APPENDIX H

Davis Consulting Group Preliminary Site Investigation

Peninsula Bay North End Proposed Plan Change, Wanaka Preliminary Site Investigation

For

Peninsula Bay Joint Venture

May 2015

Davis Consulting Group Limited
Arrow Lane,
Arrowtown 9302
03 409 8664
Document ID: 15031

Peninsula Bay North End

Proposed Plan Change

Wanaka

Preliminary Site Investigation

Document Status

Version	Purpose of Document	Prepared By	Reviewer	Review Date
A	Draft for review	CP	GD	9 June 2015
O	FINAL DRAFT	CP	GD	10 June 2015
	FINAL	CP	GD	2 September 2015

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

EXECUTIVE SUMMARY

Infinity Investment Group is managing a plan change in behalf of Peninsula Village Limited and Wanaka Bay Limited herein referred to as the Peninsula Bay Joint Venture (PBJV). The plan change application will be submitted to the Queenstown Lakes District Council to rezone Open Space Zoned land to Low Density Residential Zoned land in Peninsula Bay, north of Wanaka. The plan change process and the NES requires the applicant to undertake a number of investigations to determine the suitability of the subject land for its proposed land use under the plan change. One of these investigations includes a review of the soil quality across the site to determine if historical activities have impacted the soil condition such that it may present a risk to human health or the environment.

In order to understand the condition of the site soils, PBJV commissioned Davis Consulting Group (DCG) to undertake a Preliminary Site Investigation (PSI) of the site. This PSI is designed to review the historical activities across the area proposed for re-zoning, identify any hazardous activities that may have occurred and whether there are any risks to human health and the environment as a result of any change in land use resulting from the rezoning of the subject land.

The scope of work completed during the PSI included the following:

- Review of land use history including records held by the Queenstown Lakes District Council and search the Lakes District Museum Archives, Titles and historical photographs;
- Identification of hazardous activities and substances that may have been associated with the land use and consideration of likely impacts to soil quality;
- Completion of a site visit;
- Preparation of a soil sampling and analysis plan based on the findings of the historical activities that occurred on the site;
- Collection of soil samples to characterise the nature of soil quality in the vicinity of the areas of the site where persistent pesticides and hydrocarbons had been used;
- Consideration of the risk to human health based on the historic activities that have occurred on the site, the soil contaminant concentrations detected and the proposed land use of the site; and
- Preparation of a Preliminary Site Investigation report in accordance with the requirements of the Contaminated Land Management Guidelines (CLMG) No.1.

Based on the findings of the PSI, the following conclusions can be made:

- The first use of the land was farming in the early to mid 1900's.
- No agricultural infrastructure such as sheds or yards were observed within or in the immediate vicinity of the zone change boundary in aerial photography from 1956 to present day.
- Surrounding land uses include rural / lifestyle block and residential development.
- The site is subject to the provisions of the NES due to the history of agricultural activities that are associated with the application of persistent pesticides and fertilizers and the storage of hydrocarbons.
- Based on the Contaminated Land Management Guidelines Schedule B, the hazardous substances that may be associated with the former farming operation on the site include a range of organochlorine pesticides and trace metals associated with application of fertilisers.
- Searches of the Otago Regional Council's "Database of Selected Landuses" did not find any records of contaminated sites on the study site.
- No organochlorine pesticides were detected in analysis of soils taken from the site.
- Due to the low intensity of historical farming on the site and absence of organochlorine pesticides found in soil analysis, DCG considers it is unlikely that concentrations of pesticides within the soil would be present at concentrations that will exceed the contaminant standards for a rural residential land use scenario.
- Within the groundworks laydown area, petroleum hydrocarbon fractions concentrations in soil were below limits of detection. BTEX analysed in the soil screening yielded concentrations below limits of detection, except for xylene which was present at concentrations below adopted soil guideline values.
- DCG considers it is unlikely that concentrations of hydrocarbons and BTEX within the soil would be present at concentrations that exceed the soil contaminant standards for a rural residential land use scenario.
- Average arsenic concentrations detected across the site are below the NES soil contaminant standard and are representative of the natural background levels,
- DCG considers the risk to human health from arsenic concentrations in soil are not over and above the risk that is inherent in the NES soil contaminant standards.

In summary, the PSI has identified historical land use activities that may have impacted the soil quality of the site. Based on the results of this Preliminary Site Investigation, DCG concludes it is highly unlikely that there is a risk to human health from the proposed plan change and future subdivision and residential use of the site.

1.0 INTRODUCTION

1.1 Purpose

Infinity Investment Group is managing a plan change in behalf of Peninsula Village Limited and Wanaka Bay Limited herein referred to as the Peninsula Bay Joint Venture (PBJV). The plan change application will be submitted to the Queenstown Lakes District Council to rezone Open Space Zoned land to Low Density Residential Zoned land in Peninsula Bay, north of Wanaka. The plan change process and the NES requires the applicant to undertake a number of investigations to determine the suitability of the subject land for its proposed land use under the plan change. One of these investigations includes a review of the soil quality across the site to determine if historical activities have impacted the soil condition such that it may present a risk to human health or the environment.

In order to understand the condition of the site soils, PBJV commissioned Davis Consulting Group (DCG) to undertake a Preliminary Site Investigation (PSI) of the site. This PSI is designed to review the historical activities across the area proposed for re-zoning, identify any hazardous activities that may have occurred and whether there are any risks to human health and the environment as a result of any change in land use resulting from the rezoning of the subject land. DCGs experience in the provision of contaminated land services is provided in Appendix A.

1.2 Scope of Work

The scope of work completed during the PSI included the following:

- Review of land use history including records held by the Queenstown Lakes District Council and search the Lakes District Museum Archives, Titles and historical photographs;
- Identification of hazardous activities and substances that may have been associated with the land use and consideration of likely impacts to soil quality;
- Completion of a site visit;
- Preparation of a soil sampling and analysis plan based on the findings of the historical activities that occurred on the site;
- Collection of soil samples to characterise the nature of soil quality in the vicinity of the areas of the site where persistent pesticides and hydrocarbons had been used;
- Consideration of the risk to human health based on the historic activities that have occurred on the site, the soil contaminant concentrations detected and the proposed land use of the site; and

- Preparation of a Preliminary Site Investigation report in accordance with the requirements of the Contaminated Land Management Guidelines (CLMG) No.1.

1.3 Limitations

The findings of this report are based on the Scope of Work outlined above. DCG performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental science profession. No warranties, express or implied, are made. Subject to the Scope of Work, DCG's assessment is limited strictly to identifying the risk to human health based on the historical activities on the site. The confidence in the findings is limited by the Scope of Work.

The results of this assessment are based upon site inspections conducted by DCG personnel, information from interviews with people who have knowledge of site conditions and information provided in previous reports. All conclusions and recommendations regarding the properties are the professional opinions of DCG personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, DCG assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside DCG, or developments resulting from situations outside the scope of this project.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Site Location

The site under investigation is located to the north of Wanaka, north of Infinity Drive and the Peninsula Bay housing development (Figure 1) within land zoned Open Space.

The area of the site is approximately 6.8 ha.

Central coordinates for the site are 5608886.2 N 2203511.6 E NZMG.

Figure 1: Site Location Plan

2.2 Site History

Farming activities are observed in aerial imagery dating back to 1956 (see Figures 2 to 4).

No farming infrastructure such as sheds or yards were observed within or in the immediate vicinity of the site in aerial photography from 1956 to present (see Figure 2 to 4).

A powerline is observed in 1976 aerial photograph (see Figure 3). No transformers were observed in aerial images. Powerlines were present in 2005 aerial imagery (see Figure 5) and removed prior to the 2015 site inspection. There was only 1 remaining power pole at the time of assessment. This was located in the eastern perimeter of the site.

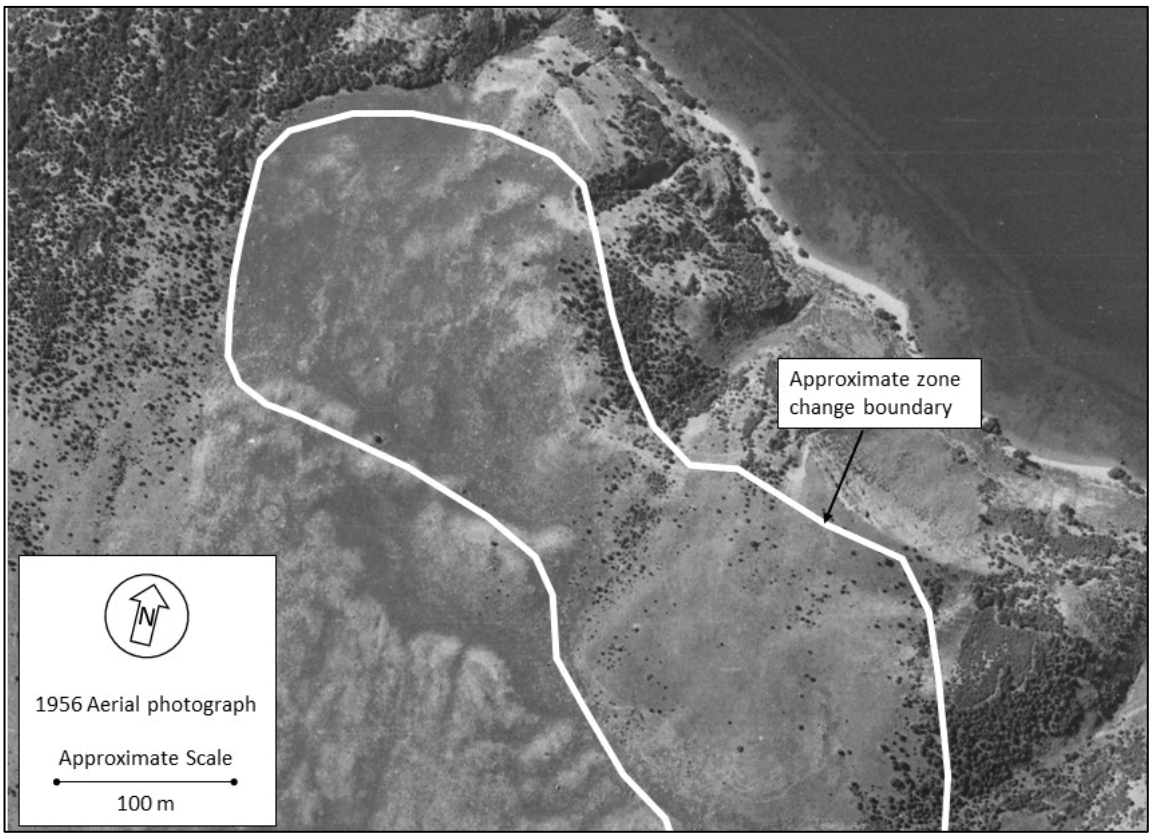


Figure 2: 1956 aerial photograph

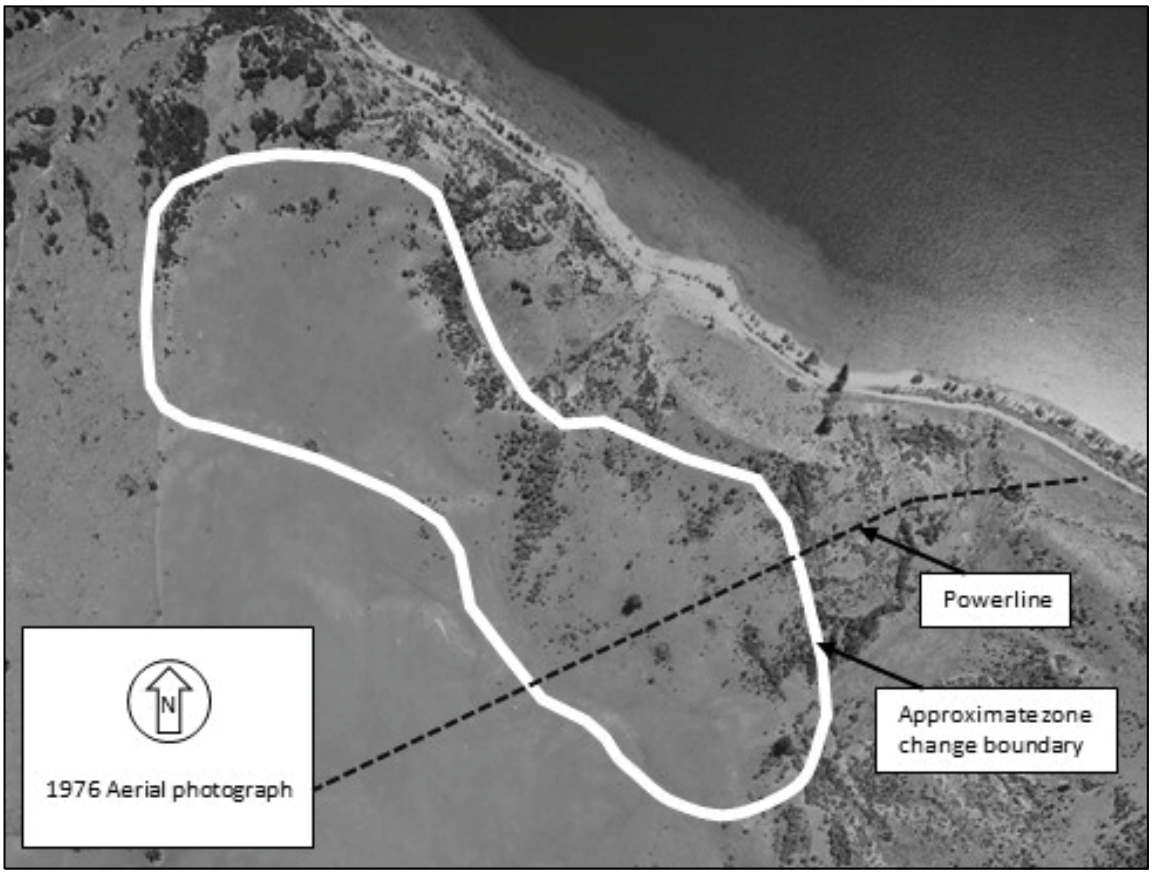


Figure 3: 1976 aerial photograph

Figure 4: 2005 aerial photograph showing approximate zone change boundary

2.3 Site Condition and Surrounding Environment

The site is surrounded by recent residential subdivisions to the west and south, plantation forest to the east and the southern shores of Lake Wanaka to the north (see Figure 1).

At the time of the site visit an earth and groundworks crew were working from a laydown area located in the north western corner of the area under investigation. The laydown area was approximately 300 m^2 and was sheeted with grey gravel/sand regolith. Within this area there was a transportable building, shipping container, portable self-contained toilet, mobile trailer mounted fuel storage, and a transportable rubbish bin (see Figure 5 and Plate 1-2). Several stockpiles of gravel and earth were located on the eastern perimeter of the yard. Water was pooling within a low lying area in-between stockpiles of earth and gravel (see Plate 3). There was no evidence of surface staining from hydrocarbon leaks and no odours observed during the site walk over. Surface soil from sample 11 had a slight hydrocarbon odour.

To the west of the groundworks area there is a wooden fence bordering the Penrith Park residential area (see Figure 5 and Plate 5).

At the time of the site visit, residential subdivisions were under construction south of the study site, with road construction underway and several building foundations in preparation (see Figure 1 and 5 and Plate 2).

To the south east of the study site there is a grassed area, manuka/kanuka shrubland and a pine timber plantation further east beyond Infinity Drive (see Figure 1 and Plate 6).

Other than the groundworks yard, the investigation area was largely undisturbed, with grass covered rolling hills and scattered native shrubs, increasing with density to the south (see Plate 7). Within the north western section of the study area, there were several stockpiles of rock and earth (see Figure 5 and Plates 8-10). There was no sign of contamination within these stockpiles and their most likely source was the groundworks being undertaken south of the site.

Access to the site was limited to the groundworks area in the northwest, and a gravel access track extending northeast of Infinity Drive in the south-eastern portion of the site and a trafficked track up the hill through the south eastern portion of the study area (see Plate 11 and 12).

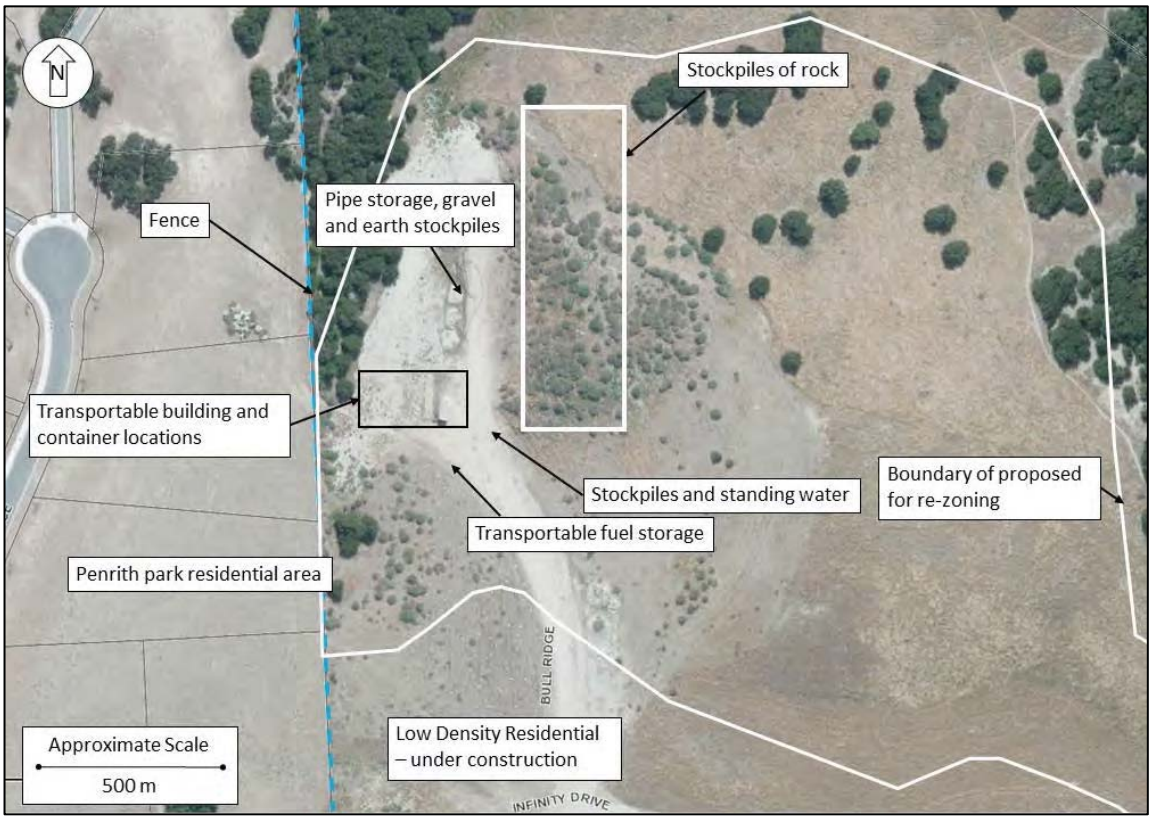


Figure 5: Layout of groundworks laydown area and rock stockpiles

Plate 1: Groundworks yard

Plate 2: Groundworks yard showing fuel storage, general waste bin and subdivision under construction in background

Plate 3: Southern portion of groundworks yard. Stockpiles of gravel and earth. Pooled water from recent rain

Plate 4: Gravel and earth stockpiles east of groundworks yard

Plate 5: Neighbouring property to the north of groundworks yard

Plate 6: Southern portion of proposed zone change area. Access track and timber plantation on right. Shrubland in centre

Plate 7: Typical grassed areas and shrubland within site

Plate 8: Stockpile of rock and soil near WPSS08

Plate 9: Stockpile of soil near WPSS09

Plate 10: Stockpile of soil near WPSS06

Plate 11 Access track in south-eastern portion of proposed re-zoning study area

Plate 12: Gravel track extension of Infinity Drive in south-eastern portion of the proposed re-zoning study area

2.4 Additional Site Information

The CLMG No 1 requires information associated with fuel storage facilities, spill loss history, recorded discharges and onsite and offsite disposal locations. DCG requested a search of the Otago Regional Council (ORC) records for Landuse and Site Contamination Status, Resource Consents, and Resource Management Act (RMA) incidents for the site. The ORC stated that there are no records held on the Otago Regional Council's "Database of Selected Landuses" for the site regarding on or off-site disposal locations, recorded discharges, or spill loss history. The Mt Iron Timber Mill is located 1 km south east of the site. This is currently listed as 'unknown' contamination on the Otago Regional Council's "Database of Selected Landuses".

The following provides a summary of information that the CLMG No. 1 (MfE, 2003a) indicates should be included in a PSI/DSI report:

- Presence of Drums – No drums were recorded during the site visit.
- Wastes – Other than the rubbish bin, no other waste were observed.
- Fill Materials – Several stockpiles of gravel and earth were located on the eastern perimeter of the groundworks yard. Within the north western section of the proposed re-zoning there were several stockpiles of rock and earth. There was no sign of contamination within these stockpiles and their most likely source was the groundworks being undertaken south of the site.
- Odours – No odours were noted other than hydrocarbon odour at soil sample site 11 within the groundworks yard.
- Flood Risk – The flood risk to the site is minimal given its elevation above Lake Wanaka.
- Surface Water Quality – The only surface water observed on site was a small puddle within the groundworks area. This water was turbid due to the frequent trafficking.
- Site boundary condition – The site boundary is fenced in the areas adjoining residential developments.
- Visible Signs of Contamination – No visible signs of contamination were observed.
- Local Sensitive Environments – The nearest sensitive environment is Lake Wanaka approximately 100 m to the north of the proposed re-zoning.

2.5 Contaminants Commonly Associated with the Land use

Based on the Contaminated Land Management Guidelines Schedule B, the hazardous substances that may be associated with farming operations on the site include a range of organochlorine pesticides and trace metals associated with both pesticide and fertiliser use. The hazardous substances that may be associated with fuel storage include hydrocarbons, polycyclic aromatic hydrocarbons (PAH's), solvents and metals contained in waste oil.

2.6 Geology and Hydrogeology

The subject site is upslope from the shores of Lake Wanaka between Beacon Point to the west and the Clutha River to the east. The site is elevated between 40 and 60 m above the lake water level and is undulating with well to moderately drained, melanic soils (GrowOTAGO, 2015). Soil descriptions for the site can be found in Appendix D.

The geology of the property is within Pleistocene outwash undifferentiated till and associated outwash gravel (Turnbull 2000).

The only geological hazard within the area is a low risk of liquefaction (QLDS GIS, 2015).

The site is located in the northern portion of the Wanaka Basin Cardrona Gravel Aquifer (ORC, 2014). Groundwater bores within a one kilometre radius of the site (held by the Otago Regional Council) are shown on a plan provided in Appendix C. Two observation bores are located 200 m east of the site on the shore of Lake Wanaka. An irrigation bore is located 200 m south west of the investigation site. Three domestic bores are located approximately 800 m to the south west. This site investigation did not include a groundwater assessment.

3.0 SAMPLING AND ANALYSIS PLAN

3.1 Data Quality Objectives

The data quality objectives (DQOs) of the PSI were to:

- Characterise the presence and concentration of contamination associated with the historical farming activities and potential storage of hydrocarbons; and
- Determine the risk of any soil contamination encountered onsite to human health, based on the proposed residential subdivision.

The sampling undertaken was designed to support the PSI rather than provide the level of detail that may be required for a detailed site investigation. Laboratory analysis of the soils was considered appropriate given the proposed sensitive land use of the site, the possible accumulation of pesticides and heavy metals that can be associated with agricultural activity and DCGs experience regarding naturally elevated arsenic levels in the Wanaka area.

3.2 Sampling and Analysis Plan

The sampling and analysis plan was designed to address the specific objectives, namely characterise the presence and concentration of any contamination associated with historical agricultural activities and storage of hydrocarbons. A combined approach of judgemental and systematic sampling was adopted.

The soil sample locations and analysis are provided in Figure 6 and summarised in Table 1 below. The laboratory certificates are provided in Appendix E. Samples were analysed for heavy metals, organochlorine pesticides and hydrocarbons.

The investigation took place on the 22nd May 2015. A total of 18 surface soil samples were collected on site from 0 – 10 cm depth for assessment of pesticides and arsenic and 3 soil samples from 0 to 0.05 cm and 1 from 0.1 to 0.15 cm depth for assessment of hydrocarbons and arsenic.

3.3 Sampling rationale

Arsenic and pesticides were assessed throughout the study area to investigate the impact of historical agricultural activities. The relevant sample sites 1 to 9 and 13 to 18 are marked in Figure 6. Surface sampling was considered appropriate for the assessment of pesticides for two

reasons. First, pesticides and heavy metals generally bind strongly to soils, generally remaining in the surface profile. Second, people living on the site will predominantly be exposed to surface soils.

Hydrocarbon contamination was investigated within the groundworks laydown after hydrocarbon storage activities were observed in the area during the site inspection. The relevant sample sites 10 to 12 are marked in Figure 6. Surface sampling was considered appropriate for the assessment of hydrocarbons for two reasons. First, contamination is most likely limited to small drips and spills on surface. Second, people living on the site will predominantly be exposed to surface soils.

Figure 6: Soil sample location plan

3.4 Soil Sampling Methodology

Soil sampling was undertaken with the use of a spade. The following procedures were applied during the soil sampling process to gain representative samples:

- Field personnel wore a fresh pair of nitrile gloves between sampling events.
- Soil samples were transferred to 250 mL glass jars with Teflon lids as supplied by Hill Laboratories.
- All soil samples were unambiguously marked in a clear and durable manner to permit clear identification of all samples in the laboratory.
- All samples were immediately placed in a chilly bin to reduce the potential for volatilisation should volatile contaminants be present.

Soil logs are included in Appendix D.

3.5 Analytical Parameters

The laboratory analytical suite determined for the site investigation is in recognition of our understanding of the current and historical use of the subject site. DCG understands the site has had a history of pesticide use associated with agricultural activities. Based on these activities the following substances were included in the analytical suite:

- Organochlorine pesticides (including 4,4-DDE, 2,4-DDT and Dieldrin);
- Arsenic;
- Total Petroleum Hydrocarbons in Soil;
- BTEX in Soil.

Laboratory methods utilised for the analysis are provided in the laboratory report (see Appendix E).

3.6 Soil Sample Field and Laboratory QA/QC

The field QA/QC procedures performed during the soil sampling are listed as follows:

- Use of standardised field sampling forms and methods;
- Samples were transferred under chain of custody procedures;
- All samples were labelled to show point of collection, project number, and date;
- Headspace in sample jars was avoided;

- The threads on the sampling jars were cleaned to avoid Volatile Organic Compound (VOC) loss;
- All samples were stored in a chilly bin while in the field.

All soil samples were couriered on ice to Hill Laboratories. Hill Laboratories is IANZ accredited for the analysis of heavy metals and pesticides. Hill Laboratories conduct internal QA/QC in accordance with IANZ requirements.

3.7 Soil Guideline Values

DCG have applied soil guideline values (SGVs) which are consistent with the principles of the Contaminated Land Management Guidelines No. 2: Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2003b). According to the hierarchy, SGVs for residential landuse have been taken from either the NES Soil Contaminant Standards (MfE, 2012) or Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater (National Environmental Protection Measure (Assessment of Site Contamination) NEPC, 2013).

In addition to the soil contaminant standards provided in the NES, soil guideline values for BTEX and TPH were taken from Tier 1 soil acceptance criteria for residential use defined within the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999).

3.8 Soil Analytical Result Review

Following the receipt of laboratory data, a detailed review of the data was performed to determine its accuracy and validity. All laboratory data was checked for analytical and typographical errors.

Once the data quality was established the soil data was checked against the Sampling Program DQOs.

4.0 INVESTIGATION RESULTS

4.1 Analytical Results

The soil sample locations and analysis are provided in Figure 6 and summarised in Table 1 below. The laboratory certificates are provided in Appendix E.

Table 1: Soil Sample Summary

Samples	Sample Depth (m)	Composite	Analysis
WPSS01 (0-0.1)	0 - 0.1	Composite 1	Organochlorine pesticides and arsenic
WPSS02 (0-0.1)	0 - 0.1		
WPSS03 (0-0.1)	0 - 0.1		
WPSS01B (0-0.1)	0 - 0.1	Composite 1 duplicate	Organochlorine pesticides and heavy metals
WPSS02B (0-0.1)	0 - 0.1		
WPSS03B (0-0.1)	0 - 0.1		
WPSS04 (0-0.1)	0 - 0.1	Composite 2	Organochlorine pesticides and arsenic
WPSS05 (0-0.1)	0 - 0.1		
WPSS06 (0-0.1)	0 - 0.1		
WPSS07 (0-0.1)	0 - 0.1	Composite 3	Organochlorine pesticides and arsenic
WPSS08 (0-0.1)	0 - 0.1		
WPSS09 (0-0.1)	0 - 0.1		
WPSS010 (0-0.1)	0 - 0.05		TPH + BTEX profile and heavy metals
WPSS011 (0-0.05)	0 - 0.05		TPH + BTEX profile and heavy metals
WPSS011 (0.1-0.15)	0.1-0.15		Sample held
WPSS012 (0-0.1)	0 - 0.1		TPH + BTEX profile and heavy metals
WPSS013 (0-0.1)	0 - 0.1	Composite 4	Arsenic
WPSS014 (0-0.1)	0 - 0.1		
WPSS015 (0-0.1)	0 - 0.1		
WPSS016 (0-0.1)	0 - 0.1	Composite 5	Arsenic
WPSS017 (0-0.1)	0 - 0.1		
WPSS018 (0-0.1)	0 - 0.1		
BTEX in soil: *Benzene, Toluene, Ethylbenzene, m&p-Xylene, o-Xylene* TPH in soil: *C7 – C9, C10 – C14, C15 – C36, Total Hydrocarbons (C7 – C36)* Organochlorine Pesticides Screening in Soil: *Aldrin, alpha-BHC, beta-BHC, delta-BHC, gamma-BHC (Lindane), cis-Chlordane, trans-Chlordane, Total Chlordane [(cis+trans)*100/42], 2,4' DDD, 4,4'-DDD, 2,4'-DDE, 4,4"DDE, 2,4'-DDT, 4,4'-DDT, Dieldrin, Endosulfan I, Endosulfan II, Endosulfan sulphate, Endrin, Endrin aldehyde, Endrin ketone, Heltachlor, Heptachlor epoxide, Hexachlorbenzene, Methoxychlor*			

4.1.1 Organochlorine Pesticides

All pesticides analysed in the organochlorine pesticides soil screening yielded concentrations below limits of detection.

4.1.2 Arsenic

Arsenic concentrations from the composited samples ranged from 11 to 18 mg/kg. Composite arsenic results are listed below:

- WP01 – 03 composite 16 mg/kg
- WP04 – 06 composite 18 mg/kg
- WP07 – 09 composite 16 mg/kg
- WP13 – 15 composite 11 mg/kg
- WP16 – 18 composite 15 mg/kg

Arsenic concentration was greater than the rural residential SGV of 17 mg/kg in only one composite sample, WP04 – 06, located in the centre west of the proposed subdivision (Figure 6). The average arsenic concentration is 15 mg/kg. In DCGs experience, all the results represent background arsenic concentrations. In summary the arsenic results show arsenic levels are generally slightly below the NES soil contaminant standard.

4.1.3 Hydrocarbons

Petroleum hydrocarbon fractions concentrations in soil were below limits of detection in all soils analysed.

BTEX analysed in the soil screening were below limits of detection, except for xylene in the surface sample from WPSS11. Xylene was 0.2mg/kg (m&p-Xylene) and 0.1mg/kg (o-Xylene). These concentrations are well below the adopted soil guideline value (59 mg/kg).

4.1.4 Laboratory Procedures

Methods used by Hills Laboratories for laboratory analysis are summarised in the analysis report provided included in Appendix E. Hill Laboratories did not complete specific in-house QA/QC analysis

5.0 CONCEPTUAL SITE MODEL

5.1 Sources of Potential Contamination

Based on our review of the current and historical activities that have occurred within the site the potential hazardous substances that may be present include;

- a range of heavy metals and pesticides associated with the potential broad acre application of persistent pesticides and fertilisers, and
- hydrocarbons associated with fuel storage within the groundworks yard.

5.2 Risks to Human Health

The risk to human health from exposure to contaminants depends on the contaminant toxicity, concentration and the length of time and type of the exposure. To account for the range of exposure scenarios, the NES soil contaminant standards have been derived for five standard landuse scenarios. Based on the proposed zone change, DCG understands the landuse of the site will be consistent with a rural/lifestyle landuse scenario.

5.2.1 Persistent Pesticides and Heavy Metals

Due to the low intensity of historical farming on the site and absence of persistent pesticides found in soil analysis, DCG considers it is unlikely that concentrations of contaminants within the soil would be present at concentrations that will exceed the contaminant standards for a rural residential land use scenario.

The arsenic concentrations detected in the soils collected from the site are representative of background concentrations. The average concentration of the five samples analysed was 15 mg/kg and is below the NES soil contaminant standard for the rural residential landuse scenario. One sample slightly exceeded the guideline. This result is highly unlikely to represent a hotspot, and is instead more likely to be due to natural variation of arsenic concentration in soils.

DCG considers the risk to human health from arsenic concentrations in soil across the site are not over and above the risk that is inherent in the NES soil contaminant standard.

5.2.2 Hydrocarbons

Hydrocarbon contamination associated with minor spills over the groundworks yard are highly unlikely to be more than localised contamination associated with small drips and spills. If a significant loss had occurred the district council or regional councils should have been informed or staining of the surface soils would have been encountered during the site visit. Neither council holds any records associated with any fuel spills on the sites.

Total Petroleum Hydrocarbon concentrations in soil were below limits of detection. BTEX analysed in the soil screening yielded concentrations below limits of detection, except for xylene which was present at concentrations well below adopted soil guideline values.

In conclusion, DCG considers it is unlikely that concentrations of hydrocarbon associated contaminants within the soil would be present at concentrations that will exceed the Tier 1 soil acceptance criteria for residential use provided in the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999).

5.3 Other NES Matters

The risks to human health from contaminated soils are considered low. However there are other risks associated with the development of the site that need to be considered, specifically any offsite disposal that may be required. Section 5.2.1 highlights the slightly elevated background concentrations of arsenic in soil. As discussed, the concentrations are highly unlikely to be a risk to human health based on the proposed landuse however the Class B landfill acceptance criteria are often much lower than the NES soil contaminant standards. For example, the Class B landfill acceptance criteria for arsenic is 10 mg/kg compared to the NES soil contaminant standard for rural residential activity of 17 mg/kg. Testing of the soil would be required if offsite disposal of the soil is required and disposal off site may be limited to Class A landfills, dependant on leachate analysis.

6.0 SUMMARY AND RECOMMENDATIONS

Based on the findings of the PSI, the following conclusions can be made:

- The first use of the land was farming in the early to mid 1900's.
- No agricultural infrastructure such as sheds or yards were observed within or in the immediate vicinity of the zone change boundary in aerial photography from 1956 to present day.
- Surrounding land uses include rural / lifestyle block and residential development.
- The site is subject to the provisions of the NES due to the history of agricultural activities that are associated with the application of persistent pesticides and fertilizers and the storage of hydrocarbons.
- Based on the Contaminated Land Management Guidelines Schedule B, the hazardous substances that may be associated with the former farming operation on the site include a range of organochlorine pesticides and trace metals associated with application of fertilisers.
- Searches of the Otago Regional Council's "Database of Selected Landuses" did not find any records of contaminated sites on the study site.
- No organochlorine pesticides were detected in analysis of soils taken from the site.
- Due to the low intensity of historical farming on the site and absence of organochlorine pesticides found in soil analysis, DCG considers it is unlikely that concentrations of pesticides within the soil would be present at concentrations that will exceed the contaminant standards for a rural residential land use scenario.
- Within the groundworks laydown area, petroleum hydrocarbon fractions concentrations in soil were below limits of detection. BTEX analysed in the soil screening yielded concentrations below limits of detection, except for xylene which was present at concentrations below adopted soil guideline values.
- DCG considers it is unlikely that concentrations of hydrocarbons and BTEX within the soil would be present at concentrations that exceed the soil contaminant standards for a rural residential land use scenario.
- Average arsenic concentrations detected across the site are below the NES soil contaminant standard and are representative of the natural background levels,
- DCG considers the risk to human health from arsenic concentrations in soil are not over and above the risk that is inherent in the NES soil contaminant standards.

In summary, the PSI has identified historical land use activities that may have impacted the soil quality of the site. Based on the results of this Preliminary Site Investigation, DCG concludes it is

highly unlikely that there is a risk to human health from the proposed plan change and future subdivision and residential use of the site.

7.0 REFERENCES

Ministry for the Environment (MfE) (1999) *Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Module 4, Tier 1 soil acceptance criteria.*

MfE (2012). *Users' Guide: National Environmental Standard forAssessing and Managing Contaminants in Soil to Protect Human Health*. Wellington: Ministry for the Environment.

MfE (2003) *Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand.*

MfE (2012). *Users' Guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*. Wellington: Ministry for the Environment.

National Environment Protection Council (NEPC) (1999) *National Environment Protection (Assessment of Site Contamination) Measure - Schedule B (1) Guideline on Investigation Levels for Soil and Groundwater.* National Environment Protection Council.

Otago Regional Council (ORC) 2014 Regional Plan: Water for Otago. 1 May 2014

Otago Regional Council (ORC) GrowOTAGO online maps. http://growotago.orc.govt.nz accessed 26/05/2015

Queenstown Lakes District Council (QLDC) Webmaps. Accessed 20/05/2015 http://maps.qldc.govt.nz/qldcviewer/

QLDC E Document Viewer. Accessed 20/05/2015 https://edocs.qldc.govt.nz/

Turnbull, I.M. (compiler) (2000) *Geology of the Wakatipu area.* Institute of Geological & Nuclear Sciences 1:250 000 geological map 18. 1 sheet + 72 p. Lower Hutt, New Zealand. Institute of Geological & Nuclear Sciences Ltd.

Appendices

Appendix A

Davis Consulting Group Contaminated Land Experience

Appendix A

Glenn Davis is the director of Davis Consulting Group and has over 15 years post graduate experience working as an Environmental Scientist. Glenn has accumulated a significant volume of work experience in the Contaminated Land field undertaking preliminary site investigations (PSIs), detailed site investigations (DSIs) and remediation projects in New Zealand, Australia, Asia, the United Kingdom and Ireland. The following provides a summary of Glenn Davis's experience.

Davis Consulting Group (2007 – present): Principal Environmental Scientist – completed multiple preliminary and detailed site investigations in Otago and Southland predominantly for the land development industry. DCG also provides contaminated land advice to district and regional councils.

RPS Australia (2003 – 2006): Supervising Environmental Scientist managing multiple detailed site investigations in the land development industrial and operated as an environmental specialist for Chevron on Barrow Island monitoring and managing a number of large contaminated groundwater plumes.

URS Ireland (2001 – 2003): - Senior Environmental Scientist undertaking multiple PSIs and DSIs on services stations and train station throughout Ireland. Glenn was also involved in the design and operation of a number of large scale remediation projects, predominantly associated with the removal of hydrocarbon contaminated soil and recovery or hydrocarbons impacting groundwater.

ERM Australia (1998 – 2000) – Working as a project level environmental scientist Glenn completed in excess of 30 detailed site investigations and remedial projects on service stations, concrete batching plants, and transport depots.

Appendix B

Historical Certificates of Title

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Historical Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**685724**
Land Registration District	**Otago**
Date Issued	27 January 2015

Prior References
683554

Estate	Fee Simple
Area	17.9589 hectares more or less
Legal Description	Lot 919 Deposited Plan 479637

Original Proprietors
Peninsula Village Limited as to a 1/2 share
Wanaka Bay Limited as to a 1/2 share

Interests

Subject to Section 59 Land Act 1948

7124098.2 Mortgage to Bank of New Zealand - 23.11.2006 at 11:39 am

Subject to a right (in gross) to convey electricity over part marked C and E on DP 479637 in favour of Aurora Energy Limited created by Easement Instrument 9585989.6 - 23.1.2014 at 4:27 pm

The easements created by Easement Instrument 9585989.6 are subject to Section 243 (a) Resource Management Act 1991

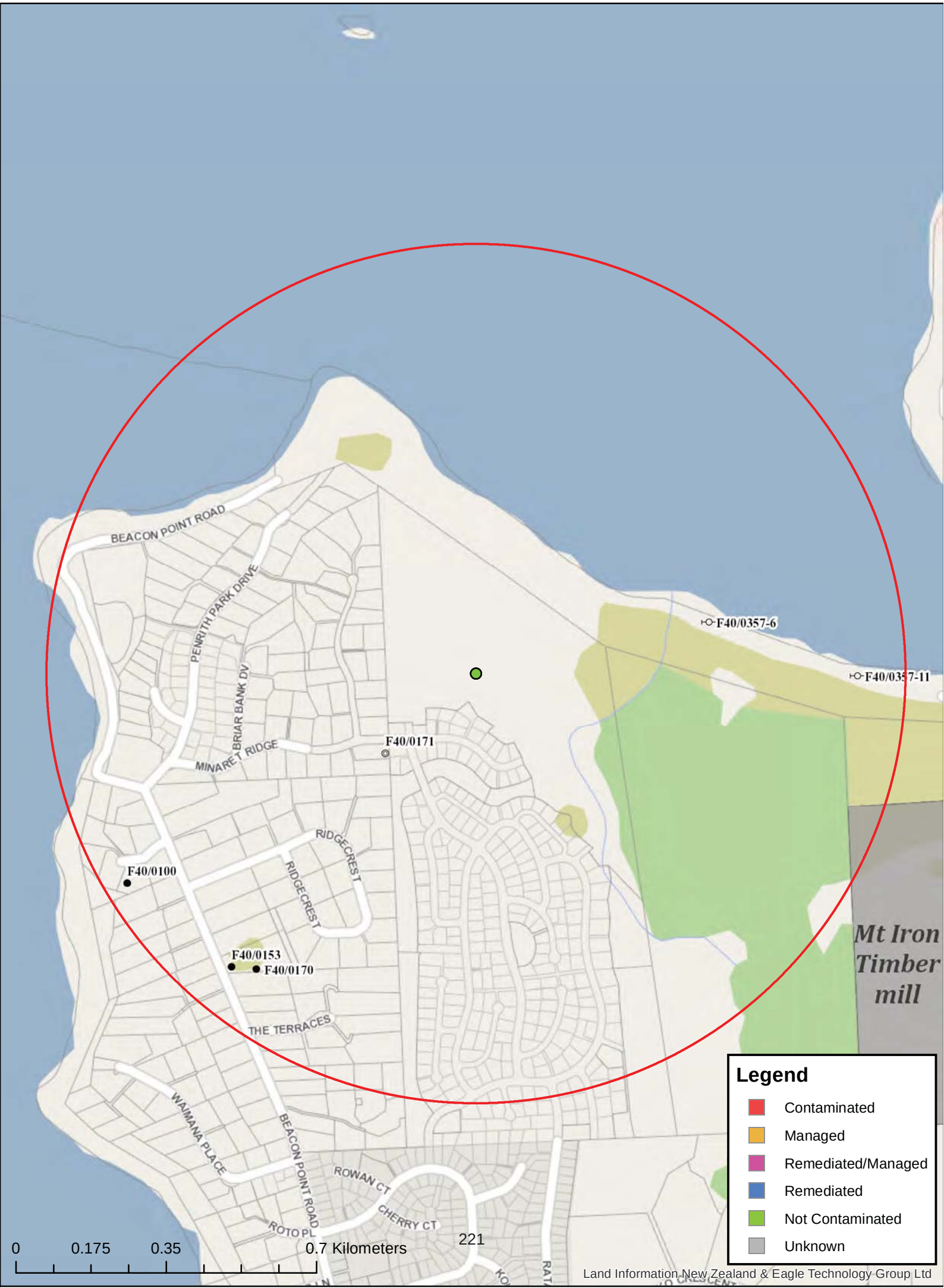
Subject to a right (in gross) to drain sewage and water over part marked C and D on DP 479637 in favour of Queenstown Lakes District Council created by Easement Instrument 9859288.5 - 26.11.2014 at 12:19 pm

The easements created by Easement Instrument 9859288.5 are subject to Section 243 (a) Resource Management Act 1991

Appendix C

Supporting Maps

Land-use and Site Contamination Request - Lot 916 DP 454163



Appendix D

Soil Logs

SOIL PROFILE LOGS

PROJECT NUMBER: 15031 FIELD STAFF: CP DATE: 22/05/2015
SITE NAME: Wanaka Peninsula PSI METHOD: Spade WEATHER: Fine

Sample Location	Coordinates		Sample Depth	Sample ID	Soil Lithology
1	1293577	5047266	0 - 0.1	WPSS01 (0-0.1)	Moist. Brown sandy SILT. Grass roots to 0.15
2			0 - 0.1	WPSS01B (0-0.1)	Duplicate
3	1293535	5047294	0 - 0.1	WPSS02 (0-0.1)	Moist. Brown sandy SILT. Some gravel (under 10%) Grass roots to 0.15
4			0 - 0.1	WPSS02B (0-0.1)	Duplicate
5	1293494	5047339	0 - 0.1	WPSS03 (0-0.1)	Moist. Brown sandy SILT. Some cobbles (under 10%) Grass roots to 0.15
6			0 - 0.1	WPSS03B (0-0.1)	Duplicate
7	1293434	5047435	0 - 0.1	WPSS04 (0-0.1)	Moist. Brown sandy SILT. Some cobbles (under 10%) Grass roots to 0.15
8	1293448	5047395	0 - 0.1	WPSS05 (0-0.1)	Moist. Brown sandy SILT. Thick grass roots to 0.15
9	1293447	5047347	0 - 0.1	WPSS06 (0-0.1)	Moist. Brown sandy SILT. Grass roots to 0.15. Some gravels noted on surface.
10	1293414	5047357	0 - 0.1	WPSS07 (0-0.1)	Moist. Brown sandy SILT. Some cobbles (under 10%) Grass roots to 0.15
11	1293396	5047399	0 - 0.1	WPSS08 (0-0.1)	Moist. Brown sandy SILT. Grass roots to 0.15. 4WD traffic has moved over the area
12	1293387	5047429	0 - 0.1	WPSS09 (0-0.1)	Moist. Brown sandy SILT. Thick grass roots to 0.15
13	1293336	5047349	0 - 0.1	WPSS10 (0-0.1)	Moist. Brown sandy SILT. Some gravel (under 20%) . Compact
14	1293352	5047343	0 - 0.05	WPSS11 (0-0.05)	Moist. Brown sandy SILT. Some gravel (under 30%) . Compact. Odor of hydrocarbons
15			0.1 - 0.15	WPSS11 (0.1-0.15)	Moist. Brown sandy SILT. Some gravel (under 30%) . No change with depth. No odor.
16	1293338	5047364	0 - 0.1	WPSS12 (0-0.1)	Moist. Brown sandy SILT. Some gravel (under 20%). Earth had been translocated. Very loose.
17	1293775	5047037	0 - 0.1	WPSS13 (0-0.1)	Moist. Brown sandy SILT. Grass roots to 0.15. On a track.
18	1293774	5047093	0 - 0.1	WPSS14 (0-0.1)	Moist. Brown sandy SILT. Some grass roots to 0.15. On a track.
19	1293778	5047135	0 - 0.1	WPSS15 (0-0.1)	Moist. Brown sandy SILT. Grass roots to 0.15. On a track.
20	1293685	5047177	0 - 0.1	WPSS16 (0-0.1)	Moist. Brown sandy SILT. Some cobbles (under 10%) Grass roots to 0.15
21	1293718	5047199	0 - 0.1	WPSS17 (0-0.1)	Moist. Brown sandy SILT. Groundcover roots to 0.15.
22	1293755	5047245	0 - 0.1	WPSS18 (0-0.1)	Moist. Brown sandy SILT. Thick grass roots to 0.15.

Appendix E

Laboratory analytical certificate and results, and chain of custody documentation.

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Davis Consulting Group Limited	**Lab No:**	1429944	SPv1
Contact:	C Pritchard	**Date Registered:**	23-May-2015	
	C/- Davis Consulting Group Limited	**Date Reported:**	08-Jun-2015	
	PO Box 2450	**Quote No:**	68892	
	Wakatipu	**Order No:**		
	QUEENSTOWN 9349	**Client Reference:**	15031	
		Submitted By:	C Pritchard	

Sample Type: Soil

Sample Name:		WPSS 10 (0-0.05 22-May-2015 1:50 pm	WPSS 11 (0-0.05) 22-May-2015 1:58 pm	WPSS 12 (0-0.1) 22-May-2015 2:20 pm	Composite of WPSS 01 (0-0.1), WPSS 02 (0-0.1) & WPSS 03 (0-0.1)	Composite of WPSS 04 (0-0.1), WPSS 05 (0-0.1) & WPSS 06 (0-0.1)
Lab Number:		1429944.13	1429944.14	1429944.16	1429944.23	1429944.25
Individual Tests						
Dry Matter	g/100g as rcvd	90	92	90	-	-
Total Recoverable Arsenic	mg/kg dry wt	-	-	-	16	18
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
Toluene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
m&p-Xylene	mg/kg dry wt	< 0.10	0.20	< 0.10	-	-
o-Xylene	mg/kg dry wt	< 0.05	0.10	< 0.05	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	-	-	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	-	-	-	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	-	-	-	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	-	-	-	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	-	-	-	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	-	-	-	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	-	-	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	-	-	-	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	-	-	-	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	-	-	-	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	-	-	-	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	-	-	-	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Dieldrin	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Endrin	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	-	-	-	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		WPSS 10 (0-0.05 22-May-2015 1:50 pm	WPSS 11 (0-0.05) 22-May-2015 1:58 pm	WPSS 12 (0-0.1) 22-May-2015 2:20 pm	Composite of WPSS 01 (0-0.1), WPSS 02 (0-0.1) & WPSS 03 (0-0.1)	Composite of WPSS 04 (0-0.1), WPSS 05 (0-0.1) & WPSS 06 (0-0.1)
Lab Number:		1429944.13	1429944.14	1429944.16	1429944.23	1429944.25
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	< 8	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	-	-
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	< 70	-	-

Sample Name:		Composite of WPSS 07 (0-0.1), WPSS 08 (0-0.1) & WPSS 09 (0-0.1)	Composite of WPSS 13 (0-0.1), WPSS 14 (0-0.1) & WPSS 15 (0-0.1)	Composite of WPSS 16 (0-0.1), WPSS 17 (0-0.1) & WPSS 18 (0-0.1)		
Lab Number:		1429944.26	1429944.27	1429944.28		
Individual Tests						
Total Recoverable Arsenic	mg/kg dry wt	16	11	15	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	-	-	-
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	-	-	-
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	-	-	-
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	-	-	-
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	-	-	-
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	-	-	-
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	-	-	-
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	-	-	-
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endrin	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	-	-	-

SUMMARY OF METHODS

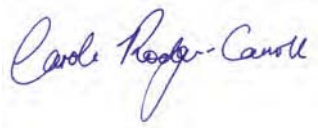
The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	23, 25-28
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	13-14, 16
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	0.010 - 0.04 mg/kg dry wt	23, 25-27

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	13-14, 16
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	13-14, 16
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	23, 25-28
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-12, 17-22
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	23, 25-28

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.



Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental Division

QUOTE No. 68892. PAGE 1 of 2

Davis Consulting Group Limited
Arrow Lane
Arrowtown
Phone: 03 409 8664

DAVIS consulting group

Chain of Custody

Sheet of

Laboratory use

Date Collected: 22ND MAY 2015

Sampling Conditions *(brief description of weather conditions/flow rates etc)*: FINE WEATHER.

Your Address: Davis Consulting Group Ltd.
Arrow Lane
Arrowtown 9302

Samples Filtered and/or Preserved?

Priority:

CoC to be emailed back: carrie@daviesconsultinggroup.co.nz

Phone Number: 03 409 8664

Email Address:

Project No/Property Name: 15031

Who Sampled: Carrie Pritchard

Samples Released By (Signature):
Date and Time Released:

Samples Received By (Signature):
Date and Time Received:

Organochlorine pesticides in soil.

Sample ID	Date	Time	Matrix	Analytes						
				TPH/BTEX	PAH	Metals[1]	pH	OCP		
WPSS01 (0-0.1)		11.26	Soil			✓	✓	✓	composite (1)	
WPSS01B (0-0.1)		11.28	Soil			✓	✓	✓	composite (1B)	
WPSS02 (0-0.1)		11.40	Soil			✓	✓	✓	composite (1)	
WPSS02B (0-0.1)		11.42	Soil			✓	✓	✓	composite (1B)	
WPSS03 (0-0.1)	22.5.15.	11.55	Soil			✓	✓	✓	composite (1)	
WPSS03B (0-0.1)		11.57	Soil			✓	✓	✓	composite (1B)	
WPSS04 (0-0.1)		12.46	Soil			✓	✓	✓		
WPSS05 (0-0.1)		12.55	Soil			✓	✓	✓	composite (2)	
WPSS06 (0-0.1)		13.01	Soil			✓	✓	✓		
WPSS07 (0-0.1)		13.10	Soil			✓	✓	✓		
WPSS08 (0-0.1)		13.26	Soil			✓	✓	✓	composite (3)	
WPSS09 (0-0.1)		13.30	Soil			✓	✓	✓		

Note:

1 Metals Analysis to include Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Lead and Zinc

Temperature On Arrival

9.1 °C

Temperature was measured on one or more arbitrarily chosen samples in this batch.

Job No: 142 9944

Date Recv: 23-May-15 07:19

Received by: David Nicholls

3114299447

QUOTE No.: 68892

Davis Consulting Group Limited
Arrow Lane
Arrowtown
Phone: 03 409 8664

DAVIS consulting group

Chain of Custody

Sheet of

Laboratory use

Date Collected: 22nd MAY 2015	Sampling Conditions *(brief description of weather conditions/flow rates etc)*
Your Address: Davis Consulting Group Ltd. Arrow Lane Arrowtown 9302	Samples Filtered and/or Preserved? / Priority: / CoC to be emailed back: As on Page 1
Phone Number: 03 409 8664	Email Address:
Project No/Property Name: 15031	Who Sampled: Carrie Pritchard
Samples Released By (Signature): Date and Time Released:	Samples Received By (Signature): Date and Time Received:

Sample ID	Date	Time	Matrix	Analytes						
				TPH/BTEX	PAH	Metals[1]	pH	OCP		
WPSS10 (0-0.05)		1350	Soil	✓						
WPSS11 (0-0.05)		1355	Soil	✓						
WPSS11 (0.1-0.15)		1405	Soil	✓						
WPSS12 (0-0.1)		1420	Soil	✓						
WPSS13 (0-0.1)		1440	Soil			✓	✓	✓		
WPSS14 (0-0.1)		1450	Soil			✓	✓	✓	composite	4
WPSS15 (0-0.1)		1457	Soil			✓	✓	✓		
WPSS16 (0-0.1)		1518	Soil					✓		
WPSS17 (0-0.1)		1525	Soil					✓	composite	5
WPSS18 (0-0.1)		1537	Soil					✓		
			Soil							
			Soil							

Note:

1 Metals Analysis to include Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Lead and Zinc

Hill Laboratories
BETTER TESTING BETTER RESULTS
R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand
Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

Job Information Summary

Client: Davis Consulting Group Limited
Contact: C Pritchard
C/- Davis Consulting Group Limited
PO Box 2450
Wakatipu
QUEENSTOWN 9349

Lab No: 1429944
Date Registered: 23-May-2015 12:38 pm
Priority: High
Quote No: 68892
Order No:
Client Reference: 15031
Add. Client Ref:
Submitted By: C Pritchard
Charge To: Davis Consulting Group Limited
Target Date: 03-Jun-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	WPSS 01 (0-0.1) 22-May-2015 11:26 am	Soil	GSoil300	Composite Environmental Solid Samples
2	WPSS 01B (0-0.1) 22-May-2015 11:28 am	Soil	GSoil300	Composite Environmental Solid Samples
3	WPSS 02 (0-0.1) 22-May-2015 11:40 am	Soil	GSoil300	Composite Environmental Solid Samples
4	WPSS 02B (0-0.1) 22-May-2015 11:42 am	Soil	GSoil300	Composite Environmental Solid Samples
5	WPSS 03 (0-0.1) 22-May-2015 11:55 am	Soil	GSoil300	Composite Environmental Solid Samples
6	WPSS 03B (0-0.1) 22-May-2015 11:57 am	Soil	GSoil300	Composite Environmental Solid Samples
7	WPSS 04 (0-0.1) 22-May-2015 12:46 pm	Soil	GSoil300	Composite Environmental Solid Samples
8	WPSS 05 (0-0.1) 22-May-2015 12:55 pm	Soil	GSoil300	Composite Environmental Solid Samples
9	WPSS 06 (0-0.1) 22-May-2015 1:01 pm	Soil	GSoil300	Composite Environmental Solid Samples
10	WPSS 07 (0-0.1) 22-May-2015 1:10 pm	Soil	GSoil300	Composite Environmental Solid Samples
11	WPSS 08 (0-0.1) 22-May-2015 1:26 pm	Soil	GSoil300	Composite Environmental Solid Samples
12	WPSS 09 (0-0.1) 22-May-2015 1:30 pm	Soil	GSoil300	Composite Environmental Solid Samples
13	WPSS 10 (0-0.05 22-May-2015 1:50 pm	Soil	GSoil300	TPH + BTEX profile, Soil
14	WPSS 11 (0-0.05) 22-May-2015 1:58 pm	Soil	GSoil300	TPH + BTEX profile, Soil
15	WPSS 11 (0.1-0.15) 22-May-2015 2:05 pm	Soil	GSoil300	TPH + BTEX profile, Soil
16	WPSS 12 (0-0.1) 22-May-2015 2:20 pm	Soil	GSoil300	TPH + BTEX profile, Soil
17	WPSS 13 (0-0.1) 22-May-2015 2:40 pm	Soil	GSoil300	Composite Environmental Solid Samples
18	WPSS 14 (0-0.1) 22-May-2015 2:50 pm	Soil	GSoil300	Composite Environmental Solid Samples
19	WPSS 15 (0-0.1) 22-May-2015 2:57 pm	Soil	GSoil300	Composite Environmental Solid Samples
20	WPSS 16 (0-0.1) 22-May-2015 3:18 pm	Soil	GSoil300	Composite Environmental Solid Samples
21	WPSS 17 (0-0.1) 22-May-2015 3:25 pm	Soil	GSoil300	Composite Environmental Solid Samples
22	WPSS 18 (0-0.1) 22-May-2015 3:37 pm	Soil	GSoil300	Composite Environmental Solid Samples
23	Composite of WPSS 01 (0-0.1), WPSS 02 (0-0.1) & WPSS 03 (0-0.1)	Soil	GSoil300	~~pH~~ Heavy metal screen level (As,Cd,Cr,Cu,Ni,Pb,Zn), Organochlorine Pesticides Screening in Soil

HOLD

HOLD COLD

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
24	Composite of WPSS 01B (0-0.1), WPSS 02B (0-0.1) & WPSS 03B (0-0.1)	Soil	GSoil300	pH; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil
25	Composite of WPSS 04 (0-0.1), WPSS 05 (0-0.1) & WPSS 06 (0-0.1)	Soil	GSoil300	~~pH; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil~~
26	Composite of WPSS 07 (0-0.1), , WPSS 08 (0-0.1) & WPSS 09 (0-0.1)	Soil	GSoil300	~~pH; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil~~
27	Composite of WPSS 13 (0-0.1), WPSS 14 (0-0.1) & WPSS 15 (0-0.1)	Soil	GSoil300	~~pH; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil~~
28	Composite of WPSS 16 (0-0.1), WPSS 17 (0-0.1) & WPSS 18 (0-0.1)	Soil	GSoil300	~~Organochlorine Pesticides Screening in Soil~~ Arsenic only

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	23-27
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	23-27
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	23-27
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	13-16
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	0.010 - 0.04 mg/kg dry wt	23-28
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	13-16
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	13-16
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2	-	23-27
Composite Environmental Solid Samples	Individual sample fractions mixed together to form a composite fraction.	-	1-12, 17-22
pH	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH.	0.1 pH Units	23-27

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz

Job Information Summary

Client:	Davis Consulting Group Limited	**Lab No:**	1429944
Contact:	C Pritchard	**Date Registered:**	23-May-2015 12:38 pm
	C/- Davis Consulting Group Limited	**Priority:**	High
	PO Box 2450	**Quote No:**	68892
	Wakatipu	**Order No:**	
	QUEENSTOWN 9349	**Client Reference:**	15031
		Add. Client Ref:	
		Submitted By:	C Pritchard
		Charge To:	Davis Consulting Group Limited
		Target Date:	08-Jun-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	WPSS 01 (0-0.1) 22-May-2015 11:26 am	Soil	GSoil300	Composite Environmental Solid Samples
2	WPSS 01B (0-0.1) 22-May-2015 11:28 am	Soil	GSoil300	Composite Environmental Solid Samples
3	WPSS 02 (0-0.1) 22-May-2015 11:40 am	Soil	GSoil300	Composite Environmental Solid Samples
4	WPSS 02B (0-0.1) 22-May-2015 11:42 am	Soil	GSoil300	Composite Environmental Solid Samples
5	WPSS 03 (0-0.1) 22-May-2015 11:55 am	Soil	GSoil300	Composite Environmental Solid Samples
6	WPSS 03B (0-0.1) 22-May-2015 11:57 am	Soil	GSoil300	Composite Environmental Solid Samples
7	WPSS 04 (0-0.1) 22-May-2015 12:46 pm	Soil	GSoil300	Composite Environmental Solid Samples
8	WPSS 05 (0-0.1) 22-May-2015 12:55 pm	Soil	GSoil300	Composite Environmental Solid Samples
9	WPSS 06 (0-0.1) 22-May-2015 1:01 pm	Soil	GSoil300	Composite Environmental Solid Samples
10	WPSS 07 (0-0.1) 22-May-2015 1:10 pm	Soil	GSoil300	Composite Environmental Solid Samples
11	WPSS 08 (0-0.1) 22-May-2015 1:26 pm	Soil	GSoil300	Composite Environmental Solid Samples
12	WPSS 09 (0-0.1) 22-May-2015 1:30 pm	Soil	GSoil300	Composite Environmental Solid Samples
13	WPSS 10 (0-0.05 22-May-2015 1:50 pm	Soil	GSoil300	TPH + BTEX profile, Soil
14	WPSS 11 (0-0.05) 22-May-2015 1:58 pm	Soil	GSoil300	TPH + BTEX profile, Soil
15	WPSS 11 (0.1-0.15) 22-May-2015 2:05 pm	Soil	GSoil300	Hold Cold
16	WPSS 12 (0-0.1) 22-May-2015 2:20 pm	Soil	GSoil300	TPH + BTEX profile, Soil
17	WPSS 13 (0-0.1) 22-May-2015 2:40 pm	Soil	GSoil300	Composite Environmental Solid Samples
18	WPSS 14 (0-0.1) 22-May-2015 2:50 pm	Soil	GSoil300	Composite Environmental Solid Samples
19	WPSS 15 (0-0.1) 22-May-2015 2:57 pm	Soil	GSoil300	Composite Environmental Solid Samples
20	WPSS 16 (0-0.1) 22-May-2015 3:18 pm	Soil	GSoil300	Composite Environmental Solid Samples
21	WPSS 17 (0-0.1) 22-May-2015 3:25 pm	Soil	GSoil300	Composite Environmental Solid Samples
22	WPSS 18 (0-0.1) 22-May-2015 3:37 pm	Soil	GSoil300	Composite Environmental Solid Samples
23	Composite of WPSS 01 (0-0.1), WPSS 02 (0-0.1) & WPSS 03 (0-0.1)	Soil	GSoil300	Minimum charge for ICP-MS analysis; Organochlorine Pesticides Screening in Soil; Total Recoverable Arsenic

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
24	Composite of WPSS 01B (0-0.1), WPSS 02B (0-0.1) & WPSS 03B (0-0.1)	Soil	GSoil300	Hold Cold
25	Composite of WPSS 04 (0-0.1), WPSS 05 (0-0.1) & WPSS 06 (0-0.1)	Soil	GSoil300	Minimum charge for ICP-MS analysis; Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
26	Composite of WPSS 07 (0-0.1), WPSS 08 (0-0.1) & WPSS 09 (0-0.1)	Soil	GSoil300	Minimum charge for ICP-MS analysis; Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
27	Composite of WPSS 13 (0-0.1), WPSS 14 (0-0.1) & WPSS 15 (0-0.1)	Soil	GSoil300	Minimum charge for ICP-MS analysis; Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
28	Composite of WPSS 16 (0-0.1), WPSS 17 (0-0.1) & WPSS 18 (0-0.1)	Soil	GSoil300	Minimum charge for ICP-MS analysis; Total Recoverable Arsenic

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	23, 25-28
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	13-14, 16
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	0.010 - 0.04 mg/kg dry wt	23, 25-27
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	13-14, 16
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	13-14, 16
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	23, 25-28
Composite Environmental Solid Samples	Individual sample fractions mixed together to form a composite fraction.	-	1-12, 17-22
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	23, 25-28

APPENDIX I

Paterson Pitts Group Infrastructure Design Report

PENINSULA VILLAGE LTD & WANAKA BAY LTD

Peninsula Bay North End Rezoning
Infrastructure Design Report

PATERSONPITTSGROUP

Your Land Professionals
www.ppgroup.co.nz
0800 PPGROUP

1 September 2015

Table of Contents

1.0 EXECUTIVE SUMMARY

Paterson Pitts Group (PPG) has been engaged by Peninsula Village Ltd & Wanaka Bay Ltd to prepare an infrastructure and servicing report for the rezoning of land located at the northern end of the Peninsula Bay, Wanaka. This report will form part of the rezoning application for the proposed development. Additional detailed engineering design would be required at the time of actual subdivision to refine further the preliminary findings of this report.

This assessment demonstrates that existing infrastructure together with new infrastructure elements can cope with the potential demand for services resulting from the development. An additional possible 31 Lots have been identified by modelling as being able to connect to Council services however the proposed plan change is only seeking connection of an additional 26 lots.

Land Stability and Earthworks
The geological assessment completed in 2003 by Royden Thompson covered all of the Peninsula Bay site from its southern boundary through to the northern boundary. The findings of this report did not identify any issues of concern in the area now subject to the proposed rezoning.

Roading
The area subject to the proposed rezoning is intended to be accessed from the end of Infinity Drive and Bull Ridge.

Stormwater
Connection into the recently constructed stormwater system installed within Stages 1 to 5b of Peninsula Bay is possible.

Wastewater
Connection to the existing sewer lines installed within Peninsula Bay is proposed by way of extension of 150mm diameter sewer mains.

Water Supply
Connection to existing water lines installed within Peninsula Bay is proposed by extension of 100mm diameter water mains.

Power, Telecommunications
Power and telecommunications are available from existing supplies already installed within the site. New connections will be installed underground.

2.0 GEOLOGY AND EARTHWORKS

2.1 Geology

The geological assessment completed in 2003 by Royden Thompson, contained in Appendix A1, covered all of the Peninsula Bay site from its southern boundary through to the northern boundary. The findings of that report did not identify any issues of concern in the area now subject to the proposed rezoning. The key findings of the report in relation to the proposed rezoning of the northern end of Peninsula Bay land are

- The Peninsula Bay subdivision occupies an area of glacial moraine that has a varying surface morphology and generally westerly aspect. Along the northern boundary there is a steep drop to the shoreline of Lake Wanaka.

- Ablation till of significant but poorly determined thickness underlies the whole subdivision. Minor exposures on site and better exposures in the peripheral area, indicate the till will comprise heterogeneous gravel/sand/silt mixture without any associated water-laid deposits of consequence. Other lithologies, such as interglacial lake sediments and fluvioglacial alluvium, will underlie the subdivision at depth (below RL300) in the north east corner but their sub surface presence elsewhere is speculative.

- There are no known groundwater seepages and the water table is expected to be well below the ground surface.

- Road and service corridors should be entirely in till and there should be no excavation or slope integrity problems. Fills, using locally-derived till, should be similarly constructed but local practices should be utilized to suit the slightly variable characteristics the will be encountered.

2.2 Earthworks

Earthworks will be required to form and shape proposed roads and to shape and form suitable building areas within proposed lots. The final design of the earthworks will need to take into account overland flowpaths and convey these via roading corridors or out into the reserve land away from residential buildings.

Earthworks utilising material derived from onsite is possible as confirmed by previous work undertake in Stages 1 to 6 of Peninsula Bay and by the geological appraisal undertaken by Royden Thompson.

Enclosed in Appendix A2 are preliminary earthworks plans which identify the main areas of earthworks associated with forming the proposed roads and also proposed building platforms. The earthworks has been designed to minimize the removal of existing vegetation as much as is practical. Where earthwork batters require removal of existing vegetation, these will be replanted as per the proposed landscaping plan.

Preliminary earthworks volumes are 4500m^3 of cut and 1800m^3 of fill undertaken over an area 1.5ha. It is envisaged that any excess material would be utilised onsite to create additional landscape bunding and mounding with the final design and location of these subject to further detailed landscaping design during actual subdivision works.

2.3 Erosion & Sediment Controls

Management of stormwater runoff will be straightforward and can be fully contained within the confines of the site. The topography of the site means that stormwater generally flows in a southerly direction into the existing stormwater ponds installed under Stage 4 of Peninsula Bay.

The control of erosion and silt-laden water can easily be achieved through the use of silt fences and or hay bale barriers as appropriate to prevent any silt or sediment from leaving the site during development.

2.4 Dust control

Control of dust will be important due to the nature of underlying till material, which if left exposed will give rise to wind blown dust.

Appropriate controls measures such k-line irrigation, limiting exposed surfaces, use of water carts and prompt re-grassing/stabilisation of exposed areas will used as necessary to effectively control dust throughout the construction period.

2.5 Suitability of Site for Development

The geological assessment did not identify any areas of concern regarding site stability nor identify any special soils which will require further geotechnical assessment during development.

Based on the geological assessment the site is considered very suitable for residential development given its soil structure, gentle ground slope and stability.

3.0 ROAD DESIGN

3.1 Place & Context

The proposed rezoning is to enable low density residential development. Under Council's engineering standards this is characterised as live and play, suburban landuse.

3.2 Proposed Roading

The area subject to the proposed rezoning is intended to be accessed from the end of Infinity Drive and Bull Ridge. Infinity Drive has been recently been constructed partway through Stage 5b of Peninsula Bay and terminates near where the proposed eastern reserve carpark is intended to be constructed. A roading corridor up into the eastern end of the plan change land will likely follow a gully feature before terminating in a cul-de-sac head.

The western end of the plan change land will be accessed from Bull Ridge which is due to be constructed by mid-2015. This road will also be extended and likely split into two small cul-de-sacs or a loop road.

3.3 Road Dimensions

Under Councils amendments to NZS 4404:2004 the roads proposed within the north end of Peninsula Bay fall under the category of "Short Residential cul-de-sac" under Table 3.1 – Road Design Standards – Urban. This table specifies that a short residential cul-de-sac servicing up to 20du is to have a minimum road reserve width of 12m, with carparking allowed within one traffic lane. The minimum carriageway width required is 6m.

3.4 Pedestrian Network Connectivity

A high level of pedestrian network connectivity is proposed within the north end of Peninsula Bay for pedestrian and cyclists. The combination of smaller local cul-de-sacs merging into the existing shape of the land provide entry points for several walking and cycling pathways throughout the northern end of the Peninsula Bay site. These

walking and cycling trails link back into existing pathways recently constructed within the earlier stages of the Peninsula Bay development.

4.0 STORMWATER

4.1 Existing Infrastructure

There are existing stormwater water mains installed at the end of Infinity Drive and Minaret Ridge which are able to be extended to service the plan change area.

The development of the Peninsula Bay site required the installation of a new 900mm diameter trunk main extending from Lake Wanaka, near Roto Place, up Hunter Crescent and into the south western corner of the site. The earthworks, roading and lot layout of the Peninsula Bay site was designed to incorporate swales and retentions ponds to provide treatment and temporary retention of stormwater runoff onsite.

The large diameter trunk main was installed up the western side of the Peninsula Bay before extending into an area referred to as the central depression in the middle of the site. Located at this point are two large retention stormwater basins which temporarily store runoff and provide treatment of suspended sediment.

4.2 Proposed Stormwater Treatment and Management

The development of the north end of Peninsula Bay will be serviced by two extension of 300mm diameter stormwater drains. The eastern end will be serviced by extending the recently installed stormwater drainage located in Stage 5b of Peninsula Bay off the end of Infinity Drive. The western end will be serviced by extending the existing stormwater drainage in Minaret Ridge up through Stage 6b of Peninsula Bay which is due for completion in mid-2015. All new stormwater pipes will be 300mm diameter. The treatment of runoff will be attained via the existing swale and stormwater treatment ponds located in the central part of Peninsula Bay.

5.0 WASTE WATER

5.1 Existing Waste Water Reticulation

There are existing waste water mains installed at the end of Infinity Drive and Minaret Ridge which are located at sufficient depth to be extended to provide gravity drainage to the plan change area.

5.2 Proposed Disposal of Wastewater

The plan change area is divided into two distinct catchments split approximately in the middle of the plan change area. All new drains will be 150mm diameter.

The eastern catchment will be serviced from existing gravity waste water drains located at the end of Infinity Drive within the recently completed Stage 5b of Peninsula Bay. This drains down through the existing stages of Peninsula Bay to the south west corner of the site and into the Hunter Crescent wastewater network.

The western catchment will be serviced from existing gravity drainage in Minaret Ridge and at the end of the short section of Infinity Drive yet to be extended through from Stage 4 to Stage 5b. This drains down into the Penrith Park area.

Both catchments are conveyed via gravity drainage to the existing pump station located at Bremner Bay.

5.3 Rationale Ltd Wastewater Reticulation modelling

Rationale Ltd were commissioned to model the wastewater generated by the plan change area into the Council reticulated network. This report is contained in Appendix B.

The conclusion of this modelling is that the plan change area be allowed to connect to Council's existing reticulation. The report identifies that 31 possible additional lots can be connected to the existing network.

6.0 WATER SUPPLY

6.1 Existing Infrastructure

There are existing water mains installed at the end of Infinity Drive and Minaret Ridge which are able to be extended to service the plan change area.

6.2 Proposed Water Supply

The plan change area will be serviced by extension of two 100mm diameter watermains. The eastern end will be serviced by extending the recently installed water supply located in Stage 5b of Peninsula Bay off the end of Infinity Drive. The western end will be serviced by extending the water supply located in Minaret Ridge up through Stage 6b of Peninsula Bay which is due for completion in mid-2015. All new water supply pipes will be 100mm diameter.

6.3 Tonkin & Taylor Water Modelling

Tonkin & Taylor were commissioned to model the water supply required for the plan change area. This report is contained in Appendix C.

The conclusion of this modelling is that the plan change area be allowed to connect to Council's existing reticulation. The report identifies that 31 possible additional lots can be connected to the existing network.

7.0 POWER & TELECOMMUNICATIONS

Confirmation of supply of power and telecommunications has been obtained from the suppliers of these services. Written confirmations of supply availability are contained in Appendix D.

Power & Telecommunications will be supplied to the site from existing infrastructure installed within recently completed stages of Peninsula Bay. All cabling will be underground.

Paterson Pitts Group

Mike Botting
Registered Professional Surveyor

APPENDIX A1 – GEOLOGICAL ASSESSMENT REPORT

INFINITY INVESTMENT GROUP: DEVELOPMENT OF THE PENINSULA BAY SUBDIVISION

Geological Assessment of the Site and Surrounds in Relation to the Construction of Roads and Services.

Prepared by: R. Thomson
Geologist
Cromwell

For: Infinity Investment Group Holdings Ltd.
Wanaka

Date: July 2003

Contents

SUMMARY

The subdivision is wholly underlain by ablation till, with a characteristic morainic morphology and a predominantly westerly aspect. Drainage systems are variably west-trending or directed in part to closed basins.

Glacial tills will be heterogeneous, grey, compact silt/sand/gravel mixtures with some boulders expected towards the north. Total thicknesses are unknown. Excavations within the till should encounter dry and free-standing materials but there are potential problems with fills if the utilised tills are particularly fine-grained; follow existing roading practice in the area.

There is no need to undertake a test-pitting exercise to identify deletarious materials along roading and service corridors as there are no identified targets on the site. However, fine-grained infill materials may be present in the depression designated as a sports area, and some subsurface investigations would be desirable here during the early construction phase.

1. INTRODUCTION

Except for the northern fringe, the subdivision has a benign appearance and a paucity of geological exposure across the site. As such, there is some uncertainty about the lithologies which will be encountered along road corridors – particularly in relation to service installation – and it was considered prudent to assess the site geology to pre-empt possible problems with excavations.

This report is the result of a field mapping phase. A second phase of subsurface investigations (test pits) was planned but there are few prospective targets and none in perceived crucial areas. Minor works should be kept in mind, as mentioned below, but these could be more suitably implemented during development.

2. GEOLOGICAL SETTING

2.1 Physiography

Although surface textures are similar in general there are significant morphological difference across the site, such as:

a) Northern Segment. Characterised by:

- irregular, mounded terrain. Crestal elevations in excess of RL 330.
- poorly developed drainage systems, most channels of which lead into two closed depressions (Photos 1, 6, part 8).
- a precipitous boundary to the north.

b) Central Segment. Characterised by:

- closely spaced, NS-trending ridges that tend slightly arcuate. (Photos 1, 8).
- a progressive elevation drop to the west.
- poorly developed drainage systems.

c) Southern Segment. Characterised by:

- a stepped elevation drop to the west.

- moderately developed, incised, ephemeral drainage channels that trend west.

2.2 Glacial History and Lake Wanaka Evolution

The last two of a large number of glacial advances that have overridden the site left morainic deposits that can be subjectively differentiated by a variety of features and means. In the interest area, they are (Figure 1):

a) an assessed 23,000 year old event, termed the Mt. Iron Advance that, almost reached Albert Town and the Cardrona River (present location) around the flanks of Mt. Iron.

   The ablation moraine forms the higher terrain at and beyond the eastern subdivision boundary.

b) an assessed 18,000 year old event, termed the Hawea Advance, which abutted (locally) against the inside of the more proud fringe area of the older moraine. Characteristic landforms are fresh.

Between the advances there would have been a proto Lake Wanaka, similar to the present water body, that would have been infilled with lake sediment then river alluvium as the Hawea Glacier advanced. Deposits from such a genesis are exposed along the steep slopes at the north end of the subdivision and have been modelled as extending beneath it, as shown on the Figure 2b cross sections.

When the Hawea Glacier melted the present Lake Wanaka formed in the cavity. Its level was controlled by aggradational deposits at and downstream from the present outlet and the various beach remnants (Figure 1) suggest it had an initial surface elevation at about RL 300. As the Clutha River incised into the outwash alluvium along an extended reach of its channel the lake level progressively dropped to its present position (i.e. nominal RL 279 m).

2.3 Rock Types

Schist has not been located in the vicinity of the subdivision but it is extensively exposed at Mt. Iron to the south-east (Figure 1). The depth to schist bedrock at the site is unknown.

Glacial moraines formed by the youngest two advances are present in the area but only that deposited by the Hawea Advance has site pertinence. (Note the term "moraine" is used here as a landform while glacial "till" refers to the deposit.)

Interglacial lake sediment outcrops near the north-east corner of the subdivision and just west of the Penrith development area (Figure 2a). Slightly younger, but effectively associated river alluvium is exposed at the former location.

Loess is present as a cover bed within the subdivision but it is anomalously thin and is expected to have no significant influence on site construction.

2.4 Groundwater

There are no obvious seepages on or peripheral to the subdivision and it is interpreted that the water table will be low, perhaps controlled by lake level and extending back from the shoreline at a low gradient. No attempt has been made to model the groundwater regime on the cross sections.

3. SUBDIVISION GEOLOGY

3.1 Morainic Morphology and Surface Outcrops

Glacial landforms, produced during the wasting phase, wholly pervade the subdivision. As previously described, they have varying morphological styles, elevations and surface aspects.

Glacial till outcrops within the subdivision are small and widespread, as indicated on Figure 2. They are sufficient to suggest, however, that the till will be a heterogeneous mixture of gravely detritus in a grey, silt/sand matrix. While it is compact the till is not expected to be particularly hard as the moraines in this situation are ablation types i.e. accumulated near the surface as the ice progressively melted. There is insufficient exposure to determine gross till textures, such as banding or any suggestion deposition has been in a water body of significance, but road batters at the south end of Kirimoko Crescent (700 m south of Peninsula Bay) display features considered as typifying the tills in the subdivision. With reference to Photos 9 a/b and 10 a/b, relevant comment includes:

a) There is a dominance of gravel clasts in a sand/silt matrix.

b) Layering is common but beds are thin and relatively coarse grained. Strong deformation is evident as meltout of underlying ice caused collapse of the transient, surface deposits. On a large scale the till is heterogeneous.

c) No perceived groundwater or slope stability problems; steep batters remain intact.

d) An application to the moraine in the central and southern segments of Peninsula Bay. The ablation till in the northern segment may have some differing textural features (see below).

Along the steep face at the north end of the subdivision there are sporadic till outcrops at different heights. Features of note:

a) There is an upper unit that contains a varying proportion of boulders; evident both in situ and as surface lag detritus. Boulder piles within the northern segment of the subdivision (Photo 6) suggest this anomalously coarse till may extend, perhaps, 300 m south of the cliff face.

In the latter, finer till outcrops intersperse with coarse outcrops at the same level, suggesting bouldery concentrations are discontinuous.

b) At RL 310 approximately there is a persistent, thick (5-6 m?), coarse fluvial unit within the till sequence. It is subhorizontal and has a discontinuous exposure length of approximately 700 m (Fig. 2a).

The fluvial unit suggest multiple phases of glacial advances and retreats.

c) On the lower face below the north boundary mid point the base of the till clearly dips (apparently) to the west (Photo 2) and the till is very firm and compact (Photo 3). Here the till is interpreted as a lodgement deposit, having been overridden by the ice.

e) There are no till exposures attributed to the older Mt. Iron Advance adjacent to the northern boundary.

3.2 Fluvial and Lake Sediment Outcrops

The only exposures of interglacial sediments in the subdivision vicinity are on the face adjoining the north boundary. These are illustrated by Photos 2, 4 and 5 and located on Figure 2a. Of particular note:

a) The fluvioglacial alluvium is fine-grained in outcrop (Photo 4) and has an uncertain relationship to the lake sediments. It is assumed, however, that the alluvium is the younger formation and that the host river incised into the lake sediments in an irregular manner as the glacier advanced.

b) Lake sediments can be seen in outcrop, or can be inferred from detritus, as forming the lower half of the steep face approximately east of the dominant gully. (Figure 2a). The better bedded units comprise sand and silty sand (Photos 5a and 5b) but there are indications of much thicker sand units as well.

Materials are soft and tend to have a low cohesion. As indicated on Figure 2a the formation crest may be as high as RL 300 beneath the north-east corner of the subdivision but contact positions here are a bit uncertain.

3.3 Expected Subsurface Lithologies

As illustrated by the Figure 2b cross sections there is likely to be a variety of geological formations beneath the subdivision, with an increasing level of uncertainty away from the outcrops by the northern boundary. Pertinent comments include:

a) The surface and near-surface lithology is obviously ablation till deposited during the retreat of the Hawea Glacier. At lower levels there should be remnant till deposited by the Mt. Iron Glacier, and sandwiched between the tills will be interglacial deposits of uncertain thickness and extents.

b) Lake sediments should underlie at least the north-east corner of the property (e.g. Cross Section AA') where the crestal elevation will be at about RL 300 and the base has an uncertain morphology. Expect the lake sediments to pinch out to the north-west (stripped by the advancing Hawea Glacier) and any remnants to be at lower elevations. To the south and south-west such remnants should be thin and the upper surface, at RL 300 approximately, will be well below the ground within the subdivision.

c) The fluvial sediment persistence is also speculative. If present beneath much of the subdivision (suggested on the sections) there will be a significant till mantle. In any case, the presence of alluvium at shallow depths should not be an adverse factor as it will be a competent and free-draining lithology.

3.4 Perceived Construction Issues

The geological assessment indicates that a thick deposit of ablation till, deposited by the last intruding glacier, mantles the complete subdivision. In regard to roading construction and service installations it is considered that:

a) The till will be readily excavated and cut batters should be stable. It is noted that most roads are to be aligned on relatively proud terrains so cuts will be low.

b) Fills are expected to be formed from locally derived till. There is no preponderance of silt in the matrix so liquefaction issues should not arise. Large amounts of roading have been formed in recent times in the vicinity of Peninsula Bay without apparent fill problems so site experience in till placement should be followed, with successful outcomes expected.

c) Service trenches should remain open for extended time periods.

d) Groundwater is not expected. Surface flows will occur during storm events but these should be minor.

e) There are two closed depressions that are likely to have some bedded infill of uncertain grading. However, the current layout plan shows the depression to the north as a recreational reserve while that to the south is to be a swimming and sporting complex site and a reserve in part.

While the former depression is essentially issue free, the latter may (potentially) generate foundation problems of a minor nature and must be prone to wetting during major storms.

f) An arterial road from Hunter Crescent is shown as trending to the east up an incised channel in an ephemeral stream. Disruption of the upper tributary channels would be prudent to ensure the lower road section is not within a future stormwater conduit.

4. CONCLUSIONS

a) The Peninsula Bay subdivision occupies an area of glacial moraine that has a varying surface morphology and a generally westerly aspect. Along the north boundary there is a steep drop to the shoreline of Lake Wanaka.

b) Ablation till, of significant but poorly determined thickness, underlies the whole subdivision. Minor exposures on site, and better exposures in peripheral areas, indicate the till will comprise a heterogeneous gravel/sand/silt mixture without any associated water-laid deposits of consequence.

Other lithologies, such as interglacial lake sediments and fluvioglacial alluvium, will underlie the subdivision at depth (below RL 300) in the north-east corner but their subsurface presence elsewhere is speculative.

c) There are no known groundwater seepages and the water table is expected to be well below the ground surface.

d) Road and service corridors should be entirely in till and there should be no excavation or slope integrity problems. Fills, using locally-derived till, should similarly be constructed satisfactorily but local practises should be utilised to suit the slightly variable characteristics that will be encountered.

e) Two closed depressions are present in the northern half of the subdivision. While neither are in key locations there could be fine-grained infill materials and prospective flooding issues during rainstorms.

f) Drainage systems grade in part to closed depressions (e) above) or to the west through the southern segment. Catchments for the latter are small.

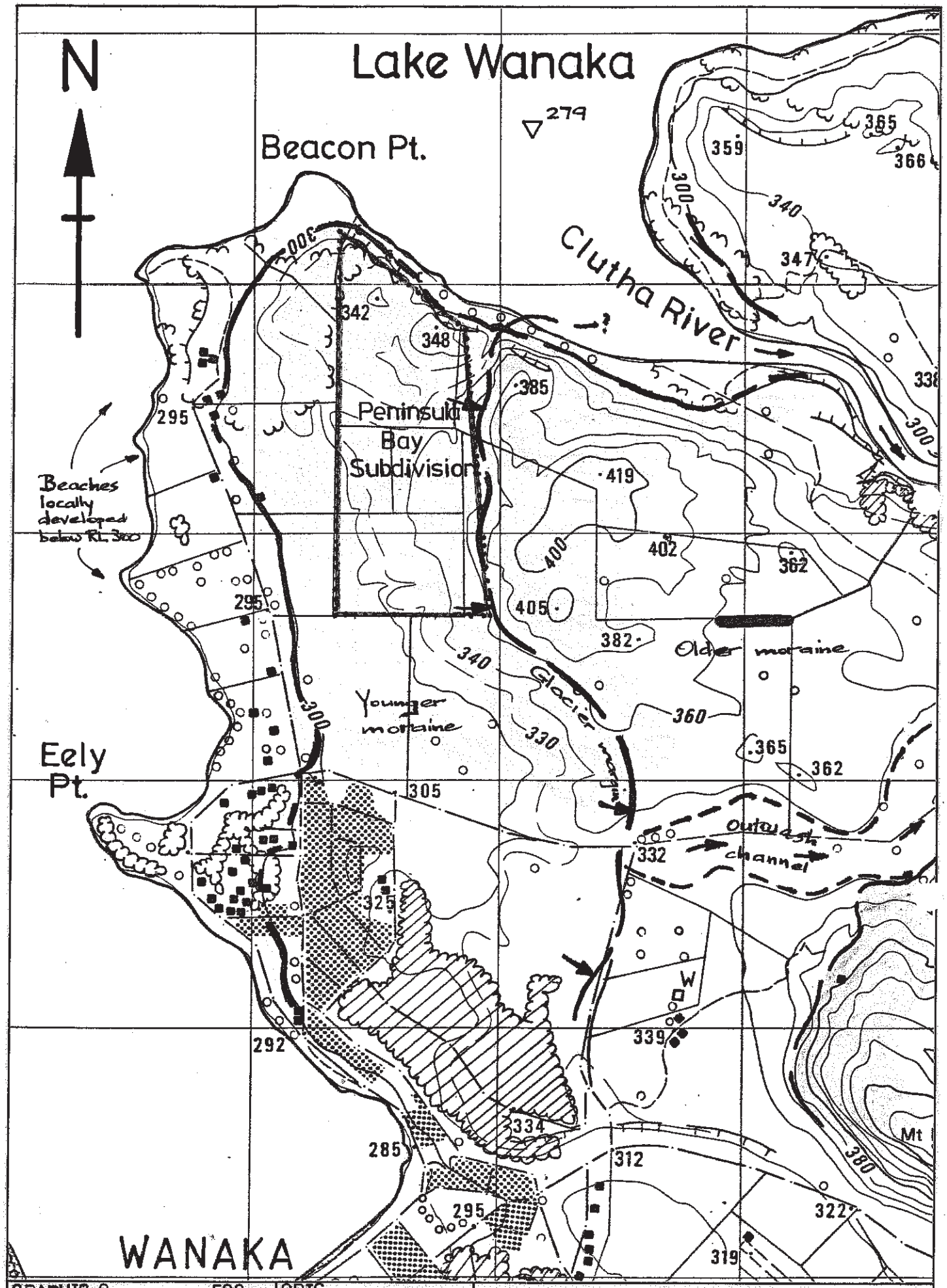
5. RECOMMENDATIONS

a) No test pitting is warranted to investigate potential deletarious materials along road and service corridors, in general.

b) Minor pitting should be undertaken in the more southerly of the two closed depressions to assess the nature of postglacial infill materials where a sports complex is proposed. Pitting to be done during the construction period.

c) A related issue is the mitigation of potential flooding in the depression. The possibility of bunding and rerouting flood channels from the east, and directing basin drainage to ground, should be investigated.

d) Review the alignment of the most southerly arterial road up an incised gully from a flooding perspective.


N
Lake Wanaka
279
Beacon Pt.
Clutha River
Peninsula Bay Subdivision
Beaches locally developed below RL. 300
Younger moraine
Older moraine
Glacier margin
Outwash channel
Eely Pt.
WANAKA
Mt
GRAPHIC SCALE: 0 500 m
EXPLANATION:
Initial lakeshore, L. Wanaka
18,000 yr. glacial advance moraine
23,000 yr (est) " " "
Schist
ORIG. SCALE : 1:20,000
DRAWN: R. Thomson
DATE : July '03
SHEET : 1 of 1
Infinity : Peninsula Bay
Fig.1 Location of Geolog! Features & Subdivisn

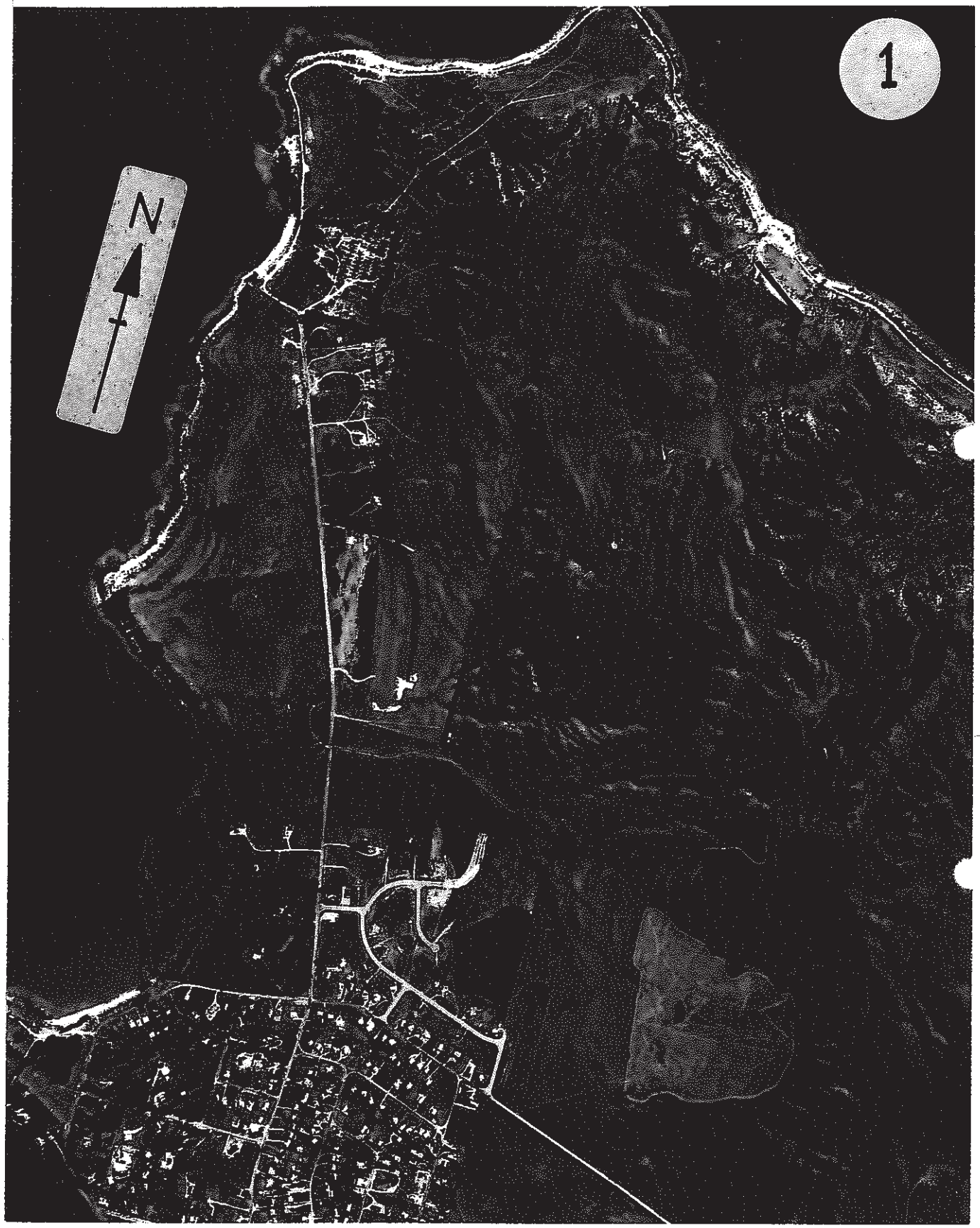
ATTACHMENT

Captions for photos taken on the 13 June 2003

Photo	Description
1	Section of vertical aerial photo taken in March 1974. The moraine with the subdivision (annotated) has amorphous, hummocky morphology in the northern segment but the central segment has a prominent, N-S alignment of morainic ridges reflecting late-stage glacier flow patterns. Note the high level lakeshore left of centre.
2	View of steep, eroded slope at the north end of the subdivision. At right glacial till overlies outwash alluvium; the last advance glacier sole forms the contact. To the left glacial till overlies bedded sand (lake) deposits.
3	Typical hard, compact glacial till at right of Photo 2. Disseminated schist clasts lie within a silt/sand matrix.
4	Fluvioglacial alluvium beneath the till. Here it is a uniform sandy gravel with rare, small boulders.
5a, b	Lake sediments just above HWL of the lake. Photo 5b at top right of Photo 5a. A horizontally bedded sequence of sand, silty sand, and sandy silt deposited in a lake assumed to have formed after the second last advance.
6	Looking south across Peninsula Bay subdivision. The morainic terrain is very pronounced. Of particular interest is a closed depression at bottom centre; it may have some fine sediments in the floor transported by small tributaries over time.
7	Profile of the southern segment of the subdivision. The hummocky terrain is less pronounced than that in Photo 6.
8	View to the north-west across central and northern segments of the subdivision. At left are the north-south-aligned morainic ridges obvious in Photo 1. Hummocks are more pronounced at centre and right where closed depressions remain.

9a, b, 10a, b General and close views of typical glacial till in road batters at southern end of Kirimoko Crescent, approximately 700 m south-east of the subdivision.
It is considered that the glacial till within the hummocks on the subdivision are similar in general to silt/sand/gravel mixtures displayed in the photos; i.e. compact, heterogeneous deposits that are not expected to be problematical in road corridors or service excavations.

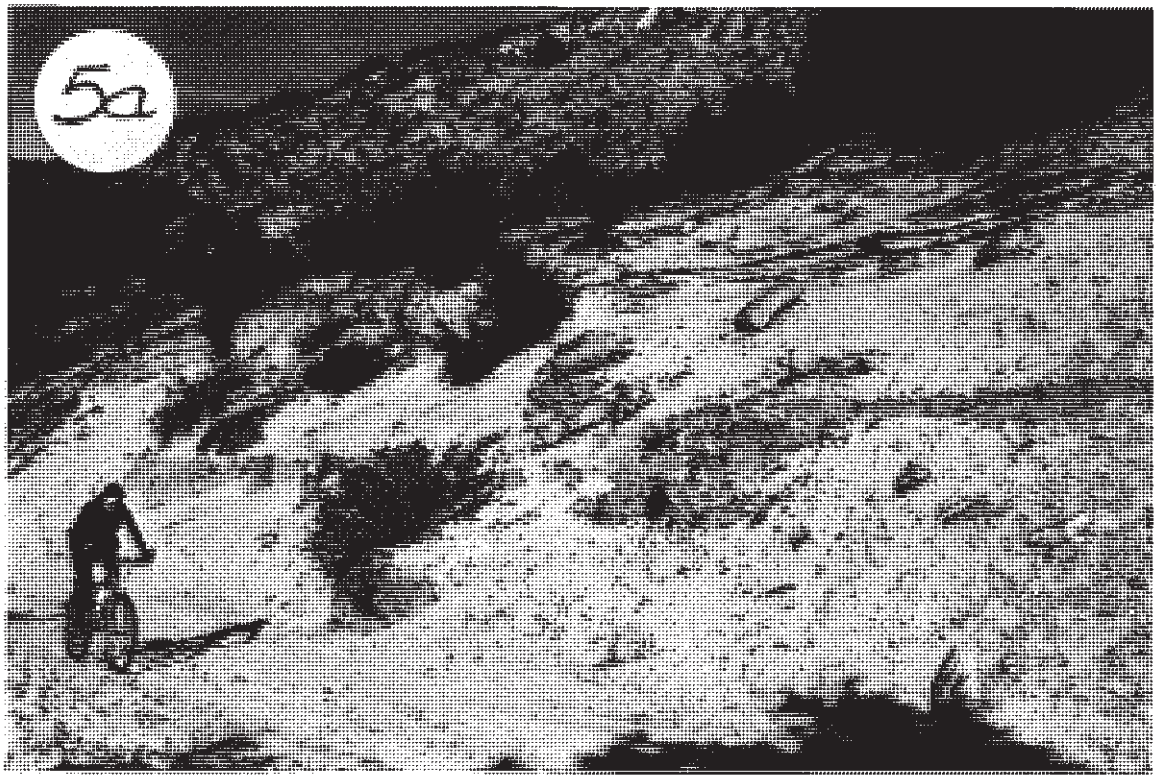
1

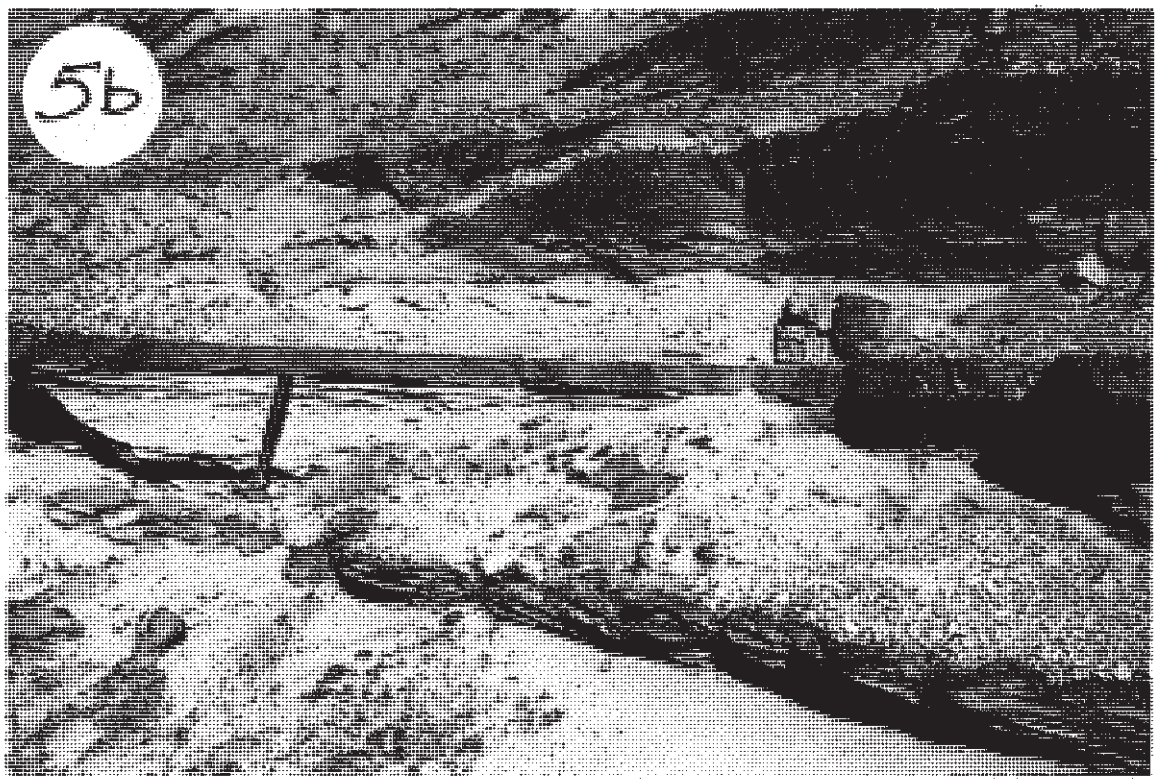

1
N


2

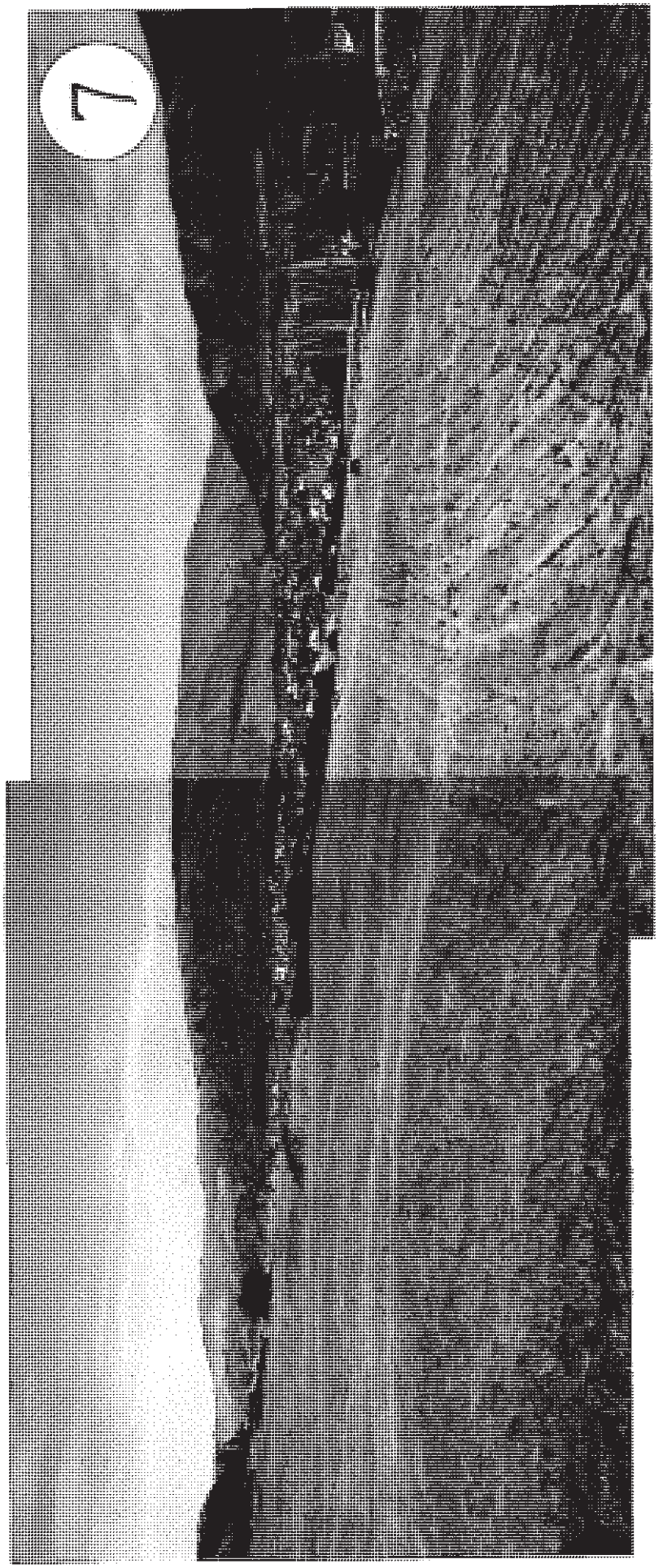

3


4

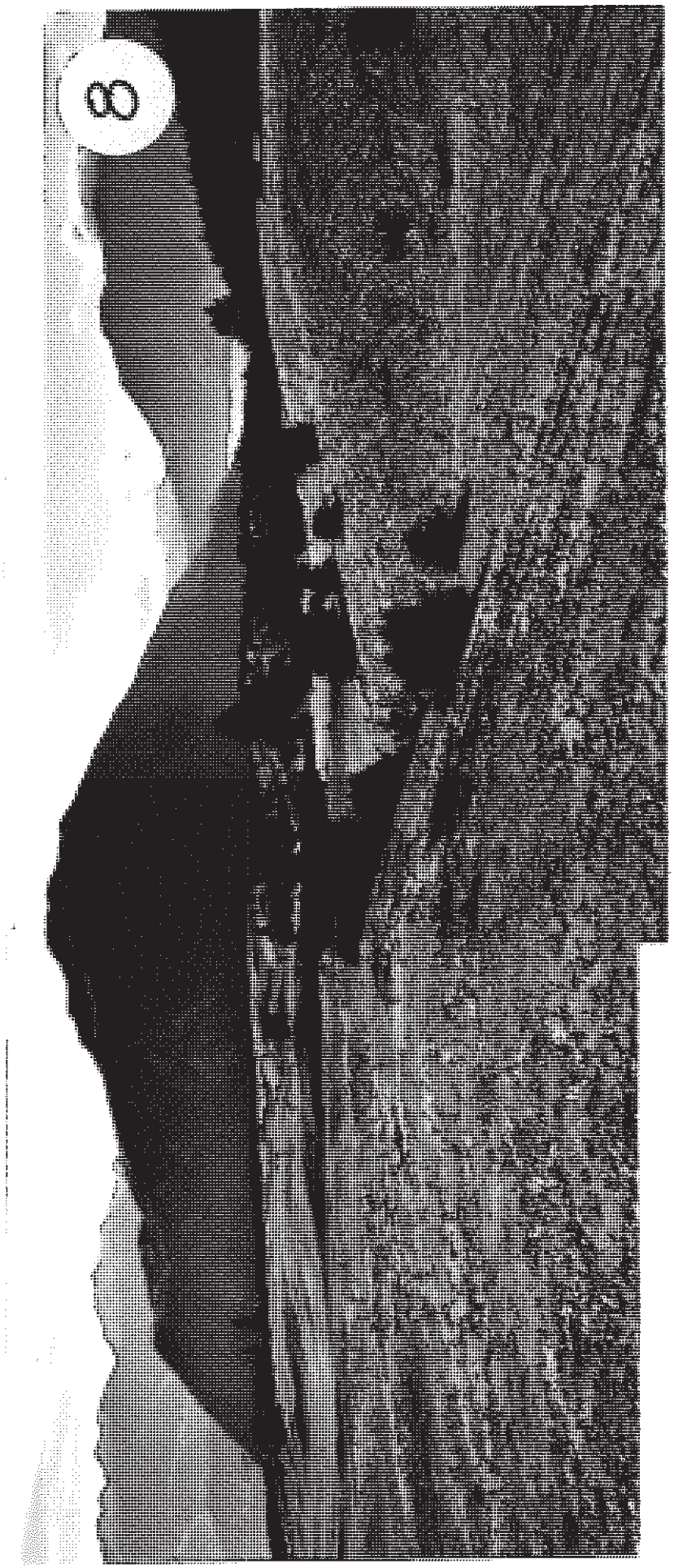

5a


5b

Fold out

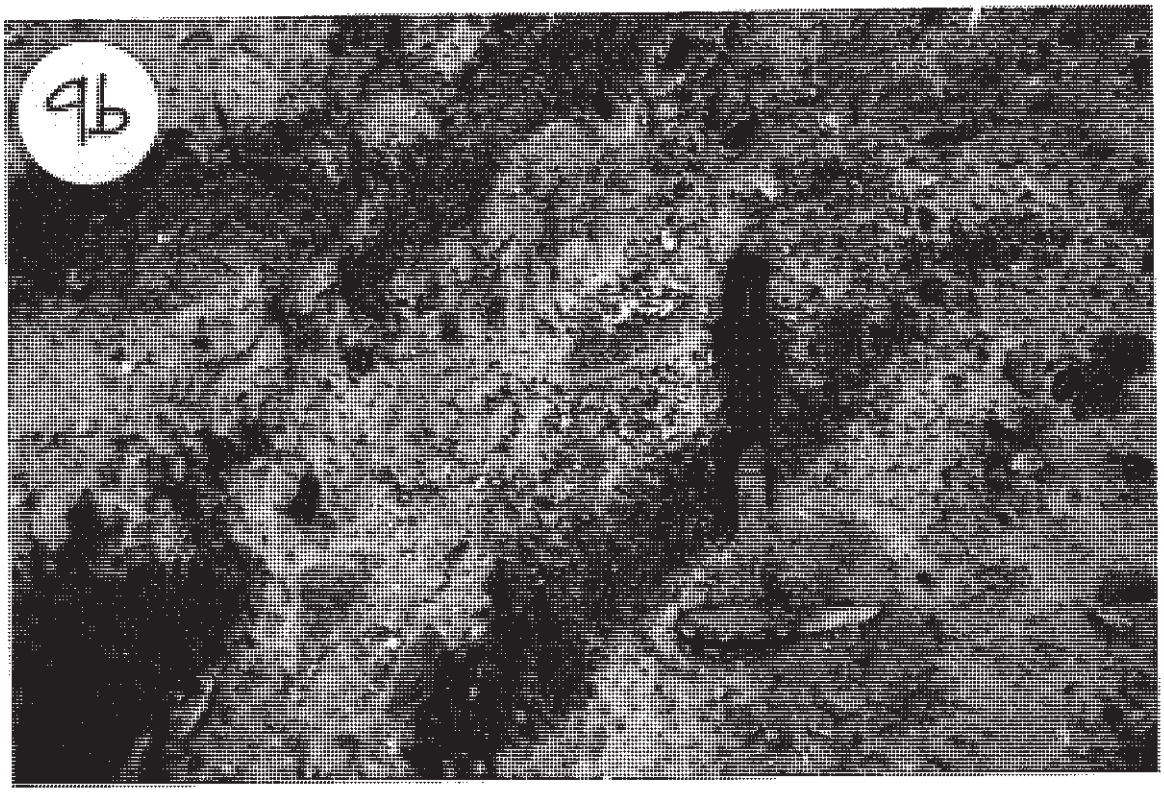


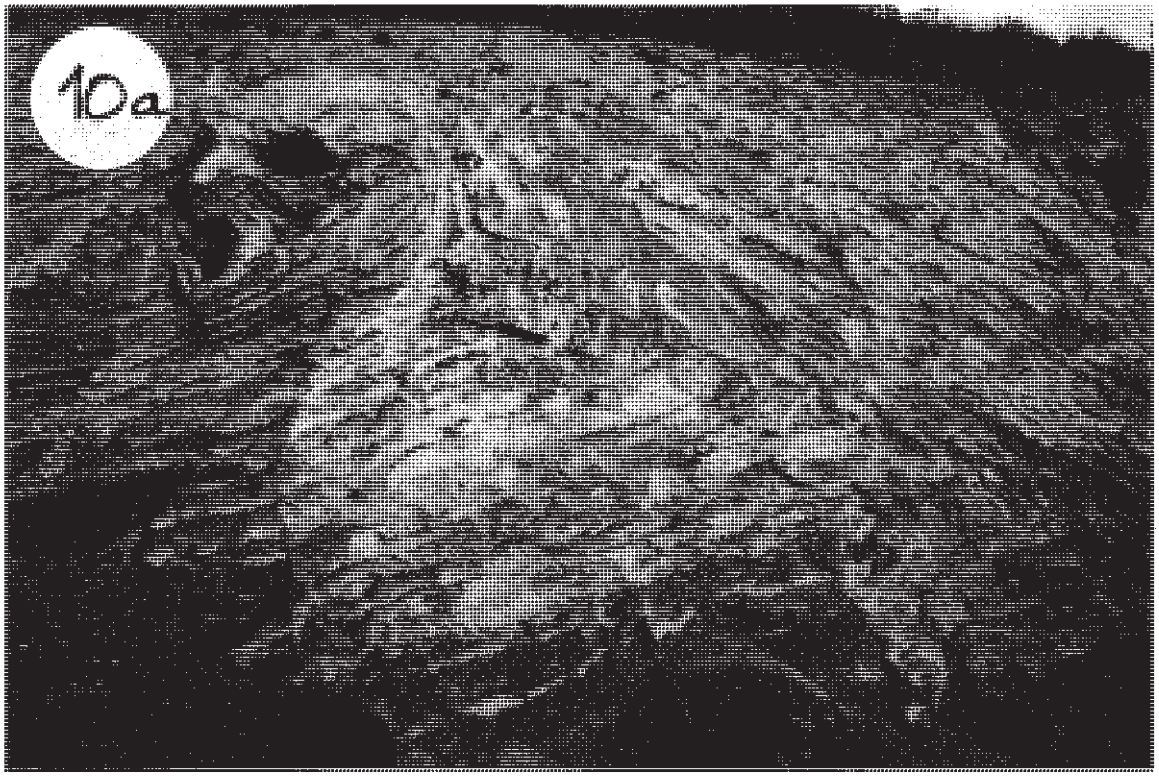
Fold out



Fold out


9a


9b


10a


10b

APPENDIX A2 – PRLIMINARY EARTHWORKS PLAN

NOTES

1. The contractor shall be responsible for locating all existing services prior to commencement of works. The contractor shall make good at their own expense any damage to existing services

2. Levels are in terms of Dunedin Vertical Datum 1958

3. All works are to be installed as per NZS 4404:2004 and QLDC amendments to those standards. Standard drawings are available from the Engineer

4. Contours at 1.0m Interval

LEGEND

CUT
- 3.0m +
- 2.5m to 3.0m
- 2.0m to 2.5m
- 1.5m to 2.0m
- 1.0m to 1.5m
- 0.5m to 1.0m
- 0.2m to 0.5m
- 0.0m to 0.2m

FILL
- 0.0m to 0.2m
- 0.2m to 0.5m
- 0.5m to 1.0m
- 1.0m to 1.5m
- 1.5m to 2.0m
- 2.0m to 2.5m
- 2.5m to 3.0m
- 3.0m +

Depth Contours (at 0.5m Intervals)

AA Section Views

Lot Boundaries

PATERSONPITTSGROUP
Surveying • Planning • Engineering
Your Land Professionals
www.ppgroup.co.nz
0800 PPGROUP

WANAKA
19 Reece Crescent
or P.O. Box 283
Wanaka 9343
T 03 443 0110
E wanaka@ppgroup.co.nz

Client & Location:

Infinity Investments
Peninsula Bay
North

Purpose & Drawing Title:

Engineering Drawings
Earthworks Cut Fill
Plan

Surveyed by:	-	Original Size:	Scale:
Designed by:	PGS	A1	1:800 @ A3
Drawn by:	PGS		DO NOT SCALE
Checked by:	MJB		
Approved by:	MJB		
Job No: W4332		Sheet No: 201	Revision No: A
			Date Created: 19/07/2015

L:\DATA\4300\4332\ACAD\NORTH END OF PEN BAY\EARTHWORKS\W4332_150714_PENINSULA BAY

APPENDIX B – WASTE WATER MODELLING REPORT

12 January 2015

Queenstown Lakes District Council

Private Bag 50072

Queenstown 9348

ATTENTION: Myles Lind

Dear Myles

Re: Peninsula Bay Development, Wanaka

As outlined in your e-mail dated 8 December 2014 our wastewater modelling report has been prepared for the proposed additional units for the Peninsula Bay development in Wanaka. This report is based on the Wanaka dynamic wastewater model (2011), calibrated to flow data from December 2010 and January 2011. The approximate location of the development is outlined in orange in the map below.

The objective of this work is to determine if the wastewater network has sufficient capacity with the addition of this development.

It is noted that we previously completed a report for this development on 18 September 2006 assuming a completed development of 340 residential properties. We have completed this investigation based on the completed development potentially containing the following loads:

Load Type	Units	Total Units	Load / Unit / Day (l/d)	PDWF (l/d)	Approx Peaking Factor	Rainfall Catchment Area (Ha)
Residential	Units	365	660	240,900	2.1	N/A

5 Arrow Lane | PO Box 226 | Arrowtown | New Zealand
+64 3 442 1156 | info@rationale.co.nz | www.rationale.co.nz

All loads have been modelled as per the standard load from the calibrated model. No additional rainfall catchment area has been added to the model as this area was previously included in the model.

The topography of the developments defines that loads generated will drain into two existing mains:

1. 26 connections (including 15 possible additional lots) to the north of the development will flow by gravity to connect to SM16026 in Minaret Ridge.

2. 339 connections (including 16 possible additional lots) will flow by gravity through the development and drain via the existing trunk main in Hunter Crescent.

Modelling Standard

The model has been run to the following standard, as is currently agreed with Council:

- 2012 peak day population sanitary loadings and diurnal patterns.
    - Residential load, 660 l/d/dwelling, approximate peaking factor of 2.1
    - Accommodation load, 370 l/d/unit, approximate peaking factor of 1.7
    - Commercial load, 150 l/d/connection, approximate peaking factor of 1.2
- 20 year return, 12 Hr duration storm.

The relevant sections of the network have been checked for capacity using the following criteria:

- No overflows allowed at any network element.
- No pump station overflows based on the duty pump capacity.

Lakeside Pump Station 1 has recently undergone a pump upgrade as it was approaching capacity. This upgrade is assumed to be completed for this exercise. The performance curve for the upgraded pump has been used in the model for this scenario achieves a pump flow of 73.7 l/s.

Results – SM16026 to Waimana Place Pump Station

- There are no related network elements overflowing.
- The Waimana Place Pump Station inflow does exceed outflow but does not result in an overflow. This is based on a single duty pump capacity of 11 l/s and a total storage volume of 31.1 m^3, including the inline emergency storage volume. It is noted that the pump operating points for this pump station results in a small part of the inline emergency storage being utilised for each pump run. This effect can be seen in the inflow plot as the inflow increases during a pump run as the volume stored enters the wet well.

Results – Waimana Place and Hunter Crescent to Lakeside Pump Station 1

- Waimana Place to Lakeside Pump Station 1, there are no related network elements overflowing.
- Hunter Crescent to Lakeside Pump Station 1, there are no related network elements overflowing.
- The Lakeside Pump Station inflow does not exceed outflow at any time. This is based on a single duty pump capacity of 73.7 l/s and a total storage volume of 48.5 m^3. The large flow achieved by the upgraded pump and the relatively small operating volume have also resulted in short pump runs.

Results – Lakeside Pump Station 1 to Dungarvon Pump Station 1

- There are no related network elements overflowing. However it is noted that in a significant number of pipe sections the flow is indicated to be in excess of the pipe full running capacity. Currently surcharging of the

manholes is creating the extra head required for the flow to pass without an overflow occurring. See Figure 7 for surcharging locations.

- Dungarvon Pump Station 1 inflow does not exceed outflow at any time. This is based on a single duty pump capacity of 150l/s and a total storage volume of 101.2m^3.

Results – Dungarvon Pump Station 1 to Riverbank Road Pump Station

- There are no related network elements overflowing.

- Riverbank Road Pump Station inflow does not exceed outflow. This is based on a single duty pump capacity of 250l/s and a total storage volume of 141.8m^3.

Results – Riverbank Road Pump Station to Albert Town – Hawea Road Pump Station 2

- Albert Town – Hawea Road Pump Station 2 inflow does exceed outflow. However this does not result in an overflow. This is based on a single duty pump capacity of 215l/s and a total storage volume of 114.8m^3.

It should be noted that the reticulation between Riverbank Road Pump Station and Albert Town – Hawea Road Pump Station 2 is a pressure main construction and therefore is not subject to overflow.

Discussion

Modelling of the network from the proposed development through to Dungarvon Pump Station 1 and the downstream network indicates that the existing network has sufficient downstream capacity to handle the addition of this development, based on the above assumptions.

The recent pump upgrade undertaken at Lakeside Pump Station 1 has reduced the short term risk of overflow due to the pump capacity. However, due to the small operating volume available at the pump station, this has resulted in pump runs of less than 2 minute duration. The model also indicates that a high number of pump starts are likely to occur, with the model indicating that up to 15 pump runs per hour would be required during this scenario.

This upgrade increases the flow to the downstream network and Dungarvon Pump Station 1. The model indicates that there is significant surcharging in the downstream network with a lessening effect as the short pumped volume attenuates to a steady flow. The effect at Dungarvon Pump Station 1 is also minimised by the attenuation that occurs and following the diversion of the Anderson Road catchment away from the Dungarvon Pump Station 1 catchment there is currently sufficient capacity to service this catchment.

Further growth in the Lakeside Pump Station 1 catchment will extend the pump runs and will have the effect of lessening the attenuation which will increase the risk of overflow in the downstream network.

Recommendation

It is our recommendation that the development is allowed to connect. However a long term solution for Lakeside Pump Station 1 should be investigated in the near future in order to manage the risk of overflow in the network downstream from Lakeside Pump Station 1 and to optimise the operation of the network.

Due to the rapid growth occurring in this area, the validity of this letter should be checked any time it is used as supporting evidence in a consent application.

It should be noted that the wastewater model is an attempt to simulate a physical system using hydraulic equations and various assumptions, hence it bears some uncertainty. QLDC's GIS data was used to develop the models and we can offer no guarantee on the accuracy of this information. The sanitary loads, diurnal patterns and infiltration and inflow rates are an approximation of the patterns in the townships which have been agreed with QLDC.

Yours Sincerely,

Mark Baker
Infrastructure Analyst

Tom Lucas
Director / Infrastructure Analyst

Figure 1 – Long Section, SM16026 to Waimana Place Pump Station

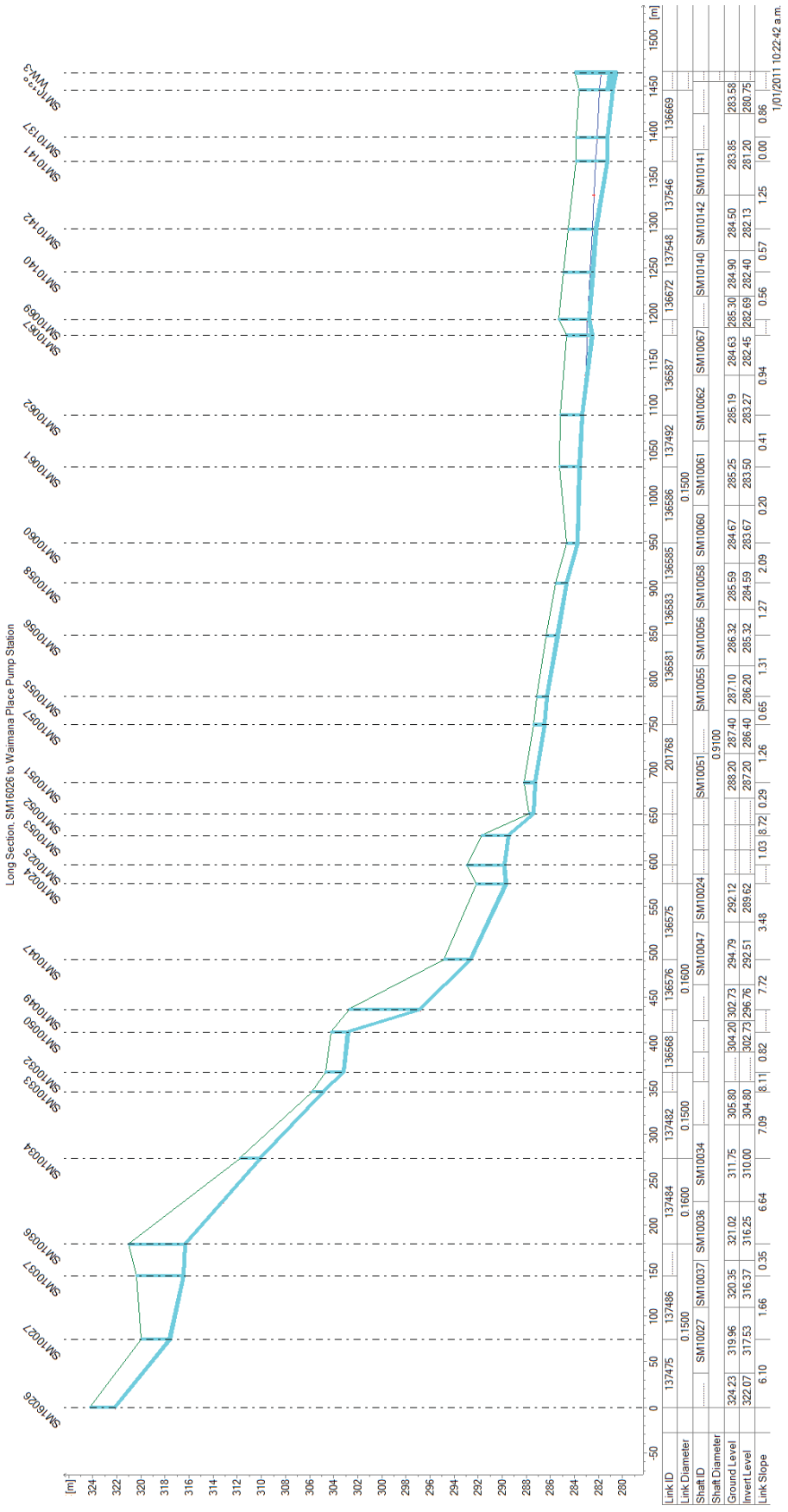


Figure 2 – Waimana Place Pump Station - Inflow / Outflow

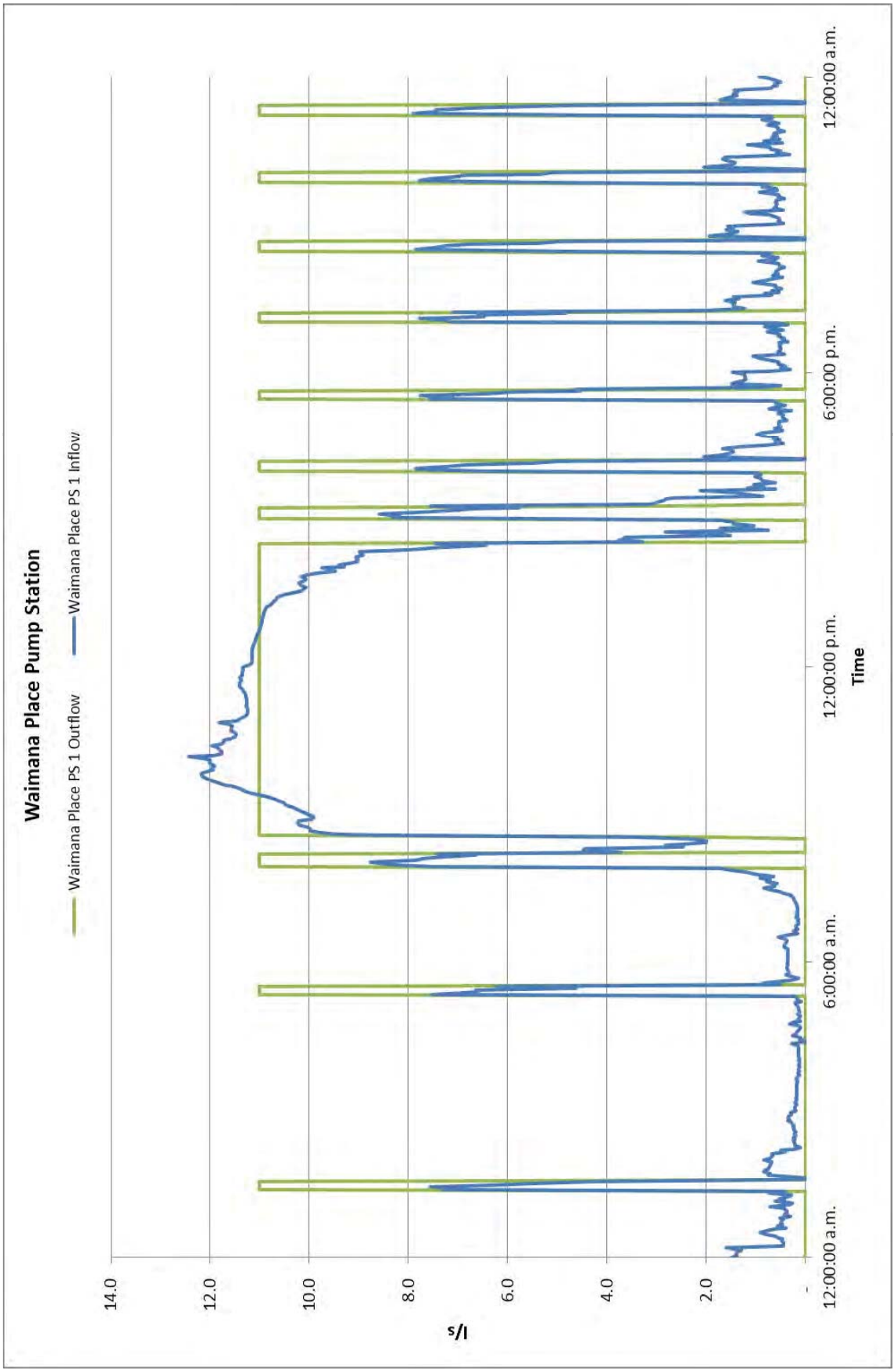


Figure 3 – Long Section, Waimana Place Pump Station to Lakeside Pump Station 1

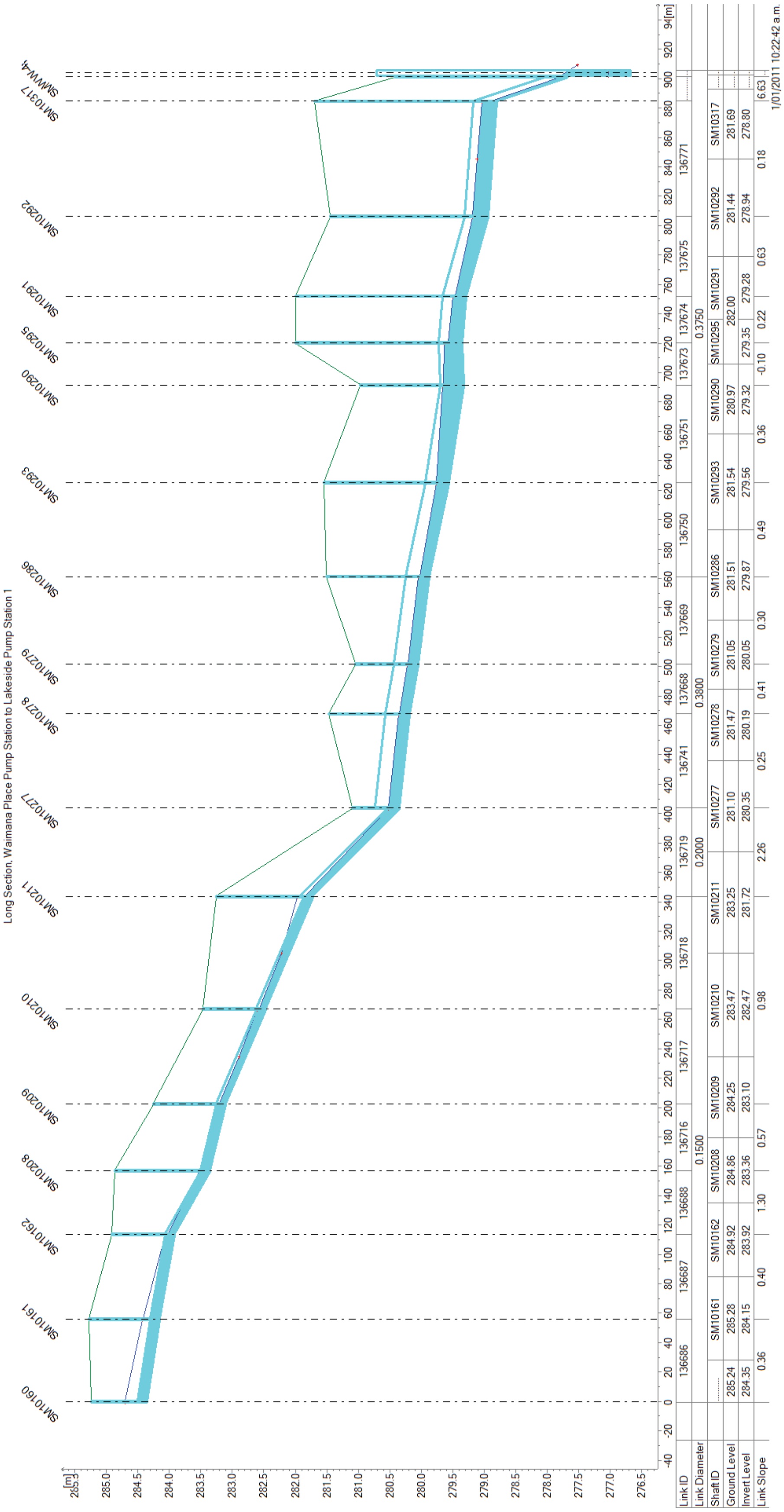


Figure 4 – Long Section, Hunter Crescent to Lakeside Pump Station 1

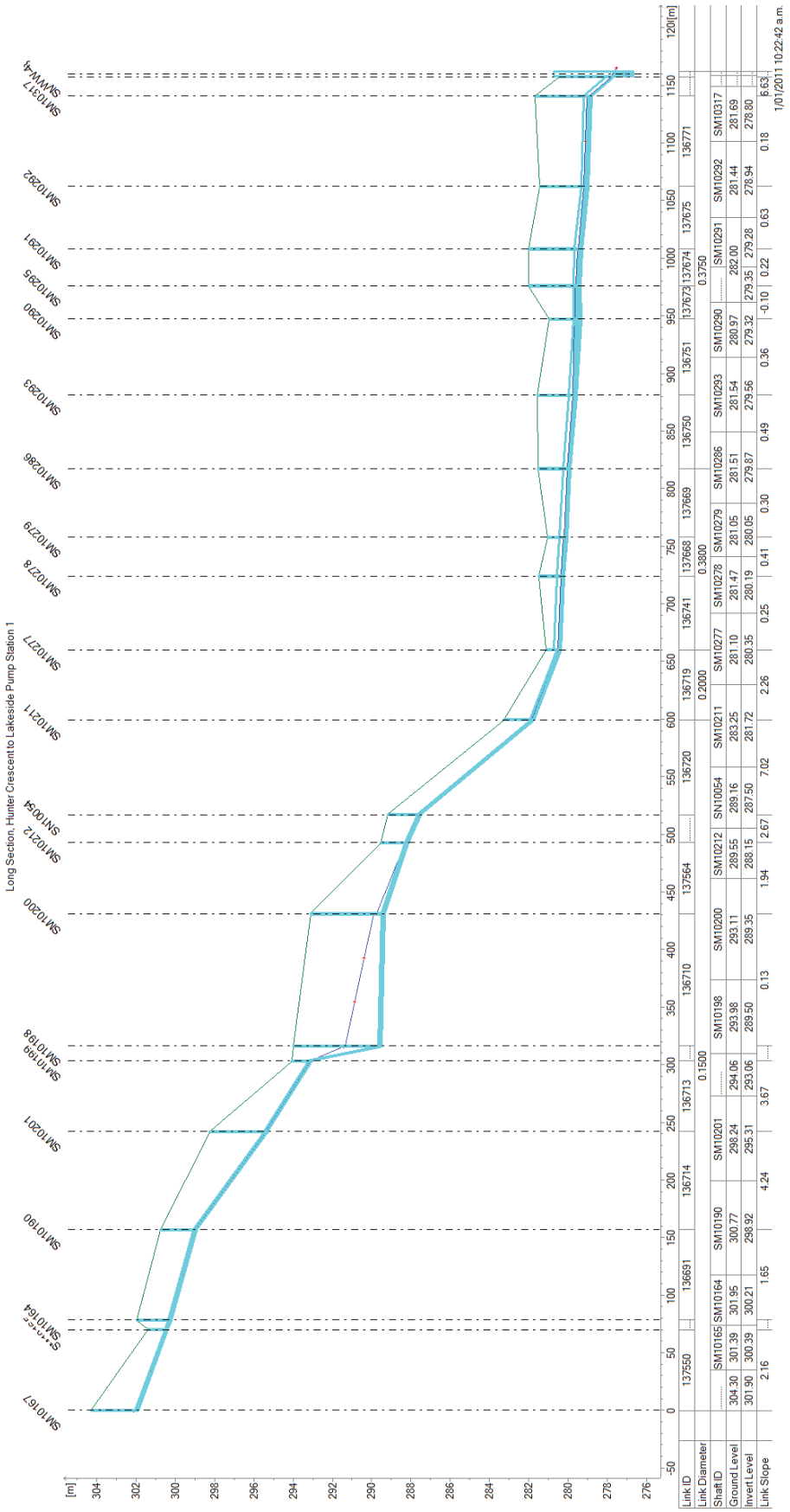


Figure 5 – Lakeside Pump Station 1 Inflow / Outflow

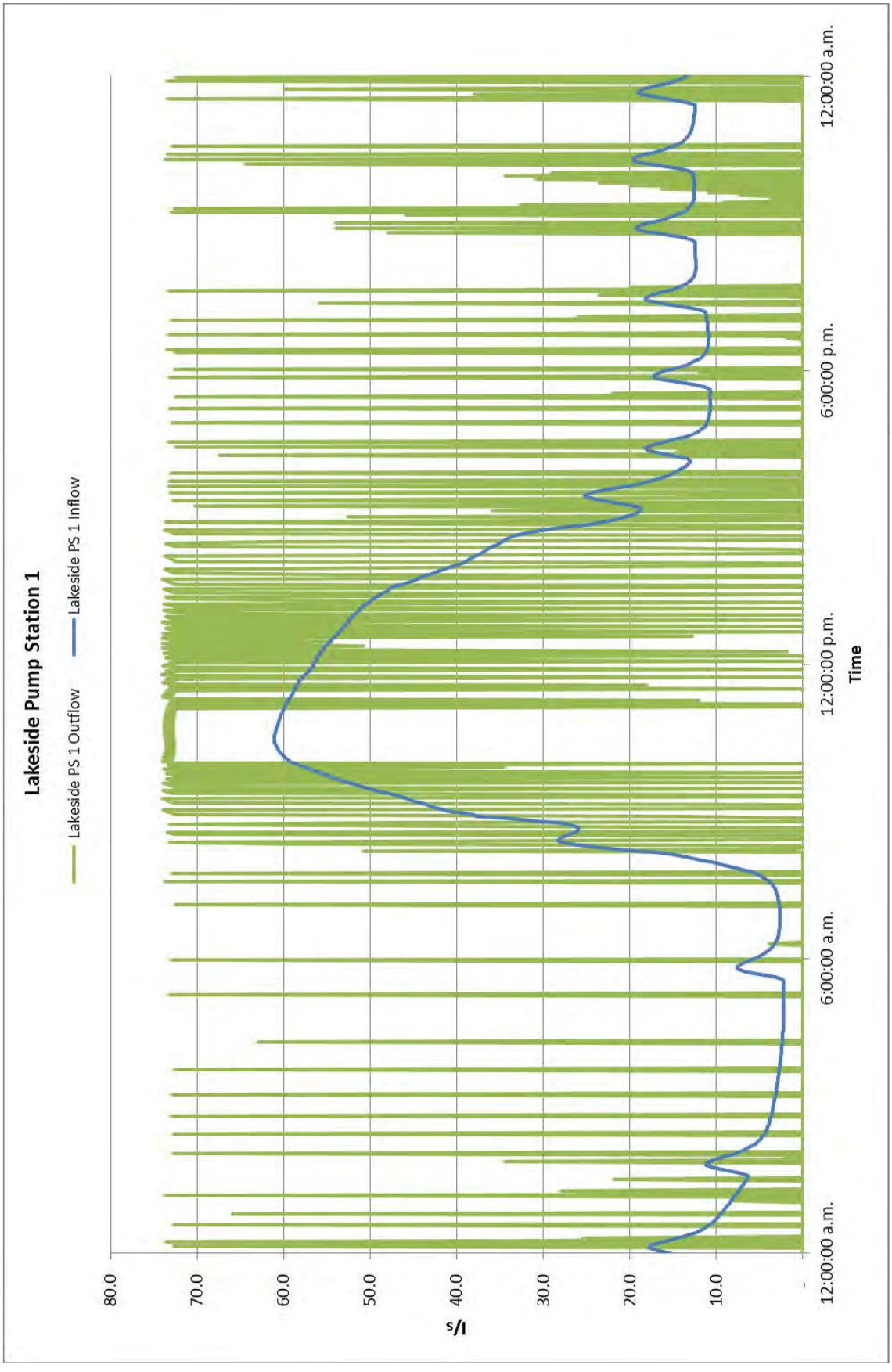


Figure 6 – Long Section, Lakeside Pump Station 1 to Dungarvon Pump Station 1

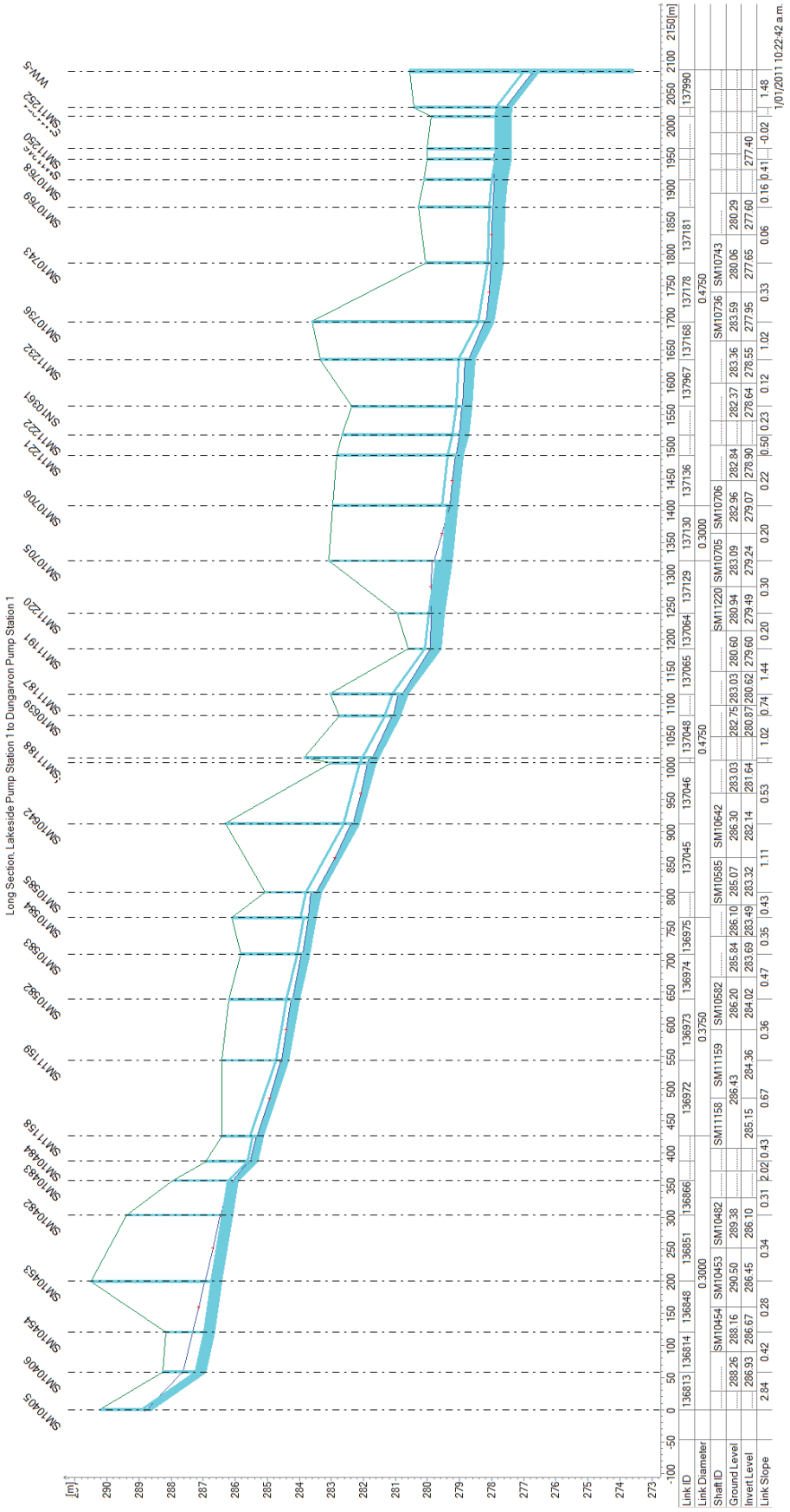


Figure 7 – Map, Lakeside Pump Station 1 to Dungarvon Pump Station 1 Flow / Capacity Ratio

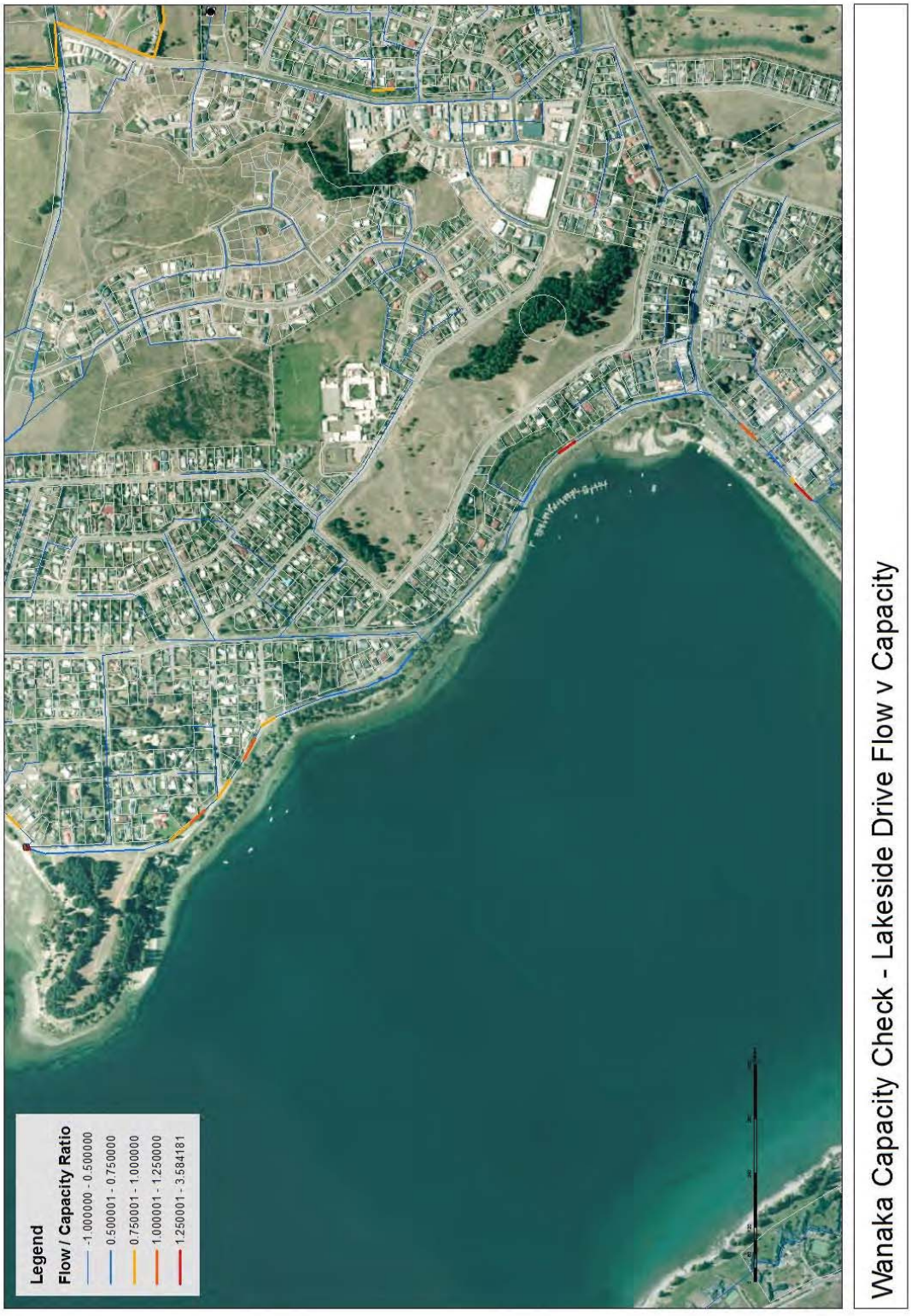


Figure 8 – Dungarvon Pump Station 1 Inflow / Outflow

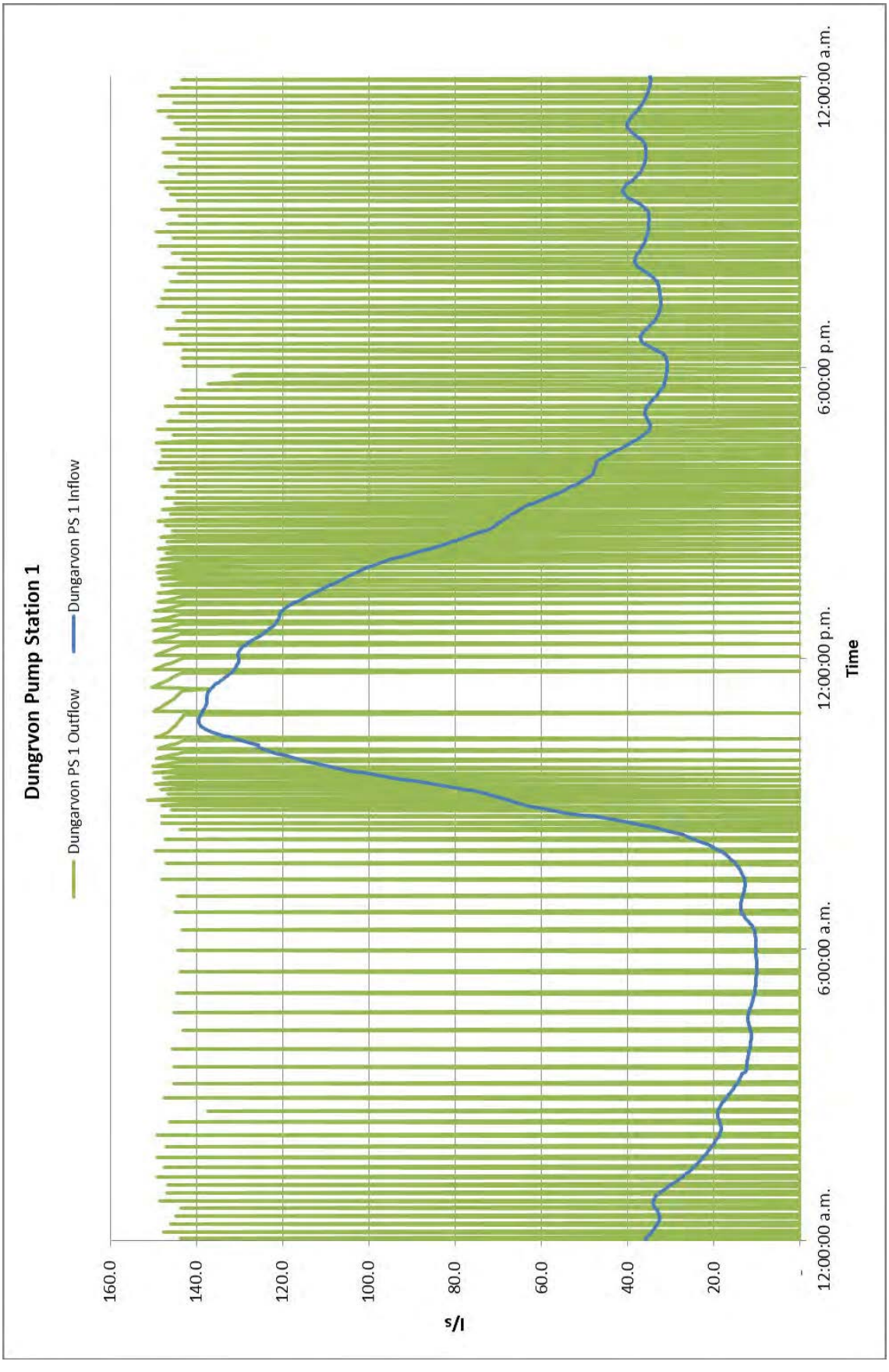


Figure 9 – Long Section, Dungarvon Pump Station 2 to Riverbank Road Pump Station

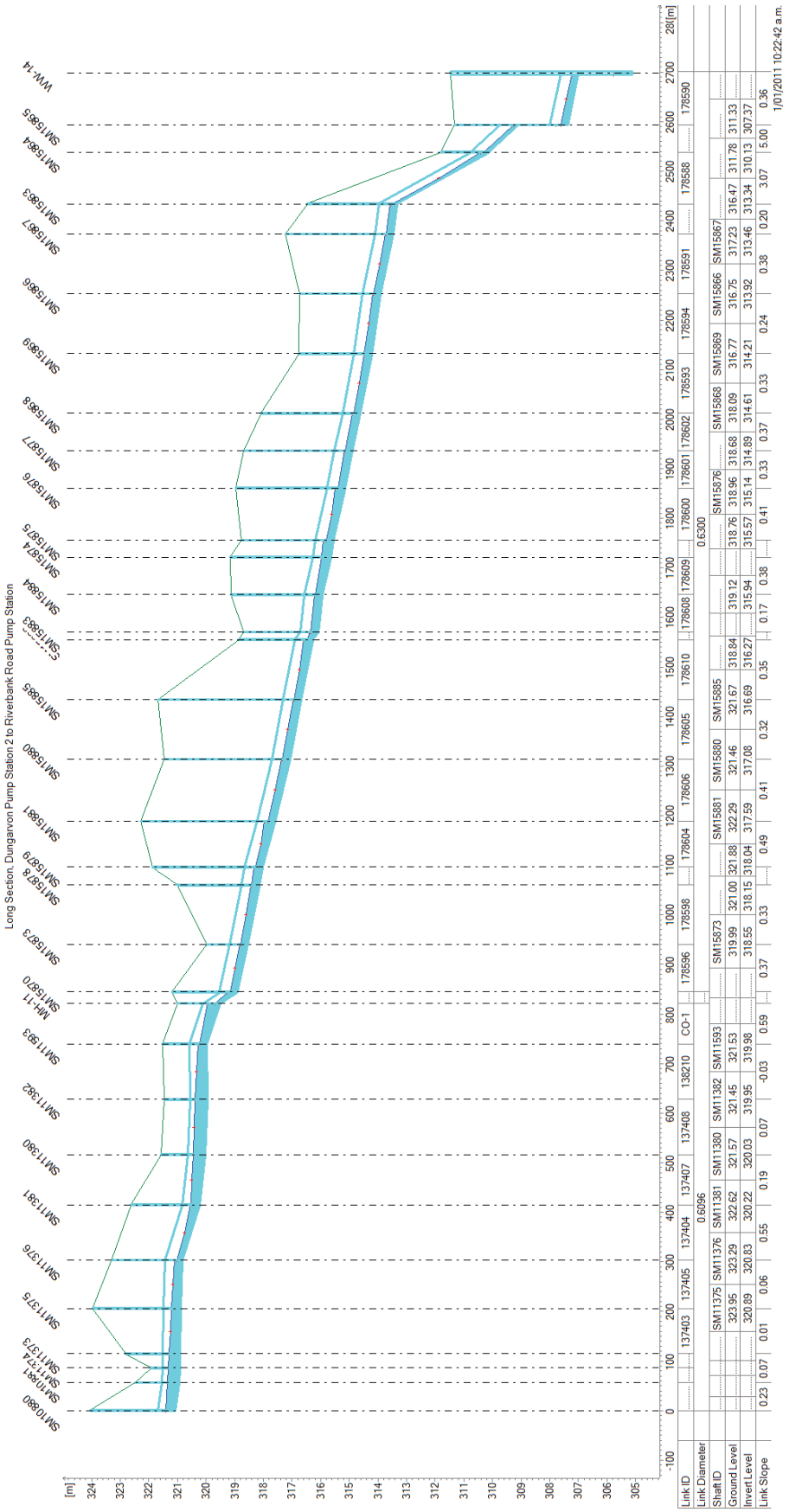


Figure 10 – Riverbank Road Pump Station Inflow / Outflow

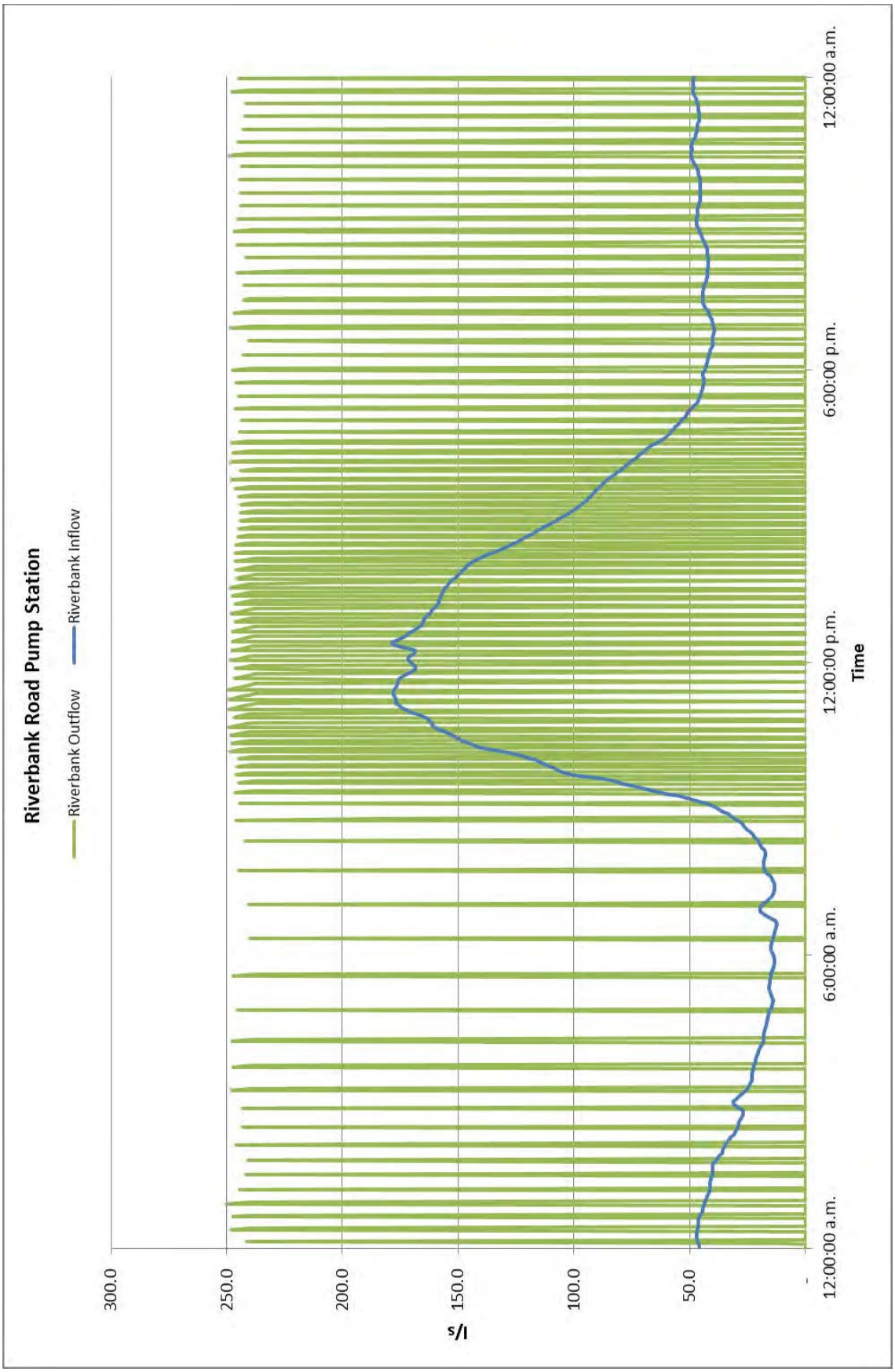
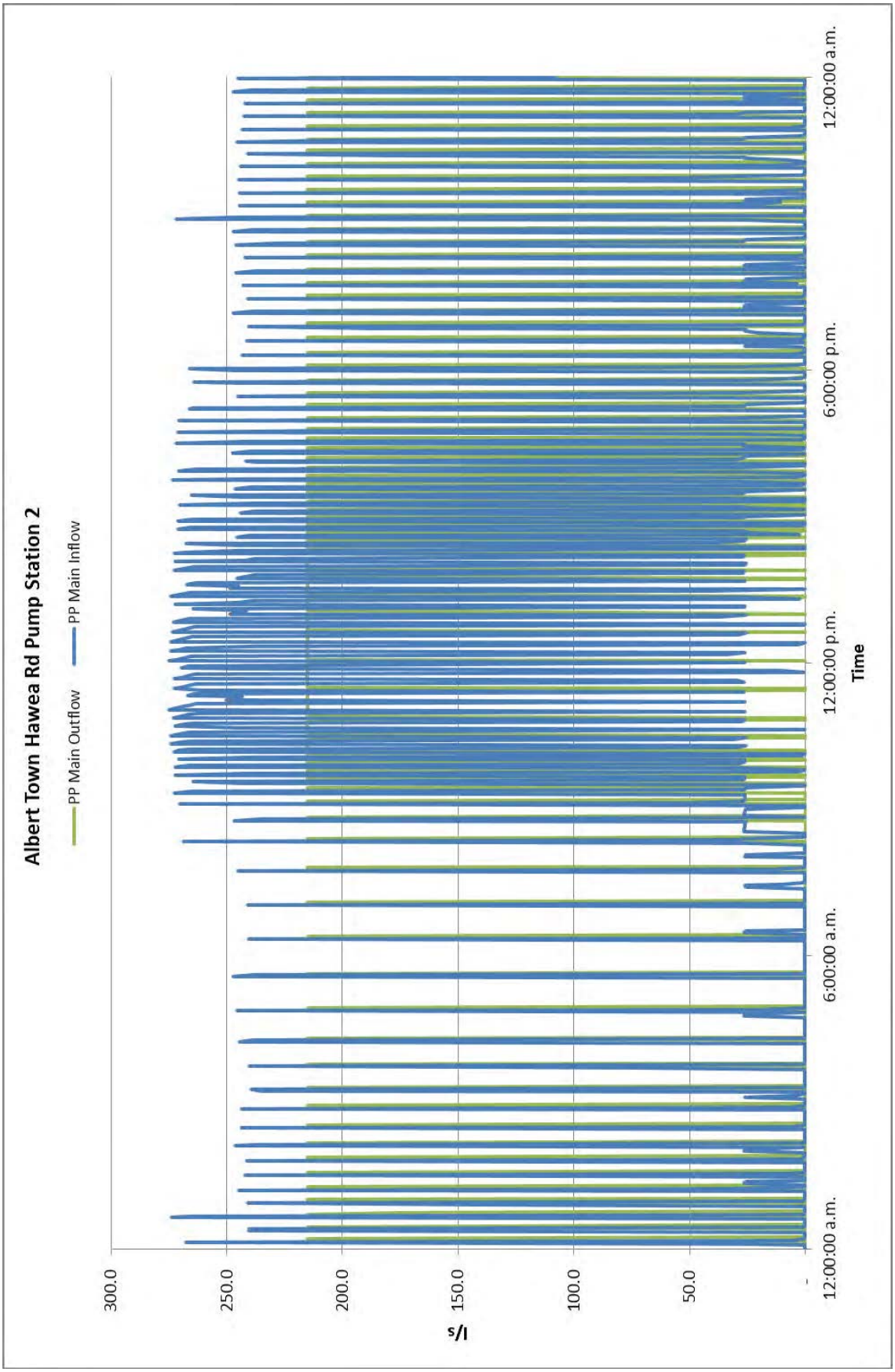


Figure 11 – Albert Town / Lake Hawea Road Pump Station 2 Inflow / Outflow



APPENDIX C – WATER MODELLING REPORT

Tonkin & Taylor

T&T Ref: 51556.027
05 February 2015

Queenstown Lakes District Council
Private Bag 50072
Queenstown 9348

Attention: Myles Lind

Dear Myles

Results of water modelling re-run for proposed additional 31 lots of Peninsula Bay development, Wanaka

Following your email received 11 December 2014**,** and in accordance with your request and our conditions of engagement, we have run our Wanaka water supply model to check the levels of service for the proposed development at Peninsula Bay, Wanaka. This work was undertaken for Queenstown Lakes District Council (QLDC) as our client.

The most recent water supply modelling for the Peninsula Bay development prior to this work was undertaken in 2011. The modelling presented in this report proceeded on the basis of an additional 31 lots to the north of the development, as detailed in the drawing provided by you (PPP Dwg W4332, titled "Plan of Water catchments", Dated 3/12/2014), modelling a total of 365 residential dwellings in the proposed development.

Modelling methodology

Modelling was undertaken using the current partially calibrated Wanaka water supply model and the design peak day demand scenario. The modelled demand scenarios used to determine levels of service for the development and the potential effects on the Wanaka water supply network were:

- Average flow on peak day demand - To determine whether available fire flows meet fire fighting requirements [1], and
- Peak hour demand on peak day - To determine whether minimum residual pressures at each connection are ≥ 300 kPa [2]

[1] Fire flow requirements are in accordance with SNZ PAS 4509:2008, "*New Zealand Fire Service Fire Fighting Water Supplies Code of Practice*".

Tonkin & Taylor Ltd - Environmental and Engineering Consultants, 33 Parkhouse Rd, Wigram, Christchurch, New Zealand
PO Box 13-055, Christchurch, Ph: 64-3-363 2440, Fax: 64-3-363 2441, Email: chch@tonkin.co.nz, Website: www.tonkin.co.nz

Development setting

The proposed development is in Beacon Point pressure zone which is supplied from the Beacon Point reservoir via the 300 mm main along Rata Street. The Wanaka water supply network near the proposed development is shown in Figure 1, attached.

Due to the unknown layout of the reticulation for the proposed 31 lots, the water supply network adopted consisted of two additional 100 mm diameter mains connected to Infinity Dr (see Figure 2, attached). The length of pipe to the proposed 16 dwellings and proposed 15 dwellings from Infinity Drive have been modelled to ensure that firefighting hydrant location requirements can be met for all dwellings (2 hydrants providing 12.5 l/s at 135 m and 270 m from any dwelling for FW2). Fire flow availability for the two catchment areas was assessed based on a hydrant at the end of each main.

Due to contour information within Catchment A being unavailable, modelling proceeded on the basis of the highest dwelling platform at approximately 340 mRL. Contour data has been used when modelling the dwelling platform elevations in Catchment B.

Demands

The average daily flow (ADF) demand was calculated assuming an average population of 3 people per residential dwelling and an average daily water consumption of 700 litres per person per day, as per Queenstown Lakes District Council requirements. Development demands during the peak day and peak hour demand scenarios were calculated as follows

- Peak day flow (PDF) = 3.3 x ADF
- Peak hour flow (PHF) = 6.6 x ADF

Table 1 Design demands for Peninsula Bay Development

Development	Number of dwellings	Average daily flow (ADF)		Peak day flow (PDF)		Peak hour flow (PHF)	
		m^3/day	*l/sec*	*m^3/day*	*l/sec*	*m^3/hour*	*l/sec*
Peninsula Bay	15	32	0.4	104	1.2	9	2.4
	16	34	0.4	111	1.3	9	2.6
	334	701	8.1	2315	28.6	191	53.6
Total	365	767	8.9	2531	29.3	211	58.6

We have added the demand of the proposed 334 consented lots, and 31 additional lots (total of 365 lots) into the current Mike Urban PDF EPS network analysis model for Wanaka. Demands were entered into the model at the 10 nodes outlined in Table 2 below. The node locations are as shown in Figure 2, attached.

[2] The minimum residual pressure requirement is as set out in Queenstown Lakes District Council Amendments and Modifications (2005) to NZS 4404:2004 , *"Land Development and Subdivision Engineering".*

Modelling results

Modelling results are presented in Table 2 below. Note that these results relate to the Peninsula Bay development alone, with current Wanaka water supply model peak day design demands, and do not include demands from other proposed developments recently modelled by Tonkin & Taylor.

Table 2 Minimum pressures and fire flow availability

Nodes assessed	Residual pressure (kPa) (1)	Fire flow available (l/sec) (2)
J1	430 ≥ 300 **OK**	50 ≥ 25 **OK**
J2	660 ≥ 300 **OK**	63 ≥ 25 **OK**
J3	490 ≥ 300 **OK**	51 ≥ 25 **OK**
J4	320 ≥ 300 **OK**	37 ≥ 25 **OK**
J5	490 ≥ 300 **OK**	56 ≥ 25 **OK**
J6	360 ≥ 300 **OK**	43 ≥ 25 **OK**
J7	340 ≥ 300 **OK**	28 ≥ 25 **OK**
J8	500 ≥ 300 **OK**	63 ≥ 25 **OK**
J9	470 ≥ 300 **OK**	37 ≥ 25 **OK**
J10	400 ≥ 300 **OK**	33 ≥ 25 **OK**
J11	380 ≥ 300 **OK**	25 ≥ 25 **OK**
J12	310≥ 300 **OK**	22 ≥ 12.5 **OK** (3)

(1) A minimum residual peak hour pressure of 300 kPa is required as per QLDC amendments to NZS 4404:2004.

(2) A total of 25 l/sec is required from within 270 m of each non-sprinklered, residential dwelling for Class FW2 fire fighting as per SNZ PAS 4509:2008.

(3) A minimum of 12.5 l/sec is required from each hydrant as per SNZ PAS 4509:2008.

Modelling shows that during the current design peak hour demand scenario, the residual pressures in the development will be at least 310 kPa. This is for all dwellings below 340 m RL. Hence, the Queenstown Lakes District Council (QLDC) requirement for minimum pressures being ≥ 300 kPa **is met** within the proposed development.

Modelling also shows that a minimum of **Class FW2 fire flow can be achieved** during the design peak day demand scenario, as required for residential dwellings. All hydrants can deliver at least 12.5 l/sec within 135 m of each lot, with the remaining 12.5 l/sec available from within 270 m (total of 25 l/sec as required for FW2 firefighting).

As previously reported[3], the addition of the Peninsula Bay development reduces pressures along Minaret Ridge by approximately 90 kPa to 540 - 660 kPa (upstream of the PRV). Modelling indicates that with connection of the additional 31 lots in the Peninsula Bay development, **the effects on the rest of the water supply network are minimal.**

[3] Infinity Investments group Limited, *'Water supply modelling – Peninsula Bay development – Revised Modelling Results'*, dated 02 June 2011, T&T Ref. 51556.016

Applicability and Closure

The model is a numerical representation of the physical reality, and subsequently bears some uncertainty. The demands and peaking factors used are based on assumptions regarding the patterns of water use in the township, and are an approximation of the physical reality. Hence, actual demands within the network may differ from those modelled.

This report has been prepared for the benefit of Queenstown Lakes District Council 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.

In addition, the modelling results presented in this report show the available levels of service for the Wanaka network, based on the current design peak day demands, and are not a guarantee of available levels of service in the future.

We trust this modelling report meets your requirements. Please contact Dominic Fletcher (dfletcher@tonkin.co.nz) on 03 363 2440 if you wish to discuss these results or any other aspect of this modelling report.

Yours sincerely,

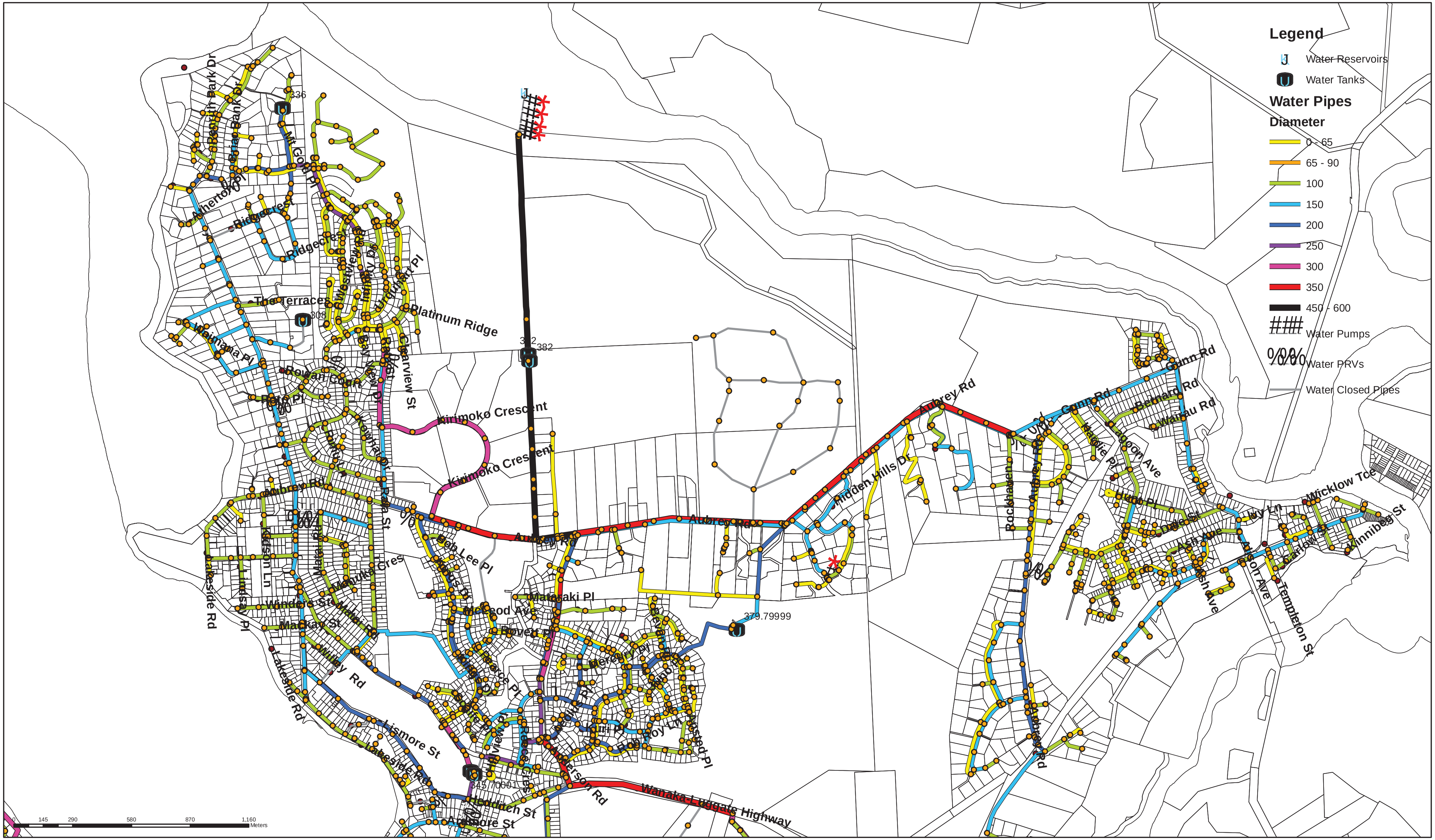
TONKIN & TAYLOR LTD

Grant Lovell
PROJECT DIRECTOR

Attachments:

- Figure 1 – Wanaka Network Layout
- Figure 2 – Peninsula Bay Additional Lots Water Supply Network Layout

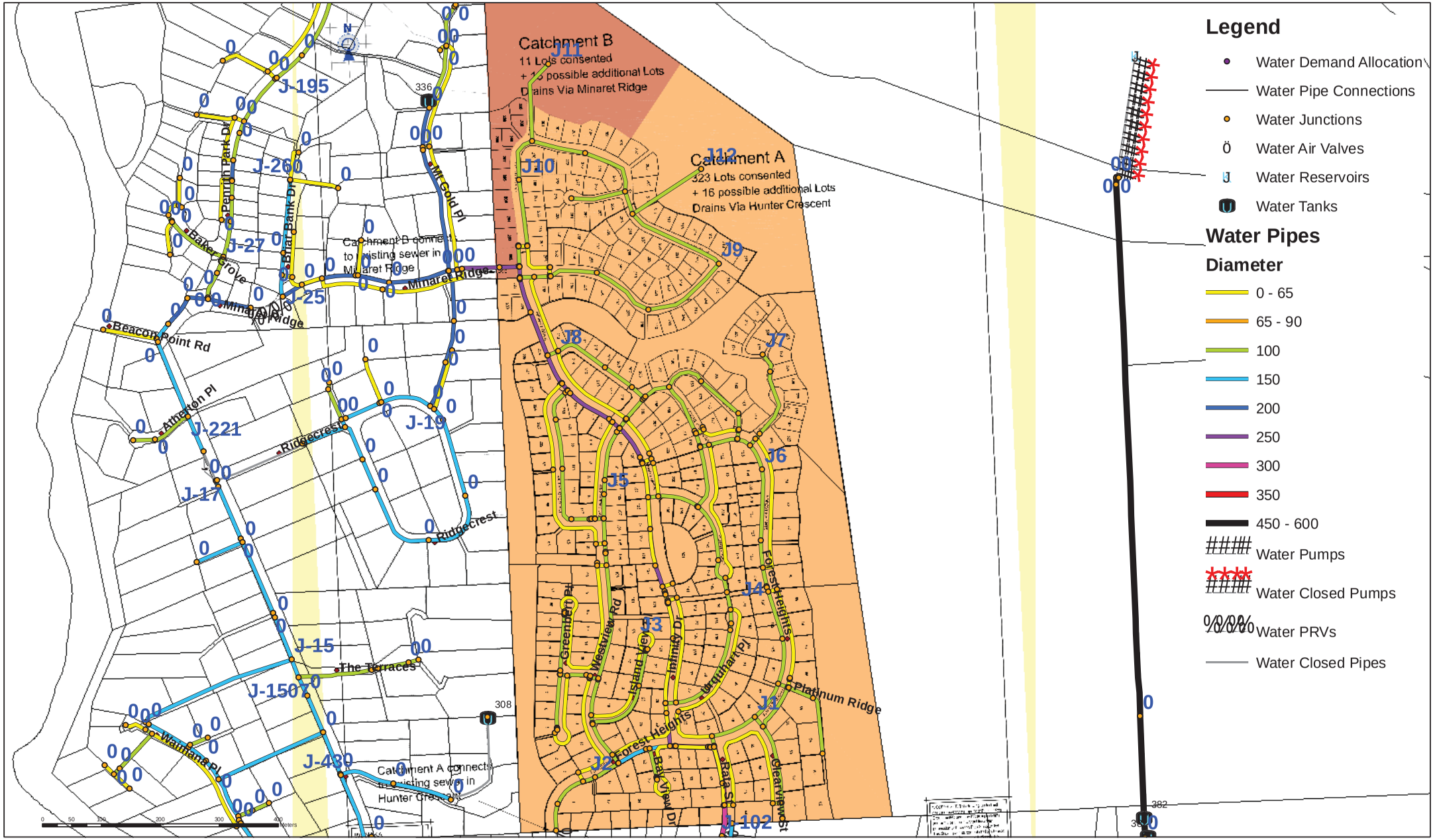
5-Feb-15
p:\51556\51556.0270\workingmaterial\2015-02-02.mlaa.ltr.water modelling results.doc



Wanaka network layout

Figure 1

Drawn By:	JTC
Date:	04/02/2015
Approved:	
Scale:	1:17,500



Peninsula Bay Additional Lots
Water Supply Network Layout

Figure 2

MIKE URBAN

Drawn By:	MLAA
Date:	02/02/2015
Approved:	DAF
Scale:	1:6,000

APPENDIX D – CONFIRMATION OF UTILITY SERVICE AVAILABILITY

Aurora

27 January 2015

Mr Pete Smallfield
Paterson Pitts Group
P O Box 283
WANAKA 9343

By email only: pete.smallfield@ppgroup.co.nz

Dear Pete

RE: ELECTRICITY SUPPLY FOR PROPOSED 31-LOT SUBDIVISION INFINITY INVESTMENT GROUP - PENINSULA BAY - NORTHEND

Thank you for your letter and accompanying plans dated 23 January 2015, outlining the above proposed development.

Aurora can make an electricity supply available for this development, subject to the following conditions:

- Supply confirmation is limited to a single phase 15kVA supply per lot.
- Easements in gross, in favour of Aurora, must be granted over the placement of all new and existing Aurora plant associated with this development, unless installed in road reserve.
- Where the development involves further subdivision of a land parcel containing an existing serviced installation, the mains cables (overhead or underground) intended to supply each lot must be completely contained within the lot that it serves. In some cases this will require relocation of the cable serving the existing installation.
- All electrical installations must comply with Aurora's Network Connection Requirements and related standards and policies.
- The developer must co mply with the Electricity Act, subordinate Regulations and associated Codes of Practice. Particular attention must be paid to the minimum distances between power lines and other structures defined in NZECP34:2011 "NZ Electrical Code of Practice for Electrical Safe Distances".
- No building shall be erected over any electricity easement without specific written authority from Delta's General Manager – Asset Management
- The developer is responsible for all resource consents and local authority approvals.
- The developer will be required to make capital contributions toward the costs of providing the power supply, in accordance with Aurora's Capital Contributions policy prevailing at the time the development, or each stage of development, proceeds.
- This approval will lapse within 12 months of the date of this letter, unless the developer enters into a formal supply agreement with Aurora for this development.

Aurora Energy Limited
10 Halsey Street • Dunedin • New Zealand
Email enquiries @auroraenergy.co.nz
Postal PO Box 1404
Phone 03-474-0322
Fax 03-477-5771

Please note that this letter is to confirm that a power supply can be made available and does not imply that a power supply is available now, or that Aurora will make power available at its cost.

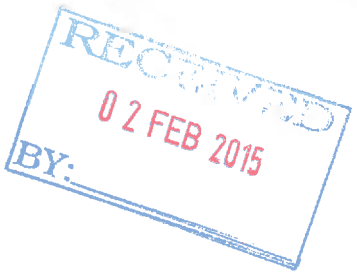
Aurora's Network Connection Requirements and Capital Contributions policy are available from http://www.auroraenergy.co.nz/. Should you require further information or clarification, please contact the undersigned.

Yours sincerely

Alec Findlater
COMMERCIAL MANAGER (Delta)
for Aurora Energy Limited

DDI Phone (03) 479 6695
Mobile 027 222 2169
Fax (03) 477 5771
Email alec.findlater@thinkdelta.co.nz

The Subdivision Group
55 Shands Road, Hornby 8042
P O Box 1374, Christchurch 8140
Telephone: (03) 339 3402
Facsimile: (03) 338 0133
Email: tsg@chorus.co.nz



28 January 2015

Chorus Ref: WNK26881
Your Ref:

Infinity Investments Peninsula Bay
c/- Paerson Pitts Group
19 Reece Crescent
P O Box 283
Wanaka 9343

Attention: Pete Smallfield

Re: Proposed Subdivision: WNK: Infinity Drive, Peninsula Bay North End - 31 lots (lots 1-31)ABF

(Subdivision Location: Bull Ridge & Infinity Drive Wanaka)

Dear Sir / Madam

Thank you for letter and scheme plan for the above subdivision.

Chorus requires infrastructure and architecture design work to be completed prior to quoting the price for the provision of their services. At this time, due to other works in the area, the situation regarding spare capacity is unclear and requires further investigation.

Please allow up to six weeks for the Network design work to be completed, (some can occasionally take longer), before we can get back to you with confirmation of the cost to extend Chorus Network in Subdivision Location: Bull Ridge & Infinity Drive Wanaka.

Please do not hesitate to contact me should you have any queries.

Yours faithfully

Nuncy Maposa

Sub Division Specialist

Aurora

27 January 2015

Mr Pete Smallfield
Paterson Pitts Group
P O Box 283
WANAKA 9343

By email only: pete.smallfield@ppgroup.co.nz

Dear Pete

RE: ELECTRICITY SUPPLY FOR PROPOSED 31-LOT SUBDIVISION INFINITY INVESTMENT GROUP - PENINSULA BAY - NORTHEND

Thank you for your letter and accompanying plans dated 23 January 2015, outlining the above proposed development.

Aurora can make an electricity supply available for this development, subject to the following conditions:

- Supply confirmation is limited to a single phase 15kVA supply per lot.
- Easements in gross, in favour of Aurora, must be granted over the placement of all new and existing Aurora plant associated with this development, unless installed in road reserve.
- Where the development involves further subdivision of a land parcel containing an existing serviced installation, the mains cables (overhead or underground) intended to supply each lot must be completely contained within the lot that it serves. In some cases this will require relocation of the cable serving the existing installation.
- All electrical installations must comply with Aurora's Network Connection Requirements and related standards and policies.
- The developer must co mply with the Electricity Act, subordinate Regulations and associated Codes of Practice. Particular attention must be paid to the minimum distances between power lines and other structures defined in NZECP34:2011 "NZ Electrical Code of Practice for Electrical Safe Distances".
- No building shall be erected over any electricity easement without specific written authority from Delta's General Manager – Asset Management
- The developer is responsible for all resource consents and local authority approvals.
- The developer will be required to make capital contributions toward the costs of providing the power supply, in accordance with Aurora's Capital Contributions policy prevailing at the time the development, or each stage of development, proceeds.
- This approval will lapse within 12 months of the date of this letter, unless the developer enters into a formal supply agreement with Aurora for this development.

Aurora Energy Limited
10 Halsey Street • Dunedin • New Zealand
Email enquiries @auroraenergy.co.nz
Postal PO Box 1404
Phone 03-474-0322
Fax 03-477-5771

Please note that this letter is to confirm that a power supply can be made available and does not imply that a power supply is available now, or that Aurora will make power available at its cost.

Aurora's Network Connection Requirements and Capital Contributions policy are available from http://www.auroraenergy.co.nz/. Should you require further information or clarification, please contact the undersigned.

Yours sincerely

Alec Findlater
COMMERCIAL MANAGER (Delta)
for Aurora Energy Limited

DDI Phone (03) 479 6695
Mobile 027 222 2169
Fax (03) 477 5771
Email alec.findlater@thinkdelta.co.nz

The Subdivision Group
55 Shands Road, Hornby 8042
P O Box 1374, Christchurch 8140
Telephone: (03) 339 3402
Facsimile: (03) 338 0133
Email: tsg@chorus.co.nz

Chorus

Chorus Ref: WNK26881
Your Ref:

17 April 2015

Infinity Investments Peninsula Bay
c/- Paerson Pitts Group
19 Reece Crescent
P O Box 283
Wanaka 9343

Attention: **Pete Smallfield**

Fibre Reticulation Offer Letter

RE: Subdivision: WNK: Infinity Drive, Peninsula Bay North End - 31 lots (lots 1-31)ABF

(Subdivision Location: Bull Ridge & Infinity Drive Wanaka)

Dear Sir / Madam

Thank you for your enquiry and scheme plan for the above subdivision. This letter is to confirm that Chorus will install Fibre to the Premises (FTTP) reticulation for the subdivision.

Fibre reticulation will enable the delivery of high bandwidth internet connections for new multi-media services, internet-based applications and phone services. This is why Chorus is currently laying thousands of kilometres of fibre optic cable to bring ultra-fast broadband to more than 800,000 homes and businesses across New Zealand.

Important information about premises wiring
It is important for you to know that the wiring requirements for premises in a subdivision connected by fibre are different from the requirements for connecting to the traditional copper network. Premises wiring is the responsibility of the homeowner. Any new homes built in the subdivision should be installed with telecommunications cabling that complies with the Telecommunications Carriers' Forum's Premises Wiring Code. Information about this code and wiring requirements is available on our website at **www.chorus.co.nz/wiring**

Failing to install telecommunications wiring that meets the standard in the Code may mean services will not function as expected within the home. It is therefore important that information about wiring requirements and service delivery is passed on to your electricians, builders and potential property owners for this subdivision.

If the developer wishes to reticulate the subdivision and install connection points on the boundaries prior to selling sections, they'll need to commit to a Chorus Subdivision Reticulation Agreement and pay the required subdivision fees. The charge for Chorus to provide reticulation for this subdivision of 31 lots/units is $37,145.00 (G.S.T inclusive). This quote is valid for 90 days from the date of this letter.

The charge is a contribution to Chorus' total costs to extend its network and infrastructure to the lots in the supplied plan. Chorus' costs include network design, supply of telecommunications specific materials and supervising installation.

The quote above also assumes that the Developer, or their nominated contractor, will supply and reinstate trenches, and install Chorus plant within the subdivided area.

Easements
In any areas where Chorus Network is not installed in public road reserve vested to the Local Council, the subdivider is to ensure that a legal easement is registered over the route and Network in favour of Chorus New Zealand Limited. The easement should provide for an "easement in gross for Telecommunications purposes". Chorus has standard forms for easements transfer where an easement is being granted to Chorus as part of the requirements associated with the depositing of a subdivisional plan

Please Note: this includes service lead-in pipes and cable extending from the main network cabling into Right of

Ways.

Information relating to Street Names and Addresses
Please note that there are now multiple service providers who can potentially connect into communications networks in new subdivision areas. In order for connection requests to proceed without delays, accurate street address and numbering that aligns with Council plans needs to be recorded in the network providers data base.

This is particularly important for multiple dwelling units, campus developments or retirement villages that use both street addresses and unit numbering

Most subdivision developments at design stage start without Council registered road names and contain allotment numbers through the early build phase of the project. At build completion, the road names and the street address information is often available to developers before the final survey plans are sent for registration

It's vital that this information gets recorded in the Chorus network data base to ensure that connection requests to the network are completed successfully. The information can be provided back into the Chorus system via our Service Company staff who have provided the network designs for the subdivision area

I hope that this information assists with your enquiry and look forward to hearing from you in due course if a Reticulation Agreement is required.

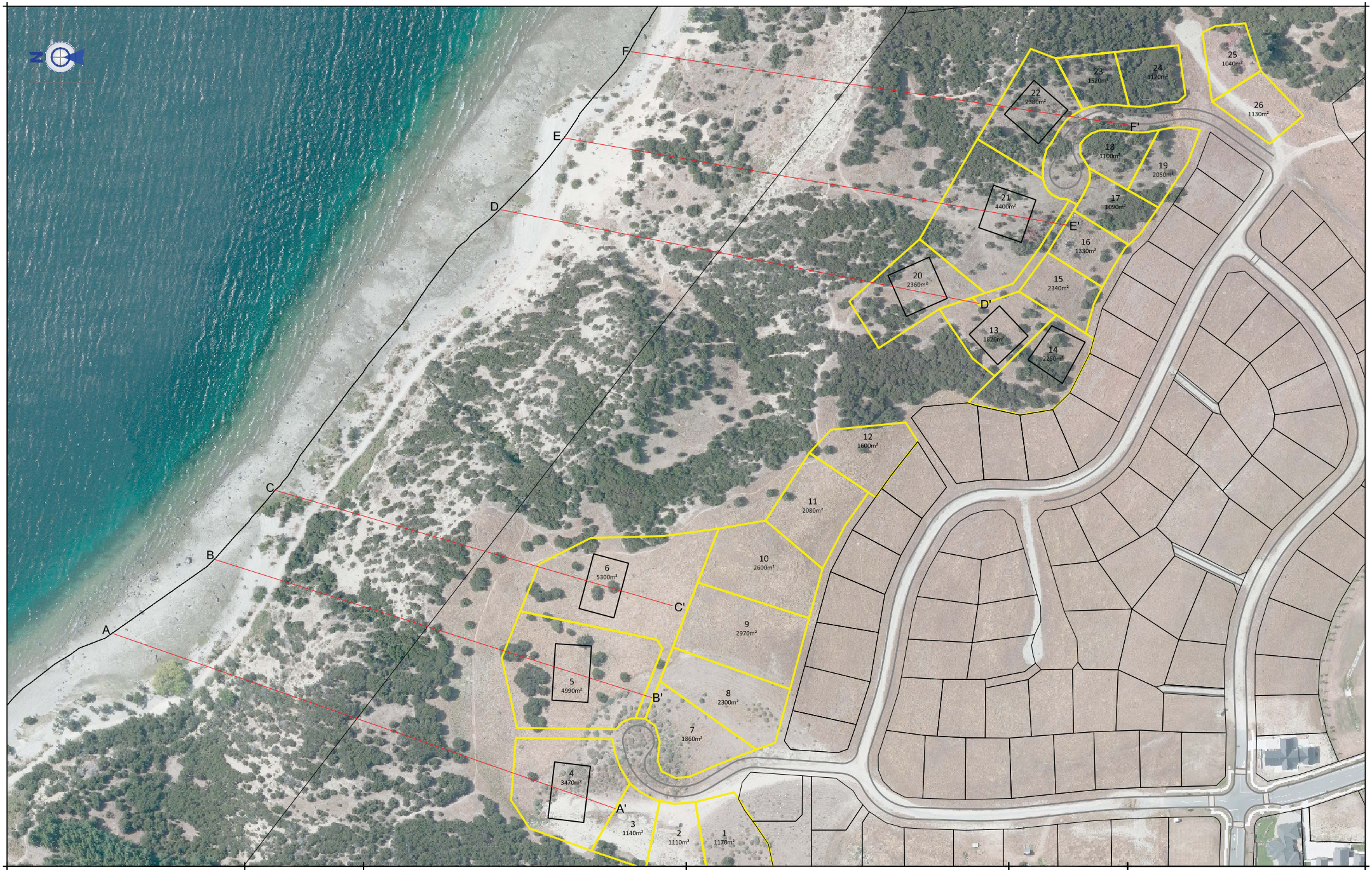
Yours faithfully

Nuncy Maposa

Sub Division Specialist

ANNEXURE C

Additional Pages to Appendix I of Section 32 Report
(Infrastructure Report)
Cross Sections



PATERSONPITTSGROUP
Your Land Professionals
www.ppgroup.co.nz
0800 PPGROUP

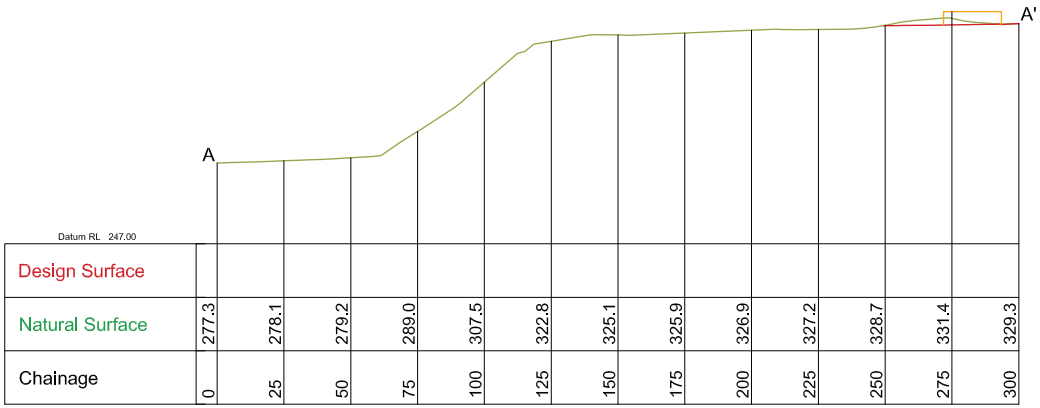
WANAKA BRANCH
19 Reece Crescent
or P.O. Box 283
Wanaka 9343
T 03 443 0110
E wanaka@ppgroup.co.nz

Client & Location:
Infinity Investments
Peninsula Bay

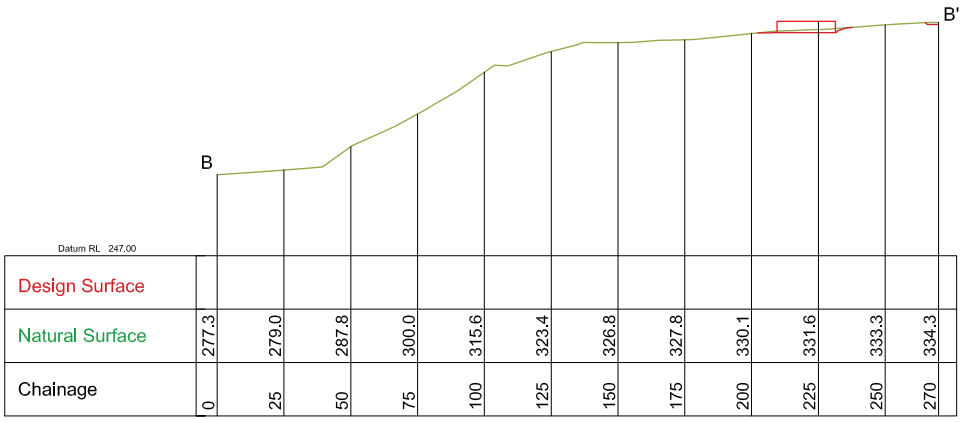
Purpose & Drawing Title:
Building Platform
Cross section
Plan

Surveyed by:		Original Size: A3	Scale: 1:2000 @ A3
Designed by:			
Drawn by:	PGS		DO NOT SCALE
Checked by:	MJB		
Approved by:	MJB		
Job No: W4332		Sheet No: 1	Revision No: A
			Date Created: 9/11/2015

L:\DATA\4300\4332\ACAD\EARTHWORKS\W4332 BP CROSS SECTIONS.DWG



Lot 4



Lot 5

PATERSONPITTSGROUP
Your Land Professionals
www.ppgroup.co.nz
0800 PPGROUP

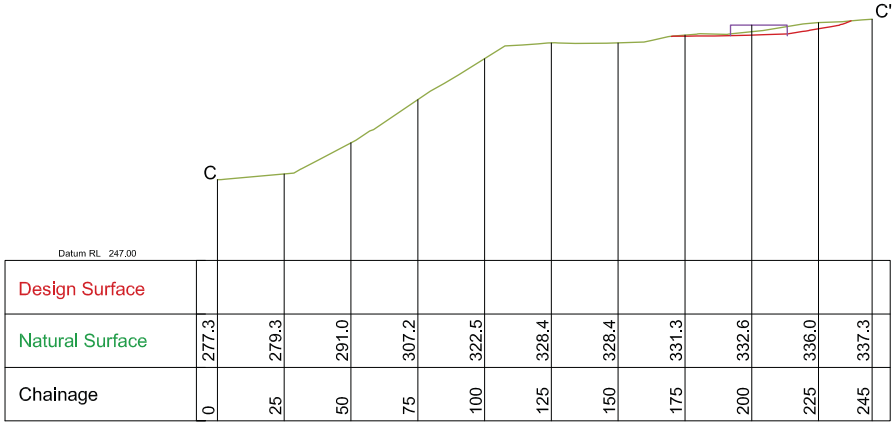
WANAKA BRANCH
19 Reece Crescent
or P.O. Box 283
Wanaka 9343
T 03 443 0110
E wanaka@ppgroup.co.nz

Client & Location:
Infinity Investments
Peninsula Bay

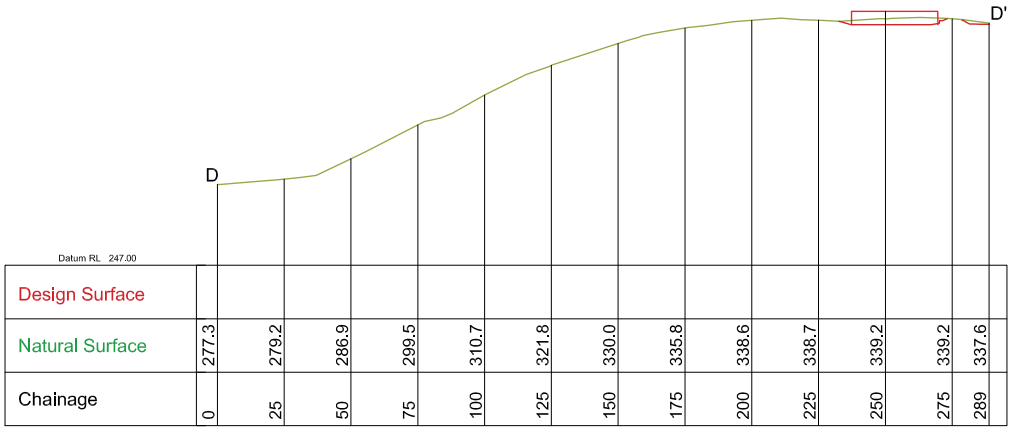
Purpose & Drawing Title:
Building Platform
Cross section
Lot 4 & 5

Surveyed by:		Original Size: A3	Scale: 1:2000 @ A3
Designed by:			
Drawn by:	PGS		
Checked by:	MJB		DO NOT SCALE
Approved by:	MJB		
Job No: W4332		Sheet No: 2	Revision No: A
			Date Created: 9/11/2015

L:\DATA\4300\4332\ACAD\EARTHWORKS\W4332 BP CROSS SECTIONS.DWG



Lot 6



Lot 20

PATERSONPITTSGROUP
Your Land Professionals
www.ppgroup.co.nz
0800 PPGROUP

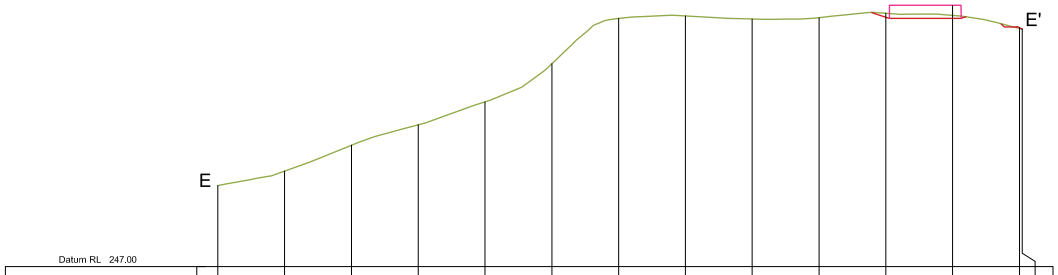
WANAKA BRANCH
19 Reece Crescent
or P.O. Box 283
Wanaka 9343
T 03 443 0110
E wanaka@ppgroup.co.nz

Client & Location:
Infinity Investments
Peninsula Bay

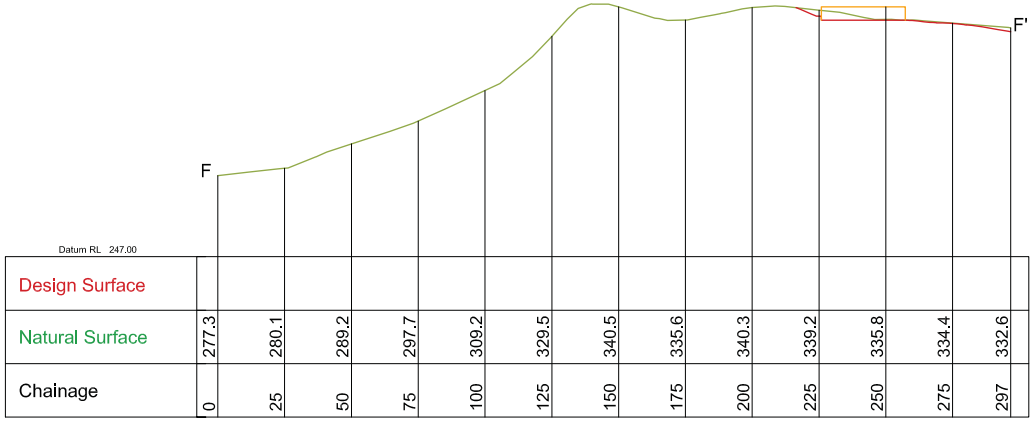
Purpose & Drawing Title:
Building Platform
Cross section
Lot 6 & 20

Surveyed by:		Original Size: A3	Scale: 1:2000 @ A3
Designed by:			
Drawn by:	PGS		
Checked by:	MJB		DO NOT SCALE
Approved by:	MJB		
Job No: W4332		Sheet No: 3	Revision No: A
			Date Created: 9/11/2015

L:\DATA\4300\4332\ACAD\EARTHWORKS\W4332 BP CROSS SECTIONS.DWG



Lot 21



Lot 22

PATERSONPITTSGROUP
Your Land Professionals
www.ppgroup.co.nz
0800 PPGROUP

WANAKA BRANCH
19 Reece Crescent
or P.O. Box 283
Wanaka 9343
T 03 443 0110
E wanaka@ppgroup.co.nz

Client & Location:
Infinity Investments
Peninsula Bay

Purpose & Drawing Title:
Building Platform
Cross section
Lot 21 & 22

Surveyed by:		Original Size: A3	Scale: 1:3000 @ A3
Designed by:			
Drawn by:	PGS		
Checked by:	MJB		DO NOT SCALE
Approved by:	MJB		
Job No: W4332		Sheet No: 4	Revision No: A
			Date Created: 9/11/2015

L:\DATA\4300\4332\ACAD\EARTHWORKS\W4332 BP CROSS SECTIONS.DWG

APPENDIX J

Otago Regional Council Operative Regional Policy Statement
Objectives and Policies

Relevant objectives and policies in the Otago Regional Policy Statement

5 Land

5.4 Objectives

5.4.1. To promote the sustainable management of Otago's land resources in order:

(a) To maintain and enhance the primary productive capacity and life-supporting capacity of land resources; and

(b) To meet the present and reasonably foreseeable needs of Otago's people and communities.

5.4.2. To avoid, remedy or mitigate degradation of Otago's natural and physical resources resulting from activities utilising the land resource.

5.4.3. To protect Otago's outstanding natural features and landscapes from inappropriate subdivision, use and development.

5.4.4. To ensure that public access opportunities exist in respect of activities utilising Otago's natural and physical land features.

5.5 Policies

5.5.1 To recognise and provide for the relationship Kai Tahu have with Otago's land resource through:

(a) Establishing processes that allow the existence of heritage sites, waahi tapu and waahi taoka to be taken into account when considering the subdivision, use and development of Otago's land resources; and

(b) Protecting, where practicable, archaeological sites from disturbance; and

(c) Notifying the appropriate runanga of the disturbance of any archaeological site and avoiding, remedying, or mitigating any effect of further disturbance until consultation with the kaitiaki runanga has occurred.

5.5.2. To maintain and enhance Otago's land resource through avoiding, remedying or mitigating the adverse effects of activities which have the potential to, amongst other adverse effects:

(a) Reduce the soil's life supporting capacity

(b) Reduce healthy vegetative cover

(c) Cause soil loss

(d) Contaminate soils

(e) Reduce productivity

(f) Compact soils

(g) Reduce soil moisture holding capacity.

5.5.3. To promote the diversification and use of Otago's land resource to achieve sustainable landuse and management systems for future generations.

5.5.4. To minimise the adverse effects of landuse activities on the quality and quantity of Otago's water resource through promoting and encouraging the:

(a) Creation, retention and where practicable enhancement of riparian margins; and

(b) Maintaining and where practical enhancing, vegetation cover, upland bogs and wetlands to safeguard land and water values; and

(c) Avoiding, remedying or mitigating the degradation of groundwater and surface water resources caused by the introduction of contaminants in the form of chemicals, nutrients and sediments resulting from landuse activities.

5.5.6 To recognise and provide for the protection of Otago's outstanding natural features and landscapes which:

(a) Are unique to or characteristic of the region; or

(b) Are representative of a particular landform or land cover occurring in the Otago region or of the collective characteristics which give Otago its particular character; or

(c) Represent areas of cultural or historic significance in Otago; or

(d) Contain visually or scientifically significant geological features; or

(e) Have characteristics of cultural, historical and spiritual value that are regionally significant for Tangata Whenua and have been identified in accordance with Tikanga Maori.

5.5.7 To promote the provision of public access opportunities to natural and physical land features throughout the Otago region except where restriction is necessary:

(i) To protect areas of significant indigenous vegetation and/or significant habitats of indigenous fauna; or

(ii) To protect Maori cultural values; or

(iii) To protect public health or safety; or

(iv) To ensure a level of security consistent with the purpose of a resource consent or in circumstances where safety and security concerns require exclusive occupation; or

(v) In other exceptional circumstances sufficient to justify the restriction notwithstanding the importance of maintaining that access.

9 Built Environment

9.4 Objectives

9.4.1. To promote the sustainable management of Otago's built environment in order to:

(a) Meet the present and reasonably foreseeable needs of Otago's people and communities; and

(b) Provide for amenity values; and

(c) Conserve and enhance environmental and landscape quality; and

(d) Recognise and protect heritage values.

9.4.2. To promote the sustainable management of Otago's infrastructure to meet the present and reasonably foreseeable needs of Otago's communities.

9.4.3. To avoid, remedy or mitigate the adverse effects of Otago's built environment on Otago's natural and physical resources.

9.5 Policies

9.5.1 To recognise and provide for the relationship Kai Tahu have with the built environment of Otago through:

(a) Considering activities involving papatipu whenua that contribute to the community and cultural development of Kai Tahu; and

(b) Recognising and providing for the protection of sites and resources of cultural importance from the adverse effects of the built environment.

9.5.2 To promote and encourage efficiency in the development and use of Otago's infrastructure through:

(a) Encouraging development that maximises the use of existing infrastructure while recognising the need for more appropriate technology; and

(b) Promoting co-ordination amongst network utility operators in the provision and maintenance of infrastructure; and

(c) Encouraging a reduction in the use of non-renewable resources while promoting the use of renewable resources in the construction, development and use of infrastructure; and

(d) Avoiding or mitigating the adverse effects of subdivision, use and development of land on the safety and efficiency of regional infrastructure.

9.5.4 To minimise the adverse effects of urban development and settlement, including structures, on Otago's environment through avoiding, remedying or mitigating:

(a) Discharges of contaminants to Otago's air, water or land; and

(b) The creation of noise, vibration and dust; and

(c) Visual intrusion and a reduction in landscape qualities; and

(d) Significant irreversible effects on:

(i) Otago community values; or

(ii) Kai Tahu cultural and spiritual values; or

(iii) The natural character of water bodies and the coastal environment; or

(iv) Habitats of indigenous fauna; or

(v) Heritage values; or

(vi) Amenity values; or

(vii) Intrinsic values of ecosystems; or

(viii) Salmon or trout habitat.

9.5.5 To maintain and, where practicable, enhance the quality of life for people and communities within Otago's built environment through:

(a) Promoting the identification and provision of a level of amenity which is acceptable to the community; and

(b) Avoiding, remedying or mitigating the adverse effects on community health and safety resulting from the use, development and protection of Otago's natural and physical resources; and

(c) Avoiding, remedying or mitigating the adverse effects of subdivision, landuse and development on landscape values.

9.5.6 To recognise and protect Otago's regionally significant heritage sites through:

(a) Identifying Otago's regionally significant heritage sites in consultation with Otago's communities; and

(b) Developing means to ensure those sites are protected from inappropriate subdivision, use and development.

11 Natural Hazards

11.4 Objectives

11.4.1 To recognise and understand the significant natural hazards that threaten Otago's communities and features.

11.4.2 To avoid or mitigate the adverse effects of natural hazards within Otago to acceptable levels.

11.4.3 To effectively and efficiently respond to natural hazards occurring within Otago.

11.4.4 To avoid, remedy or mitigate the adverse effects of hazard mitigation measures on natural and physical resources.

11.5 Policies

11.5.2 To take action necessary to avoid or mitigate the unacceptable adverse effect of natural hazards and the responses to natural hazards on:

(a) Human life; and

(b) Infrastructure and property; and

(c) Otago's natural environment; and

(d) Otago's heritage sites.

11.5.3 To restrict development on sites or areas recognised as being prone to significant hazards, unless adequate mitigation can be provided.

11.5.4 To avoid or mitigate the adverse effects of natural hazards within Otago through:

(a) Analysing Otago's natural hazards and identifying their location and potential risk; and

(b) Promoting and encouraging means to avoid or mitigate natural hazards; and

(c) Identifying and providing structures or services to avoid or mitigate the natural hazard; and

(d) Promoting and encouraging the use of natural processes where practicable to avoid or mitigate the natural hazard.

APPENDIX K

Otago Regional Council Proposed Regional Policy Statement
Objectives and Policies

Relevant objectives and policies in the Proposed Regional Policy Statement for Otago

Objective 2.1 The values of Otago's natural and physical resources are recognised, maintained and enhanced.

Policy 2.1.2 Managing for the values of beds of rivers and lakes, wetlands, and their margins
Recognise the values of beds of rivers and lakes, wetlands, and their margins, and manage them to:

a) Protect or restore their natural functioning; and
b) Protect outstanding water bodies and wetlands; and
c) Maintain good water quality, or enhance it where it has been degraded; and
d) Maintain ecosystem health and indigenous biodiversity; and
e) Retain the range and extent of habitats supported; and
f) Maintain or enhance natural character; and
g) Protect Kāi Tahu values; and
h) Provide for other cultural values; and
i) Maintain their aesthetic and amenity values; and
j) Avoid the adverse effects of pest species, prevent their introduction and reduce their spread; and
k) Mitigate the adverse effects of natural hazards, including flooding and erosion; and
l) Maintain bank stability

Policy 2.1.6 Managing for ecosystem and indigenous biodiversity values

Recognise the values of ecosystems and indigenous biodiversity, and manage ecosystems and indigenous biodiversity, to:

a) Maintain or enhance ecosystem health and indigenous biodiversity; and
b) Maintain or enhance areas of predominantly indigenous vegetation; and
c) Buffer or link existing ecosystems; and
d) Protect important hydrological services, including the services provided by tussock grassland; and
e) Protect natural resources and processes that support indigenous biodiversity; and
f) Maintain habitats of indigenous species that are important for recreational, commercial, cultural or customary purposes; and
g) Protect biodiversity significant to Kāi Tahu; and
h) Avoid the adverse effects of pest species, prevent their introduction and reduce their spread.

Policy 2.1.7 Recognising the values of natural features, landscapes, and seascapes

Recognise the values of natural features, landscapes, seascapes and the coastal environment are derived from the following attributes, as detailed in Schedule 4:

a) Biophysical attributes, including:

i. Natural science factors;
ii. The presence of water;
iii. Vegetation (indigenous and introduced);
iv. The natural darkness of the night sky;

b) Sensory attributes, including:
i. Legibility or expressiveness;
ii. Aesthetic values;
iii. Transient values, including nature's sounds;
iv. Wild or scenic values;

c) Associative attributes, including:
i. Whether the values are shared and recognised;
ii. Cultural and spiritual values for Kāi Tahu;
iii. Historical and heritage associations.

Objective 2.2 Otago's significant and highly valued natural resources are identified, and protected or enhanced to maintain their distinctiveness.

Policy 2.2.1 Identifying areas of significant indigenous vegetation and significant habitats of indigenous fauna.

Identify areas and values of significant indigenous vegetation and significant habitats of indigenous fauna, using the attributes detailed in Schedule 5.

Policy 2.2.2 Managing significant indigenous vegetation and significant habitats of indigenous fauna.

Protect and enhance the values of areas of significant indigenous vegetation and significant habitats of indigenous fauna, by:

a) Avoiding adverse effects on those values which contribute to the area or habitat being significant; and
b) Avoiding significant adverse effects on other values of the area or habitat; and
c) Assessing the significance of adverse effects on those values, as detailed in Schedule 3; and
d) Remediating, when adverse effects cannot be avoided; and
e) Mitigating where adverse effects cannot be avoided or remediated; and
f) Encouraging enhancement of those areas and values.

Policy 2.2.3 Identifying outstanding natural features, landscapes and seascapes. Identify areas and values of outstanding natural features, landscapes and seascapes, using the attributes as detailed in Schedule 4.

Policy 2.2.4 Managing outstanding natural features, landscapes, and seascapes.

Protect, enhance and restore the values of outstanding natural features, landscapes and seascapes, by:

a) Avoiding adverse effects on those values which contribute to the significance of the natural feature, landscape or seascape; and

b) Avoiding, remedying or mitigating other adverse effects on other values; and

c) Assessing the significance of adverse effects on values, as detailed in Schedule 3; and

d) Recognising and providing for positive contributions of existing introduced species to those values; and

e) Controlling the adverse effects of pest species, preventing their introduction and reducing their spread; and

f) Encouraging enhancement of those areas and values

Policy 2.2.5 Identifying special amenity landscapes and highly valued natural features.

Identify areas and values of special amenity landscape or natural features which are highly valued for their contribution to the amenity or quality of the environment, but which are not outstanding, using the attributes detailed in Schedule 4.

Policy 2.2.6 Managing special amenity landscapes and highly valued natural features.

Protect or enhance the values of special amenity landscapes and highly valued natural features, by:

a) Avoiding significant adverse effects on those values which contribute to the special amenity of the landscape or high value of the natural feature; and

b) Avoiding, remedying or mitigating other adverse effects on other values; and

c) Assessing the significance of adverse effects on those values, as detailed in Schedule 3; and

d) Recognising and providing for positive contributions of existing introduced species to those values; and

e) Controlling the adverse effects of pest species, preventing their introduction and reducing their spread; and

f) Encouraging enhancement of those values.

Objective 2.3 Natural resource systems and interdependencies are recognised and sustained

Policy 2.3.1 Applying an integrated management approach among resources.

Apply an integrated approach to the management of Otago's natural and physical resources, to achieve sustainable management, by:

a) Taking into account the impacts of management of one resource on the values of another, or on the environment in general; and

b) Recognising that the form and function of a resource may extend beyond the immediate, or directly adjacent, area of interest.

Policy 2.3.2 Applying an integrated management approach within a resource.

Apply an integrated management approach within a natural and physical resource, to achieve sustainable management, by:

a) Ensuring that resource objectives are complementary across administrative boundaries; and

b) Ensuring that effects of activities on the whole of a resource are considered when that resource is managed by sub-units.

Communities in Otago are resilient, safe and healthy

Objective 3.1 Protection, use and development of natural and physical resources recognises environmental constraints.

Policy 3.1.1 Recognising natural and physical environmental constraints.

Recognise the natural and physical environmental constraints of an area, the effects of those constraints on activities, and the effects of those activities on those constraints, including:

a) The availability of natural resources necessary to sustain the activity; and
b) The ecosystem services the activity is dependent on; and
c) The sensitivity of the natural and physical resources to adverse effects from the proposed activity/land use; and
d) Exposure of the activity to natural and technological hazard risks; and
e) The functional necessity for the activity to be located where there are significant constraints.

Objective 3.2 Risk that natural hazards pose to Otago's communities are minimised.

Policy 3.2.1 Identifying natural hazards.

Identify natural hazards that may adversely affect Otago’s communities, including hazards of low likelihood and high consequence.

Policy 3.2.2 Assessing natural hazard likelihood.

Assess the likelihood of natural hazard events occurring, having regard to a timeframe of no less than 100 years, including by considering:

a) Hazard type and characteristics;
b) Multiple and cascading hazards;
c) Cumulative effects, including from multiple hazards with different risks;
d) Effects of climate change;
e) Using the best available information for calculating likelihood;
f) Exacerbating factors.

Policy 3.2.3 Assessing natural hazard consequence.

Assess the consequences of natural hazard events, including by considering:

a) The nature of activities in the area;
b) Individual and community vulnerability;
c) Impact on individual and community health and safety;
d) Impact on social, cultural and economic wellbeing;
e) Impact on infrastructure and property, including access and services;
f) Risk reduction and hazard mitigation measures;

g) Lifeline utilities, essential and emergency services, and their co-dependence;

h) Implications for civil defence agencies and emergency services;

i) Cumulative effects;

j) Factors that may exacerbate a hazard event

Policy 3.2.4 Managing natural hazard risk.

Manage natural hazard risk, including with regard to:

a) The risk they pose, considering the likelihood and consequences of natural hazard events; and

b) The implications of residual risk, including the risk remaining after implementing or undertaking risk reduction and hazard mitigation measures; and

c) The community's tolerance of that risk, now and in the future, including the community's ability and willingness to prepare for and adapt to that risk, and respond to an event; and

d) The changing nature of tolerability and risk; and

e) Sensitivity of activities to risk.

Policy 3.2.5 Assessing activities for natural hazard risk

Assess activities for natural hazard risk, by considering:

a) The natural hazard risk identified, including residual risk; and

b) Any measures to avoid, remedy or mitigate those risks, including relocation and recovery methods; and

c) The long term viability and affordability of those measures; and

d) Flow-on effects of the risk to other activities, individuals and communities; and

e) The availability of, and ability to provide, lifeline utilities, and essential and emergency services, during and after a natural hazard event.

Policy 3.2.6 Avoiding increased natural hazard risk

Avoid increasing natural hazard risk, including by:

a) Avoiding activities that significantly increase risk, including displacement of risk off-site; and

b) Encouraging design that facilitates:

   i. Recovery from natural hazard events; or

   ii. Relocation to areas of lower risk.

Policy 3.2.7 Reducing existing natural hazard risk.

Reduce existing natural hazard risk, including by:

a) Encouraging activities that:

   i. Reduce risk; or

   ii. Reduce community vulnerability; and

b) Discouraging activities that:

i. Increase risk; or
ii. Increase community vulnerability; and

c) Considering the use of exit strategies for areas of significant risk; and

d) Encouraging design that facilitates:

i. Recovery from natural hazard events or
ii. Relocation to areas of lower risk; and

e) Relocating lifeline utilities, and facilities for essential and emergency service, to areas of reduced risk, where appropriate and practicable; and

f) Enabling development, upgrade, maintenance and operation of lifeline utilities and facilities for essential and emergency services; and

g) Re-assessing natural hazard risk, and community tolerance of that risk, following significant natural hazard events.

Policy 3.2.9 Protecting features and systems that provide hazard mitigation.
Protect, restore, enhance and promote the use of natural or modified features and systems, which contribute to mitigating the effects of both natural hazards and climate change.

Objective 3.4 Good quality infrastructure and services meet community needs

Policy 3.4.1 Integrating infrastructure with land use.

Achieve the strategic integration of infrastructure with land use, by:

a) Recognising functional needs of infrastructure of regional or national importance; and

b) Designing infrastructure to take into account:

i. Actual and reasonably foreseeable land use change; and
ii. The current population and projected demographic changes; and
iii. Actual and reasonably foreseeable change in supply of, and demand for, infrastructure services; and
iv. Natural and physical resource constraints; and
v. Effects on the values of natural and physical resources; and
vi. Co-dependence with other infrastructural services; and
vii. The effects of climate change on the long term viability of that infrastructure; and

c) Managing urban growth:

i. Within areas that have sufficient infrastructure capacity; or
ii. Where infrastructure services can be upgraded or extended efficiently and effectively; and

d) Co-ordinating the design and development of infrastructure with the staging of land use change, including with:

i. Structural design and release of land for new urban development; or
ii. Structural redesign and redevelopment within existing urban areas.

Policy 3.4.2 Managing infrastructure activities.

Manage infrastructure activities, to:

a) Maintain or enhance the health and safety of the community; and

b) Reduce adverse effects of those activities, including cumulative adverse effects on natural and physical resources; and

c) Support economic, social and community activities; and

d) Improve efficiency of use of natural resources; and

e) Protect infrastructure corridors for infrastructure needs, now and for the future; and

f) Increase the ability of communities to respond and adapt to emergencies, and disruptive or natural hazard events; and

g) Protect the functioning of lifeline utilities and essential or emergency services.

Objective 3.7 Urban areas are well designed, sustainable and reflect local character

Policy 3.7.1 Using the principles of good urban design.

Encourage the use of good urban design principles in subdivision and development in urban areas, as detailed in Schedule 6, to:

a) Provide a resilient, safe and healthy community, including through use of crime prevention through environmental design principles; and

b) Ensure that the built form relates well to its natural environment, including by:

    i. Reflecting natural features such as rivers, lakes, wetlands and topography; and

    ii. ii. Providing for ecological corridors in urban areas; and

    iii. Protecting areas of indigenous biodiversity and habitat for indigenous fauna; and

    iv. Encouraging use of low impact design techniques; and

    v. Encouraging construction of warmer buildings; and

c) Reduce risk from natural hazards, including by avoiding areas of significant risk; and

d) Ensure good access and connectivity within and between communities; and

e) Create a sense of identity, including by recognising features of heritage and cultural importance; and

f) Create areas where people can live, work and play, including by:

    i. Enabling a diverse range of housing, commercial, industrial and service activities; and

    ii. Enabling a diverse range of social and cultural opportunities.

Policy 3.7.2 Encouraging use of low impact design techniques.

Encourage the use of low impact design techniques in subdivision and development, to:

a) Reduce potential adverse environmental effects, including on water and air quality; or

b) Mitigate the effects of natural hazards and climate change; or

c) Enhance amenity; or

d) Enhance habitat for indigenous species and biodiversity values.

Objective 3.8 Urban growth is well designed and integrates effectively with adjoining urban and rural environments

Policy 3.8.1 Managing for urban growth

Manage urban growth and creation of new urban land in a strategic and co-ordinated way, by:

a) Ensuring there is sufficient residential, commercial and industrial land capacity, to cater for demand for such land, projected over at least the next 10 years; and

b) Co-ordinating urban growth and extension of urban areas with relevant infrastructure development programmes, to:

   i. Provide infrastructure in an efficient and effective way; and

   ii. Avoid additional costs that arise from unplanned infrastructure expansion; and

c) Identifying future growth areas that:

   i. Minimise adverse effects on rural productivity, including loss of highly valued soils or creating competing urban demand for water and other resources; and

   ii. Maintain or enhance significant biodiversity, landscape or natural character values; and

   iii. Maintain important cultural or heritage values; and

   iv. Avoid land with significant risk from natural hazards; and

d) Considering the need for urban growth boundaries to control urban expansion; and

e) Ensuring efficient use of land; and

f) Requiring the use of low or no-emission heating systems in buildings, when ambient air quality in or near the growth area is:

   i. Below standards for human health; or

   ii. Vulnerable to degradation given the local climatic and geographical context; and

g) Giving effect to the principles of good urban design, as detailed in Schedule 6; and

h) Giving effect to the principles of crime prevention through environmental design.

Policy 3.8.2 Controlling growth where there are identified urban growth boundaries or future urban development areas.

Where urban growth boundaries, as detailed in Schedule 8, or future urban development areas, are needed to control urban expansion, control the release of land within those boundaries or areas, by:

a) Staging development, using identified triggers to release new stages for development; or

b) Releasing land in a way that ensures a logical spatial development, and efficient use of existing land and infrastructure before new land is released; and

c) Avoiding urban development beyond the urban growth boundary or future urban development area.

People are able to use and enjoy Otago's natural and built environment.

Objective 4.4 Otago's communities can make the most of the natural and built resources available for use

Policy 4.4.3 Encouraging environmental enhancement.

Encourage activities which contribute to enhancing the natural environment, including to:

a) Improve water quality; or

b) Protect or restore habitat for indigenous species; or

c) Regenerate indigenous species; or

d) Mitigate natural hazards; or

e) Restore the natural character of wetlands; or

f) Improve the health and resilience of:

i. Ecosystems supporting indigenous biodiversity; or

ii. Important ecosystem services, including pollination; or

g) Improve access to rivers, lakes, wetlands and their margins; or

h) Buffer or link ecosystems, habitats and areas of significance that contribute to ecological corridors; or

i) Control pest species.

Objective 4.5 Adverse effects of using and enjoying Otago's natural and built environment are minimised

Policy 4.5.7 Enabling offsetting of indigenous biodiversity.

Enable offsetting of adverse effects on indigenous biodiversity values, only when:

a) The activities causing those effects have a functional necessity to locate in significant or outstanding areas; and

b) Those effects cannot be avoided, remedied or mitigated; and

c) Those effects do not result in the loss of irreplaceable or vulnerable biodiversity.

Policy 4.5.8 Offsetting for indigenous biodiversity.

Provide for offsetting for indigenous biodiversity, when it is enabled, by ensuring that:

a) The offset achieves no net loss and preferably a net gain in indigenous biodiversity values; and

b) The offset is undertaken close to the location of development, where this will result in the best ecological outcome; and

c) The ecological values being achieved are the same or similar to those being lost; and

d) The positive ecological outcomes of the offset last at least as long as the impact of the activity, if practicable.