25 October 2014

BY EMAIL

Gillian Logan
160 Bangor Road, Darfield, Canterbury.

c/o Kim Logan
Avanzar Consulting Ltd

Project No. 42198040

Dear Gillian

Letter report - Geo-environmental desk study to support private plan change, 160 Bangor Road, Darfield – Revision 1.

1 INTRODUCTION AND OBJECTIVES

URS New Zealand Limited (URS) is pleased to present this report to Mrs Gillian Logan summarising the findings of a desk-based geo-environmental assessment of land located at 160 Bangor Rd, Darfield (the 'property').

URS understands that you are proposing to submit a private plan change to the Selwyn District Plan to allow the rezoning of the property from its current zoning of 'Deferred Living 2A' to a zoning that will allow the subdivision of the property to an average of 1 hectare.

The total area of the proposed plan change is approximately 130 Ha, therefore it is anticipated that the number of lots will be greater than 15 (i.e. a "larger subdivision" for the purposes of geotechnical assessment requirements within the Selwyn District Council [SDC]). Plan changes to facilitate "larger subdivisions" normally require a geotechnical assessment

The desktop investigation is intended to assist the SDC to understand the potential implications for rezoning the property. However, the investigation does not comment on the potential implications of any land use change, subdivision, or any other activity that may otherwise trigger the requirements of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES-CS).

2 SCOPE

URS completed the following:

- A review of historical aerial photographs, Environment Canterbury (ECan) online data and other publically available information to characterise the usage history of the property;

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- A review of readily available geotechnical information including maps, bore records and topographical maps; and
- A walkover of the property and interview with yourself to discuss the operational history of the property and in particular identify potential sources of contamination (such as sheep dip pits, waste pits, storage tanks etc).

No sampling or intrusive investigations or testing were completed as part of the desk top assessment.

3 DESCRIPTION OF SITE

The property includes a large area of farmland with the legal descriptions Sec 2 SO 438759, CT 548760 and Lot 2 DP 81020 BLK 6 SD; CT CB 47A/153. The property comprises approximately 130 hectares and is located in the western edge of the Darfield township as shown in **Figure 1**.

The property is predominantly used for grazing of sheep. There are also two small forestry blocks consisting of eucalypt trees, with a partial shelter belt of pine trees. The property contains a residential dwelling and a number of farm buildings/sheds containing in use and disused farm equipment.

The property is located above the Canterbury unconfined/semi confined aquifer system. Environment Canterbury records indicate that the depth to groundwater is greater than 6m in the vicinity of the property. Groundwater flow in the area is anticipated to be in a generally south easterly direction.

The Kowai River water race crosses the property, entering on its northern boundary and exits on its southern. This water race is used to provide stockwater at the property.

4 GEOTECHNICAL ASSESSMENT FINDINGS

4.1 Regional Geology & Hazards

A review of available 1:250,000 geological mapping (GNS QMap 16, Geology of the Christchurch Area, Forsyth et al. 2008) indicates that the property is predominantly underlain by a thick sequence of unweathered alluvial “outwash” (Q2a) gravels, which was deposited during the last glaciation (i.e. between approximately 12,000 to 24,000 years ago). In modern (Holocene) river/stream channels and associated floodplains, Q2a outwash gravels have been eroded by fluvial action, and are overlain by a veneer of Holocene (Q1a) river gravels, commonly in a series of degradational terraces. In areas not affected by Holocene river activity, Q2a outwash gravels are typically preserved beneath a thin (up to 2m thick) mantle of wind-blown Holocene silt (loess). There are no geological structures (e.g. faults, folds, landslides) identified within approximately 3.5 km of the property.

The property is located within the “low geotechnical risk area” (orange thatched area) on current SDC mapping, indicating that the area has already been broadly assessed as having an extremely low risk of liquefaction or other geo-hazards. Geotechnical conditions specific to the property are discussed in the following section.

4.2 Site Geotechnical Assessment

A site visit and visual assessment were undertaken by a geotechnical engineer on 6 November 2014. The surface geomorphology and current land use of the property were investigated; no intrusive investigations (i.e. test pits or boreholes) were undertaken, however an existing, open pit was observed which confirmed the local geomorphology.

4.2.1 Site Geomorphology

The property comprises and area of approximately 130 Ha, sloping gently to the south with a uniform gradient of around 8m per km. Local relief is in the order of 1-3m. Site observations and aerial photos indicate that surficial sediments are predominantly a thin layer of topsoil overlying loess and alluvial gravels. A small stream drains the south-eastern boundary of the property, and a SDC-owned water race crosses the property at various locations. No evidence of geological hazards was observed to have affected the property, based on field observations of surface geomorphology and inspection of available aerial photography.

4.2.2 Available Subsurface Information

An existing burial pit was observed along the north-eastern boundary of the property (see **Figure 2**); the excavation exposed ~20-30cm of topsoil above ~30-50cm of loess, which overlies Q2a gravels. These observations are consistent with published geological mapping and the ECan well log from the subject property (attached in **Appendix A**).

4.3 Conclusions

It is considered that the property has undergone only minor anthropogenic surface modification, mostly related to agricultural activity. In general, the site is underlain by a thick sequence of competent alluvial outwash gravels, with a veneer of loess and an overlying thin layer of topsoil. The alluvial gravels are unlikely to be susceptible to liquefaction or lateral spreading, and should provide adequate ground bearing pressure for residential building sites (i.e. “good ground” as defined by NZS 3604:2011), providing that the overlying loess and topsoil are removed beneath building foundations. Moderate shaking but no liquefaction was observed during the Canterbury earthquake sequence.

There are active burial pits along the north-eastern boundary of the property, and other burial pits were identified at selection locations across the property, typically along existing fence lines. These likely contain organic waste, farm debris, and other fill material which is likely to be unsuitable for building foundation. If encountered during foundation earthworks during development, unsuitable fill should be removed and replaced with compacted hardfill.

The Ministry of Business, Innovation & Employment’s (MBIE) guidance document (Guidance: Repairing and rebuilding houses affected by the Canterbury earthquakes, 2012 update) recommends that 0.2 to 0.5 investigations per hectare be performed for a plan change. When obtaining subdivision consent, 1 investigation per house site is recommended in rural settings. Given our understanding of the site geology, our observations of the ground conditions and proposed development, we do not recommend any further site investigations to meet the plan change requirements. Once the subdivision layout is known, we recommend performing shallow site investigations (hand augers and scala penetrometer tests) to assess the strengths of

the near surface soils. This data can be used to verify building foundation capacities, as well as subgrade strengths for pavement design within the subdivision. In our opinion, it is not necessary to perform an investigation at each house site, but rather if unsuitable soils are encountered during construction, the geotechnical engineer should be notified to provide recommendations on how best to proceed.

5 ENVIRONMENTAL ASSESSMENT FINDINGS

5.1 Environment Canterbury Listed Land Use Register

As of 21st November 2014 the ECan Land Use Register (LLUR) did not hold any information about a Hazardous Activities and Industries List (HAIL) site on the property.

5.2 Historic Aerial Photographs

URS has reviewed historical aerial photographs of the property and surrounding area captured in 1941 and 2004 (**Appendix B**). Both photographs show the property to comprise agricultural land. The current residential dwelling is present in the 1941 image, but has been significantly expanded by 2004 and in addition, a tennis court and swimming pool has been constructed at the property. Also, by 2004 several large shed-like structures have been constructed together with two circular above ground storage silos. Relatively little other change is apparent.

The 1941 appears to show several feeding troughs indicating that the property was likely being used for sheep/cattle at the time. No evidence of sheep dips sites are noted, however the scale of the image would not necessarily allow the identification of such features and so the presence of dip sites on the property cannot be discounted.

The area surrounding the property has undergone moderate change since the 1941, with the township of Darfield being developed to the east and a number of residential properties being developed to the west and south.

5.3 Environment Canterbury Resource Consents

ECan records indicate that there are no currently active resource consents assigned to the property. A resource consent was issued to Ron Stewart at the property in 1995 for the purpose of installing a bore for water quality monitoring. The consent expired in 1997 thought it is unclear whether or not the bore was installed. Mrs Logan has advised URS that a capped redundant (dry) well is located in the centre of the property – this well is not registered with ECan

A total of 244 resource consents have been issued within 500m of the property boundary, the majority being for the discharge of human effluent (i.e. via septic tank systems) or stormwater to land.

Two active resource consents to take groundwater are located on a parcel of land (Section 1 SO 438579) which is understood to have formerly been party of the property until sold to SDC in approximately 2012. The consents are held by SDC and relate to two wells drilled to over 200 meters depth for the purpose of municipal groundwater supply.

No silent files or areas of cultural or historical significance are registered as located on the property.

5.4 Site Walkover and Interview with Landowner

A site walkover was undertaken by a Suitably Qualified and Experienced Practitioner (SQEP) on 6th November 2014, and discussions were held with the landowner to document the known site history.

URS understands that Mrs Logan acquired the property in the late 1980s, and since this time the property has been used for a mixture of sheep farming and cropping. Although details of property use prior to this are not known, it is thought that the property has only ever been used for mixed agricultural use. The property (with the exception of the residential areas) is currently leased to a Mr Murray Rowlands who continues to utilise the property for sheep farming and crops, including barley.

With the exception of the residential property (which has been present since at least 1941) other buildings at the property comprise farm storage sheds and a wool shed. Mrs Logan advised that the larger farm sheds were constructed in the 1970s. A small (approx. 2,500 litre) steel above ground storage tank is present adjacent to a farm shed approximately 20m north of the residential property. Historically this tank was used to fuel farm vehicles but has not been used for at least 10 years. An underground petrol storage tank is understood to be present to the east of the same shed. Tank vent and dispensing pipes are present in the tank area. The age, size and condition of the underground tank are not known, but it is understood that the tank is empty and has not been used for at least 10 years.

With respect to the use of the property for sheep farming, Mrs Logan confirmed that to her knowledge there were no sheep dip sites or spray races at the property, and in her ownership only drench treatment had been undertaken. Only small quantities of treatment chemicals, vehicle oils, cleaners etc. are stored in the farm stores. Mrs Logan was not aware of any bulk storage of chemicals (other than the previously noted fuels) at the property.

A number of former and active offal pits are located at the property. URS observed one active pit located near to a fence line in the north-eastern area of the property. The pit was approximately 3m deep and contained sheep carcasses. Former pits are understood to have been filled in with soil and covered.

5.5 Conclusions

From the information available URS has identified the following actual or potential HAIL activities at the property:

- Category A8 – Livestock dip or spray race operations (potential given extended agricultural history);
- Category A17 – Storage tanks or drums for fuel, chemical or liquid waste; and,
- Category G5 – waste disposal to land (former and current offal pits).

URS considers that these activities are quite typical of agricultural properties and does not recommend that any further site investigations are necessary to meet the plan change requirements. Additional investigation of specific HAIL activities as listed above in accordance with Ministry for Environment guidelines will be required for subdivision and development.

Yours sincerely
URS New Zealand Limited

Paul Walker
Principal

Jim Dabkowski
Principal

Document Delivery.

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Limitations

URS Christchurch (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Mrs Gillian Logan and only those third parties who have been authorised in writing by URS to rely on the report.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report.

It is prepared in accordance with the agreed scope of work and for the purpose outlined in the URS Proposal dated 16th October 2014 and section 2 (Scope of Work) of this report.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by URS for use of any part of this report in any other context.

This Report was prepared between 16th October 2014 and 25th November 2014. The information in this report is considered to be accurate at the date of issue and is in accordance with conditions at the site at the date visited. Opinions and recommendations presented herein apply to the site existing at the time of our investigation and cannot necessarily apply to site changes of which URS is not aware and has not had the opportunity to evaluate. This document and the information contained herein should only be regarded as validly representing the site conditions at the time of the investigation unless otherwise explicitly stated in a preceding section of this report. URS disclaims responsibility for any changes that may have occurred after this time.

Except as required by law, no third party may use or rely on, this Report unless otherwise agreed by URS in writing. Where such agreement is provided, URS will provide a letter of reliance to the agreed third party in the form required by URS.

To the extent permitted by law, URS expressly disclaims and excludes liability for any loss, damage, cost or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this Report. URS does not admit that any action, liability or claim may exist or be available to any third party.

URS does not represent that this Report is suitable for use by any third party in deciding whether to enter a transaction in relation to the property which is the subject of the report or to put that property to a particular use.

It is the responsibility of third parties to independently make inquiries or seek advice in relation to their particular requirements and proposed use of the relevant property.

Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

MRS GILLIAN LOGAN

PRELIMINARY GEO-ENVIRONMENTAL ASSESSMENT, 160 BANGOR RD, DARFIELD

SITE LOCATION PLAN

Draft

URS

File: D:\URS-DATA\Works\42198040\Site_Location.mxd Drawn: **SS** Approved: **PW** Date: 24/11/2014 Figure: **1** Rev. **A** A4

N

Current Offal Pit

Former (infilled) Offal Pit

Farm Sheds

Petrol UST

Diesel AST

Residential House

Former (infilled) Offal Pit

HORNDON ST

MCHUGH CRESCENT

WEST COAST (DRFLD-SHFLD) ROAD

BANGOR ROAD

CRIDGES ROAD

Legend

- SDC Water Supply Bore
- Kowai Stockwater Race
- Property Boundary

0 37.5 75 150 225 300 m

Scale: 1:5,500 (A3)

MRS GILLIAN LOGAN

PRELIMINARY GEO-ENVIRONMENTAL ASSESSMENT, 160 BANGOR RD, DARFIELD

SITE LAYOUT PLAN

Draft

URS

File: D:\URS-DATA\Works\42198040\Site_Layout.mxd Drawn: **SS** Approved: **PW** Date: 24/11/2014

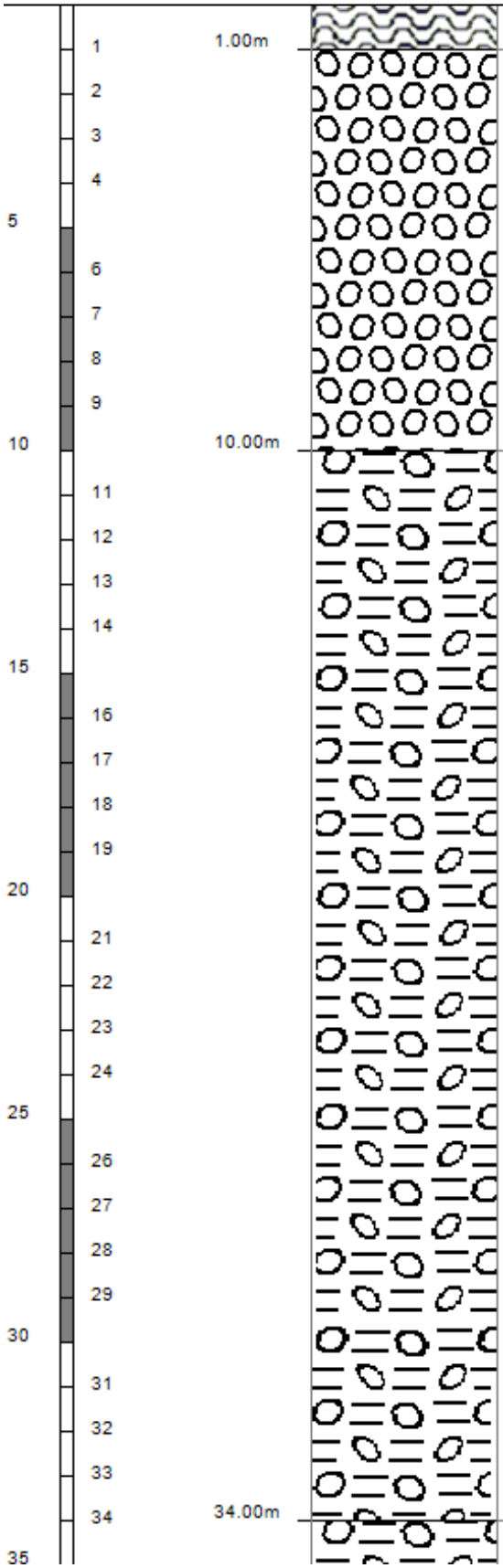
Figure: **2**

Rev. **A** A3

Borelog for well BX22/0006

Map Reference (NZMG): 2435937 mN, 5747290 mE
QAR Accuracy: 3
Ground Level Altitude: +MSD
Driller: McMillan Drilling Group
Drill Method: Rotary/Percussion
Well Depth: 245m Drill Date: 30/07/2013

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
		1.00m	Not Logged TOPSOIL. Not Recorded.	
		10.00m	Not Logged GRAVEL (2 - 60 MM).. Not Recorded.	
		34.00m	Not Logged clayey GRAVEL (2 - 60 MM).. Not Recorded.	
			Not Logged clayey GRAVEL (2 - 60 MM) with some sand.. Not Recorded.	

Borelog for well BX22/0006 page 2 of 7

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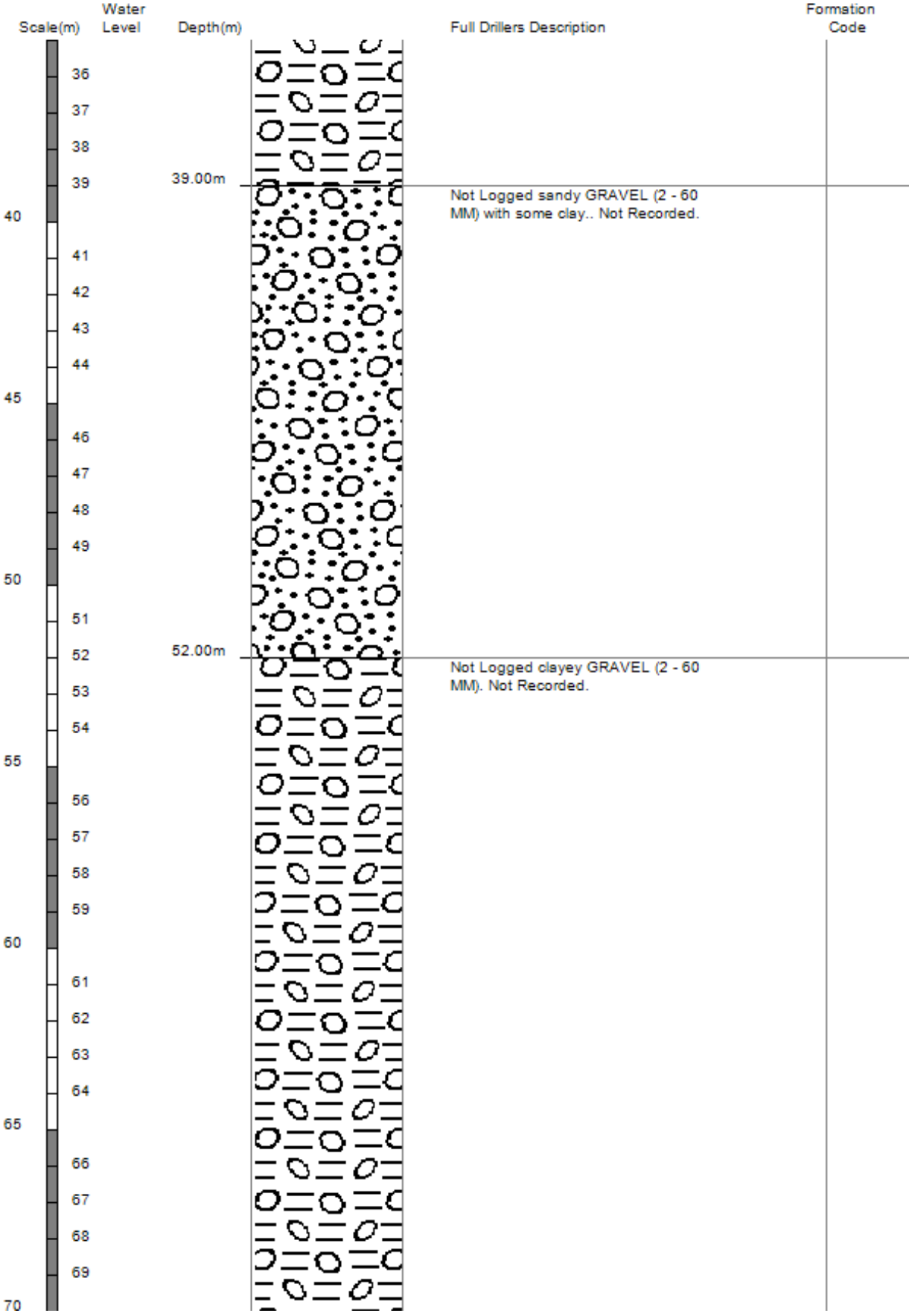

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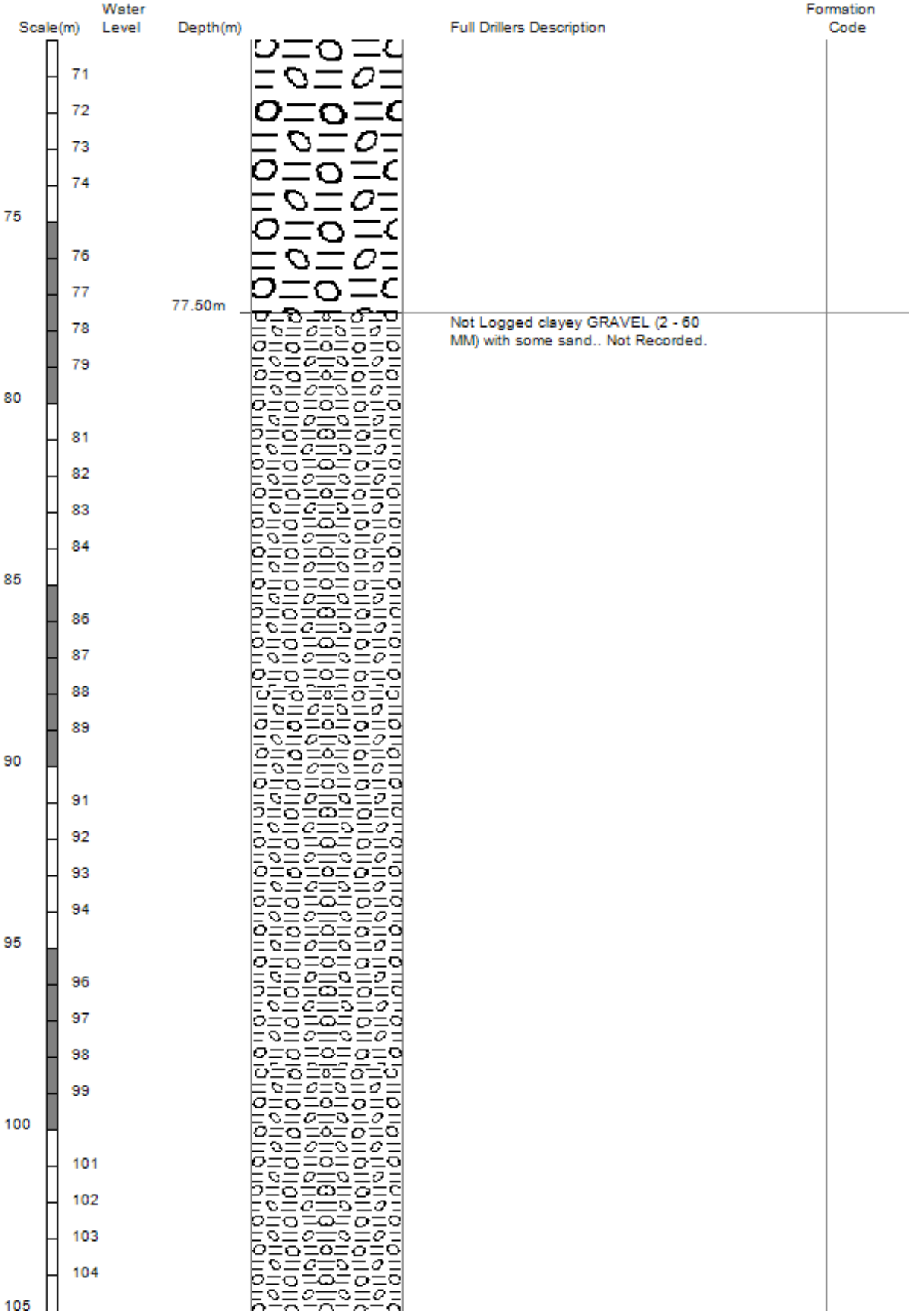

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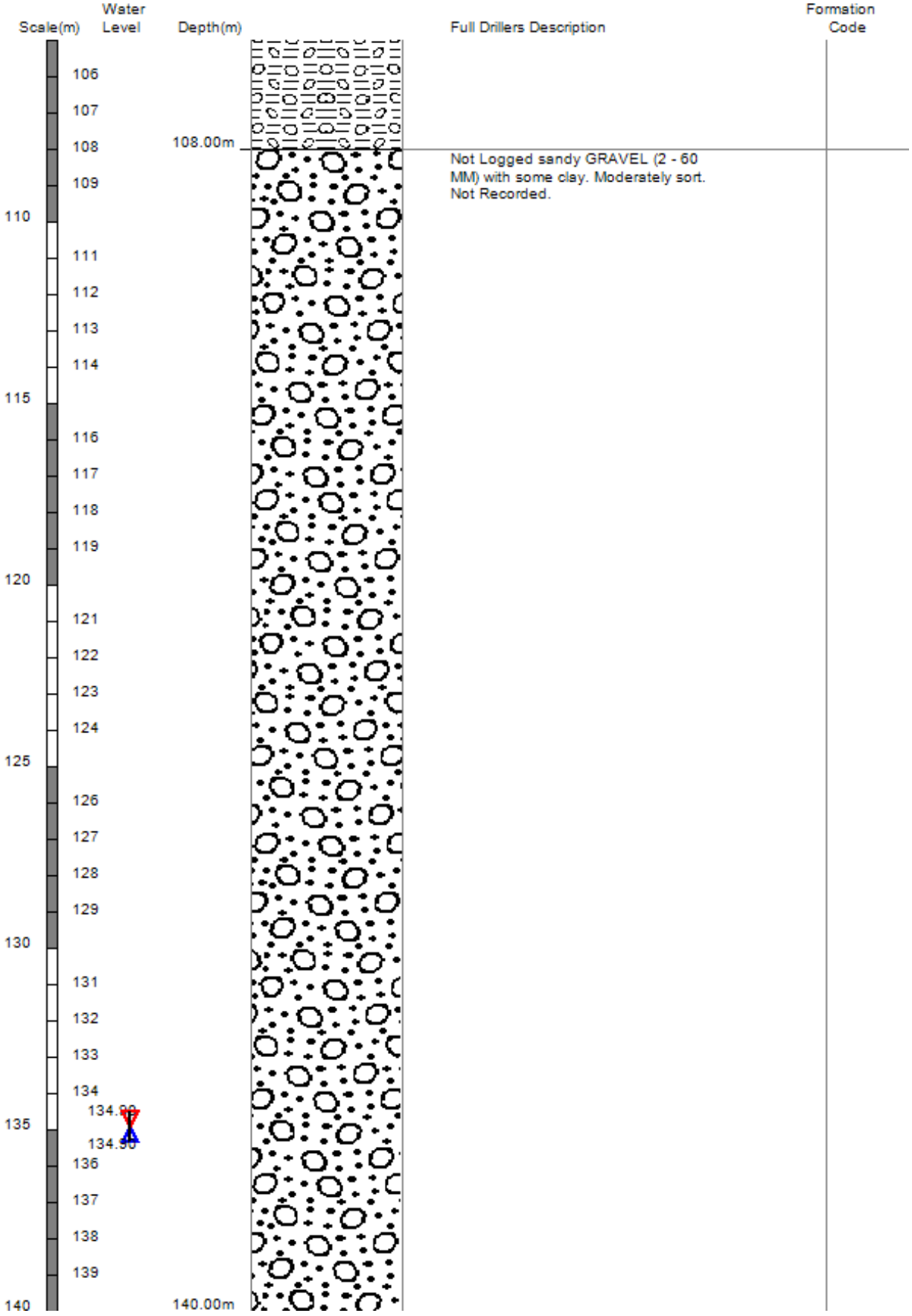

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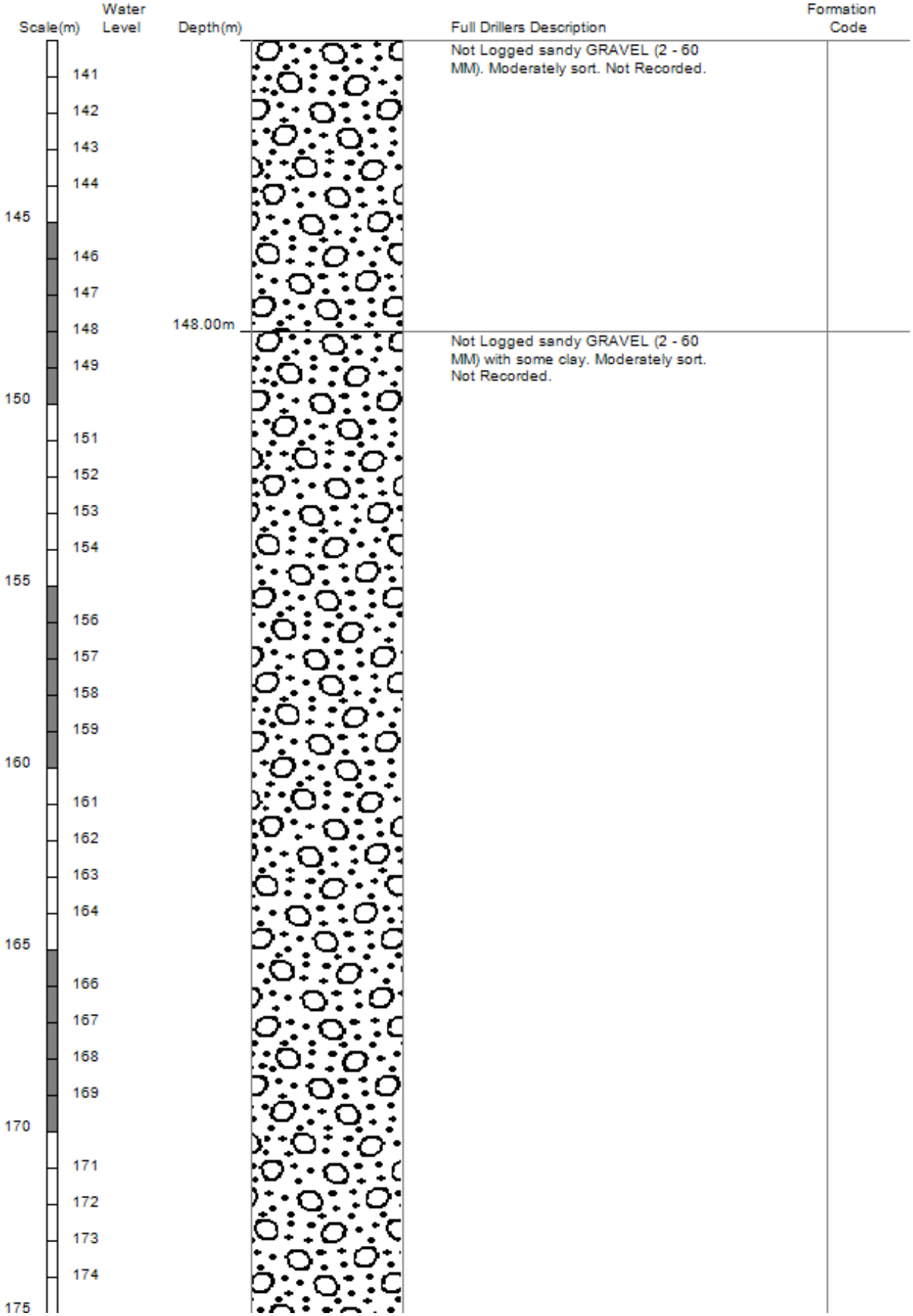

Borelog for well BX22/0006 page 6 of 7

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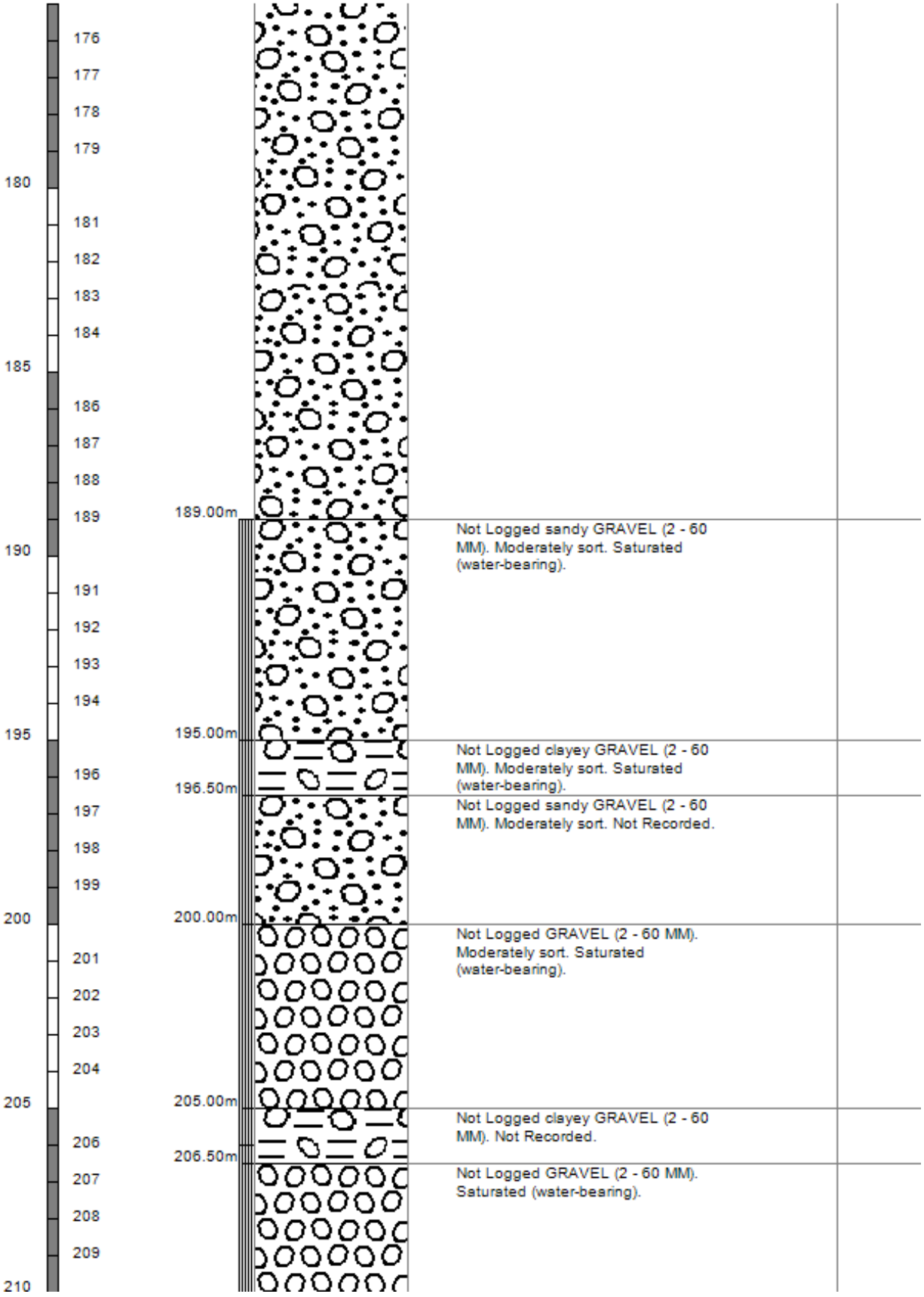

Borelog for well BX22/0006 page 7 of 7

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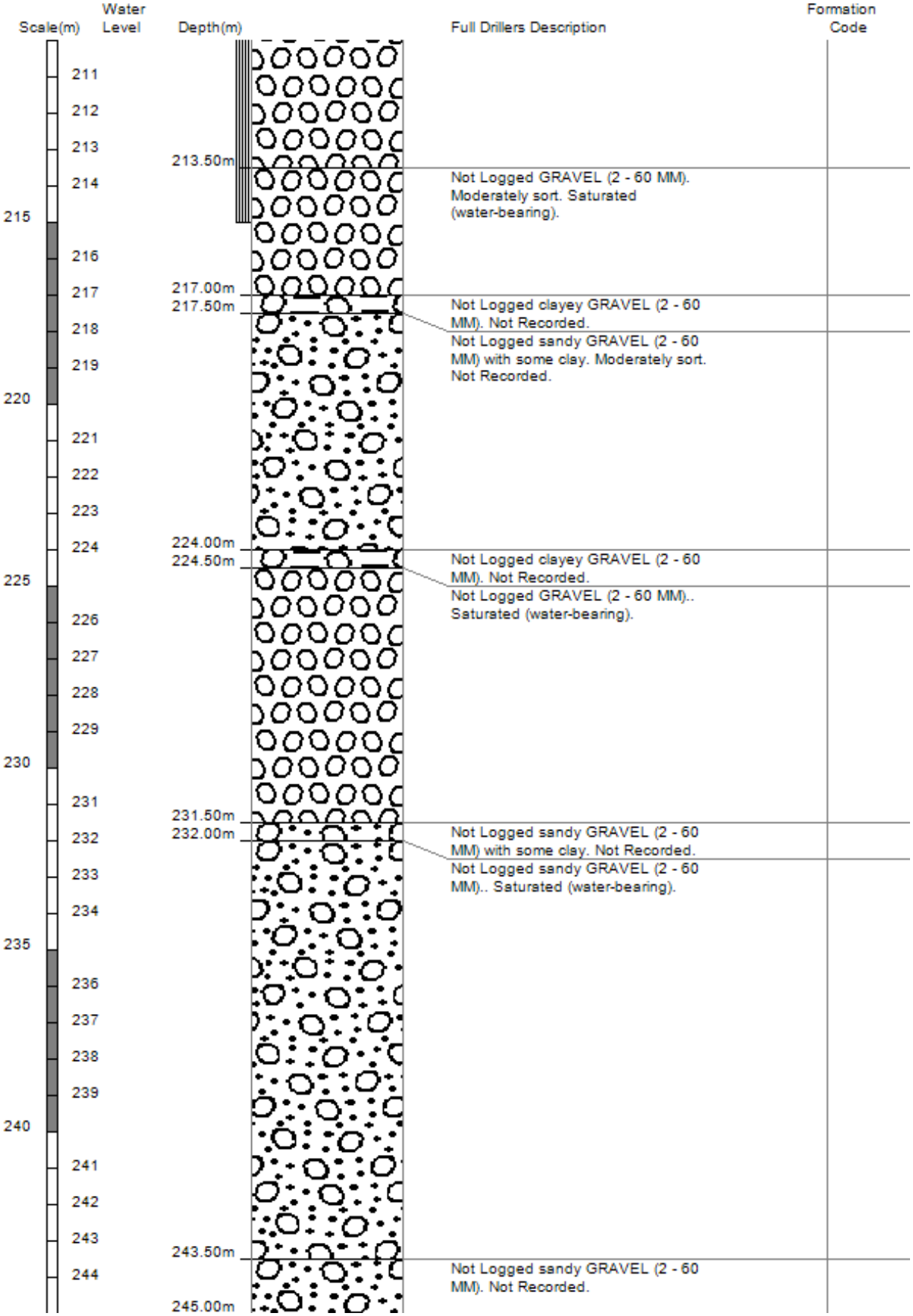
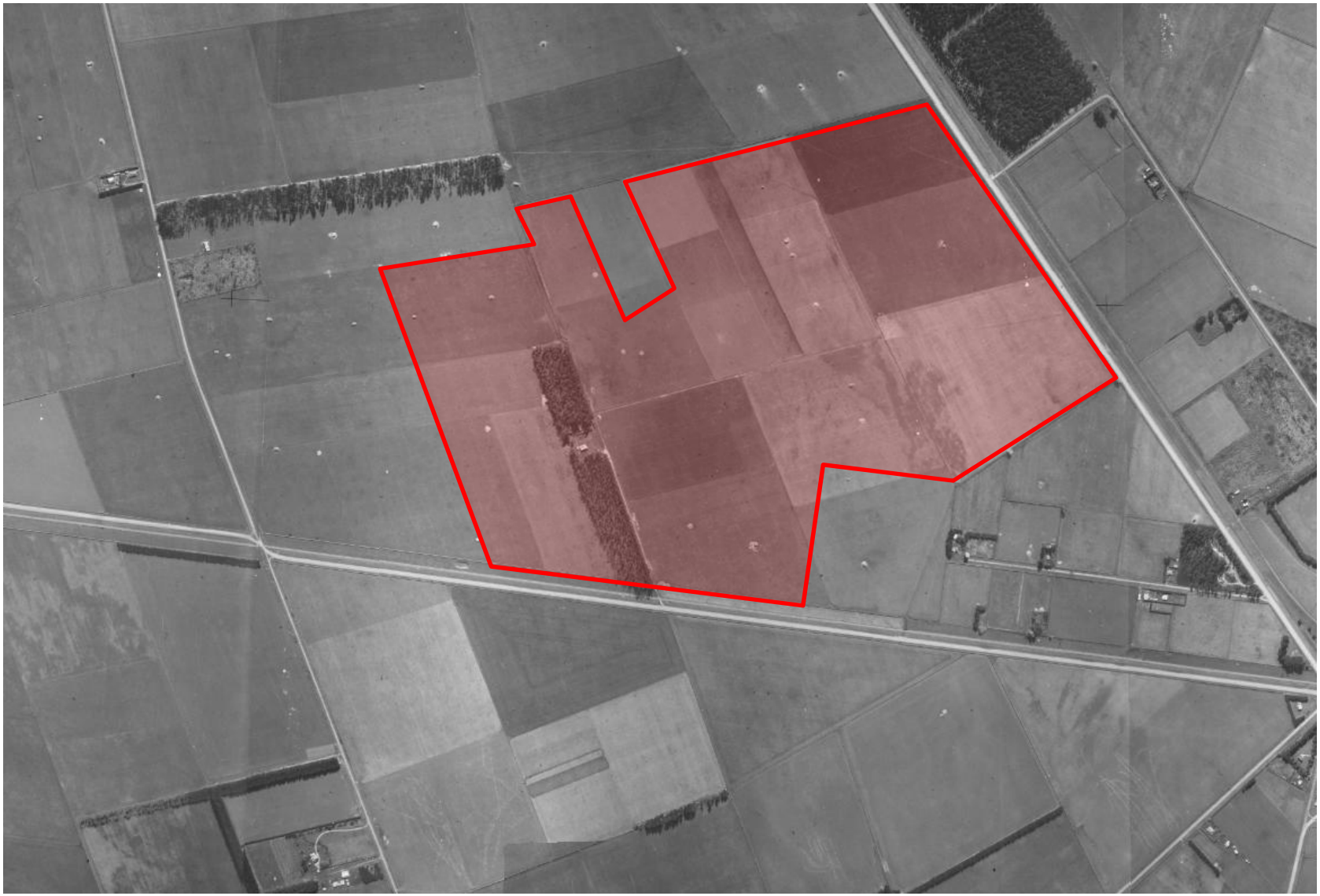


Appendix B - Environment Canterbury Aerial Photograph, 1941



Appendix B - Environment Canterbury Aerial Photograph, 2004