BEFORE THE QUEENSTOWN LAKES DISTRICT COUNCIL HEARINGS PANEL

UNDER	the Resource Management Act 1991
IN THE MATTER	of the review of parts of the Queenstown Lakes District Council's District Plan under the First Schedule of the Act
AND	
IN THE MATTER	of submissions and further submissions by **REMARKABLES PARK LIMITED AND QUEENSTOWN PARK LIMITED**

STATEMENT OF EVIDENCE OF PAUL GEORGE FAULKNER ON BEHALF OF REMARKABLES PARK LIMITED AND QUEENSTOWN PARK LIMITED

(GEOTECHNICAL/ENGINEERING GEOLOGY)

STREAM 13 REZONING HEARINGS

9 June 2017

BROOKFIELDS
LAWYERS
J D Young / M Broekman
Telephone No. 09 379 2155
Fax No. 09 379 3224
P O Box 240
DX CP24134
AUCKLAND

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1. QUALIFICATIONS AND EXPERIENCE

1.1 My name is Paul George Faulkner. I am a Senior Engineering Geologist at GeoSolve Limited (**GeoSolve**). I have 19 years of experience in my field and hold the qualifications of B.Sc (Geological Science) and M.Sc (Engineering Geology), from the University of Leeds in the United Kingdom. I am a fellow of the Geological Society, London.

1.2 I currently work with Geosolve and have been based in the Queenstown region for approximately 11 years. I have worked for Tonkin & Taylor Ltd and Geosolve during this period.

1.3 Since 2006 I have worked on a wide variety of projects in the South Island of New Zealand with most of my work being in the Otago and Queenstown area. I have worked on many large commercial and residential developments, often in steep mountainous environments where natural hazards such as debris flow, land stability, liquefaction and rock fall are key issues.

1.4 I have been involved with the proposed gondola from the Remarkables Park area to the Remarkables Ski field since 2014. During this process several iterations of the gondola route have been presented and discussed. This is further addressed in the evidence of Rick Spear. I have completed broad scale geomorphological mapping and specific inspections at key locations throughout this period to inform the current proposal.

2. CODE OF CONDUCT

2.1 I have read and am familiar with the Code of Conduct for Expert Witnesses in the current Environment Court Practice Note (2014), have complied with it, and will follow the Code when presenting evidence to the Council. I also confirm that the matters addressed in this statement of evidence are within my area of expertise, except when relying on the opinion or evidence of other witnesses. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

3. SUMMARY

3.1 My main conclusions are:

(a) Construction of a gondola system in the proposed corridor is considered feasible from a natural hazards and geotechnical perspective;

(b) The proposed corridor avoids areas where elevated risks from natural hazards have been identified, whilst also accommodating the requirements of non-geotechnical aspects, for example, environmental and commercial reasons for the route choice;

(c) The gondola route will traverse steep mountainous terrain and low lying ground adjacent to the Kawarau River. Localised geotechnical issues specific to those areas are present along the proposed corridor;

(d) Assessments completed to date indicate the identified hazards and associated risks are manageable with additional engineering input;

(e) Geotechnical aspects of the gondola design, particularly stanchion/building locations, foundation options and protection measures, will require detailed assessment to confirm the final layout and construction requirements. This work will need to be of sufficient detail to support future consent stages of the project;

(f) For the upslope areas several local developments, particularly ski-fields, have been constructed and operate successfully in very similar geological terrain, with similar hazards and risks. Commercial and residential development has been completed in similar terrain to that present in low lying areas;

(g) The general risk from hazard/geotechnical issues is expected to be broadly similar to those present at other ski field developments and access roads; and

(h) A gondola constructed in the proposed corridor is not expected to worsen the identified hazards.

4. INTRODUCTION

4.1 This assessment has been completed to support an application to rezone the subject area for a future gondola development. It is expected further geotechnical input will be required to refine design elements, and confirm final proposals suitable for future consent applications.

4.2 The proposed gondola corridor starts close to the existing Remarkables Park commercial development, Frankton (approximate RL350 m). The corridor then heads east from this location and crosses to the south side of the Kawarau River where it follows the true right bank for approximately 4km. Depending on the final design the final route may cross briefly to the north side the Kawarau River, before re-crossing to the open fields close to the Rastus Burn and the Kawarau River confluence. From here the corridor climbs up to the Remarkables Ski area running roughly parallel to the Rastus Burn. The upslope end of the corridor terminates immediately adjacent to and on the western side of the existing Remarkables Ski field base building at RL1600 m (approximate).

4.3 For this assessment I have reviewed existing published data on the site geology and documented hazards, and completed site geomorphological mapping. In some cases, specific inspection of potential future stanchion locations was completed.

4.4 The work completed does not constitute a specific assessment for a particular gondola design, and is a feasibility assessment only.

5. CORRIDOR GEOLOGY

5.1 The geology along the proposed corridor shows significant variation and a future gondola will traverse a range of soil types and bedrock.

5.2 On the valley bottom the geological environment comprises recently deposited deltaic alluvial and lake materials typically comprising silts, sands and gravels in variable fractions. At the eastern extent of the proposed lower part of the corridor localised fan deposits associated with the Rastus Burn are present. Localised schist rock outcrops and glacial till deposits are present along the south side of the Kawarau River.

5.3 In upslope areas a range of geological environments are present:

(a) Schist rock;

(b) Slope colluvium. The colluvium was observed to be several metres thick in some places;

(c) Local deposition of down-washed materials around drainage paths;

(d) Schist landslide deposits; and

(e) Glacial till.

5.4 The regional groundwater table is present at shallow depths in low lying areas around the Kawarau River. In elevated areas of the proposed corridor the groundwater table is expected to be at depth, however, perched groundwater seepages are expected to be present at shallow depths particularly around drainage features.

5.5 No active fault traces are known to exist in the vicinity of the corridor. An unnamed fault is shown on the regional geological map to cross the corridor on the lower slopes of the Remarkables. This fault is designated as inactive, concealed and inferred in this area.

5.6 The nearest known active fault is the Cardona-Nevis Fault system located approximately 10km east of the Rastus Burn. This fault has a recurrence interval estimated to be 5000-10000 years (GNS Science Active Faults Database). A significant seismic risk exists in the region from potentially ground shaking associated with rupture of the Alpine Fault located along the west coast of the South Island.

6. SUMMARY OF NATURAL HAZARDS

6.1 The main hazard locations are shown on the **attached** site plan, Figures 1a, 1b and 1c and are summarised in the sections below.

6.2 Historic landslides are present in the corridor area and are several thousand years in age. These features are common in the Otago region and, where active, are characterised by slow downward ‘creep’ of <10mm/yr. Rates can increase locally in response to rainfall and seismic events, or these features can lay dormant for long periods.

6.3 Loose rock debris is present on some areas of the hillside presenting a low risk of rock roll downslope. It is noted that there is very little evidence for rock debris (from rock roll) along the Kawarau River section.

6.4 Rock fall may occur from the ridge line where the proposed corridor climbs up the bluffs to the south of the Rastus Burn, and from other isolated low bluffs and outcrops.

6.5 Debris Flows may develop along flow paths and drainage features in response to high rainfall.

6.6 Liquefaction and lateral spreading may occur in the low lying areas adjacent to the Kawarau River, where high ground water levels and loose granular soil deposits are present.

6.7 An alluvial fan risk has been identified at the base of the mountain side adjacent to the Rastus Burn – Kawarau River confluence.

6.8 Flooding may affect low lying areas along the Kawarau River.

6.9 Avalanches may occur in upper areas of the route.

6.10 Fire risk has not been assessed.

7. CORRIDOR ROUTE CHOICE

7.1 In general, the proposed location of the corridor route takes into consideration the site geology and the location of the hazards outlined above. Note that other requirements (visual, environmental, landscaping etc.) also influenced the corridor location.

7.2 In general the route choice

(a) Avoids the steep more actively unstable slopes in close proximity to Rastus Burn;

(b) Avoids debris flow/flood issues associated with placing the corridor lower downslope in close proximity to the true right of the Rastus Burn;

(c) Avoids more active landslide and/or rock fall areas in general e.g. northern or north western areas of the Remarkables Mountain Range;

(d) Targets in-situ rock where feasible in upper areas;

(e) Is located where preliminary design works indicate a gondola can span across potential hazard areas, e.g. the Rastus Burn, or areas with higher rates of ground creep; and

(f) Provides minimum exposure to rock-roll and rock fall in upslope areas.

7.3 The hazards in the corridor are expected to be manageable over the lifetime of the structure (assumed to be 50 years) provided the detailed design phase addresses local conditions along the route.

7.4 Other corridor route options are technically feasible from a geotechnical perspective, and are likely to have a similar risk, however are not suitable due to non-geotechnical restrictions.

8. PRELIMINARY RISK ASSESSMENT

8.1 In high mountain terrain full avoidance of all hazards is not technically feasible, however, I consider the corridor route to be in the lowest risk areas, given other non-geotechnical constraints on the route.

8.2 Overall risks are likely to be similar to those:

(a) On the adjacent access road, or at the Remarkables Park Ski building/slope areas;
(b) At other Otago Ski Field developments and associated access roads.

8.3 The risk of an intolerable negative impact on the gondola from natural hazards is considered to be low based on a qualitative assessment. Provided appropriate

design is completed for future consent stages, ensuring risk is at an acceptable and tolerable level, is considered to be achievable.

9. FURTHER ASSESSMENT FOR FUTURE CONSENT STAGES

9.1 Further assessment will be required for future consenting stages of a gondola development within the proposed corridor. Assessments will need to be sufficient to confirm the final location of the individual stanchions and any specific design, safety or stabilisation requirements for foundations and structural elements of the system.

9.2 Liquefaction and/or lateral spreading may be a risk for stanchion locations in low lying areas adjacent to the Kawarau River. Assessments should be sufficient to address specific foundations design requirements.

9.3 Upper sections of the corridor traverse steeply sloping rock bluff areas, and slopes with loose rock. My preliminary assessment is that these areas are generally favourable with respect to the proposal. Local issues e.g. rock fall, rock roll, and competency of the rock materials will need to be confirmed for each stanchion location.

9.4 Foundation areas may be subject to flooding and or scouring/erosion associated with flooding along the Kawarau River, or where the line crosses minor creeks and surface run-off features. Appropriate assessment and design will be needed to confirm any particular measures to address this issue.

9.5 Avalanche control and/or protection measures typical for developments in high mountain environments may be required.

9.6 Standard engineering assessment, construction and monitoring practices are expected to be sufficient to quantify and control the risks identified.

9.7 Future assessment should consider the effects of climate change, which for this project is expected to be increased rainfall, run-off and peak flow for drainage paths.

10. CONCLUSION

10.1 From the assessments I have completed to date the construction of a gondola in the proposed corridor is feasible from a geotechnical perspective and represents the most suitable routes for the corridor. Other routes of similar suitability are available, however I understand they are unsuitable due to non-geotechnical constraints.

10.2 Geological hazards are present within the corridor however I consider the impact from these features is manageable using standard engineering assessment and construction, and with sufficient inspection and maintenance during the lifetime of a future gondola.

10.3 A gondola in the proposed corridor is not be expected to worsen any of the existing hazards.

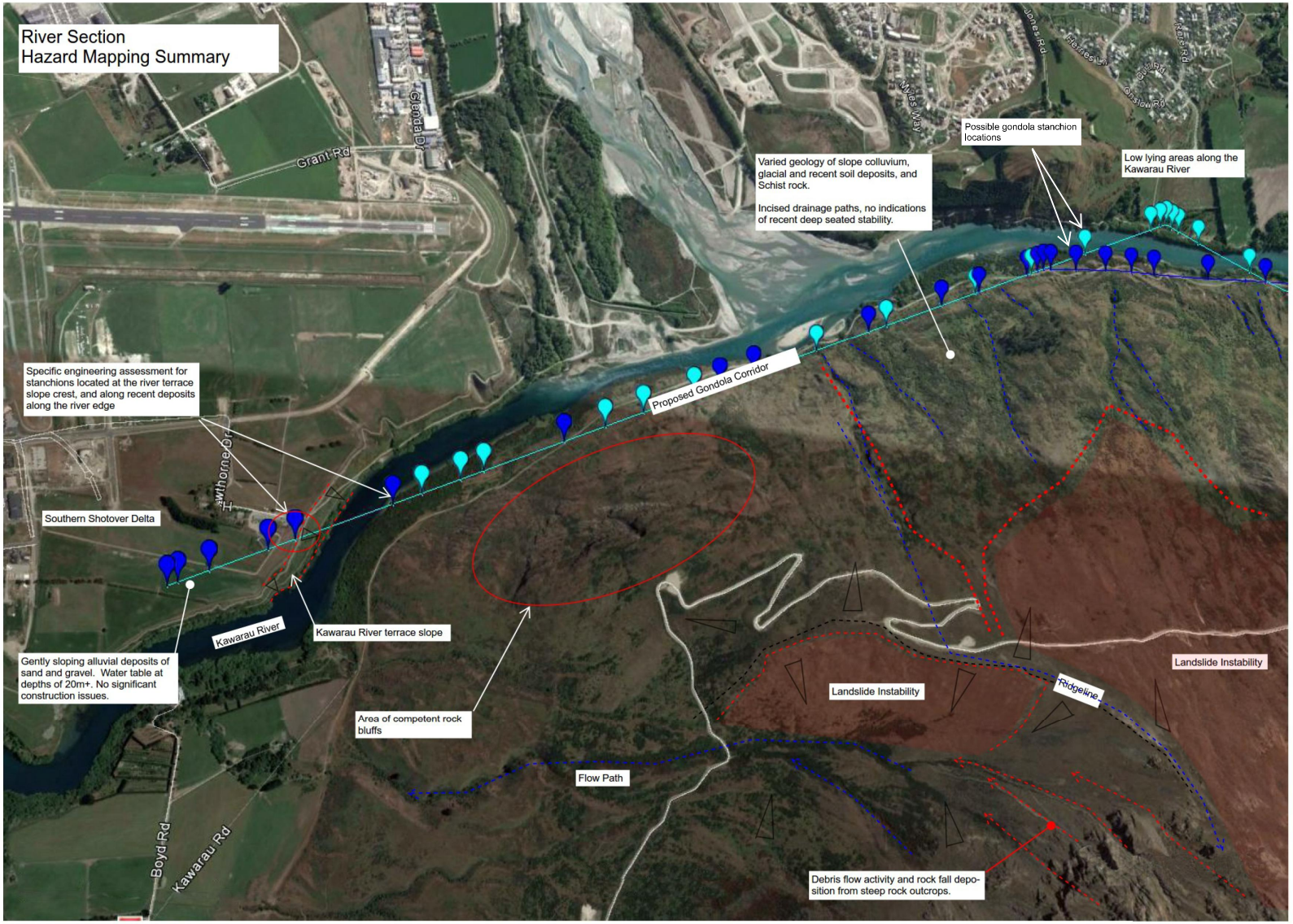
10.4 Overall, risks are considered similar to other nearby developments in similar terrain.

10.5 Further geotechnical input will be required to refine the engineering inputs for future consent stages of a gondola development. This work should be completed for resource and/or building consent as appropriate.

Paul Faulkner

9 June 2017

ATTACHMENTS: NATURAL HAZARD SUMMARY PLANS, FIGURES 1A,1B AND 1C



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GEOTECHNICAL ENGINEERING
Level 1, 70 MacAndrew Road, South Dunedin
www.geosolve.co.nz

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CADFILE: 140478_SP1.dwg		
SCALES AT A3 SIZE: AS SHOWN		
PROJECT No: 140478		

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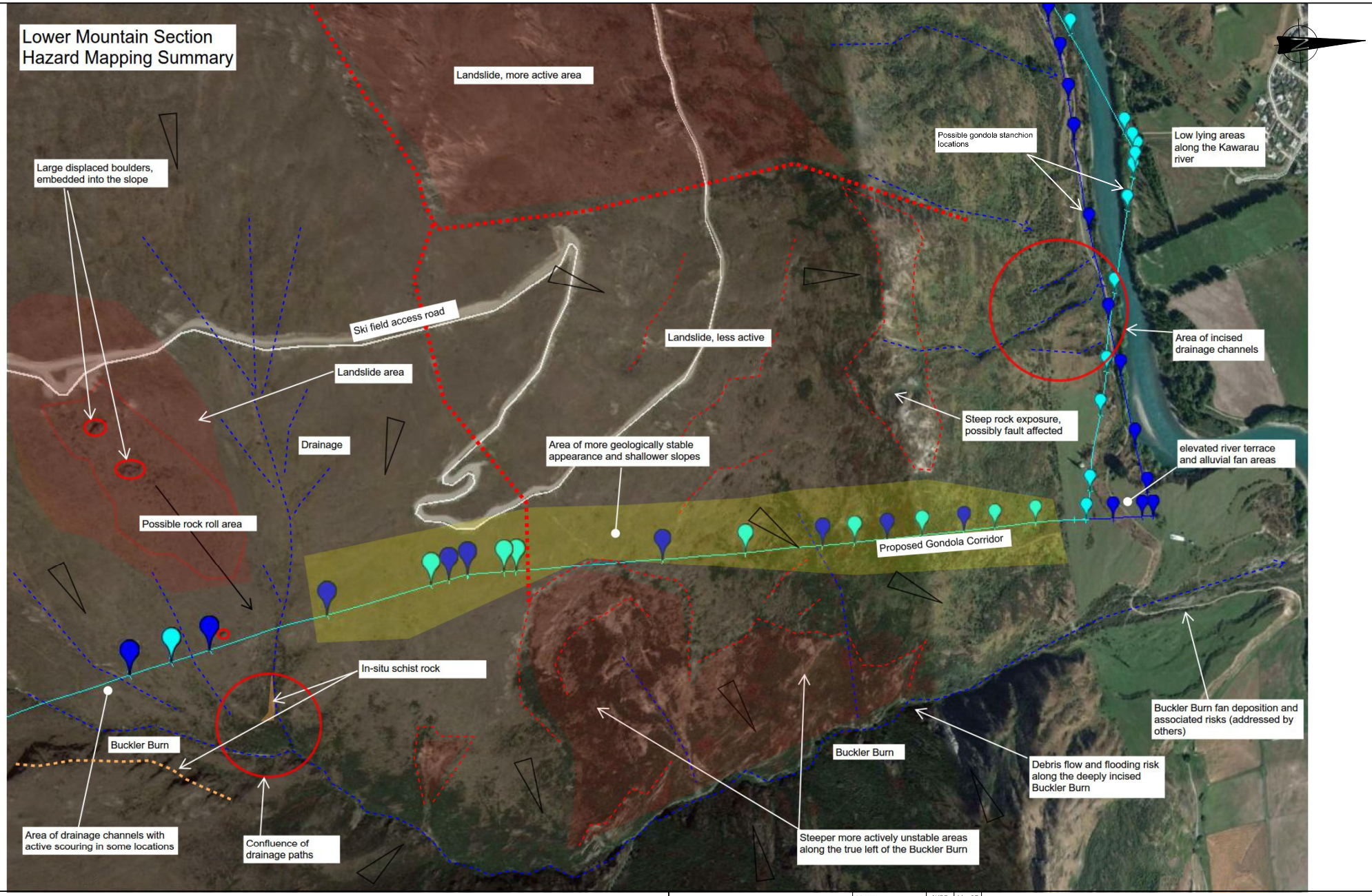
Natural Hazard Summary Plan - Proposed Gondola Corridor

River Section

FIG No: Figure 1a

REV: 0



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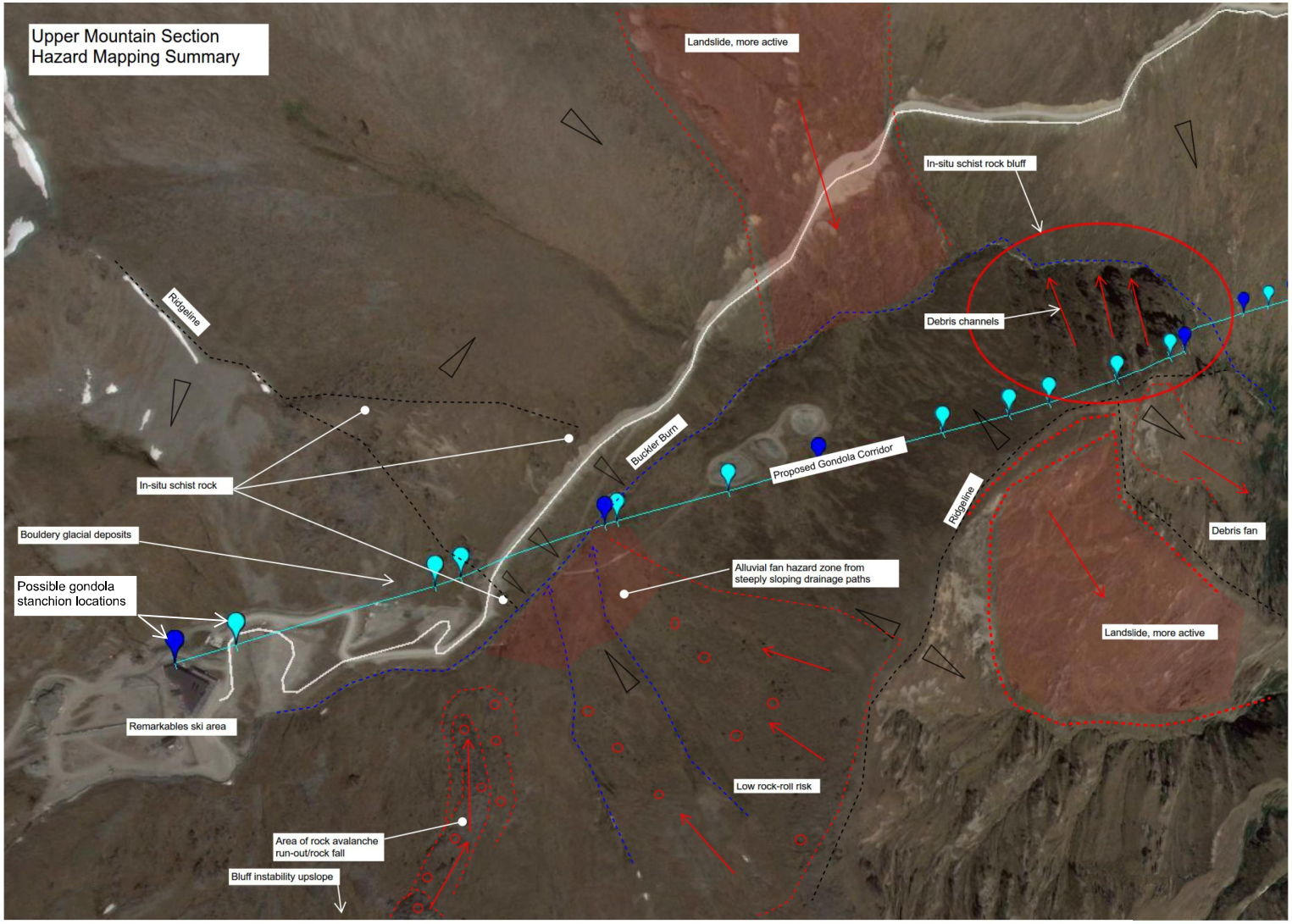
Natural Hazard Summary Plan – Proposed Gondola Corridor

Lower Mountain Section



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Natural Hazard Summary Plan – Proposed Gondola Corridor

Upper Mountain Section

FIG No: Figure 1c

REV: 0