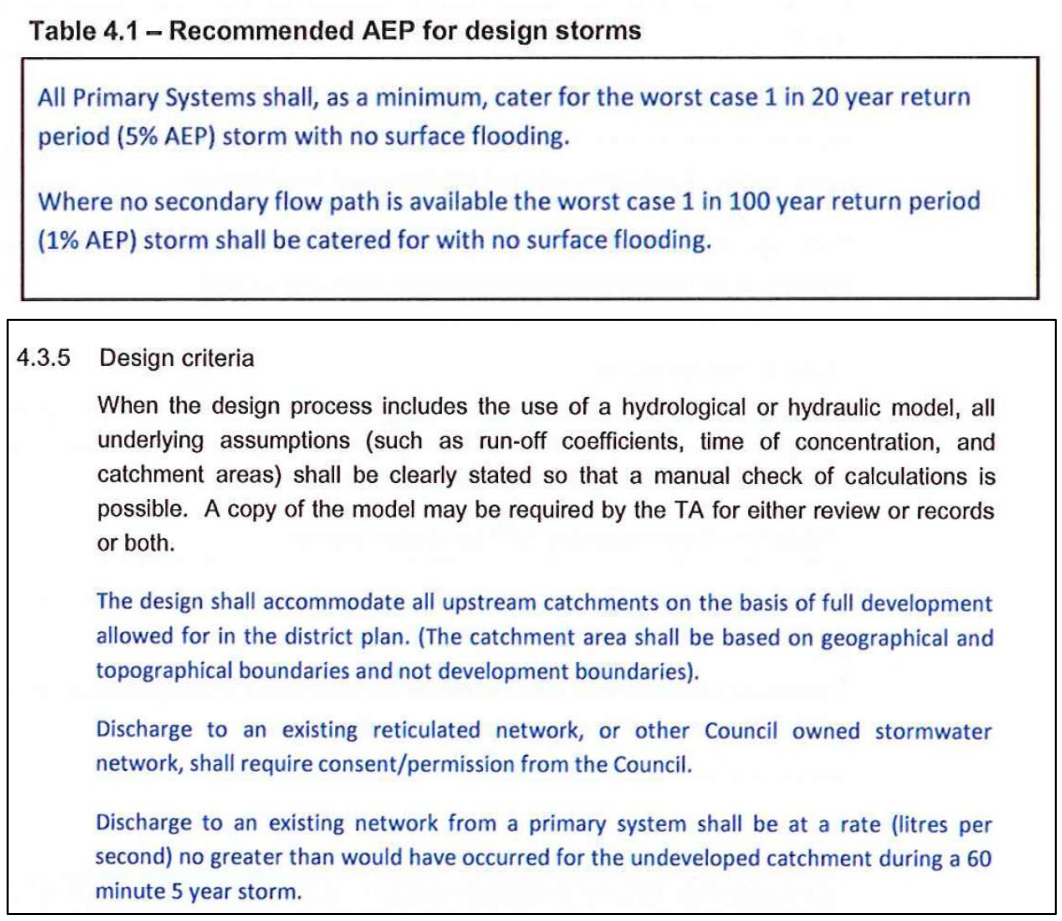


Table 4.1 – Recommended AEP for design storms

All Primary Systems shall, as a minimum, cater for the worst case 1 in 20 year return period (5% AEP) storm with no surface flooding.

Where no secondary flow path is available the worst case 1 in 100 year return period (1% AEP) storm shall be catered for with no surface flooding.

4.3.5 Design criteria

When the design process includes the use of a hydrological or hydraulic model, all underlying assumptions (such as run-off coefficients, time of concentration, and catchment areas) shall be clearly stated so that a manual check of calculations is possible. A copy of the model may be required by the TA for either review or records or both.

The design shall accommodate all upstream catchments on the basis of full development allowed for in the district plan. (The catchment area shall be based on geographical and topographical boundaries and not development boundaries).

Discharge to an existing reticulated network, or other Council owned stormwater network, shall require consent/permission from the Council.

Discharge to an existing network from a primary system shall be at a rate (litres per second) no greater than would have occurred for the undeveloped catchment during a 60 minute 5 year storm.

Figure A-6: Relevant sections of the Queenstown Lakes District Council Land Development and Subdivision Code of Practice

MEMORANDUM

To:	Anita Vanstone		
Company:	Queenstown Lakes District Council		
From:	Andrea Jarvis		
Date	19 July 2016	Project No:	114649.00
Subject:	WATERFALL PARK - INFRASTRUCTURE REPORT CLARIFICATION		

This memorandum is to clarify some aspects of our infrastructure report for Waterfall Park, in response to the MWH three waters review. It is noted in general that the intention at this stage of the project is only to discuss feasibility, and concept designs will not be progressed until acceptance of the SHA application is confirmed.

1.1 Water

We concur with MWH that water supply to the Waterfall Park site is feasible, as supported by the initial modelling carried out. We also concur that full, updated modelling of the scheme will be required during the detailed design phase.

1.2 Sewer

We concur with MWH that it is feasible to drain wastewater from the Waterfall Park site. With regard to their comments relating to upgrades to the network, as noted in our report, we agree that upgrades to the Lake Hayes Pump Station #1 are required, and note that the initial modelling undertaken highlights the need for some upgrades to this pumping station regardless of whether Waterfall Park connects to it or not. As outlined in our report, we also agree that any gravity main upgrades or rising main upgrades would be considered concurrently to determine the best solution for the network during future design phases.

1.3 Stormwater

As outlined in our infrastructure report, the stormwater from the Waterfall Park site will be both treated and attenuated within the site before being discharged to Mill Creek at pre-development flows. The net effect on the creek will be nil, with the methodology, levels, number of attenuation and treatment devices/locations and other details determined during future design phases. Coordination with flood levels, including outlet design and any backflow prevention devices necessary will be determined in future design phases.

Andrea Jarvis
PROJECT DIRECTOR
Holmes Consulting Group LP
www.holmesgroup.com
Queenstown
T: +64 (03) 441 3055

Copies to: Ben Farrell, JEA
Andrew Cavill, Winton Partners

Otago Regional Council

Our Reference: A915747

1 July 2016

Anita Vanstone
Queenstown Lakes District Council
PO Box 50072
Queenstown

Dear Anita

ORC feedback on expression of interest for the Waterfall Park proposal as a Special Housing Area

1. Background

Otago Regional Council (ORC) has provided Queenstown Lakes District Council (QLDC) feedback on proposal for similar large developments as Special Housing Areas in June 2015 and February 2016.

Again, given the information supporting the proposal is not detailed, nor complete at this time, I can only provide an indication of issues the ORC would expect to see further addressed in any formal application, before considering a decision on its position.

ORC considers it as important to provide QLDC with any preliminary concerns ORC holds in respect to aspects of the proposals prior to making their decision.

2. Natural Hazards

ORC notes the following points:

- There is an active debris-dominated alluvial fan through the centre of the proposed development area (with a 100 annual return interval).
- Residential development will significantly increase risk.
- A geotechnical and flood hazard review has been provided and make a number of recommendations. ORC expects these recommendations would be followed if the project proceeds further.
- It is noted the geotechnical report only covers approximately half the proposed development area and that no geotechnical test appear to have been undertaken in the forested section of the Waterfall Park development where significant development is proposed. Consideration should be given if further work in this area is necessary due to the potential for liquefiable soils.

- No mention is made of rock fall risk in the confined Waterfall Park section of the development. ORC notes while it may not be an issue, it is a matter to consider in a steep, confined valley.

3. Stormwater

Storm water proposed to be discharged to Mill Stream will be required to have no decrease in the quality of storm water discharge from this site nor an increase in its rate of discharge. The activity of stormwater discharging and associate activities (detention ponds etc) should be discussed with ORC's consents team to determine how ORC's plans may apply.

4. Regional Transport

ORC seeks that a strategic approach is considered to address transport issues, particularly public transport, to, from and within these developments as well as connection to other necessary infrastructure. In particular, ORC would expect QLDC and the developer to pay adequate attention in the proposal to:

- Linking the subdivision by cycleway to Arrowtown, Frankton and Queenstown, and by footpath to Arrowtown and Lakes Hayes; and
- The development would need adequate footpaths, on both sides of the internal roads, for people to walk directly through to any bus stop on the main road, or near entrances to the development; this may require shortcut lanes between houses to ensure the walking route to the bus stop is direct.

Any proposal should have regard to the Otago Southland Regional Land Transport Plans 2015-2021.

5. Passenger Transport

ORC passenger transport staff have expressed no specific concerns with the proposal. However, it is appropriate to reiterate ORC's earlier comments for a large residential development in this area:

- The proposed development is isolated from other residential areas and this can be problematic for providing public transport.
- Isolated developments results in a lot of "dead" running where there are no passengers to pick up- e.g. running past paddocks and this type of land use leads to indirect services, as the routes need to deviate to pick people up.
- Consideration needs to be given to the likely cost implications and uptake of any public passenger transport service to ensure it is feasible and sustainable.

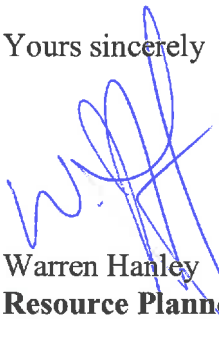
Any proposal should have regard to the Regional Public Transport Plan 2014.

Compliance with other higher level regulations such as National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health will also be important.

Otago Regional Council

Please contact me at this office if you have any further questions.

Yours sincerely



Warren Hanley
Resource Planner – Liaison

MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

1 July 2016

Anita Vanstone – Senior Planner
Queenstown Lakes District Council
Private Bag 50072
Queenstown 9348
New Zealand

Dear Anita

Expression of Interest – Waterfall Park: Proposed Special Housing Area

Thank you for your email of 20 June 2016 seeking the Ministry of Education's feedback on the proposed Waterfall Park special housing area.

Having considered the proposal the Ministry expects that there would be a minimal impact on the schooling network from the Waterfall Park proposal. It is noted that 100 dwellings of the 141 dwellings estimated from the SHA were already identified in the QLDC's dwelling capacity model data.

The Ministry's revised planning for Arrowtown School has considered the potential residential growth within the enrolment scheme home zone of Arrowtown School. This planning includes a review of the master plan and an expanded master planning roll for the site. The revised master plan is yet to be completed and therefore a final site capacity is yet to be determined.

The Ministry of Education anticipates that any increase in school age children resulting from this proposal will have a negligible direct impact on Arrowtown School.

It is noted that consideration of individual proposals that result in having a negligible direct impact may not account for the cumulative impact of incremental change through private plan changes and further SHA proposals, or changes to the operative District Plan. The Ministry will continue to monitor ongoing growth and how the planning context impacts this, and would like to establish regular and ongoing engagement with QLDC will to support this.

Yours sincerely

Kathryn Palmer
Manager Education Otago Southland

DDI: 03 4715209 or 027 433 2126
Email: kathryn.palmer@education.govt.nz

KTKO LTD consultancy

13 July 2016

Queenstown Lakes District Council
Private Bag 50072
QUEENSTOWN 9348

Attn: Anita Vanstone

Special Housing Area- Queenstown Lakes District Council

Proposal
Ngā Rūnanga understands that the Queenstown Lakes District Council are seeking advice on Māori archaeological and cultural values for:

- Special Housing Area – Waterfall Park, Queenstown (as specified in the information provided)

Situation
Kāi Tahu ki Otago Ltd writes this report on behalf of Kāti Huirapa Rūnaka ki Puketeraki and Te Rūnanga o Ōtākou, two of the kaitiaki Rūnanga whose takiwā includes the site the proposal relates to.

Decision
Rūnanga representatives have been informed of the proposal received 20 June 2016.
Please be advised that Ngā Rūnanga have no specific concerns with the above proposed Special Housing Areas, but do request the following be a condition:-

- If kōiwi (human skeletal remains), waahi taoka (resource or object of importance including greenstone/pounamu), waahi tapu (place or feature of special significance) or other artefact materials are discovered work shall stop, allowing for a site inspection by the appropriate Rūnaka and their advisors and the Heritage New Zealand Regional Archaeologist. In the case of kōiwi, the New Zealand Police must also be advised. These people will determine if the discovery is likely to be extensive and whether a thorough site investigation will be required. Materials discovered should be handled and removed by takata whenua who possess knowledge of tikanga (protocol) appropriate to their removal or preservation and an appointed qualified archaeologist. (All Māori archaeological sites are protected under the Heritage New Zealand Pouhere Taonga Act 2014).

Ngā Rūnanga would like it noted that although there are no recorded Maori archaeological sites within the boundaries of the proposed Special Housing Area, the area is known to be utilised by Maori in the past. Therefore, any earthworks undertaken should be carried out in a way that allows monitoring for artefacts or archaeological material.

From the information provided, Ngā Rūnanga understand that the existing infrastructure will accommodate the new Special Housing Area.

Ngā Rūnanga understand that if the site is accepted as a Special Housing Area, that the Developer will be required to apply for resource consent applications related to the proposed subdivisions, for which Ngā Rūnanga may or may not make a submission.

KTKO Ltd
Level 1, 258 Stuart Street, P O Box 446, Dunedin 9054, New Zealand
Phone - 03 477 0071
info@ktkoltd.co.nz www.ktkoltd.co.nz

This reply is specific to the above proposal. Any changes to the proposal will require further consultation.

Kāi Tahu ki Otago Ltd request that the Council forward a copy of the recommending report, and if issued, a copy of the consent.

Nahaku noa
Na

Chris Rosenbrock
Manager

cc Kāti Huirapa Rūnaka ki Puketeraki
Te Rūnanga o Ōtākou

NZ TRANSPORT AGENCY
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24 June 2016

Chief Executive
Queenstown Lakes District Council
Private Bag 50072
QUEENSTOWN 9348

Attention: Anita Vanstone

Dear Anita

Winton Partners - Proposed Waterfall Park Special Housing Area

Thank you for recently providing details of the above proposal to the NZ Transport Agency for comment. We understand that the proposal relates to a development of up to 141 housing lots (ranging in size from 288m² to 4000m² in area) at 341-345 Arrowtown Lake Hayes Road, Arrowtown. Access to the site will be from a formed intersection on Arrowtown Lake Hayes Road.

On the basis of the information currently available to us, we are satisfied that the proposal is unlikely to have a significant adverse effect on the safety, efficiency and functionality of the State Highway 6/ Arrowtown Lake Hayes Road intersection, especially in the short to medium term. We are satisfied that the intersection is likely to be able to accommodate the traffic likely to be generated by this proposal.

We do have some concerns around the longer term operational capability of the State highway in this part of the Wakatipu Basin, particularly given the growing volume of consented but unrealised residential development on the eastern side of the Shotover River. It may ultimately prove difficult in the short to medium term to reprioritise investment funding to deliver on any required capital assets such as a new State highway bridge to respond to what is unanticipated and/or unintentional residential growth on the eastern side of the Shotover River delta.

Please do not hesitate to contact me if you have any further queries or require further information.

Yours sincerely

Kirsten Tebbutt
Planning and Investment Manager - Southern (Acting)