Stantec

Memo

To:	Dunedin City Council	From:	Edward Guerreiro
		Review:	Lee Paterson
File:	2GP Rezoning sites_ March2022	Date:	May 6, 2022

SUMMARY

The purpose of this letter is to transmit our assessment the hazards and respond to public submissions at the requested sites:

- RS160: Part 155 and part 252 Scroggs Hill Road
- GF02 and GF02a: 201, 207, 211 Gladstone Road South, East Taieri
- GF03: 16 Hare Road and 7 Kayforce Road
- GF05 and GF05a: Parts 353 Main South Road, Fairfield (part of)
- GF11 and GF11a: Wakari Road area
- GF12: 233 Signal Hill Road (in part)
- GF14: 336 and 336A Portobello Road, The Cove
- GF16: Highcliff Road and Hereweka Street, Portobello
- RS176: 234/290 Malvern Street, Leith Valley
- RS14: Freeman Cl and Lambert St, Abbotsford

We have summarized our findings using a "traffic light" system.

"Green" indicates no significant hazards are present and that the site does not require any specific engineering for development (e.g. elevated areas with shallow slopes and competent underlying geology).

"Yellow" indicates that there are hazards identified on part or all of the site that will require some specific engineering design to mitigate and enable higher density development (e.g. within low risk flood and overland flow susceptible areas, liquefaction susceptible geology, moderately steep terrain, or potentially unstable geology).

"Red" indicates that there are significant hazards on part or all of the site that will require significant specific engineering design or further investigation to enable development (e.g. steep slopes, high risk flood hazards, low strength or known unstable geology, and existing known instability).

The sites in this memo have already had initial hazards assessments. The public has since provided submissions for these sites. Our assessment contains the original assessment and addresses the public submissions against the site, and any changes made to the hazard status of the site as a result.

Table 1 summarizes our assessment of the requested sites.

Table 1 - Hazard Summary

Site	Original Assessment Hazard Category	Summary of change	New Hazards Category
RS160: Part 155 and part 252 Scroggs Hill Road	Medium	Slight site boundary increase does not affect original assessment.	Medium
GF02 and GF02a: 201, 207, 211 Gladstone Road South, East Taieri	Low	Clarify flood hazard mitigation requirement. No change to hazard category. Addition of 195 and 197 Gladstone Road South into application.	Low
GF03: 16 Hare Road and 7 Kayforce Road	Low	The provided submission raised valid concerns of flood risk to the site that was not included on DCC records. Hazard category and recommendations changed as a result.	Medium
GF05 and GF05a: Parts 353 Main South Road, Fairfield (part of)	High	The newly proposed GF05a site is considered high risk along with the rest of GF05. Significant investigations required to exclude or mitigate the risk of land instability.	High
GF11 and GF11a: Wakari Road area	Low	The submissions concerns are valid but the proposed changes are inconsequential. Stormwater hazard assessments will be required as part of future subdivision application. The addition of GF11a area is in line with the rest of the site.	Low
GF12: 233 Signal Hill Road (in part)	Medium	The submissions concerns are valid and in line with our original concerns. These will be addressed at the time of subdivision. No changes required.	Medium
GF14: 336 and 336A Portobello Road, The Cove	Medium	The submissions concerns are valid and in line with our original concerns. These will be addressed at the time of subdivision. No changes required.	Medium

Site	Original Assessment Hazard Category	Summary of change	New Hazards Category
GF16: Highcliff Road and Hereweka Street, Portobello	Medium	No change to hazard level.	Medium
RS176: 234/290 Malvern Street, Leith Valley	Low to Medium	No change to hazard level.	Low to medium
RS14: Freeman Cl and Lambert St, Abbotsford	Medium to High	No change to hazard level.	Medium to High

A detailed assessment of each site is presented below.

RS160: PART 155 AND PART 252 SCROGGS HILL ROAD

Site Summary

The proposed site is indicated in Figure 1. The site is located within undulating Otago Schist hills above Brighton.

Figure 1 – 155 and 252 Scroggs Hill Road Site

Geology and Slopes

The geology of the site consists of Otago Schist and Taratu Coal Measures (Quartz conglomerate).

The site is typically sloping by less than 12 degrees on the ridge tops and up to 35 degrees within numerous gullies within the area.

The underlying lithology is generally globally stable at steep slope angles (<26°), however is subject to weakness under certain conditions and slope angles. Excavation within lower schist slopes can

destabilize uphill land. Though instability is generally limited to the overlying superficial deposits (loess). In this case, there is dense vegetation covering the steeper parts of the site.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 11965: Land Stability – Land Movement (unknown)

  Activity: Unknown, Sensitivity: Low, Certainty: Likely, Type: Translational Slide,

  Initiation Time: Probably Prehistoric, Last Movement: Unknown

- Hazard ID 11504: Land Stability – Land Movement (Landslide Slip ID=135 and 136)

  Landslides triggered by 17-19 March 1994 rainstorm

The site consists of multiple mapped landslides from unknown movement to certain historic activity. These are all occurring within the gullies and zones of steep terrain.

A mapped historic landslip has occurred at the site within the steeper terrain to the east. The trigger for this site was related to stormwater and mapped landslip extents are within the proposed site.

This does not exclude this site from development, but engineering assessments of these steep areas is definitely required to permit development and confirm the extents of the proposed site.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **medium level hazard**. This decision is based on the following summary of information:

- There are **medium level hazards** associated with slope instability on the site
  - Global stability of steeper parts of the site appears to be governed by stormwater management and steepness/aspect of the slopes.
  - Geotechnical advice will be required prior to subdivision of this site to confirm the extents of instability and ensure it will not affect any potential lots. This may also identify any offsets that might be required from unstable areas.

Geotechnical assessment will be required to confirm the stability of any proposed lots. Provided the site is found to be globally stable, some specific earthworks and stormwater management requirements would be applicable for lots on the site. It is likely that removal of trees from the gully areas will exacerbate instability.

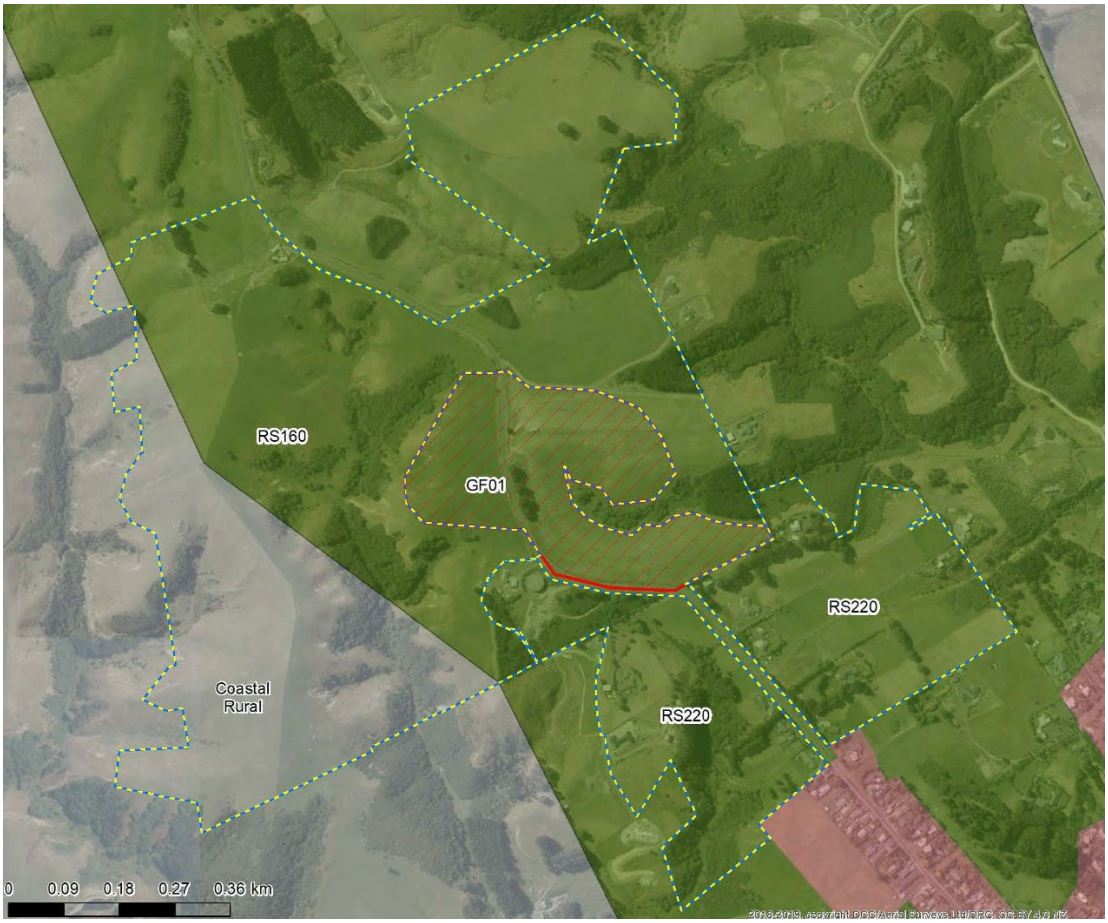
The ridgelines and flatter areas appear to be suitable for building platforms.

Submissions for the site

The site received the following submissions for hazards consideration:

- S249.001 & S249.003 (Ross McLeary & COF Ltd & Scroggs Hill Farm Ltd): Request to rezone the site from Rural Residential 1 zone to Township and Settlement Zone with a Structure Plan Mapped Area (inferred not stated).
    - The effective change is to very slightly increase/vary the site boundaries of the original assessment.

The proposed new rezoning area is shown in the figure below.



Changes from original assessment

We have reviewed the above submission and related documents and recommend that the original assessment is relevant and there is **no change** from the original assessment.

GF02 AND GF02A: 201, 207, 211 GLADSTONE ROAD SOUTH, EAST TAIERI

Site Summary

The proposed site is indicated in Figure 2. The site is located on the South Mosgiel plains.

Figure 2 – 336 and 336A Portobello Road Site

Existing Information

There is no preexisting hazard information found within historic ECM files.

Geology and Slopes

The geology of the site consists of alluvial deposits of south Mosgiel. The site is flat.

Although not directly a hazard, the underlying soils are relatively young, and as a result may be loose / lower strength. This will affect foundation design.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 10106: Land Stability - Land Movement (Alluvial Fans – Inactive Floodwater Dominated)
- Hazard ID 11407: Seismic – Liquefaction (Domain B)
- Hazard ID 11407: Seismic – Liquefaction (Domain C)

  Domain B/C - The ground is predominantly underlain by poorly consolidated marine or estuarine sediments with a shallow groundwater table. There is considered to be a moderate to high likelihood of liquefaction-susceptible materials being present in some parts of the areas classified as Domain C.

- Hazard ID 11582: Flood – Overland Flow Path (Flood Hazard Area 22)
- Hazard ID 11582: Flood – Overland Flow Path (Flood Hazard Area 23)

All the hazards are relating to flood and liquefaction associated with weak floodplain alluvium. This is no different than many other locations within Mosgiel and is controlled using engineering design for foundations and guidelines for minimum floor levels.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low hazards level**. This decision is based on the following summary of information:

- There are **low level hazards** associated with seismic instability on the site
  - Liquefaction is typically mitigated with geotechnical investigation followed by site specific design. This is typically a building control issue that is not a limiting factor for subdivision of the lots
- There are **low level hazards** associated with flood hazard on the site:
  - The site lies within flood hazard overlays that are typically mitigated through minimum floor levels implemented at the time of subdivision

Geotechnical assessments will be required for liquefaction assessments which can be recommended at the time of subdivision.

Minimum floor levels will be required to be set for any subdivision within the proposed area.

Specific engineering design or exclusion of liquefaction risk will still be required for all lots within liquefaction risk areas across the site.

Submissions for the site

The site received the following submissions for hazards consideration:

- S24.001 (Darrin and Sheree Healy): The property at 201 Gladstone Road is often prone to flooding in the winter months. Submitter therefore requests that change is removed or is conditional on consideration to be made that development will not impact their existing property.
- S271.033 (ORC): While a lower risk hazard on a large section of the site, the section 32 report has assessed the mapped Hazard 3 alluvial fan as presenting no issues. ORC would expect the hazard, while low, would be acknowledged and what risk may or may not need to be mitigated, including from stormwater run-off etc. ORC, accordingly, requests to remove the change unless:
    a. the mapped alluvial fan risk is appropriately recognised and any mitigation that might be required is made.
- S30.003 (Sonia & Karl Thom): General concerns over flooding risk issues from the subject sites to the neighbouring ones.
- S30.001 (Sonia & Karl Thom): Requested to extend the rezoning to the submitters' properties at 195 & 197 Gladstone Road South.
- FS184.505 & FS184.506 (ORC): Submitter support OS30.003 & OS30.002 in part to allow proposed amendments to Change GF02 if areas of identified natural hazards are excluded.
- FS184.507 (ORC): Oppose S82.005 in part. Disallow submission and do not amend Change GF02 to remove the new development mapped area and apply a Structure Plan Mapped Area instead unless development accounts for identified hazards and assesses and clarifies adverse effects from density increase.
- FS184.508 (ORC): Oppose OS223.002 in part. Disallow submission and do not amend Change GF02 to remove the new development mapped area and apply a Structure Plan Mapped Area instead unless development accounts for identified hazards and assesses and clarifies adverse effects from density increase.
- FS184.509 (ORC): Oppose OS1.002 in part. Disallow submission and do not amend Change GF02 so dwellings built collect rainwater in sizeable tanks as potable water to reduce impact on the 3 water issues unless development accounts for identified hazards and assesses and clarifies adverse effects from density increase.
- FS184.56 (ORC): Support OS24.001 in part. Allow submission and support the removal of GF02, if amended only allow submission to rezone GF02 if the areas where natural hazards are identified are excluded.
- FS184.510 (ORC): Oppose OS99.002 in part. Disallow submission to either remove Change GF02 or amend Change GF02 to extend it to 195 and 197 Gladstone Road South. If amended ensure it is conditional on the exclusion of areas where natural hazards are identified.
- FS184.10 (ORC): Oppose OS118.001. Disallow submission and do not rezone 207 Gladstone Road (GF02) as any development must account for where identified hazards are present and adverse effects from density increase must be clarified and assessed.
- FS184.46 (ORC): Oppose OS223.001. Any development must account for where identified hazards are present and adverse effects from density increase must be clarified and assessed.
- FS184.87 (ORC): Oppose OS30.001. Disallow submission and do not extend Change GF02 over 195 & 197 Gladstone Rd South as any development must account for where identified hazards are present and adverse effects from density increase must be clarified and assessed.

- FS184.57 (ORC): Oppose S240.002. Disallow submission and do not extend Change GF02 over 195 & 197 Gladstone Rd South as any development must account for where identified hazards are present and adverse effects from density increase must be clarified and assessed.
- FS184.111 (ORC): Oppose S99.001. Disallow submission and do not extend Change GF02 over 195 & 197 Gladstone Rd South as any development must account for where identified hazards are present and adverse effects from density increase must be clarified and assessed.

Changes from original assessment

We have reviewed the above submission and related documents. Most of the submissions relate to concerns around flood risk to the surrounding properties as a result of the development or are concerned that the effects of increased density will negatively affect the natural hazards. These concerns are well founded, and any development within the newly proposed site will be subject to specific design to not cause any adverse effects on neighbouring properties. In many cases this will be addressed through detention tanks and specifically designed stormwater reticulation systems. We acknowledge this was not specifically written into the recommendations of our original assessment but would have occurred as part of standard assessments of the site at the time of subdivision. This site is no different from the adjacent residential lots which are already developed.

We recommend that the original assessment is relevant and there is **no change** from the original hazard assessment level. However, the advice provided in our original hazards assessment can be updated to include flood related comments. These are assessments and mitigating works that would have been undertaken anyway, but have been included here for clarity and to satisfy community concerns.

Request S30.001 (Sonia & Karl Thom) is to include 195 and 197 Gladstone Road South in the rezoning of the original application. This site is directly adjacent to the original site and faces exactly the same flood considerations and ground conditions. We recommend the same hazard assessment of this site as the main site.

Updated Recommendations

We would like to add the following recommendations to improve clarity:

- The site lies within a flood area where hazards are typically mitigated through specific design as part of the subdivision.
    - These may include, but not limited to detention features and specifically designed stormwater reticulation
    - Any modification to the site shall not increase any adverse ponding or stormwater flow effects on neighbouring lots as a result of the work
    - Any cumulative effects of increased density on stormwater and flood hazards shall not affect neighbouring lots.

GF03: 16 HARE ROAD AND 7 KAYFORCE ROAD

Site Summary

The proposed site is indicated in Figure 3.

Figure 3 – 16 Hare Road Site

Existing Information

There is no preexisting hazard information found within historic ECM files.

Geology and Slopes

The geology of the site is raised river terrace deposits between Otago Schist hills. The site is typically sloping by less than 12 degrees then steeply sloping towards the boundaries with slopes of up to 35 degrees.

Although not directly a hazard, the underlying soils are relatively young, and as a result may be loose / lower strength. This will affect foundation design.

The steep schist slopes along the northern boundary are heavily vegetated and unlikely to present a slope stability hazard if left untouched. Excavation into the toe of this slope will require geotechnical input.

Existing Hazards and Effects

There are no hazards within the proposed area, however we have identified the following hazard directly adjacent to this lot:

- Hazard ID 11965: Land Stability – Land Movement

  Activity: Unknown, Sensitivity: Medium, Certainty: Likely, Type: Translational Slide,

  Initiation Time: Probably Prehistoric, Last Movement: Unknown

The land stability hazard affects the land towards the northern boundary of the proposed area and is not considered a hazard for the whole site.

- Hazard ID 10116: Land Stability – Land Movement (Landslides from Forsyth)
- Hazard ID 11407: Seismic – Liquefaction (Domain B)
- Hazard ID 10106: Land Stability – Land Movement (Alluvial Fans – Active Floodwater dominated)

All the hazards relating to liquefaction and alluvial material are associated with weak floodplain alluvium. This is no different than many other locations along Hare Rd and is controlled using engineering design for foundations.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low hazards level**. This decision is based on the following summary of information:

- There are **low level hazards** associated with slope instability within the slope angles and geology of the site

The proposed area is predominantly developable with minor geotechnical input required. However, some general geotechnical assessments may be beneficial to confirm the extents of developability adjacent to the steep schist slopes to the north. This may also include some information regarding stormwater management, offsets from the slope, and vegetation retention to prevent erosion.

Submissions for the site

The site received the following submissions for hazards consideration:

- S42.001 (Mike Ind): The submitter raises concerns regarding the flooding from Taylors Creek during weather events and the exacerbating effects of the Climate change increasing frequency of weather "events", which exceed the flow capacity of the creek resulting in localised flooding, inundation of houses, and loss of access to existing properties during the flood event. Improvement / upgrade of Taylors Creek is required to prevent inundation of site during weather events. The submitter accordingly rejects the proposed rezoning.

Changes from original assessment

We have reviewed the above submission and related documents. The provided submission raises concerns about flooding of Taylors Creek. Our original assessment did not review this possibility as it is not considered a hazard in the hazards register.

The submission claims that Taylor Creek floods during severe weather events and inundates the proposed rezoning site. This is valuable local information and influences our recommendation for the original assessment for the site to be increased from a **low level hazards** to **medium level hazards** site.

This does not preclude development of the site but it does more accurately reflect the level of engineering required to ensure any development is suitably considered.

In light of this change the following recommendations can be added:

- There are **medium level hazards** associated with stormwater and flooding from Taylor Creek.
    - Flood hazard assessments are required to identify suitability (or not) of the site for higher density development. The specific assessments would be required to confirm the extents and impacts of flooding, especially in relation to potential landslides further impeding Taylor Creek. It is likely that hazard mitigation will require extensive earthworks to develop the lower lying land within this site.

GF05 AND GF05A: PARTS 353 MAIN SOUTH ROAD, FAIRFIELD (PART OF)

Site Summary

The proposed site is indicated in Figure 4. The site is located west of the historic Abbotsford landslides.

Figure 4 – Main South Road Site

Existing Information

There is no preexisting hazard information found within historic ECM files.

Geology and Slopes

The geology of most of the site is Abbotsford Mudstone sloping towards alluvial gravels south of the site.

The site is predominately sloping by less than 12 degrees, though has many areas of up to 20 degrees and localized slopes of up to 26 degrees.

The steepest part of the site is located within the vegetated embankment with consistent slopes of 20-26 degrees. Earthworks within this area may cause significant large scale instability within the uphill lots off Severn St and Tate Cres.

Abbotsford Mudstone is known for its susceptibility to groundwater and earthworks and historic large-scale instabilities. The material typically become unstable at slopes of over 15 degrees, however there have been several cases of instabilities within slopes of less than 12 degrees. An example of this is the historic Abbotsford motorway landslide within the same geology. Excavation of the toe of the slope caused a global landslip within land sloping by less than 12 degrees.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 10106: Land Stability – Land Movement (Alluvial Fans – Inactive Floodwater)

  Most of the northern half of the area contains this non-hazard.

- Hazard ID 11807: Land Stability – Land Movement (Landslide)

  It is noted that an area within the eastern wing of the site has this landslide hazard. There is a "swampy area" and possible recent land instability in this area.

- Hazard ID 11965: Land Stability – Land Movement (Miller Street Landslide)

  Adjacent to the previous hazard, there is an area within the eastern half of the site containing this mapped pre-historic landslide.

There are other land stability hazards on nearby slopes and within similar geology that have historically failed (Abbotsford Motorway Slide, East Abbotsford Landslide. There are also mapped hazards and recent commentary on land instability within the proposed area.

There is also a large quarry still active directly adjacent to the west of the proposed site, and was previously active within the lower slopes and terraces to the southwest.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **high level hazard** site. This decision is based on the following summary of information:

- There are several **high level hazards** associated with slope instability and precedent for land instability within similar geology and slope angles nearby.
    - Global stability of the site could be affected by development, especially from earthworks and/or groundwater changes. Any global instabilities would be large to massive in scale and affect multiple potential lots.

- The site is located within the same geology and slope angles as other large historic landslides nearby.
- Geological investigations are required to determine the suitability of the site. Investigations may require deep drilling.

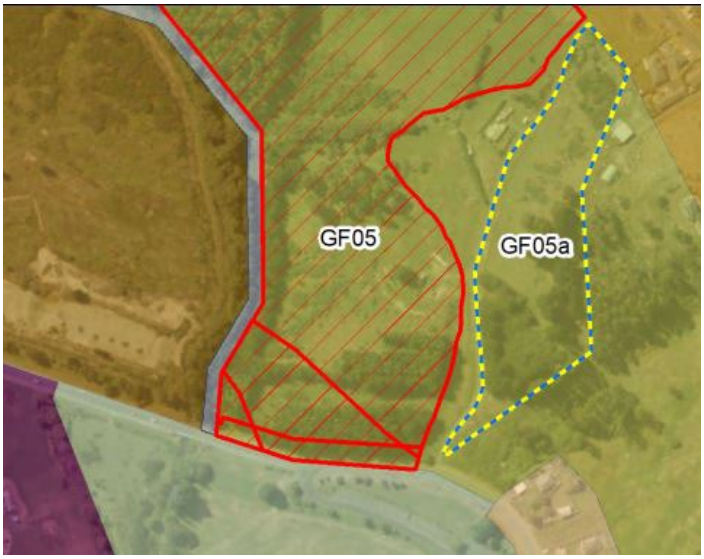
Extensive geotechnical assessments are required to substantiate the applicability of earthworks or higher density development in this area. Specific assessment and design would be required to confirm the global stability of the site. It is possible that much of this area is not developable without earthworks that may destabilize a large slip.

There is precedent for development of the Grand Vista Subdivision adjacent to the site which underwent intensive geotechnical investigation to identify land instability and no build zones. At least one site within this area is subject to section 72 of the Building Act.

Submissions for the site

The site received the following submissions for hazards consideration:

- Submission S204.001 seeks to rezone the area marked GF05a with a restriction of the establishment of only one dwelling.



Changes from original assessment

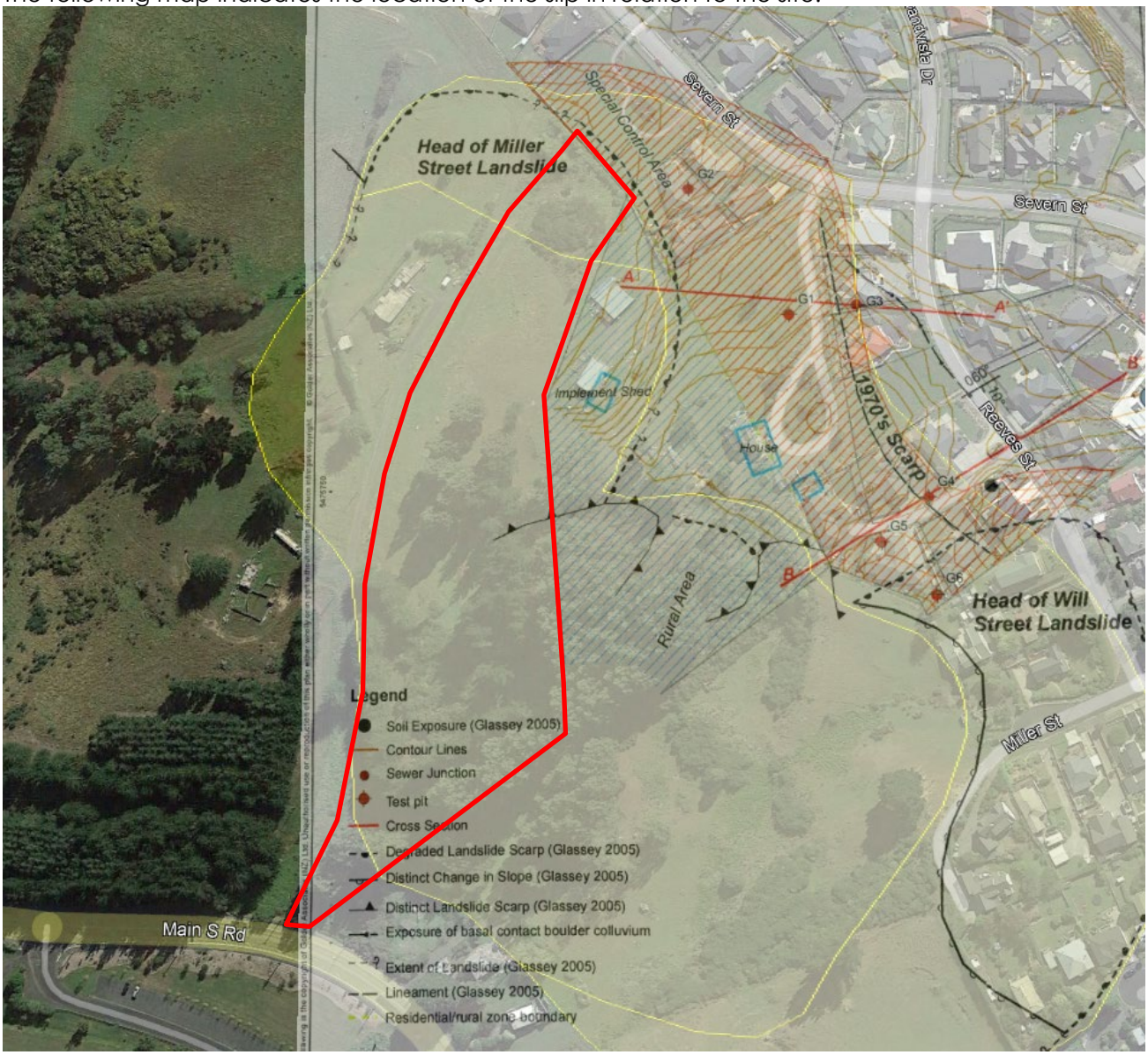
We have reviewed the above submission and related documents. The provided submission seeks to rezone an adjacent area (GF05a) to allow only one dwelling (a single home for the retirement of the owner). The applicant accepts that the right to establish a dwelling on the site will be conditional upon a building platform that is to be engineered.

We consider that the hazard level for this adjacent site is **high.** The site is located entirely within the Miller Street landslide with distinct head scarps from historic landslide features as recent as 1970s. It is

uncertain that there will be any location within the site that a geotechnical engineer would consider stable enough for a dwelling. As such it is a possibility that any new structures within this area will be uninsurable, though this cannot be known until geotechnical investigations have been sought.

We recommend that specific geotechnical advice is sought before any zone changes in this area. From our desktop assessment, the site appears to be unsuitable for any subdivision or reduction in lot sizes where there are massive landslips present. Detailed site investigations would need to be undertaken to support any development proposals in this area.

The following map indicates the location of the slip in relation to the site.



GF11 AND GF11A: WAKARI ROAD AREA

Site Summary

The proposed site is indicated in Figure 5. The site is located within undulating volcanic terrain.

Figure 5 – Polwarth Road & Wakari Road Site

Existing Information

There have historically been earthworks consents and contamination sites within this proposed area.

There is no preexisting hazard information found within historic ECM files.

Geology and Slopes

The geology of the site is third main eruptive phase volcanics (various basalts). The site is typically sloping by less than 12 degrees with some thin depressions/gullies.

The underlying lithology is generally globally stable at moderately steep slope angles (<20°), unless over-excavated or subject to weathering / ground water. Instability is generally limited to the overlying superficial deposits (loess). In this case, there are no slope stability hazards associated with the geology or sloping terrain.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 11965: Land Stability – Land Movement

  Activity: Unknown, Sensitivity: Medium, Certainty: Likely, Type: Translational Slide,

  Initiation Time: Probably Prehistoric, Last Movement: Unknown

- Hazard ID 11550: Contaminated Land – Pesticide Bulk Storage

The land stability hazard only affects a minute corner of the proposed area and is not considered a hazard for the site. There are no other hazards on adjacent land that may affect this site.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low hazards level**. This decision is based on the following summary of information:

- There are **no hazards** associated with slope instability
- There are no other listed natural hazards on the site which would affect development

Submissions for the site

The site received the following submissions for hazards consideration:

- S222.001 (John Hurley): Due to flooding from neighbouring property and the creek in front of residence (flooding happens once or twice a year, after long periods of rain) the boundary line of the new residential zone on 301 Wakari Road needs to be realigned, as shown on the plan below.
- The small addition of GF11a to the proposed rezoning.

Changes from original assessment

We have reviewed the above submission and related documents. The provided submission seeks to modify the boundary of the original area rezoning to accommodate flood hazards on the site. Our original assessment did not consider the risk of flooding and it is not mapped on DCC records.

The area of concern is relatively minor and would have been addressed through the subdivision process anyway. The addition of the flood hazard does not elevate the hazard level for the site and it remains a **low hazards level**. The risk of flooding in this area is an engineering issue that would be addressed through offsets from the creek or fortifying the banks. The adjustment of the boundary isn't necessary to address the risk.

Similarly, the addition of GF11a is in line with the rest of the site and the original assessment.

GF12: 233 SIGNAL HILL ROAD (IN PART)

Site Summary

The proposed site is indicated in Figure **6**. The proposed site area follows around the base of the steep slopes around Signal Hill.

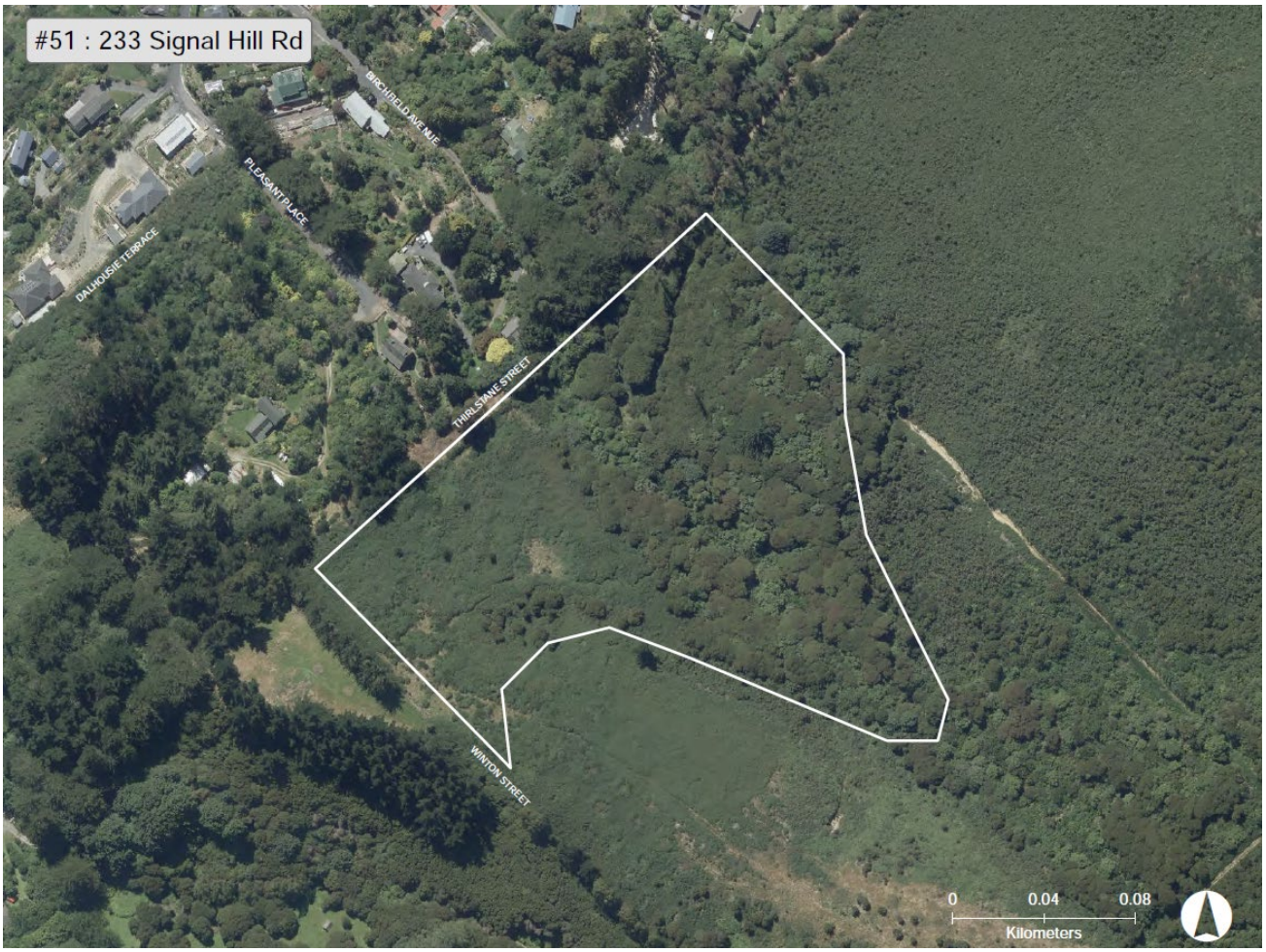


Figure 6 – 233 Signal Hill Road Site

Existing Information

The site has a complicated history with consents. A recent Geolink report is also provided for both 233 and 235 Signal Hill Road. The recent geotechnical report is not relating to the proposed area.

Geology and Slopes

The geology of the site consists of second main eruptive phase volcanics. The site is very steeply sloping in some areas by up to 35 degrees.

The underlying lithology is generally globally stable at moderately steep slope angles (<20°), unless over-excavated or subject to weathering / ground water. Instability is generally limited to the overlying superficial deposits (loess).

The outlined area in yellow consists of ground that is sloping by up to 20 degrees (or just slightly over) which would be more readily developable.

Existing Hazards and Effects

There are no hazards on this site or adjacent land that may affect this site within the hazards register.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low-to-medium hazard level**. This decision is based on the following summary of information:

- There are **low hazards** associated with slope instability within the red highlighted area, however excavation into the toe of the steep slopes may exacerbate slope instability.
- There are **medium level hazards** associated with slope instability within the wider area:
    - There are possibly sensitive slopes of up to 35 degrees within the proposed area that may become unstable with excavation and improper stormwater management.
- There are **medium level hazards** associated with stormwater within the wider area:
    - There is a well defined watercourse running through the proposed area, particularly through the main "flat" section of the site. Although the land in the gully is less steep, there are other hazards associated with stormwater management and associated erosion and land stability.

There is readily developable land within the proposed area, however geotechnical investigation and assessments of the adjacent slopes is required to confirm the extents of the readily developable land.

It is possible that excavation into the steeper slopes within the proposed area may cause instability uphill, or within the watercourse.

Submissions for the site

The site received the following submissions for hazards consideration:

- S152.001 (Dempster-Passang) - concerns about flooding of downhill properties.
- S134.001 (Layland) –concerns regarding flooding and running springs in the property of 50 Birchfield Avenue.
- S175.001 (Youard) – "Natural Hazards: The impacts are described as "Low" in part and "Medium" for the remainder due to slope instability and storm-water run-off. The areas are not described on any map so it is impossible to judge the respective size of the Low vs Medium risk areas. Very significant storm-water issues, including land movement have occurred to properties below 233 Signal Hill, namely properties on Pleasant Place and

Birchfield Ave as a result of existing land topography and alteration of storm-water flows when adverse heavy weather events have occurred and also when land clearance has occurred. The area is also well known for hidden springs, as many local home builders have discovered to their cost once excavation of their building platforms has begun. The water table in this area is notoriously difficult to assess. Submissions, including video evidence , were made to council concerning these very issues a few years ago when proposals were made by the Court family to extend Pleasant Place across Thurlstone Rd to allow subdivision on what is now 233 Signal Hill Rd. Additionally, there does not appear to be any requirements for reforestation of this area to mitigate these existing natural hazards."

Changes from original assessment

We have reviewed the above submission and related documents. The provided submissions all have concerns with the proposal due to flooding and stormwater runoff and spring flows concerns. These are all valid concerns, however the hazards associated with runoff and spring flows all lie with the developer. A condition of subdivision of this site will be retention of vegetation, specific engineering design for slope stability, stormwater runoff and any encountered spring flows. There will also be a requirement to ensure that any existing stormwater flow remains less or equal to the current runoff during and after construction.

The site is a **medium hazard** site, which indicates that challenges will exist, and engineering design will be required for development of the site. The concerns presented by the public are in line with our original concerns where we stated "*there are possibly sensitive slopes of up to 35 degrees within the proposed area that may become unstable with excavation and improper stormwater management*", and "…*geotechnical investigation and assessments of the adjacent slopes is required to confirm the extents of the readily developable lan*d".

Our original reservations have been validated by the submissions and we recommend that no change is made to the current hazard level of the site. However, the development of this slope is will likely be dictated by geotechnical and stormwater constraints, rather than simply optimizing the boundaries for maximum geometric efficiency.

It may be worth informing the concerned parties that labelling the site "medium hazards level" does not guarantee that the site will be developable. It is a category assigned to the site from a desktop level assessment that indicates the requirement for further geotechnical investigation and advice. If the geotechnical advice is found to be not in favor of development, or the proposal would create or exacerbate any hazard to neighbouring lots, then it will not go ahead. If there is found to be favorable conditions and the detailed geotechnical assessment concludes the site is suitable for development, specific geotechnical design will still be required to ensure no negative effects on neighbouring lots. This includes control of spring flows, long and short-term stormwater runoff, vegetation clearance and earthworks through design and supervision.

GF14: 336 AND 336A PORTOBELLO ROAD, THE COVE

Site Summary

The proposed site is indicated in Figure 7. The site is located on the sedimentary foothills of a volcanic formation.

Figure 7 – 336 and 336A Portobello Road Site

Existing Information

There is preexisting hazard information found within historic CST100 files regarding land instability from stormwater on Lot 3 DP4349. The hazard information is regarding Hazard ID 10749 described in the hazards section of this proposed area.

Geology and Slopes

The geology of the site consists of second main eruptive phase volcanics. The site is typically sloping by 20 - 26 degrees and rolling off to up to 35 degrees towards the western gully.

The underlying lithology is generally globally stable at moderately steep slope angles (<20°), unless over-excavated or subject to weathering / ground water. Instability is generally limited to the overlying superficial deposits (loess).

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 10127: Land Stability – Land Movement (Peninsula Landslides Class 3)
- Hazard ID 10127: Land Stability – Land Movement (Peninsula Landslides Class 4)
- Hazard ID 10127: Land Stability – Land Movement (Peninsula Landslides Cass 2)
- Hazard ID 10127: Land Stability – Land Movement (Peninsula Landslides Cass 1)
- Hazard ID 10127: Land Stability – Land Movement (Alluvial Fans – Active Debris Dominated)
- Hazard ID 10749: Land Stability – Land Movement

  "the proposed subdivision area is within a gully containing relatively thin colluvium over volcanic bedrock. Shallow seated slumping is likely upslope from the building platform. A small stream runs down the centre of the site with a culvert used to control its flow next to the existing building platform on proposed lot 2, which might result in other potential land stability issues to the building platform. A suitably qualified person is recommended for the foundation design, please refer to CST100 files in ECM for more details"

The site consists of various levels of land stability hazards from the Peninsula Landslide Complex. Generally, most of the site is within Class 3 and slopes of 26 degrees or less.

This does not exclude this site from development, but engineering assessments of these steep areas is definitely required to permit development of the proposed site.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **medium level hazard**. This decision is based on the following summary of information:

- There are **medium level hazards** associated with slope instability on the site
    - Global stability of steeper parts of the site appears to be governed by variable geological conditions and stormwater management and may be affected by development.
    - Geotechnical advice will be required prior to subdivision of this site to confirm the extents of any instabilities and ensure it will not affect any lots. This may also identify any offsets that might be required from unstable slopes

Geotechnical assessment will be required to confirm the stability of the entire proposed area. Provided the site is found to be globally stable, specific earthworks requirements and specific engineering design will still be required for most lots on the site.

Engineering assessment will need to identify the areas of land instability (or otherwise) prior to any subdivision of the site. There is precedent for development in the area on similar slopes, however further development must be subject to thorough geotechnical testing and assessment.

Submissions for the site

The site received the following submissions for hazards consideration:

- S46.001 (Watts) – reject GF14 due to concerns regarding it being an unstable steep environment and stormwater erosion.
- S38.001 (Estate of David Cull) – reject GF14 due to geotechnical and stability issues.
- S37.001 (Chan) – reject GF14 due to geotechnical and stability issues.
- S72.001 (Watts) – reject GF14 due to concerns regarding it being an unstable steep environment and stormwater erosion.
- S180.001 (Walker) – reject GF14 due to concerns regarding it being an unstable steep environment and stormwater erosion.
- S102.001 (Temple) – reject GF14 due to instability of the slope and cliff face erosion.
- S165.001 (Davies) – reject GF14 due to concerns regarding it being an unstable steep environment and stormwater erosion
- S182.001 (Wheeler) – reject GF14 due to concerns about landslips, instability, and erosion.
- S53.001 (Brady) – reject GF14 due to concerns regarding it being an unstable steep environment and stormwater erosion.
- S41.001 (Shaw) – reject GF14 due to concerns regarding it being an unstable steep environment and stormwater erosion.

Changes from original assessment

We have reviewed the above submission and related documents. The provided submissions all have concerns with the proposal due to instability/erosion. These concerns are well founded for some of the steeper slopes and within the gully features. We originally assessed this site as a medium hazard level due to the very steep slopes on the site. There are no mapped landslides, and most of the proposed area lies within a spur of relatively strong rock types. The gully features steep slopes and possible shallow failures/erosion.

The ability to develop this site will be dependent on geotechnical investigations and advice. The conditions of subdivision will constrain lot shapes and require any development to not pose any additional hazards to surrounding lots.

There will definitely be some localised areas within the proposed rezoning that are not suitable for development due to geotechnical hazards. These will be identified by appropriate geotechnical assessments.

We consider the site category should remain the same.

GF16: HIGHCLIFF ROAD AND HEREWEKA STREET, PORTOBELLO

Site Summary

The proposed site is indicated in Figure **8**. The site is located within the "Peninsula Landslide" area.

Figure 8 – Area Bounded By Seaton Highcliff Rd And Portobello Sites

Existing Information

There is no preexisting hazard information found within historic ECM files.

Geology and Slopes

The geology of the site consists of "flows and tuffs" volcanic material.

The site is typically sloping by up to 20 degrees and rolling off to over 26 degrees towards the west and east of the site. There are slopes over 35 degrees adjacent to the eastern boundary of the proposed area.

The underlying lithology is highly variable and varies from very strong to very weak and unstable slopes. Instability can range from shallow to large scale failures.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 10127: Land Stability – Land Movement (Peninsula Landslides Class 3)
- Hazard ID 11965: Land Stability – Land Movement (Unknown)
- Hazard ID 10127: Land Stability – Land Movement (Peninsula Landslides Cass 2)
- Hazard ID 10127: Land Stability – Land Movement (Peninsula Landslides Cass 1)
- Hazard ID 10127: Land Stability – Land Movement (Alluvial Fans – Active Debris Dominated)

The site consists of various levels of land stability hazards from the Peninsula Landslide Complex. Generally, most of the site is within Class 2 and slopes of 20 degrees or less.

This does not exclude this site from development, but engineering assessments of these steep areas is definitely required to permit development of the proposed site.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **medium level hazard**. This decision is based on the following summary of information:

- There are **medium level hazards** associated with slope instability on the site
    - Global stability of steeper parts of the site appears to be governed by variable geological conditions and stormwater management and may be affected by development.
    - Geotechnical advice will be required prior to subdivision of this site to confirm the extents of any instabilities and ensure it will not affect any lots. This may also identify any offsets that might be required from unstable slopes

Geotechnical assessment will be required to confirm the stability of some parts of the proposed area. Provided the site is found to be globally stable, regular earthworks requirements would be applicable for most lots on the site.

Some parts of the site (such as within landslide class 1-2 and sloping less than 15 degrees) are free of any significant hazards.

Extensive geotechnical assessments are required to substantiate the applicability of earthworks or higher density development in this area. Specific assessment and design would be required to confirm the global stability of the site, and identify weaker geologies. It is possible that much of this area is not developable without earthworks that may destabilize weaker material.

Submissions for the site

The site received the following submissions for hazards consideration:

- S67.001 (Barton) – amend change GF16 to ensure that a) the area does not become more prone to flooding and endanger our house at 13 Hereweka St; and b) the streams water quality will not decline, whether through silting, other pollutants from building work, increased water flow/speed or similar. These concerns could be mitigated by making the stream at the bottom of the rezoned area less straight and plant its banks for shade.

Changes from original assessment

We have reviewed the above submission and related documents. The concerns submitted in S67.001 are primarily related to exacerbating hazards as a result of development. Any subdivision or development application for the site will result in conditions controlling the impact on neighbouring lots.

The proposed changes to the area of the original assessment results in no additional hazards. The site is within the same or similar hazard zones.

We recommend that the original assessment is relevant and there is **no change** from the original hazard assessment level

RS176: 234/290 MALVERN STREET, LEITH VALLEY

Site Summary

The proposed site is indicated in Figure **9**.

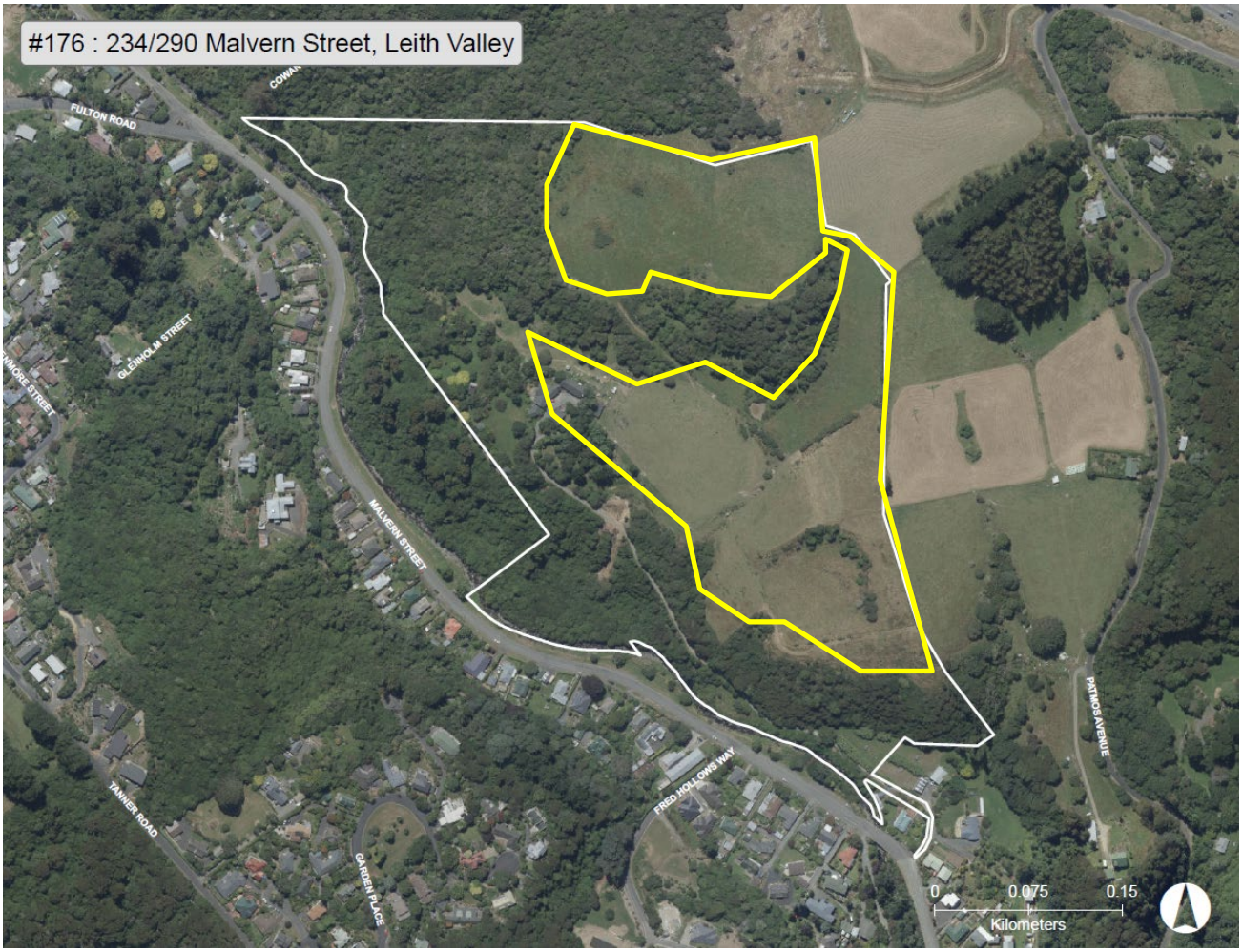


Figure 9 – 234/290 Malvern Street, Leith Valley Sites (yellow outline indicates slopes of less than 20 degrees)

Existing Information

There is no preexisting hazard information found within historic ECM files.

Geology and Slopes

The geology of the site is third main eruptive phase volcanics (various basalts). The site is typically sloping by up to 15 degrees within the yellow highlighted area. The site is heavily vegetated on the steeper slopes which are up to 35 degrees. This vegetation is likely stabilizing erosional land stability.

The underlying lithology is generally globally stable at moderately steep slope angles (<20°), unless over-excavated or subject to weathering / ground water. Instability is generally limited to the overlying superficial deposits (loess). In this case, there are no slope stability hazards associated with the geology or sloping terrain.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 11965: Land Stability – Land Movement

  Activity: Unknown, Sensitivity: Low, Certainty: Likely, Type: Rotational Slide,

  Initiation Time: Probably Prehistoric, Last Movement: Unknown

- Hazard ID 11965: Land Stability – Land Movement

  Activity: Unknown, Sensitivity: Medium, Certainty: Likely, Type: Translational Slide,

  Initiation Time: Probably Prehistoric, Last Movement: Unknown

- Hazard ID 10106: Land Stability – Land Movement (alluvial fans – active floodwater dominated)
- Hazard ID 11581: Flood – Waterway (Upper Leith Floodplain)

The flood and alluvial hazards are associated with the Upper Leith flood area at the toe of the proposed area. This is not a hazard for the main site.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **low to medium level hazard**. This decision is based on the following summary of information:

- There are **low level hazards** associated with slope instability on the site within the yellow highlighted area:
  - Global stability of the yellow area is within typical stability limits.
  - Geotechnical advice will be required prior to subdivision of this site to confirm the extents of instability in the adjacent slopes and ensure it will not affect any development. This may also identify any offsets that might be required from the active slopes.
- There are **medium level hazards** associated with slope instability across the proposed area:
  - Stability of steeper parts of the site appear to be governed by stormwater management and vegetation and may be affected by development.

Geotechnical advice will be required prior to subdivision of this site to confirm the extents of any instabilities and ensure it will not affect any lots. This may also identify any offsets that might be required from unstable slopes

Submissions for the site

The site received the following submissions for hazards consideration:

- FS126.1 – oppose S77.001 due to concerns about land stability and a local sinkhole present on the riverbank.

Changes from original assessment

We have reviewed the above submission and related documents. The concerns submitted in FS126.1 are related to a small portion of the wider site. At least half of the site appears to be fairly low risk for development, but due to steep slopes and the presence of localized features such as landslip mapping and other unknown geotechnical issue, we originally recommended that geotechnical investigations will be required to inform the subdivision process. The process of geotechnical investigation and advice will identify geotechnical hazards such a sink holes and landslides and will help inform any proposed future developments.

We recommend that the original assessment is relevant and there is **no change** from the original hazard assessment level.

RS14: FREEMAN CL AND LAMBERT ST, ABBOTSFORD

Site Summary

The proposed site is indicated in Figure 10. The site is located North and West of historic Abbotsford landslides.

Figure 10 – Freeman Cl, Lambert St, Abbotsford Site

Existing Information

There is no preexisting hazard information found within historic ECM files.

Geology and Slopes

The geology of most of the site is Abbotsford Mudstone with some conglomerate and alluvial sediment towards the north-western creek.

The site is predominately sloping by less than 12 degrees, though has some large areas of up to 15 degrees and gullies of 35 degrees.

Abbotsford Mudstone is known for its susceptibility to groundwater and earthworks and historic large-scale instabilities. The material can typically become unstable at slopes of over 15 degrees, however there have been several cases of instabilities within slopes of less than 12 degrees. An example of this is the historic Abbotsford motorway landslide within the same geology (although slightly different geological circumstances). Excavation of the toe of the slope caused a global landslip within land sloping by less than 12 degrees.

Existing Hazards and Effects

We have identified the following hazards within the Hazards Register that are applicable for this lot:

- Hazard ID 10358: Unknown (possibly related to "slippage, slope stability, erosion"

  Noted hazard with comments relating to land stability and erosion
- Hazard ID 10710: Unknown (possible related to land stability)

  Noted hazard with no data
- Hazard ID 10105: Flood – Waterway (Abbots Creek)

  Possible indicative area of flooding from Abbots Creek
- Hazard ID 10106: Land Stability – Land Movement (Alluival Fans – Active Floodwater Dominated)

  Possible transport of sediment from flooding within this area
- Hazard ID 11965: Land Stability – Land Movement (multiple)

  Activity: Unknown, Sensitivity: Low, Certainty: Likely, Type: Complex,

  Initiation Time: Probably Prehistoric, Last Movement: Unknown
- Hazard ID 10116: Land Stability – Land Movement (Landslides from Forsyth)

  This hazard area represents the limits of this mapped hazard
- Hazard ID 11498: Land Stability – Subsidence (Mine)

  This hazard area represents maximum limits of mine workings
- Hazard ID 10632: Land Stability – Subsidence (Mine)

  This hazard area represents possible extents of coal mine workings. "Fill ex brickworks '93"
- Hazard ID 10633: Land Stability – Subsidence (Mine)

  This hazard area represents possible extents of coal mine workings. "Fill ex brickworks '93"

There are other land stability hazards on nearby slopes and within similar geology that have historically failed (Abbotsford Motorway Slide, East Abbotsford Landslide. There are also readily identifiable features of land movement and disturbance in the area.

Recommendations/ Specific Engineering Requirements

We consider that this site is a **medium** to **high level hazard** site. This decision is based on the following summary of information:

- There are several **high level hazards** associated with slope instability and precedent for land instability within similar geology and slope angles nearby.
    - Global stability of the site could be affected by development, especially from earthworks and/or groundwater changes. Any global instabilities would be large to massive in scale and affect multiple potential lots.
    - The site is located within the same geology and slope angles as other large historic landslides nearby.
    - Mine site hazards require further investigation to confirm the affects on developability of the site
    - Geological investigations are required to determine the suitability of the site. Investigations may require deep drilling
- There are also several **medium level hazards** associated with stormwater
    - Alluvial sediment transport within the flood hazard area
    - Flooding within the flood hazard area

Extensive geotechnical assessments are required to identify suitability (or not) of the site for higher density development. The specific assessments would be required to confirm the extents and impacts of historic mine works, and global stability of the site. It is possible that extensive hazard mitigation design and conditions would be required for development in much of this area.

Submissions for the site

The site received the following submissions for hazards consideration:

- S298.001 – rezone part of RS14 (specifically, 25 McMeakin Road) from Rural (Hill Slopes) to General Residential 1.
- S281.001 – rezone part of RS14 (specifically, 42 Lambert Street) from Rural (Hill Slopes) to General Residential 1.
- S228.003 – rezone part of RS14 (specifically, 45 McMeakin Road and part of 188 North Taieri Road) to a mixture of zones in accordance with the submitter's proposed structure plan, including General Residential 1 zone, Low Density Residential zone, and Recreation zone, and do not apply a New Development Mapped Area (NDMA).
- S302.001 – rezone part of RS14 (specifically, 55 McMeakin Road) from Rural (Hill Slopes) to General Residential 1.

- FS137.1 – oppose S228.003 due to numerous concerns, including multiple around geotechnical and hazards as outlined within the submission

Changes from original assessment

We have reviewed the above submission and related documents. The concerns submitted in FS137.1 is related to geotechnical hazards. All of the other original submissions have modified their proposed areas. A Geosolve report has been provided to support the rezoning submission S228.003.

Our original high level classification based on geological type, slope angles, and existing hazard mapping suggested the site was high risk and that extensive geotechnical advice is required for development of much of the area.

The Geosolve report identifies a number of areas that would be suitable or unsuitable for development. It also recommends that significant further investigations would be required to confirm suitable areas for development.

We have reviewed the proposed revised areas and the Geosolve report, however the nature of the site is quite complex, and a general desktop overview is insufficiently granular to address the issues of the site.

We recommend that the original assessment that the site is high risk is still appropriate and significant subsurface investigations will be required for development of the site. This classification does not mean that development is not possible, just that it may be constrained by geotechnical hazards and cost of mitigation.