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GEOTECHNICAL DESK STUDY – REABY ROAD

JOB TITLE	GORE DISTRICT PLAN GEOTECH REVIEW
ADDRESS	REABY ROAD, GORE
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52665 TPG Gore DP Review – Reaby Road

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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 the 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 on whether areas are more suitable for a particular land use (Industrial vs Lifestyle).

2. REABY 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 Reaby Road.

2.1. SITE INFORMATION

The Reaby Road study area is located approximately 4 km west of Gore township (Figure 1). The area is bounded on the southwestern perimeter by Reaby Road and is located near the Gore Golf Course. The general area is gently sloping, becoming flat in the northeast. The study area is currently utilized as agricultural land.

Underground mining activity has previously occurred at this site. Smyth's Coal Mine was operational from 1905 to 1924 and is no longer an active mining area. As the works were underground, there has been minimal impact of the surface. There is a small amount of scrub and uneven ground where mining activities have occurred.

The site is to be rezoned to industrial or lifestyle.



Figure 1: An aerial photograph of the Reaby Road study area.

2.2. HISTORICAL MINING

There are records of underground coal mining being carried out within the Reaby Road study area (Appendix A), occurring between 1905 – 1924. Due to their age, the true extent of the activities undertaken is limited and unless extensive ground investigations are undertaken, cannot be accurately represented.

Mining records obtained from the Gore District Council show two main underground mining areas on the southern boundary of the site. The site has been georeferenced in Figure 2, and the general extent of the underground activity has been ascertained (Figure 3).



Figure 2: Georeferencing of old mine workings on the southern perimeter of the study area. The mine workings are primarily underground.



Figure 3: The identified area where underground mining activity has occurred.

Aerial photographs show some evidence of the mining activity in the area, in particular the old underground mine portal.

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 4.

- Gore Lignite Measures sandstone (East Southland Group) – Neogene sedimentary rocks consisting of sandstone with lignite and carbonaceous mudstone; mudstone; claystone and minor conglomerate.
- (Middle Pleistocene) river deposits – Alluvial deposits consisting of deeply weathered greywacke, quartz gravel, silt sand and clay.
- (Late Pleistocene) river deposits – Alluvial greywacke gravel and sand overlain by loess.

An unnamed fault has been approximated by GNS to run through the area, however the fault has been designated as inactive.

3.2. SURFACE SOIL

The surface soils are designated by Environment Southland as Pukemutu, Chatton, and Hokonui. Pukemutu soils have been described as poorly draining heavy silt loams, increasing to silty clay in the lower subsoil. Moderately deep variants contain gravel between 45 and 90 cm in depth. Chatton soils typically consist of silt overlying clay loams and alluvial gravel. Hokonui soils are typically heavy silt loams and clay, overlying gravel alluvium or bedrock, with clayey topsoil.

3.3. MORPHOLOGY

The land is generally characterised as gently sloping pastoral grassland, which flattens onto the valley floor in the northeast. Due to the historical underground mining activity, a small amount of mine subsidence in the form of shallow troughs have occurred on the land surface above the old workings.

3.4. GROUNDWATER

The area is considered within the Lower Matura Groundwater Management Zone (GMZ) by Environment Southland. The Lower Matura GMZ contains an extensive unconfined aquifer system hosted in silt. Groundwater depths generally range from 2 to 3 meters below ground level, with the exception of higher alluvial terraces, where groundwater depth may average

between 5 and 10 meters 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 Mataura GMZ are typically weathered, poorly sorted silty sandy gravel. (Environment Southland, 2022).

Environment Southland have groundwater well information for one drilled well within the area. The well, classified F45/0053, was drilled to 216.4 m below ground level, however it was noted that the well unlikely still exists.

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



Figure 4: GNS 1:250k geology map of the Reaby 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 non-existent due to the geomorphology and geology. The assessment is considered general and more specific localised hazards will exist in differing zones.

4.1. IDENTIFIED HAZARDS

4.1.1. LIQUEFACTION POTENTIAL

Environment Southland's Beacon overlay shows the site to have negligible risk of liquefaction. The mapped geology, and coal mining, suggest that alluvial gravels are present across the study area. Underground mining would also suggest that the soils that provide the most potential for liquefaction, such as shallow sand, are not generally present. Therefore, the widespread potential risk of liquefaction is negligible.

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). Seismic risk is typically mitigated for structures by a prudent design in accordance with NZ Building code and Building act requirements.

4.1.3. FLOODING

The site is elevated above the floodplain and on a gently sloping hill, therefore potential flood risk is negligible. No flooding has been designated within the study area by Environment Southland.

4.1.4. SLOPE STABILITY

There is no significant elevation change that would permit large scale slope instability. While the site is on sloping ground, there are no signs of slope instability at present seen in the general area. However, earthworks from road cuttings and mining may have over steepened faces, which may cause slope stability issues.

4.1.5. SUBSIDENCE

Subsidence associated with mining activities is to be expected. Underground mining may have caused instability in the above soils that are, at present, not showing any surface expression. While most subsidence is likely to have already occurred, future earthworks, construction, and development conditions may contribute to subsidence and collapse of underground mine workings. Development in this zoned area should have detailed geotechnical investigation requirements required to assess the potential for the specific development proposed.

4.1.6. LAND CONTAMINATION

No registered contaminated sites are present on the Environment Southland SLUS register. Although no 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 or coal mining activities. Coal mining is often a cause of soil contamination and caution should be advised.

4.1.7. SETTLEMENT

Quarrying and mining activities often relocate soil and rock into stockpiles or back into other open pits. The immediate area around these sites may have extensive non-engineered fill. Where stockpiling and fill has occurred from quarry and mine activity, settlement maybe ongoing, however, due to the time occurred since cessation of activity, primary settlement may have 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 access ways, and to cover refuse holes. 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.

4.2. GEOTECHNICAL HAZARD RISK ASSESSMENT

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

Table 1: Potential risk summary of the geotechnical hazards 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		
Subsidence from Mining			X
HAIL Land Contamination		X	
Settlement		X	

5. DEVELOPMENT CONSIDERATIONS

5.1. MINE AND QUARRY WORKINGS

Underground mining imparts major geotechnical challenges on developments overlying them, this is particularly present on the area adjacent to Reaby Road. The old underground workings were extensive and while information has been provided, it may not be complete, therefore the southern area would require extensive Geotech investigation, which may include excavation, drilling and geophysics.

5.2. NON-ENGINEERED FILL

Where old workings have been filled, the fill material used is generally unknown and may consist of hazardous materials and refuse. Much of the fill, however, is likely to have been sourced from the nearby underground mining activities. Development of structures and infrastructure on fill may result in further settlement. Development would require site specific investigations and structures may require Specific Engineering and design.

5.3. GENERAL CONSTRAINTS

Other geotechnical hazards within the study area are generally negligible, with the abandoned mining areas noted in Figure 3 of most concern. Outside these areas development constraints are considered minimal. However, there is a risk that not all mining activities undertaken on the site have been identified.

Most of the land within the study area 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

The area is considered suitable for lifestyle development with consideration given of the outlined mining activity above. Large hardstand areas and larger developments often associated with industrial sites will increase the risk of development upon previously mined land and non-engineered fill. Large structures constructed on slopes often require extensive levelling of the building footprint, which can increase slope instability. Development in this zoned area should have geotechnical investigations required to assess the potential of adverse geotechnical conditions present.

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

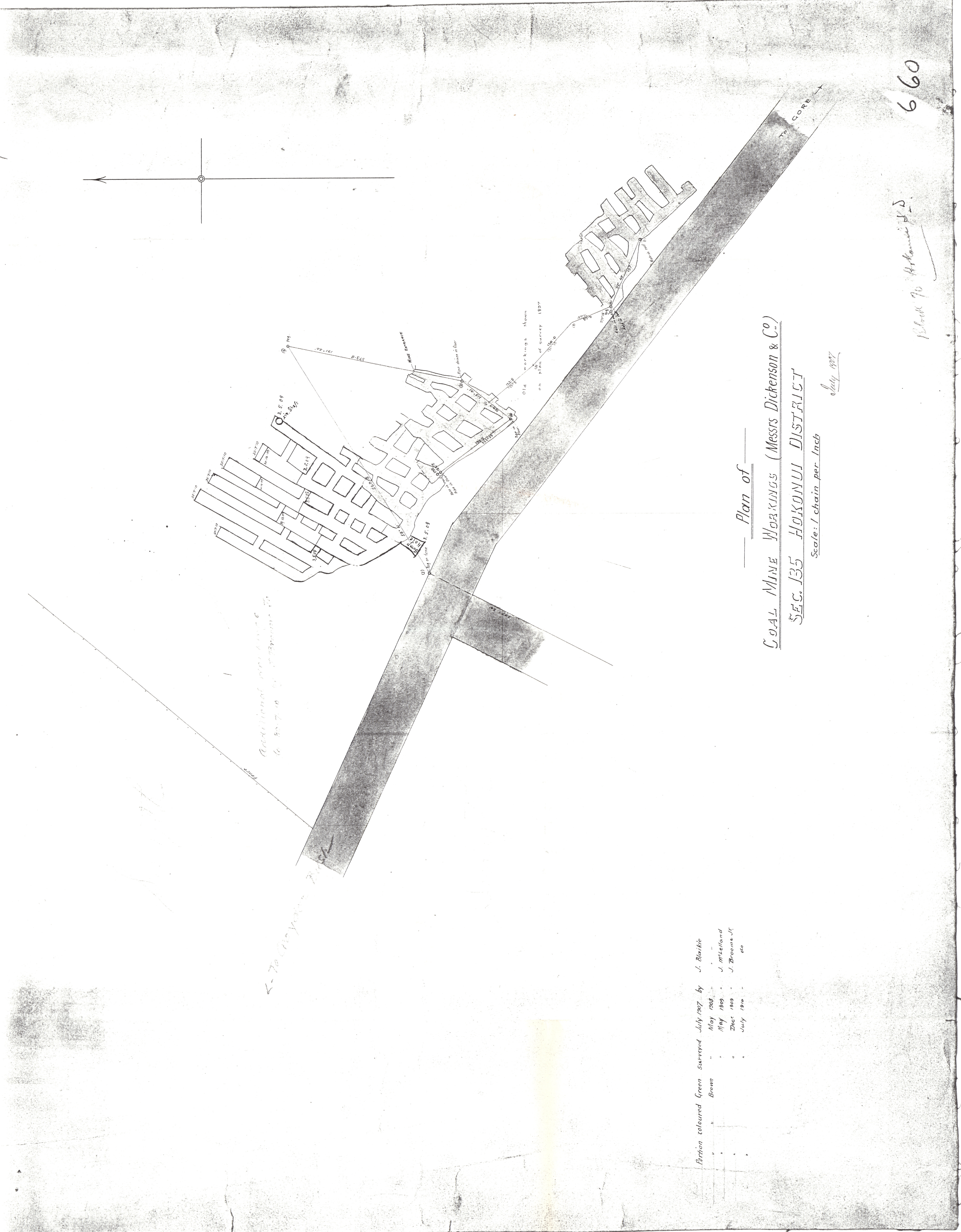
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APPENDIX A. HISTORIC MINING PLANS



Portion coloured Green surveyed July 1907 by J. Blackie
" " " " May 1908 " " " "
" " " " May 1909 " J. McElland
" " " " Dec 1909 " J. Brown & Co.
" " " " July 1910 " do

660

Block 70 Hokonui D.S.

— Plan of —
COAL MINE WORKINGS (Messrs Dickenson & Co.)
SEC. 135 HOKONUI DISTRICT

Scale: 1 chain per inch
July 1907