

Michaela Groenewegen

From: Emma Peters <sweepconsultancy@gmail.com> on behalf of emma <Emma@sweepconsultancy.co.nz>
Sent: Friday, 12 March 2021 09:52 a.m.
To: District Plan Submissions
Subject: Re: Submission of Wendy Campbell - 188 Taieri Road North
Attachments: Corrected Variation 2 Submission Notes - Wendy Campbell - 188 North Taieri Road.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Roxy

Hi,

Please find attached a corrected version of the submission notes - changes include completion of sentence at last bullet point under submission point 1 and removal of reference to change area GF01 in bullet points under submission point 2.

Please delete the previous version from your records and make the attached version of the submission notes available for further submissions.

Cheers,

Emma Peters Consultant Sweep Consultancy Limited P.O. Box 5724 Dunedin 9054 Phone 0274822214
www.sweepconsultancy.co.nz

On 5/03/2021 12:15 am, emma wrote:

Hi,

Apologies I had not attached the submission notes to the email below - attached now.

Cheers,

Emma Peters Consultant Sweep Consultancy Limited P.O. Box 5724 Dunedin 9054 Phone 0274822214
www.sweepconsultancy.co.nz

On 4/03/2021 11:48 pm, emma wrote:

Hi,

Please find attached the following documents forming the submission of Wendy Campbell in relation to the residential rezone of part of 188 Taieri Road North pursuant to a structure plan:

- Completed Form 5;
- Submission Notes;
- Table 1;
- Geotech Report and
- Structure Plan.

Cheers,

Emma Peters Consultant Sweep Consultancy Limited P.O. Box 5724 Dunedin 9054
Phone 0274822214 www.sweepconsultancy.co.nz

SUBMISSION FORM 5

CLAUSE 6 OF FIRST SCHEDULE, RESOURCE MANAGEMENT ACT 1991



SECOND GENERATION DISTRICT PLAN

This is a submission on Variation 2 to the Second Generation Dunedin City District Plan (2GP). Your submission must be lodged with the Dunedin City Council by midnight on 4 March 2021. All parts of the form must be completed.

Privacy

Please note that submissions are public. Your name, organisation, contact details and submission will be included in papers that are available to the media and the public, including publication on the DCC website, and will be used for processes associated with Variation 2. This information may also be used for statistical and reporting purposes. If you would like a copy of the personal information we hold about you, or to have the information corrected, please contact us at dcc@dcc.govt.nz or 03 477 4000.

Make your submission

Online: www.dunedin.govt.nz/2GP-variation-2 | **Email:** districtplansubmissions@dcc.govt.nz

Post to: Submission on Variation 2, Dunedin City Council, PO Box 5045, Dunedin 9054

Deliver to: Customer Services Agency, Dunedin City Council, Ground Floor, 50 The Octagon, Dunedin

Submitter details (You must supply a postal and/or electronic address for service)

First name: Wendy

Last name: Campbell

Organisation (if applicable):

Contact person/agent (if different to submitter): Emma Peters, consultant, Sweep Consultancy Ltd

Postal address for service: P.O. Box 5724

Suburb:

City/town: Dunedin

Postcode: 9054

Email address: emma@sweepconsultancy.co.nz

Trade competition

Please note: If you are a person who could gain an advantage in trade competition through your submission, your right to make a submission may be limited by clause 6(4), Schedule 1 of the Resource Management Act.

I could gain an advantage in trade competition through this submission: Yes ☒ No ☐

If you answered yes, you could gain an advantage in trade competition through this submission please select an answer:

- Yes No My submission relates to an effect that I am directly affected by and that:
- a. adversely affects the environment; and
- b. does not relate to trade competition or the effects of trade competition.

Submission

Submissions on Variation 2 can only be made on the provisions or mapping, which are proposed to change or alternatives that are clearly within the scope of the 'purpose of the proposals', as stated in the Section 32 report. Submissions on other aspects of the 2GP are not allowed as part of this process.

You must indicate which parts of the variation your submission relates to. You can do this by either:

- making a submission on the Variation Change ID (in which case we will treat your submission as applying to all changes related to that change topic or alternatives within the scope of the purpose of that proposal); or
- on specific provisions that are being amended.

The specific aspects of Variation 2 that my submission relates to are:

Variation 2 change ID (please see accompanying Variation 2 – Summary of Changes document or find the list on www.dunedin.govt.nz/2GP-variation-2)

Residential rezone of 'area 1' & 'area 2' of 188 North Taieri Road
For example: D2 in accordance with the structure plan & application of a
structure plan mapped area

Provision name and number, or address and map layer name (where submitting on a specific proposed amendment):

All provisions relating to New Development Mapped Areas
For example: Rule 15.5.2 Density or zoning of 123 street name.

My submission seeks the following decision from the Council: (Please give precise details, such as what you would like us to retain or remove, or suggest amended wording.)

☒ Accept the change

☒ Accept the change with amendments outlined below

☐ Reject the change

☐ If the change is not rejected, amend as outlined below

] see attached submission notes

see attached submission notes

Reasons for my views (you may attach supporting documents):

If you wish to make multiple submissions, you can use the submission table on page 3 or attach additional pages.

see attached submission notes

Hearings

Do you wish to speak in support of your submission at a hearing: ☒ Yes ☐ No

If others make a similar submission, would you consider presenting a joint case at a hearing: ☒ Yes ☐ No

Signature:

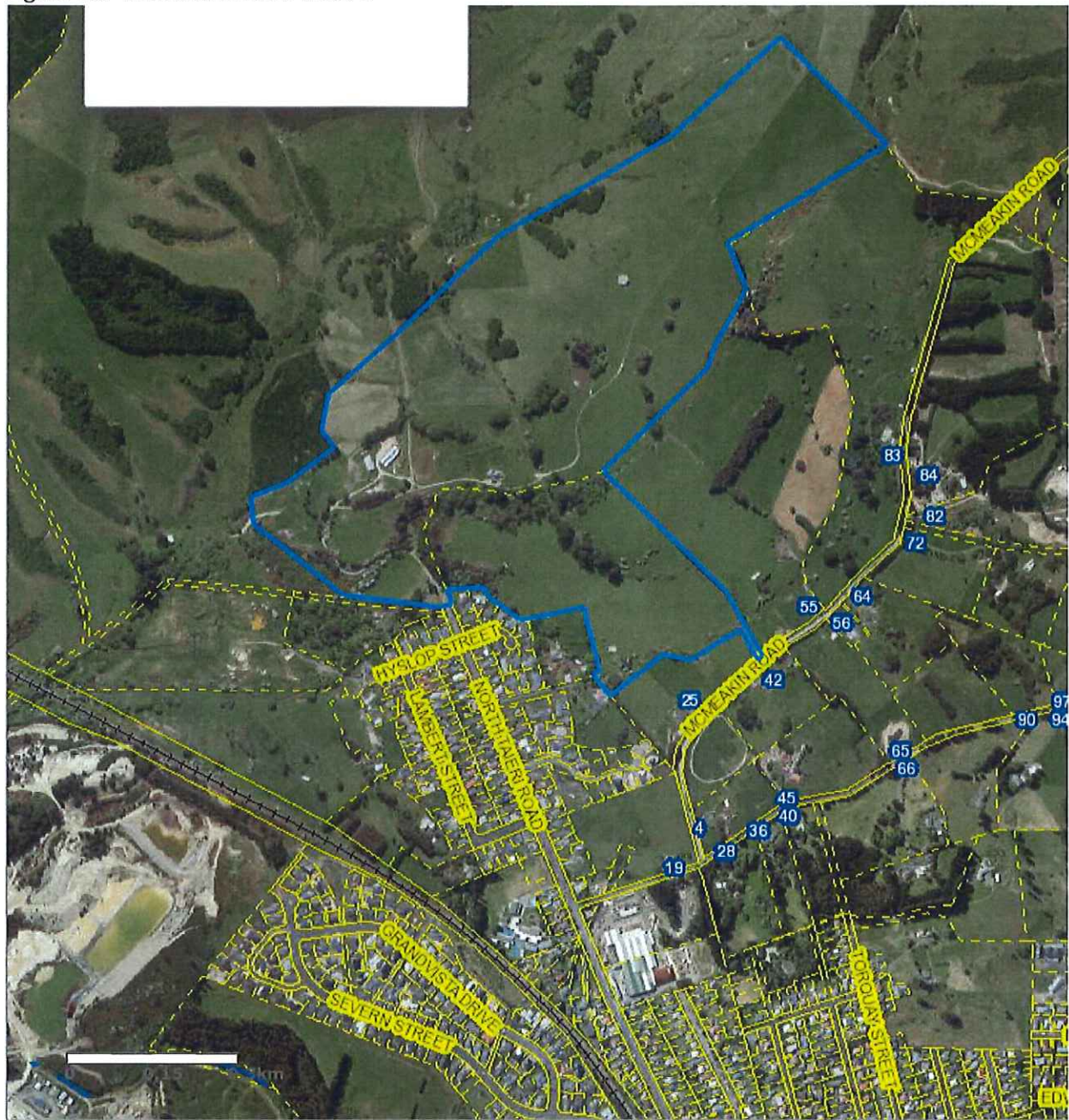
 Emma Peters, Consultant, Sweep Consultancy Ltd

Date:

4/3/21

Variation 2 Submission Notes – Wendy Campbell – 188 North Taieri Road

Figure 1a: Location of Site: Area 1



Note:

- Area 1 has been adjusted for geotechnical reasons and true extent of site in this area is shown in the structure plan (see Figure 2 below).

This mapped area is in scope only as it relates to the area mapped for rejected site RS014 (see Appendix 4 of the Section 32 Report for extent). The additional area is out of scope.

Figure 1b: Location of Site: Area 2



This entire mapped area is out of scope.

Figure 2: Structure Plan for Site

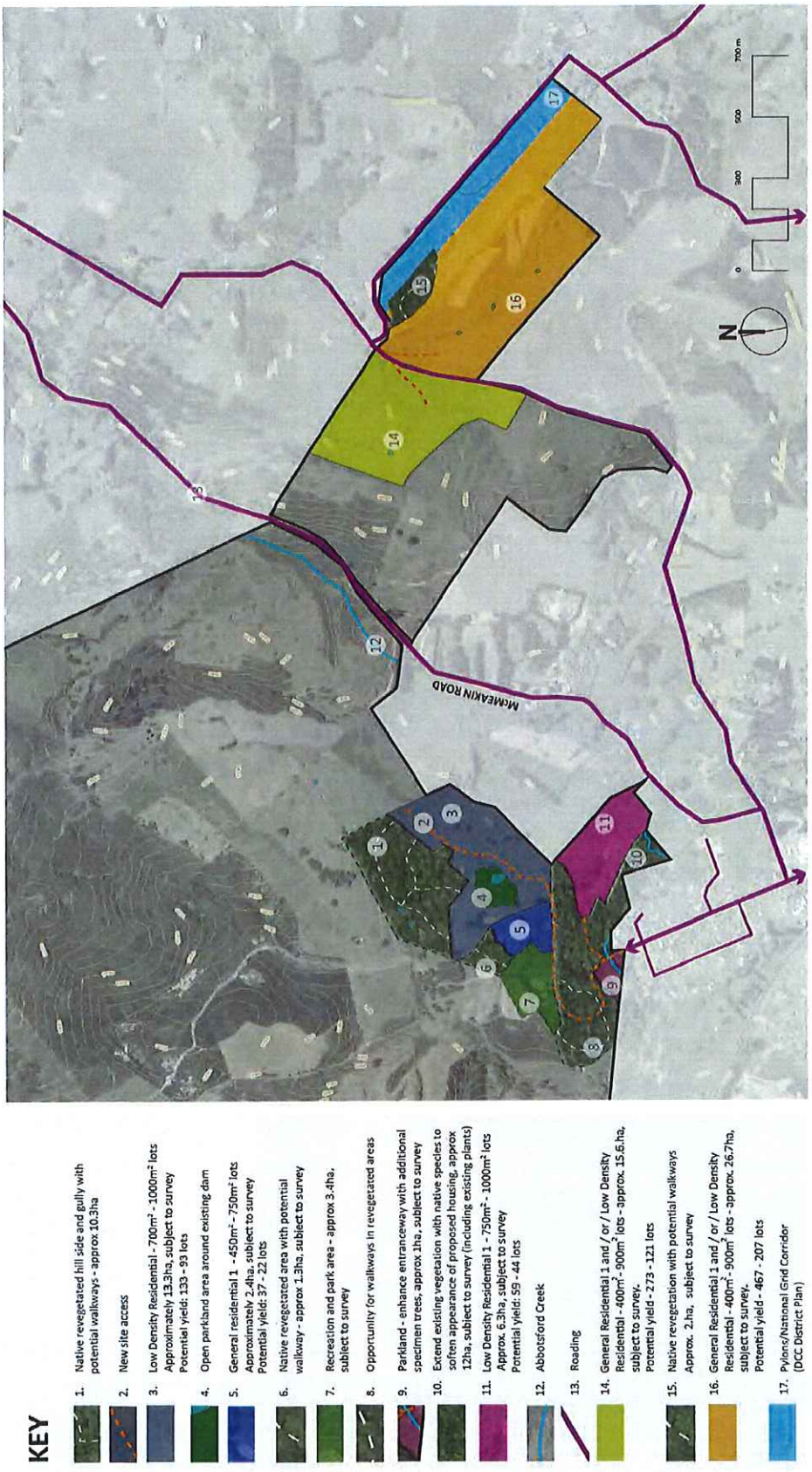
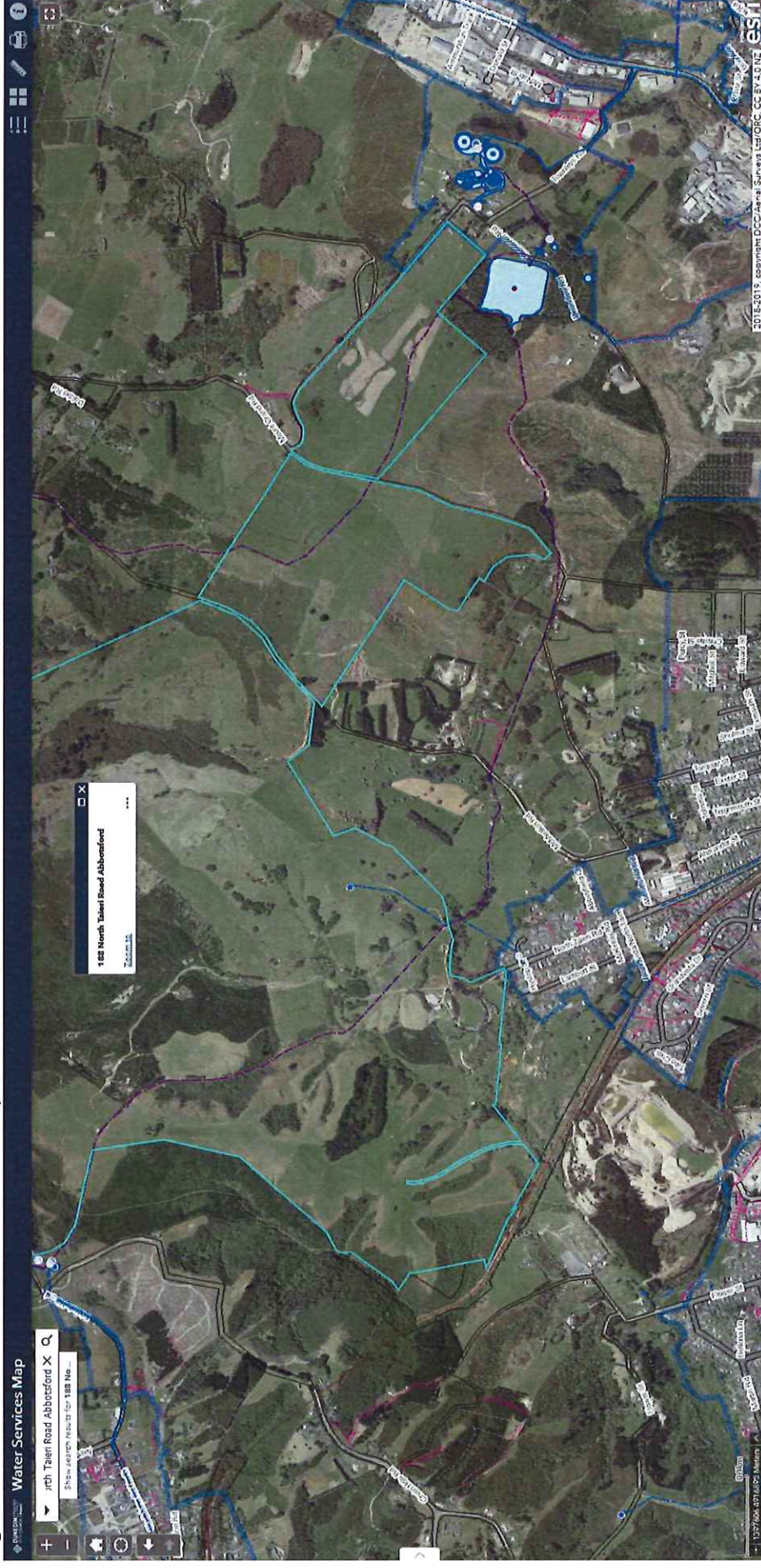


Figure 3: 3 waters Infrastructure in Proximity to Areas 1 and 2.



Submission:

The proposal makes provision for varying types of housing, recreational uses, good transportation links as well as providing for ecological enhancement.

1. Rezone two parts of 188 North Taieri Road in Accordance with the Structure Plan and

Apply a Structure Plan Mapped Area

Only in scope as it relates to the area mapped for rejected site RS014 - see Appendix 4 of the Section 32 Report.

Reasons:

- Experienced severe shortage of residential capacity in Dunedin, including in this locale, meaning Council cannot satisfy the short through to long term demand with sufficient capacity to meet Council's obligations pursuant to *NPS-UD 2020*. Rezoning this site residential helps Council meet its obligations pursuant to *NPS-UD 2020* by ensuring available capacity to the market demand. The structure plan also provides the opportunity to achieve other policy objectives such as conservation and ecological enhancement in an 'ecologically threatened' landscape.
- Area 1 rezone meets rezoning criteria specified in 2GP (see 2.6.2.1) – in particular, it provides a logical extension of the Abbotsford valley community over an area which is close to infrastructure, services, a school and public amenities. The rezone will ensure that this community continues to grow in resilience.
- Area 2 rezone meets the rezoning criteria specified in 2GP (see 2.6.2.1) – in particular, it provides the opportunity for lower cost housing on fairly flat land with good sun aspect.
- The proposal has landscape support – see attached landscape figures and report.
- Provides for flexibility of development in this locale for which there is experienced high demand for more residential capacity. Provides an opportunity to provide a residential community with recreation and conservation / ecological gains.
- The scale of this proposal provides the ability to tackle any infrastructure issues via agreement between Council and the site developer. If Council considers that more land needs to be released for residential capacity in this area, the submitter is open to making more land available for residential development.

2. Do not put a New Development Mapped Area over the Site and Instead use a Structure Plan Mapped Area

Reasons:

- Provision of infrastructure is adequately governed by existing subdivision and land use performance standards in the 2GP and the subdivision and development process.

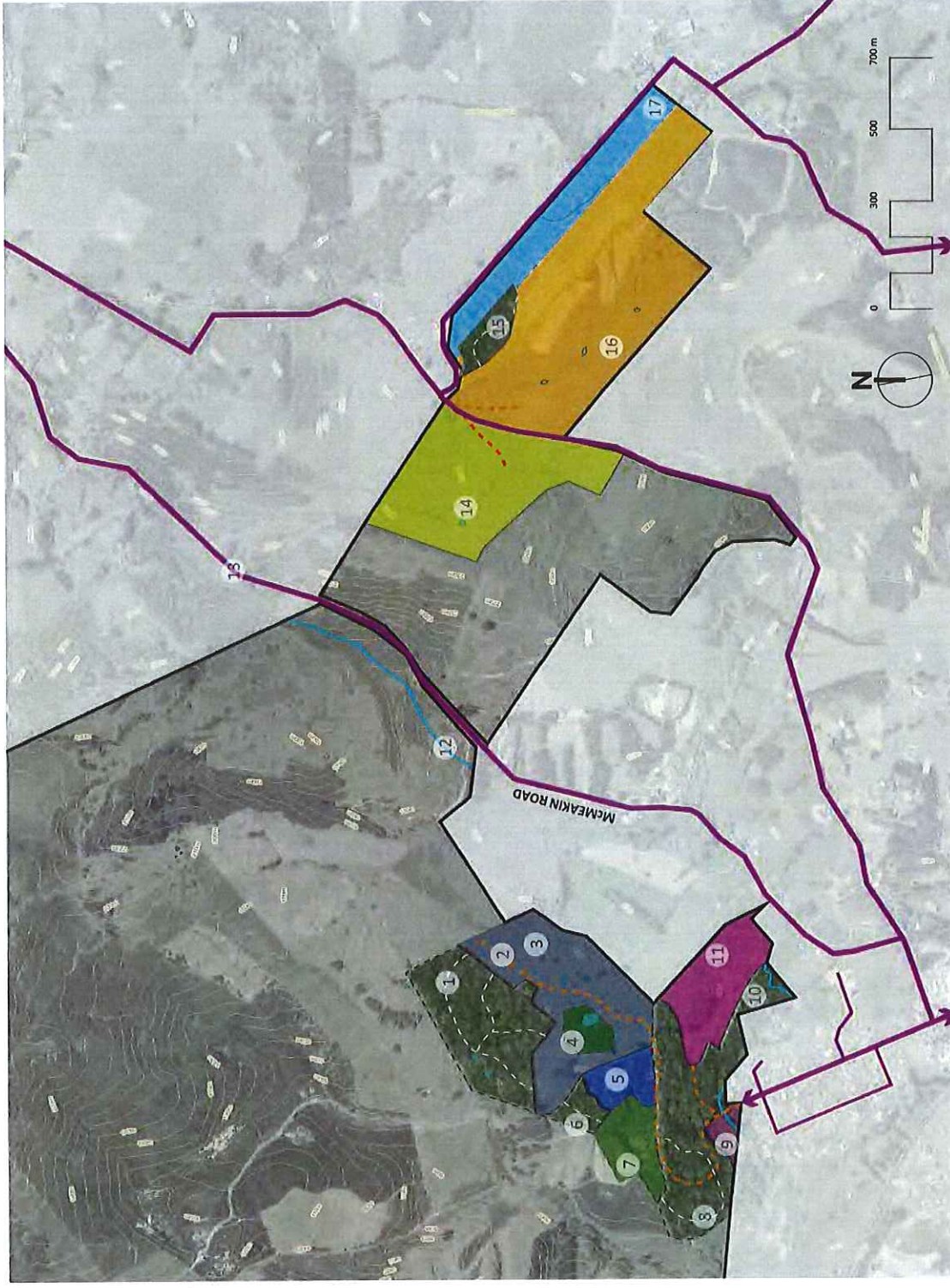
- The application of the Structure Plan Mapped Area provides the opportunity for Council to attach performance standards necessary to achieve desired outcomes for this specific site (e.g. attenuation onsite of stormwater and / or wastewater at time of subdivision if found to be necessary on assessment of infrastructure capacity). This is a more appropriate methodology than applying the NDMA to the residential rezone sites.
- The NDMA provisions will, in this case, act as an impediment to development.

In the alternative, the submitter requests changes to the NDMA provisions as set out in Table 1 of these submission notes. Table 1 contains the NDMA related provisions, issues and potential solutions.

On the submission form the submitter states that their submission relates to *“All provisions relating to New Development Mapped Area”*. In the event that Table 1 is not a complete list of all such provisions, the submitter reserves the right to make comment in evidence on any other NDMA related provisions which are found to be missing from Table 1.

KEY

1. Native revegetated hill side and gully with potential walkways - approx 10.3ha
2. New site access
3. Low Density Residential - 700m² - 1000m² lots
Approximately 13.3ha, subject to survey
Potential yield: 133 - 93 lots
4. Open parkland area around existing dam
5. General residential 1 - 450m² - 750m² lots
Approximately 2.4ha, subject to survey
Potential yield: 37 - 22 lots
6. Native revegetated area with potential walkway - approx 1.3ha, subject to survey
7. Recreation and park area - approx 3.4ha, subject to survey
8. Opportunity for walkways in revegetated areas
9. Parkland - enhance entranceway with additional specimen trees, approx 1ha, subject to survey
10. Extend existing vegetation with native species to soften appearance of proposed housing, approx 12ha, subject to survey (including existing plants)
11. Low Density Residential 1 - 750m² - 1000m² lots
Approx. 6.3ha, subject to survey
Potential yield: 59 - 44 lots
12. Abbotsford Creek
13. Roading
14. General Residential 1 and / or / Low Density Residential - 400m² - 900m² lots - approx. 15.6ha, subject to survey.
Potential yield - 273 - 121 lots
15. Native revegetation with potential walkways
Approx. 2ha, subject to survey
16. General Residential 1 and / or / Low Density Residential - 400m² - 900m² lots - approx. 26.7ha, subject to survey.
Potential yield - 467 - 207 lots
17. Pylons/National Grid Corridor (DCC District Plan)



LANDSCAPE PROPOSAL

188 NORTH TAIERI ROAD

DATE: 03-03-21 SCALE @A1: 1:6000
DWG: 002 REVISION #: A

GeoSolve Ref: 210116
2 March 2021

Wendy Campbell
188 North Taieri Road
Abbotsford
Dunedin 9018

Preliminary Geotechnical Assessment 188 North Taieri Road, Abbotsford, Dunedin

Dear Wendy,

In accordance with our Agreement dated 22 February 2021 we have undertaken a preliminary engineering geological appraisal of the above property. Our appraisal has comprised a site inspection and desktop review of existing information, relating mainly to natural hazards and coal mining hazard.

Potential Development

We understand that you are seeking to re-zone two areas of the above property from their existing rural land use to residential land use, i.e.

- Area 1 is under consideration for potential rezoning to General Residential 1 land use (minimum lot size 500m²).
- Area 2 is under consideration for potential rezoning to Large Lot Residential 1 or Large Lot Residential 2 land use (minimum lot size 2,000m² and 3,500 m² respectively).

We understand that the potential rezoning has already been considered by Dunedin City Council (DCC) for inclusion in notification of Variation 2 of the 2GP, however we understand that the property was not shortlisted for notification based on concerns about natural hazards on the property.

The existing property comprises approximately 511 ha of rural land (Rural Industry: Stock Finishing). The property appears to have a long history of rural and industrial land use including coal mining, sand/clay quarrying, farming and is currently used as a farm. The land is generally gently to moderately-sloping with localised steep areas.

This report summarises a desktop review of readily available Council hazard mapping and a preliminary site inspection by an engineering geologist. Not all areas of the property have been mapped or assessed and the intent at this stage is to provide broad comment on any potential constraints to residential land use from the geotechnical viewpoint, based on general visual observations and preliminary interpretation only.

Areas 1 and 2 are shown in Figures A & B below and in Figures 1 and 2 (appended). We have defined areas that are unlikely to be suitable for residential land use (shown in grey) and areas that are possibly suitable for residential land use (shown in blue and subject to further detailed checks). All other areas appear to be relatively straightforward for residential development.



Figure A – Location of Area 1



Figure B – Location of Area 2

Geological Setting

The geology of the Dunedin area is dominated by volcanic rock types of basaltic to andesitic composition that were intruded through pre-existing marine sediments during Miocene times. Extensive volcanism at that time produced lava flows and bedded volcanoclastic materials were widely distributed by eruptions. The generalised stratigraphic profile comprises schist at depth, overlain by a Cretaceous to Tertiary-age sequence; initially by thin non-marine sediments and then a thick accumulation of marine sediments including sandstones and mudstones. The volcanic rock types cross-cut these sediments where vents were present and extensively mantle them where lava flows or volcanic ejecta were deposited.

Area 1 is shown on published geological maps to be underlain predominantly by two rock types, the Taratu Formation and the Abbotsford Formation. The approximate mapped extents of these rock types is shown on Figure 1 appended. The Taratu Formation is a coal-bearing terrestrial sedimentary rock type and the Abbotsford Formation is a fine-grained marine siltstone.

Area 2 is shown on published geological maps to be underlain predominantly by three rock types, the Caversham Sandstone, Burnside Mudstone and the Dunedin Volcanic Group.

Overburden soils are likely to be a combination of colluvium, loess and possibly ancient landslide debris. Some relatively deep railway cuttings in Area 1 expose colluvium or debris with boulders of volcanic rock, suggesting relatively deep colluvium at least locally.

Two minor faults are mapped on Area 1, however these have not been mapped as active faults by GNS Science Ltd.

Landslide Hazard

The property generally contains numerous recognised landslides (mapped by GNS Science Ltd), however Areas 1 and 2 are notable for being largely free of landslides, with only small areas of mapped landslide, as follows:

Area 1 coincides with three landslides, referred to here as Landslides A, B & C.

Area 2 coincides with two landslides, referred to here as Landslides D & E.

- Landslide A (contained within Area 1) is located near a dammed pond and an area where trees have been planted to assist with slope stability. GNS Science Ltd has mapped this as likely certainty, probably prehistoric with unknown activity, unknown last movement and low sensitivity. A note indicates that a dam has been constructed across landslide debris.
- Landslide B (contained within Area 1) is located towards the north-east extents of Area 1 and is mapped as definite certainty, probably prehistoric with unknown activity, unknown last movement and low sensitivity.
- Landslide C (contained within Area 1) is a small area of the lateral scarp region of a much larger landslide that lies to the north of Area 1. This is mapped as likely certainty, prehistoric with unknown activity, unknown last movement and low sensitivity.

- Landslide D (contained within Area 2) affects Mt Grand Road and also neighbouring property, partly coinciding with Area 2. This is mapped as possible certainty, prehistoric, with unknown activity, unknown last movement and low sensitivity. Visual inspection confirms upslope scarps, downslope debris with ponds and tree plantings, as well as some cracking damage to the surface of Mt Grand Road. This may indicate that the landslide is periodically active, however it occupies only a small part of Area 2.
- Landslide E (contained within Area 2) is a large landslide feature, with the head area coinciding with the western corner of Area 2. The landslide is likely to be formed within Burnside Mudstone, a rock type which is known to host several other major landslides in the Dunedin area. This landslide is mapped as definite certainty, prehistoric with unknown activity, unknown last movement and medium sensitivity.

We do not recommend residential development over the above areas of mapped landslide and a sufficient setback should be nominated (based on detailed subsurface investigations). Provisional setbacks are indicated on Figures 1 and 2 for the purposes of preliminary planning but these may be overly conservative (subject to confirmation by subsurface investigations). Development within these areas may be possible in the future, but would require extensive geotechnical investigations, slope stability analysis and possibly stabilisation works (e.g. deep drainage, significant earthworks).

Part of Area 2 coincides with Burnside Mudstone which is well known for being susceptible to major landslide activity in some settings. Landslide E appears to be hosted by this rock type and care will be required if residential activity is to be established over this rock type. We recommend confirmatory subsurface investigations to more fully evaluate the extents and characteristics of the Burnside Mudstone over the area shown in blue on Figure 2.

Area 2 also contains a geological contact that is well known in the Dunedin area as a source of spring flow and possible triggering of landslide activity, i.e. the contact between low permeability Caversham Sandstone and overlying fractured volcanic rock. Rainwater infiltration through the fractures within the volcanic rock can lead to a perched groundwater table forming on the much less permeable upper surface of the Caversham Sandstone and spring flows often emerge where the stratigraphic contact daylights with the ground surface. We noted extensive areas of wet surficial soils along part of the Abbots Hill Rd walking track and some areas of clear spring flow defined by growth of sedges etc. Landslide D coincides with this stratigraphic contact and is likely to have been triggered by soil saturation resulting from these types of spring flows. An important design consideration for subdivision in this setting will be to ensure that adequate drainage is in place to prevent saturation of proposed residential subgrades. This can usually be accomplished by capturing and diverting the groundwater flows using deep subsoil cut-off drains.

In general the areas underlain by Dunedin Volcanic Group and Caversham Sandstone are likely to be straightforward for residential development (subject to test pitting investigations) and we note that very few landslides are developed over these rock types on site, with the exception of Landslide D where adverse groundwater conditions are likely at the contact zone only, as discussed above. The areas of the site underlain by Abbotsford Formation and Burnside Mudstone could potentially be more susceptible to slope

instability, however we note that most areas of this rock type are on relatively gentle slopes with no apparent indicators of increased vulnerability to landsliding. Large areas of residential activity have already been successfully established on these rock types (e.g. in Abbotsford and Green Island). The Taratu Formation is only mapped over the western extents of Area 1, however as discussed below, this area coincides with underground coal workings and for that reason is unlikely to be suitable for residential land use. The above rock types are likely to be overlain by variable overburden soils that may comprise colluvium, slopewash, loess and some localised ancient landslide debris.

Further investigation of landslide hazard will be required for any subdivision within Areas 1 and 2, however it is notable that the landslide areas are limited in extent and unlikely to widely influence the majority of Areas 1 and 2. Test pitting and trenching is likely to be suitable for further investigations, however some drilling may be required locally.

In addition, the north-eastern extents of Area 1 includes an area of land that is in close proximity to landslides and should be investigated further to ensure that it is suitable for residential use (eastern-most blue area on Figure 1). It should be noted that the exact location of the landslides and any setbacks required should be determined by detailed geotechnical investigations at the subdivision consent stage.

Coal Mine Hazard

The property is not shown on the DCC 2GP mapping as lying within any formally defined land stability hazard zone with respect to historic coal mining activity, however general hazard maps provided by DCC show that underground coal mining has previously occurred on a minor area of the property. Compilation of historical mine records and mapping by DSIR (A.R. Mutch 1982) has defined an area of mine workings within Area 1, as shown on Figure C below and Figure 1 (appended). This includes annotation of features such as adits and shafts. Isopach mapping indicates that the main worked coal seam was up to 4 m thick, however there are no obvious data regarding the depth of the workings in this area. Detailed mine maps held by the landowner have been supplied which show that significant underground workings are likely to be present, however geo-referencing has not been carried out at this stage. There is a note that some entrances may lie outside the areas defined.

Areas known to be underlain by underground mine workings can present a hazard of surface subsidence resulting from collapse of voids at depth and crown holes that can propagate to the surface. Collapse of mined voids in such situations could occur under static conditions (e.g. from decay of props and roof support capping timbers) however the risk will likely be greater during earthquake. Any structures could therefore be at risk of damage in this setting and safety concerns could apply if voids are present. It is possible that most mine workings have already collapsed as the mining began in the late 1800s and significant decay of timber supports could be expected since that time. Areas of collapse are often evident as depressions at surface and the soils under these areas can be disturbed by bulking.

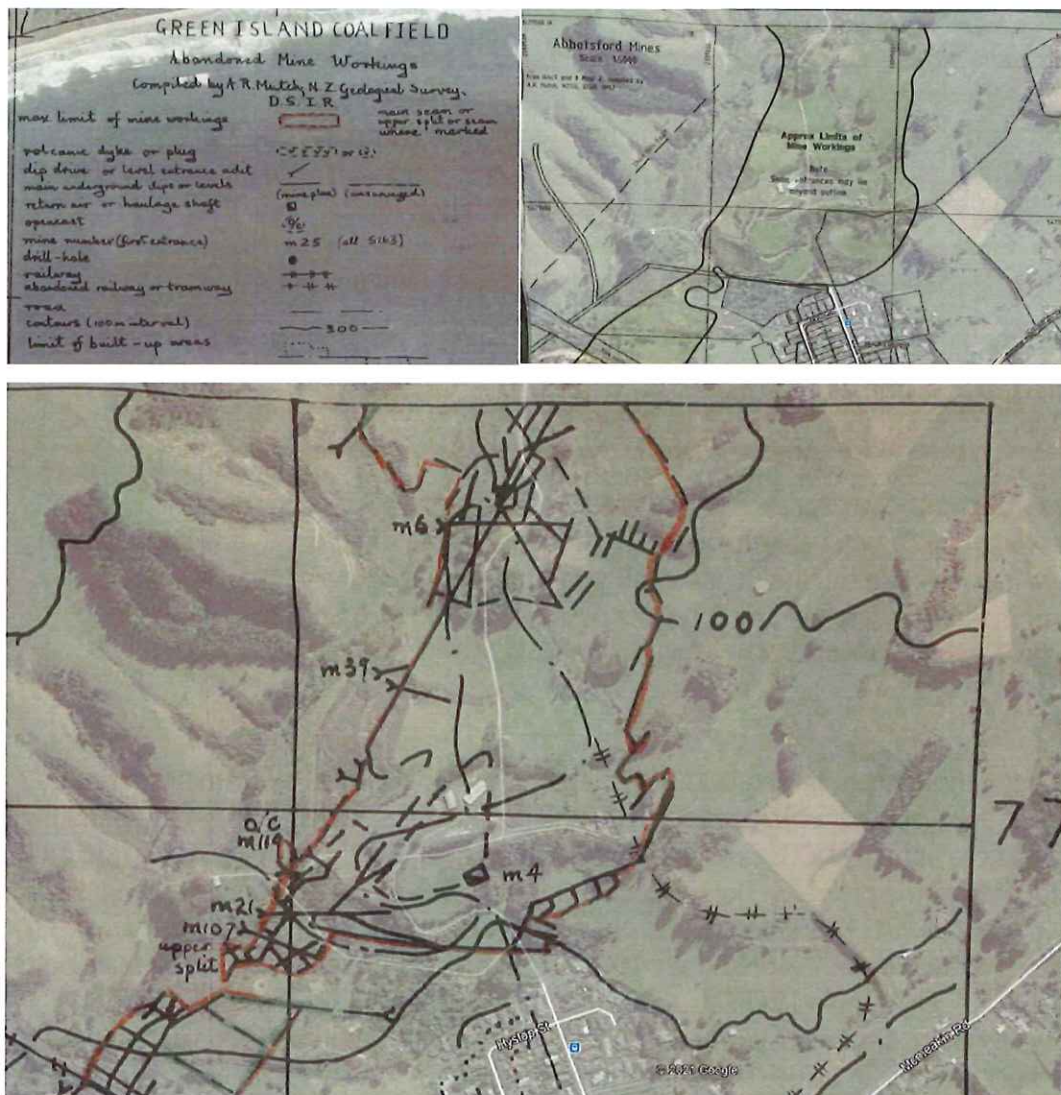


Figure C – Compilation of historical coal mine records by DSIR, 1982 over part of Area 1 including farm sheds and existing dwelling.

Council are likely to be reluctant to grant consent for close residential subdivision in an area where an undefined coal mine subsidence risk has been identified. For unrestricted development without specific foundation design requirements, detailed site drilling would need to be carried out to identify an absence of voids and confirm that unsuitable bulked soils in loose condition are not present. This is unlikely to be fully successful and would in any case be very costly. It may be possible to obtain and research full historical records of the mining activity, however this may not enable reduction of the area currently considered to be underlain by workings. It may however enable the eastern extents of the mined area to be understood in greater detail with definition of a safe building area.

The eastern extents are expected to be deepest and the coal bearing rock type (Taratu Formation) is overlain by Abbotsford Mudstone in this area. Precedent performance appears positive as no subsidence features were noted here. This deeper mined area appears to have no evidence of previous crown hole collapse features based on review of existing and early (1942 and 1947) aerial photography. In addition, the existing dwelling lies within the hazard zone and hence residential activity has previously been considered possible within the overall mined area.

It may therefore be possible to demonstrate that overburden thickness above the coal seam is sufficiently thick to mitigate the potential for crown hole collapses reaching the surface. Crown-hole subsidence is most likely to occur in areas where the coal to overburden thickness ratio is less than 1:10. Based on preliminary assessment of topography and the average dip angle of regional sedimentary bedding, the eastern-most extents of the mined area may be up to 100 m deep assuming that the seam was followed from surface. Assuming a coal seam thickness of 4 m, it is likely that the coal to overburden thickness ratio will be less than 1:10 over much of the coal mine hazard zone and hence high potential for crown hole collapse features at surface is only likely to apply to part of the site. These areas are possibly suitable for residential land use and are provisionally shown on Figure 1 (western blue area), however detailed research of coal mine records, further analysis, cross section preparation and some drilling investigations will be required to fully confirm suitability within this area.

We can provide further detailed investigations and analysis if the area of coal mining is to be considered for residential use.

Liquefaction Hazard

The site has been mapped in a 2014 liquefaction hazard assessment¹ as belonging to Domain A, which is predominantly underlain by rock or firm sediments; in this domain there is little or no likelihood of damaging liquefaction occurring.

Consequently, no liquefaction hazard is expected to apply to Areas 1 and 2, however full confirmation generally requires some subsurface investigation

Active Fault Hazard

Dunedin has traditionally been considered to have lower than average seismic activity when compared to other areas in New Zealand, however nearby active faults are known and strong shaking is certain to occur periodically.

Cook et al² states that the earthquake hazard in Dunedin is dominated by relatively infrequent moderate to large earthquakes (magnitude up to M_w 7.5) in eastern Otago, and

¹ Barrell, D.J.A., Glassey, P.J., Cox, S.C., Smith Lyttle, B. (2014). Assessment of liquefaction hazards in the Dunedin City district. GNS Science Consultancy Report 2014/068. 68p.

² Cook, DRL, McCahon, IF and Yetton, MD (1993). The Earthquake Hazard in Dunedin. Study funded by EQC, Research Project 91/56.

large to very large earthquakes in the much more seismically active Fiordland and Westland regions.

The nearest active faults with demonstrated Late Quaternary movement history are the Green Island Fault and the Akatore Fault. The Green Island Fault is currently considered to be the cause of the 1974 earthquake that caused damage in Dunedin. It is mapped approximately 7 km to the south of the subject site.

Several faults have been recorded on the ORC Natural Hazards Database as potentially relevant to the subject site, i.e. the Dunstan North Fault, Dunstan South Fault, Alpine Fault and Akatore Fault.

The Dunstan Faults are distant from Dunedin and not expected to constrain residential development at this site.

The Akatore Fault is likely to be capable of generating magnitude 7.5 earthquakes in Dunedin. Published small-scale geological mapping indicates the Akatore Fault is at least 2.5 km to the south of the subject site and hence ground rupture damage is not relevant to this site. The Akatore Fault is indicated as 'active', with results from the latest investigations by GNS Science indicating at least part of the fault last ruptured 742 to 973 years ago. Its mapped (active) fault trace is truncated 11 km southwest of the site and its location at that point is concealed. Its continuation (mapped as inactive) passes approximately 50 m north of the subject site. A recent paleoseismic study of the Akatore fault found that three recent ruptures of this fault occurring in the past 15,000 years (two of which occurred in the past 1,300 years) were preceded by a minimum 110,000 year period of quiescence, suggesting this fault exhibits strong aperiodicity of earthquake occurrence. The authors suggest it is prudent to assume that the relatively high rates of recent fault activity will continue, with an estimated recurrence interval of 450-5110 years.

Other known faults that have some potential to cause strong shaking in Dunedin are the Titri Fault and the North Taieri Fault, located roughly 1.5 km and 7 km northwest of the site, respectively.

Strong ground shaking throughout the South Island is likely to be associated with a rupture of the Alpine Fault, located along the West Coast of South Island. There is a high probability an earthquake with an expected magnitude of over 7.5 will occur along the Alpine Fault within the next 50 years.

Average return periods for shaking intensity are: MM 7 = 100 years, MM 8 = 450 years and MM 9 = >2,500 years. The most recent major earthquake to affect Dunedin occurred in 1974 and produced damage consistent with MM 7 intensity.

A risk of seismic activity has been identified for the region as a whole and appropriate allowance should be made for seismic loading during detailed design of the proposed development, but there are no site-specific constraints.

Flood Hazard

Flood hazard assessment is beyond the scope of this report, however we note from the ORC Natural Hazards Database, that there may be some minor flood hazard associated with the lowest lying area of the site, shown in Figure D. A hydrologist can advise further on any mitigation required, however simple adoption of minimum floor levels may be appropriate if required.



Figure D – Potential area of flood hazard.

Previous Land Use Considerations

We have not carried out a full review of historical land use or LIM reports etc, however we note that parts of the property have been used for various industrial and extractive industry land use.

As described above, part of Area 1 has been utilised for coal mining and a sand quarry was also located elsewhere on the property. A railway line has operated on the property for the purposes of coal and sand extraction. The remains of the railway are visible as a series of cuttings and embankments that cross part of Area 1. Some remnants of sand processing structures are also visible within Area 1. It is likely that some fill has been placed locally as part of these activities and some minor localised slope instability is associated with these fills. These industrial activities are of unknown scale, however, appear to be largely contained within the area underlain by former coal mines.

Area 2 does not appear to have been used for major industrial activity, however we understand from the landowner that a former owner carried out trenching for the purposes of waste burial from freezing works industry. The full extent of the trenching/burial is not confirmed, however these trenches are clearly visible over parts of Area 2 (see Figure 2 appended). The areas indicated on Figure 2 may need earthworks treatment or specific foundation design for residential use.

A water race has also been noted within Area 1.

Consequently, previous land use may result in some localised geotechnical considerations for subdivision design and these can be advised in greater detail following detailed subsurface investigations at the subdivision planning stage.

Summary of Geotechnical Considerations for Residential Land Use

- We recommend that at least part of the area underlain by former coal workings should be excluded from residential land use as there is a risk of surface subsidence and bulked soils over parts of Area 1. This area is shown provisionally on Figure 1, based on existing hazard mapping, however further research into the mining history may enable refining of the boundary of the workings. It may also be possible that areas of the deepest workings (shown in blue on Figure 1) could potentially be suitable for residential land use, as discussed above. However, further research and investigations will be required to confirm suitable areas. We can provide further detailed investigations and analysis if the area of known coal mining is to be considered further for residential use.
- The areas of the five landslides described above should also be provisionally excluded from residential land use, with adequate setbacks defined. Other minor areas may also be susceptible to slope instability. Such areas are likely to be relatively limited areas but could include steep slopes, fill slopes and setback areas at the toe and crest of the known landslides. These details can be advised further during standard geotechnical investigations at the subdivision stage, when conceptual scheme plans are available. Development within these areas may be possible in the future, but would require extensive geotechnical investigations, slope stability analysis and possibly stabilisation works (e.g. deep drainage, significant earthworks).
- Further research will be required to determine the full extent of soil disturbance from trenching and freezing works offal burial activities within Area 2. The areas of the most obvious trenches indicate that considerable settlement of the backfill has occurred and that the trenches are likely to be underlain by soft uncontrolled fill and organic soil types. Such soils are unsuitable for standard foundations, however if trenching depths are relatively shallow, then it may be possible to remediate the areas with earthworks (cut and fill). Piling of structures may also be possible, however the trenched areas are likely to be prone to ongoing differential settlement which would be generally disruptive to pavements and yard areas. Further investigations will be required to advise on options.
- Groundwater control is likely to be necessary for parts of the site, particularly Area 2 where there is a geological contact between Caversham Sandstone and overlying fractured volcanic rock as discussed above. An important design consideration for subdivision in this setting will be to ensure that adequate drainage is in place to prevent saturation of proposed downslope residential subgrades. This can usually

be accomplished by capturing and diverting the groundwater flows using simple deep subsoil cut-off drains, perhaps directed to existing watercourses.

- Figures 1 and 2 and the discussion above indicates that much of the area being considered for rezone is likely to be appropriate for residential land use. The areas of landslides and former coal mines will likely need to be specifically excluded from residential use (unless demonstrated to be suitable) or otherwise utilised for other purposes such as reserves.
- Standard subsurface investigations will be required to confirm geotechnical requirements for any subdivision and residential land use within Areas 1 and 2. Specific objectives of these investigations will include investigations to determine appropriate setbacks, further checks to confirm limitations related to coal mines, characterisation of the Burnside Mudstone, determination of the extent of trenching in Area 2 and investigation of groundwater conditions in Area 2.
- Further investigation of landslide hazard will be required for any subdivision within Areas 1 and 2, however it is notable that the landslide areas are limited in extent and unlikely to widely influence the majority of Areas 1 and 2. Test pitting and trenching is likely to be suitable for further investigations, however some drilling may be required locally. Geometric design of any future subdivision earthworks should be carried out by a land development specialist with consideration of existing watercourses.
- Soil contamination inputs are beyond the scope of this report, however industries such as coal mining, quarrying and burial of waste can result in contamination which could be further assessed by environmental engineer.
- We note that there are major Council-owned water services pipes on the property as well as a concrete reservoir. We assume that these can be adequately managed via appropriate easements. Care will be required to ensure that potential leakage from buried pipes is adequately managed to prevent soil saturation and potential instability.

Applicability

This report has been prepared for the benefit of Wendy Campbell 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.

We have not carried out any subsurface investigations at this early stage. This report is intended to provide preliminary comment on likely geotechnical issues at the rezoning application phase only.

Yours faithfully,





Mark Walrond
Senior Engineering Geologist

Reviewed for GeoSolve by: Colin Macdiarmid, Senior Geotechnical Engineer

GeoSolve Limited

Appended: Figures 1 and 2

Figure 1 - Area 1 hazard considerations

-  Areas unlikely to be suitable for residential land use.
-  Areas possibly suitable for residential land use (subject to further analysis and investigations).

Scale 1:5000

Mapped fault - not considered active

Approximate extent of proposed Area 1

Mapped landslides
(GNS Science Ltd 2017)

LANDSLIDE C

LANDSLIDE B

Mapped fault - not considered active

ABBOTSFORD FORMATION

LANDSLIDE A

ABBOTSFORD FORMATION

TARATU FORMATION

Area of coal mine hazard zone to the east of green line likely to have a coal to overburden thickness ratio less than 1:10 and may be suitable for residential development (subject to detailed investigation and analysis).

Yellow hatching - Approximate extents of coal mine hazard zone based on mapping/compilation by A.R. Mutch 1982. Unlikely to be suitable for residential development. at least partially.

Scale 0 100m

N

Google

Figure 2 - Area 2 hazard considerations

