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**APPENDIX D**

Holmes Consulting Group: Infrastructure Assessment  
and two Addenda



## REPORT

STRUCTURAL AND CIVIL ENGINEERS

LAKEVIEW PLAN CHANGE

INFRASTRUCTURE ASSESSMENT

PREPARED FOR

QUEENSTOWN LAKES DISTRICT COUNCIL

111265

JULY 2014





## Lakeview Plan Change Infrastructure Assessment

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The QLDC-led Queenstown Convention Centre proposal is being considered as part of a wider mixed-use development over much of the Lakeview site, above the Queenstown CBD, including residential, commercial and public/recreational purposes. To determine the feasibility of the plan change associated with this wider development on this site, an investigation has been undertaken to assess the infrastructure effects of the development, both within and outside the subject site.

It is noted that two possible developments are being considered for the site – a convention centre and a hot pools tourism activity. For the purpose of this assessment of infrastructure effects for the plan change, these possible developments have been considered in the range of activities that may develop at the subject site.

### WATER SUPPLY

The water infrastructure in the area of the plan change is considered adequate to support the future development, with no major infrastructure upgrades required.

The domestic water demand generated on the site is not likely to be the governing factor when considering the impact on the water supply infrastructure. Rather, fire fighting water supply demand is far greater; this has formed the basis of this analysis.

However, to service the individual development elements a new water ring main is required, including two new fire hydrants. A bypass device to provide security of supply is recommended if the ring main cannot be connected to an alternative supply pathway at the Isle Street end of the site.

### WASTEWATER

QLDC's wastewater infrastructure provides a number of potential connection points below the site, and these have been assessed to determine the potential capacity available for use by the development of the Lakeview site in accordance with the proposed zoning. Of these, two mains were found to be at the right depth and in an appropriate location for use by any future development. The flows from the development will logically split to use approximately half of the spare capacity in each of those lines.

Whilst this high level analysis suggests no required upgrades to the QLDC infrastructure outside of the site, gravity sewer lines will be required within the site to transport the wastewater to the local infrastructure.

### STORMWATER

As the future development of the Lakeview site will comprise mainly impermeable surfaces, and the existing site (camping ground) is mainly grassed, site development will significantly increase the stormwater run-off over the baseline situation.

A high level analysis of the existing stormwater network identified no spare capacity within the local infrastructure, particularly at manholes and junctions. It is therefore

determined that a new 525 mm diameter stormwater main will be required to be laid within Brunswick Street to convey stormwater to Lake Wakatipu, via a proprietary stormwater treatment device to accommodate future development of the site.

The portion of the site draining via the stormwater mains that pass from Glasgow Street through to Kilmarnock Street will utilise all of the remaining capacity in this line. Therefore attenuation of stormwater within this area to reduce the peak run-off rates is recommended.

Gravity stormwater infrastructure within the site will also be required to accommodate the future development of the site, to deliver the stormwater run-off from the site to the new external trunk main.

#### GAS

The site is located directly above the Queenstown CBD and as such is in close proximity to hotels and other facilities currently utilising LPG gas for hot water, cooking and heating. This LPG gas infrastructure external to the site is adequate to support the future development provided for by way of the proposed plan change. However, as per the water and other services, a ring main through the site will be required to service the individual elements within the site.

#### POWER

Although Aurora Energy's network surrounds and traverses the site, the switch gear, transformers and associated discrete infrastructure elements associated with the power network in the area have been sized to support the buildings or developments they are associated with. As such, it is necessary when considering the plan change to allow for this infrastructure.

Further, the Aurora feeder main currently traversing the site may require relocation to avoid clashes with future structures.

#### TELECOMMUNICATIONS

Specific confirmation of the ability of the telecommunications network to support the proposed plan change has not been received at this time, however, due to the location of the site within the area of benefit for the Ultra-Fast Broadband roll out, the network is assumed to have the capacity to support the development.

Telecommunications ducts will need to be installed within the common services trench along with the power, gas and water supply infrastructure to service future development.



The Queenstown Lakes District Council is proposing a plan change to re-zone the Lakeview site to a commercial-mixed use zone. The Lakeview site currently contains the QLDC owned Queenstown Lakeview Holiday Park, which is currently operated by CCR Ltd, a local consortium. The Lakeview Sub-Zone incorporates the area shown on the plan below:



The proposed plan change will provide for residential, commercial and public/recreational uses at the site. The Convention Centre and a hot pools tourism activity development are being considered as part of a wider mixed-use development at the site under the proposed plan change, as depicted on the proposed master plan for the council owned portion of the site shown below:



For the purposes of this assessment two hotels have been considered, a 150 bed hotel within the Council-owned portion of the site, and a 124 bed hotel in the land south of the Lynch Block (shown as Development Land #2 on the master plan above). Further to this, a total of 191 residential units (of which 6 are in the same block of land as the 124 bed hotel described above) have been allowed for.

The feasibility of servicing the site when developed in accordance with the proposed zoning via local infrastructure therefore needs to be assessed to support the plan change application.

## 1.1 SCOPE OF WORK

The scope of work for this project included the following:

- Revise our previous report, assessing the existing load on the infrastructure from the current camping ground activity and comparing this to the load expected to be generated by the change of zoning at the site
- Revise our assessment of the impact of the proposed development on the existing wastewater, water supply, stormwater, gas reticulation, power and telecommunications infrastructure to address future development provided for by the plan change
- Revise our recommended upgrades to the above mentioned infrastructure both external to and within the site to accommodate future development provided for via the plan change

This report is intended to provide sufficient information for QLDC to support the Plan Change request for the Lakeview site.

## 1.2 ASSUMPTIONS

The investigation at this stage is a high level assessment only, and the detail around each component of the proposed/future development at the site is not yet known. As such, the infrastructure demand for the commercial developments has generally been considered using averaged per hectare rates as provided in NZS4404:2010 (Land Development and Subdivision Infrastructure). Residential loads have been assessed based on the QLDC amendments to NZS4404:2004 (the amendments have not been updated to account for the most recent release of the standard). The possible development of the convention centre and hot pools tourism venture have been included in this assessment as these activities are currently under consideration for this site.

The assessment of the baseline situation (the camping ground) and its effect on the existing infrastructure has made the following assumptions: in accordance with the Camping Ground Regulations 1985, an occupancy of 3.5 people per site has been assumed for powered and unpowered sites, and full occupancy of the cabins. This represents the peak demand during times of full occupancy, for example during the summer holiday peak tourist season.

All levels provided within this report are given relative to mean sea level.

### 1.3 LIMITATIONS

Findings presented as a part of this project are for the sole use of Queenstown Lakes District Council in its evaluation of the subject properties. The findings are not intended for use by other parties, and may not contain sufficient information for the purposes of other parties or other uses. Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice presented in this report.



## 2.1 EXISTING INFRASTRUCTURE

The QLDC wastewater infrastructure is well distributed around the subject site. In particular, there are existing connection points adjacent to the site as follows:

- 150 mm PVC line running West along Thompson Street, passing to the West of the Rydges Hotel and eventually connecting in to the 475 mm diameter trunk main along Lake Esplanade (**Line 1**)
- 150 mm PVC line through the centre of the subject site, connecting in to an 150 mm diameter AC line that passes down Brunswick Street to Lake Esplanade (**Line 2**)
- 100 mm PVC line connecting to a 150 mm PVC line from Isle Street to Hay Street and on to Lake Esplanade (**Line 3**)

### 2.1.1 Capacity

The invert levels and lengths of the individual pipes making up lines 1, 2 and 3 as defined above have been taken from QLDC's GIS information and the slopes calculated to determine the capacity of each of these pipes. These calculations are shown in Appendix 3.

The catchments feeding in to each of these pipes was then assessed and a conservative number of equivalent dwellings assessed. NZS4404:2010 provides that a DN 150 pipe laid at its minimum grade of 0.55% (i.e. with a capacity of 13.05 l/s) can support up to 250 dwelling units. This capacity has been used to back-calculate an average flow per dwelling of 0.0522 l/s.

Line 1, which passes along Thompson Street and past Rydges Queenstown has both the largest contributing catchment and the lowest capacity, at 14.39 l/s. Based on the above per dwelling demands and an estimated contributing catchment, excluding the Lakeview site but including Skyline Queenstown, of 180 equivalent dwelling units, the minimum spare capacity in this pipe is estimated at approximately 4.73 l/s.

Line 2, originating at the centre of the site and heading towards Brunswick Street, has a smaller contributing catchment of approximately 50 equivalent dwelling units, including the cabins located within the recreation reserve in the northern portion of the Lakeview site, and a minimum remaining capacity of approximately 31.3 l/s, from the intersection of Man and Thompson Streets downstream. The invert levels of the line within the site are not known, and it has been assumed for the sake of this assessment that these lines will require replacement to better align with the proposed discrete development elements.

Line 3, at Isle Street, has a similar contributing catchment to Line 2, however the 100 mm PVC line at the top of the line is unlikely to be at an appropriate depth to convey the wastewater from the majority of the site.

Due to the topography and spatial distribution of the future development at the site, it is recommended that the entire site, with the exception of the land immediately south of the Lynch Block (assumed to contain the previously consented 124 bed hotel and 6 residential dwellings), connect to Line 2.

All of these lines feed into a 475 mm trunk main. QLDC's amendments to NZS4404:2004 state that trunk mains (above 225 mm diameter) do not need to be assessed for capacity. The 475 mm main eventually feeds to the Marine Parade Pump Station, which is a known pinch point in the QLDC sewer network. However, recent pump upgrades to the pumping station have helped to alleviate the problem somewhat, and the additional flow into this pump station is considered insignificant when compared to the current demands.

## 2.2 EXISTING SITE USAGE

As per the water demand, the Lakeview Holiday Park generates a relatively high peak wastewater load, as outlined in the table below.

Table 3-1: Existing Wastewater Demand

| <b>Accommodation Type</b>       | <b>Demand per person</b> | <b>People</b> | <b>Total Instantaneous Demand (including peaking factors)</b> |
|---------------------------------|--------------------------|---------------|---------------------------------------------------------------|
| Motel Rooms, Cabins, Apartments | 300 l/day                | 198           | 3.44 l/s                                                      |
| Powered Sites                   | 150 l/day                | 472           | 4.10 l/s                                                      |
| Unpowered Sites                 | 150 l/day                | 343           | 2.98 l/s                                                      |

This equates to a total of 10.5 l/s, however, the majority of the motel rooms, cabins and apartments are within the portion of the plan change area proposed to remain as recreation reserve; in the current plan change this portion of the existing camping ground will remain. This area drains to a separate sewer network to the main Lakeview site and has not been included in the assessment below as the flows to this catchment will not change.

## 2.3 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

The potential wastewater demands generated by future development have been outlined in the table below. Where district specific demands for wastewater have been outlined in QLDC's amendments to NZS4404:2004, these have been used to determine the values below. Where no information is available and only generalised areas for activities have been provided, an estimate of the water demand has been taken from the commercial and industrial wastewater demands outlined in Table 5.1 of NZS4404:2010. It is assumed that the Convention Centre and commercial activities are classified as generating a "medium" demand of 0.7 l/s/Ha, whilst the hot pools have been classified as generating a "heavy" demand of 1.3 l/s/Ha. These figures include peaking factors and both trade waste and sanitary wastewater.

For the mixed use town centre zone proposed, both commercial and high density residential developments are possible. The number of residential dwelling units is not limited by specific rules within the district plan for town centre zones; instead it is technically limited only by the height of the building and coverage of the site. Thus for this site, it is likely that the limiting factor for the number of residential units on the site would be the infrastructure capacity. As discussed above, the area south of the Lynch Block would need to connect to line 1, making the available capacity in Line 2 the limiting factor for the development of the council owned portion of the Lakeview plan change area.

These demands are outlined in the table below.

Table 3-2: Proposed Development Wastewater Demand

| Facility                                   | Demand per person | People    | Average Dry Weather Flow (ADWF) | Peak Wet Weather Flow (PWWF)                           |
|--------------------------------------------|-------------------|-----------|---------------------------------|--------------------------------------------------------|
| Potential 150 Bed Hotel                    | 300 l/day         | 300       | 1.04 l/s                        | 5.2 l/s                                                |
| 185 Residential Units                      | 300 l/day         | 348       | 1.2 l/s                         | 6.04 l/s                                               |
| 124 Bed Hotel (south of Lynch Block)       | 300 l/day         | 248       | 0.86 l/s                        | 4.31 l/s                                               |
| 6 Residential Units (South of Lynch Block) | 300 l/day         | 15        | 0.052 l/s                       | 0.26 l/s                                               |
| Facility                                   | Demand per Ha     | Area (Ha) |                                 | Total Instantaneous Demand (including peaking factors) |
| Convention Centre                          | 0.7 l/s/Ha        | 1.0205    |                                 | 0.71 l/s                                               |
| Hot Pools                                  | 1.3 l/s/Ha        | 0.635     |                                 | 0.83 l/s                                               |
| Commercial/Retail                          | 0.7 l/s/Ha        | 0.650     |                                 | 0.445 l/s                                              |

The worst case scenario from a wastewater infrastructure perspective would be for the entire site to be dedicated to high density residential, which may exceed the 185 units described above. The maximum number of units able to be supported without undertaking significant upgrades to the wastewater infrastructure outside the site is 510,

or 1785 people. This assumes a minimum 3.5% fall can be achieved on the 150 mm diameter sewer pipes connecting in to the existing Line 2.

Should future development at the site be over and above that set out in the table then upgrades to the wastewater infrastructure may be required.

## 2.4 PROPOSED UPGRADE

It is recommended that new sewer connections are made as follows:

- A new 150 mm diameter sewer main to be laid from SM15058 at the intersection of Man and Thompson Streets north to collect two feeder mains, one collecting the wastewater generated by the development in the eastern portion of the site, and one collecting the wastewater generated by the development in the north western quadrant of the development. The sewer main would also continue to the north to collect any wastewater load from the land remaining as reserve land for the potential retention of the campground.
- A new 150 mm diameter feeder main along Thompson Street to collect the sewage from the lower parcels of land, connecting in to the same 150 mm sewer main described above.
- Realignment of the existing 150 mm diameter sewer on Thompson Street to move it into the road reserve, depending on the location of future structures / buildings at the site. If these structures are set back a minimum of 3 metres from the road frontage, this realignment is not likely to be necessary.

Sketches outlining the proposed new connections are shown in the sketches in Appendix 1.



### 3.1 EXISTING INFRASTRUCTURE

The water supply into the Queenstown CBD from the Fernhill No 1 Reservoir (also known as Twin Reservoir) is fed via two main lines, a 450 mm main located within Fernhill Road and a smaller 300 mm diameter main running along Thompson and Man Streets. The 300 mm diameter line passes directly along the southern boundary of the Lakeview site.

The existing camping ground site is fed via a number of smaller diameter rider mains, between 100 and 200 mm in diameter. A number of hydrants exist around the site, providing fire fighting water supply coverage to the camping ground.

### 3.2 EXISTING SITE USAGE

The Lakeview Holiday Park is a reasonably high water user from a domestic supply perspective. Visitors in apartments and cabins, and on powered and unpowered sites generate water demands as shown in the table below. In accordance with the Camping Ground Regulations 1985, an occupancy of 3.5 people per site has been assumed for powered and unpowered sites, and an average of 4.5 people for each of the cabins, motel rooms and apartments. This represents the peak demand during times of full occupancy, for example during the summer holiday peak tourist season.

Table 2-1: Existing Water Supply demand

| <b>Accommodation Type</b>       | <b>Demand per person</b> | <b>People</b> | <b>Total Instantaneous Demand (including peaking factors)</b> |
|---------------------------------|--------------------------|---------------|---------------------------------------------------------------|
| Motel Rooms, Cabins, Apartments | 300 l/day                | 198           | 2.75 l/s                                                      |
| Powered Sites                   | 150 l/day                | 472           | 3.28 l/s                                                      |
| Unpowered Sites                 | 150 l/day                | 343           | 2.38 l/s                                                      |

The required fire fighting water supply to the existing Lakeview Holiday Park is estimated to be an FW3 supply (suitable for non-sprinklered sleeping activities with the largest fire cell below 200 m<sup>2</sup>), which requires a minimum of 25 l/s from each of two hydrants (that is, a total of 50 l/s).

### 3.3 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

Future development in accordance with the proposed plan change will place demands on the water supply for both the domestic supply and the fire fighting water supply. Due to the uncertainty regarding the specific development entities at this stage, a “worst case scenario” infrastructure demand has been assessed.

The proposed plan change area is to allow for both commercial and high density residential activities. These two uses have contradictory water demands; the residential uses dominate for domestic supply, whereas the commercial activities dominate for fire fighting supply.

Residential lots in the Queenstown Lakes District are assessed to require approximately 700 litres/person/day of water for domestic use. This volume allows for both indoor and outdoor use, including landscape watering, external cleaning, and all internal uses. By nationwide standards, this is a high allowance, and is mainly due to the high landscaping/irrigation use in the summer months. For high density residential such as that potentially included within the plan change area, the domestic water demands are considered to be lower due to the reduced per person irrigation requirements, and for this reason, flows at 1.5 times the peak average wastewater demands are considered appropriately conservative. This equates to 450 litres/person/day.

For potential commercial development entities, an estimate of the water demand has also been taken to be 1.5 times the peak average wastewater demands. These wastewater demands are those outlined in Table 5.1 of NZS4404:2010. This is also thought to be a conservative estimate.

These demands are outlined in the table below.

Table 2-2: Proposed Development Water Supply demand

| Facility                                   | Demand per person | People    | Total Instantaneous Demand (including peaking factors) |
|--------------------------------------------|-------------------|-----------|--------------------------------------------------------|
| Potential 150 Bed Hotel                    | 450 l/day         | 300       | 6.25 l/s                                               |
| 185 Residential Units                      | 450 l/day         | 555       | 11.56 l/s                                              |
| 124 Bed Hotel (south of Lynch Block)       | 450 l/day         | 248       | 5.17 l/s                                               |
| 6 Residential Units (South of Lynch Block) | 450 l/day         | 18        | 0.375 l/s                                              |
| Facility                                   | Demand per Ha     | Area (Ha) | Total Instantaneous Demand (including peaking factors) |
| Convention Centre                          | 1.05 l/s/Ha       | 1.0205    | 1.1 l/s                                                |
| Hot Pools                                  | 1.95 l/s/Ha       | 0.635     | 1.2 l/s                                                |

Water supply for domestic uses is very rarely the governing factor in the design or assessment of water infrastructure. As can be seen by the table above, the combination of the residential units and two possible hotels generates a domestic water demand of 23.355 l/s. The fire fighting water supply requirements for the proposed convention centre and other similar commercial developments is 25 l/s from two hydrants, assuming sprinklers are installed. On top of this hydrant demand, the sprinkler demands must also be met. SNZPAS4508:2008 defines the sprinkler demands for an ordinary fire hazard site at approximately 1200-1500 l/minute (20-25 l/s). The combined fire fighting demands are therefore approximately 50 l/s.

### 3.4 ASSESSMENT OF INFRASTRUCTURE EFFECTS

#### 3.4.1 Water Pressure

The Public Health Risk Management Plan for the Queenstown Water Supply identifies a Top Water Level (TWL) of 407.2 m for the Fernhill No 1 reservoir. The highest existing ground level at the site is approximately RL 354. Although in general the buildings will be four levels or lower, one area of the site includes the potential for up to seven levels. The existing ground level in this area is approximately RL 353, and a seven level building in this area is assumed to result in a highest floor level of approximately RL 371, with a ceiling level of RL 374.

The difference in height between the TWL and highest ceiling level is 33.2 m. The pipe distance from the reservoir to the site is approximately 900 m (as measured via QLDC's

GIS system). Friction losses in the pipe have been assumed to comply with clause 6.5.3.4 of NZS4404:2010 and are therefore assumed to be less than 3 m/km. Based on this, the expected pressures at the site are approximately 300 kPa, which is just within the acceptable range as defined by the QLDC amendments to NZS4404:2004 (which defines minimum pressures of 300 kPa).

#### 3.4.2 Water Quantity

As noted above, the domestic water demand is very rarely the governing factor when determining the ability of a water supply to service a new development, due to the flow rates required for fire fighting.

For this site, the fire hazard risk represented by the Lakeview Holiday Park is assessed to be a greater hazard than future development, assuming the structures within the proposed development are sprinklered. The current fire hazard category requires 50 l/s combined from two hydrants, and the future developments will require 25 l/s from two hydrants, on top of a sprinkler demand expected to be in the realm of 25 l/s (based on similar recent developments within the district).

Based on this high level assessment, it is expected that the 300 mm diameter main from Fernhill No 1 reservoir will be able to adequately provide the required fire fighting water supply for the site under the proposed zoning.

#### 3.4.3 Location of infrastructure

The existing structures on the site currently have full coverage via existing hydrants, however some of the outer bounds of the site may not have full coverage. Some of these existing hydrants are provided on lines which are likely to be removed when development occurs at the site, due to the inappropriateness of building over pipes, particularly asbestos cement pipes, which are likely to be older and with a shorter remaining service life. As a result, it is likely that these hydrants will need to be relocated onto a new water ring main through the site.

### 3.5 PROPOSED UPGRADE

It is recommended that a new water main is installed within a common services trench through the site. Although the size and location will need to be confirmed once the details of the proposed developments at the site are known, based on similar developments elsewhere within the district and the empirical design charts provided in NZS4404:2010, it is expected that a 225 mm ID (280 mm OD) PE pipe will be sufficient to service the development.

It is recommended that the main connection into the site is provided from the 300 mm main line, and for the purposes of security of supply to the convention centre and commercial activities within the site, it is recommended that the ring main connects to a separately fed line at the Isle Street end of the site. If this is not possible, a smaller diameter bypass should be considered, connecting to the stub of the 150 mm AC line currently feeding the camping ground, as shown in the sketch plans in Appendix 1. This 150 mm AC line is connected to the 125 mm line on Brunswick Street and by connecting to this, the development is less likely to experience water outages, should any maintenance be required on the larger main.



#### 4.1 EXISTING INFRASTRUCTURE

The stormwater infrastructure in the vicinity of the site is not as extensive as the foul sewer and water supply. Two stormwater lines drain the area surrounding the site, along with a network of pipes within the site with unknown connections to the network outside of the site. A 225 mm line within Thompson Street becomes a 300 mm dia trunk main down Brunswick Street before discharging into Lake Wakatipu.

A second, smaller diameter (150 mm) line exists within the Isle Street road reserve, becoming a 225 mm diameter line travelling East along Man Street.

#### 4.2 DESIGN STORM AND METHOD OF ANALYSIS

In accordance with NZS4404:2010, the chosen design storm for this assessment is one with a ten year average return interval (10 year ARI storm). Rainfall intensities (in mm/hr) have been obtained from Niwa's HIRDS database, and are outlined in the table below.

Table 4-1: Rainfall Data (HIRDS)

| ARI(y) | Duration |      |      |      |    |    |     |     |     |     |
|--------|----------|------|------|------|----|----|-----|-----|-----|-----|
|        | 10m      | 20m  | 30m  | 60m  | 2h | 6h | 12h | 24h | 48h | 72h |
| 10     | 29.4     | 23.7 | 20.8 | 16.9 | 12 | 7  | 5   | 3.6 | 2.1 | 1.6 |

The storm duration depends on the cumulative time of travel over the ground surface and within pipes across the site to the connection to existing infrastructure. For conservatism, a storm duration of 10 minutes (the most intense rainfall) has been used, with a resultant rainfall rate of 29.4 mm/hour.

With this information, peak flow rates from the catchments have been calculated using the Rational Method as described in the New Zealand Institute of Engineers: Guidelines and Procedure for Hydrological Design of Urban Stormwater Systems.

#### 4.3 EXISTING SITE USAGE

The existing camping ground site is dominated by permeable, grassed surfaces. Because of this, the stormwater run-off from the site is minimal, and the infrastructure in the vicinity is sized accordingly.

The upstream catchment (above the camping ground) comprises a portion of the front face of Bob's Peak. Although the majority of the rainfall landing on this face will be absorbed by the pine trees and other vegetation, there does not appear to be any stormwater infrastructure dedicated to the excess surface run off generated from the hill. A desk study and site walk over suggest that the majority of any run off is diverted by the small localised drainage associated with the bike park tracks. This, combined

with the divergent hill shape, means the small volumes of stormwater run-off are likely to end up at the top of Glasgow Street or near the Gondola base building, where it will pass into the road stormwater network (for smaller rainfall events) or eventually into the lake via the road network, which also forms the secondary overland flow path.

The run-off generated by the existing site is outlined below in table 4-2.

Table 4-2: Existing Stormwater Catchments and Run-off

| <b>Development Element</b> | <b>Area</b>           | <b>Run-off Coefficient</b> | <b>Run-off flow rate (l/s)</b> |
|----------------------------|-----------------------|----------------------------|--------------------------------|
| Lakeview Holiday Park      | 60,826 m <sup>2</sup> | 0.5                        | 248.6                          |
| Lynch Block                | 11,604 m <sup>2</sup> | 0.65                       | 61.6                           |
| Area south of Lynch Block  | 6,200 m <sup>2</sup>  | 0.5                        | 25.3                           |
| Upstream Catchment         | 13,000 m <sup>2</sup> | 0.5                        | 53.1                           |
| Downstream Catchment       | 20,000 m <sup>2</sup> | 0.65                       | 106.3                          |

The Lynch block and the area south of the Lynch Block are assumed to drain to the existing Glasgow Street stormwater main, which is a 300 mm diameter pipe, passing down Kilmarnock Street to Lake Wakatipu. With the exception of the two blocks within the Lakeview subzone described above, the remainder of the catchment of this pipe is approximately 14,000 m<sup>2</sup>; approximately 4,000 m<sup>2</sup> of this is part of Rydges Queenstown, and the remainder is a mix of roading and typical residential use. The combined run-off coefficient of this area is considered to be 0.75, resulting in a run-off rate of 85 l/s.

For the remainder of the site, although the upstream catchment and the holiday park combine to generate peak run-off of approximately 300 l/s, this appears to be largely disposed of to ground at present, as the existing stormwater infrastructure does not appear to connect in to the site. Therefore, excluding the Lynch block, the net stormwater impact on the QLDC infrastructure outside the site is virtually nil.

#### 4.4 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

The proposed development will significantly increase the stormwater run-off generated on the site, by creating impermeable surfaces where permeable surfaces currently exist. It is assumed that the Convention Centre and Hot Pools areas will comprise mainly impermeable surfaces (and if developed for general commercial uses, this assumption remains applicable).

It is assumed that the building coverage of the remainder of the development land will be 80%, as per the current town centre zoning. The remainder of the sites (20%) is assumed to be split equally between asphalt/paving and gardens.

Run-off coefficients have been assigned as follows:

- Roofs: 0.9
- Asphalt and paving: 0.85
- Gardens: 0.3

For mixed surfaces, the run-off coefficients have been pro-rated accordingly.

Table 4-3: Proposed Stormwater Catchments and Run-off

| <b>Development Element</b> | <b>Area (m<sup>2</sup>)</b> | <b>Run-off Coefficient</b> | <b>Run-off flow rate (l/s)</b> |
|----------------------------|-----------------------------|----------------------------|--------------------------------|
| Convention Centre          | 14,142                      | 0.9                        | 104                            |
| Hot Pools                  | 7,718                       | 0.9                        | 56.8                           |
| Development Land #2        | 11,604                      | 0.835                      | 79.2                           |
| Development Land Remainder | 22,048                      | 0.835                      | 150.5                          |
| Area South of Lynch Block  | 6,200                       | 0.835                      | 42.3                           |
| Public Amenity Land        | 4,836                       | 0.85                       | 33.6                           |
| Reserves                   | 14,106                      | 0.3                        | 34.6                           |
| Holiday Park               | 19,798                      | 0.5                        | 80.9                           |
| Road Reserve               | 9,113                       | 0.85                       | 63.3                           |

Taken as a whole, the average run-off coefficient of the development is 0.76, with a peak run-off rate of 602 l/s. However, the 79.2 l/s associated with Development Land #2 and the land south of the Lynch Block will continue to drain to Glasgow Terrace as per the existing situation. Further to this, the nearly 2 Ha of Holiday Park land will continue to drain towards Brecon Street.

With these two areas removed, the peak run-off rate for the design storm is approximately 442 l/s at the outlet of the Lakeview site.

The combined run-off flow rate into the 300 mm diameter stormwater main from Glasgow Terrace to Kilmarnock Street is approximately 130 l/s.

#### 4.5 ASSESSMENT OF INFRASTRUCTURE EFFECTS

##### 4.5.1 Piped Infrastructure

The 150 mm concrete stormwater line within Isle Street, is, by observation, of insufficient size to support any portion of the development at the site. The minimum size for a single mud tank/sump lead is 225 mm diameter, and a 150 mm concrete pipe is only suitable for supporting downpipes from a small to medium sized building.

A more detailed assessment has been carried out for the 225-300 mm diameter stormwater main in Thompson and Brunswick Streets, as outlined in the calculations shown in Appendix 3.

Although, due to the steep gradients involved, the majority of this pipeline appears to have sufficient capacity for the entire upstream catchment of approximately 10-11 Ha, in reality this is not the case. The limiting factor for most stormwater lines, including this one, is the headwater depth at each manhole due to the restricted outlet. Based on

the charts in clause E1 of the New Zealand Building Code, to limit the surcharge to no more than twice the outlet pipe diameter, the discharge rate through a 300 mm diameter pipe should be no more than 120 l/s. Based on the design storm rainfall intensities and the average run-off coefficient of 0.7 defined above, 120 l/s represents a catchment of approximately 2.1 Ha, significantly less than the area of the Lakeview Site, but equivalent to the catchment downstream of the site.

For piped infrastructure to handle the design storm run-off rate of approximately 442 l/s from the Lakeview site with the surcharge limitations stated above, a minimum pipe diameter of 525 mm will be required. Should this pipe be upgraded to accommodate the approximately 2 Ha of land below the site feeding in to the same pipe (as opposed to the existing pipe being maintained alongside the new pipe), a further 120 l/s contributing to the peak run-off rate, a 600 mm diameter pipe will be required.

The 300 mm diameter main from Glasgow Terrace to Kilmarnock Street will need to handle an overall flow rate of 130 l/s. As per the above, ideally to maintain surcharge depths of no more than twice the outlet pipe diameter, the flow in a 300 mm diameter pipe should be kept to no more than 120 l/s. However, the pipe in question appears to have over 1 m depth to the invert of the pipe within the manholes in question and therefore a slightly increased surcharge depth should be within the tolerances of this pipe. Developments in the Lynch Block and the area South of the Lynch Block, should however, be required to attenuate stormwater flows by a minimum of 15% to mitigate the risks associated with surcharge of this pipe. This can be achieved through the use of permeable paving, roof water attenuation tanks or oversized in-ground pipework. These types of attenuation are common throughout New Zealand and are required by most local and territorial authorities.

#### 4.5.2 Secondary Overland Flow Path

Secondary overland flow paths need to be designed to allow a path for stormwater run-off from rainfall events larger than the design storm. In accordance with NZS4404:2010, the catchment currently utilises the existing road network. This is considered appropriate for the fully developed catchment, as the kerb and channel network will allow water to flow through the subject area and eventually into Lake Wakatipu.

#### 4.6 PROPOSED UPGRADE

The existing stormwater network is only just adequate for the existing level of development within the catchment, and will require significant upgrade to support the Lakeview Development.

There are two main options for the stormwater infrastructure to support the site. The first is to attenuate the run-off to the pre-development rates. For this site, that will mean disposing of the stormwater to ground within the site. With the site coverage proposed, and the run-off volumes expected to be generated, the minimum volume of a soakage chamber comprising a proprietary support structure would be 1,200 m<sup>3</sup>.

An arch chamber soakage and attenuation system such as the Stormwater 360 ChamberMaxx system to support the volumes required would cover 2,350 m<sup>2</sup> under the Convention Centre outdoor space. Whilst there is the area available to support this solution, it is likely that concentrating the soil soakage in this area will cause downstream effects such as slope instability and seepage of groundwater out of the existing slopes.

The alternative solution is to provide a piped infrastructure network, discharging to Lake Wakatipu. The most feasible route for this new pipe to take is through the area within the Thompson St/Brunswick Street road reserve, through to Lake Wakatipu.

This pipe would discharge into Lake Wakatipu in the same location as the existing stormwater outfall (which would need to be upgraded). The effects on Lake Wakatipu of this drain are similar to the existing outfall, however it is recommended that a proprietary stormwater treatment device, such as a Downstream Defender, is installed to treat the stormwater prior to discharge.

Other alternative pipe locations have been considered and discounted as follows:

- The route of the existing 150 mm stormwater line within Lake Street discharges within the public St Omer's Wharf area, and would require not only significant reinstatement works in this area, but also laying of pipes down one of the steepest streets in Queenstown, with associated construction difficulties.
- The 300 mm diameter main to the West of the Brunswick Street Main passes under a portion of the Rydges Queenstown structure.
- The main down Isle and Hay Streets terminates adjacent to Steamer Wharf and crosses Lake Esplanade at the busy intersection where Beach Street, Shotover Street and Lake Esplanade join. Where possible, works in this area should be avoided.



### 5.1 EXISTING INFRASTRUCTURE

Contact Energy/Rock Gas advise that gas infrastructure exists in the vicinity of the Lakeview Site. The hotels to the south and south west of the site are supplied with Gas reticulation via a 160 mm main on Thompson Street, and the ablutions block at the eastern end of the holiday park are also supplied with piped LPG via a 110 mm gas main located within Isle Street. Bottled gas supply is provided to other amenities in the area.

### 5.2 EXISTING SITE USAGE

As mentioned above, the camping ground currently uses both the piped gas supply and a bottled gas supply. Primarily this supply is to ensure a continuous hot water supply.

### 5.3 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

Future commercial activities at the site may require LPG gas reticulation to support a number of the future development elements. With gas reticulation available, it is likely that the residential units will also utilise gas for heating, cooking and hot water

Table 5-1: Proposed Development Gas Reticulation Requirements

| Development Element     | Potential Gas Usage         |
|-------------------------|-----------------------------|
| Residential Units       | Heating, hot water, cooking |
| Commercial Developments | Hot water, cooking, heating |
| Convention Centre       | Hot water, cooking, heating |
| Hot Pools               | Heating of pools, hot water |

### 5.4 ASSESSMENT OF INFRASTRUCTURE EFFECTS

Contact/RockGas have advised that the existing reticulation in the vicinity of the development has the ability to support the development, however, the reticulation will need to be extended to within the development.

### 5.5 PROPOSED UPGRADE

If required, a 110 mm MDPE, SDR 17.6 PN100 gas ring main within the common services trench described in the water supply section of this report could be installed. The new ring main will require isolating valves at each end. A sketch of this common services trench is shown in Appendix 1.



## 6.1 EXISTING INFRASTRUCTURE

The existing site is supplied with power via Aurora Energy's electricity network. A feeder main traverses the site, both above ground and underground, and power services also exist within the road reserves surrounding the development.

## 6.2 EXISTING SITE USAGE

The camping ground provides power at the powered camp sites, ablutions blocks, and the numerous privately owned leasehold cabins on the perimeter of the site. The power demands at peak times are considerably lower than a residential development supporting an equivalent population – the peak population is equivalent to approximately 300-400 dwellings, however, due to the lack of heating load, the power demand is significantly lower than this would imply.

## 6.3 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

When fully developed with commercial mixed-use activities all of the discrete development elements at the site will generate demands on the infrastructure, including power infrastructure. Electricity will be required for all usual domestic and commercial uses.

## 6.4 ASSESSMENT OF INFRASTRUCTURE EFFECTS

The power requirements have been assessed by Peak Power Ltd, who have had a long involvement in the site. Peak Power have advised that, although in general the site is supplied with electricity via Aurora's network, switchgear and transformers in the area are only sized to support other existing power users, such as hotels.

Further, the existing Aurora Energy feeder main traversing the site may be located within the footprint of future buildings.

## 6.5 PROPOSED UPGRADE

Switchgear, transformers and cabling within the site to support the new zoning will be required, as outlined by Peak Power Ltd. Relocation and undergrounding where required of the Aurora feeder main will also be required.

Power infrastructure below the subject site, in some locations, has not been undergrounded, and to maximise the potential views from the development, undergrounding these lines may be desired. However, this is not required to adequately service future development at the site.



## 7.1 EXISTING INFRASTRUCTURE

Specific information about the telecom infrastructure in the area is not known, however Chorus's website shows the site is within the area currently serviced by the Ultra-Fast Broadband (UFB) roll out. The existing holiday park and the surrounding residential and commercial developments are all supplied with telephone lines and broadband internet connections.

## 7.2 EXISTING SITE USAGE

As noted above, the existing holiday park is serviced with both phone and broadband internet services. A number of the small privately-owned leasehold cabins are also serviced with landline and broadband services around the perimeter of the site.

## 7.3 PROPOSED DEVELOPMENT

As noted in the sections above, a number of discrete development elements are proposed for the land, which will generate demands on the infrastructure, including telecommunications infrastructure.

All of the proposed elements on the site will require telecommunications infrastructure, including broadband internet. The convention centre and potential commercial developments are also likely to require internal PABX-type phone systems, which have been excluded from this investigation.

## 7.4 ASSESSMENT OF INFRASTRUCTURE EFFECTS

Advice from Chorus, the local telecommunications network provider, has not yet been received with regard to this development.

However, due to the location of the site within the area already serviced by the UFB roll out, it is expected that the development can be serviced by the infrastructure external to the site.

## 7.5 PROPOSED UPGRADE

As per the power, gas and water supply upgrades, it is recommended that telecommunications cables are laid within a common services trench through the site.



1. Queenstown Lakes District Council GIS Mapping System
2. *A Guideline and Procedure for Hydrological Design of Urban Stormwater Systems*, New Zealand Institute of Engineers, Auckland Branch, 1980
3. *NZS4404:2010 Land Development and Subdivision Infrastructure*, Standards New Zealand
4. Queenstown Lakes District Council's approved amendments to NZS4404:2004
5. *Camping Ground Regulations 1985*, New Zealand Government
6. *SNZ PAS 4509:2008 New Zealand Fire Service Fire fighting Water Supplies Code of Practice*, Standards New Zealand
7. *Scuttlebutt Special Edition, Queenstown Convention Centre Proposal Summary*, Queenstown Lakes District Council, August 2013.



## APPENDIX 1 – SKETCH PLANS



New Stormwater Line

Downstream Defender or Similar

The map is an approximate representation only and must not be used to determine the location or size of items shown, or to identify legal boundaries. To the extent permitted by law, the Queenstown Lakes District Council, their employees, agents and contractors will not be liable for any costs, damages or loss suffered as a result of the data or plan, and no warranty of any kind is given as to the accuracy or completeness of the information represented by the GIS data. While reasonable use is permitted and encouraged, all data is copyright reserved by Queenstown Lakes District Council. Cadastral information derived from Land Information New Zealand. CROWN COPYRIGHT RESERVED



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## APPENDIX 2 – CALCULATIONS

# Sewer Details

US MH #

A

DS MH # US IL US LL DS IL DS LL Length Slope Pipe Dia Pipe Material  
(Past Rydges)

|   |   |        |       |        |        |      |          |     |     |
|---|---|--------|-------|--------|--------|------|----------|-----|-----|
| 1 | 2 | 342.8  | 343.8 | 342.11 | 343.11 | 100  | 0.0069   | 150 | AC  |
| 2 | 3 | 342.11 |       | 341.93 | 344.31 | 27   | 0.006667 | 150 | AC  |
| 3 | 4 | 341.93 |       | 339.61 |        | 10.9 | 0.212844 | 150 | PVC |
| 4 | 5 | 339.61 |       | 339.28 |        | 17.2 | 0.019186 | 150 | PVC |
| 5 | 6 | 339.28 |       | 328    |        | 36.4 | 0.30989  | 150 | PVC |
| 6 | 7 | 328    |       | 312.06 |        | 56.5 | 0.282124 | 150 | PVC |

B

(Through to Brunswick St)

|    |    |        |        |        |        |      |          |     |    |
|----|----|--------|--------|--------|--------|------|----------|-----|----|
| 8  | 9  | 346.19 | 347.94 | 342.25 | 343.25 | 45.3 | 0.086976 | 150 | AC |
| 9  | 10 | 342.25 |        | 340.22 |        | 22.6 | 0.089823 | 150 | AC |
| 10 | 11 | 340.22 |        | 329.31 |        | 43.9 | 0.248519 | 150 | AC |
| 11 | 12 | 329.31 |        | 314.05 |        | 64.5 | 0.236589 | 150 | AC |
| 12 | 13 | 314.05 |        | 311.03 |        | 83.6 | 0.036124 | 150 | AC |

C

(Via Hay Street)

|    |    |        |        |        |        |      |          |     |     |
|----|----|--------|--------|--------|--------|------|----------|-----|-----|
| 14 | 15 | 348.45 | 349.74 | 344.04 | 345.04 | 47.5 | 0.092842 | 100 | PVC |
| 15 | 16 | 344.04 |        | 335.89 |        | 62.7 | 0.129984 | 150 | PVC |
| 16 | 17 | 335.89 |        | 315.05 |        | 90.8 | 0.229515 | 150 | PVC |
| 17 | 18 | 315.05 |        | 310.67 |        | 49.4 | 0.088664 | 150 | PVC |

Calc #

Slope

Dia

Capacity (l/s)

Capacity (EDU)

Feeding in

Remaining Capacity (l/s)

|     |          |      |          |          |     |          |
|-----|----------|------|----------|----------|-----|----------|
| 1-2 | 0.0069   | 0.15 | 14.64775 | 280.6083 | 185 | 4.990753 |
| 2-3 | 0.006667 | 0.15 | 14.39331 | 275.734  | 185 | 4.736314 |
| 3-4 | 0.212844 | 0.15 | 82.66251 | 1583.573 | 185 | 73.00551 |
| 4-5 | 0.019186 | 0.15 | 24.61182 | 471.4909 | 185 | 14.95482 |
| 5-6 | 0.30989  | 0.15 | 99.80567 | 1911.986 | 185 | 90.14867 |
| 6-7 | 0.282124 | 0.15 | 95.21549 | 1824.052 | 185 | 85.55849 |

|       |          |      |          |          |    |          |
|-------|----------|------|----------|----------|----|----------|
| 8-9   | 0.086976 | 0.15 | 52.733   | 1010.211 | 30 | 51.167   |
| 9-10  | 0.089823 | 0.15 | 53.59406 | 1026.706 | 30 | 52.02806 |
| 10-11 | 0.248519 | 0.15 | 89.34637 | 1711.616 | 30 | 87.78037 |
| 11-12 | 0.236589 | 0.15 | 87.16807 | 1669.886 | 30 | 85.60207 |
| 12-13 | 0.036124 | 0.15 | 33.87946 | 649.0317 | 30 | 32.31346 |

|       |          |      |          |          |    |          |          |
|-------|----------|------|----------|----------|----|----------|----------|
| 14-15 | 0.092842 | 0.1  | 18.5697  | 355.7413 | 50 | 15.9597  | EDU      |
| 15-16 | 0.129984 | 0.15 | 96.45172 | 1847.734 | 50 | 93.84172 |          |
| 16-17 | 0.229515 | 0.15 | 85.8505  | 1644.646 | 50 | 83.2405  |          |
| 17-18 | 0.088664 | 0.15 | 53.24522 | 1020.023 | 50 | 50.63522 | 970.0234 |

|                             |        |                |
|-----------------------------|--------|----------------|
| Minimum Gradient Capacity   | 13.05  | (= 250 houses) |
| Capacity required per house | 0.0522 |                |

| Demands           | Number | People | Per head | Area  | Per Ha | Daily Flow | ADWF     | PWWF     | Line |          |
|-------------------|--------|--------|----------|-------|--------|------------|----------|----------|------|----------|
| Residential       | 300    | 750    | 300      |       |        | 225000     | 2.604167 | 13.02083 | B/C  | (Pref B) |
| Hotel             | 100    | 200    | 300      |       |        | 60000      | 0.694444 | 3.472222 | B    |          |
| Hotel 2           | 124    | 248    | 300      |       |        | 74400      | 0.861111 | 4.305556 |      |          |
| Res 2             | 6      | 15     | 300      |       |        | 4500       | 0.052083 | 0.260417 |      |          |
| Retail            |        |        |          | 3500  | 0.7    |            |          | 0.245    | B    |          |
| Casino            |        |        |          | 2400  | 1.3    |            |          | 0.312    | B    |          |
| Convention Centre |        |        |          | 10205 | 0.7    |            |          | 0.71435  | B    |          |
| Commercial        |        |        |          | 8213  | 0.7    |            |          | 0.57491  | B    |          |

|   | Req'd    | Spare Capacity |
|---|----------|----------------|
| A | 4.565972 | 4.736314       |
| B | 18.33932 | 32.31          |
| C |          | 15.95          |

# Stormwater Details

| US MH # | DS MH #        | US IL   | US LL | DS IL  | DS LL  | Length | Slope    | Pipe Dia | Pipe Material |
|---------|----------------|---------|-------|--------|--------|--------|----------|----------|---------------|
| A       | Down Brunswick |         |       |        |        |        |          |          |               |
| 1       | 2              | 346.645 | 343.8 | 342.11 | 342.4  | 180    | 0.025194 | 225      | CONC          |
| 2       | 3              | 342.11  |       | 337.87 | 344.31 | 27     | 0.157037 | 300      | CONC          |
| 3       | 4              | 337.87  |       | 335.7  |        | 10.9   | 0.199083 | 300      | CONC          |
| 4       | 5              | 335.7   |       | 325.23 |        | 17.2   | 0.608721 | 300      | CONC          |
| 5       | 6              | 325.23  |       | 314.75 |        | 36.4   | 0.287912 | 300      | PVC           |
| 6       | 7              | 314.75  |       | 311.65 |        | 56.5   | 0.054867 | 375      | CONC          |

| Calc # | Slope    | Dia   | Capacity (l/s) | Catchment (Ha) |
|--------|----------|-------|----------------|----------------|
| 1-2    | 0.025194 | 0.225 | 96.79244       | 1.691809       |
| 2-3    | 0.157037 | 0.3   | 521.1133       | 9.108399       |
| 3-4    | 0.199083 | 0.3   | 587.3237       | 10.26567       |
| 4-5    | 0.608721 | 0.3   | 1030.52        | 18.01218       |
| 5-6    | 0.287912 | 0.3   | 857.4052       | 14.98635       |
| 6-7    | 0.054867 | 0.375 | 549.3147       | 9.601322       |

## Pre-Development

|                        |                |      |                  |
|------------------------|----------------|------|------------------|
| Lakeview Holiday Park  | 60,826         | 0.5  | 248.571532       |
| Lynch Block            | 11,604         | 0.65 | 61.6471783       |
| South of Lynch Block   | 6,200          | 0.5  | 25.33692         |
| Upstream Catchment     | 13,000         | 0.5  | 53.1258          |
| Downstream Catchment   | 20,000         | 0.65 | 106.2516         |
| Downstream Catchment 2 | 14,000         | 0.75 | 85.8186          |
|                        | <b>125,630</b> |      | <b>580.75163</b> |

Post-Development

| Development Element                       | Area    | Runoff Coefficient | Runoff flow rate |
|-------------------------------------------|---------|--------------------|------------------|
| Convention Centre                         | 14,142  | 0.9                | 104.026855       |
| Hot Pools                                 | 7,718   | 0.9                | 56.7726818       |
| Development Land 2                        | 11,604  | 0.835              | 79.1929137       |
| South of Lynch Block                      | 6,200   | 0.835              | 42.3126564       |
| Development Land Other                    | 22,048  | 0.835              | 150.469266       |
| Public Amenity Land                       | 4,836   | 0.85               | 33.5967559       |
| Reserves                                  | 13,974  | 0.3                | 34.263689        |
| Road Reserve between Residential Sections | 2,540   | 0.85               | 17.6459388       |
| Upstream                                  | 8,568   | 0.3                | 21.0083933       |
| Downstream                                | 20,000  | 0.74               | 120.96336        |
| Total                                     | 111,630 |                    | 660.25251        |

C \* A

12727.8

6946.2

9689.34

18410.08

4110.6

4192.2

2159

2570.4



## REPORT

STRUCTURAL AND CIVIL ENGINEERS

LAKEVIEW PLAN CHANGE

INFRASTRUCTURE ASSESSMENT

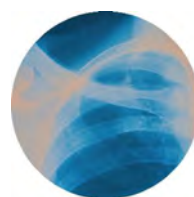
ADDENDUM

PREPARED FOR

QUEENSTOWN LAKES DISTRICT COUNCIL

111265

AUGUST 2014





## Lakeview Plan Change Infrastructure Assessment - Addendum

Prepared For:

Queenstown Lakes District Council - Engineering

Private Bag 50072

QUEENSTOWN

Date: 8 August 2014

Project No: 111265

Revision No: 1 - Final

Prepared By:

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Holmes Consulting Group LP  
Queenstown Office



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As part of the Lakeview plan change application, Queenstown Lakes District Council (QLDC) is considering rezoning the land between the current Queenstown Town Centre Zone and the proposed Lakeview Sub-Zone to include this land in a revised Queenstown Town Centre Zone. These blocks are the two blocks between Isle and Man Streets.

To determine the feasibility of the extending the Lakeview plan change to include these blocks, an investigation has been undertaken to assess the infrastructure effects of development within this zone.

This addendum report should be read in conjunction with the infrastructure assessment completed for the Lakeview site.

#### WASTEWATER

QLDC's wastewater infrastructure provides a number of potential connection points adjacent to the blocks in question, and these have been assessed to determine the potential capacity available for use by future development in the zone in question. The sewer lines closest to each of the proposed blocks have been found to have capacity for the types of development currently anticipated in the zone.

Whilst this high level analysis suggests no required upgrades to the QLDC infrastructure outside of the site, the earthenware and asbestos cement pipes draining the two blocks may require replacement due to the age of the pipes and the location within the blocks.

#### WATER SUPPLY

The water infrastructure in the area of the plan change is considered adequate to support the future development, with no major infrastructure upgrades required.

The domestic water demand generated on the site is not likely to be the governing factor when considering the impact on the water supply infrastructure. Rather, fire fighting water supply demand is far greater; this has formed the basis of this analysis.

#### STORMWATER

As with the proposed Lakeview plan change, development of the blocks in question is likely to increase the stormwater run-off from the land.

The two Man Street blocks are drained by a 225 mm diameter main, passing to a 450 mm diameter main through to the culverted section of Horne Creek. Both of these lines have insufficient capacity for additional run-off, and an upgrade of both of these pipes would be required. Due to the location of the 450 mm main (under commercial buildings), a new pipe within the road reserves may be more feasible.

Alternatively, various stormwater attenuation devices such as tanks or green roofs may be able to be used to reduce the peak stormwater run-off by a minimum of 20% to maintain flow rates less than the capacity of the existing pipes.

#### GAS

The blocks are located directly adjacent to the Queenstown CBD and as such are in close proximity to hotels and other facilities currently utilising LPG gas for hot water, cooking and heating. This LPG gas infrastructure external to the site is adequate to support future development provided for by way of the proposed plan change.

#### POWER

Although Aurora Energy's network surrounds the blocks in question, the switch gear, transformers and associated discrete infrastructure elements associated with the power network in the area have been sized to support the buildings or developments they are associated with. As such, it is necessary when considering the plan change to allow for this infrastructure.

#### TELECOMMUNICATIONS

Specific confirmation of the ability of the telecommunications network to support the proposed plan change has not been received at this time, however, due to the location of the site within the area of benefit for the Ultra-Fast Broadband roll out, the network is assumed to have the capacity to support future development.



As part of the Lakeview plan change application, Queenstown Lakes District Council (QLDC) is considering rezoning the land between the current Queenstown Town Centre Zone and the proposed Lakeview Sub-Zone to include this land in a revised Queenstown Town Centre Zone. This land is shown in the plan below:



This addendum report to our report describing the infrastructure effects of the Lakeview Sub-Zone describes the infrastructure effects of re-zoning this land. This addendum is to be read alongside the Lakeview Plan Change report prepared by Holmes Consulting Group, and the same assumptions apply.

#### 1.1 EXISTING SITE USAGE

The blocks of land being considered have a combination of residential and low density commercial. A number of the former residential dwellings in this area now house office-based businesses.

#### 1.2 LIMITATIONS

Findings presented as a part of this project are for the sole use of Queenstown Lakes District Council in its evaluation of the subject properties. The findings are not intended for use by other parties, and may not contain sufficient information for the purposes of other parties or other uses. Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice presented in this report.



## 2.1 EXISTING INFRASTRUCTURE

The two blocks are serviced via 150 mm earthenware and asbestos cement pipes running through the two blocks, roughly in the centre from a north-south perspective, and running from west to east. This line also collects the wastewater from the motel units associated with the existing Lakeview camping ground and the other commercial premises in this area, before connecting to a 300 mm asbestos cement pipe located within the western most section of Man Street.

### 2.1.1 Capacity

The invert levels and lengths of the individual pipes making up these lines defined above have been taken from QLDC's GIS information and the slopes calculated to determine the capacity of each of these pipes. These calculations are shown in Appendix 3.

The catchments feeding in to each of these pipes was then assessed and a conservative number of equivalent dwellings assessed. NZS4404:2010 provides that a DN 150 pipe laid at its minimum grade of 0.55% (i.e. with a capacity of 13.05 l/s) can support up to 250 dwelling units. This capacity has been used to back-calculate an average flow per dwelling of 0.0522 l/s.

The Man Street line has a contributing catchment of approximately 200 equivalent dwelling units (including estimated commercial loads), with a minimum spare capacity of approximately 12 l/s at the top of the catchment. At the point where this pipe enters the western block, the spare capacity increases to approximately 30 l/s, or over 600 equivalent dwelling units.

## 2.2 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

For the mixed use town centre zone proposed, both commercial and high density residential developments are possible. The number of residential dwelling units is not limited by specific rules within the district plan for town centre zones; instead it is technically limited only by the height of the building and coverage of the site.

The worst case scenario from a wastewater infrastructure perspective would be for the entirety both blocks to be dedicated to high density residential.

## 2.3 ASSESSMENT OF INFRASTRUCTURE EFFECTS

The sewer line currently servicing the blocks has capacity to service some development within these lots.

Indicatively, the line servicing the western block can support just over 200 equivalent dwelling units, and the line servicing the eastern block can support over 600 dwelling units (including the 200 dwelling units able to be supported on the western block).

This spare capacity implies that the existing sewer lines should be able to support a mixed-use town centre zone within these blocks of land.

However, due to the likely age of the earthenware and asbestos cement lines servicing blocks 2 and 3, it is recommended that the replacement of these lines be considered prior to development proceeding on this land.



### 3.1 EXISTING INFRASTRUCTURE

The water supply into the Queenstown CBD from the Fernhill No 1 Reservoir (also known as Twin Reservoir) is fed via two main lines, a 450 mm main located within Fernhill Road and a smaller 300 mm diameter main running along Thompson and Man Streets. As per the Lakeview site, the 300 mm diameter asbestos cement line passes directly along the boundary of the blocks of land in question. The line passes to the South of the two Man Street blocks.

Smaller diameter rider mains, between between 100 and 200 mm in diameter run along the side streets and within Man Street to supply the existing buildings in the area. A number of hydrants also exist around the blocks, located regularly on all of the rider mains.

### 3.2 EXISTING WATER DEMANDS

The existing water demands for these blocks are largely related to residential or commercial office uses.

As per the Lakeview site, fire fighting demands are likely to dominate over the residential demands. As determined during the Lakeview infrastructure assessment, the required fire fighting water supply in the vicinity of these blocks is estimated to be an FW3 supply (suitable for non-sprinklered sleeping activities with the largest fire cell below 200 m<sup>2</sup>), which requires a minimum of 25 l/s from each of two hydrants (that is, a total of 50 l/s).

### 3.3 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

The proposed plan change area is to allow for both commercial and high density residential activities. These two uses have contradictory water demands; the residential uses dominate for domestic supply, whereas the commercial activities dominate for fire fighting supply.

As mentioned above, water supply for domestic uses is very rarely the governing factor in the design or assessment of water infrastructure. The fire fighting water supply requirements for most high density residential, accommodation and similar commercial developments is 25 l/s from two hydrants, assuming sprinklers are installed. On top of this hydrant demand, the sprinkler demands must also be met. SNZPAS4508:2008 defines the sprinkler demands for an ordinary fire hazard site at approximately 1200-1500 l/minute (20-25 l/s). The combined fire fighting demands are therefore approximately 50 l/s.

### 3.4 ASSESSMENT OF INFRASTRUCTURE EFFECTS

#### 3.4.1 Water Pressure

The Public Health Risk Management Plan for the Queenstown Water Supply identifies a Top Water Level (TWL) of 407.2 m for the Fernhill No 1 reservoir. The highest

existing ground level within either of the blocks is approximately RL 344. It is expected that buildings will be four levels or lower within this zone. This is assumed to result in a highest floor level of approximately RL 353, with a ceiling level of approximately RL 356.

The difference in height between the TWL and highest ceiling level is 54.2 m. The pipe distance from the reservoir to the site is approximately 1200 m (as measured via QLDC's GIS system). Friction losses in the pipe have been assumed to comply with clause 6.5.3.4 of NZS4404:2010 and are therefore assumed to be less than 3 m/km. Based on this, the expected pressures at the site are approximately 500 kPa, which is within the acceptable range as defined by the QLDC amendments to NZS4404:2004 (which defines minimum pressures of 300 kPa).

#### 3.4.2 Water Quantity

As noted above, the domestic water demand is very rarely the governing factor when determining the ability of a water supply to service a new development, due to the flow rates required for fire fighting.

For this site, the fire hazard risk represented by the existing Lakeview Holiday Park is assessed to be a greater hazard than both the future development on the Lakeview site and future development on these blocks, assuming the structures within any future developments are sprinklered. The current fire hazard category requires 50 l/s combined from two hydrants, and the future developments will require 25 l/s from two hydrants, on top of a sprinkler demand expected to be in the realm of 25 l/s (based on similar recent developments within the district).

Based on this high level assessment, it is expected that the 300 mm diameter main from Fernhill No 1 reservoir will be able to adequately provide the required fire fighting water supply for the site under the proposed zoning.



#### 4.1 EXISTING INFRASTRUCTURE

The two blocks fall towards a 225 mm concrete stormwater line within Man Street. This drains to a 450 mm concrete line passing under commercial buildings on the corner of Camp and Memorial Streets, before connecting to the Horne Creek Culvert.

#### 4.2 DESIGN STORM AND METHOD OF ANALYSIS

In accordance with NZS4404:2010, the chosen design storm for this assessment is one with a ten year average return interval (10 year ARI storm). Rainfall intensities (in mm/hr) have been obtained from Niwa's HIRDS database, and are outlined in the table below.

Table 4-1: Rainfall Data (HIRDS)

| ARI(y) | Duration |      |      |      |    |    |     |     |     |     |
|--------|----------|------|------|------|----|----|-----|-----|-----|-----|
|        | 10m      | 20m  | 30m  | 60m  | 2h | 6h | 12h | 24h | 48h | 72h |
| 10     | 29.4     | 23.7 | 20.8 | 16.9 | 12 | 7  | 5   | 3.6 | 2.1 | 1.6 |

The storm duration depends on the cumulative time of travel over the ground surface and within pipes across the site to the connection to existing infrastructure. For conservatism, a storm duration of 10 minutes (the most intense rainfall) has been used, with a resultant rainfall rate of 29.4 mm/hour.

With this information, peak flow rates from the catchments have been calculated using the Rational Method as described in the New Zealand Institute of Engineers: Guidelines and Procedure for Hydrological Design of Urban Stormwater Systems.

#### 4.3 EXISTING SITE COVERAGE

The two blocks are currently largely in residential or light commercial use, with site coverage similar to residential blocks. These have been assessed as having an average runoff coefficient of 0.5.

The run-off generated by the existing blocks is outlined below in table 4-2.

Table 4-2: Existing Stormwater Catchments and Run-off

| <b>Development Element</b>         | <b>Area</b>           | <b>Run-off Coefficient</b> | <b>Run-off flow rate (l/s)</b> |
|------------------------------------|-----------------------|----------------------------|--------------------------------|
| Blocks for re-zoning               | 26,000 m <sup>2</sup> | 0.5                        | 106.25                         |
| Entire Catchment, Man Street block | 80,000 m <sup>2</sup> | 0.5                        | 326.93                         |

#### 4.4 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

The potential development of the three blocks will increase the stormwater run-off generated on the site, by creating impermeable surfaces where permeable surfaces currently exist.

It is assumed that the building coverage of any future development will be 70%, as per the current town centre zoning. The remainder of the sites (30%) is assumed to be split equally between asphalt/paving and gardens.

Run-off coefficients have been assigned as follows:

- Roofs: 0.9
- Asphalt and paving: 0.85
- Gardens: 0.3

The combined runoff coefficients for the blocks as a whole is therefore 0.8025, and the associated peak run-off flow rates are shown in Table 4-3 below.

Table 4-3: Proposed Stormwater Catchments and Run-off

| <b>Development Element</b> | <b>Area (m<sup>2</sup>)</b> | <b>Run-off Coefficient</b> | <b>Run-off flow rate (l/s)</b> |
|----------------------------|-----------------------------|----------------------------|--------------------------------|
| Blocks for re-zoning       | 26,000 m <sup>2</sup>       | 0.8025                     | 170.53                         |

As can be seen from table 4-3, the development of the sites will increase the run-off in the Man Street pipes by 64.28 l/s.

#### 4.5 ASSESSMENT OF INFRASTRUCTURE EFFECTS

##### 4.5.1 Piped Infrastructure

The 225 mm diameter pipe within Man Street is at a slope of 5.6%. This represents a maximum capacity of 145.4 l/s. The post development flows out of blocks 2 and 3 alone exceeds this capacity. Further, the 450 mm concrete pipe passing under commercial buildings to connect to the Horne Creek culvert has an estimated capacity of approximately 372 l/s, and the post-development flows are approximately 400 l/s.

For the piped infrastructure to support an extension of the town centre zone into the blocks in question, upgrade of this stormwater pipe will be necessary. The Man Street

main will need to be upgraded to a 300 mm minimum diameter main, and the 450 mm pipe upgraded to a 525 mm diameter main.

It is likely to be difficult to upgrade the 450 mm concrete pipe that passes under commercial buildings, and as a result a new pipe along Camp Street to the intersection with Shotover Street and then along Shotover Street to the Horne Creek culvert will likely be necessary.

Alternatively, it may be possible to attenuate the stormwater run-off from the Man Street block to reduce the peak flows into the pipes. This is likely to be expensive due to the high density development anticipated in the Town Centre zone – underground tanks or rain water tanks would need to be located within each site to reduce the peak run-off by approximately 20%, or green roofs or similar attenuation devices used.

#### 4.5.2 Secondary Overland Flow Path

Secondary overland flow paths need to be designed to allow a path for stormwater run-off from rainfall events larger than the design storm. In accordance with NZS4404:2010, the catchment currently utilises the existing road network. This is considered appropriate for the fully developed catchment, as the kerb and channel network will allow water to flow through the subject area and eventually into Lake Wakatipu.



### 5.1 EXISTING INFRASTRUCTURE

Contact Energy/Rock Gas advise that gas infrastructure exists in the vicinity of all three blocks. Gas reticulation in the area comprises a 160 mm main on Thompson Street and a 110 mm gas main located within Isle Street. Bottled gas supply is provided to other amenities in the area.

### 5.2 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

Future commercial activities on the proposed blocks may require LPG gas reticulation to support a number of the future development elements. With gas reticulation available, it is likely that residential units will also utilise gas for heating, cooking and hot water.

### 5.3 ASSESSMENT OF INFRASTRUCTURE EFFECTS

Contact/RockGas have advised that the existing reticulation in the vicinity of the development has the ability to support development in this area.



### 6.1 EXISTING INFRASTRUCTURE

The blocks are currently supplied with power via Aurora Energy's electricity network. Power services exist within the road reserves in the area.

### 6.2 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

When fully developed with commercial mixed-use activities all of the discrete development elements at the site will generate demands on the infrastructure, including power infrastructure. Electricity will be required for all usual domestic and commercial uses.

### 6.3 ASSESSMENT OF INFRASTRUCTURE EFFECTS

The power requirements for the neighbouring Lakeview site have been assessed by Peak Power Ltd, who have had a long involvement in the site. Peak Power have advised that, although in general the site is supplied with electricity via Aurora's network, switchgear and transformers in the area are only sized to support other existing power users, such as hotels.

It is likely that future development in this area may require upgrades of switchgear and transformers. This is usually undertaken by the owner of the site at the time of development.



#### 7.1 EXISTING INFRASTRUCTURE

Specific information about the telecom infrastructure in the area is not known, however Chorus's website shows the site is within the area currently serviced by the Ultra-Fast Broadband (UFB) roll out. The existing buildings in the area are all supplied with telecommunications connections for both landlines and broadband.

#### 7.2 ASSESSMENT OF INFRASTRUCTURE EFFECTS

Advice from Chorus, the local telecommunications network provider, has not yet been received with regard to this development.

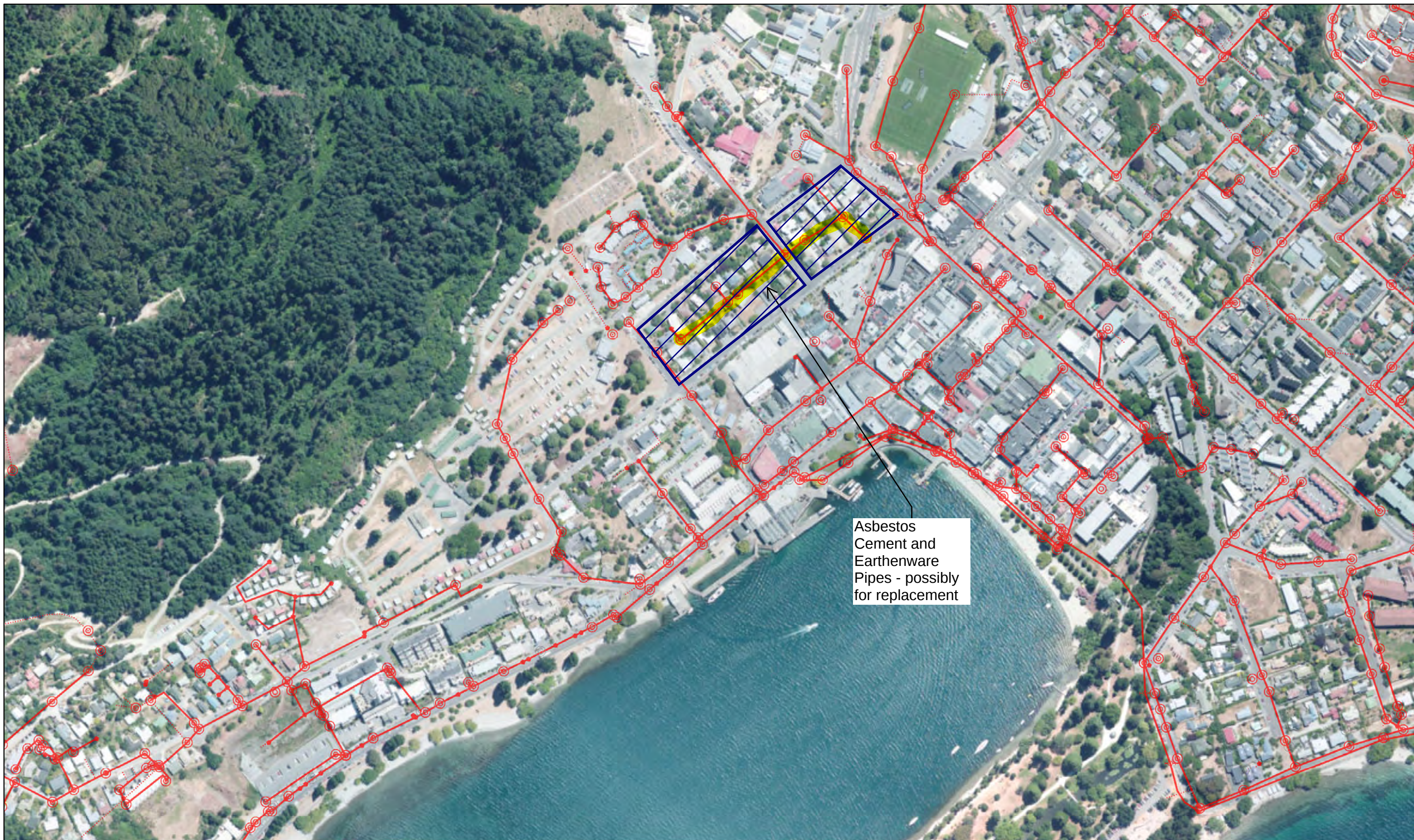
However, due to the location of the site within the area already serviced by the UFB roll out, it is expected that the development can be serviced by the infrastructure external to the site.



1. Queenstown Lakes District Council GIS Mapping System
2. *A Guideline and Procedure for Hydrological Design of Urban Stormwater Systems*, New Zealand Institute of Engineers, Auckland Branch, 1980
3. *NZS4404:2010 Land Development and Subdivision Infrastructure*, Standards New Zealand
4. Queenstown Lakes District Council's approved amendments to NZS4404:2004
5. *Camping Ground Regulations 1985*, New Zealand Government
6. *SNZ PAS 4509:2008 New Zealand Fire Service Fire fighting Water Supplies Code of Practice*, Standards New Zealand
7. *Scuttlebutt Special Edition, Queenstown Convention Centre Proposal Summary*, Queenstown Lakes District Council, August 2013.



## APPENDIX 1 – SKETCH PLANS



The map is an approximate representation only and must not be used to determine the location or size of items shown, or to identify legal boundaries. To the extent permitted by law, the Queenstown Lakes District Council, their employees, agents and contractors will not be liable for any costs, damages or loss suffered as a result of the data or plan, and no warranty of any kind is given as to the accuracy or completeness of the information represented by the GIS data. While reasonable use is permitted and encouraged, all data is copyright reserved by Queenstown Lakes District Council. Cadastral information derived from Land Information New Zealand. CROWN COPYRIGHT RESERVED



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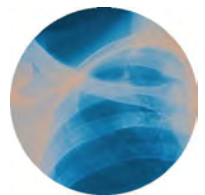
## APPENDIX 2 – CALCULATIONS

| Man St Blocks | US IL  | US LL | DS IL  | DS LL | Length | Slope | Pipe Dia | Pipe Material | Capacity (l/s) | Capacity (EDU) | Feeding in | Remaining Capacity (l/s) |          |
|---------------|--------|-------|--------|-------|--------|-------|----------|---------------|----------------|----------------|------------|--------------------------|----------|
| 1-2           | 329.95 |       | 329.49 |       | 82.8   | 0.56% | 150      | EW            | 13.11569       | 251.2585       | 13         | 12.43709                 | 238.2585 |
| 2-3           | 329.49 |       | 328.93 |       | 70.2   | 0.80% | 150      | AC            | 15.77027       | 302.1125       | 20         | 14.72627                 | 282.1125 |
| 3-4           | 328.93 |       | 323.46 |       | 84.1   | 6.50% | 150      | AC            | 45.56116       | 872.8191       | 182        | 36.06076                 | 690.8191 |
| 4-5           | 323.46 |       | 322.15 |       | 42.4   | 3.09% | 150      | AC            | 31.31007       | 599.8098       | 206        | 20.55687                 |          |
| 5-6           | 322.15 |       | 320.39 |       | 45.4   | 3.88% | 300      | AC            | 219.415        | 4203.353       | 210        | 208.453                  |          |



## REPORT

STRUCTURAL AND CIVIL ENGINEERS



LAKEVIEW INFRASTRUCTURE ASSESSMENT

– 34 BRECON STREET ADDENDUM

PREPARED FOR

BRECON STREET PARTNERSHIP LTD /

QUEENSTOWN LAKES DISTRICT COUNCIL

111265.01

AUGUST 2014



Lakeview Plan Change Infrastructure Assessment  
34 Brecon Street Addendum

Prepared For:

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QUEENSTOWN

Date: 15 August 2014  
Project No: 111265  
Revision No: 2 - Final

Prepared By:

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As part of the Lakeview plan change application, Queenstown Lakes District Council (QLDC) is considering rezoning the land between the current Queenstown Town Centre Zone and the proposed Lakeview Sub-Zone to include this land in a revised Queenstown Town Centre Zone. This land is also to be extended to include 34 Brecon Street, adjacent to the existing Lakeview Holiday Park.

To determine the feasibility of the extending the Lakeview plan change to include 34 Brecon Street, an investigation has been undertaken to assess the infrastructure effects of development on the site.

This addendum report should be read in conjunction with the infrastructure assessment completed for the Lakeview site.

#### WASTEWATER

QLDC's wastewater infrastructure provides a number of potential connection points adjacent to 34 Brecon Street, and these have been assessed to determine the potential capacity available for use by future development in the zone in question. The sewer lines closest to each of the proposed blocks have been found to have capacity for the types of development currently anticipated in the zone.

Whilst this high level analysis suggests no required upgrades to the QLDC infrastructure outside of the site, it is recommended that when the existing asbestos cement pipe within Brecon Street reaches the end of its design life, consideration is given to upgrading the size of this pipe.

#### WATER SUPPLY

The major water infrastructure in the area of the plan change is considered adequate to support the future development. However, due to the size of the main within Brecon Street, it is recommended that future development within 34 Brecon Street connect to the 150 mm water main located within the Brecon Street/Isle Street intersection.

#### STORMWATER

Development of the subject site will potentially generate a further 1.3 l/s peak runoff into the stormwater network. Whilst this is a very small percentage (<1%) of the capacity of the stormwater mains draining the site, the existing network does not currently have capacity for the flows already anticipated within the catchment.

Therefore it is recommended that the 300 mm diameter main within upper Camp Street is upgraded to a 375 mm diameter pipe. Also as discussed in our previous reports relating to the Lakeview site, the 450 mm main through to the culverted section of Horne Creek also requires upgrade.

## GAS

The site is located directly adjacent to the Queenstown CBD and as such is in close proximity to hotels and other facilities currently utilising LPG gas for hot water, cooking and heating. This LPG gas infrastructure external to the site is able to be adequately extended to support future development provided for by way of the proposed plan change.

## POWER

Although Aurora Energy's network surrounds the site in question, the switch gear, transformers and associated discrete infrastructure elements associated with the power network in the area have been sized to support the buildings or developments they are associated with. As such, it is necessary when considering the plan change to allow for this infrastructure.

## TELECOMMUNICATIONS

Specific confirmation of the ability of the telecommunications network to support the proposed plan change has not been received at this time, however, due to the location of the site within the area of benefit for the Ultra-Fast Broadband roll out, the network is assumed to have the capacity to support future development.



As part of the Lakeview plan change application, Queenstown Lakes District Council (QLDC) is considering rezoning the land between the current Queenstown Town Centre Zone and the proposed Lakeview Sub-Zone to include this land in a revised Queenstown Town Centre Zone. Further to this, at the request of Brecon Street Partnership Limited, the site located at 34 Brecon Street is also being considered for this extended town centre zone. This site is shown below:



This further addendum report to our previous reports describing the infrastructure effects of the Lakeview Sub-Zone and the Isle Street Blocks (referred to as the “addendum report”) describes the infrastructure effects of re-zoning this land. This addendum is to be read alongside the Lakeview Plan Change report and the Isle Street Blocks Addendum report prepared by Holmes Consulting Group, and the same assumptions apply.

#### 1.1 EXISTING SITE USAGE

34 Brecon Street is approximately 3900 m<sup>2</sup> in area. It is currently occupied by Queenstown Mini Golf, an 18 hole outdoor mini golf with associated car parking and ticketing facilities.

#### 1.2 LIMITATIONS

Findings presented as a part of this project are for the sole use of Queenstown Lakes District Council in its evaluation of the subject properties. The findings are not intended for use by other parties, and may not contain sufficient information for the purposes of other parties or other uses. Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice presented in this report.



## 2.1 EXISTING INFRASTRUCTURE

150 mm sewer lines run within both Cemetery Road and Brecon Street, adjacent to 34 Brecon Street. The Cemetery Road line is constructed in uPVC, collecting the wastewater from the motel units and apartments at Lakeview Holiday Park. The 150 mm main in Brecon Street is constructed in Asbestos Cement and collects wastewater from the commercial developments in the area, including the base of Skyline Gondola, Queenstown Childcare Centre and the Caddyshack indoor mini golf. The 150 mm uPVC line connects to the asbestos cement line, which in turn connects to a further 150 mm asbestos cement line (the line passing through the Man Street blocks assessed in the Holmes Consulting Group addendum report referenced in section 1 above).

### 2.1.1 Capacity

The invert levels and lengths of the individual pipes making up these lines defined above have been taken from QLDC's GIS information and the slopes calculated to determine the capacity of each of these pipes. These calculations are shown in Appendix 1.

The catchments feeding in to each of these pipes was then assessed and a conservative number of equivalent dwellings assessed. NZS4404:2010 provides that a DN 150 pipe laid at its minimum grade of 0.55% (i.e. with a capacity of 13.05 l/s) can support up to 250 dwelling units. This capacity has been used to back-calculate an average flow per dwelling of 0.0522 l/s.

The Cemetery Road line drains the area of Lakeview Holiday Park utilised for the motel units and apartments, previously assessed in our plan change report to generate approximately a wastewater load of 3.5 l/s. This line therefore has spare capacity of approximately 12.9 l/s.

The line within Brecon Street collects this catchment, plus as noted above, the commercial developments in the area including the Queenstown Childcare Centre and the base of Skyline Gondola. These commercial developments are conservatively estimated to generate a wastewater load similar to 50 residential dwellings, or 2.6 l/s.

The spare capacity within this line is approximately 8.4 l/s. This is less than the remaining capacity in the Man Street blocks, and therefore this line is considered to be the limiting factor in this assessment. This represents spare capacity of more than 150 equivalent dwelling units.

## 2.2 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

For the mixed use town centre zone proposed, both commercial and high density residential developments are possible. The number of residential dwelling units is not limited by specific rules within the district plan for town centre zones; instead it is technically limited only by the height of the building and coverage of the site.

The worst case scenario from a wastewater infrastructure perspective would be for 34 Brecon Street to be dedicated to high density residential.

### 2.3 ASSESSMENT OF INFRASTRUCTURE EFFECTS

The sewer line currently servicing 34 Brecon Street has capacity to service some development within these lots. The site in question is 3900 m<sup>2</sup> in area and the line has capacity for more than 150 equivalent dwelling units.

The sewer line within Brecon Street is an asbestos cement pipe. There is potential for more future development within the catchment of this pipe than is being considered in this report, and it is recommended that when this pipe reaches the end of its economic life, upgrading this pipe and those immediately downstream to 225 mm diameter pipes is considered.



### 3.1 EXISTING INFRASTRUCTURE

The water supply into the Queenstown CBD from the Fernhill No 1 Reservoir (also known as Twin Reservoir) is fed via two main lines, a 450 mm main located within Fernhill Road and a smaller 300 mm diameter main running along Thompson and Man Streets. Smaller mains taken off the 300 mm main pass along Cemetery Road (50-100 mm diameter) and Brecon Street (150 mm diameter, reducing to 100 mm diameter past the subject site).

A number of hydrants also exist around the blocks, located regularly on all of the rider mains. One hydrant is located on the Cemetery Road main and three are located in Brecon Street in the portions immediately adjacent to the site.

### 3.2 EXISTING WATER DEMANDS

The existing water demands for these blocks are largely related to residential or commercial office uses.

As per the Lakeview site and Man Street blocks, fire fighting demands are likely to dominate over the residential demands. The required fire fighting water supply in the vicinity of the site at present is estimated to be a minimum FW3 supply (suitable for non-sprinklered crowd activities with fewer than 100 people, and with the largest fire cell below 600 m<sup>2</sup>), which requires a minimum of 25 l/s from each of two hydrants (that is, a total of 50 l/s).

Domestic demands in the area are similar to those described in the wastewater section above, conservatively up to 50 equivalent dwelling units.

### 3.3 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

The proposed plan change area is to allow for both commercial and high density residential activities. These two uses have contradictory water demands; the residential uses dominate for domestic supply, whereas the commercial activities dominate for fire fighting supply.

As mentioned above, water supply for domestic uses is very rarely the governing factor in the design or assessment of water infrastructure. The fire fighting water supply requirements for most high density residential, accommodation and similar commercial developments is 25 l/s from two hydrants, assuming sprinklers are installed. On top of this hydrant demand, the sprinkler demands must also be met. SNZPAS4508:2008 defines the sprinkler demands for an ordinary fire hazard site at approximately 1200-1500 l/minute (20-25 l/s). The combined fire fighting demands are therefore approximately 50 l/s.

### 3.4 ASSESSMENT OF INFRASTRUCTURE EFFECTS

#### 3.4.1 Water Pressure

The Public Health Risk Management Plan for the Queenstown Water Supply identifies a Top Water Level (TWL) of 407.2 m for the Fernhill No 1 reservoir. The highest existing ground level within 34 Brecon Street is approximately RL 350. It is expected that buildings will be four levels or lower on this site. This is assumed to result in a highest floor level of approximately RL 362, with a ceiling level of approximately RL 366.

The difference in height between the TWL and highest ceiling level is 41.2 m. The pipe distance from the reservoir to the site is approximately 1200 m (as measured via QLDC's GIS system). Friction losses in the pipe have been assumed to comply with clause 6.5.3.4 of NZS4404:2010 and are therefore assumed to be less than 3 m/km. Based on this, the expected pressures at the site are approximately 375 kPa, which is within the acceptable range as defined by the QLDC amendments to NZS4404:2004 (which defines minimum pressures of 300 kPa).

#### 3.4.2 Water Quantity

As noted above, the domestic water demand is very rarely the governing factor when determining the ability of a water supply to service a new development, due to the flow rates required for fire fighting.

For this site, the fire hazard risk represented by the existing Lakeview Holiday Park is assessed to be a greater or equal hazard than both the future development on the Lakeview site and future development on the 34 Brecon Street site, assuming the structures within any future developments are sprinklered. The current fire hazard category requires 50 l/s combined from two hydrants, and the future developments will require 25 l/s from two hydrants, on top of a sprinkler demand expected to be in the realm of 25 l/s (based on similar recent developments within the district).

However, the empirical guide to sizing principal water mains provided in table 6.2 of NZS4404:2010 shows that the 100 mm mains adjacent to the site are able to cater for up to 40 equivalent dwelling units. 150 mm mains are able to supply up to 160 dwelling units.

It is therefore recommended that any future development of the 34 Brecon Street site is fed from the 150 mm water main which currently decreases to 100 mm in diameter at the Isle Street/Brecon Street intersection. This junction lies at a distance of approximately 50-60 m from the site.



#### 4.1 EXISTING INFRASTRUCTURE

The site falls towards a 225 mm uPVC stormwater line within Cemetery Road. This main continues through to Isle Street and connects to a 300 mm concrete line within upper Camp Street, which then drains to the 450 mm concrete line previously assessed within our addendum report referenced in section 1 above, before connecting to the Horne Creek Culvert..

#### 4.2 DESIGN STORM AND METHOD OF ANALYSIS

In accordance with NZS4404:2010, the chosen design storm for this assessment is one with a ten year average return interval (10 year ARI storm). Rainfall intensities (in mm/hr) have been obtained from Niwa's HIRDS database, and are outlined in the table below.

Table 4-1: Rainfall Data (HIRDS)

| ARI(y) | Duration |      |      |      |    |    |     |     |     |     |
|--------|----------|------|------|------|----|----|-----|-----|-----|-----|
|        | 10m      | 20m  | 30m  | 60m  | 2h | 6h | 12h | 24h | 48h | 72h |
| 10     | 29.4     | 23.7 | 20.8 | 16.9 | 12 | 7  | 5   | 3.6 | 2.1 | 1.6 |

The storm duration depends on the cumulative time of travel over the ground surface and within pipes across the site to the connection to existing infrastructure. For conservatism, a storm duration of 10 minutes (the most intense rainfall) has been used, with a resultant rainfall rate of 29.4 mm/hour.

With this information, peak flow rates from the catchments have been calculated using the Rational Method as described in the New Zealand Institute of Engineers: Guidelines and Procedure for Hydrological Design of Urban Stormwater Systems.

#### 4.3 EXISTING SITE COVERAGE

34 Brecon Street is currently occupied by Queenstown Mini Golf. The majority of the site contains pervious surfaces, with a similar permeability to a bare site. This has been assessed to have an average runoff coefficient of 0.4

The runoff generated by this site is therefore 12.7 l/s.

#### 4.4 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

The potential development of 34 Brecon Street will increase the stormwater run-off generated on the site, by creating impermeable surfaces where permeable surfaces currently exist.

It is assumed that the building coverage of any future development will be 80%, as per the current town centre zoning. The remainder of the sites (20%) is assumed to be split equally between asphalt/paving and gardens.

Run-off coefficients have been assigned as follows:

- Roofs: 0.9
- Asphalt and paving: 0.85
- Gardens: 0.3

The combined runoff coefficients for the blocks as a whole is therefore 0.835, and the associated peak runoff flow rate is 26.6 l/s. This represents an increase of approximately 13 l/s over the existing site runoff.

#### 4.5 ASSESSMENT OF INFRASTRUCTURE EFFECTS

##### 4.5.1 Piped Infrastructure

The minimum slope of the 225 mm diameter pipe within Cemetery Road and Isle Street is 6.7%. This represents a maximum capacity of 188.2 l/s. The runoff flow rate of the upstream catchment and the Cemetery Road/Brecon Street block is approximately 135 l/s and therefore 50 l/s capacity currently exists within this pipe.

The shallowest grade on the 300 mm diameter pipe within Camp Street is 2.95%, representing a capacity of 237.7 l/s. The catchment draining into this pipe generates approximately 250 l/s and therefore the flows currently entering this pipe are shown in this analysis as exceeding the capacity of the pipe.

Further, as previously assessed, the 450 mm concrete pipe passing under commercial buildings to connect to the Horne Creek culvert has an estimated capacity of approximately 372 l/s, and the post-development flows are approximately 400 l/s.

The increase in stormwater flows exiting Brecon Street as a result of the extension of the town centre zone to cover this site are only 13 l/s. This is not a significant flow in the context of the pipe network it is fed into, however this analysis shows there is currently no capacity within this pipe network.

For the piped infrastructure in this area to work as currently intended, this 300 mm main within Camp Street needs to be upgraded to a minimum 325 mm diameter pipe. This upgrade is required to support the existing situation, without any additional flows feeding in. Due to the pipe sizes readily available, it is likely that this pipe will need to be upgraded to 375 mm in diameter. This additional pipe capacity will easily cater for the development of 34 Brecon Street.

As previously mentioned in our Addendum Report, the 450 mm pipe from Camp Street through to the Horne Creek Culvert will also need to be upgraded to a 525 mm diameter main.

#### 4.5.2 Secondary Overland Flow Path

Secondary overland flow paths need to be designed to allow a path for stormwater run-off from rainfall events larger than the design storm. In accordance with NZS4404:2010, the catchment currently utilises the existing road network. This is considered appropriate for the fully developed catchment, as the kerb and channel network will allow water to flow through the subject area and eventually into Lake Wakatipu.



### 5.1 EXISTING INFRASTRUCTURE

Contact Energy/Rock Gas advise that gas infrastructure exists in the vicinity of 34 Brecon Street. Gas reticulation in the area comprises a 110 mm gas main located within Isle Street. Bottled gas supply is provided to other amenities in the area.

### 5.2 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

Future commercial activities on the proposed blocks may require LPG gas reticulation to support a number of the future development elements. With gas reticulation available, it is likely that residential units will also utilise gas for heating, cooking and hot water.

### 5.3 ASSESSMENT OF INFRASTRUCTURE EFFECTS

Contact/RockGas have advised that the existing reticulation in the vicinity of the development has the ability to support development in this area.



### 6.1 EXISTING INFRASTRUCTURE

The blocks are currently supplied with power via Aurora Energy's electricity network. Power services exist within the road reserves in the area.

### 6.2 PROPOSED DEVELOPMENT UNDER THE PLAN CHANGE

When fully developed with commercial mixed-use activities all of the discrete development elements at the site will generate demands on the infrastructure, including power infrastructure. Electricity will be required for all usual domestic and commercial uses.

### 6.3 ASSESSMENT OF INFRASTRUCTURE EFFECTS

The power requirements for the neighbouring Lakeview site have been assessed by Peak Power Ltd, who have had a long involvement in the site. Peak Power have advised that, although in general the site is supplied with electricity via Aurora's network, switchgear and transformers in the area are only sized to support other existing power users, such as hotels.

It is likely that future development in this area may require upgrades of switchgear and transformers. This is usually undertaken by the owner of the site at the time of development.



## 7.1 EXISTING INFRASTRUCTURE

Specific information about the telecom infrastructure in the area is not known, however Chorus's website shows the site is within the area currently serviced by the Ultra-Fast Broadband (UFB) roll out. The existing buildings in the area are all supplied with telecommunications connections for both landlines and broadband.

## 7.2 ASSESSMENT OF INFRASTRUCTURE EFFECTS

Advice from Chorus, the local telecommunications network provider, has not yet been received with regard to this development.

However, due to the location of the site within the area already serviced by the UFB roll out, it is expected that the development can be serviced by the infrastructure external to the site.



1. Queenstown Lakes District Council GIS Mapping System
2. *A Guideline and Procedure for Hydrological Design of Urban Stormwater Systems*, New Zealand Institute of Engineers, Auckland Branch, 1980
3. *NZS4404:2010 Land Development and Subdivision Infrastructure*, Standards New Zealand
4. Queenstown Lakes District Council's approved amendments to NZS4404:2004
5. *Camping Ground Regulations 1985*, New Zealand Government
6. *SNZ PAS 4509:2008 New Zealand Fire Service Fire fighting Water Supplies Code of Practice*, Standards New Zealand



## APPENDIX 1 – CALCULATIONS

| Calc No. | Qtarget<br>(l/s) | ks<br>(mm) | S<br>(m/m) | D<br>(m) | V<br>(m/s) | Qpipe<br>(l/s) |
|----------|------------------|------------|------------|----------|------------|----------------|
|----------|------------------|------------|------------|----------|------------|----------------|

# SEWER

## 34 Brecon St

|             |  |     |        |      |          |          |
|-------------|--|-----|--------|------|----------|----------|
| Cemetery Rd |  | 0.6 | 0.0087 | 0.15 | 0.932659 | 16.48145 |
| Brecon St   |  | 0.6 | 0.0069 | 0.15 | 0.828893 | 14.64775 |

## STORMWATER - BRECON ST

|      |       |          |       |          |          |
|------|-------|----------|-------|----------|----------|
| 1-3  | 0.015 | 0.074514 | 0.225 | 5.002986 | 198.9226 |
| 3-4  | 0.015 | 0.09341  | 0.225 | 5.637567 | 224.1541 |
| 4-5  | 0.015 | 0.067105 | 0.225 | 4.733092 | 188.1914 |
| 5-6  | 0.15  | 0.033333 | 0.3   | 3.36302  | 237.7179 |
| 6-7  | 0.015 | 0.029598 | 0.3   | 3.673352 | 259.6539 |
| 7-9  | 0.015 | 0.051884 | 0.3   | 4.948122 | 349.7622 |
| 9-10 | 0.015 | 0.613636 | 0.3   | 17.92116 | 1266.772 |

Brecon Street

| US MH # | DS MH # | US IL   | US LL   | DS IL   | DS LL   | Length | Slope    | Pipe Dia | Pipe Material |
|---------|---------|---------|---------|---------|---------|--------|----------|----------|---------------|
| 1       | 3       | 342.164 | 343.584 | 333.036 | 334.891 | 122.5  | 0.074514 | 225      | PVC           |
| 3       | 4       | 333.036 | 334.891 | 326.105 | 327.9   | 74.2   | 0.09341  | 225      | PVC           |
| 4       | 5       | 326.105 | 327.9   | 323.3   | 325.045 | 41.8   | 0.067105 | 225      | PVC           |
| 5       | 6       | 323.3   | 325.045 | 322.3   | 324.13  | 30     | 0.033333 | 300      | Conc          |
| 6       | 7       | 322.3   | 324.13  | 321.27  | 322.62  | 34.8   | 0.029598 | 300      | PVC           |
| 7       | 9       | 321.27  | 322.62  | 319.205 | 320.705 | 39.8   | 0.051884 | 300      | PVC           |
| 9       | 10      | 319.205 | 320.705 | 316.505 | 320.995 | 4.4    | 0.613636 | 300      | PVC           |

Brecon St

Cemetery Rd

Upstream of Fire Station

Camp St

Upstream

|        |      |          |          |
|--------|------|----------|----------|
| 16,000 | 0.6  | 78.46272 |          |
| 28,000 | 0.5  | 114.4248 | 192.8875 |
| 2,700  | 0.75 | 16.55073 | 209.4383 |
| 17,000 | 0.4  | 55.57776 | 134.0405 |
|        |      |          | 248.4653 |

|                           | US IL  | US LL  | DS IL  | DS LL  | Length | Slope | Pipe Dia | Pipe Material | Capacity (l/s) | Capacity (EDU) | Feeding in (l/s) | Remaining Capacity (l/s) | EDUs     |
|---------------------------|--------|--------|--------|--------|--------|-------|----------|---------------|----------------|----------------|------------------|--------------------------|----------|
| Brecon St Cemetery Rd 1-3 | 329.99 | 330.99 | 329.34 | 330.34 | 74.4   | 0.87% | 150      | PVC           | 16.48          | 315.7088       | 3.6              | 12.88                    | 246.7433 |
| Brecon St 1-2             | 329.34 | 330.34 | 328.93 | 329.5  | 59.6   | 0.69% | 150      | AC            | 14.64          | 280.4598       | 8.82             | 5.82                     | 111.4943 |

**AEE**  
**APPENDIX E**

Hadley Consultants Ltd: Preliminary Geotechnical Assessment  
and Addendum

Queenstown Lakes District Council

**Proposed Queenstown Town  
Centre: Lakeview Subzone Plan  
Change**

Preliminary Geotechnical  
Assessment

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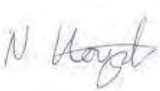
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### Document Status

| Revision          | Author:  |                                                                                     | Reviewer: |                                                                                      |              |
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|                   | Name     | Signature                                                                           | Name      | Signature                                                                            | Date         |
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| Final             | N. Lloyd |  | J. Hadley |  | 29 July 2014 |

### Limitations

This report has been written for the particular brief to HCL from their client and no responsibility is accepted for the use of the report for any other purpose, or in any other context or by any third party without prior review and agreement.

In addition, this report contains information and recommendations based on information obtained from a variety of methods and sources including inspection, sampling or testing at specific times and locations with limited site coverage and by third parties as outlined in this report. This report does not purport to completely describe all site characteristics and properties and it must be appreciated that the actual conditions encountered throughout the site may vary, particularly where ground conditions and continuity have been inferred between test locations. If conditions at the site are subsequently found to differ significantly from those described and/or anticipated in this report, HCL must be notified to advise and provide further interpretation.

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# 1. Introduction

Queenstown Lakes District Council (QLDC) have engaged Hadley Consultants Limited (HCL) to undertake an initial desktop review and a preliminary geotechnical assessment for the section of land owned by QLDC within the Queenstown Town Centre: Lakeview Subzone Plan Change Area. It is intended that the Lakeview Subzone Plan Change Area (the "zone area") be rezoned from high density residential to mixed use commercial.

The Council owned portion of the proposed Lakeview Subzone Plan Change Area is made up of 4 distinct blocks known as the;

- i) Lynch Block,
- ii) Freehold Block,
- iii) Reserve Block, and the
- iv) Holiday Park Block.

The Council owned portion of the zone area includes the former Queenstown Camping Ground, the existing Lakeview Holiday Park and a number of residential cabins. A portion of the zone area, primarily the Freehold Block, is the preferred site for the proposed Queenstown Convention Centre (QCC).

This preliminary report expands on our previous assessment of parts of the zone area and considers the following;

- The nature of the zone area,
- The geological setting and geomorphology,
- The expected ground conditions,
- The published natural hazard data, and
- Previous site investigations.

The above parameters are considered in terms of how they might affect possible future development of the zone area including, but not limited to, the proposed QCC development.

The report is prepared in order to provide QLDC with a high-level overview of the likely site conditions and to identify any critical constraints that may limit or unduly impact on future development of the site as a result of the rezoning.

## 2. Site Overview and Site Description

The Council owned portion of the Lakeview Subzone Plan Change Area is located to the north of Thompson, Man and Isle Streets between Glasgow Street to the west and Cemetery Road to the northeast on the lower, south-western flank of Bob's Peak. The site was formerly part of the Queenstown camping ground and contains a number of residential cabins along with disused visitor accommodation and associated buildings.

The Council owned zone area includes a number of individual lots and comprises an area of approximately 11 Hectares (including some reserve and legal road). A plan indicating the extent of the Council owned portion of the Lakeview Subzone Plan Change Area and the individual blocks that make up this portion of the zone area is included as Appendix 1. An annotated site plan illustrating key features pertinent to this geotechnical assessment is also included as Appendix 2.

As the project is currently at a Plan Change approval stage, no confirmed development concepts or information regarding the possible extent, location or nature of future development within the area is currently available. As such this report focusses on the likely conditions across the Council owned portion of the zone area as a whole. However, it is important to note that it is assumed that the steep slopes that extend into the zone area on the northern fringes, particularly within the Lynch and Freehold Blocks, will be excluded from intensive development, unless subject to further detailed assessment.

The majority of the area consists of a generally flat to gently sloping terrace of low relief, but also includes an elevated spur towards the western boundary and steep hill slopes along the northern boundary. The main terrace portion of the site ranges from approximately RL340 metres in the east to RL355 metres above mean sea level.

A minor gully extends into the western corner of the site from the steep adjacent slopes which may result in surface water flows, although these appear to be small and ephemeral in nature. Some areas of minor groundwater seepage have been identified in the toe of the steeper north slopes in several areas. Minor groundwater is expected to be present beneath the site in some locations.

### 3. Geomorphology and Geological Setting

The majority of the Council owned portion of the Lakeview Subzone consists of a generally flat terrace remnant, but also includes an elevated spur on the western fringe and steep hill slopes on the northern extremities. Beyond the site to the north lie steep, bluffy slopes which extend upwards towards Bob's Peak.

The site is overlain with alluvial deposits and glacial till over schist bedrock. The depth of the alluvial and till deposits vary across the site with some surface outcrops of schist bedrock present.

The Wakatipu Basin has been sculpted by numerous glacial advances. The last glacial advance (approximately 18,000 years ago) is expected to have deposited glacial till across the site and marginal rivers may also have impacted the site as the glacier retreated.

Following the last glacial advance into the basin the level of Lake Wakatipu was higher than its current level at approximately RL357m and is thought to have lowered over time in stages to reach its current level as the outlet to the Kawarau River was created.

Alluvial river delta deposits, beach formations and shallow lacustrine deposits were formed in various locations around the Wakatipu basin during this period of higher lake level occupation and remnant features still remain in many locations. The historic maximum lake level corresponds approximately to the upper northern edge of the Lakeview Subzone and therefore beach deposits are expected to be present in and around the area.

The alluvial and glacial till deposits comprise silts, sands and gravels of variable grading as is typical at this elevation. Some variability in bearing strength in these deposits can be expected, but this is unlikely to unduly constrain future development.

The basement rock or bedrock beneath the site consists of metamorphic schist with a well-developed foliation. The degree of weathering and rock mass defects present within the schist rock can be expected to vary across the site. The surface exposures present in and around the zone area show that the schist predominantly consists of greyschist with some greenschist bands. The foliation observed within the exposures dips to the southwest at a moderate angle of approximately 20 – 30 degrees and the exposures observed are considered to be in-situ basement rock.

The depth to bedrock is relatively shallow across large portions of the zone area. This may impact development costs. Similarly, the dip angle of the bedrock may necessitate rock bolting if required excavation depths become significant or jointing is exposed which requires stabilisation.

Areas of rockfall and/or colluvium debris are present in many areas around the toe of the steep glacially sculptured slopes flanking the Wakatipu Basin. Previous aerial photo interpretation has identified one such debris cone series to the north of the site and extending into the north-east

fringe of the Lakeview Subzone. This limited area would require more detailed investigation prior to development.

## 4. Preliminary Hazard Assessment

We have reviewed the QLDC hazard maps and a copy of the relevant map is included as Appendix 3 of this report.

The Council owned portion of the Lakeview Plan Change Area is shown as predominantly classified as Liquefaction Category LIC 1(P) in terms of the Preliminary Liquefaction Hazard Assessment that was undertaken by Tonkin & Taylor for QLDC in 2012. This category is expected to be low risk, but is considered provisional due to lack of information available at the time of the assessment.

A small area along the northern fringe of the zone area is also shown as classified as Liquefaction Category Susceptible in terms of the Hazards Register Part II Stage 2 Risk management Study Report that was undertaken by Opus for QLDC in 2002. The inclusion of this area beyond the extent of the LIC 1(P) area discussed above is considered to be the result of slightly different reporting boundaries between the different studies and can therefore be discounted.

The majority of the area is also classified in the Otago Regional Council (ORC) Alluvial Fan Hazard Study that was undertaken by GNS in 2008 to be "fan less recently active". This category has been adopted by QLDC and is also shown in the hazard map for the site.

Based on the geological model and our experience of the ground conditions within the zone area we consider the risk of liquefaction to be very low/negligible. This is due to the predominantly coarse grained soils and limited near surface permanent groundwater expected to be present across the site.

Similarly, based on the geological model developed for the zone area, any large scale alluvial features in and around the area are expected to relate to either the last glacial retreat and/or the previous higher lake level. As such, any large scale alluvial features within the zone area are expected to be stable remnant features and we do not consider there to be large scale alluvial fan hazard.

Notwithstanding the above, it is noted that proper care and attention will be needed when planning for and designing future developments to ensure upslope runoff from the steep slopes above, and any groundwater encountered in excavations, are allowed for and addressed by the proposed development. It may also be necessary to consider the possible effect of reduced vegetation cover in the upslope catchment above the zone area towards Bob's Peak when assessing stormwater control measures as a part of detailed design of any future development.

## 5. Review of Previous Investigations

Geotechnical site conditions for the majority of the Council owned portion of the Lakeview Subzone Area have previously been investigated and reported on for QLDC as a part of possible redevelopment of the campground area. Where relevant we have reviewed this information and reports. Documents reviewed as part of this report include;

- *Redevelopment of the Lakeview Park Complex, Queenstown*; R Thomson; June 2003.
- *Lakeview Project: Assessment of Depths to Schist*; R Thomson; March 2005.

The previous reports above included subsurface investigation work comprising 16 logged boreholes across a portion of the area.

The R. Thomson 2005 report confirms the geological model that we have developed for the area. The 2005 work did not include strength testing of soils by way of SPT tests or Dynamic Cone penetration tests, but the geological classification was thorough and is summarised as follows;

*"An erosion resistant schist spur exists between the Lakeview site and Glasgow Street to the south while a gully within the schist that has partially been in-filled by deposition of materials in post glacial times is expected to extend through the central portion of the site. Significant thicknesses of clast rich glacial till will be present in some areas of the site and will be located beneath the more recent terrace deposits.*

*The primary sequence on the Lakeview site is stream transported sandy and gravelly alluvium related to the retreat of the most recent glacier. A series of overlapping debris cones are located on the northern fringe of the Lakeview site and these are assessed as rockfall and/or colluvium deposits. The rockfall/colluvium deposits display evidence of subsequent mass movement, erosion by the higher lake level and possible ongoing creep. Groundwater seepage was observed at the toe of these rockfall/colluvium deposits. Beach deposits consisting of reworked alluvium are expected to cover much of the terrace and be of limited thickness.*

*Gravel and sandy gravel beach deposits were found in varying thicknesses up to 2.5 metres across the site. These materials are well drained, but poorly graded and loose which may affect their stability in steep cut batters and suitability for foundations.*

*Glacial till was found to be the dominant subsurface material across the site, this was found to be highly variable in nature and displayed evidence of varying depositional environments across the site.*

*The depth to schist was found to vary across the site and an in filled channel was confirmed as extending north-east through the central portion of the site where the thickness of material overlying the schist was found to be greater than in other areas of the site at up to approximately 10 metres."*

## 6. Conclusions and Recommendations

Based on site visits, observations of surface features, review of previous reports for the Lakeview site, our interpretation of the geology and results from previous subsurface investigation works we make the following conclusions;

- The area is overlain with generally competent alluvial material and glacial till over schist bedrock, all being suitable for building development.
- Liquefaction risk within the area is considered very low and, in our view, should not need to be a consideration in future design.
- Alluvial fan hazard risk is also considered very low, although a small area of debris cone exists which encroaches on to the northern fringe of the zone area within the Lynch and Freehold Blocks as indicated within Appendix 2. This area is limited but will require specific evaluation to confirm any development constraints if future development is proposed in this area.
- Schist bedrock is present at relatively shallow depths at some locations across the site and this may impact development costs.

We recommend that any large scale future development within this area will require normal, specific evaluation of the site tailored to the location and type of development and structures proposed. This work will likely include;

- Referencing of previous subsurface investigation work against proposed building location in order to avoid duplication and additional investigations as required.
- Specific strength testing of soils by SPT investigations or similar in regions where significant structures and foundations are proposed. This investigation information would be used to inform foundation design.

We note that a number of other factors will need to be considered as part of normal development within this area. These include;

- Control of stormwater and groundwater.
- Optimising building location to account for the variable depth to rock and the risk of rock mass defects.
- The possibility of variability in the strength and excavation stability of the overburden materials (alluvial materials, beach deposits and glacial till).
- Any undercutting in close proximity to the steep slopes to the north.

All of the above are typical considerations for development within the Wakatipu Basin and their impact will be a function of the nature and extent of the proposed development.

Appendix 1  
Council Owned Portion of  
the Lakeview Subzone  
Plan Change Area

## Council Owned Portion of the Lakeview Subzone Plan Change Area

(Various blocks as indicated)



## Appendix 2

### Site Plan

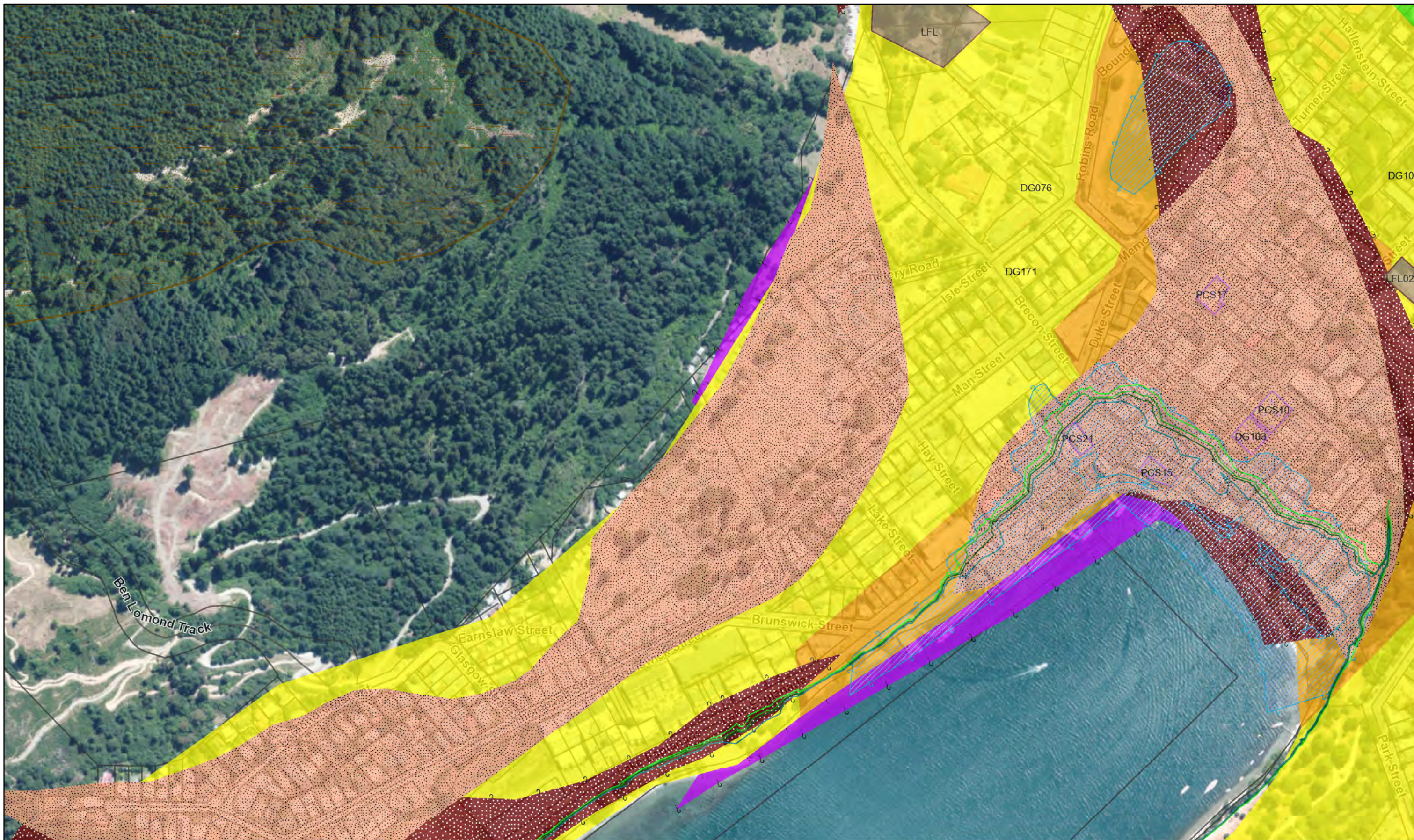
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| Notes: | Issue | Description        | By | Date     | Project:                     | Client: | <div><br/>CONSULTING CIVIL &amp; STRUCTURAL ENGINEERS</div> <div>44 Robins Road, PO Box 1356, Queenstown, New Zealand, P: +64 3 450 2140, F: +64 3 441 3513, W: www.hadleys.co.nz</div> | <div>This drawing is supplied on the understanding that the information contained herein will not be passed to any other party without written permission first being obtained from Hadley Consultants Ltd.</div> |  |  |
|        | A     | Preliminary Issue. | NL | 06.06.14 | LAKEVIEW SUBZONE PLAN CHANGE |         |                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                   |  |  |
|        | B     | Final Draft        | NL | 09.07.14 |                              |         |                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                   |  |  |
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## Appendix 3

### QLDC Hazard Map



The map is an approximate representation only and must not be used to determine the location or size of items shown, or to identify legal boundaries. To the extent permitted by law, the Queenstown Lakes District Council, their employees, agents and contractors will not be liable for any costs, damages or loss suffered as a result of the data or plan, and no warranty of any kind is given as to the accuracy or completeness of the information represented by the GIS data. While reasonable use is permitted and encouraged, all data is copyright reserved by Queenstown Lakes District Council. Cadastral information derived from Land Information New Zealand. CROWN COPYRIGHT RESERVED

# Lakeview Subzone Hazard Map

## Legend

### Property Address

— Roads

### Property Land

□ Parcel Boundaries

### Hazards

— 150 Year Flood Return Period

— 100 Year Flood Return Period

— 75 Year Flood Return Period

— 50 Year Flood Return Period

—? Active Fault - Location approximate

—? Inactive Fault - Location approximate

▨ Flooding due to Rainfall

▨ Flooding due to Damburst

▨ Landslide: Active Pre-existing Schist Debris Landslides

▨ Landslide: Pre-existing Schist Debris Landslides (Activity Unknown)

▨ Landslide: Dormant Pre-existing Schist Debris Landslides

▨ Landslide: Shallow Slips and Debris Flows in Colluvium

▨ Landslide: Debris Flow Hazards

▨ Landslide: Slope Failure Hazard in Superficial Deposits

▨ Landslide: Rockfall

▨ Landslide: Pre-existing or Potential Failure in Lake Sediments or Tertiary Sediments

▨ Landslide: Piping potential in the Artesian Zone of the Wanaka Aquifer

▨ Landslide: Potential Hazard - Debris Flood/Debris Flow

▨ Landslide Areas - non verified

▨ Contaminated Sites

▨ Potentially Contaminated Sites

▨ Managed Sites

▨ Landfill

▨ Erosion Areas

— Alluvial Fan - Incision Line

— Alluvial Fan - Channels

▨ Alluvial Fan - Source Area

▨ Alluvial Fan - Catchment Areas

▨ Alluvial Fan - Hazard Area

▨ Alluvial Fan - ORC: fan active bed

▨ Alluvial Fan - ORC: fan recently active

▨ Alluvial Fan - ORC: fan less recently active

▨ Alluvial Fan (Regional scale) Active, Composite

▨ Alluvial Fan (Regional scale) Active, Debris-dominated

▨ Alluvial Fan (Regional scale) Active, Floodwater-dominated

▨ Alluvial Fan (Regional scale) Inactive, Composite

▨ Alluvial Fan (Regional scale) Inactive, Debris-dominated

▨ Alluvial Fan (Regional scale) Inactive, Floodwater-dominated

▨ Avalanche Areas

▨ Liquefaction Risk: Nil to Low (T&T 2012)

▨ Liquefaction Risk: Probably Low (T&T 2012)

▨ Liquefaction Risk: Possibly Moderate (T&T 2012)

▨ Liquefaction Risk: Possibly High (T&T 2012)

▨ Liquefaction Risk: Possibly Susceptible (Opus 2002)

▨ Liquefaction Risk: Susceptible (Opus 2002)

20 August 2014

Our Ref: 142696

Brecon Street Partnerships Limited  
34 Brecon Street  
**Queenstown**

via email: [grw@xtra.co.nz](mailto:grw@xtra.co.nz)

**Attn:** Mr Graham Wilkinson

Dear Graham,

**PROPOSED QUEENSTOWN TOWN CENTRE ZONE – LAKEVIEW SUB-ZONE PLAN CHANGE  
PRELIMINARY GEOTECHNICAL ASSESSMENT - ADDENDUM REPORT  
34 BRECON STREET, QUEENSTOWN – FINAL**

**1.0 Introduction**

Hadley Consultants Limited (HCL) have been engaged by Brecon Street Partnerships Limited (BSPL) to undertake a preliminary geotechnical assessment of the 34 Brecon Street site ("the site" or "the subject site"). This assessment has been undertaken in order to allow the subject site to be included within the proposed Queenstown Town Centre – Lakeview Sub-Zone plan change process.

HCL has previously assessed and reported on the QLDC owned portion of the plan change area and this is detailed in the HCL report dated 29 July 2014. It is intended that this letter report be considered as an addendum to the original report prepared for QLDC.

As the project is currently at a Plan Change approval stage, no confirmed development concepts or information regarding the possible extent, location or nature of future development on the site is currently available. As such this report focusses on the general conditions only.

## **2.0 Site Overview**

The subject site is located at the north-western most corner of the plan change area. It is bounded by Brecon Street to the east, Cemetery Road to the south and west and the Queenstown Cemetery to the north. The site is legally described as Lot 1, DP 27703 and has an area of approximately 3,900m<sup>2</sup>.

The site is at an elevation of approximately 330 metres above sea level and is generally flat or slopes gently to the southeast. It currently contains an outdoor mini-golf facility with a number of established trees around the perimeter.

We have reviewed the bore logs from drilling investigations that have previously been undertaken by others within the subject site. In general this information confirms our previous assessment for the Council owned portion of the plan change area. This previous work indicates that the depth to rock is typically in the order of 15 – 20 metres or more beneath the site.

In particular we note that the site is located on a remnant terrace as is the majority of the remainder of the plan change area. The site is overlain by alluvial and glacial deposits that in turn overlie schist bedrock. Due to the numerous glacial advances within the Wakatipu Basin and varying lake levels alluvial river delta deposits, beach formations and shallow lacustrine deposits are likely to be present beneath the subject site. Some variability in bearing strength in the subsurface deposits and degree of defects within the basement rock can be expected, but this is unlikely to unduly constrain future development.

## **3.0 Preliminary Hazard Assessment**

We have reviewed the QLDC hazard maps and a copy of the relevant map is included as an attachment to this letter.

The site is shown as being classified as Liquefaction Category LIC 1(P) in terms of the Preliminary Liquefaction Hazard Assessment that was undertaken by Tonkin & Taylor for QLDC in 2012. This category is expected to be low risk, but is considered provisional due to lack of information available at the time of the assessment. Based on the geological model and our experience of the ground conditions within the plan change area we consider the risk of liquefaction to be very low/negligible. This is due to the predominantly coarse grained soils and limited groundwater expected to be present beneath the site.

The site is also classified in the Otago Regional Council (ORC) Alluvial Fan Hazard Study that was undertaken by GNS in 2008 to be "fan less recently active". This category has been adopted by QLDC and is also shown in the hazard map for the site. The alluvial formations beneath the site are expected to relate to either the last glacial retreat and/or the previous higher lake level. As such, these are no longer considered to be active or present an alluvial fan hazard.

Notwithstanding the above, it is noted that proper care and attention will be needed when planning for and designing future developments to ensure that items such as stability of cut batters, rock mass defects, upslope runoff from the slopes above, and any groundwater encountered in excavations, are allowed for and addressed by the proposed development.

#### **4.0 Conclusions & Recommendations**

As per our previous assessment for the Council owned portion of the plan change area based on site visits, observations of surface features, review of previous reports for the Lakeview site, our interpretation of the geology and results from previous subsurface investigation works we make the following conclusions;

- The area is overlain with generally competent alluvial material and glacial till over schist bedrock, all being suitable for building development.
- Liquefaction risk within the area is considered very low and, in our view, should not need to be a consideration in future design.
- Alluvial fan hazard risk is also considered very low.

We recommend that any large scale future development on the site will require normal, specific evaluation of the site tailored to the layout and type of development and structures proposed. This work will likely include;

- Referencing of previous subsurface investigation work against proposed building location in order to avoid duplication and additional investigations as required.
- Specific strength testing of soils by SPT investigations or similar in regions where significant structures and foundations are proposed. This investigation information would be used to inform foundation design.

We note that a number of other factors will need to be considered as part of normal development within this area. These include;

- Control of stormwater and groundwater.
- The possibility of variability in the strength and excavation stability of the overburden materials (alluvial materials, beach deposits and glacial till).
- The possibility of encountering significant rock noting that if encountered it may contain rock mass defects.

All of the above are typical considerations for development within the Wakatipu Basin and their impact will be a function of the nature and extent of any future proposed development.

## 5.0 Limitations

This report has been written for the particular brief to HCL from their client and no responsibility is accepted for the use of the report for any other purpose, or in any other context or by any third party without prior review and agreement.

In addition, this report contains information and recommendations based on information obtained from a variety of methods and sources including inspection, sampling or testing at specific times and locations with limited site coverage and by third parties as outlined in this report. This report does not purport to completely describe all site characteristics and properties and it must be appreciated that the actual conditions encountered throughout the site may vary, particularly where ground conditions and continuity have been inferred between test locations. If conditions at the site are subsequently found to differ significantly from those described and/or anticipated in this report, HCL must be notified to advise and provide further interpretation.

Should you have any questions please contact the undersigned in the first instance.

Yours faithfully

**Hadley Consultants Ltd**



Nigel Lloyd

**Senior Civil & Environmental Engineer**

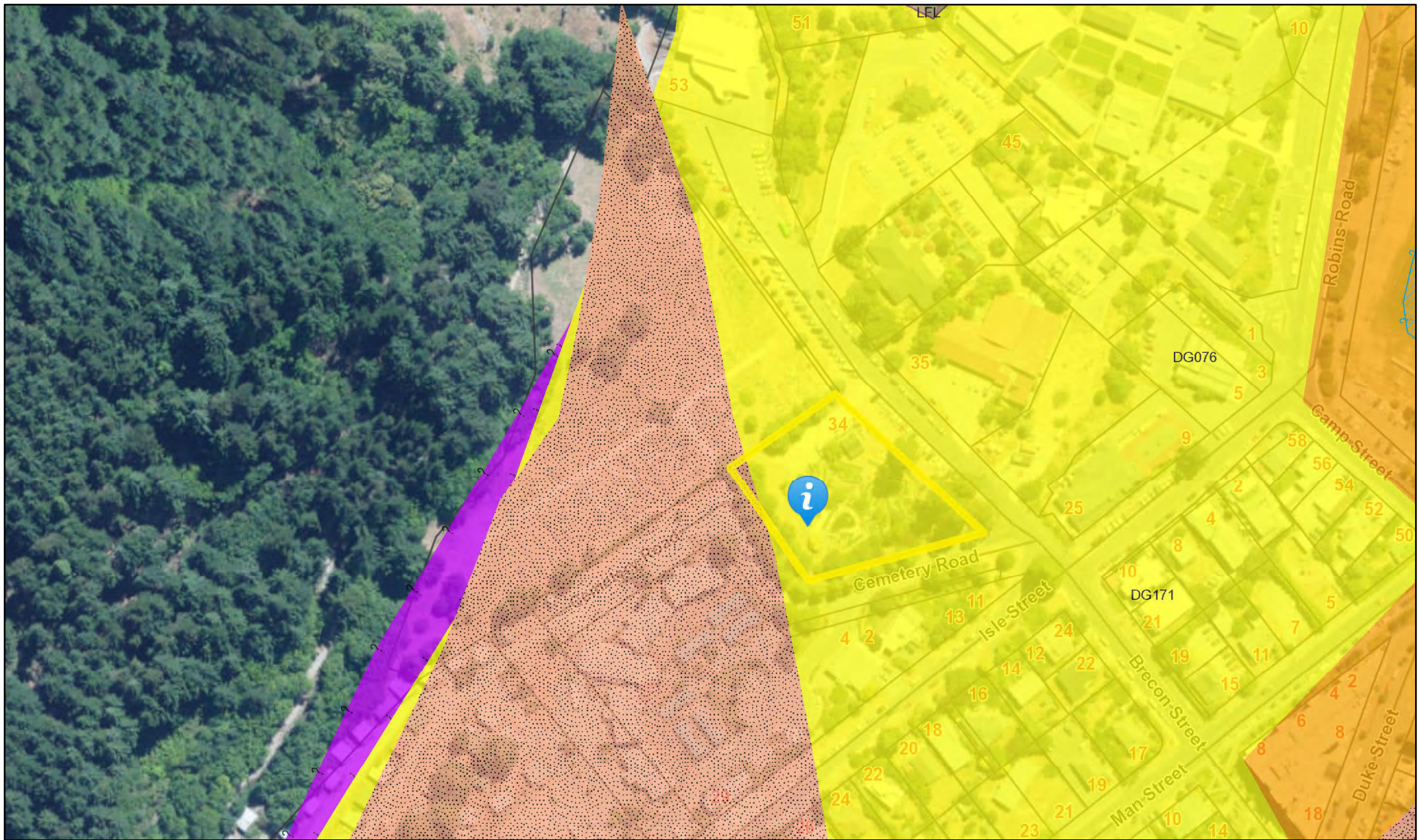
Attachments: *QLDC Hazard Map*

Copies to: *QLDC, Attn: Paul Speedy;*

[paul.speedy@qldc.govt.nz](mailto:paul.speedy@qldc.govt.nz)

*Mitchell Partnerships Ltd, Attn: Megan Justice;*

[megan.justice@mitchellpartnerships.co.nz](mailto:megan.justice@mitchellpartnerships.co.nz)



The map is an approximate representation only and must not be used to determine the location or size of items shown, or to identify legal boundaries. To the extent permitted by law, the Queenstown Lakes District Council, their employees, agents and contractors will not be liable for any costs, damages or loss suffered as a result of the data or plan, and no warranty of any kind is given as to the accuracy or completeness of the information represented by the GIS data. While reasonable use is permitted and encouraged, all data is copyright reserved by Queenstown Lakes District Council. Cadastral information derived from Land Information New Zealand. CROWN COPYRIGHT RESERVED

## Legend

### Property Land

 Parcel Boundaries

### Property Address

 Roads

### Hazards

 150 Year Flood Return Period

 100 Year Flood Return Period

 75 Year Flood Return Period

 50 Year Flood Return Period

 Active Fault - Location approximate

 Inactive Fault - Location approximate

 Flooding due to Rainfall

 Flooding due to Damburst

 Landslide: Active Pre-existing Schist Debris Landslides

 Landslide: Pre-existing Schist Debris Landslides (Activity Unknown)

 Landslide: Dormant Pre-existing Schist Debris Landslides

 Landslide: Shallow Slips and Debris Flows in Colluvium

 Landslide: Debris Flow Hazards

 Landslide: Slope Failure Hazard in Superficial Deposits

 Landslide: Rockfall

 Landslide: Pre-existing or Potential Failure in Lake Sediments or Tertiary Sediments

 Landslide: Piping potential in the Artesian Zone of the Wanaka Aquifer

 Landslide: Potential Hazard - Debris Flood/Debris Flow

 Landslide Areas - non verified

 Contaminated Sites

 Potentially Contaminated Sites

 Managed Sites

 Landfill

 Erosion Areas

 Alluvial Fan - Incision Line

 Alluvial Fan - Channels

 Alluvial Fan - Source Area

 Alluvial Fan - Catchment Areas

 Alluvial Fan - Hazard Area

 Alluvial Fan - ORC: fan active bed

 Alluvial Fan - ORC: fan recently active

 Alluvial Fan - ORC: fan less recently active

 Alluvial Fan (Regional scale) Active, Composite

 Alluvial Fan (Regional scale) Active, Debris-dominated

 Alluvial Fan (Regional scale) Active, Floodwater-dominated

 Alluvial Fan (Regional scale) Inactive, Composite

 Alluvial Fan (Regional scale) Inactive, Debris-dominated

 Alluvial Fan (Regional scale) Inactive, Floodwater-dominated

 Avalanche Areas

 Liquefaction Risk: Nil to Low (T&T 2012)

 Liquefaction Risk: Probably Low (T&T 2012)

 Liquefaction Risk: Possibly Moderate (T&T 2012)

 Liquefaction Risk: Possibly High (T&T 2012)

 Liquefaction Risk: Possibly Susceptible (Opus 2002)

 Liquefaction Risk: Susceptible (Opus 2002)

# **AEE**

## **APPENDIX F**

Clinton Bird: Urban Design Peer Review

## **PROPOSED QUEENSTOWN TOWN CENTRE PLAN CHANGE**



### **URBAN DESIGN PEER REVIEW**

**Prepared for:** Queenstown Lakes District Council

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**27 August 2014**

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*Pedestrian linkages*

*Building height*

*Minimum floor to floor heights*

*Roof Bonus*

*Building length*

*Public space edge conditions*

*Shading*

*The Convention Centre*

*The Hot Pools*

*Protected trees*

**7 The Structure Plan**

**8 Photomontages of building bulk and location**

*Location of viewpoints*

*Preparation of panoramic photographs for photomontages*

*Assessment of photomontages*

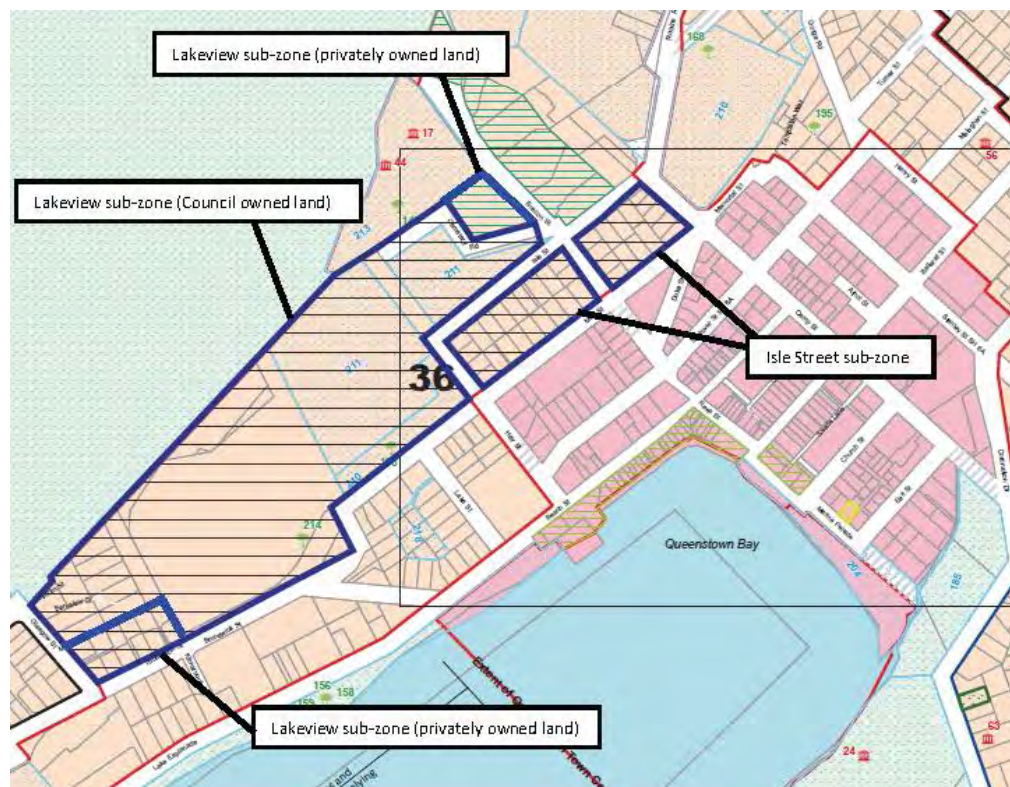
**9 Town Centre Zone urban design controls and assessment criteria**

**10 Conclusions**

**Appendix 1: The Urban Design Framework**

## 1.0 EXECUTIVE SUMMARY

- 1.1 This report was commissioned by the Queenstown Lakes District Council. Its purpose is to provide an urban design peer review of the Urban Design Framework (**UDF**) for the Lakeview sub-zone and provisions for the Isle Street sub-zone in the context of the proposed Plan Change.
- 1.2 The Lakeview sub-zone includes the Lynch Block, Council owned reserves, the Camping Ground, twelve residential lots on the corner of Glasgow and Thompson Street, and the privately owned land at 34 Brecon Street (see Figure 1).
- 1.3 The Isle Street subzone comprises the land bounded by Isle Street, Hay Street, Man Street and Camp Street (see Figure 1).



**Figure 1: A map illustrating the location and extent of the Lakeview and Isle Street sub-zones and their constituent lots.**

- 1.4 The author visited the site and its Queenstown surrounds on Wednesday and Thursday 6 and 7 August, 2014. Key locations from which views of the site and its potential development were considered to be important were identified. Photographs from these viewpoints formed the bases of photomontages subsequently prepared.

- 1.5 The work of fearonhay<sup>1</sup>, the authors of the UDF for the Lakeview sub-zone, has been thoroughly reviewed. This review began by focussing on the work fearonhay had completed in the process leading up to the formulation of the draft UDF and, after that, continued in an iterative manner through to the completion of the UDF and the Structure Plan and Height Limit Plan, the latter two of which form part of the Rules in the proposed Plan Change.
- 1.6 So, the final UDF was born out the work of fearonhay, but has been subsequently added to and refined as a result of the reviewer's series of iterative conclusions and recommendations during the peer review process.
- 1.7 The author has also reviewed the District Plan provisions that relate to the Lakeview sub-zone and the Isle Street sub-zone.
- 1.8 The analytical work leading up to the UDF is considered to be very thorough and highly cognisant of the outstanding natural landscape of the Queenstown setting, the character of the Town Centre and the relationship of the site to its immediate context. The exploration and evaluation of various *conceptual* development design options was rigorous and the recommended option upon which the UDF is based is considered to be well considered and the preferable option.
- 1.9 In its currently proposed form, the UDF is considered to be thoroughly appropriate to and worthy of the outstanding natural landscape settings around Queenstown, as well as to the site and its anticipated development. Very importantly, it is also considered to be flexible enough to not unduly constrain future development but at the same time not be so flexible as to risk the urban design outcome being anything less than a fully integrated and well connected extension to the Town Centre, with strong visual and physical linkages to the lake and the mountains that form the key components of Queenstown's exceptional natural beauty, identity and sense of place. In other words, the UDF is considered to strike an appropriate balance between providing for future development flexibility on the one hand and certainty that a high quality and integrated urban design outcome will be achieved on the other.
- 1.10 In my opinion, there is nothing in the UDF, or in the provisions for the Lakeview and Isle Street sub-zones, that would not be considered an

---

<sup>1</sup> The name of the architecture practice 'fearonhay' is correctly spelt without any capitals.

essential ingredient in a document seeking to optimize the quality of the urban design outcome that the proposed Plan Change to the Queenstown Town Centre zone provisions seeks to achieve in the Lakeview and Isle Street sub-zones. Put simply, the UDF and the District Plan provisions are considered eminently worthy of and appropriate to a key site within the outstanding natural, and generally attractive man-made, Queenstown contexts.

## **2.0 THE BRIEF**

- 2.1 The brief for this work was to provide an iterative peer review of the Lakeview UDF prepared by fearonhay, and to review the Lakeview and Isle Street sub-zone provisions for inclusion in the proposed Plan Change to the Town Centre Zone (**Plan Change**). In this context the term 'iterative' refers to the process whereby the review commenced prior to the final completion of the UDF and had an influence over some of the urban design ingredients of and final form of the UDF and its associated proposed Plan Change rules and assessment criteria.

## **3.0 THE PLANNING CONTEXT**

- 3.1 The Structure Plan and the Height Limit Plan, together with its associated suite of development controls and assessment criteria, forms part of the proposed Queenstown Town Centre Plan Change. The Plan Change proposes that the Lakeview site, the two Isle Street blocks and the 34 Brecon Street site be incorporated into the extended Queenstown Town Centre zone.

## **4.0 THE SITE**

### ***Location***

- 4.1 The site is located on the north-western edge of Lake Wakatipu and nestles into the base of the Ben Lomond Scenic Reserve precipitous cliff face. It is highly visible from the Queenstown Town Centre lakefront, the pedestrian pathway around the lake edge of Queenstown Gardens and the elevated

residential areas to the north-east and south-east of the Town Centre (see Figures 1 and 2).

### ***Boundaries***

- 4.2 The site comprises all the land contained within the two proposed new Queenstown Town Centre sub-zones. The Lakeview sub-zone includes the Lynch Block, Council owned reserves, the Camping Ground, twelve residential lots on the corner of Glasgow and Thompson Street, and the privately owned land at 34 Brecon Street, while the Isle Street sub-zone comprises the block bounded by Isle, Hay, Man and Brecon Streets and the block bounded by Isle, Brecon, Man and Camp Streets (see Figures 1 and 2).

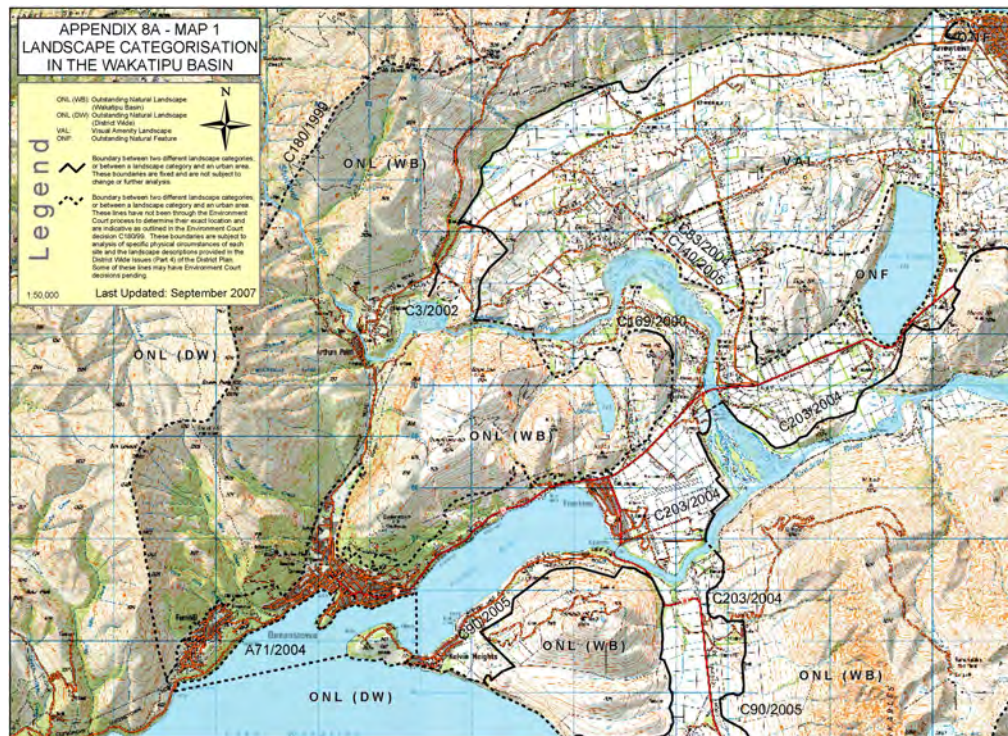


**Figure 2: A Google Earth aerial photograph of the site illustrating the area of Queenstown comprising the two sub-zones.**

### ***Character of context***

- 4.3 The site sits immediately adjacent to base of the Ben Lomond Scenic Reserve which is categorized as an 'ONL (WB)' i.e. an Outstanding Natural Landscape (Wakatipu Basin) (see Figure 3). The potential for adverse effects

on this ONL have been taken into account through this review of the UDF and the proposed District Plan provisions.



**Figure 3: Appendix 8A – Map 1 Landscape Categorisation in the Wakatipu Basin.**

- 4.4 The local context is extremely varied and includes the immense natural backdrop of Ben Lomond Scenic Reserve, Lake Wakatipu, a variety of sizes of hotel buildings providing visitor accommodation, a cemetery, the base of the Queenstown Gondola, relatively modest private residential properties, retail shops on the edges of the existing Town Centre, and ferry terminal and food and beverage facilities on the edge of the lake (see Figure 2).
- 4.5 Relatively few buildings would exceed three storeys in height and those that do frequently step down in height to follow the slope of the underlying topography.

### ***Topography***

- 4.6 The site sits on an elevated shelf of land not far back from the north-western edge of Lake Wakatipu. The land is gently sloping in two directions; down towards the lake and, parallel to the lake, down towards the existing Town Centre.

- 4.7 To the north of the site is the very highly vegetated seemingly vertical backdrop provided by the Ben Lomond Scenic Reserve, classified as an ONL.

### ***Existing buildings***

- 4.8 Largely occupied by the Lakeview Holiday Park, the Lakeview sub-zone contains buildings varying widely in age, value and architectural style.
- 4.9 Much of the Lakeview sub-zones elevated boundary to Thompson Street is edged by a double row of quite old and simple but nonetheless quite charming single storey cabins/cribs. Similar buildings occupy the Lynch Block which, together with a group of private dwellings and a parcel of vacant land, form the south-western corner of the Lakeview sub-zone. This block is significantly elevated above the level of the remainder of the Lakeview site. It is understood that the proposed Town Centre Plan Changes anticipates that all of the cabins/cribs will eventually be relocated.
- 4.10 The north-eastern area of the Lakeview sub-zone is occupied by the relatively modern and high quality Lakeview Holiday Park tourist flats and leisure lodges.
- 4.11 The interior of the Lakeview site is predominantly occupied by 'powered' and 'unpowered' camping sites, all of which are serviced by modern amenities.
- 4.12 The Isle Street sub-zone site comprises relatively modest and largely one and two storey high private residential properties varying in age and value interspersed with two residentially scaled hotels and commercial offices.
- 4.13 The Lynch Block at the south-eastern end of the Lakeview site, which is significantly elevated above the rest of the site, is home to a number of camping ground cabins/cribs.

### ***Existing vegetation***

- 4.14 For a site of its size, and probably because of the open nature of the camping ground, the Lakeview site contains relatively little substantial vegetation. There are six oaks, two Wellingtonias and eight cedars that have been identified as worthy of retention and are statutorily protected. However, there is a group of three protected cedar trees on the north-western edge of James Clouston Memorial Park that would preclude any future buildings on this part

of the north-western edge of the Park from activating the edge of the Park. For this reason it is recommended that consideration be given to the removal of these trees to enable a superior urban design outcome.

### ***Access***

- 4.15 The Lakeview site is highly accessible from a number of surrounding roads, including Isle Street, Man Street, Lake Street, Hay Street, Brecon Street, Thompson Street, Glasgow Street and Earnslaw Street.
- 4.16 The Isle Street site is accessible from Brecon Street, Isle Street, Hay Street, Man Street and Camp Street.
- 4.17 Both sites are within a comfortable 10-15 minute walk uphill from the Town Centre. The walk could be made easier with flights of public steps, similar to those in Brecon Street, at strategic locations along the way.

### ***Neighbouring properties***

- 4.18 The neighbouring properties are generally residential and visitor accommodation in nature except for the north-western boundary with Ben Lomond Scenic Reserve and Brecon Street which borders the historic Queenstown cemetery to the north-west and one and two storey high predominantly retail and recreational premises on the opposite side of the street.
- 4.19 The Brecon Street cemetery has significant heritage values, whilst its elevated physical setting provides public views out to the mountains and the town.

## **5.0 PEER REVIEW OF FEARONHAY'S WORK LEADING UP TO THE FORMULATION OF THE URBAN DESIGN FRAMEWORK**

- 5.1 The work carried out by fearonhay prior to the formulation of the UDF involved the following analyses:
  - i. Key site attributes, including constituent 'blocks' and their respective view/aspect orientations;
  - ii. Site topography;
  - iii. Proximity to accommodation;

- iv. Vantage points;
- v. Prevailing wind;
- vi. Sunlight access (during mid-summer and mid-winter);
- vii. Figure - ground (building footprint/public space) scale relationships;
- viii. Current Town Centre and commercial intensification;
- ix. Anticipated Town Centre growth and intensification;
- x. Existing infrastructure (arterial routes, local roads and interconnecting pedestrian and service lanes);
- xi. Grid patterns;
- xii. Pedestrian networks;
- xiii. Development 'blocks' and areas;
- xiv. Land title status and areas (in m<sup>2</sup>);
- xv. Existing land uses and areas (in m<sup>2</sup>);
- xvi. Protected tree retention;
- xvii. Potential site activities and requirements (Convention Centre, Hot Pools, Commercial, Mixed Use, Hotel and Residential, and Public Square);
- xviii. Road access options (four, with Option 1 recommended);
- xix. Campground land allocation options (medium to long term) (three, with Option 1 recommended);
- xx. Convention Centre location options (three, with Option 2 recommended);
- xxi. Hot Pools location options (three, with Option 2 recommended);
- xxii. Interrelationship between Core Activities (Convention Centre, Commercial Development and Public Square location mix strategy);
- xxiii. Market Square strategy options;
- xxiv. UDF options (two, with Option 2 recommended); and
- xxv. Indicative Staging.

5.2 In my opinion, the analysis underpinning the proposed UDF was both extensive and thorough, and the conclusions sound.

## **6.0 THE URBAN DESIGN FRAMEWORK**

### ***Existing town centre grid pattern***

- 6.1 The existing Queenstown Town grid pattern plays a pivotal role in establishing the character of the centre and its relationship to its landscape and lakefront setting. The generally rectilinear grid pattern, based upon small development blocks, and further broken down by rear lanes, creates a particularly human scaled and intimate urban character. Streets aligned north-east/south-west establish strong visual and physical links to the lakefront, while views from streets aligned north-west/south-east offer views of Arthur's Point, Queenstown Gardens and glimpses of the Remarkables.
- 6.2 The UDF will inextricably connect the Lakeview and Isle Street sub-zones with the Queenstown Town Centre. This will be achieved as a result of the Structure Plan having projected key components of the town centre grid pattern across the Lakeview and Isle Street sites. In this regard, Man Street will become a key linking device as does, to a slightly lesser extent, Isle Street. It will fall to the extension of Thompson Street and the spatial (but not vehicular carriageway) extensions of Hay and Lake Streets, in the form of the view shafts and lanes identified on the Structure Plan, to establish key linkages to Ben Lomond Scenic Reserve, Lake Wakatipu, Queenstown Gardens and Cecil Peak.

### ***Grid pattern and topography***

- 6.3 Just as the orthogonal grid pattern on the predominantly flat land occupied by the existing Town Centre core has had to bend and give way to the more steeply sloping topography of the land rising up from the north-western side of the Lakefront, so too will the extension of Man Street as it encounters and is laid across the site comprising the Lakeview sub-zone.

### ***Streets***

- 6.4 Two existing streets play a particularly vital role in linking the two sub-zones into their Town Centre context. These are Isle Street and the short, north-oriented leg of Thompson Street, leading up to its intersection with Man Street.

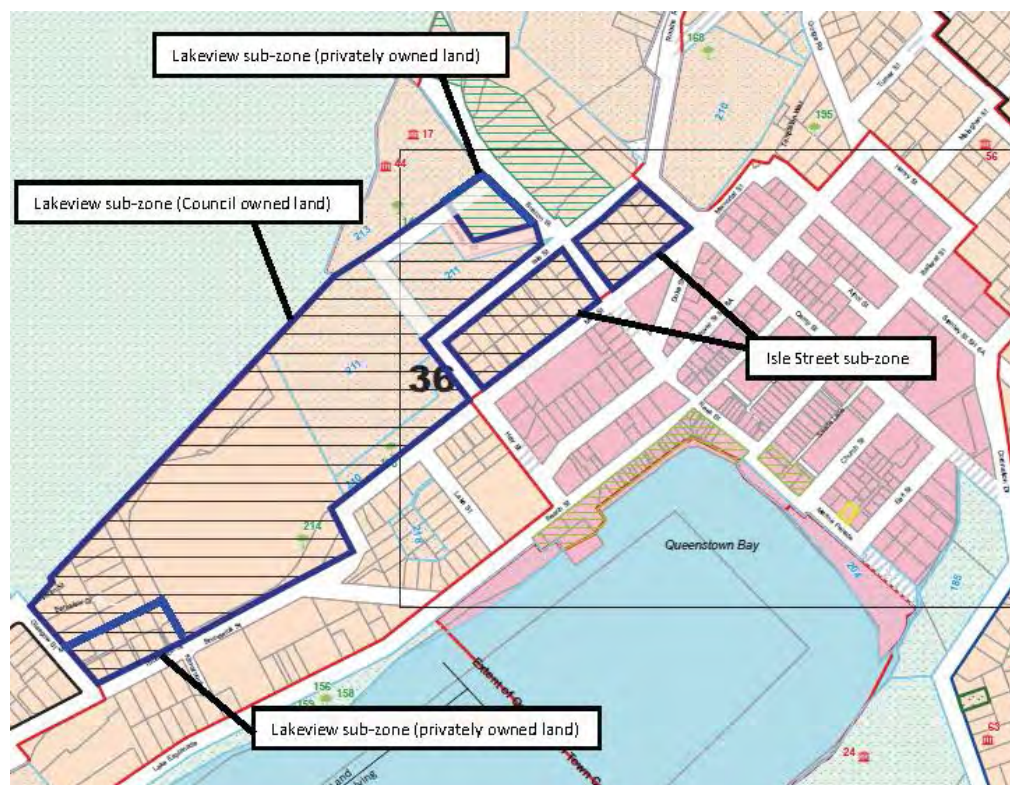
- 6.5 The Structure Plan recognizes, establishes and reinforces the criticality of these two streets being literally extended across the site on precisely the same alignments and in the same widths in which they currently exist (see Figure 4). The alignments and widths of these two streets should be regarded as sacrosanct and immutable.



**Figure 4: Streets (see Page 19 of the UDF).**

- 6.6 The projection of Isle Street across the site will require the two existing camping ground communal facilities buildings to be relocated in the future. Consideration was given to retaining them in their current location and curving the extended Isle Street around them but this was considered to seriously compromise and undermine the desired extension and pattern of the existing Town Centre orthogonal street grid network, and the long-term quality and amenity of the urban design outcome.

- 6.7 It should be noted that the extension of Hay Street into and across the site would only be possible once the Holiday Park was no longer occupying the site (see Figures 4 and 5).
- 6.8 It is also considered that the street pattern associated with the interface of the camping ground site and the 34 Brecon Street site could be much better resolved than it currently is. It is suggested that, ultimately, the elongated parcel of land running off to the north-west of the intersection of Hay and Isle Streets (shaded white in Figure 5) could continue the alignment of Hay Street north-westwards before turning at 90 degrees to run parallel to the boundary of the sub-zone all the way to Brecon Street (see Figure 5). The land taken off the Brecon Street site could be off set by incorporating into that site the then redundant portion of Cemetery Road currently separating the camping ground from 34 Brecon Street. It was suggested that this street pattern rationalization, together with its associated land swap, would result in a much improved urban design outcome, but Council has advised that this would not be possible within proposed Town Centre Plan Change time frame.



**Figure 5: The recommended re-configuration of the road around the 34 Brecon Street block (shown in opaque white) and the associated compensatory land swap by incorporating into the Brecon site the existing Cemetery Road (shown in pale pink).**

## ***The Square***

- 6.9 The UDF proposes a public square to the north of the Convention Centre and Hot Pool sites (see Figure 6). In accordance with sound urban design tradition and precedent, the plan footprint of this square very successfully reconciles the 'collision' of the various underlying street grid geometries as they have been variously rotated by, and adjusted to, the topography of the underlying landform. This will help to elevate the square within the hierarchy of public spaces within the two sub-zones to a level entirely commensurate with its importance and function in urban design terms.



**Figure 6: The Square (see Page 19 of the UDF).**

- 6.10 The square has been conceived as a fundamentally robust, 'urban', generally hard surfaced/paved, multi-used space, more akin to a plaza/piazza than to a park. It is intended to provide a contrast with the soft, green ambience of the

associated James Clouston Memorial Park and the area immediately to its south (see Figure 6). It should not be developed as a green/park space.

- 6.11 The location of the square indicated on the Structure Plan will ensure its visual prominence, its physical accessibility and provide its occupants with extensive views over the lake to Cecil Peak beyond. Maximum permitted building heights have been established to ensure the square will be as sunny as possible, while the proposed Plan Change rules require that its various edges be activated by the activities accommodated within the ground floors of its adjoining buildings.

### ***Lanes***

- 6.12 The UDF identifies three lanes that are required to break up the scale of the development blocks created by the pattern of streets and to provide lane frontages and/or access to lots created by the subdivision of the blocks.
- 6.13 In order to remain spatially subservient to the importance of streets as the key public circulation spaces, in order to provide a rich variety of public spatial experiences within the sub-zone, and with the view to imbuing the lanes with an intimate character and ambiance, all three lanes should have a minimum width of 8m.
- 6.14 The location of the lanes on the Structure Plan is critical to the quality of the urban design outcome of the proposed Plan Change for the Lakeview sub-zone and they should be in general accordance with the locations indicated on the Structure Plan.
- 6.15 The alignment of the lanes has been carefully considered with regard to their alignment with existing streets adjoining the sub-zone. For example, the centre line of one lane is aligned on the extension of the centre line of Lake Street, the second is aligned along the boundary to the north-east of the elevated Lynch Block at the south-western end of the sub-zone, and the third lane passes through the apex of the square to further break up the scale of the Thompson Street block (taking account of the envisaged uses on this part of the site). This same lane also helps to further break up the scale of and provide access to the block to the north-west of the square (see Figure 7).
- 6.16 Overall, the lanes contained within the Structure Plan will perform an invaluable role in limiting the maximum length of any particular building to one

that will be generally in scale with the characteristic urban grain and fabric of the Queenstown Town Centre.

- 6.17 With the view to striking a balance between maximizing development flexibility and ensuring an optimum urban design outcome, the locations of the lanes have also been subject to a careful scrutiny of both the existing and likely lot subdivision boundaries.



**Figure 7: Lanes (see Page 19 of the UDF).**

- 6.18 The lanes will enhance the permeability of the proposed extension to the Town Centre zone and, where they align with existing streets outside the sub-zone or with proposed view shafts, the lanes will also enhance views for pedestrians and the drivers of vehicles passing along them.

- 6.19 The Structure Plan will bring to the Lakeview sub-zone both the scale and character of the lanes that contribute so significantly to the ambience, attractiveness and popularity of the existing Town Centre.
- 6.20 The series of lanes will also link the site to the reserve containing Hammy's Track, running generally parallel with and relatively close to the southern border of Ben Lomond Scenic Reserve.

***Green spaces***

- 6.21 The UDF retains the approximately 5,436m<sup>2</sup> of Crown Recreation Reserve which includes the James Clouston Memorial Park, the recreational reserves (including the proposed Square, the reserve land to the rear of the site and the reserve area adjacent to Thompson Street, which in total is approximately 21,060m<sup>2</sup> in area, and the camping ground reserve which is approximately 20,000m<sup>2</sup> in area.
- 6.22 Within this Crown Recreation Reserve context, the key green spaces within the Structure Plan for the Lakeview sub-zone are the existing James Clouston Memorial Reserve and the land fronting onto the bend in Thompson Street (see Figure 8)

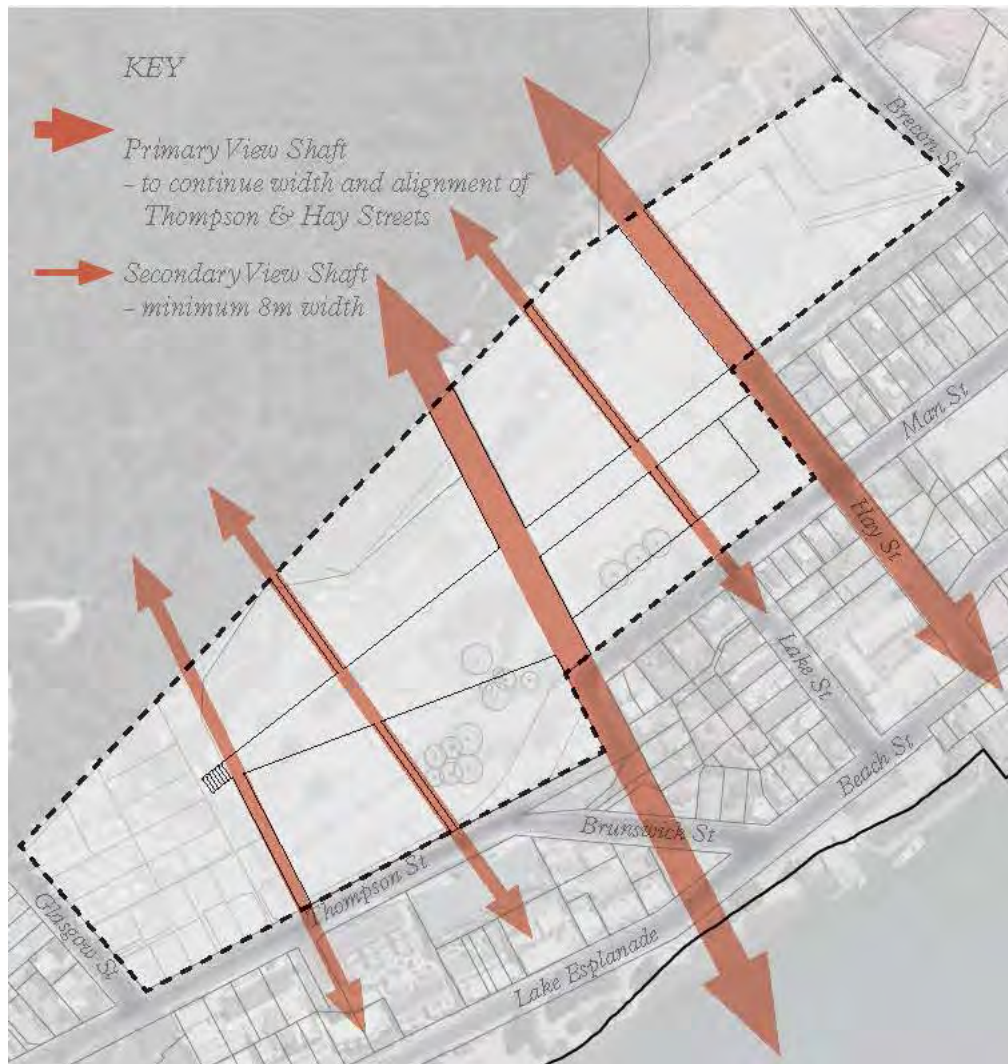


**Figure 8: Green spaces (see Page 20 of the UDF).**

### ***View shafts***

- 6.23 In order to ensure that the Lakeview and Isle Street sub-zones become strongly embedded within the Queenstown Town centre context and develop a strong sense of place within the outstanding natural landscape setting, the UDF has identified a series of view shafts that should be protected and enhanced by future development.
- 6.24 The Structure Plan requires two types of view shafts: 'primary' and 'secondary' (see Figure 9).
- 6.25 The two 'primary' view shafts project both the alignments and the widths of the short leg of Thompson Street and Hay Street across the site. The Hay Street view shaft has the added advantage of conforming to an existing

parcel of subdivided land as well as 'reserving' this land for a possible future street to connect with a reconfigured Cemetery Road alignment.



**Figure 9: View shafts (see Page 20 of the UDF).**

- 6.26 The three 'secondary' view shafts, which are centred on the centre lines of the 8m minimum wide lanes, shall have a minimum width of 8m (see Figure 9).
- 6.27 The view shafts contained within the Structure Plan will also perform an invaluable role in limiting the maximum length of any particular building. Without them, the Structure Plan would run the risk of enabling a continuous length of building development of a scale that would be out of synch with, and potentially visually dominate, the built form scale, grain and character of the existing and likely future Queenstown Town Centre, as well as with its greater landscape setting.

### ***Indicative service lanes***

- 6.28 The UDF identifies a series of indicative service lanes that will make the site more permeable and its subdivided lots more accessible (see Figure 10). These service lanes will also add to and enrich the potential scale, variety and character of pedestrian pathways through the site.



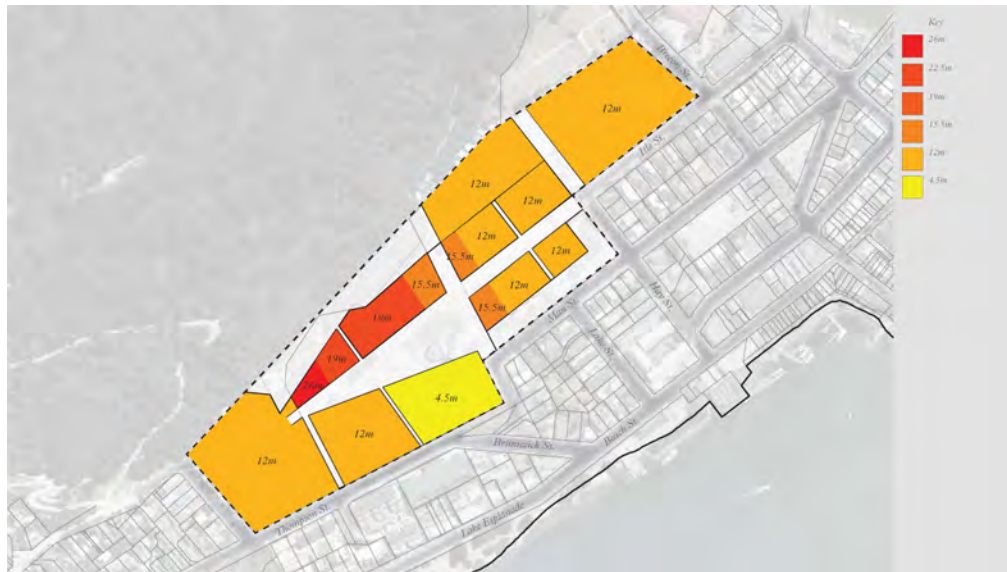
**Figure 10: Indicative service lanes (see Page 20 of the UDF).**

- 6.29 The locations of the service lanes are indicative only.
- 6.30 In future years, if and when the population reaches a sufficiently high level of intensity, these lanes will have the potential to provide the Lakeview sub-zone with the opportunity to accommodate retail, food and beverage and/or residential activities in a manner and character similar to that which has evolved within the existing Town Centre.

### ***Building height***

- 6.31 The maximum building heights indicated on the Height Limit Plan and in the District Plan provisions are the result of a careful consideration of a number of factors influencing maximum height. These factors included:
- i. The scale and height of the outstanding natural landscape backdrop of Ben Lomond Scenic Reserve to the north-west of the site;
  - ii. The importance of the north-eastern area of the site in admitting sun onto and across the site before it becomes eclipsed by the height of the mountain forming the Ben Lomond Scenic Reserve as the sun moves via the north to the west;
  - iii. The shading effects of various maximum permitted building heights on various parts of the site. This is particularly important because the shading from future development itself will at many times of the day and year be eclipsed by shadows cast by the very high and steep Ben Lomond Scenic Reserve landform to the north-west of the site;
  - iv. The desirability of achieving a variation in building height across such a large site;
  - v. The desirability of achieving a variation in roof form and pitch across the site;
  - vi. The heights of buildings and land uses on neighbouring properties;
  - vii. Photomontages based on key views from various important and well-frequented public areas within Queenstown;
  - viii. Consideration of the relationship between maximum building heights, building structure and construction dimensional requirements, minimum desirable floor to floor heights and the number of storeys achievable; and
  - ix. The desirability of achieving ground floor 'floor to floor' heights of 4.5m, which enhance the activation of public space edges and provide adaptable street level interior spaces which could accommodate many different activities during the life of the building.
- 6.32 The Height Limit Plan prescribes maximum permitted building heights of 12m (3 storeys), 15.5m (4 storeys), 19m (5 storeys), 22.5m (six storeys) and 26m

(7 storeys)<sup>2</sup>, excluding the roof bonus of 2.0m, all indexed to specific areas of the site (see Figure 11).



**Figure 11: The Height Limit Plan illustrating the maximum permitted building heights (excluding the roof bonus) for various areas of the Lakeview sub-zone (see Page 26 of the UDF).**

- 6.33 The proposed height limits have all been tested by reference to shading diagrams and photomontages.
- 6.34 It should be noted that these recommended maximum permitted building heights apply to controlled activities for which Council could not refuse consent. This is not to suggest that on individual sites, and with a more detailed and finely grained assessment of environmental effects than has been possible in this exercise, it may not be possible to demonstrate that taller buildings could be appropriate. In that event, a discretionary activity resource consent would be required.
- 6.35 The proposed maximum permitted building heights were also influenced by considerations of desirable minimum building floor-to-floor heights. The advantages of specifying minimum floor-to-floor dimensions is that it can

<sup>2</sup> The number of storeys is based upon the proposed Queenstown Town Centre Plan Rules for the Lakeview sub-zone requiring a minimum 4.5m floor-to-floor height on the ground floor of all buildings required by the Structure Plan to have an active frontage. The number of storeys is further based upon a preferred but not mandatory 3.2m floor-to-floor height on all floors above the ground floor, plus an allowance of 0.5m for roof structure, but excluding the roof bonus of 2m.

ensure that all buildings have generous floor-to-ceiling heights, which will result in a high level of internal amenity.

#### ***Minimum floor to floor height***

- 6.36 The UDF and the proposed Town Centre Zone Rules prescribe a 4.5m minimum floor-to-floor height for the ground floor of any building identified as being required to have an active frontage. From an urban design perspective, this is considered to enable a dignified and appropriately scaled internal space adjoining the street level exterior public realm. At the same time, this 4.5m floor to floor dimension will enable and promote generous ground floor 'floor-to-ceiling' heights that will help to ensure the future adaptability and continuing activation of ground floor spaces immediately alongside public streets, squares and parks. Using minimum 'floor-to-floor' dimension is considered preferable to using a floor-to-ceiling dimension because it avoids the vagaries of variable height ceiling spaces. Furthermore, architectural cross-section drawings typically document dimensions based upon floor-to-floor heights, so this approach which will make it easier for Council planning staff to assess resource consent applications.
- 6.37 The minimum ground floor floor-to-floor height of 4.5m for all buildings required to have an active frontage, should apply for a minimum depth of 8.0m from the street frontage of the building.
- 6.38 For floor levels above the ground floor, and taking into account the depth of floors, building structure and building services, a minimum floor to floor height of 3.2m makes it reasonably easy to achieve a minimum finished internal floor to ceiling height of 2.7m or more. This height is considered far superior to the once standard and fast disappearing, and somewhat mean, minimum floor-to-ceiling height of 2.4m.
- 6.39 Of the two recommended minimum floor-to-floor heights of 4.5m for ground floors with active frontages and 3.2m for all floors above, only the minimum 4.5m dimension has been included in the sub-zone Rules.

#### ***Roof bonus***

- 6.40 The maximum permitted building height limits outlined under 'building height' may be exceeded by the use of the 'roof bonus' which provides for an additional maximum height of 2m, including any roof top projections.

- 6.41 The purpose of the roof bonus is to encourage the roof design to make a positive and integrated contribution to the overall design and appearance of the building. The roof bonus is *not* intended to provide scope for increasing the number of floor levels of accommodation achievable within any one or more of the specified maximum building height limits. However, where the volume of space provided by the roof bonus is not occupied by plant, it may be incorporated contiguously into the space of the upper-most floor level permitted by the maximum building height rule, provided that the roof pitch/pitches is/are directly expressed in the slope of the ceiling of the top floor of accommodation. In addition, this 'loft' space may incorporate a mezzanine floor.

### ***Building length***

- 6.42 Like building height, building length plays an important role in determining whether or not it will sit comfortably and unobtrusively into the urban grain and fabric of its context. Although no particular building length controls have been included in the proposed Town Centre Plan Change rules, the reduction in the length of development blocks brought about by the location of the required lanes and viewshafts will help to ensure that building lengths will not be excessive when viewed within in their contextual setting (see Figures 7 and 9).

### ***Public space edge conditions***

- 6.43 The UDF prescribes the public space edges that are required to have 'active frontages' and an 'active building corner' (see Figure 12). The purpose of these edges is to ensure that key areas of the extended Town Centre public realm will be edged by new development containing activities at ground level that will provide vitality, interest and visually and physically engage the passing public. Active edges typically provide public spaces with high levels of amenity, safety and comfort.



**Figure 12: Public space edge conditions (see Page 21 of the UDF).**

### ***Shading***

- 6.44 Shading studies played a significant role in the formulation of the UDF, particular when considering and recommending appropriate maximum permitted building heights. Because of the significant degree of shading caused by the Ben Lomond Scenic Reserve landform to the north-west of the site and because only a relatively short length of the north-eastern end of the combined Town Centre sub-zones escapes the shading caused by the immediate adjacency of the site to the Ben Lomond Scenic Reserve, shading becomes a critical factor in determining building height, particularly in relation the proposed public square associated with the Convention Centre (see Figures 1, 2 and 3).

### ***The Convention Centre***

- 6.45 The possible future Convention Centre<sup>3</sup> will provide a key landmark within the Lakeview sub-zone. It will also play a key role in activating the adjacent public square, which will be the most important public space in the entire sub-zone. The architectural quality of the Convention Centre will therefore be

<sup>3</sup> The development of the Convention Centre has not yet been confirmed.

paramount, as will be the visual and functional relationship between the Centre and the square. Because the maximum permitted height of buildings to the north-west of the square will be greater than that of the Convention Centre, many floors of accommodation will look down on to the roof of the Centre and it will form the foreground of many views out to the lake and the mountainous peaks beyond.

- 6.46 For these reasons the proposed Queenstown Town Centre Plan Change includes a specific suite of rules and assessment criteria applying to the Convention Centre<sup>4</sup>.

### ***The Hot Pools***

- 6.47 The architectural quality and amenity of the Hot Pool development will also play a vital role in determining the urban design outcome. It is proposed to develop the Hot Pools on the reserve situated on the bend of Thompson Street. Like the Convention Centre, the Hot Pool development will be overlooked by taller buildings to the north-west and it will architecturally mediate the visual relationship between the Square and views out to the lake and the mountains beyond.
- 6.48 For these reasons the proposed Queenstown Town Centre Plan Change contains a maximum permitted height rule of 4.5m. Given that this site is reserve land, any building will be required to follow the appropriate process under the Reserves Act 1977 and, accordingly, controls over built form can be managed via this process.

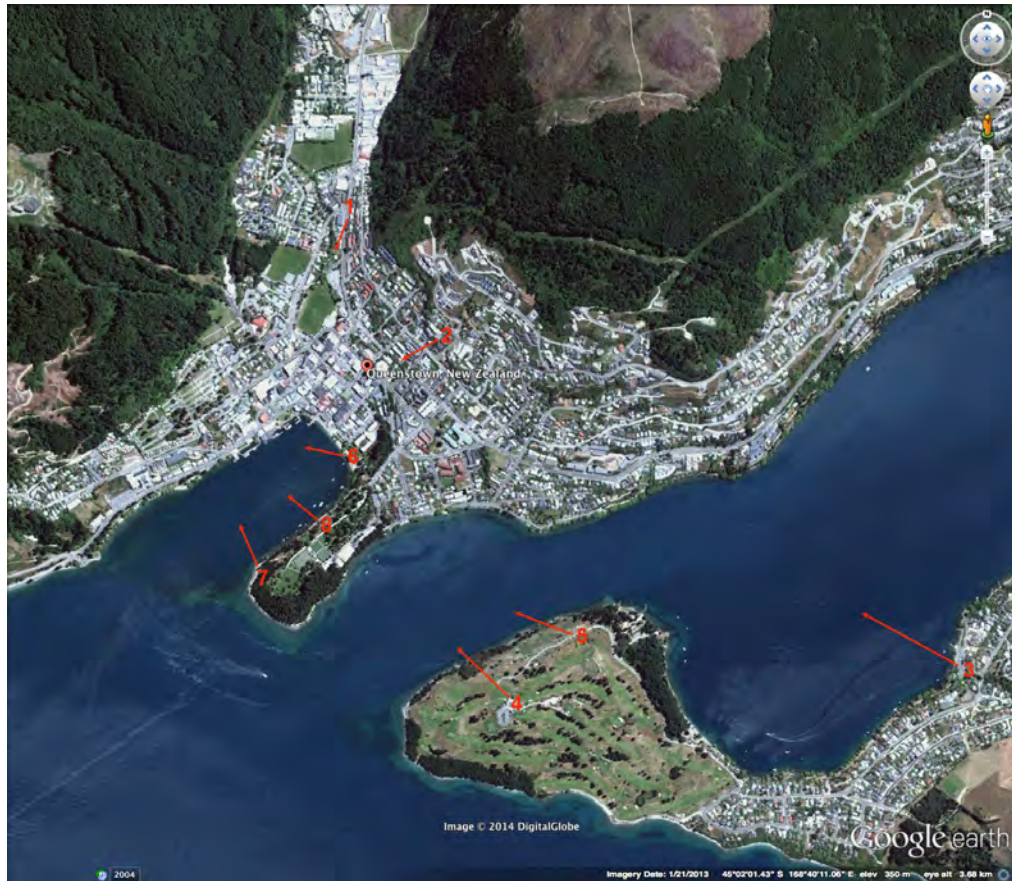
### ***Protected trees***

- 6.49 For the reasons articulated in paragraph 6.43 above, all but the row of three existing protected cedar trees on the north-western edge of James Clouston Memorial Park have been incorporated into the UDF.
- 6.50 In the context of formulating a UDF for a site of this importance in a town of such outstanding natural beauty and man-made character, it is considered important to focus on the big integrative and qualitative picture rather than get ambushed by relatively minor and relatively insignificant details such as the retention of three protected trees, particularly when their preservation would

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<sup>4</sup> Refer to the text of the Proposed Queenstown Town Centre Plan Change.





**Figure 14: A Google Earth aerial photograph of Queenstown illustrating the various locations from where photographs of the Lakeview/Isle Street site were taken.**

- 8.2 Consideration was also given to a series of photomontages prepared by fearonhay, from a viewpoint near the approximate mid-point of the Brecon Street frontage to the Queenstown cemetery, looking south towards the property at 34 Brecon Street. For this reason, no photographs were taken from this viewpoint, and it is not indicated in Figure 14.

#### ***Preparation of panoramic photographs for photomontages***

- 8.3 The preparation of the panoramic photographs used to produce the photomontages depicting the potential building bulk and heights enabled by the Plan Change generally follows the recommendations in the Best Practice Guide: Visual Simulations BPG 10.2 produced by the New Zealand Institute of Landscape Architects (**NZILA**).
- 8.4 From each viewpoint, a panoramic series of portrait format photographs were taken using a 35mm lens on a Nikon digital SLR D7000 camera. The 35mm digital lens is equivalent to a 50mm non-digital lens. These photographs were

then 'stitched' together using HP Photosmart Stitch software. The resulting image generally conforms to the fields of view of the human eye; i.e. 124 degrees horizontally and 55 degrees vertically.

- 8.5 The accuracy of the cone of vision relative to the panoramic photograph was checked using an aerial photograph of Queenstown. A line was drawn from the viewpoint to the middle of the site and then a line at an angle of 62 degrees (the 124 degree horizontal field of view of the human eye divided by 2) was drawn to each side of the central line. The points at which these two 62 degree (from centre) angled lines met the landscape depicted in the aerial photograph were checked against the actual horizontal extent of the corresponding view of the same landscape captured in the panoramic photographic image. The horizontal extents of the aerial photo view and the actual photo view were found to generally correspond with one another.
- 8.6 Because some of the panoramic images resulting from the identified viewpoints were quite similar or because the site was not sufficiently visible from some of the selected viewpoints, only photos from Viewpoints 1, 2, 3, 6, 7 and 8 were selected for use in the production of the photomontages (see Appendix 1: Queenstown Lakeview Development Photomontages pages 6-11 (pages 39-44 of this document)).
- 8.7 The modelling of the building bulk in the photomontages takes into account and accurately reflects the three dimensional spatial effects of the public spaces (streets, square, lanes, green spaces and view shafts) illuminated in the UDF and prescribed in the Structure Plan.
- 8.8 The modelling of the heights of the buildings in the photomontages is based upon the maximum permitted height, including the 2m roof bonus, which is reflected in the gently sloping roofs.

### ***Assessment of photomontages***

- 8.9 It is considered that the individual photomontages demonstrate that the potential building bulk enabled by a combination of the Structure Plan and the Height Limit Plan will result in a collective building mass that is appropriately subservient in scale to the Ben Lomond Scenic Reserve ONL. The same documents will also deliver an attractively varied and undulating roofline silhouette against the backdrop of the Ben Lomond Reserve.

- 8.10 The curving and undulating line collectively formed by the tops of the building blocks depicted in the photomontages creates a visually attractive built landscape in the foreground of the much more dominant natural landscape occupied by the Ben Lomond mountain behind (see Appendix 1: Queenstown Lakeview Development Photomontages pages 9, 10, 11 (pages 42, 43 and 44 of this document)).
- 8.11 In my opinion, the photomontages demonstrate that the urban design outcome in the Lakeview and Isle Street sub-zones resulting from the combined effects of the Structure Plan, the Height Limit Plan and the District Plan Rules will be of a development grain, scale, height and character both appropriate to and complementary to the Lakeview and Isle Street sub-zone sites and their local and greater Queenstown contexts.

## **9.0 TOWN CENTRE ZONE URBAN DESIGN CONTROLS AND ASSESSMENT CRITERIA**

- 9.1 The review of the UDF work has resulted in recommendations for additional and revised diagrams, including those underpinning the Structure Plan and the Height Limit Plan, and additional rules and assessment criteria being included in the proposed Queenstown Town Centre Plan Change for the Lakeview and Isle Street sub-zones.
- 9.2 Examples of the recommendations include:
- i. Adding required view shafts to, from and through the sub-zones. The 'primary' and 'secondary' view shafts are fixed in position but vary in width;
  - ii. Adding required streets and lanes, the centre lines of which are all required to coincide with the centre lines of the view shafts. The streets are fixed in position, alignment and width by the existing streets that are projected across the site. The locations and alignments of the lanes are also fixed as prescribed on the Structure Plan and required by the sub-zone Rules to be a minimum of 8m in width;
  - iii. Changing the originally proposed rule requiring a minimum floor-to-ceiling height of 4.0m in all ground floor spaces adjacent to public

space frontages requiring active edges to a minimum floor-to-floor height of 4.5m. This will achieve the same desired urban design outcome but resource consent applications will be easier to assess and enforce because architectural drawings, including the critical cross sections, typically indicate dimensions based upon floor-to-floor heights rather than floor-to-ceiling heights;

- iv. Providing a 'roof bonus' maximum additional height of 2.0m to encourage the roof design to make a positive and integrated contribution to the overall design and appearance of the building (refer paragraphs 6.40 and 6.41 above);
- v. Adding an active frontage requirement along the north-western boundary of James Clouston Memorial Park and along the street frontage 34 of Brecon Street;
- vi. Providing additional assessment criteria both generally and with regard to the Square and possible future Convention Centre to optimize the overall urban design outcome;
- vii. Providing guidance on the character of any future development within the Council Reserve to the north-west of the bend in Thompson Street; and
- viii. Recommending the removal altogether of the existing 2.5m plus 25 degree recession plane applying to the 34 Brecon Street site boundaries with Brecon Street and Cemetery Street, and the replacement of the existing maximum permitted building height limit of 7-8m with a maximum permitted height limit of 12m plus the 2m roof bonus, and with a maximum permitted 80% site coverage.

9.3 These recommendations have found their way into the proposed Queenstown Town Centre Plan as it relates to the Lakeview and Isle Street sub-zones.

## **10.0 CONCLUSIONS**

10.1 In my opinion, the three dimensional urban design outcome arising from a combination of the UDF's two dimensional pattern of public space on the ground plane and its expression in the third (vertical) dimension, to the degree enabled and in the character directed by the proposed Plan Change rules and assessment criteria, will ensure that the UDF is appropriately responsive to its outstanding Queenstown natural landscape setting,

including the backdrop to the site being the Ben Lomond Scenic Reserve (ONL), and that it can be relied upon to successfully extend the attractive urban character of the Queenstown Town Centre Zone.

- 10.2 The subdivision of land, into a network of public space and individual lots, is arguably one of the most significant moves in determining the quality and amenity of the urban design outcome. In this respect, the UDF is considered to be entirely consistent with this principle.
- 10.3 The three-dimensional urban design outcome will be a pattern of public space defined in its vertical dimension by buildings of varying heights, architectural scales and characters, and accommodating activities especially at ground level that will activate the directly adjoining components of the public realm. Within the limitations imposed by the scope of this review, it is anticipated that future buildings will be unlikely to cause any adverse shading effects that would be more than minor.
- 10.4 In my opinion, the Urban Design Framework strikes a very appropriate and environmentally responsible balance between prescribing those urban design ingredients that are essential to optimizing the urban design outcome associated with the future development of the Lakeview and Isle Street Town Centre sub-zones, and not unduly constraining development flexibility.



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Director of Clinton Bird Urban Design Limited and retired Associate Professor of Architecture at the University of Auckland School of Architecture

27 August 2014

## APPENDIX 1: THE QUEENSTOWN LAKEVIEW DEVELOPMENT PHOTOMONTAGES





0.02

Height Limit Plan



Queenstown Lakesview Development  
Photomontages  
August 2014

POPULOUS

fearonhay

0.01



Heights Diagram

Queenswood Lakeview Development  
Photomontages  
August 2014

NOTE: All stated heights  
are exclusive of the 2m  
roof bonus.

POPULOUS

fearonhay



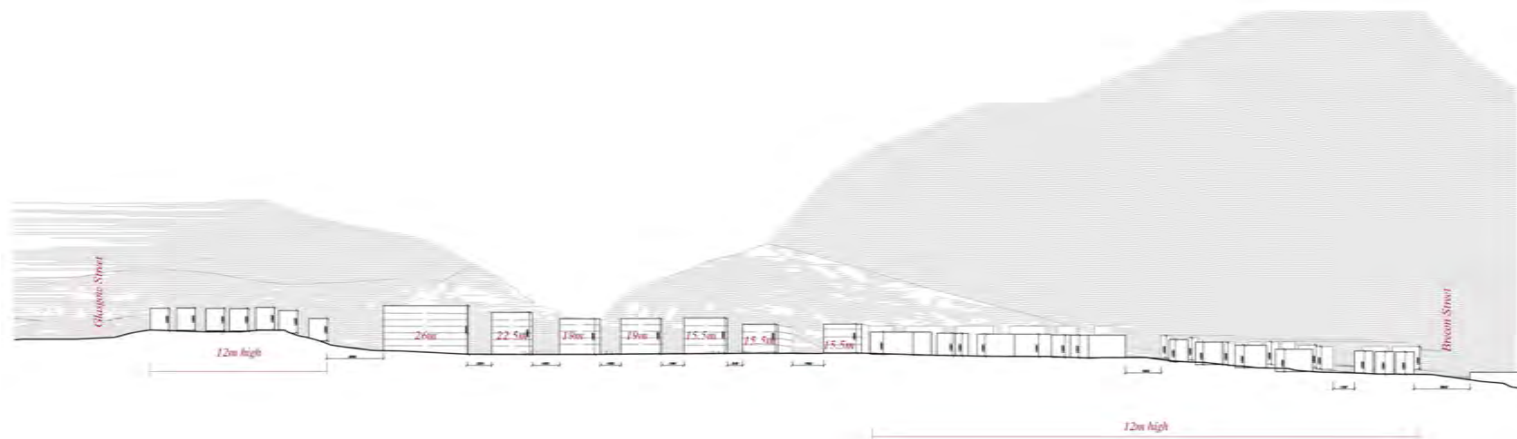
0.04

Perspectives Key

Queenstown Lakeside Development  
Photomontages  
August 2014

POPULOUS

fearonhay



NOTE: All stated heights are exclusive of the 2m roof bonus.

0.05

Scale: 1: 2,000

Section AA: height study

Queenstown Lakeside Development  
Photomontages  
August 2014

POPULOUS

fearonhay



0.06

*Perspective 1:  
Indicative View Conforming to  
Height Limit Plan (inclusive of  
2m roof bonus).*

*Queenstown Lakeside Development  
Photomontages  
August 2014*

**POPULOUS**

**fearonhay**



0.07

*Perspective 2:  
Indicative View Conforming to  
Height Limit Plan (inclusive of  
2m roof bonus).*

*Queenstown Laketown Development  
Photomontages  
August 2014*

**POPULOUS**

**fearonhay**



0.08

*Perspective 3:  
Indicative View Conforming to  
Height Limit Plan (inclusive of  
2m roof boxes).*

*Queenstown Lakeview Development  
Photomontages  
August 2014*

**POPULOUS**

fearonhay



0.09

*Perspective 6:  
Indicative View Conforming to  
Height Limit Plan (inclusive of  
2nd roof boxes).*

*Queenstown Lakeside Development  
Photomontages  
August 2014*

**POPULOUS**

**fearonhay**



0.010

*Perspective 7:  
Indicative View Conforming to  
Height Limit Plan (inclusive of  
2m roof boxes).*

*Queenstown Lakeside Development  
Photomontages  
August 2014*

**POPULOUS**

**fearonhay**



0.011

*Perspective 8:  
Indicative View Conforming to Height Limit  
Plan (inclusive of 2m roof bonus).*

*Queenstown Lakeside Development  
Photomontages  
August 2014*

**POPULOUS**

**fearonhay**