RDAgritech

ENGINEERED BY NATURE

NATURAL HAZARDS ASSESSMENT REPORT

JOB TITLE	HOMESTEAD TRUSTEES HAZARDS GEOTECH
ADDRESS	HOMESTEAD BAY, JACKS POINT
JOB NUMBER	50504
	9 June 17

Client: Homestead Bay Trustees Limited

Private Bag 39534,
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Auckland

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1. INTRODUCTION

This report presents the findings of a geotechnical natural hazards assessment carried out by RDAgritech, on behalf of Homestead Bay Trustees Limited for the proposed plan changes at the development zone located at Homestead Bay as indicated on the site plans in Appendix A.

This reporting is to be submitted to the QLDC as evidence for the application and to outline the current Hazards identified and if present their potential impacts for development.

The work was commissioned by Homestead Bay Trustees Limited in a signed Short form agreement, dated 31 May 2017 by Clark Fortune McDonald and Associates who also provided a site plan of the proposed development areas.

The initial scope of work was to provide a high level assessment of the natural hazards for the development area based on our past investigations and assessments of the natural hazards of the existing and neighbouring sites.

The work was carried out by David Rider the Senior Engineering Geologist/Geoprofessional for RDAgritech who also provided the natural hazards assessment and summary for the wider Jacks Point Zone Plan hearings held in February 2017.

2. SCOPE

We have conducted a desktop review of the natural hazards information and reporting for the jacks point zone that we have on our files. This includes review of previous investigation and site walkover information for the site area.

2.1. LIMITATIONS

Findings presented as a part of this report are for the use of Homestead Bay Trustees Limited for submission to the QLDC in accordance with the specific scope and the purposes outlined above. While other parties may find this reporting useful the findings are not intended for use by other parties, and may not contain sufficient information for the purposes of other parties or other uses.

Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice presented in this report.

3. SITE INFORMATION

- The site bounds SH6 to the east, Lakeside Estates to the south, Lake Wakatipu to the south west and west, and the Jacks point subdivision to the north.
- Full site details and information are provided in the applicant's application package submitted previously.
- The area of development is approximately 230 ha.
- The site is currently vegetated with grass and established shelter belt tree lines with an access way established to the site from the end of Maori Jack Road. And the NZone access road from SH6.
- The properties surrounding the site are open farmland. The Jacks Point subdivision to the north of the airfield and lakeside estates to the south are the closest residential developments to the site.
- The existing Jardine homestead and other farm buildings are contained with the site boundaries.
- The site has a generally concave topography sloping towards the southwest.
- Two deeply incised gully's run through the southwest of the site to the lake edge. And another overland flow path with an open channel flows through the northern portion of the site.

4. GEOLOGY

The geology of the site is mapped by the Qm18 as Late Pleistocene glacier deposits comprising: Generally unweathered, unsorted, unsorted to sorted, loose sandy gravel silt and sand (till) in terminal and ground moraines. With basement Haast schist present in the west of the site.

Holocene lake deposits comprising: laminated micaceous silt, mud, and sand in old lake deposits are mapped as well as Alluvial delta deposits comprising sands and gravels present either capping or interbedded with lake sediments.

No active faults were mapped in the field, however, the active Cardrona fault shown on the published Qm 18 approximately 14km east from the site. There is a significant seismic risk to the Wakatipu region when the rupture of the alpine fault system occurs; recent probability predictions estimate a magnitude 7.5 or greater is highly likely within the next 45 years. Significant ground shaking is expected from this type of event.

The site is located in an area of past glacial activity with several advance and retreat events causing the underlying bedrock to be scoured by glacial ice sheets resulting in the deposition of glacial sediments such as till over the schist bedrock and lacustrine and deltaic alluvial fan deposits in a somewhat chaotic mix of materials and interbedding.

Investigation reporting and borehole logs near the lake front of the property confirm the interbedded stratigraphy and depositional environment.

This interbedded stratigraphy of silts sands and gravels creates antistrophic behaviour when subject to seismic cycling.

The site topography to the southwest has a continuous series of terrace faces in the slope as it drops down to the lake. These terraces represent geological time scale instances of down cutting and lowering of the original lake level from roughly the current State highway level. This past lake environment is what facilitated the depositional alluvial fan deposit post glacial retreat with large sediment volumes eroded due to glacial drop out and the Remarkables range regression forming these alluvial fans. Several thousand years have past with no active fan indications nor likely.

5. NATURAL HAZARDS

5.1. DESKTOP QLDC HAZARD MAPS.

From the QLDC hazard maps the following natuiral hazards are mapped across the sites extent.

- Liquefaction LIC1
- Liquefaction LIC2
- Alluvial fan – ORC fan active bed
- Alluvial fan – ORC fan recently active
- Alluvial fan – (regional scale) Active, Floodwater dominated
- Alluvial fan – (regional scale) Active, Debris dominated

5.2. ASSESSED HAZARDS

Liquefaction LIC1

Site investigations for the approved Homestead Bay Subdivision on the lakefront portion of the site confirmed Liquefaction was a nil to low risk and we would concur with this finding for the areas mapped as LIC1 on the hazard maps.

Liquefaction LIC2

Site investigations for the approved Homestead Bay Subdivision on the lake front portion of the site confirmed Liquefaction was a nil to low risk and we would concur with this finding. In addition to the findings comment on lateral spreading at the lake edge was discussed and given the distance the proposed development was from the lake edge lateral spreading was considered to be nil to low of affecting the development.

We would confirm this assessment for the southern, southwest portions of the site near the lake edge. The proposed distances back from the Lake edge would indicate lateral spreading is unlikely to affect the proposed OSR zones. The OSR zone to the north/west side of the site is elevated on gravel terraces and the schist bedrock of Jacks Point hill, hence while this area is closer to the lake edge the underlying geology is not subject to lateral spreading.

RDAgritech's geotechnical investigations for Jacks point over the past year have identified only a small area subject to potential liquefaction manifesting at the surface. However the levels of settlement would still be classed within TC2 and minor areas of TC3 foundation style solutions.

The only potential areas of the development that may be subject to specific liquefaction engineering and designed foundations for structures is likely to be a small area in the western most portion of LOT6 DP 452315 (OSL)

We have sketched the approximate extent of area that could be subject to this hazard on the plan "Hazard Areas" in Appendix A. It must be noted that standard investigation and design would be expected to mitigate this potential hazard hence this area is not precluded from development.

Alluvial fan – ORC fan active bed

This hazard is confined to the deeply incised gully that is present in the southern end of the site, and shown in red below with black dots on the map below.

The deeply incised nature of the gully is providing active confinement of this bed loading and it is unlikely that the bed would aggregate out of the confined area available. We would recommend that should any earthworks or development be located within this gully that a full detailed investigation and assessment is conducted to determine the potential effects.

At this high level assessment stage we would encourage the gully channel to be retained as it is presently.

Alluvial fan – ORC fan recently active

This is shown as the orange with black dots above.

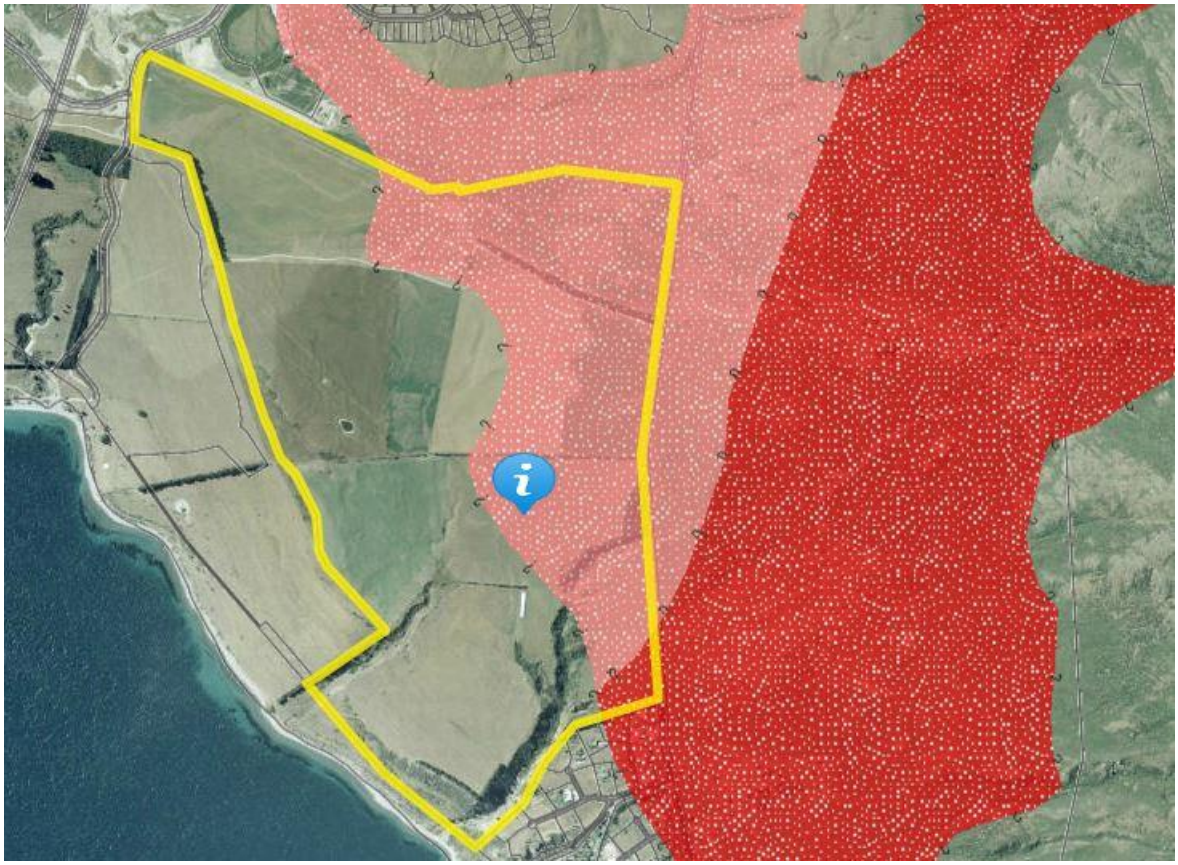
Previous reporting by Fluent Solutions - Gary Dent addressed the alluvial fan hazard for the Jacks point plan zoning and we subsequently reviewed this reporting and concured the hazard is unlikely to affect the site given the geological time scale for past "recent" activity with deposition during high lake levels.

Alluvial fan – (regional scale) Active, Floodwater dominated

This is indicated by the grey pink with white spots area on the plan below, we note this area is showing question marks as to the boundary of its extent into the site.

We have marked up the area we consider to be more appropriate on the "Hazard Areas" in Appendix A. shown as area B

This hazard is typically a flooding triggered event with moderate sediment loading and shallow flow depths. The topographical contour of the site and preexisting flow paths are likely to contain any potential from this hazard, with any flow passing through area B and into the Jackspoint subdivision area. We understand that this hazard has been previously address by the developers of Jacks point, however we have not been able to obtain a copy of any related reporting by the close of evidential submission.



Alluvial fan – (regional scale) Active, Debris dominated

This is shown as the Red area in the above image, and is typically triggered by seismic or high rainfall events with the resulting debris typically not travelling very far as the topography flattens out. The presence of SH6 and its drainage channels are further expected to provide some form of protection from this potential hazard.

We have assessed the area to potentially encroach into the development and have shown this as area C on the "Hazard Areas" plan in Appendix A.

Once again while a high level assessment is provided here, mitigation options are available should detailed investigations at subdivision Consent applications confirm potential mitigation measures are required.

6. CONCLUSIONS

Where areas of the current plan change site have not had detailed natural hazard assessments completed at this stage, the list of potential hazards have been identified and it would be my expectation that these would be addressed as part of any specific consent process at that time of applications for development of the site.

It is my expectation that provided the QLDC assess these hazards in accordance with their Code of Practice for Subdivision and Land Development and NZS4404:2010 then adequate mechanisms are in place for these hazards to be further investigated and mitigated if present.

I would surmise that the natural hazards external to the site have been adequately identified and where present suitably mitigation solutions are available to prevent undue adverse effects on the proposed development area.

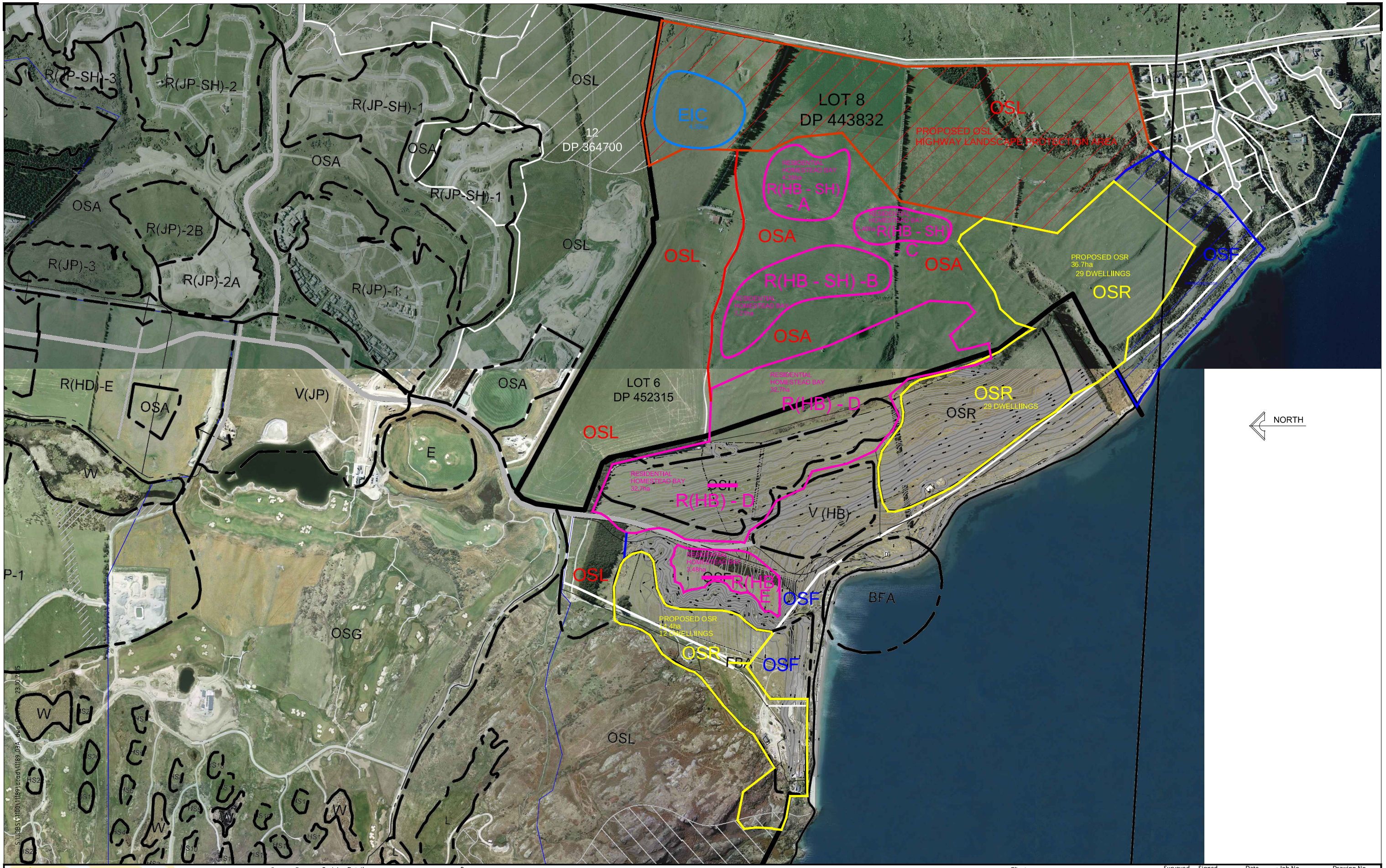
7. APPLICABILITY

This report is only to be used by the parties named above for the purpose that it was prepared and shall not be relied upon or used for any other purpose without the express written consent of the principal and RDAgritech Ltd.

The extent of testing associated with this assessment is limited to discrete locations and variations in ground conditions can occur between and away from such locations. If subsurface conditions encountered during construction differ from those given in this report further advice should be sought without delay.

APPENDIX A. SITE PLANS

1. Development Plans
2. QLDC Natural Hazards Map



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Rev.	Date	Revision Details	By
A	08.10.15	ISSUED TO PP AND JARDINE	NM

PROPOSED STRUCTURE PLAN AND EXTENSION TO JACKS POINT ZONE
HOMESTEAD BAY
OVER LOTS 1 TO 8 DP 443832

Client	Surveyed	Signed	Date	Job No.	Drawing No.
JARDINE TRUST				11189	1
	Drawn	Signed	Date	Scale	1:10,000 @ A3
	Designed	Signed	Date	Datum & Level	Rev.

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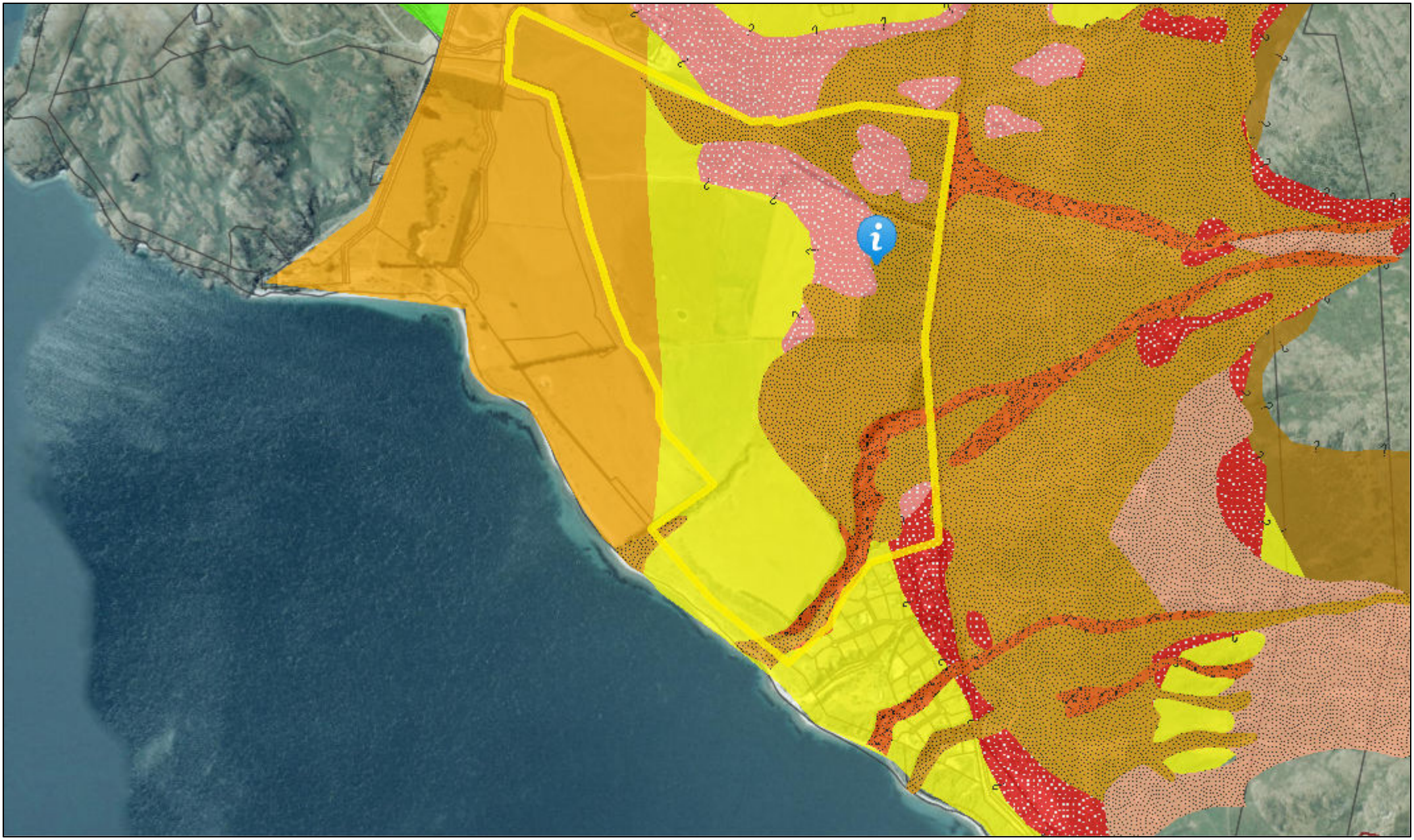

The map is an approximate representation only and must not be used to determine the location or size of items shown, or to identify legal boundaries. To the extent permitted by law, the Queenstown Lakes District Council, their employees, agents and contractors will not be liable for any costs, damages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

Queenstown Lakes District Council

Webmaps your view of your information

Homestead Bay Nat Hazard overlay QLDC

09 June 2017

0 0.15 0.3 0.45 0.6 Kilometres

N

Homestead Bay Nat Hazard overlay QLDC

Legend

Property Land

Parcel Boundaries

Property Address

Roads

Hazards

Active Fault - Location approximate

Inactive Fault - Location approximate

Flooding due to Rainfall

Flooding due to Damburst

Landslide: Active Pre-existing Schist Debris Landslides

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

Landslide: Dormant Pre-existing Schist Debris Landslides

Landslide: Shallow Slips and Debris Flows in Colluvium

Landslide: Debris Flow Hazards

Landslide: Slope Failure Hazard in Superficial Deposits

Landslide: Rockfall

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

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

Landslide: Potential Hazard - Debris Flood/Debris Flow

Landslide Areas - non verified

Erosion Areas

Alluvial Fan - Incision Line

Alluvial Fan - Channels

Alluvial Fan - Source Area

Alluvial Fan - Catchment Areas

Alluvial Fan - Hazard Area

Alluvial Fan - ORC: fan active bed

Alluvial Fan - ORC: fan recently active

Alluvial Fan - ORC: fan less recently active

Alluvial Fan (Regional scale) Active, Composite

Alluvial Fan (Regional scale) Active, Debris-dominated

Alluvial Fan (Regional scale) Active, Floodwater-dominated

Alluvial Fan (Regional scale) Inactive, Composite

Alluvial Fan (Regional scale) Inactive, Debris-dominated

Alluvial Fan (Regional scale) Inactive, Floodwater-dominated

Avalanche Areas

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

Liquefaction Risk: Probably Low (T&T 2012)

Liquefaction Risk: Possibly Moderate (T&T 2012)

Liquefaction Risk: Possibly High (T&T 2012)

Liquefaction Risk: Possibly Susceptible (Opus 2002)

Liquefaction Risk: Susceptible (Opus 2002)

HAZARD AREAS

(A) LIQUEFACTION

(B) ALLUVIAL FAN - FLOODING.

(C) ALLUVIAL FAN - DEBRIS.

9/6/2017

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