Christchurch City Council
SUPPLEMENTARY ATTACHMENTS UNDER SEPARATE COVER

Date: Thursday 8 November 2018
Time: 9.30am
Venue: Council Chambers, Civic Offices,
53 Hereford Street, Christchurch

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Christchurch City Council

DRAFT

Submission of the Christchurch City Council on Resource Consent Application CRC192153

Applicant:	Cloud Ocean Water Limited
Person Making the Submission:	Christchurch City Council PO Box 73012 Christchurch 8154 Attention: Diane Shelander Phone: 03 941 8304 Email: diane.shelander@ccc.govt.nz

1. The applicant has submitted a consent application to amend existing consent CRC182813 to allow water to be taken from an additional deep bore, BX24/1577.
2. We consider that this activity will have an impact on the public water supply for the reasons set forth below, and as such we are requesting that the consent is publicly notified.

Background

3. Christchurch City Council (the Council) operates the public drinking water supply and has previously expressed concerns about the impact of the applicant's water take consent applications on nearby public water supply wells.
4. In May 2018 the Council arranged for an assessment of potential well interference on the Council's public water supply wells at the Thompson and Belfast pumping stations. That assessment concluded that the Cloud Ocean bores could have a more than minor impact on the Council's public water supply bores in the area (see Attachment 1).
5. Concerns about the applicant's plans for groundwater extraction and its impact on Christchurch's public water supply, and well as future greenfield development, was communicated to Environment Canterbury in July 2018 and was subsequently included in our submission on Cloud Ocean Water's original consent application for this activity, CRC191770, on 16 October 2018.

Impact on Christchurch public water supply

6. The Council has previously expressed concerns about the impact of the applicant's proposed groundwater takes on the public water supply.
7. We note that the flow rate and take for BX24/1577 is significant and that given the nature of the commercial intent of the applicant – to bottle and sell water – we consider that it is reasonable to assume that the applicant intends to take at or near their current consented volume of 4320 cubic metres per day for most, if not all days, of the year. Our 16 October 2018 submission noted that this is likely have be minor or more than minor effects on the public water supply.
8. In addition, the Council has a programme in place to replace current shallow groundwater wells for the public water supply in the North West supply zone. We are concerned that future City Council water supply takes in the North West water supply zone as a consequence of the shallow well replacement programme may be adversely affected by the takes from Cloud Ocean's bore BX24/1577.

Consent variation vs new consent

9. The current application seeks to vary an existing consent. The current consent is to take up to 4,320 m^3/day (equivalent to 50 litres per second) from a shallow well (33 m deep) and the consent

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application is to allow 4,320 m³/day take from either that bore or their new deep bore (186 m deep). These are completely different aquifers and so the effects are different. As such we question the appropriateness of the application being considered as a consent variation.

10. We consider that the applicant should instead apply for a new water consent.

Need for integrated land and water management

11. Future residential, commercial and industrial growth in north-western Christchurch, including the Belfast area, would be well-known to Environment Canterbury as a partner in the Greater Christchurch Urban Development Strategy.
12. We noted in our 16 October 2018 submission that Cloud Ocean's bore BX24/1577 is located within Council's North West water supply zone where we are planning for a 50% increase in demand over the next 30 years, 20% of which is expected to be realised within the next 10 years.
13. There are several future residential and industrial growth areas in close proximity to this proposal — including Belfast industrial, North West Belfast residential and East Belfast residential — that will therefore also trigger increased future residential and industrial demand on the public water supply, and the need for additional deep wells.
14. We draw attention to the National Environmental Standard for Freshwater Management, in particular to C1 (b) that directs regional councils to manage "fresh water and land use and development in catchments in an integrated and sustainable way to avoid, remedy or mitigate adverse effects, including cumulative effects."
15. We consider that the public water supply needs in north-western Christchurch should be considered when assessing the takes from bore BX24/1577.

Environmental impacts

16. The AEE provides little detail about the effects of the proposed take from bore BX24/1577 on springs or surface waters, other than a somewhat circular argument that because the "new deep bore does not cause any stream depletion" and the "current consented shallow bore abstraction rates are not changing" "there is no change to any potential stream depletion."
17. We query whether there has been, or will be, consideration of the cumulative effects of water bottling takes in the Belfast area. We note that the total consented take by Cloud Ocean is 1,576,800 cubic metres per year, and the total consented takes of the two currently inactive consents held by Rapaki Natural Resource, one for their three deep bores and the other for their five shallow bores, are 2,096,640 and 5,117,780 cubic metres per year respectively.

Early engagement with the Council needed

18. The fact that Cloud Ocean's consent applications to date have been non-notified have allowed for little opportunity for greater consideration of potential impacts.
19. We noted in our 16 October 2018 submission that we are deeply concerned that there has not been robust consultation with Christchurch City Council concerning the applicant's water take proposals, given the concerns we have expressed in previous submissions about the impact of the applicant's water takes on the public water supplies.
20. We consider that:
    - The effect of the take from bore BX24/1577 will be more than minor if it will be on the order of the current consented take for the shallow well M35/1294
    - The Land and Water Regional Plan has provided for public drinking water supplies as a first priority
    - The potential impact of take from bore BX24/1577 justifies public consultation on CRC182813.
21. We continue to strongly urge that this consent application and any future water take consent applications from this applicant are not granted before substantive consultation with Christchurch City Council has been undertaken about the impacts of the applicant's proposed activities on the public water supply.

Attachment 1 – Well Interference Assessments for Cloud Ocean Abstraction Scenarios

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solutions for your environment

11 May 2018

Mike Bourke
Senior Technician
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Christchurch City Council
PO Box 73014
CHRISTCHURCH 8154

Dear Mike

WELL INTERFERENCE ASSESSMENTS FOR CLOUD OCEAN ABSTRACTION SCENARIOS

1.0 Introduction

Pattle Delamore Partners Limited (PDP) has been engaged by the Christchurch City Council (CCC) to assess the potential well interference effects on CCC's supply bores at the Thompson and Belfast pumping stations for two groundwater abstraction scenarios from a shallow and deep bore owned by Cloud Ocean.

The two abstraction scenarios are:

- Scenario 1 - Well Interference assessment for the existing consented abstraction at the Cloud Ocean site under resource consent, CRC182813, for 4,320 m^3/day from bore M35/1294.
- Scenario 2 - Well Interference assessment for the scenario where 4,320 m^3/day is taken from the new bore BX24/1577 at the Cloud Ocean site, with no abstraction occurring from bore M35/1294.

As requested, we have assumed that the current environment is no existing take from either bore. Based on the provided information, it is around 1025 m from the Cloud Ocean bores to the Belfast Pumping Station at 38 Darroch Street and 1400 m from the Cloud Ocean bores to the nearest Thompson Pumping Station bore.

The details of the Cloud Ocean bores and CCC's supply bores at the Thompson and Belfast pumping stations are provided in Table 1. The locations of the bores are presented in Figure 1, appended to this letter. Copies of the logs for these bores are also appended to this letter.

Table 1: CCC Bore details[1]

Name/CCC ID	ECan Bore Number	Depth (m)	Screen depth (m)
Cloud Ocean (shallow)	M35/1294	33.1	25.3 – 28.3 30 – 33.1
Cloud Ocean (deep)	BX24/1577	186	178.4 – 184.4
Belfast Stn Well-01	M35/1336	29	20.1 – 23.2 26.2 – 29.3
Belfast Stn Well-02	M35/10632	117	102.5 – 104.5 109 - 117
Thompsons Stn Well-02	M35/8972	143	139.5 – 143.5
Thompsons Stn Well-03	BX24/0153	170	163 – 170

Notes:

1. *Information obtained from https://www.ecan.govt.nz/data/well-search/*

2.0 Background hydrogeological information

Drawdown interference is the reduction in groundwater levels in surrounding bores caused by groundwater abstraction from a bore. The potential yield in a bore is dependent on the amount of available drawdown and a reduction of water levels may result in a bore not being able to achieve its required yield.

In order to assess drawdown interference effects, information on the local hydrogeology is first required, for example parameters determined from aquifer testing.

Based on the screened depth information, it is considered that both the shallow Cloud Ocean bore, M35/1294, and the Belfast Station Well-01, M35/1336, are located in Aquifer 1 (the Riccarton Gravel formation). The screen depth of the Belfast Stn Well-02, M35/10632, indicates that this bore is located in Aquifer 3 (the Burwood Formation), while the remaining bores were drilled to greater depths than the mapped aquifers in the area. The geology at the screened depths of bores BX24/1577, M35/8972 and BX24/0153 comprises sandy gravels.

ECan's aquifer test database was reviewed with the purpose of obtaining existing information in the area. The information obtained is summarised in Table 2. Some information is available for the Cloud Ocean deep bore and two of the CCC bores. A step test is recorded for the Cloud Ocean shallow bore, but no transmissivity estimate is provided on ECan's database.

Table 2: Aquifer test information for local bores[1]

ECan Bore Number	Depth (m)	Screen depth (m)	Discharge Test	Transmissivity[1] (m^2/day)
M35/17883	25	24 - 25	Constant Rate	1100
BX24/1578	28	23 - 27	Unknown	5000
BW24/0352	41	21 - 24	Step Rate	1500
M35/11446	54	51 - 54	Step Rate	1200
M35/8972	143	139.5 – 143.5	Step Rate	8000
BX24/1577	186	178.4 – 184.4	Step Rate	290
M35/8971	222	219 - 222	Step Rate	4900

Notes:

1. *Transmissivity values were estimated using the Eden-Hazel method (1973).*

Based on this information, we have selected the following information to use for the well interference assessments.

Scenario 1: Shallow pumping scenario (M35/1294)

- **Transmissivity.** A shallow aquifer transmissivity of 1000 m^2/day, based on the lower end of the reported 1100 to 5000 m^2/day range, has been chosen to provide a more conservative assessment. We note that a number of bores in the shallow aquifer have a large reported yield for a small reported drawdown, indicating that the aquifer is permeable, so the value of 1000 m^2/day is considered reasonably conservative.
- **Storage.** The shallow aquifer is considered to be confined in this area. It is likely to behave as a leaky confined aquifer with longer term pumping, however, no data on the hydraulic conductivity of the confining strata appears to be available for bores in this area. Based on this, a conservative storativity of 1 x 10^{-5} has been adopted for the assessment and it is assumed that no leakage occurs. It is also conservatively assumed for this drawdown assessment that no stream depletion, which would moderate drawdowns, is induced by the pumping.
- **Aquifer depth.** A cut-off maximum depth of 48 m has been adopted for this scenario, which is expected to exclude pumping bores in Aquifer 2 and below (NCCB, 1986). While some interference effects may occur in the longer term from deeper pumping, this cut-off is considered reasonable for the assessment of shallow interference effects based on the parameters and method chosen.

Scenario 2: Deep pumping scenario (BX24/1577)

- **Transmissivity.** A deep aquifer transmissivity of 1000 m^2/day has been chosen for the assessment. This is based on the values reported for the three bores from 144 to 222 m deep of 290 m^2/day, 4900 m^2/day and 8000 m^2/day and a consideration of the reported yields versus drawdown for other deep bores. While the deep Cloud Ocean bore has a reported transmissivity of 290 m^2/day from a step test in the bore, this does not match the reported high yield for the bore (50 L/s) for

the small reported drawdown (3.7 m after 3 days pumping). We have reviewed the step test data provided in the well card for this bore, and note that this indicates a higher transmissivity. It is considered that a transmissivity of 1000 m^2/day should provide for a reasonably conservative assessment.

- **Storage.** The deep aquifer is considered to be confined in this area. It may behave as a leaky confined aquifer with longer term pumping, however, no data on the hydraulic conductivity of the confining strata appears to be available for bores in this area. Based on this, a conservative storativity of 1 x 10^{-5} has been adopted for the assessment and it is assumed that no leakage occurs.
- **Aquifer depth.** A cut-off minimum depth of 48 m has been adopted for this scenario, which is expected to exclude pumping bores in Aquifer 1 (NCCB, 1986). This conservatively assumes all bores in Aquifer 2 and below are within a single confined aquifer. Small magnitude effects on Aquifer 1 may occur with longer term pumping from the deep aquifers, but these would be much less than predicted for the shallow pumping scenario from M35/1294.

3.0 Well interference assessment

Assessments of drawdown interference effects on neighbouring bores have been undertaken using ECan's online well interference tool and the method outlined in Schedule 12 of the Land and Water Regional Plan (LWRP). This is considered to be the most appropriate method to apply to this assessment. ECan's Schedule 12 criteria require drawdown interference effects to be calculated for all bores not owned by the applicant within 2 km of the pumped bore(s). ECan's Schedule 12 criteria also requires the assessment to be undertaken using the average pumping rate over a period of 150 days (Q150) which will deliver the seasonal allocation and also at the average daily pumping rate for a period of 7 continuous days (Q7).

ECan's LWRP Schedule 12 well interference criteria considers a neighbouring bore to be affected when a proposed groundwater take causes drawdown of more than 0.1 m in the neighbouring bore, and where the cumulative effect from all bores pumping within 2 km (including the pumped bore) exceeds the 20% threshold of available drawdown in the bore.

Consent CRC182813 authorises abstraction from bore M35/1294, a rate not exceeding 50 litres per second, with a volume not exceeding 4,320 cubic metres per day, and 1,576,800 cubic metres between 1st July and the following 30th June. 1,576,800 cubic metres equates to a take of 50 L/s continuously. Based on this, we have used an abstraction rate of 50 L/s for both the 7 day and 150 day assessments. We have adopted this same rate of 50 L/s for both the 7 day and 150 day assessments for the deep pumping scenario from BX24/1577.

The assessments have been carried out using the parameter values and cut-off depths outlined in the previous section of the letter.

We have only considered the effects in the CCC bores listed in Table 1 in our assessment. The results of the well interference assessment are presented in Table 2 below.

The total predicted drawdown at M35/1336 under Scenario 1 exceeds the currently available drawdown. However, the estimate for current cumulative drawdown effects of other bores in the region (excluding the effects from M35/1294) also exceeds the available drawdown in this assessment. This indicates that the actual effects will be much less than predicted using the conservative method, which has been adopted in the absence of good constant rate pumping test data being available in this areas on ECan's database.

Drawdown effects predicted under Scenario 2 are significantly lower, with two exceedances (M35/10632 and M35/8972). These predicted interference effects are not significantly more than the 20% threshold

(the effects are still less than 25% of the available drawdown) and as such the effects are considered likely to be minor, especially considering the conservatism of the assessment, but CCC should give some consideration to the operating requirements of their pumps. A well conducted constant rate aquifer test carried out on the new deep Cloud Ocean bore, with observations made in these CCC deep bores and any other available bores, would give the best information on drawdown interference effects.

Table 3: Drawdown Interference Effects

ECan Bore Number	Depth (m)	Available Drawdown (m)	Current Cumulative Drawdown[1] (m)	Total Predicted Drawdown Pumping M35/1294 (m)	Total Predicted Drawdown Pumping BX24/1577 (m)	Threshold Assessment
M35/1336	29	16.36	38	41.56	0	Exceeded
M35/10632	117	98.87	20.57	0	24.13	Exceeded
M35/8972	143	131.32	26.67	0	30.00	Exceeded
BX24/0153	170	163.25	26.76	0	30.13	ok

Notes:

1. *Excluding the effects of pumping at M35/1294 or BX24/1577.*

4.0 Conclusions

The results of the analysis indicate that pumping the shallow Cloud Ocean bore, M35/1336, could potentially have significant drawdown effects on the CCC supply bores screened in Aquifer 1, although this assessment has been undertaken in a conservative manner in the absence of complete information on hydrogeological parameters. Pumping from the deep Cloud Ocean bore, BX24/1577, will likely result in minor effects on CCC supply bores in the deeper aquifer, with the cumulative drawdown in these bores estimated to be less than 25%, but CCC should consider the requirements of their pumps in these deep bores. Well-conducted aquifer testing would provide more certainty on the potential effects.

5.0 References

North Canterbury Catchment Board. (1986). *The Christchurch Artesian Aquifers.* Technical Report, Resources Division, Christchurch.

6.0 Limitations

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Christchurch City Council and others (not directly contracted by PDP for the work), including Environment Canterbury. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions of Christchurch City Council for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

Yours sincerely

PATTLE DELAMORE PARTNERS LIMITED

Prepared by

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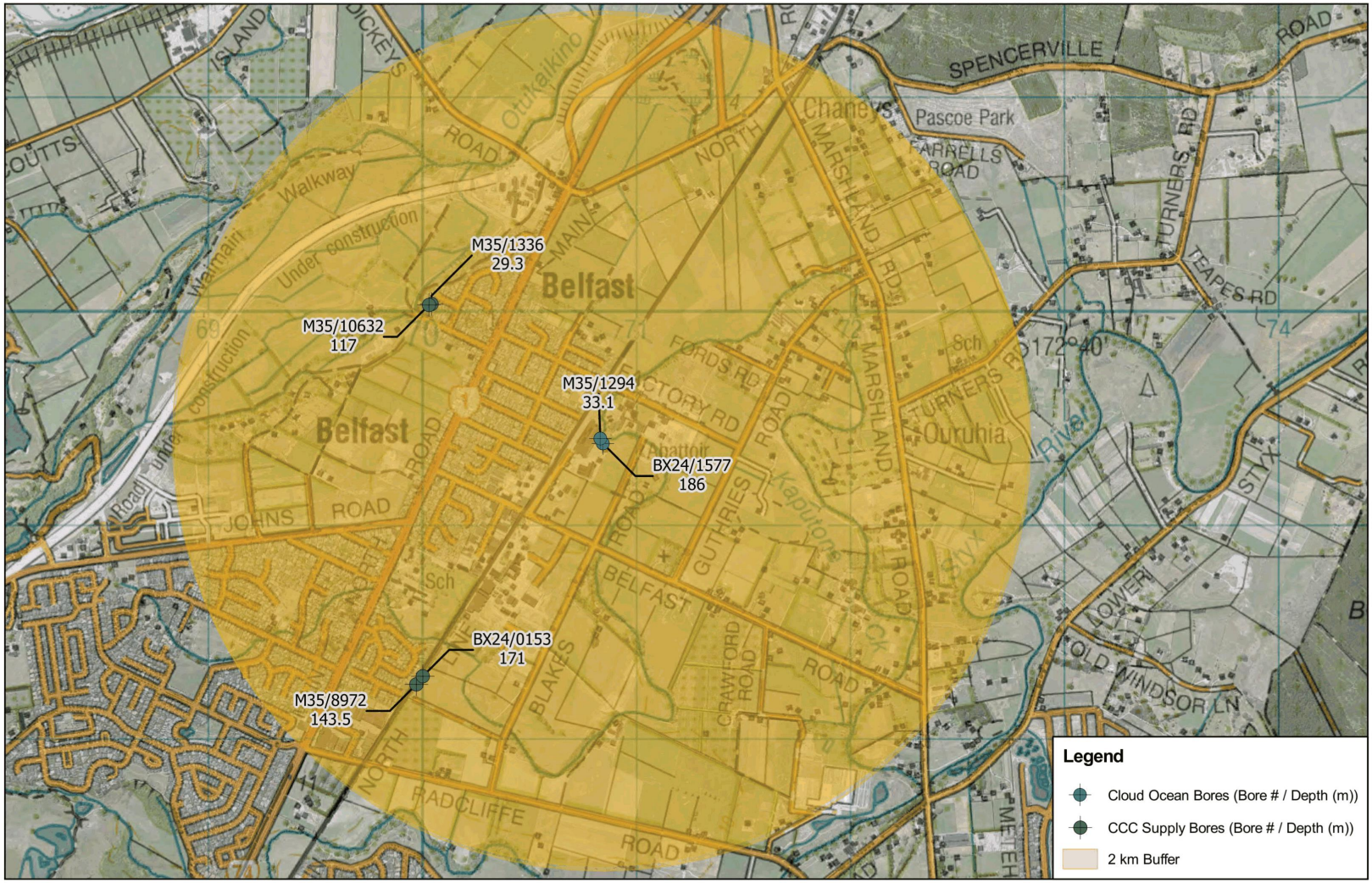
Hilary Lough

Technical Director

CCC - WELL INTERFERENCE



Note: Locations of features shown above are approximate.

FIGURE 1: LOCATION OF CLOUD OCEAN BORES AND CCC PUBLIC SUPPLY BORES

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S:/CJ723/CJ72331500/CloudOcean/CJ723315002001_CloudOcean.qgs

BX24/0153 details

Borelog for well BX24/0153

Grid Reference (NZTM): 1570000 mE, 5188293 mN
Location Accuracy: < 50m
Ground Level Altitude: m +MSD Accuracy:
Driller: Clemence Drilling Contractors
Drill Method: Rotary Rig
Borelog Depth: 171.0 m Drill Date: 20-Jun-2012

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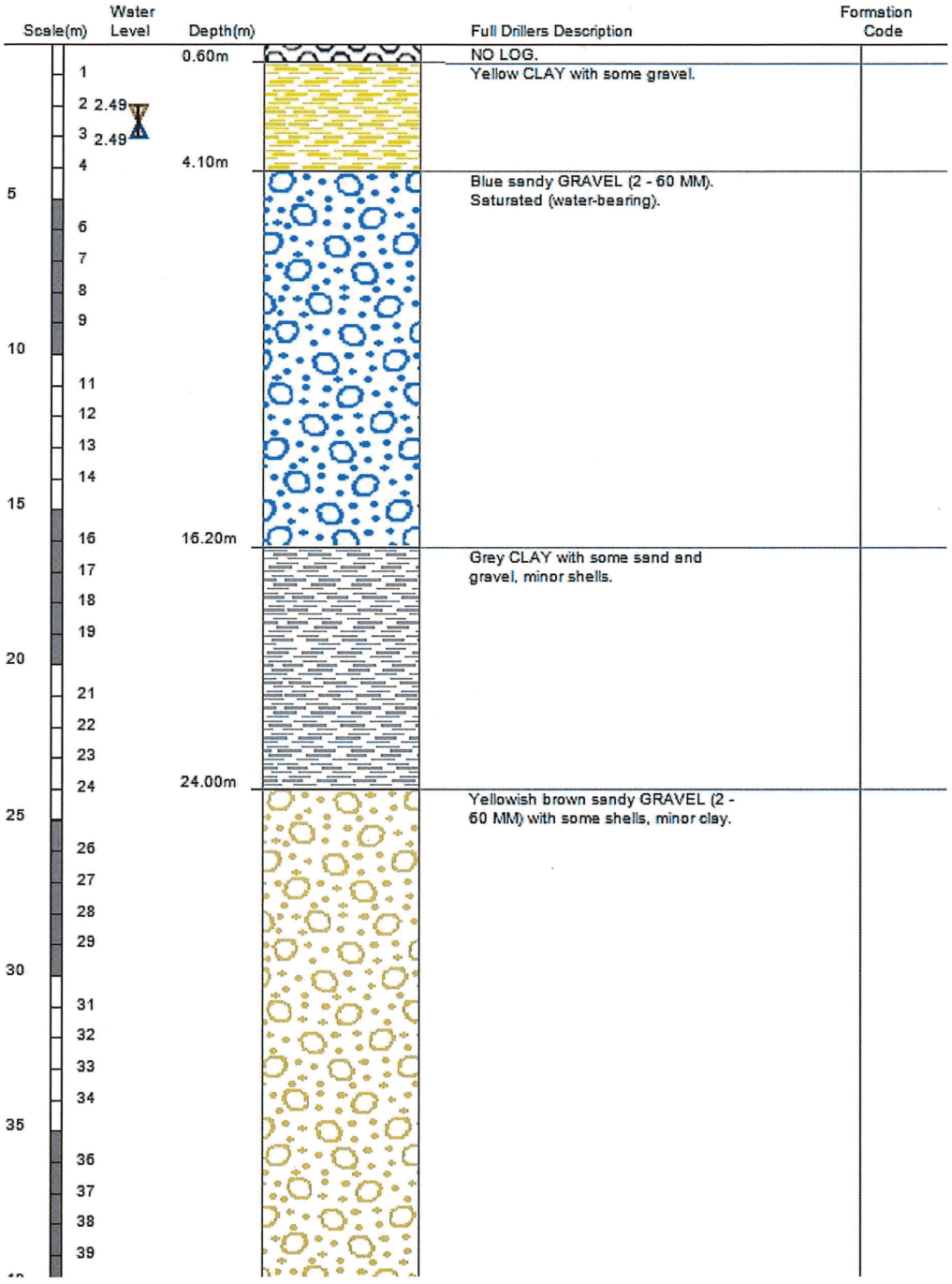

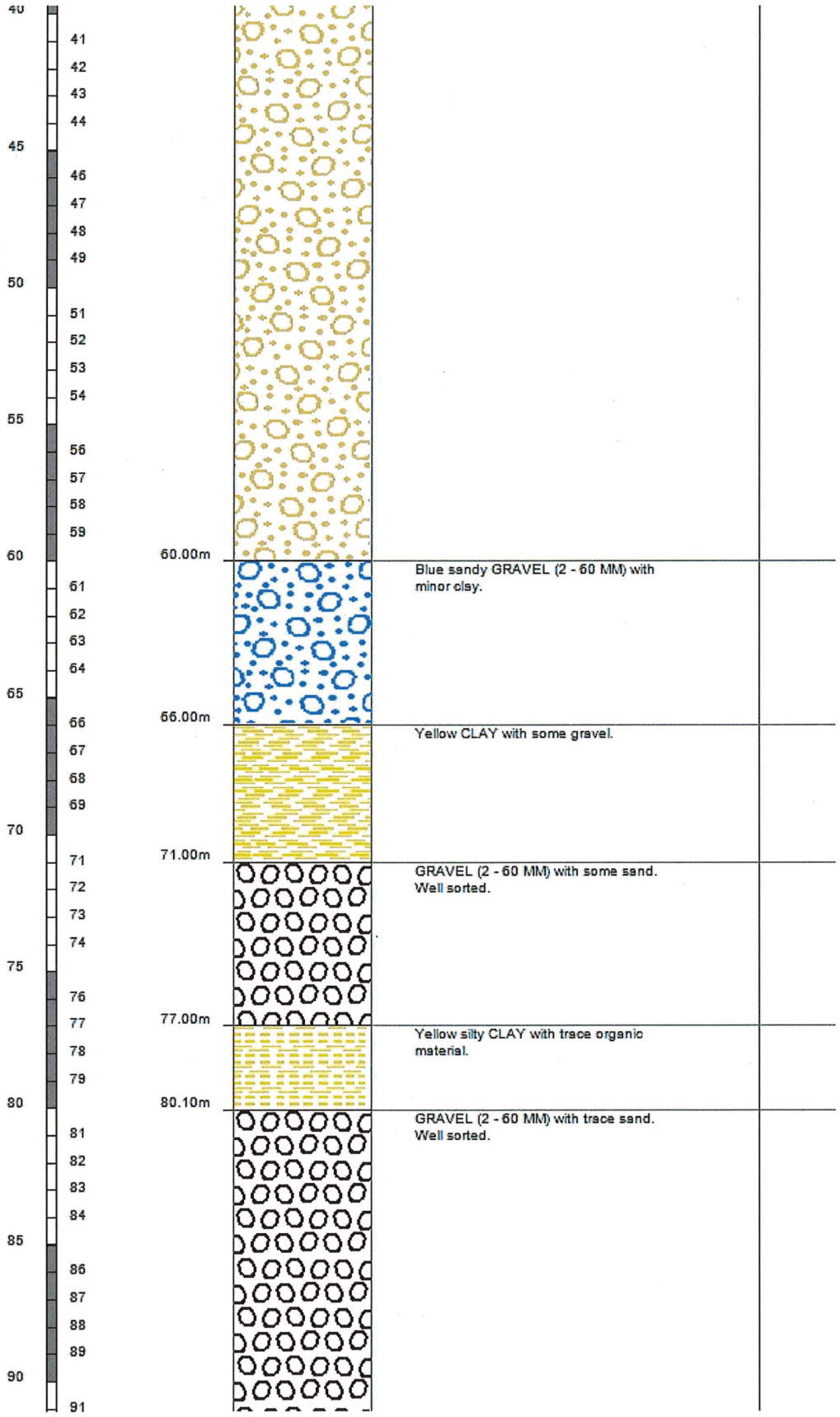
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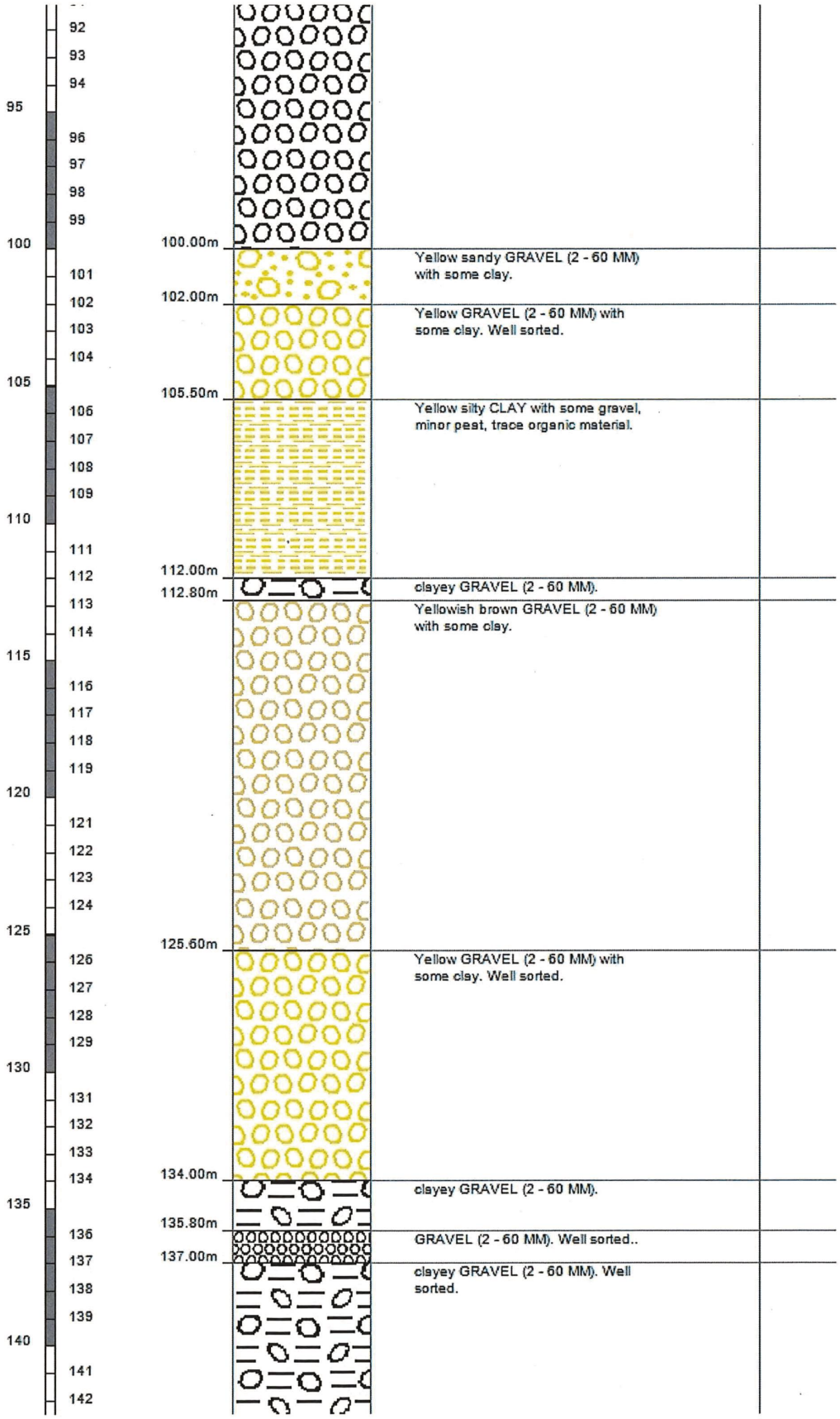
60.00m
Blue sandy GRAVEL (2 - 60 MM) with minor clay.
66.00m
Yellow CLAY with some gravel.
71.00m
GRAVEL (2 - 60 MM) with some sand. Well sorted.
77.00m
Yellow silty CLAY with trace organic material.
80.10m
GRAVEL (2 - 60 MM) with trace sand. Well sorted.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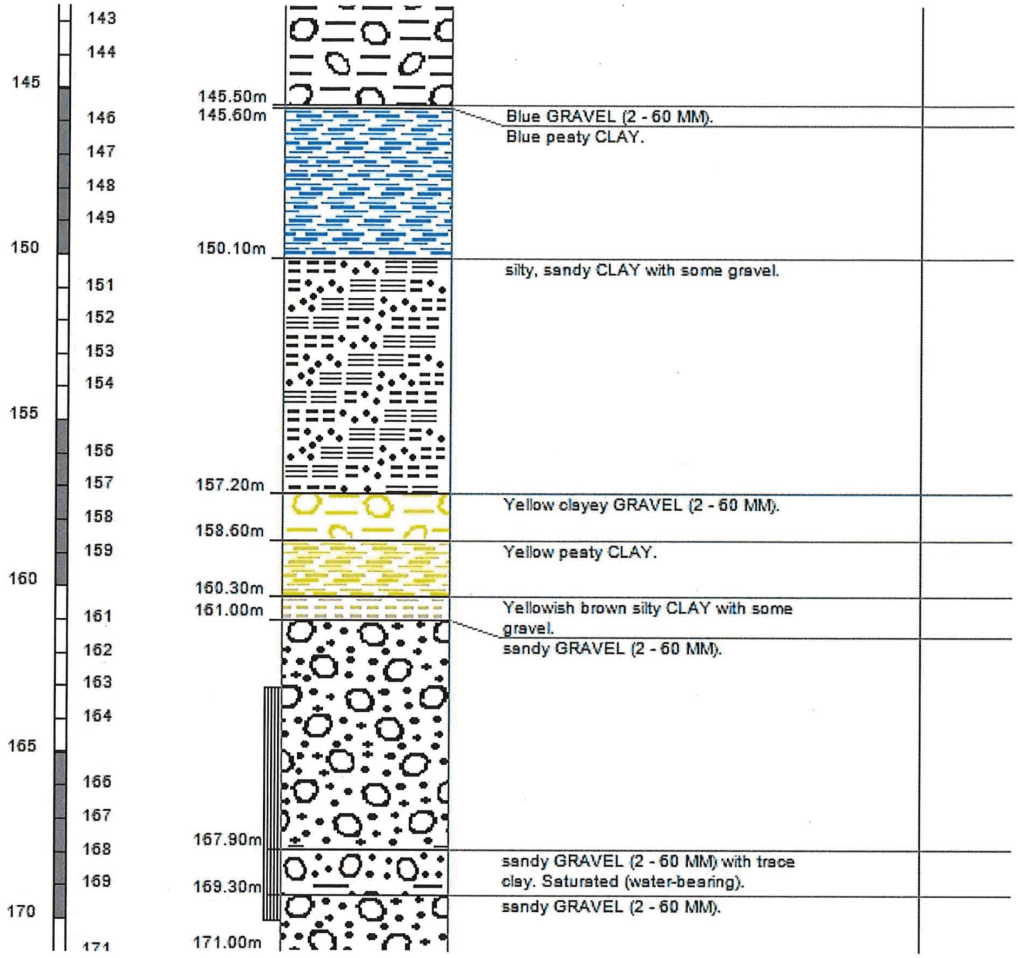
100.00m
Yellow sandy GRAVEL (2 - 60 MM) with some clay.
102.00m
Yellow GRAVEL (2 - 60 MM) with some clay. Well sorted.
105.50m
Yellow silty CLAY with some gravel, minor peat, trace organic material.
112.00m
clayey GRAVEL (2 - 60 MM).
112.80m
Yellowish brown GRAVEL (2 - 60 MM) with some clay.
125.60m
Yellow GRAVEL (2 - 60 MM) with some clay. Well sorted.
134.00m
clayey GRAVEL (2 - 60 MM).
135.80m
GRAVEL (2 - 60 MM). Well sorted..
137.00m
clayey GRAVEL (2 - 60 MM). Well sorted.



BX24/1577 details

Borelog for well BX24/1577

Grid Reference (NZTM): 1570842 mE, 5189382 mN
Location Accuracy: < 50m
Ground Level Altitude: m +MSD Accuracy:
Driller: Clemence Drilling Contractors
Drill Method: Rotary/Percussion
Borelog Depth: 186.0 m Drill Date: 19-Feb-2018

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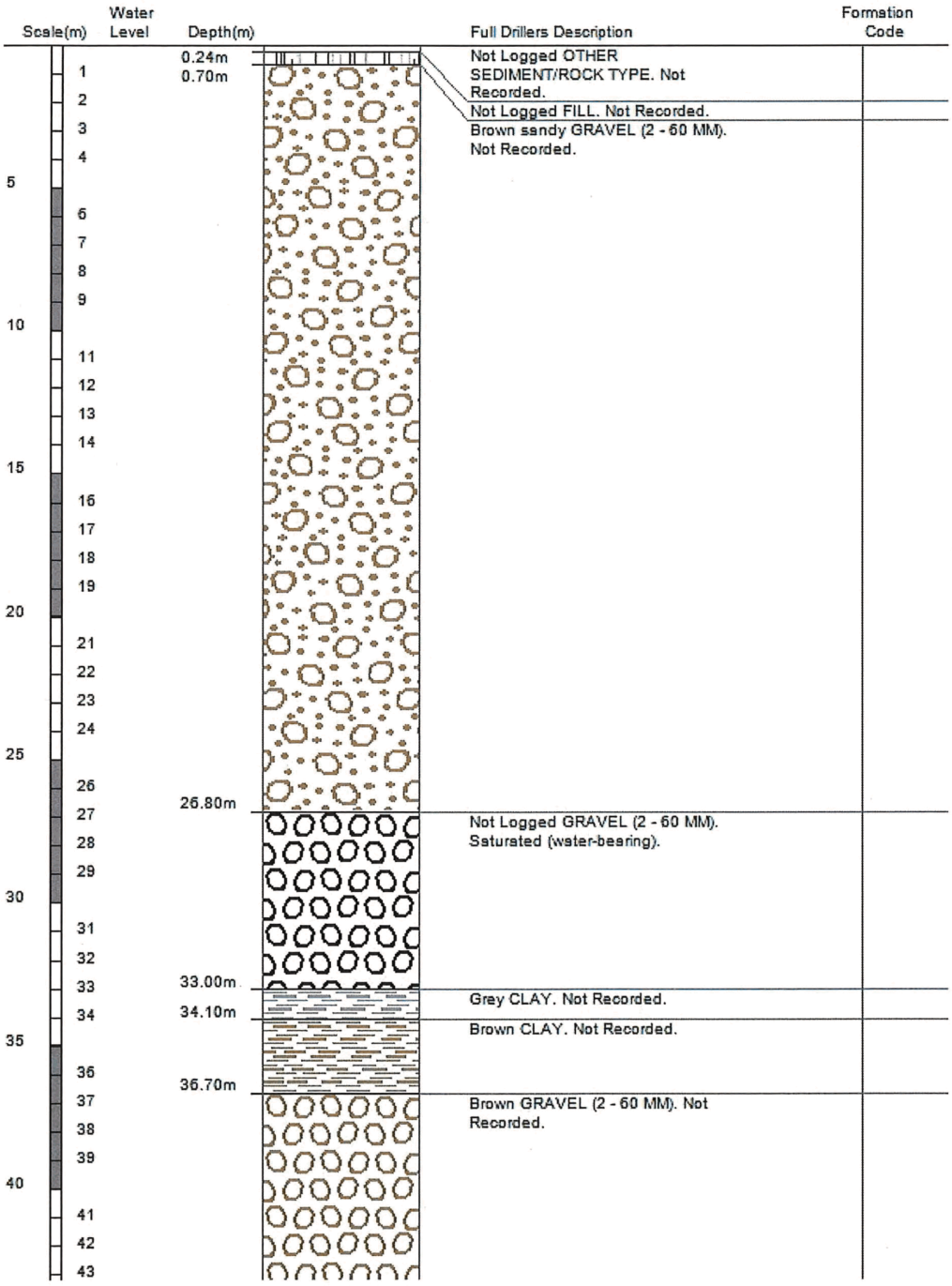

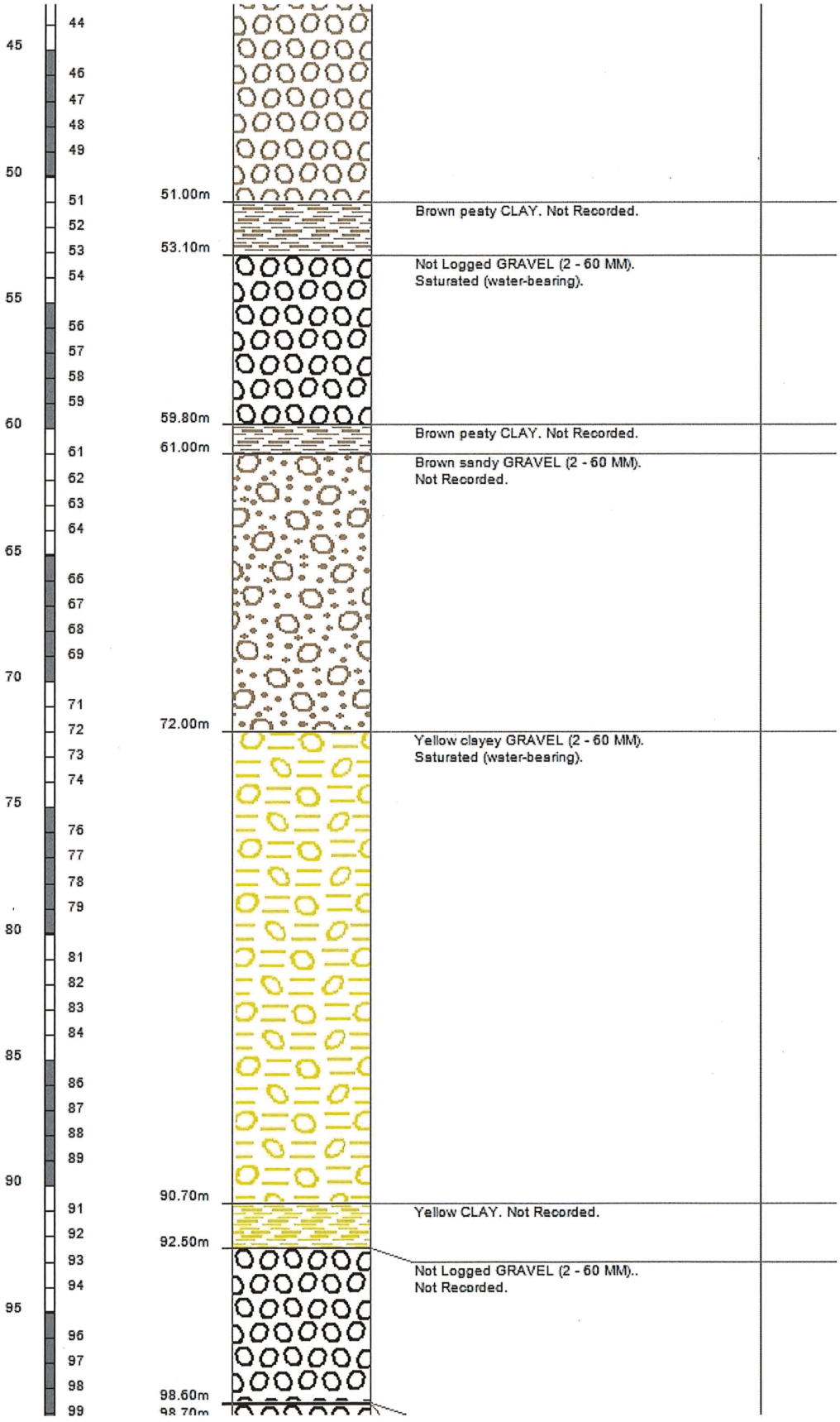
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51.00m
Brown pasty CLAY. Not Recorded.
53.10m
Not Logged GRAVEL (2 - 60 MM).
Saturated (water-bearing).
59.80m
Brown pasty CLAY. Not Recorded.
61.00m
Brown sandy GRAVEL (2 - 60 MM).
Not Recorded.
72.00m
Yellow clayey GRAVEL (2 - 60 MM).
Saturated (water-bearing).
90.70m
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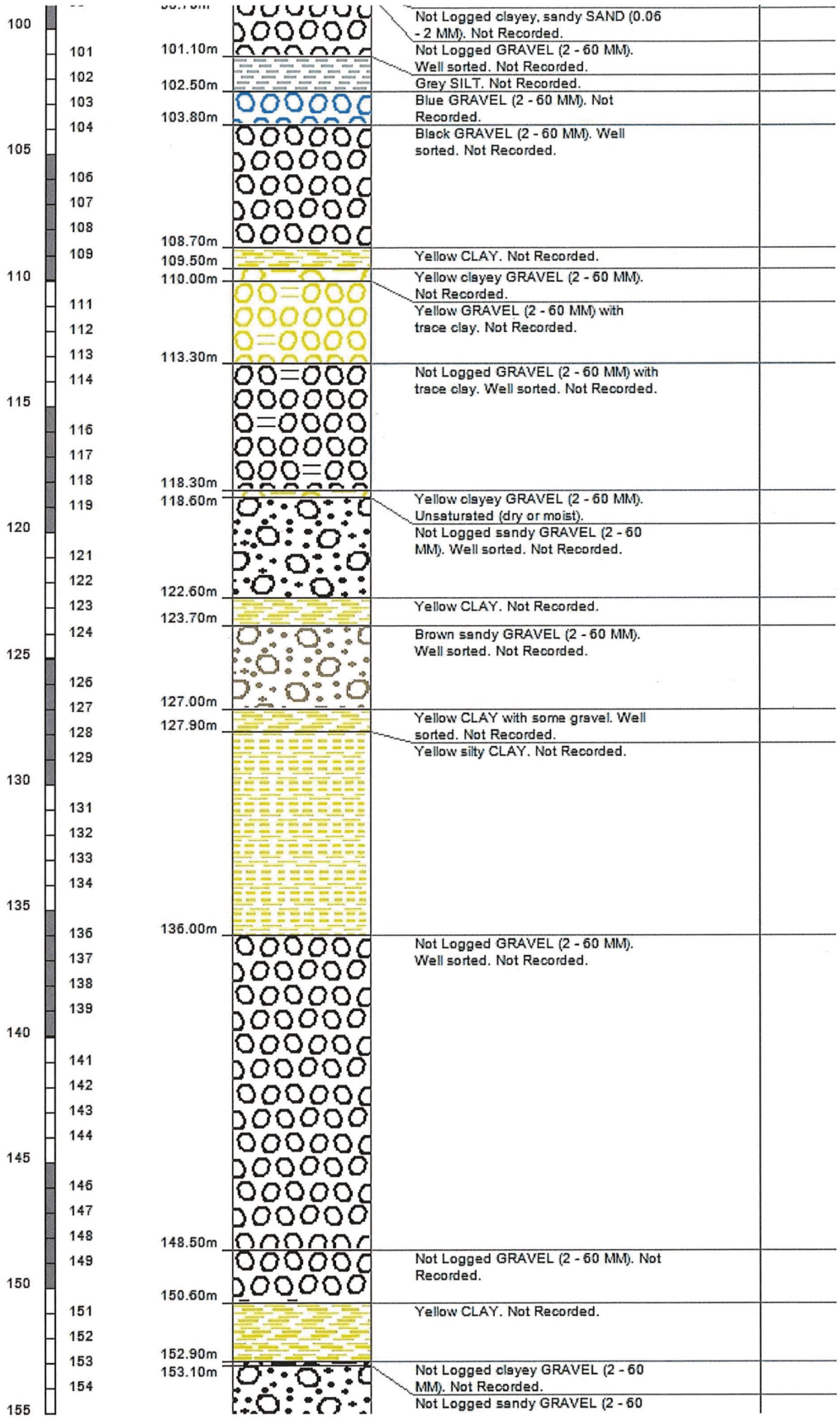
92.50m
Not Logged GRAVEL (2 - 60 MM)..
Not Recorded.
98.60m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101.10m
102.50m
103.80m
108.70m
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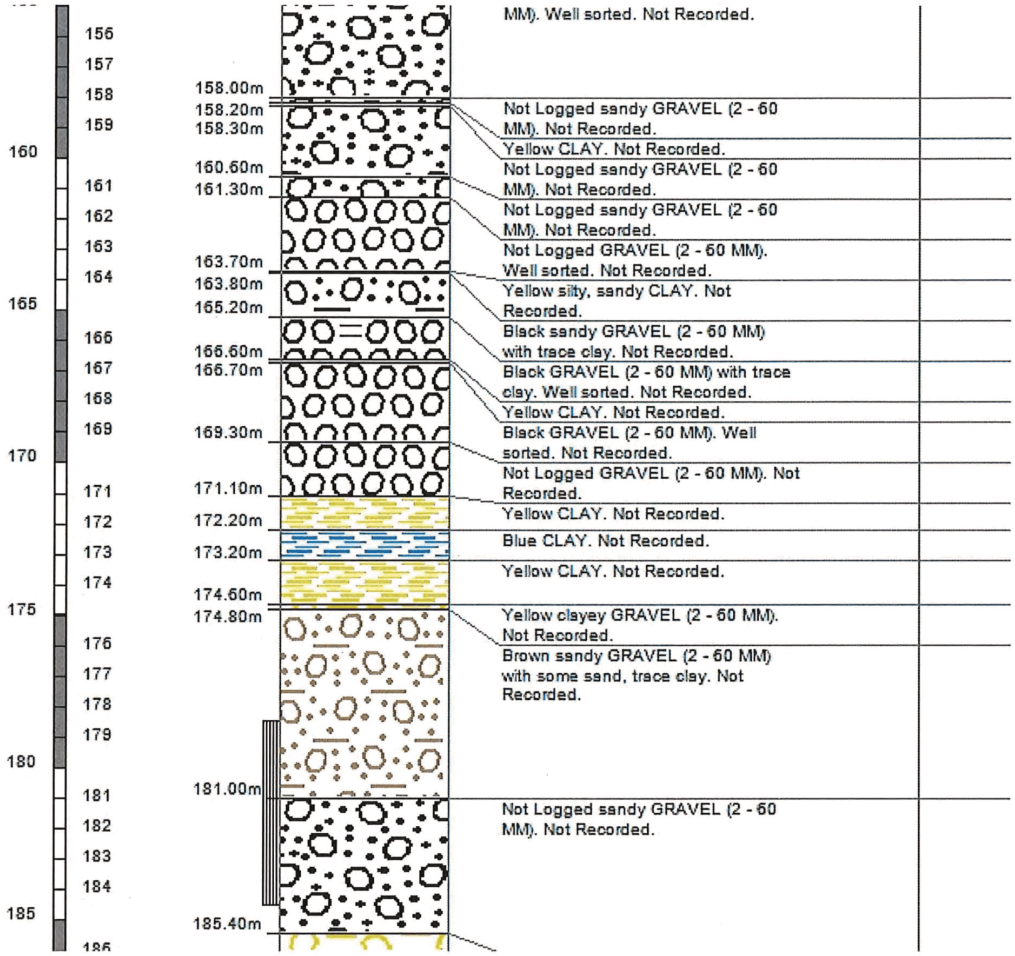
110.00m
113.30m
118.30m
118.60m
122.60m
123.70m
127.00m
127.90m
136.00m
148.50m
150.60m
152.90m
153.10m
Not Logged clayey, sandy SAND (0.06 - 2 MM). Not Recorded.
Not Logged GRAVEL (2 - 60 MM). Well sorted. Not Recorded.
Grey SILT. Not Recorded.
Blue GRAVEL (2 - 60 MM). Not Recorded.
Black GRAVEL (2 - 60 MM). Well sorted. Not Recorded.
Yellow CLAY. Not Recorded.
Yellow clayey GRAVEL (2 - 60 MM). Not Recorded.
Yellow GRAVEL (2 - 60 MM) with trace clay. Not Recorded.
Not Logged GRAVEL (2 - 60 MM) with trace clay. Well sorted. Not Recorded.
Yellow clayey GRAVEL (2 - 60 MM). Unsaturated (dry or moist).
Not Logged sandy GRAVEL (2 - 60 MM). Well sorted. Not Recorded.
Yellow CLAY. Not Recorded.
Brown sandy GRAVEL (2 - 60 MM). Well sorted. Not Recorded.
Yellow CLAY with some gravel. Well sorted. Not Recorded.
Yellow silty CLAY. Not Recorded.
Not Logged GRAVEL (2 - 60 MM). Well sorted. Not Recorded.
Not Logged GRAVEL (2 - 60 MM). Not Recorded.
Yellow CLAY. Not Recorded.
Not Logged clayey GRAVEL (2 - 60 MM). Not Recorded.
Not Logged sandy GRAVEL (2 - 60



M35/1294 details

Borelog for well M35/1294

Grid Reference (NZTM): 1570829 mE, 5189405 mN
Location Accuracy: 10 - 50m
Ground Level Altitude: 5.9 m +MSD Accuracy: < 0.5 m
Driller: Welldrilling & Exploration Co.
Drill Method: Cable Tool
Borelog Depth: 33.0 m Drill Date: 16-Dec-1966

Environment Canterbury Regional Council
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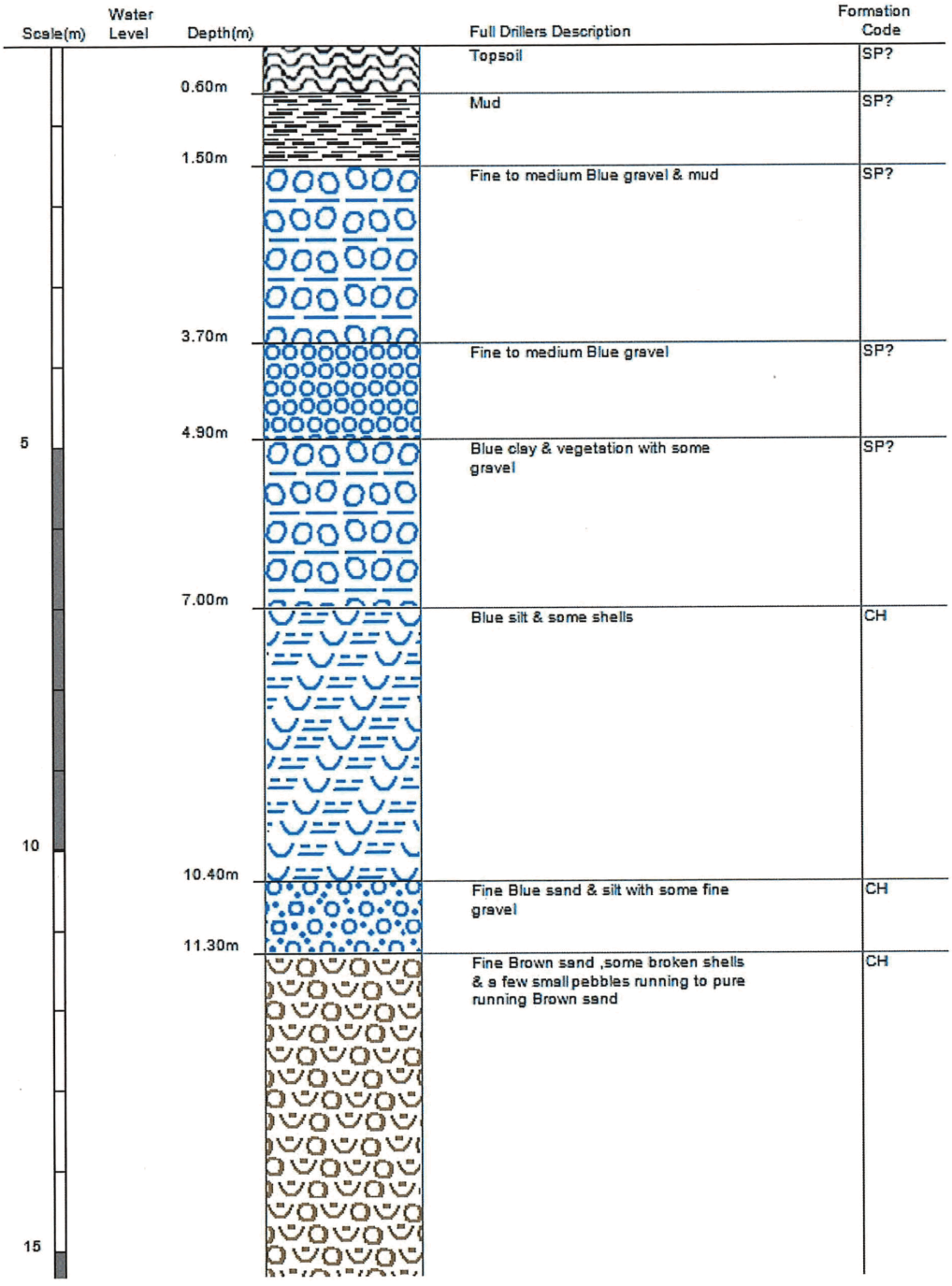

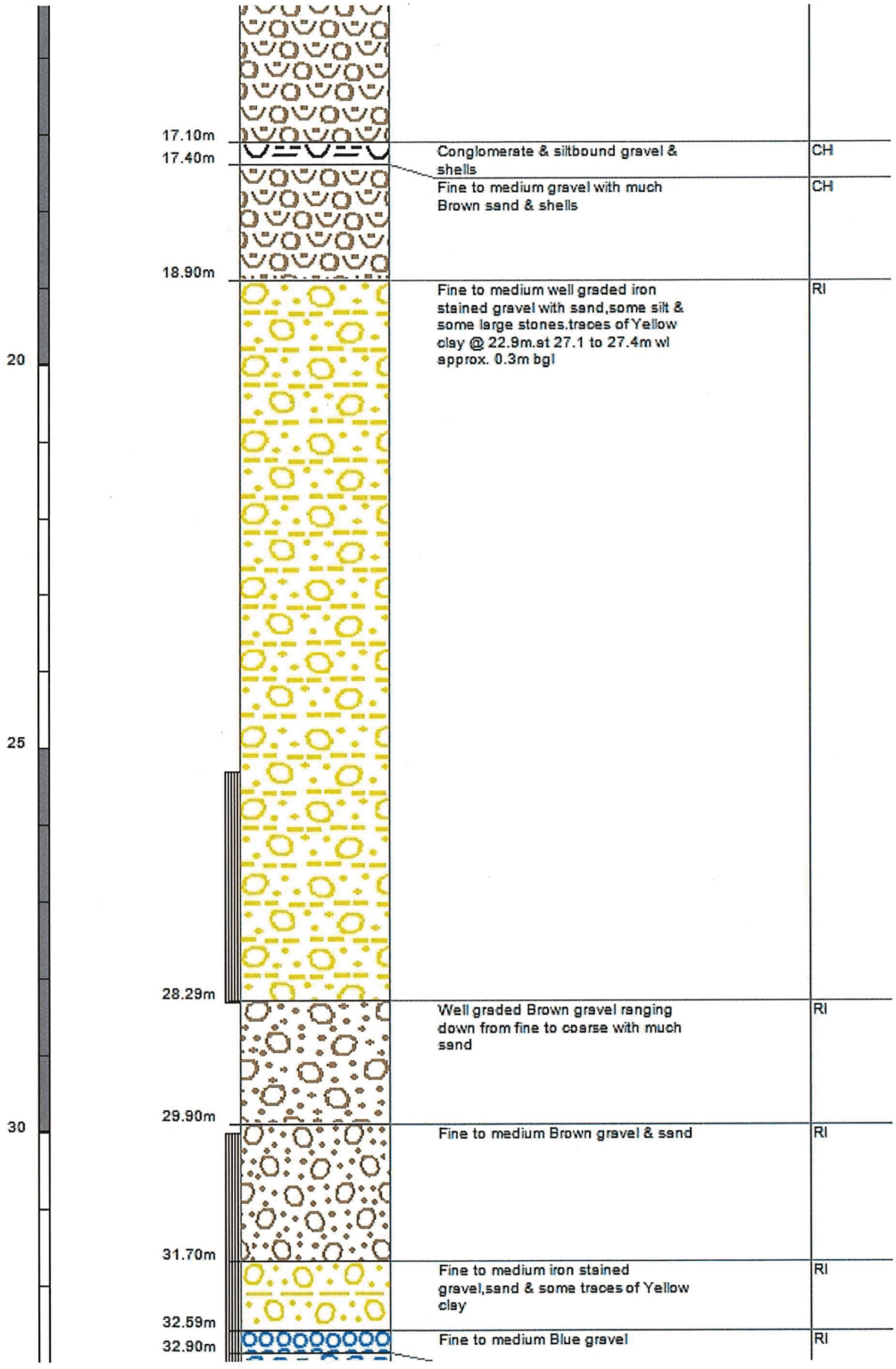

M35/1336 details

Borelog for well M35/1336

Grid Reference (NZTM): 1570041 mE, 5190033 mN
Location Accuracy: 2 - 15m
Ground Level Altitude: 8.4 m +MSD Accuracy: < 2.5 m
Driller: A M Bisley & Co
Drill Method: Cable Tool
Borelog Depth: 32.0 m Drill Date: 27-Oct-1966

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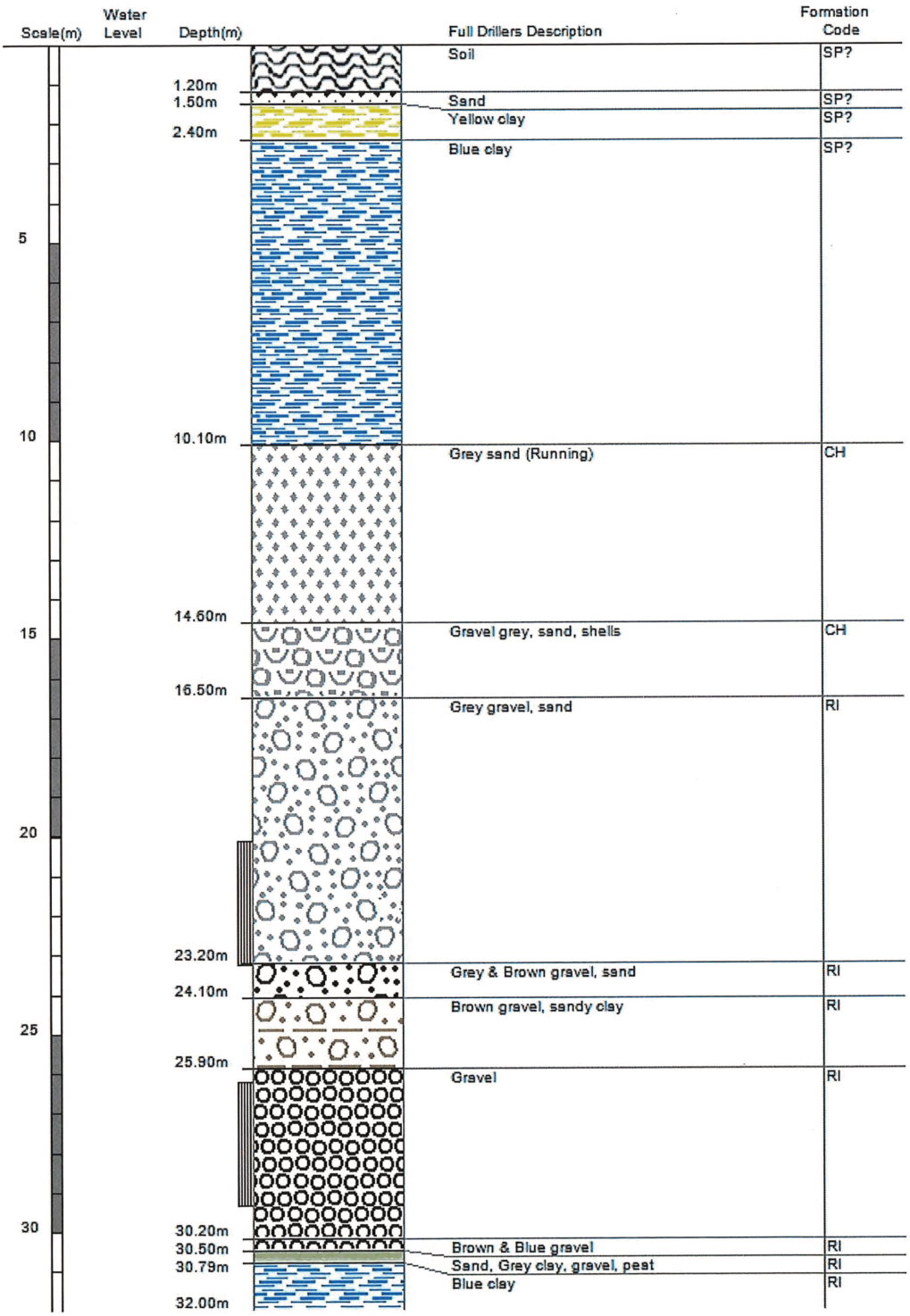

Retrieved: 11:53am, Fri 11 May 2018
https://www.ecan.govt.nz/data/well-search/

M35/8972 details

Borelog for well M35/8972

Grid Reference (NZTM): 1569970 mE, 5188255 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 18.5 m +MSD Accuracy: < 2.5 m
Driller: Clemence Drilling Contractors
Drill Method: Rotary/Percussion
Borelog Depth: 146.5 m Drill Date: 10-Jul-2002

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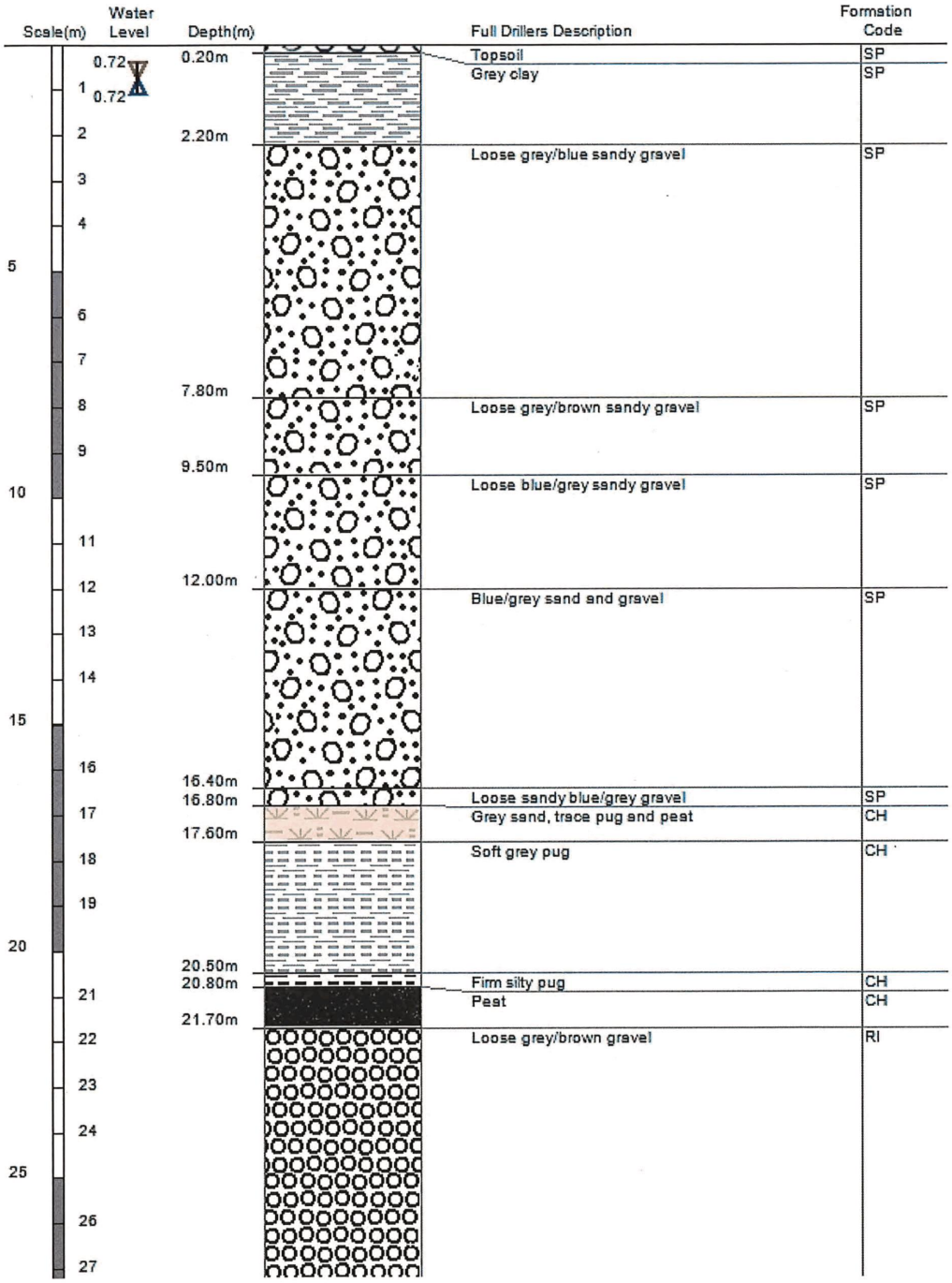

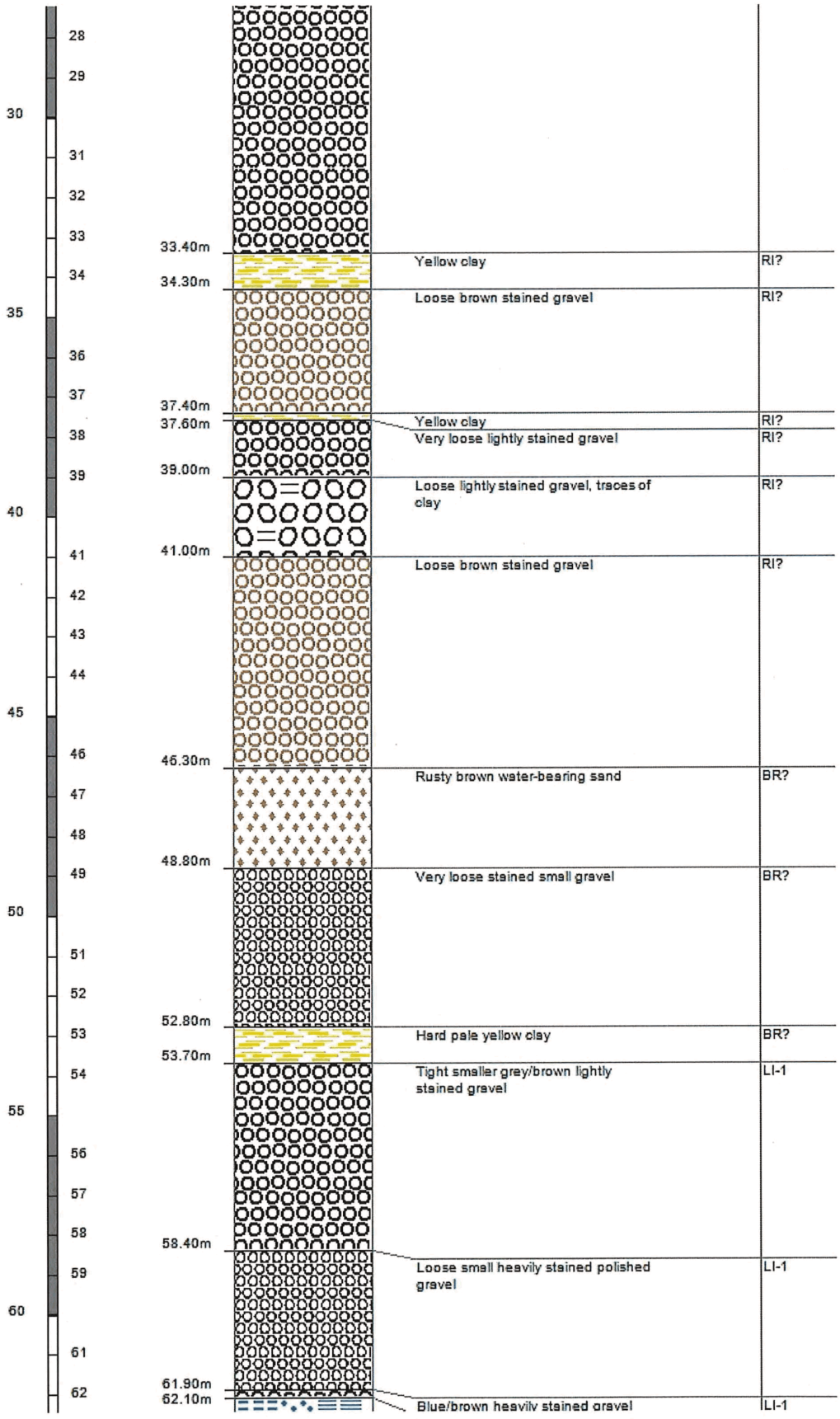
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49
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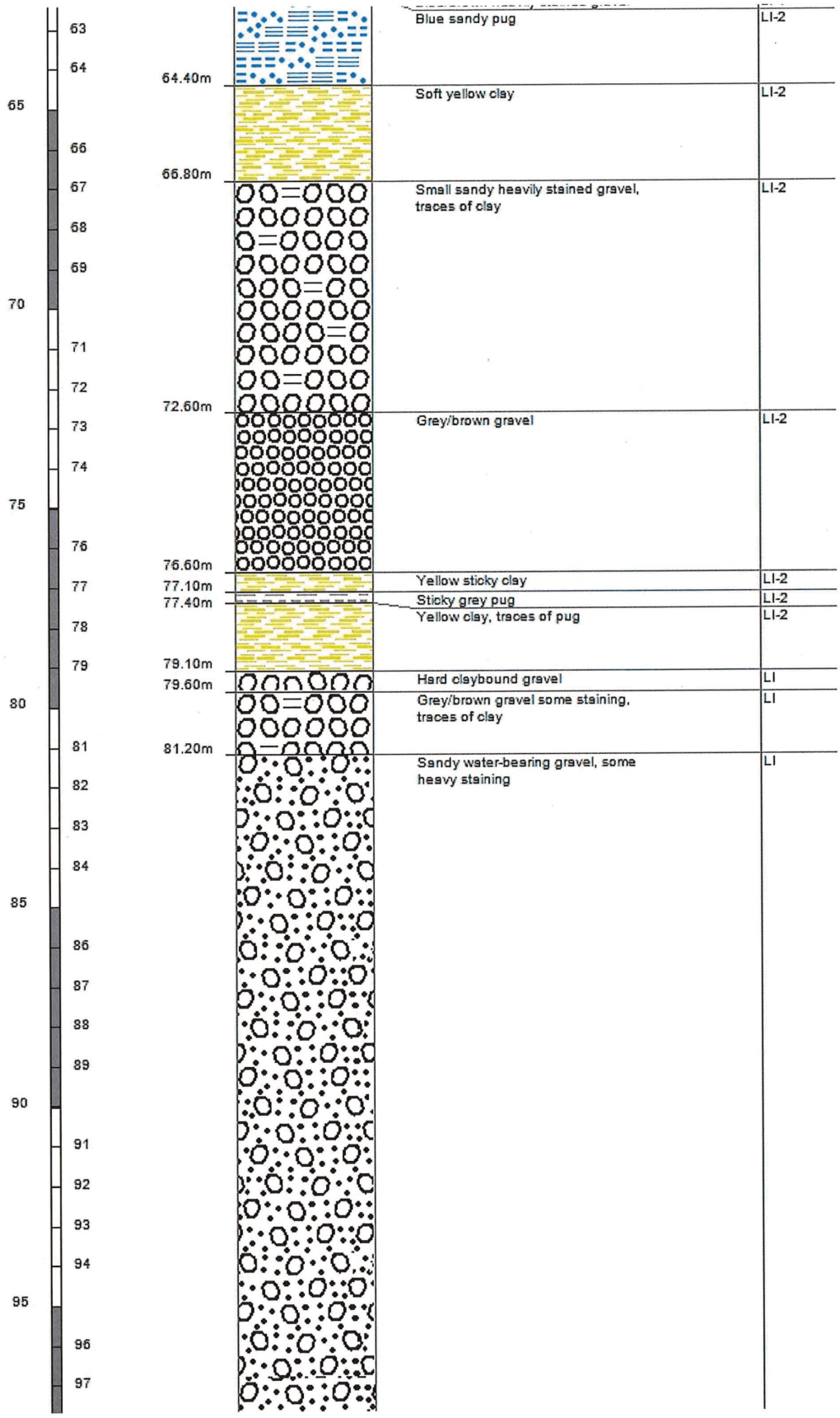
51
52
53
54
55
56
57
58
59
60
61
62
33.40m
34.30m
37.40m
37.60m
39.00m
41.00m
46.30m
48.80m
52.80m
53.70m
58.40m
61.90m
62.10m
Yellow clay
RI?
Loose brown stained gravel
RI?
Yellow clay
RI?
Very loose lightly stained gravel
RI?
Loose lightly stained gravel, traces of clay
RI?
Loose brown stained gravel
RI?
Rusty brown water-bearing sand
BR?
Very loose stained small gravel
BR?
Hard pale yellow clay
BR?
Tight smaller grey/brown lightly stained gravel
LI-1
Loose small heavily stained polished gravel
LI-1
Blue/brown heavily stained gravel
LI-1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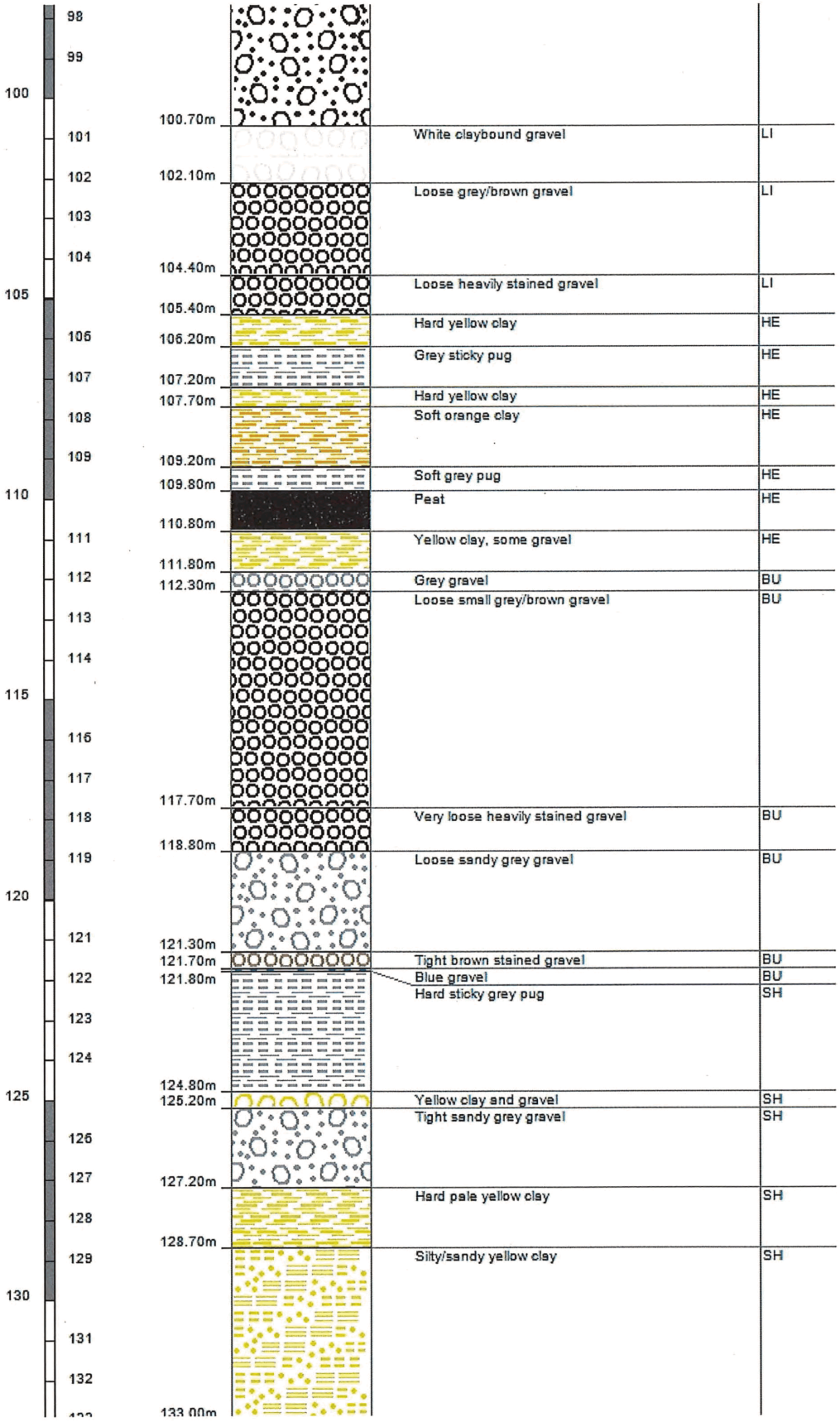
84
85
86
87
88
89
90
91
92
93
94
95
96
97
64.40m
66.80m
72.60m
76.60m
77.10m
77.40m
79.10m
79.60m
81.20m
Blue sandy pug
Soft yellow clay
Small sandy heavily stained gravel, traces of clay
Grey/brown gravel
Yellow sticky clay
Sticky grey pug
Yellow clay, traces of pug
Hard claybound gravel
Grey/brown gravel some staining, traces of clay
Sandy water-bearing gravel, some heavy staining
LI-2
LI-2
LI-2
LI-2
LI-2
LI-2
LI
LI
LI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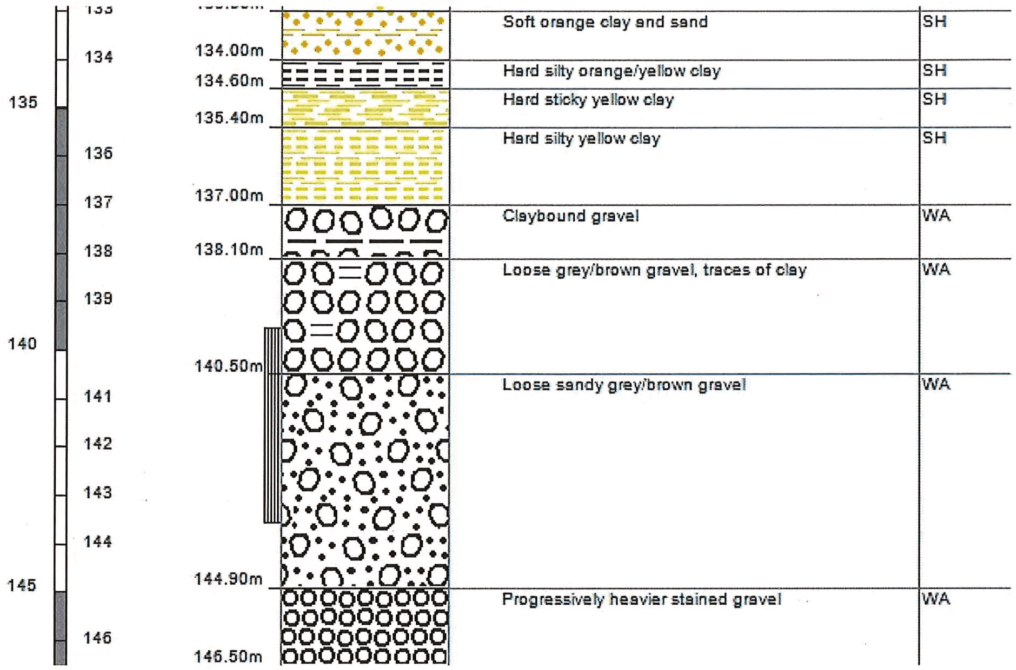
119
120
121
122
123
124
125
126
127
128
129
130
131
132
100.70m
102.10m
104.40m
105.40m
106.20m
107.20m
107.70m
109.20m
109.80m
110.80m
111.80m
112.30m
117.70m
118.80m
121.30m
121.70m
121.80m
124.80m
125.20m
127.20m
128.70m
133.00m
White claybound gravel
Loose grey/brown gravel
Loose heavily stained gravel
Hard yellow clay
Grey sticky pug
Hard yellow clay
Soft orange clay
Soft grey pug
Peat
Yellow clay, some gravel
Grey gravel
Loose small grey/brown gravel
Very loose heavily stained gravel
Loose sandy grey gravel
Tight brown stained gravel
Blue gravel
Hard sticky grey pug
Yellow clay and gravel
Tight sandy grey gravel
Hard pale yellow clay
Silty/sandy yellow clay
LI
LI
LI
HE
HE
HE
HE
HE
HE
HE
BU
BU
BU
BU
BU
BU
SH
SH
SH
SH
SH



M35/10632 details

Borelog for well M35/10632

Grid Reference (NZTM): 1570029 mE, 5190029 mN
Location Accuracy: 2 - 15m
Ground Level Altitude: 8.0 m +MSD Accuracy: < 2.5 m
Driller: Clemence Drilling Contractors
Drill Method: Hydraulic/Percussion
Borelog Depth: 117.0 m Drill Date: 03-Jun-2005

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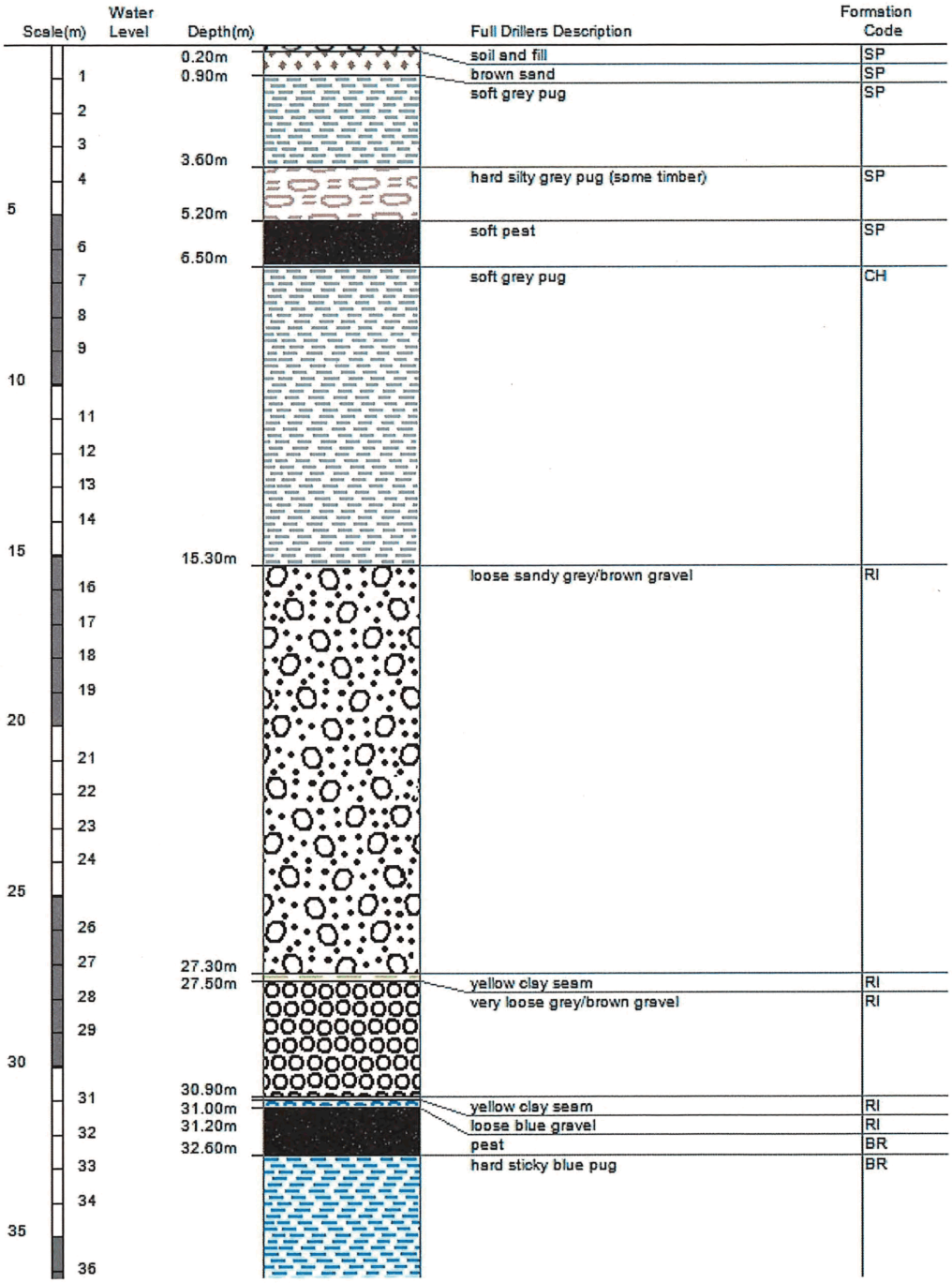

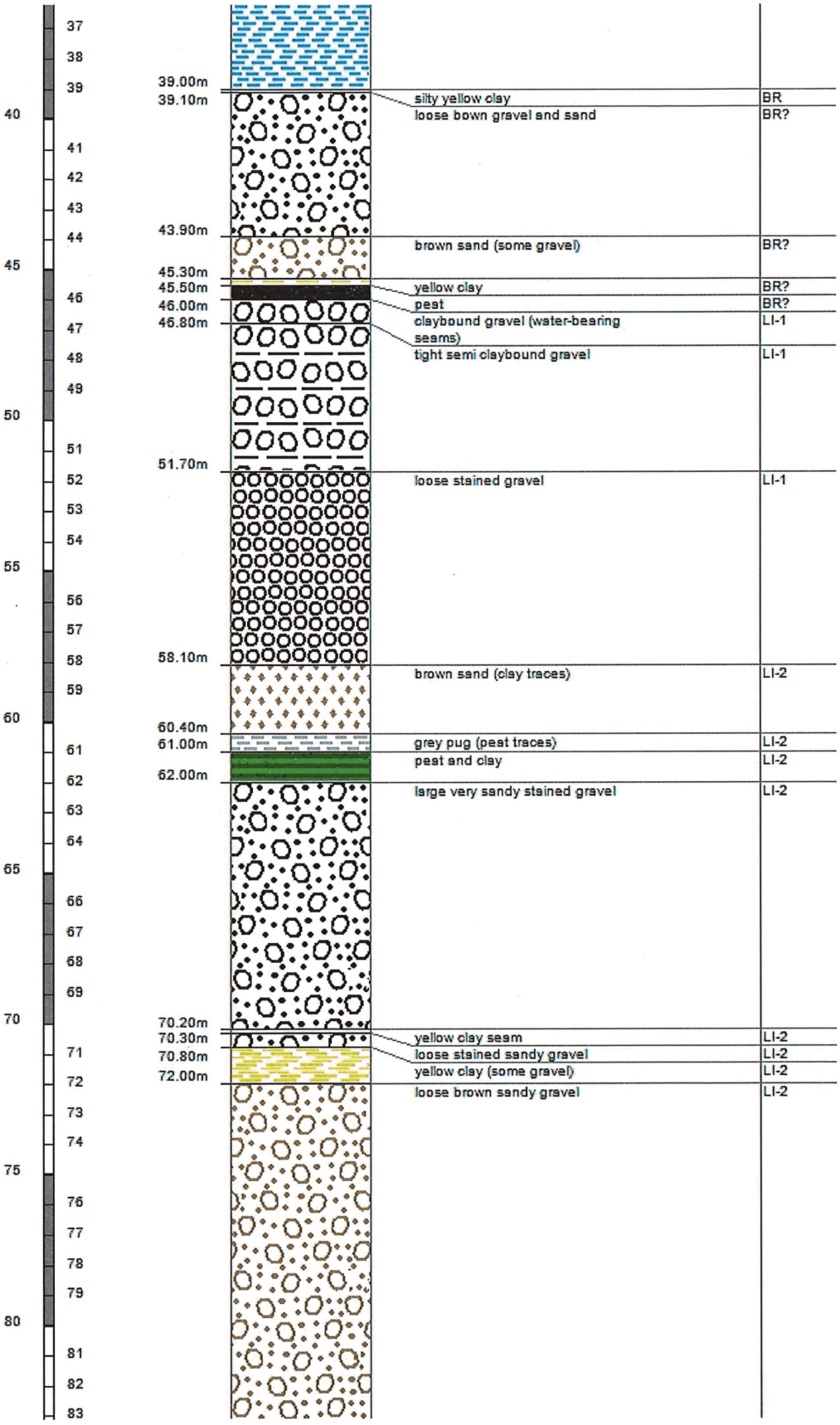
39.00m
39.10m
silty yellow clay
loose bown gravel and sand
BR
BR?
43.90m
brown sand (some gravel)
BR?
45.30m
45.50m
yellow clay
BR?
46.00m
peat
BR?
46.80m
claybound gravel (water-bearing seams)
LI-1
tight semi claybound gravel
LI-1
51.70m
loose stained gravel
LI-1
58.10m
brown sand (clay traces)
LI-2
60.40m
61.00m
grey pug (peat traces)
LI-2
peat and clay
LI-2
62.00m
large very sandy stained gravel
LI-2
70.20m
70.30m
yellow clay seam
LI-2
70.80m
loose stained sandy gravel
LI-2
72.00m
yellow clay (some gravel)
LI-2
loose brown sandy gravel
LI-2