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FLINT'S PARK
QUEENSTOWN

PROPOSED INFRASTRUCTURE AND SERVICING REPORT

Project: 1252A

DOCUMENT CONTROL RECORD

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1 EXECUTIVE SUMMARY

This report along with the appended plans and calculations have been prepared by Candor[3] to support an SHA application for land located to the northern side of Frankton-Ladies Mile Hwy (SH6), Queenstown as shown in Figure 1 in this report. The report addresses the provision of all infrastructure needed to service the area for residential development with a particular emphasis on roading, stormwater, wastewater and water supply.

A Geotechnical Investigation Report has been prepared by Geosolve for a previous SHA application, confirming that the land is stable and suitable for development subject to works being carried out in accordance with the recommendations contained within that report. The earthworks required to effect any development are relatively minor and constitute a reshaping of the land to allow for suitable overland flowpaths and formation of a stormwater detention basin and there are no technical impediments to carrying out the works to meet the requirements of the Geotechnical Report. (refer Appendix D)

In support of a Housing Infrastructure Fund (HIF) Business Case Bid, an Integrated Transport Assessment (ITA) was carried out on behalf of QLDC. This assessed the impact of the proposed QLDC indicative masterplan for the wider Ladies Mile area (of which Flint's Park forms part of this wider masterplan) and identified a package of transport measures to mitigate the impact of this scale of development. QLDC, Otago Regional Council and NZTA have since agreed a programme (Programme 3) of funding for these improvements. The detailed business case identified that developers will be responsible for the funding and construction of all the internal roading and 3 waters infrastructure, with QLDC being responsible for the construction of all external transport and 3 waters infrastructure. As such, the wider transport impacts of the Flint's Park development have been assessed, and the wider off-site transport mitigation measures required have been identified and agreed upon.

Access from Frankton-Ladies Mile Hwy (State Highway 6) is a key factor in allowing development to proceed. It has been determined by NZTA in conjunction with other stakeholders that a new roundabout shall be constructed on Frankton-Ladies Mile Hwy at the intersection with Howard's Drive to provide access to the land to the north of Frankton-Ladies Mile Hwy. NZTA has commenced preliminary design work. The owners of Lot 4, 7 DP 463532 and Section 42-44 Block III Shotover Survey District which sits immediately east of the subject site are working with the Glenpanel Development Limited to ensure that roading access for the subject land will be provided through their land. The masterplans for both developments are generally consistent in showing a road parallel to Frankton-Ladies Mile Hwy that will link to the new roundabout proposed by NZTA.

Assuming a successful outcome to this application, NZTA have indicated that construction access off SH6 using the existing driveway to the property is acceptable should construction of the development be commenced on the land in advance of the construction and completion of this roundabout. Construction of the development concurrent with the construction of the new roundabout will be the fastest way to deliver housing to market and Glenpanel Development Limited are committed to this course of action subject to obtaining the required consents, etc.

A Transport Assessment Report has been prepared to support the application for a SHA which reports on the proposed internal walking/cycling/bus connectivity, the proposed internal road layout and construction traffic access prior to the opening of the SH6 / Howards Drive roundabout. The Transport Assessment concludes that there is no reason that the land is not declared an SHA and is suitable for development.

A number of proposals for the treatment and disposal of stormwater runoff from the property have been assessed in this report. All scenarios assume that the runoff from a 20% ARI will be discharged through an existing stormwater pipe that lies within Howard's Drive and it is demonstrated within this report that sufficient attenuation can be provided on the subject land to allow this discharge to happen in accordance with QLDC standards. In large storm events overland flow naturally tracks to the east towards Lake Hayes however this report also looks at the possibility of discharge of the 1% ARI overland flow through the pipe down Howard's Drive to cover the eventuality that urbanisation of the catchment interrupts overland flows to Lake Hayes on a temporary or long term basis. The conclusion of this report

is that all options assessed are technically possible and there is no impediment to the treatment and disposal of stormwater runoff from the site.

WSP Opus prepared a Scoping and concept Design Report for QLDC in support of an application to the Government's Housing Infrastructure Fund which sets out the requirements of wastewater from the area north of the Frankton- Ladies Mile Hwy. This report concludes that a new pump station and potentially storage must be provided by the developers for the land north of the Frankton-Ladies Mile Hwy and west of the line created by an extension of Howards Drive to the base of Slope Hill (referred to in the WSP Opus Report as areas 1.1 and 3.1. The Report also concludes that the *"The Shotover Waste Water Treatment Plant was built with capacity for the Frankton-Ladies Mile Hwy developments, and hence there is an available pipe entry to the headworks launder within the plant."*

The Glenpanel Development Limited accepts the contents of the WSP Opus Report and will work with the owners within the catchment to effect a new pump station and infrastructure as necessary to connect to the Shotover Treatment Plant to facilitate development. There are no technical reasons why this cannot be carried out successfully.

The WSP Opus Scoping and Concept Design Report for QLDC in support of an application to the Government's Housing Infrastructure Fund which sets out the requirements of wastewater from the area north of the Frankton- Ladies Mile Hwy. This report concludes that a new pump station and potentially storage must be provided by the developers for the land north of the Frankton-Ladies Mile Hwy and west of the line created by an extension of Howards Drive to the base of Slope Hill (referred to in the WSP Opus Report as areas 1.1 and 3.1. The Report also concludes that the *"The Shotover Waste Water Treatment Plant was built with capacity for the Frankton-Ladies Mile Hwy developments, and hence there is an available pipe entry to the headworks launder within the plant."*

The Glenpanel Development Limited accepts the contents of the WSP Opus Report and will work with the owners within the catchment to effect a new pump station and infrastructure as necessary to connect to the Shotover Treatment Plant to facilitate development. There are no technical reasons why this cannot be carried out successfully.

As regards water supply the WSP Opus report prepared for Council confirms that ***"the existing bore field at Shotover Country is currently undergoing a capacity upgrade, which will also provide sufficient capacity to service the Frankton-Ladies Mile Hwy development without further upgrades."***

The Report goes on to conclude that two new reservoirs of 1000m^3 capacity will be required to be constructed on Slope Hill at an RL of no less than 423m. Water from the Shotover Country bore field will need to be pumped to these new reservoirs which can then gravity feed a water supply network for the land to the north of the Frankton-Ladies Mile Hwy.

The Glenpanel Development Limited accepts the contents of the WSP Opus Report and will work with QLDC and the owners within the catchment to effect the new reservoirs and infrastructure as necessary to facilitate development. If necessary the new reservoirs could be sited within the applicants land holding however there are potentially better technical solutions that Council may wish to explore. There are no technical reasons why a water supply network cannot successfully be designed and constructed to service this land.

Utility services being power and telephone services can be upgraded to service the development. Written confirmation from the various providers is appended to this report confirming this statement.

Based on preliminary design work carried out to date there are no technical impediments to providing any of the necessary services to allow residential development of the land that is the subject of this report. There are no technical engineering reasons why the land should not be declared an SHA and subsequently proceed through a consenting process and be developed to provide much needed housing for the Queenstown area.

2 INTRODUCTION

In response to a housing shortage the Queenstown Lakes District Council has been looking at options for making more land available for development and they have had an indicative masterplan for Ladies Mile area prepared in 2017. They have also had a Scoping and Concept Design Report prepared by WSP Opus to look at the infrastructure required to allow development of the land as supporting documentation for a successful application to the Government's Housing Infrastructure Fund. The opportunity exists for land owners in this area to apply to Council to have their land declared a Special Housing Area prior to this legislation becoming redundant.

The Glenpanel Development Limited wishes to develop a parcel of land sited to the north of the Frankton-Ladies Mile Highway into 151 dwellings and has prepared this application in support of an application to have the land declared an SHA. Included in this report is an overview of the infrastructure needed to support development together with an analysis as to how this can be provided if the land is granted SHA status. A copy of the proposed Flint's Park Masterplan is included in Appendix A.

3 EXISTING SITE DESCRIPTION

The proposed development is located to the northern side of Frankton-Ladies Mile Hwy, Queenstown, as shown in the figure below. The Proposed SHA area is approximately 10.1707ha in size which forms part of Lot 1 DP 22874, part of Lot 1 DP 463532, all of Lot 2 DP 463532, all of Lot 1 DP 20162, all of Section 1 SO 24954 and a portion of an unformed paper road.

Figure 1 Approximate extent of the proposed Flint's Park SHA

Frankton-Ladies Mile Hwy runs along the southern boundary of the property with rural land to the east and west. The property immediately north of Frankton-Ladies Mile Hwy is flat for approximately 250-300m after which the land starts to climb the lower slopes of Slope Hill, a prominent Queenstown landscape feature. The northern boundary of the property is well elevated sitting someway up Slope Hill. To the east and west of the subject property the land is currently rural and of similar character. Immediately south of the side on the opposite side of Ladies Mile is the Queenstown Country Club which is approved as an SHA and under development.

There are a number of farm buildings and a historic homestead within the property sitting at the base of Slope Hill. Stands of trees are dotted throughout the property as can be seen from the aerial photo with some having been planted as wind breaks to support farming operations and the balance planted around the historic homestead.

4 EARTHWORKS

4.1 Bulk Earthworks

A Geotechnical Investigation Report has been prepared for the site by Geosolve Ltd. which is included in the SHA Application (Refer to Appendix D). The Report confirms that the land is suitable for development and there are no technical matters raised in the report that are grounds for declining an SHA application.

In order to develop the site into residential allotments it will be necessary to recontour the land to provide more regular shapes and appropriate road gradients. While it is a matter for assessment at Resource Consent stage some commentary on the earthworks necessary to implement the masterplan is provided to give a better understanding of the proposed project.

Bulk earthworks for the proposed development will be carried out over the entire site. Preliminary design work indicates that approximately 10,000m^3 of fill will need to be placed to shape the site to ensure that in large storm events overland flows can be managed without causing inundation of dwellings or allowing stormwater runoff to flow across Frankton-Ladies Mile Hwy being a State Highway.

In order to detain stormwater in large storm events and prevent the issues noted above, the setback that is required along Frankton-Ladies Mile Hwy will be shaped to provide the detention area required for stormwater. This is commented on in more detail in the stormwater section of this report however the volume of detention required is 13,000m^3 providing sufficient material to complete the necessary filling on site and it is not envisaged that soil materials will need to be imported to or exported from the site to complete earthworks.

4.2 Sediment and Erosion Control

Erosion and sediment control measures will be designed in accordance with clause 2.3.7 of the QLDC Code of Practice and will be established prior to construction beginning. Controls will then be monitored throughout the construction phase. The removal of any measures will not occur until all surfaces have been sufficiently stabilised. Erosion and Sediment Control will be incorporated into the detailed engineering design work and will be in accordance with appropriate QLDC guidelines with works generally undertaken as follows:

- Construction of a stabilised vehicle entrance at the entrance to any stage.
- Install clean water diversion drains to redirect upstream runoff where required.
- Construct the Sediment Retention Pond(s).
- Construct silt fences and earth bunds around the perimeter directing water to sediment retention ponds.
- Carry out any clearing required
- Strip topsoil and stockpile on site.
- Carry out cut to fill earthworks.
- Complete civil works as appropriate with topsoil respread and grassing on completed areas as soon as possible after works are complete.
- Re-spread topsoil immediately after completion of earthworks on areas not subject to civil works.
- Seed area with grass seed and where necessary, straw mulch.
- Remove erosion and sediment control measures once site is stabilised.

The site is proposed to be treated predominantly by a number of Sediment Retention Ponds (SRP) treating areas of up to 5ha each. Continuous earth bunds will pick up runoff from overland flow / contour drains, and direct it to the ponds. The SRP will have storage volume equal to 3% of its catchment area and will be PAC flocculent dosed to assist in the settling of suspended soil particles. All chemical treatment will be designed by the contractor and submitted to council for approval prior to works commencing.

Subject to detailed design and consenting the extension of the pipeline from Howard's Drive may be constructed early and ahead of earthworks so as to provide an outlet from the sediment control ponds.

Additional measures will be employed to minimise potential erosion on site such as; completing the earthwork stages as quickly as possible, and minimising exposed areas or stabilising as soon as possible following achievement of final level.

Technically there are no impediments to carrying out earthworks in a manner that will result in stable platforms for development and, with appropriate sediment control measures in place to minimise sediment runoff during works, there is no reason from an earthworks perspective that the land cannot be declared an SHA.

5 ROADING

5.1 Existing Roading

Currently the site is accessed from a private driveway off the Frankton-Ladies Mile Hwy (SH6) that runs along the north eastern boundary of the property.

In support of a Housing Infrastructure Fund (HIF) Business Case Bid, an Integrated Transport Assessment (ITA) was carried out on behalf of QLDC. This assessed the impact of the proposed QLDC indicative masterplan for the wider Ladies Mile area (of which Flint's Park forms part of this wider masterplan) and identified a package of transport measures to mitigate the impact of this scale of development. QLDC, Otago Regional Council and NZTA have since agreed a programme (Programme 3) of funding for these improvements. The detailed business case identified that developers will be responsible for the funding and construction of all the internal roading and 3 waters infrastructure, with QLDC being responsible for the construction of all external transport and 3 waters infrastructure. As such, the wider transport impacts of the Flint's Park development have been assessed, and the wider off-site transport mitigation measures required have been identified and agreed upon.

5.2 Proposed Roading

A Transport Assessment Report has been prepared to support the application to have the proposed Flint's Park development declared an SHA. This Report sets out the proposed internal walking/cycling/bus connectivity, the proposed internal road layout and construction traffic access prior to the opening of the SH6 / Howards Drive roundabout. A copy of this assessment is appended to the SHA application and should be read in conjunction with the comments below.

The main access to the site will be from a proposed roundabout at the intersection of SH6 / Howards Drive which is being led by QLDC and NZTA. This roundabout sits within the neighbouring property. The owners of this property are also seeking to have their property become an SHA and are working with Glenpanel Development Limited to effect all of the necessary infrastructure.

In advance of the construction and completion of this roundabout, construction access into the site will be taken from the existing private driveway. Preliminary comments from NZTA have indicated that this is acceptable.

The development of the subject site will require the construction of numerous local roads, including roads of varying width and function such as Collector/Connector Roads, Local Roads and private laneways/private Jointly Owned Access Lots (JOAL).

The roads will be designed in accordance with Clauses 3.3.1 and 3.3.2 of the QLDC Land Development Code of Practice. The legal width of the roads proposed will generally vary from 14.0m to 18.0m for Collector/Connector Roads and Local Roads and typically 8m for private laneways, as shown on the Masterplan drawings set out in the SHA application and set out below.

Vested Roads

Road 1 – Collector / Connector Road

This road will connect the development to the main roundabout access at the Howards Drive / SH 6 and will run east/west parallel to SH6 along the landscape buffer set back. The road is proposed to sit within a 15m road reserve with the following cross section:

- 0.4m berm from property boundary to back of footpath.
- 1.8m footpath.
- 2.4m indented parking.
- 7m carriageway.

- 2.4m indented parking.
- 1m berm to landscape buffer.
- Total = 15m.

Road 1 is future proofed to accommodate bus movements should this become a bus route in the future. On street parking is provided on both sides of the street. Cyclists have the option to ride on the road or, in likely the case of less confident or recreational cyclists, on the parallel segregated footpath / cycleway to the south of Road 1 in the landscape buffer area.

Road 2 - Collector/Connector Road

This road runs east west along the base of Slope Hill. The road is proposed to have an 18m road reserve with the following cross section:

- 1.3m berm from property boundary to back of footpath.
- 1.8m footpath.
- 2.4m indented parking.
- 7m road.
- 2.4m indented parking.
- 1.8m footpath.
- 1.3m berm from property boundary to back of footpath.
- Total = 18m.

Road 2 is future proofed to accommodate bus movements should this become a bus route in future. On street parking is provided on the south side of the street and partly on the north side (none proposed parallel to the Neighbourhood Park). Cyclists will ride on the road.

Roads 3, 4 and 5 – Local Roads - north/south routes, 18m road reserve with the following cross section:

- 1.8m berm from property boundary to back of footpath.
- 1.8m footpath.
- 2.4m indented parking.
- 6m road.
- 2.4m indented parking.
- 1.8m footpath.
- 1.8m berm from property boundary to back of footpath.
- Total = 18m.

Cyclists will ride on the road.

Road 6 – Local Road - north /south route, 14m road reserve with the following cross section from west to east:

- 1.8m berm from property boundary to back of footpath.
- 1.8m footpath.
- 2.4m indented parking.
- 6m road.
- 2m berm to Linear Park.
- Total = 14m

No Stopping At All Times (NSAAT) road markings will be provided on the east side adjacent to the Linear Park. Cyclists will ride on the road or on the Linear Park shared route which runs parallel to the Park.

Private Laneways/JOAL's

Typical lane widths will be 8m.

Final roading cross sections will be subject to Council consenting processes and some change may be expected although this is not anticipated to be significant. All roads will be constructed in accordance with clause 3.4 of the QLDC Land Development Code of Practice standards with kerb and channel, footpaths and a hotmix surface. Parking and appropriate landscaping will be provided where required. The Transport Assessment Report details the proposed parking levels and locations.

The structural design of pavements will be carried out in accordance with clause 3.3.3 of the QLDC Land Development Code of Practice. Based on the findings of the Geotechnical Investigation Report there is no reason that the roads cannot be constructed to meet the required standards.

Treatment of stormwater runoff will be managed through a combination of standard road cesspits, swales, raingardens and tree pits.

Street lighting will be provided along all roading in accordance with Council standards set out in clause 3.3.14 of the QLDC Land Development Code of Practice. Street trees and landscaping will also be provided throughout the development in accordance with section 7 of QLDC Land Development Code of Practice.

A masterplan is included with the SHA application setting out intended roading layouts although detailed design and consenting processes may require minor changes. The masterplan is therefore included for information and is only intended to inform the SHA EOI process. The ultimate form of development will be guided by the decisions that Council makes after the land has been declared an SHA and a Resource Consent application for subdivision has been lodged.

There are no technical impediments to carrying out this work, the nature of which is routinely carried out when urbanising rural areas.

Technically there are no impediments to forming local roading in a manner that will adequately serve the development and as NZTA have already commenced preliminary design for a roundabout on the State Highway to provide access to the wider area there is no reason from a roading perspective that the proposed Flint's Park development cannot be declared an SHA.

6 STORMWATER

6.1 Existing Reticulation and Overland Flow

As part of it's Queenstown Country Club development, the Sanderson Group, has constructed a 900mm diameter stormwater pipe up Howards Drive which is intended to service land to the north of Frankton-Ladies Mile Hwy. The pipe currently ends approximately 100m to the south of Frankton-Ladies Mile Hwy and will need to be extended to service the properties to the north of Frankton-Ladies Mile Hwy. The extension of this pipe will need to be designed in conjunction with the roundabout to be constructed at the intersection of SH6 and Howard's Drive to provide access to the land to the north of Frankton-Ladies Mile Hwy.

Based on the existing contour any stormwater runoff that flows from the subject land in large events will flow to the east towards Lake Hayes with no natural flow across Frankton-Ladies Mile Hwy.

6.2 Proposed Reticulation System and Treatment

A new stormwater reticulation system will be constructed to serve the proposed development. This network will include the extension of the existing 900mm dia. pipe that sits within Howard's Drive under SH6 and through the neighbouring property to the east. The owner of this property is also seeking to have their land declared an SHA and the parties are working together to effect the necessary infrastructure that supports development.

Preliminary 3d stormwater modelling demonstrates that a primary network that will convey the 20% ARI storm event flows as per QLDC standards can be designed and constructed without difficulty. In carrying out this assessment we have looked at the capacity of the existing pipe in Howards Drive and have assumed a maximum outflow from the subject site based on a percentage of the catchment the pipe serves. The allowable outflow calculated from the subject site is 300l/s under the 20% ARI storm event. A small detention basin of around 1750m^3 will be required within the landscape buffer area to attenuate flows from the development back to this calculated allowable outflow for these conditions. Copies of our calculations are appended to this report.

6.3 Secondary Overland Flow Paths

The natural overland flow from the site runs to the east towards Lake Hayes and the design and grading of roading for the proposed development is intended to maintain the existing situation. However, with the urbanisation of the catchment, these natural flowpaths will be modified and in the future overland flow in large storm events will likely be conveyed along formed road environments. With the development intentions and timeframes of land owners between Howards Drive and Lake Hayes to the east being unclear and a potential increase in runoff as a result of urbanisation of the subject site there is therefore a possibility that there may be short term conflicts in level or alignment between natural flowpaths and the proposed overland flows down future road alignments.

There are solutions available to avoid or mitigate such conflicts should they arise during detailed design and to demonstrate this to Council we have carried out an assessment assuming that all stormwater runoff from the site in events up to and including the 100 year ARI event are managed within the site and are discharged through the pipe down Howards Drive. We have also included the runoff from Slope Hill in our analysis and as such believe that this assessment is very conservative. All calculations are included in the appendix to this report.

The exercise that we have carried out shows that it is possible to form a detention basin of sufficient size within the landscape buffer adjacent to Frankton-Ladies Mile Hwy to attenuate runoff from the fully developed site back to an outflow of 300 l/s. This means that it is possible to control runoff from events up to and including the 1 in 100 year ARI and discharge this through the pipe down Howards Drive without flow across SH6 and without any need to discharge overland flows through neighbouring properties to the east. A stormwater network has been derived based on the proposed masterplan and has been modelled in 3d including a detention basin to demonstrate that this proposal can be physically effected and preliminary information is appended to this application demonstrating this.

Ideally the future flowpaths post development will reflect the existing natural flowpaths and the analysis that we have carried out is intended only to demonstrate to Council that the development of this property can proceed without reliance on other neighbours, the only exception being the property immediately to the east. These land owners, as previously noted, are also looking to develop their land and have a development track record in the Queenstown area.

6.4 Stormwater Runoff Quality Control

The proposed reticulation will be designed in accordance with clause 4.3.5.1 of QLDC's Code of Practice with treatment of runoff provided using "on-line" treatment devices such as rain gardens, swales and an engineered detention basin before ultimate discharge into the pipe that Sanderson Group have constructed in Howard's Drive. Raingardens and swales within roads can provide "at source" and "train" treatment with retention and contaminant removal for roads and private driveways.

Figure 3 Raingardens / Streetscape at Long Bay Auckland

Stormwater swales Albany Centre Auckland

Based on work carried out to date there are no technical impediments to managing stormwater runoff from the proposed Flint's Park development should the land be granted SHA status.

7 WASTEWATER

7.1 Existing Infrastructure

The WSP Opus Report commissioned by QLDC in support of their application to the Housing Infrastructure Fund sets out the situation as regards existing wastewater networks in the area as follows -

"Waste water in the Frankton-Ladies Mile Hwy area currently relies on pump stations to return waste water to the top of the gravity main located in the approach to the Shotover River Bridge. This gravity main acts more as a force main, or inverted siphon through to the launder in the Shotover Waste Water Treatment Plant on the far (west) side of the Shotover River.

The existing operational pipe across the bridge is a DN450 steel pipe, and initial assessment by QLDC (and information provisions in the Glenpanel SHA Report) indicates that this pipe has approximately 70 l/s spare capacity. As there is no clear information on the remaining capacity of the DN300 PVC pipe upstream of the bridge, only the smaller rising main discharges will be proposed as discharge into this pipe, and a new rising main to connect to the existing DN450 would be necessary to accommodate flow from areas 1.1 and 3.1."

7.2 Proposed Infrastructure

7.2.1 Pump Station

The WSP Opus Report commissioned by QLDC states -

"The fall of the land across the site is generally towards Lake Hayes to the east, requiring a pumped solution to return the waste water towards the Shotover Waste Water Treatment Plant to the west. There are three distinct areas that will require individual pump stations due to localised fall of the land. Areas 2.2, 1.2 and 3.2 will require two smaller pump stations. These pump stations will be built by QLDC. A third pump station will be required for the Areas 1.1 and 3.1, which will be the responsibility of the developer. A rising main in the State highway corridor will be provided by QLDC, from the anticipated location of the pump station through to the existing DN450 pipe at the bridge."

Glenpanel Development Limited accepts that it will be necessary to install a new pump station to convey wastewater and will look to work with the adjacent dev eloper to the east of the subject site to design and construct an appropriate pump station to serve areas 1.1 and 3.1 as per the WSP Opus Report. It is possible to site a new pump station within the subject land that will service all of areas 1.1 and 3.1 should the adjoining developers not wish to develop within the same timeframes.

Should design work demonstrate that the capacity in any existing gravity mains is marginal it should be possible to set the pump station control systems such that the discharges from individual pump stations occur in different time windows to ensure all pumps are not discharging simultaneously and that the capacities of the existing mains can be maximised.

7.2.2 Downstream Capacity and Storage

The WSP Opus Report also comments on the capacity of the downstream treatment plant as follows -

"The Shotover Waste Water Treatment Plant was built with capacity for the Frankton-Ladies Mile Hwy developments, and hence there is an available pipe entry to the headworks launder within the plant. Provisional costing for 12 hours storage at each pump station site has been included to accommodate the gravity flows in the event of an outage. This may not be required if an appropriate level of storage can be achieved within the pipe network, which will become apparent in the design of the local reticulation by the developer."

Glenpanel Development Limited accepts that it may be necessary to provide storage in any new pump station should detailed design not be able to demonstrate that the piped network provides adequate storage. They will look to work with the adjacent developer to the east of the subject site to design and construct an appropriate pump station to serve areas 1.1 and 3.1 as per the WSP Opus Report. In the event that the adjoin developer to the east does not move forward within the same timeframes any storage required can be provided within the subject site.

If the conservative ADWF values are used, emergency storage for 156 dwellings will be 39m^3 based on 8 hours storage.

It is also assumed that the Glenpanel Development Limited would be charged development contributions under the 2018/2019 Development Contribution policy or subsequent policies. The current figure being levied is $3,500 per residential unit. This contribution is assumed to cover the developers cost of any downstream infrastructure upgrades.

7.2.3 Internal Infrastructure

The proposed lots and dwellings will be serviced with a network of 150mm diameter uPVC or PE pipes. The network will be designed in accordance with QLDC's Code of Practice. Preliminary modelling of a network demonstrates that there will no problem in delivering a suitable wastewater network.

In our opinion there is no impediment to providing wastewater disposal for the Flint's Park development in accordance with Council standards and good engineering practice which also resolves existing problems facing Council in managing their existing facility.

8 POTABLE WATER SUPPLY

8.1 Existing Infrastructure

The WSP Opus Report commissioned by QLDC in support of their application to the Housing Infrastructure Fund states that *"There is currently no water supply to the Frankton-Ladies Mile Hwy HIF area".*

8.2 Proposed Infrastructure

8.2.1 Global Infrastructure

The WSP Report goes on to discuss the master planning work that QLDC has been undertaking. The Report states (information relevant to this application in bold) -

"The master planning work QLDC has been undertaking recommends reservoirs located at height to service consumers without the need for booster pumping. At this stage, there is no specific location identified for the reservoirs, but a minimum height has been identified.

The existing bore field at Shotover Country is currently undergoing a capacity upgrade, which will also provide sufficient capacity to service the Frankton-Ladies Mile Hwy development without further upgrades. *QLDC is still looking at how the existing Kelvin Heights intake and Jacks Point intake can be dovetailed into the existing QLDC network for the purpose of ensuring a future proofed scheme that will meet the demands of their future growth projections. However, the long-term planning from QLDC indicates that 4,400 m3/day will be provided for the Frankton-Ladies Mile Hwy area by 2058, which is plenty of supply.*

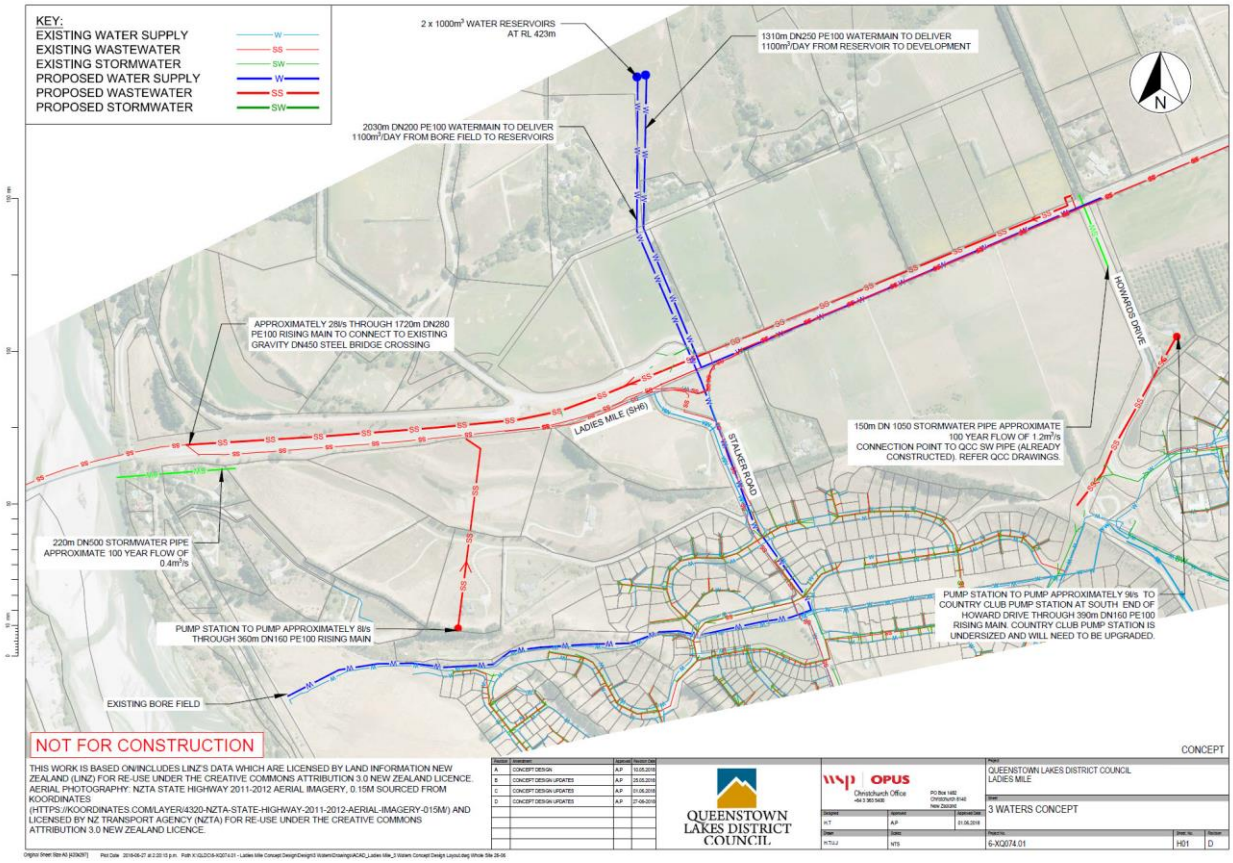
New reticulation from the Shotover Country bore field is required to charge the new water reservoirs that are needed to service the development. Due to the constrained corridor through Old School Road, where the existing trunk water main and proposed trunk main to the Frankton area are located, the new trunk main to Frankton-Ladies Mile Hwy will need to follow an alternative route.

The proposed water main route is adjacent to the existing pipe from the bore field and up through Stalker Road.

The recommended position of the new water reservoirs is on Slope Hill above HIF programme area 1.1 and is at a level of approximately RL 423 m to match the height of the reservoirs at Quail Rise. *This level will give a working pressure of between 400 and 600 kPa to the development areas. The location of the reservoirs is not confirmed at this stage, but work has been started to secure an appropriate site (in terms of access and elevation) by QLDC.*

Reservoir design parameters defined by the QLDC Land Development and Subdivision Code of Practice require service for 6 hours average demand + fire storage as the worst-case scenario. This resulted in 6 hours of 63 l/s total demand, and a reservoir size of 1360 m3. In order to provide adequate resilience to the supply, two reservoirs of 1000 m3 are proposed."

Conceptually the WSP Opus report illustrates that treated water will be pumped from the Shotover Country Bore Field to the new reservoir up Stalker Road as shown in the drawing below.



Glenpanel Development Limited accepts the need for and supports the required infrastructure identified by QLDC's master planning exercise.

While Glenpanel Development Limited understands that QLDC may have started work to secure a site for the required reservoirs they note that the Glenpanel land holding extends up Slope Hill beyond RL 423. While there may be better locations for the new reservoirs it is theoretically possible based on the proposed masterplan that is the subject of this application to construct reservoirs on Slope Hill within the subject property and provide access to them via the roading network set out in the masterplan. It is also possible to vary the route of the proposed rising and falling mains indicatively shown on the drawing above such that the new mains are contained within the proposed roading for future ease of access and maintenance. Subsequent to Council determining the best location for the new reservoirs Glenpanel will design any necessary mains serving these reservoirs within it's development if this is appropriate.

8.2.2 Local Infrastructure

As part of any design carried out a water supply model will be prepared to confirm pipe sizing, network pressures and delivery of domestic and fire fighting supply in accordance with QLDC standards. With the construction of the new reservoirs at RL 423m or above it is not anticipated that there will be any issues in providing water supply that meets Council standards. It is anticipated that the local mains within the development (excluding rising and falling mains from the new reservoirs) will be of 150mm diameter.

All new infrastructure constructed for this development would then be vested in Council ownership.

8.3 Required upgrades

It is assumed that the Flint's Park development will be levied under the 2018/2019 Development Contribution policy under the Frankton-Ladies Mile Hwy category for their contribution to headworks and trunk infrastructure upgrades. The current figure being levied is $5,683 per residential unit.

In our opinion there is no impediment to providing an adequate potable water supply for the Flint's Park development in accordance with Council standards and good engineering practice and that there are no grounds for declining the SHA based on water supply matters.

9 POWER, TELECOMMUNICATIONS AND GAS

Aurora Energy and Powernet both have high voltage electrical networks adjoining the subject site and they have both confirmed that their networks can supply suitable underground electrical supply to the proposed development.

Fibre optic telecommunications cables exist along the north side of Frankton-Ladies Mile Hwy. These are owned by Chorus who have also confirmed that extensions to their network can be made to provide telecommunications services to the proposed development.

The Shotover Country subdivision has full gas reticulation with gas being provided by Contact/Rockgas who have a 50t buried gas tank located off Jones Ave. A 110mm main runs in Stalker Road past the property boundary and gas reticulation can be made available at the discretion of the developer.

All existing infrastructure is underground and all new reticulation required to service the proposed development will continue this model of service. Confirmation from the network owners has been obtained that they will be able to service the proposed development and these confirmations are contained in the appendices to this SHA application.

Based on the feedback from the Utility Service providers it is not anticipated that there will be any supply or capacity issues that will limit the provision of necessary services and connection can be made available from existing infrastructure at the time of development in accordance with the relevant service provider's specifications.

Based on the advice from Aurora Energy, Powernet and Chorus there is no impediment to providing adequate utility services for the proposed Flint's Park development in accordance with Council standards and good engineering practice and that there are no grounds for declining the SHA based on utility service matters.

10 CONCLUSION

This report, along with other specialist documents, has been prepared in support of a SHA application for an area of approximately 10.1707ha in size which forms part of Lot 1 DP 22874, part of Lot 1 DP 463532, all of Lot 2 DP 463532, all of Lot 1 DP 20162, all of Section 1 SO 24954 and a portion of an unformed paper road. Based on investigations and preliminary work carried out and as presented in this document all necessary services required to facilitate development of the subject land can be provided.

In summary the subject land is

1. Geotechnically stable and there are no matters raised in the Geotechnical Investigation Report that cannot be adequately dealt with during construction to provide stable platforms for dwellings.

2. Free from inundation in large storm events. The land sits well above any floodplains within the wider area and runoff from Slope Hill which sits behind the proposed development can be managed within the road corridor and in detention basins sited in the landscape setback adjacent to the Frankton-Ladies Mile Hwy.

3. Able to be serviced adequately with stormwater reticulation in accordance with Queenstown Lakes District Council standards.

4. Able to be provided with adequate wastewater servicing in accordance with Council and standards through the construction of a new pump station and rising mains to connect the proposed development to the existing Shotover Treatment Plant. Additional storage may be required and can be provided if detailed design confirms that this is required. The Shotover treatment plant has been sized to deal with wastewater from the Ladies Mile area and this is confirmed within the WSP Opus HIF Scoping and Concept Report prepared for Council in June 2018.

5. Able to be provided with an adequate water supply in accordance with Council standards and the New Zealand Fire Service Firefighting Water Supplies Code of Practice through an upgrade of existing systems. Two new reservoirs must be constructed on Slope Hill at an RL in excess of 423m to provide adequate pressure for the networks that will need to be constructed to service the proposed developments. The Shotover Country bore field is being upgraded and will have sufficient capacity to provide the volumes of water necessary for the Ladies Mile area. This is confirmed within the WSP Opus HIF Scoping and Concept Report prepared for Council in June 2018.

6. Able to be provided with necessary utility services including power and phone to adequately service the proposed development.

In our professional opinion, there is no technical impediment to providing the necessary infrastructure to serve the proposed Flint's Park development and there are no engineering matters that prevent the land being declared and SHA and moving forward to provide much needed housing for the township of Queenstown.

APPENDIX A
FLINT'S MARK MASTERPLAN

FLINT'S PARK MASTERPLAN

patch CPRW architecture / design Candor³ ENGINEERING FOR LIFE

0 10 20 50m
SCALE = 1:1000 AT A1

Masterplan A
Reference PA18274 - IS04
25 February 2018

APPENDIX B
STORMWATER LAYOUTS AND CALCULATIONS

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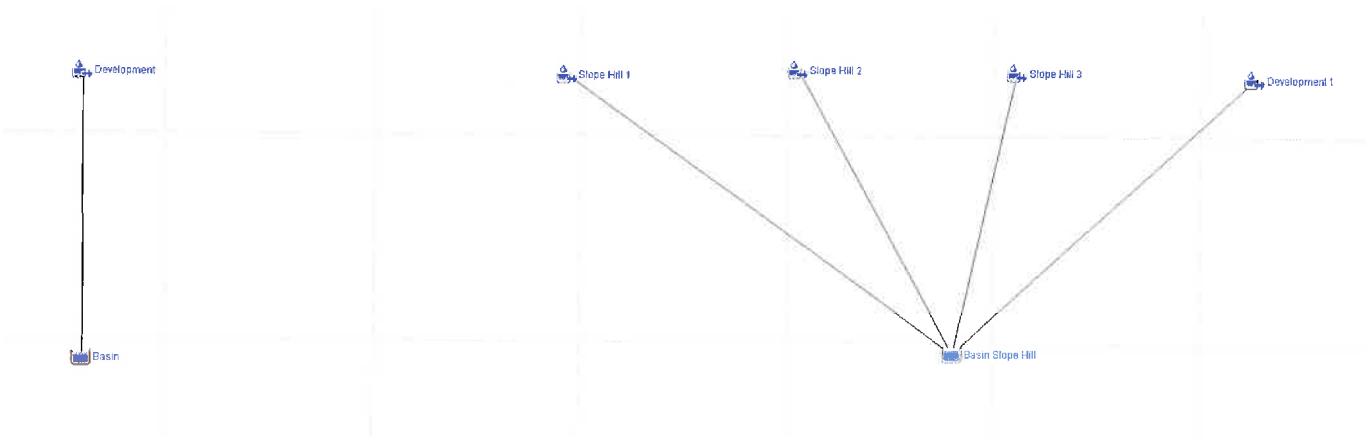
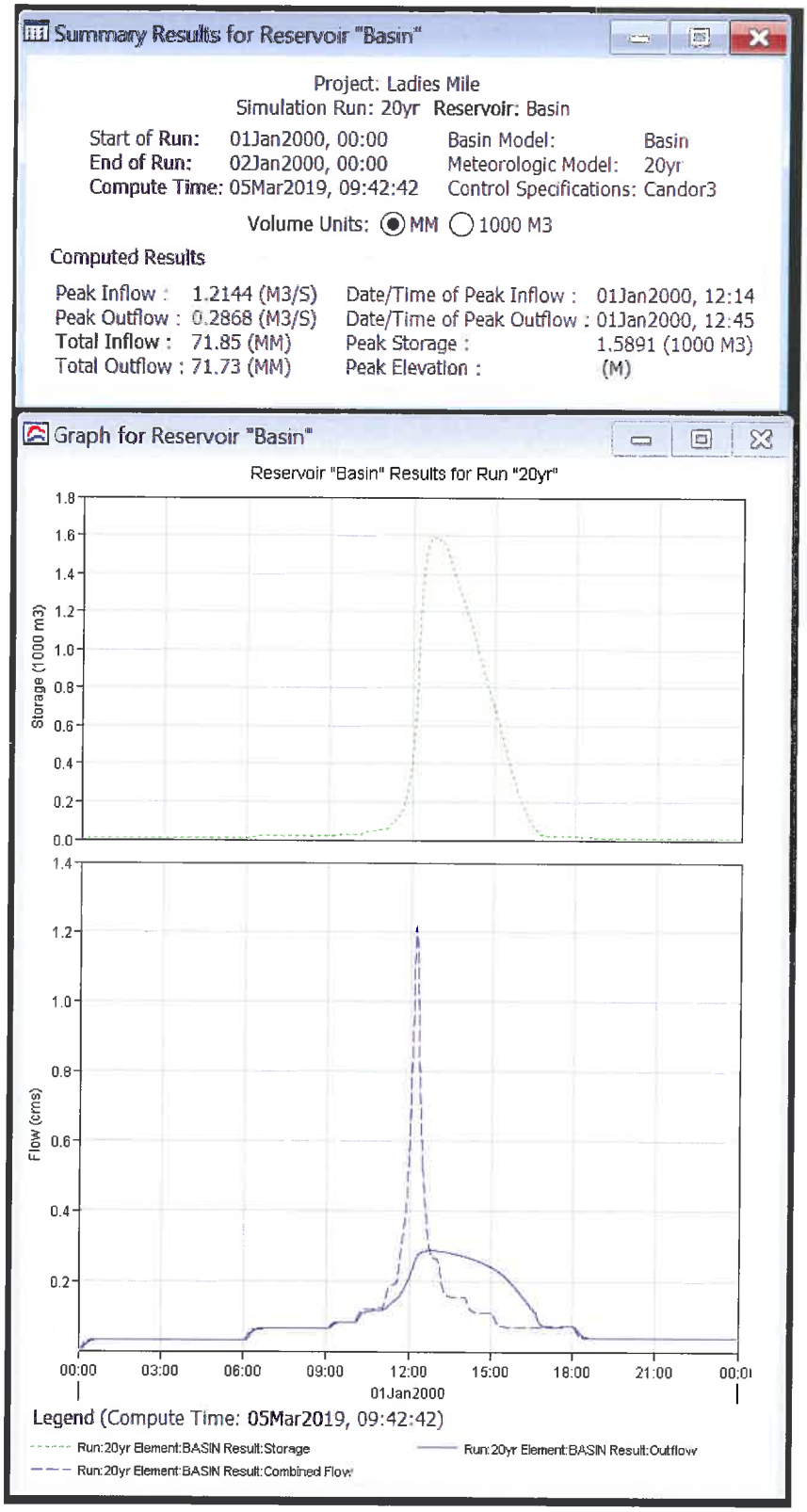
HEC-HMS MODEL OUTPUTS

1. MODEL LAYOUT



2. HYDROLOGICAL OUTPUT – 20 Year ARI



3. HYDROLOGICAL OUTPUT – 100 Year ARI (INCLUDING SLOPE HILL)

Summary Results for Reservoir "Basin Slope Hill"

Project: Ladies Mile
Simulation Run: 100 YR Reservoir: Basin Slope Hill

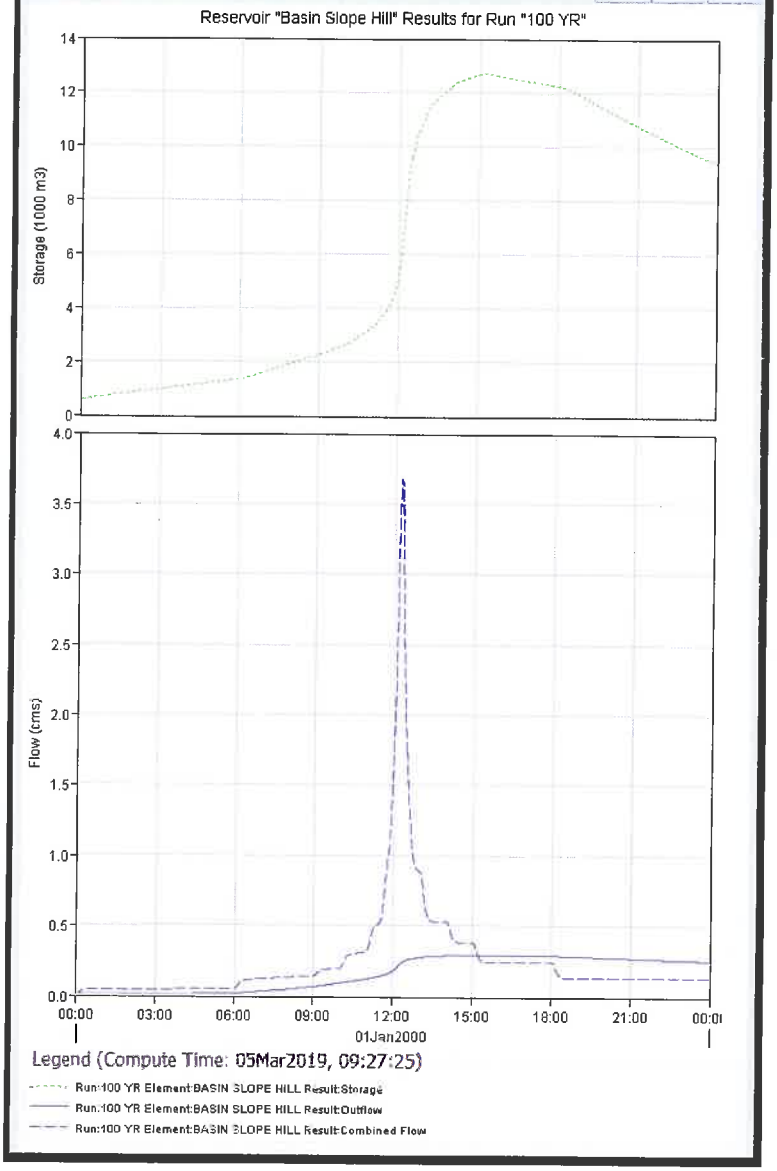
Start of Run:	01Jan2000, 00:00	Basin Model:	Basin
End of Run:	02Jan2000, 00:00	Meteorologic Model:	100YR
Compute Time:	05Mar2019, 09:27:25	Control Specifications:	Candor3

Volume Units: (•) MM ( ) 1000 M3

Computed Results

Peak Inflow :	3.6746 (M3/S)	Date/Time of Peak Inflow :	01Jan2000, 12:14
Peak Outflow :	0.2913 (M3/S)	Date/Time of Peak Outflow :	01Jan2000, 15:12
Total Inflow :	78.83 (MM)	Peak Storage :	12.7384 (1000 M3)
Total Outflow :	47.74 (MM)	Peak Elevation :	(M)

Graph for Reservoir "Basin Slope Hill"



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STORMWATER HYDROLOGICAL PARAMETERS - POST DEVELOPMENT

(INCLUDING SLOPE HILL)

PROJECT:	Ladies Mile		
LOCATION:	Queenstown		
CALC BY:	Maryam Hasanzadeh	DATE:	05-Mar-19
CHECKED BY:	Dali Suljic	DATE:	05-Mar-19

HYDROLOGICAL INPUTS						
CATCHMENT NAME	Development 1	Slope Hill 1	Slope Hill 2	Slope Hill 3		
SOIL CLASS	Class A	Class C	Class C	Class C		
IMPERVIOUS (ROADS, ROOFS ETC)	79,500 m^2					
URBAN LAWNS	26,500 m^2					
PASTURE		12,051 m^2	115,091 m^2	49,098 m^2		
TOTAL AREA	106,000 m^2	12,051 m^2	115,091 m^2	49,098 m^2		
IMPERVIOUS	75.0%	0.0%	0.0%	0.0%		
PERVIOUS CN	39.0	74.0	74.0	74.0		
PERVIOUS Ia	5.0 mm	5.0 mm	5.0 mm	5.0 mm		

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STORAGE CALCULATIONS

(INCLUDING SLOPE HILL)

PROJECT: Ladies Mile
LOCATION: Queenstown
CALC BY: Maryam Hasanzadeh DATE: 05-Mar-19
CHECKED BY: Dali Suljic DATE: 05-Mar-19

BASIN PARAMETERS						
CATCHMENT NAME	Development 1	Slope Hill 1	Slope Hill 2	Slope Hill 3		
CATCHMENT AREA	106,000 m²	12,051 m²	115,091 m²	49,098 m²		
PERCENTAGE IMPERVIOUS	75.0%	0.0%	0.0%	0.0%		
HMS BASIN PARAMETERS - POST DEVELOPMENT						
CATCHMENT NAME	Development 1	Slope Hill 1	Slope Hill 2	Slope Hill 3		
CATCHMENT AREA	0.106000 km²	0.012051 km²	0.115091 km²	0.049098 km²		
PERVIOUS AREA CURVE NUMBER	39.0	74.0	74.0	74.0		
PERVIOUS INITIAL ABSTRACTION	5.0 mm	5.0 mm	5.0 mm	5.0 mm		
PERCENTAGE IMPERVIOUS	75.0%	0.0%	0.0%	0.0%		
LAG TIME	8.1 mins	3.0 mins	9.8 mins	7.2 mins		

STORAGE CALCULATIONS:

LEVEL	ELEMENT DISCHARGE RATE *[l/s]*							
	OUTLET 1 CIRCULAR ORIFFICE	OUTLET 2	OUTLET 3	OUTLET 4	OUTLET PIPE SUBTOTAL	TOTAL DISCHARGE	POND VOLUME	COMMENT
359.90 m	0.0	0.0	0.0	0.0	0.0	0.0 l/s	0.0 m³	
360.00 m	10.0	0.0	0.0	0.0	10.0	10.0 l/s	635.2 m³	
360.10 m	42.8	0.0	0.0	0.0	42.8	42.8 l/s	1,300.4 m³	
360.20 m	90.9	0.0	0.0	0.0	90.9	90.9 l/s	1,996.6 m³	
360.30 m	121.3	0.0	0.0	0.0	121.3	121.3 l/s	2,724.5 m³	
360.40 m	145.4	0.0	0.0	0.0	145.4	145.4 l/s	3,484.8 m³	
360.50 m	166.1	0.0	0.0	0.0	166.1	166.1 l/s	4,278.5 m³	
360.60 m	184.4	0.0	0.0	0.0	184.4	184.4 l/s	5,105.5 m³	
360.70 m	201.1	0.0	0.0	0.0	201.1	201.1 l/s	5,964.7 m³	
360.80 m	216.5	0.0	0.0	0.0	216.5	216.5 l/s	6,855.0 m³	
360.90 m	230.9	0.0	0.0	0.0	230.9	230.9 l/s	7,776.0 m³	
361.00 m	244.5	0.0	0.0	0.0	244.5	244.5 l/s	8,727.5 m³	
361.10 m	257.3	0.0	0.0	0.0	257.3	257.3 l/s	9,709.3 m³	
361.20 m	269.5	0.0	0.0	0.0	269.5	269.5 l/s	10,721.1 m³	
361.30 m	281.2	0.0	0.0	0.0	281.2	281.2 l/s	11,762.5 m³	
361.40 m	292.4	0.0	0.0	0.0	292.4	292.4 l/s	12,833.5 m³	100yr ARI

OUTLET PARAMETERS

INVERT 359.90 m

DIAMETER	0.34 m
HEIGHT	
SIDE SLOPE	

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STORMWATER HYDROLOGICAL PARAMETERS - POST DEVELOPMENT

PROJECT:	Ladies Mile		
LOCATION:	Queenstown		
CALC BY:	Maryam Hasanzadeh	DATE:	05-Mar-19
CHECKED BY:	Dali Suljic	DATE:	05-Mar-19

HYDROLOGICAL INPUTS						
CATCHMENT NAME	Development					
SOIL CLASS	Class A					
IMPERVIOUS (ROADS, ROOFS ETC)	79,500 m²					
URBAN LAWNS	26,500 m²					
TOTAL AREA	106,000 m²					
IMPERVIOUS	75.0%					
PERVIOUS CN	39.0					
PERVIOUS Ia	5.0 mm					

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STORAGE CALCULATIONS

PROJECT:	Ladies Mile		
LOCATION:	Queenstown		
CALC BY:	Maryam Hasanzadeh	DATE:	05-Mar-19
CHECKED BY:	Dali Suljic	DATE:	05-Mar-19

POND PARAMETERS						
CATCHMENT NAME	Development					
CATCHMENT AREA	106,000 m²					
PERCENTAGE IMPERVIOUS	75.0%					
HMS BASIN PARAMETERS - POST DEVELOPMENT						
CATCHMENT NAME	Development					
CATCHMENT AREA	0.106000 km²					
PERVIOUS AREA CURVE NUMBER	39.0					
PERVIOUS INITIAL ABSTRACTION	5.0 mm					
PERCENTAGE IMPERVIOUS	75.0%					
LAG TIME	8.1 mins					

STORAGE CALCULATIONS:

LEVEL	ELEMENT DISCHARGE RATE *[l/s]*							
	OUTLET 1 CIRCULAR ORIFFICE	OUTLET 2	OUTLET 3	OUTLET 4	OUTLET PIPE SUBTOTAL	TOTAL DISCHARGE	POND VOLUME	COMMENT
359.60 m	82.625	0.0	0.0	0.0	82.6	82.6 l/s	0.0 m³	
359.70 m	108.182	0.0	0.0	0.0	108.2	108.2 l/s	36.8 m³	
359.80 m	128.762	0.0	0.0	0.0	128.8	128.8 l/s	77.9 m³	
359.90 m	146.479	0.0	0.0	0.0	146.5	146.5 l/s	123.5 m³	
360.00 m	162.273	0.0	0.0	0.0	162.3	162.3 l/s	173.8 m³	
360.10 m	176.660	0.0	0.0	0.0	176.7	176.7 l/s	229.1 m³	
360.20 m	189.961	0.0	0.0	0.0	190.0	190.0 l/s	290.1 m³	
360.30 m	202.390	0.0	0.0	0.0	202.4	202.4 l/s	359.0 m³	
360.40 m	214.098	0.0	0.0	0.0	214.1	214.1 l/s	438.4 m³	
360.50 m	225.199	0.0	0.0	0.0	225.2	225.2 l/s	530.7 m³	
360.60 m	235.777	0.0	0.0	0.0	235.8	235.8 l/s	638.2 m³	
360.70 m	245.901	0.0	0.0	0.0	245.9	245.9 l/s	763.5 m³	
360.80 m	255.624	0.0	0.0	0.0	255.6	255.6 l/s	907.8 m³	
360.90 m	264.991	0.0	0.0	0.0	265.0	265.0 l/s	1,072.8 m³	
361.00 m	274.037	0.0	0.0	0.0	274.0	274.0 l/s	1,260.7 m³	
361.10 m	282.795	0.0	0.0	0.0	282.8	282.8 l/s	1,474.7 m³	
361.20 m	291.289	0.0	0.0	0.0	291.3	291.3 l/s	1,719.5 m³	20yr ARI
361.30 m	299.542	0.0	0.0	0.0	299.5	299.5 l/s	2,000.8 m³	

OUTLET PARAMETERS

INVERT	359.30 m
DIAMETER	0.320 m
HEIGHT	
SIDE SLOPE	

APPENDIX C
UTILITY PROVIDER CONFIRMATION OF SUPPLY

AURORA NETWORKS
POWERNET
CHORUS

John Gardiner

From: Maryam Hasanzadeh
Sent: Monday, 25 February 2019 2:59 PM
To: John Gardiner
Subject: FW: Aurora Energy Web Enquiry

From: Richard Starkey [mailto:Richard.Starkey@auroraenergy.co.nz]
Sent: Monday, 25 February 2019 2:55 PM
To: Maryam Hasanzadeh <Maryam.Hasanzadeh@candor3.co.nz>
Subject: RE: Aurora Energy Web Enquiry

Hi Maryam,

Yes, we can absolutely provide supply to this proposed development.

To start off the process, would you like me to supply you with a Supply Availability Letter for the purposes of Resource Consent?

In order to provide a Supply Availability Letter, we would like to obtain some information about the proposed development. Could you please populate a Network Development Application form, which is located on the Aurora website at the following link http://www.auroraenergy.co.nz/get-connected/developers-and-consultants/ , and return to me.

Please feel free to contact me by phone or email should you wish to discuss further.

Regards

RICHARD STARKEY
COMMERCIAL MANAGER

Aurora ENERGY

EMAIL richard.starkey@auroraenergy.co.nz
MOB 021 177 5100
PH 0800 22 00 05 **WEB** www.auroraenergy.co.nz
Aurora Energy, 10 Halsey Street, Dunedin 9016
PO Box 5140, Dunedin 9054

John Gardiner

From: Maryam Hasanzadeh
Sent: Monday, 4 March 2019 10:16 AM
To: John Gardiner
Subject: Chorus confirmation

FYI

From: Chorus Property Developments [mailto:develop@chorus.co.nz]
Sent: Monday, 4 March 2019 9:58 AM
To: Maryam Hasanzadeh <Maryam.Hasanzadeh@candor3.co.nz>
Subject: RE: LADIES MILE, QUEENSTOWN

Hi Maryam

We can provide service for any amount of lots that you require across the wider development.

Please note that any additional build of infrastructure (ie whatever is required to provide network to the development) would be chargeable to the developer, and this is what we would quote for.

Happy to provide an indicative cost as soon as you are ready to provide details and plans to us – the details do not have to be set in stone, we can undertake a high-level cost estimate if that is what you are interested in at this time.

Many thanks

Nick Devoy
Property Development Coordinator
CHORUS

Our email address has changed - *If you have sent a message through to TSG@chorus.co.nz you'll notice a reply from our new email Develop@chorus.co.nz. Rest assured, any and all emails sent to us will still be received. If you have our email saved in your address book, please update this to Develop@chorus.co.nz*

PO Box 9405
Hamilton
www.chorus.co.nz

CHORUS

From: Maryam Hasanzadeh [mailto:Maryam.Hasanzadeh@candor3.co.nz]
Sent: Monday, 4 March 2019 9:45 a.m.
To: Chorus Property Developments <develop@chorus.co.nz>
Subject: RE: LADIES MILE, QUEENSTOWN

Hi Nick

Thank you for your quick reply.

As we are still in very early stages of the project, we cannot provide lots of details. We will definitely update you with more details as we progress more in the project.

John Gardiner

From: Maryam Hasanzadeh
Sent: Tuesday, 26 February 2019 2:41 PM
To: John Gardiner
Subject: FW: Land Milles development [PNET-PowerNet.FID2844]

Hi John,

This is the confirmation email from Powernet company

Cheers

Maryam

From: Aaron Sinclair [mailto:asinclair@powernet.co.nz]
Sent: Tuesday, 26 February 2019 2:37 PM
To: Maryam Hasanzadeh <Maryam.Hasanzadeh@candor3.co.nz>
Subject: FW: Land Milles development [PNET-PowerNet.FID2844]

Hi Maryam

Thank you for your email regarding the new development on Ladies Mile, we are most certainly very keen to work with you to reticulate the whole sub-division.

You are most likely aware that we currently supply the Shotover Country development and are currently building the electrical infrastructure for the Hanley Farms development. Our network is 100% underground, making it one of the most reliable distribution networks in the country. We have our substation on the Frankton Flats with a firm capacity of 23MW of which only 40% is utilized currently, so we therefore have plenty of capacity to supply this new development.

We would be very keen to setup a meeting with you and your client either in Queenstown or Auckland to discuss this opportunity further. In the mean-time would it be possible to send me further details of the development showing the exact location and possibly a staging plan.

I look forward to hearing back from you and working with you on this project.

Kind regards

Aaron

Aaron Sinclair
Commercial Manager
251 Racecourse Road, Invercargill, PO Box:1642, Invercargill 9840, New Zealand
Phone:+64 3 211 1899, DDI:+64 3 211 1874, Mobile:+64 27 683 8547
Electricity Faults (call free) 24 hours: 0800 808 587
www.powernet.co.nz

APPENDIX D
PRELIMINARY GEOTECHNICAL REVIEW
(Geosolve)

GEOTECHNICAL REVIEW

EXPRESSION OF INTEREST

JULY 2016

Preliminary Geotechnical Report

Proposed Glenpanel SHA

Ladies Mile

Queenstown

Report prepared for:

Maryhill Limited

Report prepared by:

GeoSolve Ltd

Distribution:

Kristan Stalker/Maryhill Limited

GeoSolve Limited (File)

June 2016

GeoSolve Ref: 160403

ACENZ MEMBER

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1 Introduction

1.1 General

This report presents the results of a preliminary geotechnical assessment undertaken by Geosolve Ltd to provide comment on the geological hazards, subsoil conditions and geotechnical issues potentially affecting the proposed Glenpanel SHA development, Ladies Mile, State Highway 6, Queenstown.

This report has been completed in accordance with the terms and conditions outlined in Geosolve proposal reference 160403, dated 18 March 2016.

The aim of this report is to provide a preliminary geotechnical assessment of the proposed development areas to support a Special Housing Area EOI submission. The comments and recommendations provided should be confirmed by further investigations and engineering assessment during the detailed design stage of a future development.

1.2 Development

Plans provided to Geosolve indicate the proposed development will comprise residential housing. Significant infrastructure (e.g. storm water) hardstand, pavement and landscaped areas will also be required. The cadastral boundary of the proposed development is shown on Figure 1c, Appendix A.

2 Site Description

2.1 General

The proposed development is located on the northern side of SH6, essentially opposite Lake Hayes Estate and Shotover Country subdivisions, and opposite the proposed Sanderson development, see Figure 1a below.

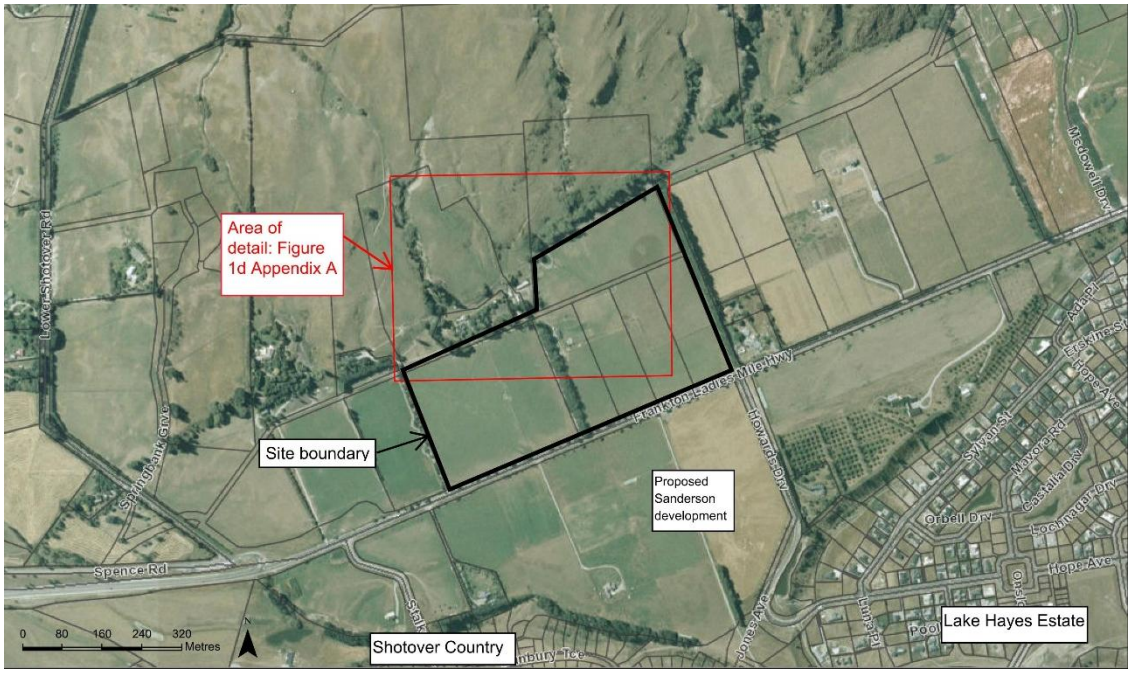

Figure 1a. Aerial view of proposed development site.

The site is undeveloped farmland, however existing dwellings and associated outbuildings are present abutting the northern and eastern boundaries. State Highway 6 (Frankton-Ladies Mile road) forms the southern boundary. Principal site observations are shown on Figure 1c in Appendix A, and general views of the site and main geological/geomorphological features are shown on the photographs provided in Appendix B.

2.2 Topography and Surface Drainage

The proposed development is situated on a sub-horizontal (gently sloping) terrace, with an altitude of approximately 360 m and gradient of 2-3° towards the south. Surface water drainage flows in a general southerly direction. Just beyond the northern boundary the ground rises and steepens, with slopes of 15-25° locally. Two well-incised gullies are formed in the schist bedrock hillslope immediately north of the site, showing low flows from their respective ephemeral creeks. Both creeks terminate in permeable ground prior to entering the site, and although diversion runoff channels or bunds have been formed along the northern boundary, no water was observed in these at the time of site visit. A small seep is present, draining the formed dam near the northern boundary. This also terminates in permeable ground (see detail Figure 1d, Appendix A).

Photographs 1-6, Appendix B show the general view of the proposed development site.

3 Expected Subsurface Conditions

3.1 Geological Setting

The site is located in the Wakatipu Basin, a feature formed predominantly by glacial advances, the last of which occurred approximately 10,000-20,000 years ago. The glaciation scoured the schist bedrock and left extensive deposits of till, outwash gravels and lake sediments. Post-glacial times have been dominated by erosion of both the schist bedrock and overlying sediments and by localised deposition of alluvial deposits by rivers and streams.

The proposed development site is located on the historic Shotover Delta. This feature was formed by the deposition (aggradation) of sediments during a period of high lake levels. Subsequent lowering of the lake, and down cutting by the Shotover and Lake Hayes River, has resulted in a series of elevated historic river terraces across this area of Lower Shotover.

The low, slightly inclined surface that comprises Frankton Flat, Ladies Mile Flat, and the Domain Road-Lower Shotover Flat is inferred to be the aggradation surface of the delta plain (the subaerial part of the fan-delta complex, which is dominated by fluvial processes). The elevation of this surface is 350 to 360 m above sea level and gently inclined towards the south. The IGNS 1:250,000 geological map indicates the proposed development area is located on 'Q1a' deposits described as 'Gravel and Sands in Alluvial Fans.' The hills on the northern margin of the proposed development are shown as Schist bedrock.

No active fault traces are known in the vicinity of the site, however a significant seismic risk exists in the region from potentially strong ground shaking associated with rupture of the Alpine Fault located on the west coast of the South Island. There is a high probability that an earthquake with a magnitude of 7.5 to 8 will occur along the Alpine Fault within the next 50 years.

3.2 Stratigraphy and Geological Conditions

A review of available data, published mapping together with site observations has been completed and the site stratigraphy over the gently sloping river terrace areas is expected to comprise:

- Topsoil, overlying:

- 0.1m to 1.0m thickness of Loess, overlying:
- 0.0-1.0m of localised Alluvial Silt, overlying:
- A significant thickness (10-70m+) of interbedded Deltaic sand and gravel deposits with varying fractions of each constituent material.

In close proximity to the hillslope on the northern boundary of the development, localised areas are expected to be underlain variably by:

- Topsoil, overlying:
- Alluvial fan depositional material, overlying:
- Alluvial Silt, overlying:
- Deltaic sand and gravel.

A review of available Otago Regional Council (ORC) bore data for the southwestern corner of the development indicates the depth of the Deltaic deposits is in excess of 66 m. The location of the ORC boreholes in this area are shown on Figure 1c, Appendix A.

3.3 Groundwater

The regional groundwater is expected to lie well below typical foundation and excavation levels. Groundwater levels are expected to rise gently from the Kawarau and Shotover Rivers towards and beneath the development area. This observation is confirmed by available ORC well data, which indicates groundwater to be 17 m below ground level in well F41/0089, 39 m below ground level in well F410090, and 51 m below ground level in well F41/0134. The location of these wells is shown on Figure 1c, Appendix A.

Perched seepages may be encountered at shallow depths near the hillside area, and within the alluvial fan material, near the northern part of the site.

3.4 Natural Hazards

3.4.1 Seismic

A significant seismic risk is present across the region, as discussed in Section 3.1 above.

3.4.2 Slope Stability

The hillside upslope of the site is identified on the QLDC Webmaps hazards register as a landslide area 'susceptible to shallow debris flows or mudflows' (Halliday 2002, Opus Consultants report). This area does not extend onto the site, and apart from localised gully erosion upstream of the historic alluvial fans, no deep seated, recent or active instability of the soil slopes was observed during the site walkover.

Small scale rock fall associated with localised weathering and gradual fretting of the rock within the incised gullies beyond the northern boundary was observed.

3.4.3 Liquefaction

The QLDC GIS mapping system indicates the proposed development area is within an area designated as 'possibly susceptible' to liquefaction. This assessment is based on a regional study completed by Opus, see Hazard Map Figure 1b, Appendix A.

The depth to groundwater (17-50m+), existing borehole summary logs, and subsequent studies completed in adjacent areas, indicate liquefaction risk is nil to low in the development area. This area

is considered, by Geosolve, to be the equivalent of LIC1 with respect to liquefaction investigation category.

3.4.4 Alluvial Fan

A small portion of the upper (northern) extent of the site lies within an area mapped by the ORC Alluvial Fans Project Stage 1 (regional scale), as lying at the toe of an active debris-dominated alluvial fan (Figure 1b, Appendix A). However, subsequent more detailed alluvial fan assessment, undertaken in the ORC Stage 2 (selected areas) mapping, did not identify alluvial fan activity at this location. A second, historic alluvial fan feature which does not appear on the QLDC database, was also identified some 300 m further east (Figure 1d, Appendix A). Again, no recent fan activity was noted, with an established topsoil horizon overlying the fan deposits. Small ephemeral streams in both gullies associated with the fans drain to permeable ground prior to reaching the site boundary (at the time of site visit), and both have northeastward-draining formed diversion channels at the outlets, should surface flows increase. These channels, just beyond the northern site boundary, will need to be maintained to preserve potential flood mitigation to the site.

From the available information and our site inspection and interpretations, we conclude that the risk from alluvial fan activity is low. If subsequent detailed investigations reveal any significant hazard, this is expected to be minor and affecting small areas only, and if necessary could be readily avoided or mitigated by standard planning or engineering measures.

4 Preliminary Engineering Considerations

4.1 General

The proposed development is expected to be achievable from a geotechnical perspective. Ground conditions will largely be similar to the adjacent Frankton Flats, Lake Hayes Estate and Shotover Country Developments, however, further investigation and assessment will be required during the detailed design phase and recommendations are provided in the sections below.

The preliminary recommendations and opinions contained in this report are based upon ground investigation data obtained at discrete locations and historical information held on the GeoSolve database. The nature and continuity of subsoil conditions away from the investigation locations is inferred and cannot be guaranteed.

Site specific intrusive investigations should be completed at the detailed design phase of the project to confirm all recommendations provided in this report.

4.2 Excavations

Excavations can be readily achieved across the site area. If deep excavations are required, geotechnical investigation should be completed to confirm the near surface soil profile and appropriate temporary and permanent batter angles and any retaining issues.

4.3 Construction near Slope Crests

Development plans, and site topography, indicate buildings are unlikely to be located close to slope crests.

4.4 Foundations

Shallow foundations can be constructed across the site, however reduced foundation bearing capacities are likely if bearing on surface silt deposits. Increased foundation bearing is expected to be available at depth on sand and gravel materials.

Specific investigation and assessment should be completed to determine a cost effective foundation solution for the proposed buildings, at the detailed design stage.

4.5 Rock Fall

Bluffs and relatively steep slopes are present immediately beyond the northern boundary of the site. Preliminary assessment indicates the risk of rock fall is low. There is some natural weathering and minor fretting of the rock faces observed in some areas in the incised gullies, but these are unlikely to impact on the site.

4.6 Groundwater issues

No significant groundwater issues are expected, however minor seepages may be encountered in excavations close to the hillslopes, and within the alluvial fan materials, in the northern areas of the site.

5 Neighbouring Structures/Hazards

Distances to adjoining structures: The site is situated in a rural setting, but with existing residential buildings at one location along the northern and one along the eastern boundaries. The existing buildings are not expected to be adversely effected provided geotechnical input to the project is provided at the detailed design and construction phase.

Aquifers: No aquifer resource will be adversely affected by the development. If ground source heating, water abstraction, or other deep drilling activity is undertaken, consenting may be required with respect to groundwater and confirmation should be sought from the local and regional councils.

Hazards: A regional seismic hazard is present in the Wakatipu area. No specific investigation and assessment is considered necessary with respect to alluvial fan and liquefaction hazards. Slope stability and rock fall hazards are discussed above in Sections 4.3 and 4.5.

6 Conclusions and Recommendations

- From a geotechnical perspective, construction of the development is considered technically feasible. Developments have been readily achieved in similar ground conditions across the Shotover, Lake Hayes and Frankton Areas.
- Preliminary assessment indicates that standard engineering or planning solutions will be available to address any likely geotechnical issues or hazards that may arise.
- There is a region-wide seismic risk at the site, which should be addressed in all future engineering design.
- Further assessment with respect to liquefaction and alluvial fan hazards is not considered necessary. Existing drainage diversion channels from the alluvial fans should be maintained and engineered sumps/discharge areas constructed as required.
- The northern-most (upslope) lots may have some degree of exposure to locally sourced storm runoff, which is common to hillside developments and unrelated to alluvial fan activity. This risk is typically addressed with minor site drainage as appropriate depending on the individual platform configurations.
- Further investigation and assessment will be required at the detailed design phase of the project. The assessment should confirm the preliminary recommendations in this report, and provide detailed engineering recommendations as appropriate. The principle geotechnical issues to be addressed include:
    - Confirmation of the near surface soil stratigraphy and foundation bearing capacities;
    - A further confirmation of rock fall/bluff instability/surficial slope erosion hazard mitigation requirements in the northern area of the site;
    - Other geotechnical inputs as required for detailed design e.g. Pavement CBR values for roadway construction, safe temporary and permanent batter angles.

7 Applicability

This report has been prepared for the benefit of Maryhill Limited with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

It is important that we be contacted if there is any variation in subsoil conditions from those described in this report.

Report prepared by:

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Peter Nicolson

Senior Geologist

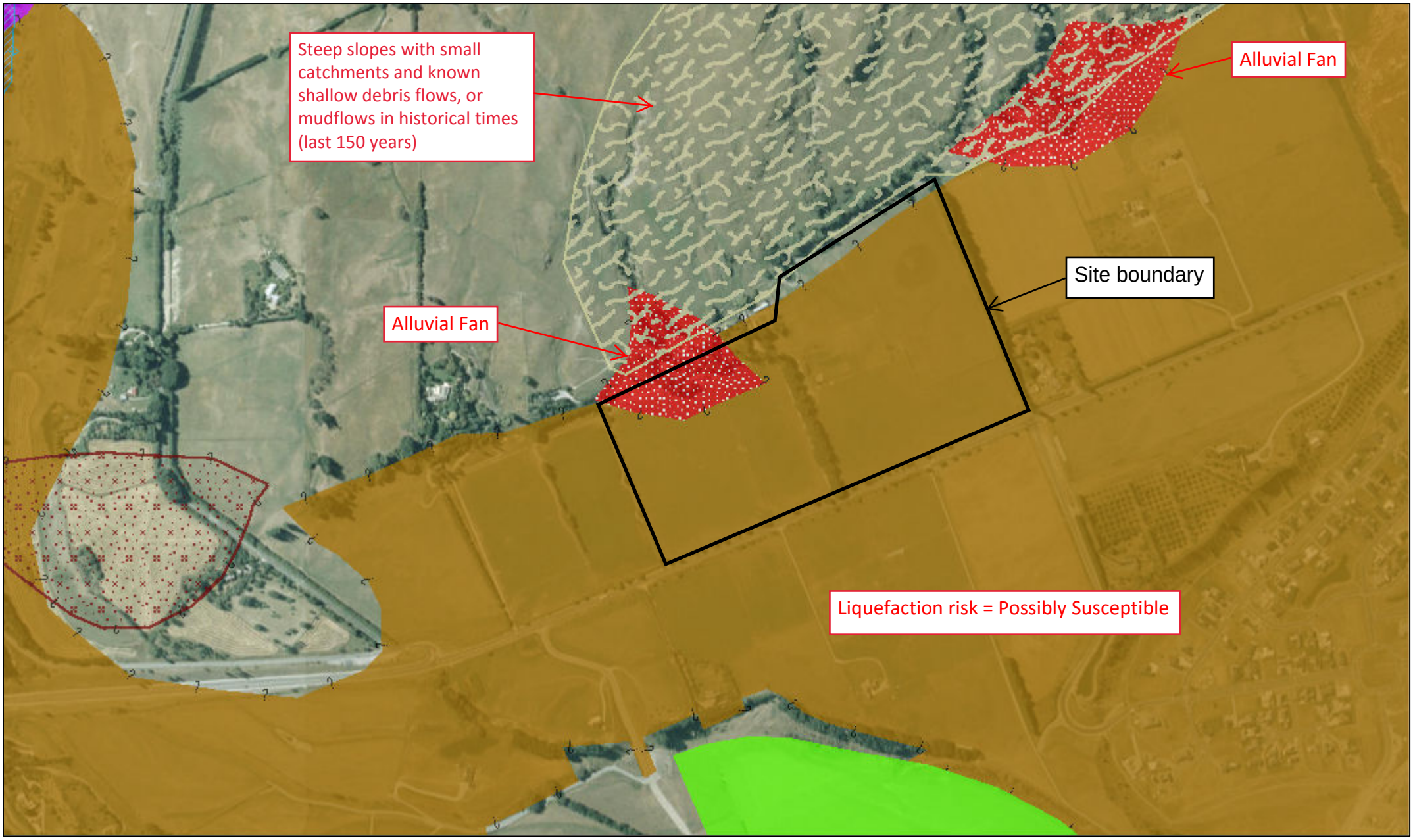
Reviewed for GeoSolve Ltd by:

.....

Fraser Wilson

Senior Engineering Geologist

Appendix A



Queenstown Lakes District Council

Webmaps your view of your information

Figure 1b **QLDC Webmaps GIS_Hazards_Proposed Glenpanel SHA**

28 June 2016

0 80 160 240 320 Metres

N

Area of detail:
Figure 1d

Shaded region is
Schist bedrock

Alluvial fans

Lot 7
DP 463532
CFR613709

Lot 1
DP 20162
CFR613707

Sec 1
SO 24954
CFR613707

Lot 4
DP 463532
CFR613709

Lot 42
Blk III Shotover
CFR 613709

Lot 43
Blk III Shotover
CFR613709

Lot 44
Blk III Shotover
CFR613709

Lot 2
DP 463532
CFR 613707

Exist.
Easements

Silts overlying
deltaic sands and gravels

S.H.A.
BOUNDARY
20.19ha

F41/0134

F41/0090

F41/0089

UNFORMED LEGAL ROAD

UNFORMED LEGAL ROAD

UNFORMED LEGAL ROAD

FRANKTON - LADIES MILE HIGHWAY (SH6)

NORTH

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Rev.	Date	Revision Details	By
-	-	-	-

Figure 1c

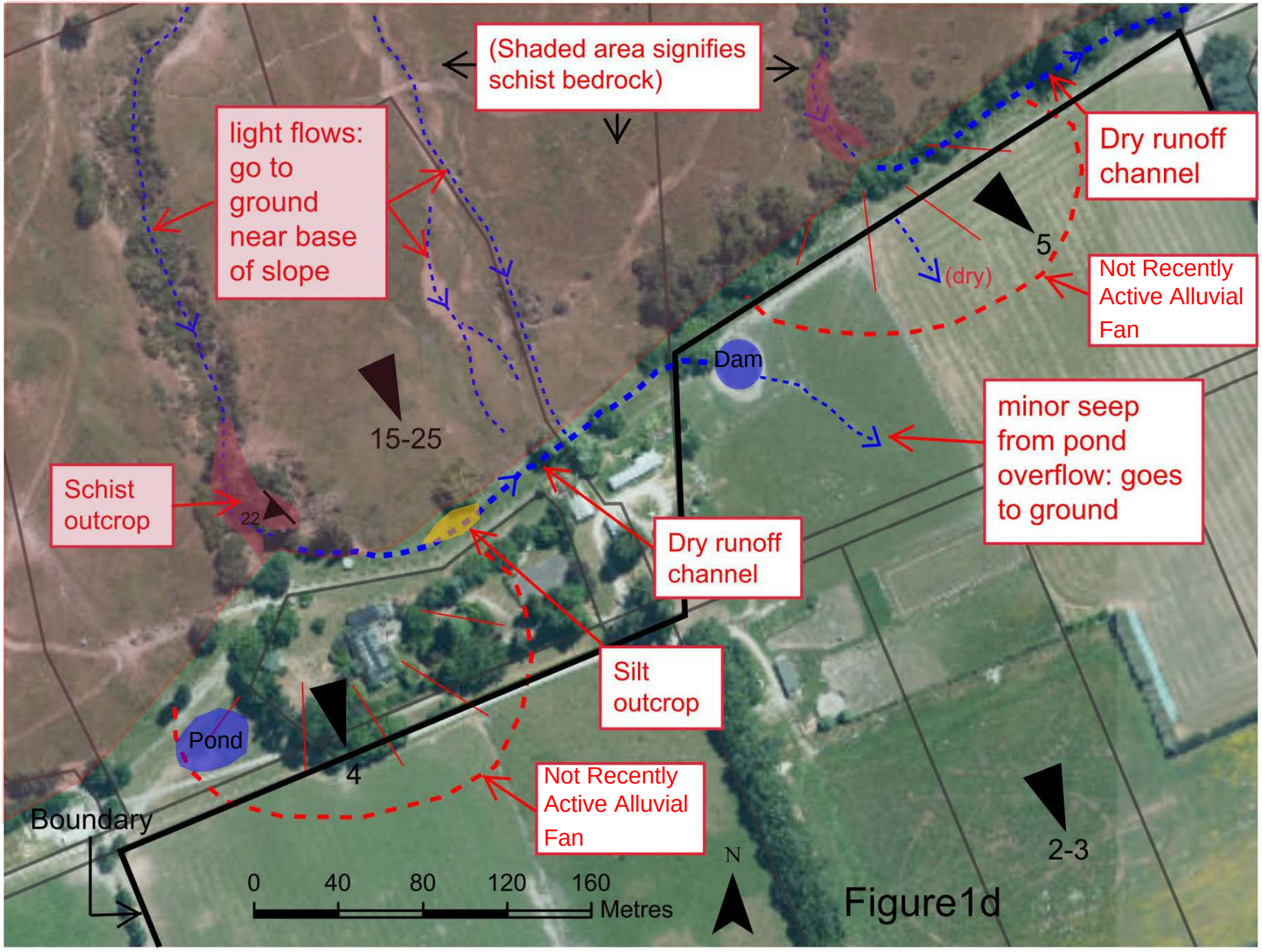
GLENPANEL SPECIAL HOUSING AREA
SITE PLAN

ORC Well locations

Client	Surveyed	Signed	Date	Job No.	Drawing No.
STALKER	-		-	12014	3 Sheet 1
	Drawn	Signed	Date	Scale	
	CCH		28.06.16	1:3000 @ A3	
	Designed	Signed	Date	Datum & Level	Rev.
	-		-	Mt Nic 2000 & MSL	-

Notes:
All dimensions shown are in meters unless shown otherwise.
Any person using Clark Fortune McDonald drawings and other data accepts the risk of:
- Using the drawings and other data in electronic form without requesting and checking them for accuracy against the original hard copy versions.
- Ensuring the information is the most recent issue.

S:\JOBS\12000\12014\acad\12014_3_Site.dwg Plotted: 29.06.2016


(Shaded area signifies schist bedrock)
light flows: go to ground near base of slope
Dry runoff channel
5
(dry)
Not Recently Active Alluvial Fan
Dam
15-25
minor seep from pond overflow: goes to ground
Schist outcrop
22
Dry runoff channel
Silt outcrop
Pond
4
Not Recently Active Alluvial Fan
Boundary
2-3
N
0
40
80
120
160
Metres
Figure1d

Appendix B

Photo 1: View west across western part of subdivision area.

Photo 2: View southeast across eastern part of subdivision area. SH6 just beyond the low treeline.

Photo 3: View south down onto eastern part of subdivision area.

Photo 4: View northeast towards eastern-most alluvial fan feature, northern boundary area. Gully indicated by vegetation extending upslope.

Photo 5: View downstream from mouth of main alluvial fan gully. Weak stream flow evident on left. Glenpanel homestead on downstream part of fan.

Photo 6: Schist exposure, main alluvial fan gully.

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This holistic, people-focussed approach isn’t just about feeling good - it also makes business sense. Outcomes that enhance the lives of people attract attention, accolades, and support in the market place.

Candor^3’s team includes some of the industry’s most experienced people. This wealth of expertise, strong commercial focus and a passion for performance means we go further to find the best solutions to the challenges of planning rules, budgets and time.

We cut through the complexity and distill each project down to its fundamentals for lasting, cost-effective solutions that truly add to people’s quality of life.

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