

RDA Consulting

GEOTECHNICAL • CIVIL • ENVIRONMENTAL



GEOTECHNICAL DESK STUDY – CHARLTON ROAD

JOB TITLE	GORE DISTRICT PLAN GEOTECH REVIEW
ADDRESS	CHARLTON ROAD, GORE
JOB NUMBER	52665
	20 December 22

Client: Gore District Council
29 Bowler Avenue
PO Box 8,
Gore, 9740

Prepared by:



Mark Adam
BSc (Geol), PMEG, DipGrad (Comp Sc)
Engineering Geologist



Stephanie Osmers
BSc (Geol)
Engineering Geologist

Reviewed by:



David Rider
BSc (Geol) MEngNZ
Principal Geoprofessional/Technical Director

52665 TPG Gore DP Review – Charlton Road

TABLE OF CONTENTS

1. INTRODUCTION
 - 1.1. BACKGROUND
 - 1.2. SCOPE
2. CHARLTON ROAD STUDY AREA
 - 2.1. SITE INFORMATION
3. GEOLOGICAL OVERVIEW
 - 3.1. GEOLOGY
 - 3.2. SURFACE SOIL
 - 3.3. MORPHOLOGY
 - 3.4. GROUNDWATER
4. GEOTECHNICAL HAZARDS
 - 4.1. IDENTIFIED HAZARDS
 - 4.1.1. LIQUEFACTION POTENTIAL
 - 4.1.2. SEISMIC SHAKING
 - 4.1.3. FLOODING
 - 4.1.4. SLOPE STABILITY
 - 4.1.5. HAIL LAND CONTAMINATION
 - 4.1.6. SETTLEMENT
 - 4.2. GEOTECHNICAL HAZARD RISK ASSESSMENT
5. POTENTIAL DEVELOPMENT CONSIDERATIONS
 - 5.1. LIQUEFACTION
 - 5.2. FLOODING
 - 5.3. NON-ENGINEERED FILL
 - 5.4. GENERAL CONSTRAINTS
6. LAND USE PREFERENCE
7. LIMITATIONS
8. REFERENCES

1. INTRODUCTION

1.1. BACKGROUND

RDA Consulting was engaged by the Gore District Council to undertake a concept level geotechnical desktop assessment for potential re-zoning of designated areas from rural to Industrial and lifestyle zones. The desktop study focuses on the geotechnical suitability of the designated rural land with an overall scope to identify possible geotechnical constraints that could have implications for development.

1.2. SCOPE

The initial scope of work for the geotechnical assessment of the potential locations to be rezoned includes study on the following:

- Desktop review of existing databases for natural hazards potentially affecting the selected areas. Typically, this would be for liquefaction and lateral spreading, flooding, earthquake susceptibility, slope stability, rockfall, debris flows, erosion, and subsidence.
- Man-made hazards, such as historic mine workings or refuse tips are known in some of these areas, additional database searches for these and aerial photo databases would also be undertaken.
- Review of preselected property files of interest, based on initial desktop review.
- Detailing the underlying geology and known fault locations.
- Database searches of the New Zealand Geotechnical database and Environment Southland's "Beacon" database for any relevant information, such as groundwater and Geotechnical conditions.
- Reporting and preliminary risk analysis, and whether areas are more suitable for a particular land use (Industrial vs Lifestyle).

2. CHARLTON ROAD STUDY AREA

The Gore District Council have identified six areas of interest, where the potential rezoning of land, from rural to industrial and residential lifestyle, may be suitable. The study areas are located around the townships of Gore, Mataura and Mandeville. The six study areas have been named: Whiterigg, Mandeville, Reaby Road, South Gore, Charlton Road, and South Mataura. Each area has been individually assessed.

This report concentrates on Charlton Road.

2.1. SITE INFORMATION

The Charlton Road study area is located approximately 3 km southwest of Gore township (Figure 1). The area is bounded on the eastern perimeter by Terry Road, and finishes in the south adjacent to the South Gore study area. The general area is gently sloping, to flat, with moderate sloping areas along the northern eastern perimeter, where the land rises in elevation. Residential property is located within the study area, with the majority situated along Charlton Road, while the remaining land is currently agricultural.

There are no significant hazards identified, however the Charlton Stream and tributaries run the length of the study area, from the north to the southwest.

The site is proposed to be rezoned to industrial or lifestyle.

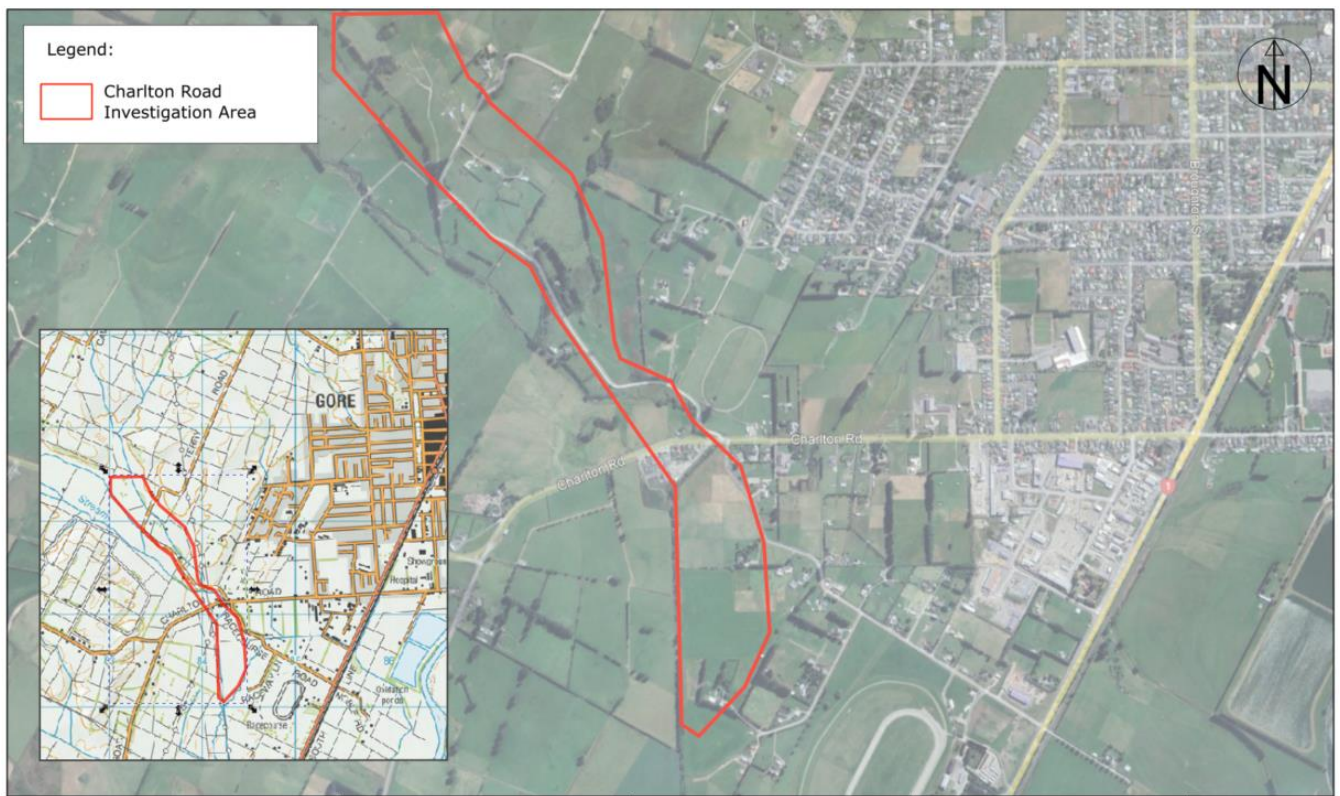


Figure 1: An aerial photograph of the Charlton Road study area, currently used primarily for agriculture.

3. GEOLOGICAL OVERVIEW

3.1. GEOLOGY

The geology of the site is mapped as comprising of three units, descriptions of the different geological units present are outlined below, and their extent is shown in Figure 2.

- (Holocene) river deposits – Unconsolidated gravel; sand and peat in modern stream beds; flood plains with minor overbank swamps.
- (Late Pleistocene) river deposits – Alluvial greywacke gravel and sand overlain by loess.
- (Middle Pleistocene) river deposits – Alluvial deposits consisting of deeply weathered greywacke, quartz gravel, silt sand and clay.

There are no active or inactive faults noted by GNS.

3.2. SURFACE SOIL

The surface soils are designated by Environment Southland as including Jacobstown, Arthurton and Tailings. Jacobstown soils are typically stone free silt loams, overlying alluvial gravel between 45 and 90 cm depth. They are formed in fine alluvium derived from greywacke and schist. Arthurton soils consist of a thin layer of loess overlying strongly weathered gravel alluvium. Arthurton soils are formed in wind deposited loess derived from greywacke and schist rocks. They typically consist of light silt loams overlying alluvial gravel between 45 and 90 cm in depth. Tailings soils are formed on river flats and terraces that have been mined by dredging and sluicing. They are formed by disturbed alluvial gravels. The soils include a wide range, with no site being typical, and are generally variable. Textures are generally loamy sands with occasional silt loams, and gravel in varying amounts.

3.3. MORPHOLOGY

The land is generally characterised by flat to gently sloping pastoral grassland, with hills beginning along the northeast perimeter of the study area. The Charlton Stream and small tributaries run the length of the study area. The area adjacent the stream has occasional marshland, which is generally defined by rushes and willow trees. Watercourses have been modified and diverted in some locations.

3.4. GROUNDWATER

The area is considered within the Lower Maitava Groundwater Management Zone (GMZ) by Environment Southland. The Lower Maitava GMZ contains an extensive unconfined aquifer system hosted in silt. Groundwater depths generally range from 2 to 3 metres below ground level, except for higher alluvial terraces where groundwater depth may average between 5 and 10 metres below ground level. Groundwater varies seasonally in the order of 1 to 1.5 metres. Higher groundwater levels are typically associated with winter, with lowest levels in early autumn. The sand and gravel layers within the Tertiary lignite measure sediments contain a limited groundwater resource. The soils overlying the Lower Maitava GMZ are typically weathered, poorly sorted silty sandy gravel. (Environment Southland, 2022).

While many boreholes have been drilled in the area, only a few are near Charlton Road. Environment Southland have groundwater well information for only select locations. In the area adjacent Charlton Road groundwater was measured between 1.5 and 4.7 metres, with groundwater measured typically around 3 metres below ground level.

Groundwater can affect slope stability, consolidation settlement, and liquefaction potential. Accurate groundwater levels should be established as part of site-specific assessments.

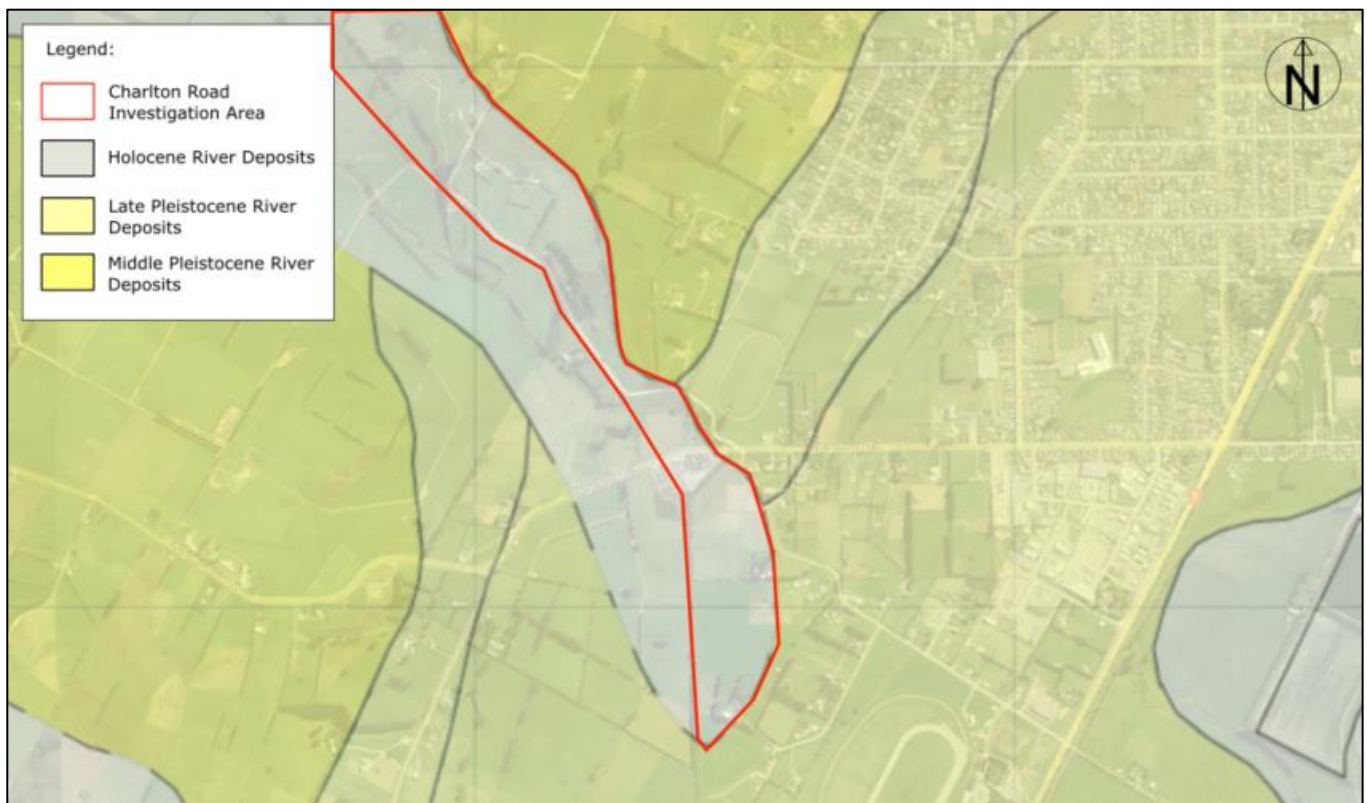


Figure 2: GNS 1:250k geology map of the Charlton Road study area.

4. GEOTECHNICAL HAZARDS

Several geotechnical hazards have been identified within the study area. Minor hazards that are not identified, such as rockfall and debris flow are considered to be negligible due to the geomorphology and geology. The assessment is considered general and more specific localised hazards will exist in differing zones within the study area.

Historic mining was not identified, however, sluicing and dredging may have been undertaken with no records or indications available for this reporting.

4.1. IDENTIFIED HAZARDS

4.1.1. LIQUEFACTION POTENTIAL

Environment Southlands Beacon overlay shows the site to have a medium risk of liquefaction, Figure 3. The liquefaction risk has been identified by Environment Southland as being directly related to the Holocene river deposits.

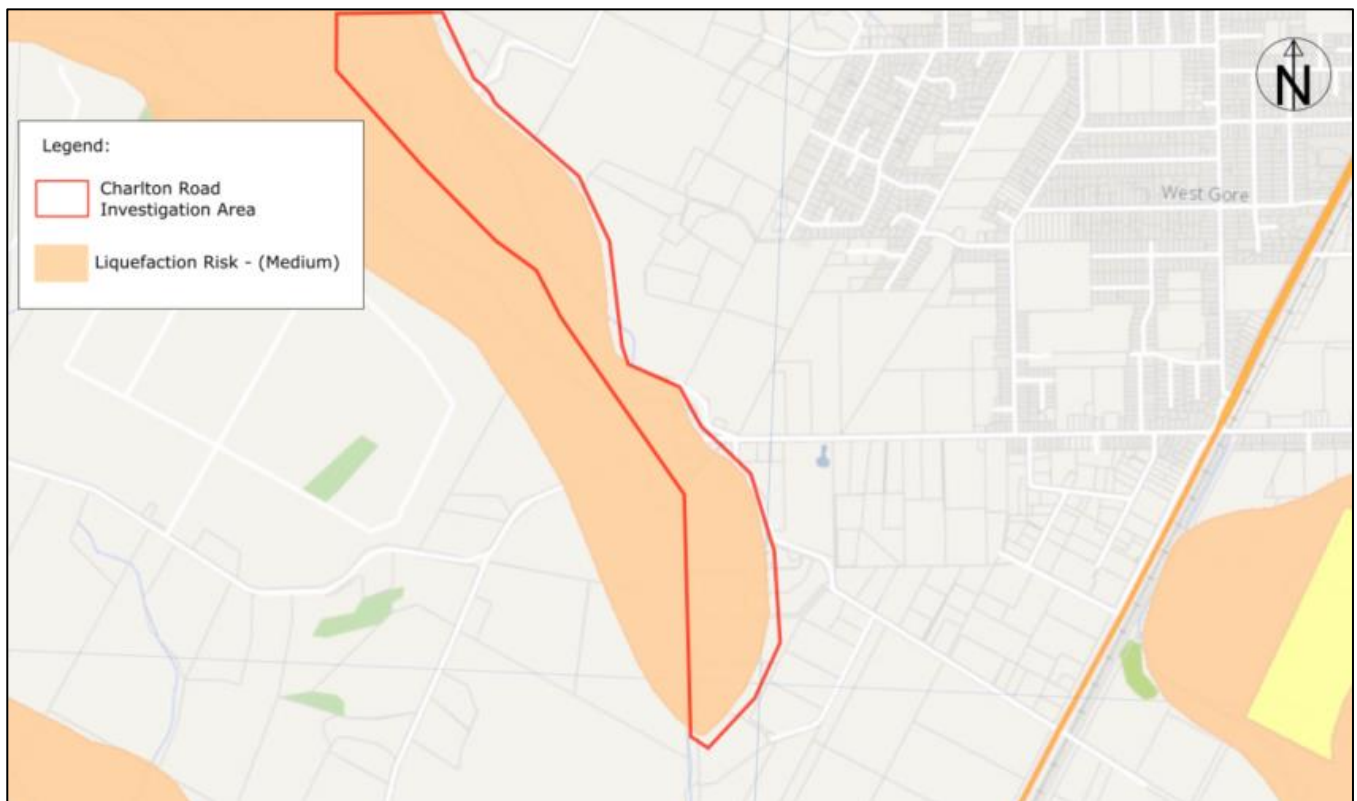


Figure 3: Potential liquefaction risk for the Charlton Road study area.

4.1.2. SEISMIC SHAKING

The closest fault currently identified as active in the area by GNS in the 1:250k geological map, is the Blue Mountain No.1 Fault. The Blue Mountain Fault (30 km east of Gore) is likely to be capable of generating magnitude 6.0 earthquakes and has estimated return periods of between 10,000 and 20,000 years (GNS fault database).

No faults have been identified within the study area by GNS in the 1:250k geological map, although, alluvial sediments can mask faults that have not ruptured during the Pleistocene. However, the risk of fault rupture for the area remains negligible. Seismic risk is typically mitigated for structures by prudent design in accordance with the NZ Building code (NZS3604) and Building act requirements.

We note the seismic model and fault database model for southland is under review and that the data sets for faulting hazards are of low data resolution and are not likely to represent actual fault locations, return periods, and activity status presently. Therefore, caution on the southland seismic model needs to be used.

4.1.3. FLOODING

The study area is designated by Environment Southland as being within the Maitai River's significant floodplain and is susceptible to large flood events. The low-lying areas around Charlton Creek also have a flood risk, low lying marshland suggests surface flooding may be frequent. Small depressions, ponds, and low-lying areas are expected to experience minor flooding in a heavy rainfall event.

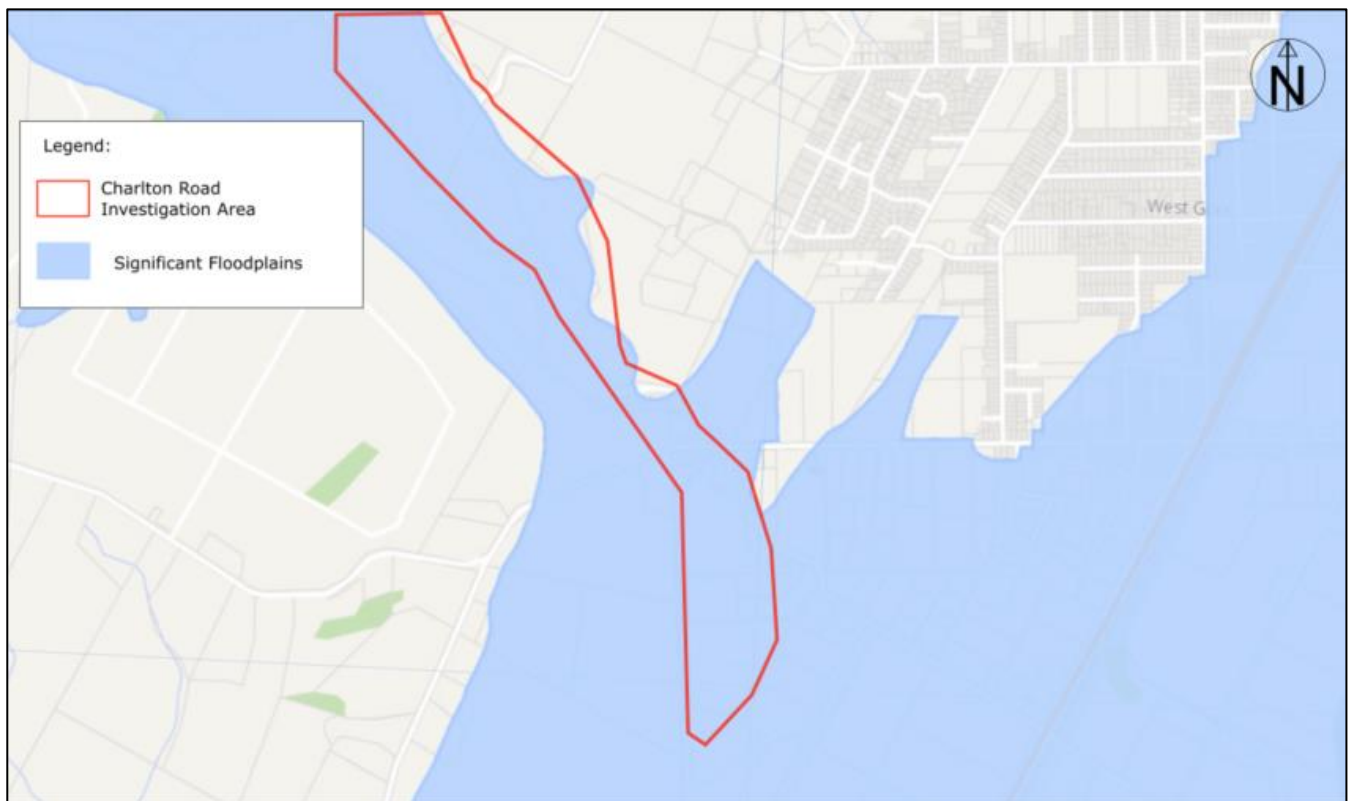


Figure 4: Significant flood hazard for the Charlton Road study area.

4.1.4. SLOPE STABILITY

There is no significant elevation change that would induce large scale slope instability. Minor localised instability may occur around road cuttings, particularly near the southern part of Terry Road.

4.1.5. HAIL LAND CONTAMINATION

No registered contaminated sites are present on the Environment Southland SLUS register, except for the substation on Charlton Road. Although no other land contamination sites are recorded, this does not preclude the possibility for contaminated sites to be present. Any contamination is likely to be associated with agricultural activities.

4.1.6. SETTLEMENT

The extent of sluicing and dredging operations is unknown in the area. It is possible some activity was undertaken in the late 19th and early 20th century, however, any sluicing and dredging activity within the study area itself is not likely to have been extensive. Due to the time occurred since these operations were undertaken, primary settlement will have already occurred.

The site has been used for agriculture for an extended period, it is possible that non-engineered fill will have been placed to level the land, create accessways, to cover refuse holes, and to straighten or otherwise modify waterways. Non-engineered fill can be prone to settlement and instability. It is appropriate to deal with any non-engineered fill during planning, development, and construction.

Areas where the ground has remained undisturbed are expected to have only minor settlement as a result of development proposals.

4.1.7. SUBSIDENCE FROM MINING

No mining activity has been identified. However, sluicing operations may have been undertaken and will be subject to settlement outlined in the above section.

4.2. GEOTECHNICAL HAZARD RISK ASSESSMENT

A summary of the potential risk of the identified geotechnical hazards has been undertaken (Table 1).

Table 1: A summary of the potential risk of each geotechnical hazard identified.

Geotechnical Hazard	Low potential Risk	Medium Potential Risk	High Potential Risk
Liquefaction		X	
Seismic Shaking	X		
Flooding			X
Slope Stability	X		
Debris Flow	X		
HAIL Land Contamination	X		
Settlement	X		
Subsidence from Mining	X		

5. DEVELOPMENT CONSIDERATIONS

5.1. LIQUEFACTION

No previous liquefaction assessment has been undertaken by RDA consulting within the area, and no records are found on the New Zealand Geotechnical Database. However, the area is designated as having medium potential risk by Environment Southland. While the area is predominantly alluvial gravels, where in general settlement due to a seismic event may be lessened, there may be areas of medium to high liquefaction potential in specific locations, where soils are more susceptible to liquefaction during a seismic event. Site specific investigations for potential liquefaction should be undertaken for all sites equal to and above an importance level of 2, or if importance level 1 building owners wish to assess the risk for the development.

While liquefaction is a potential risk there are foundation and groundwork solutions available that would be available to mitigate the risk for proposed structures on the site.

5.2. FLOODING

The potential flood risk is high, and therefore before further planning, flood and hydrology assessments should be completed ahead of any potential development to ascertain any likely flood level, frequency, and extent.

5.3. NON-ENGINEERED FILL

The potential for non-engineered fill on agricultural land is likely to be negligible in the study area. However, the downstream area of Charlton Creek has been straightened and the original water course modified. The original water course can still be seen in Figure 5, along with the man-made diversion. Where the original watercourse is present there is the likelihood for non-engineered fill to exist.

Where areas have been filled, the fill material used is likely unknown. Fill may consist of hazardous materials and refuse. Development of structures and infrastructure on fill may result in further settlement. Development requires site specific investigations and structures may require Specific Engineering and Design.

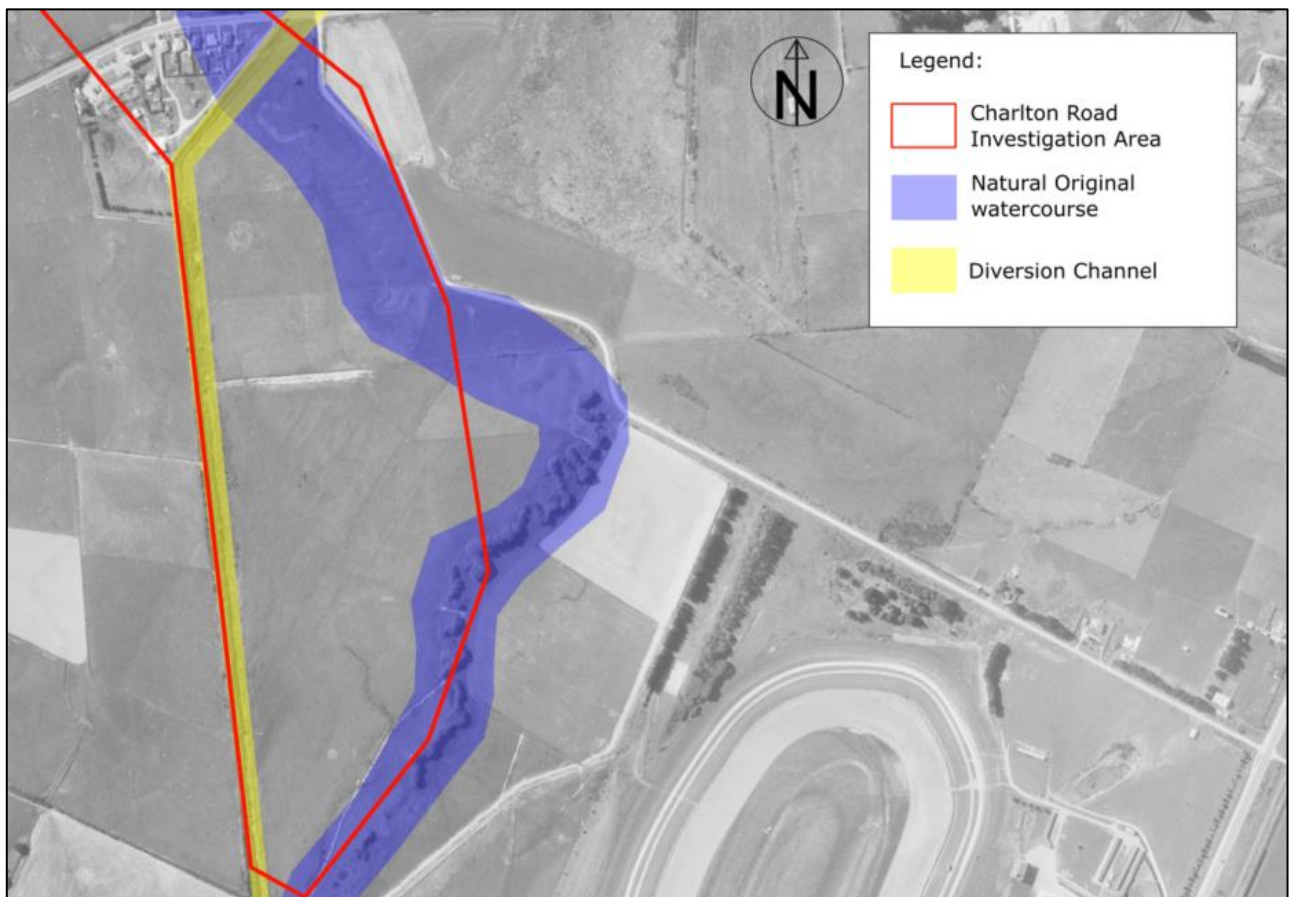


Figure 5: The diversion of Charlton Creek. The blue area has more potential for non-engineered fill.

5.4. GENERAL CONSTRAINTS

Other geotechnical hazards within the study area are generally negligible, however, there is a risk that not all geotechnical hazards have been identified during the desktop study.

Most of the land is considered geotechnically suitable for development, but with various degrees of engineering control required to remedy or mitigate the risk, or impact, of geotechnical hazards.

6. LAND USE PREFERENCE

No preference, for either lifestyle or industrial, is given from a geotechnical point of view. However, some industrial sites should consider potential groundwater runoff into local water courses, and contamination in major flood events.

7. LIMITATIONS

The findings contained in this report are based upon topography maps, geological maps, natural hazard maps, historic mining data, and engineering experience and consideration of geotechnical issues encountered within the area previously. Inferences about the nature and continuity of geohazards are made using geological principles and engineering judgement. However, it is possible that ground conditions over the site may vary and therefore it is not possible to guarantee that all hazards have been identified.

This report has been prepared for the project area provided to RDA Consulting by the clients brief and no responsibility is accepted for the use of any part of this report in other contexts or for any other purposes. Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice presented in this report.

8. REFERENCES

Environment Southland (2022). Beacon website. <https://maps.es.govt.nz/>

GNS Science (2022). Active fault database. <https://data.gns.cri.nz/>

MBIE (2021). MBIE, Earthquake geotechnical engineering practice guidelines. Modules 1-5

Standards New Zealand. (2011). NZS3604:2011, Timber Framed Buildings- New Zealand