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Residential Development,

Barnageeragh Cove, Skerries

Phase II Site Investigation/DQRA & Landfill Gas Survey

Final Report

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APPENDIX 11

GROUNDWATER STANDING WATER LEVEL RECORDS

Table A11.1 Groundwater Levels Recorded from Boreholes at Barnageeragh Cove, Skerries, Co. Dublin

BOREHOLE NO.	EASTING	NORTHING	ELEVATION (TOP OF STANDPIPE) (mAOD)	ELEVATION (TOP OF CASING) (mAOD)	GROUNDWATER LEVEL (m BGL) JULY/AUGUST 2017	GROUNDWATER LEVEL (mAOD) JULY/AUGUST 2017	GROUNDWATER LEVEL (m BGL) 26TH OCTOBER 2017	GROUNDWATER LEVEL (mAOD) 26TH OCTOBER 2017	GROUNDWATER LEVEL (m BGL) 15TH NOVEMBER 2017	GROUNDWATER LEVEL (mAOD) 15TH NOVEMBER 2017	GROUNDWATER LEVEL (m BGL) 11TH JANUARY 2018	GROUNDWATER LEVEL (mAOD) 11TH JANUARY 2018	LEVEL OF GROUNDWATER RISE (M) (FROM JULY/AUGUST - JANUARY)	GROUNDWATER LEVEL (m BGL) 24TH JANUARY 2018	GROUNDWATER LEVEL (mAOD) 24TH JANUARY 2018	GROUNDWATER LEVEL (m BGL) 30TH JANUARY 2018	GROUNDWATER LEVEL (mAOD) 30TH JANUARY 2018
BH1	323179.2	260811.8	25.06	25.43	10.78	14.28	10.54	14.52	10.54	14.52	10.36	14.7	0.42	10.05	15.01	10.05	15.01
BH2	323121.42	260847.85	25.28	25.6	10.43	14.85	10.34	14.94	10.31	14.97	10.08	15.2	0.35	9.96	15.32	9.9	15.38
BH3	323180.78	260844.73	22.73	23.13	7.94	14.79	7.84	14.89	7.83	14.9	7.645	15.085	0.295	7.43	15.3	7.37	15.36
BH4	323230.77	260838.7	18.97	19.28	5.13	13.84	4.89	14.08	4.98	13.99	4.56	14.41	0.57	4.3	14.67	4.405	14.565
BH8	323215.389	260853.182	18.51	18.79	4.775	13.735	4.37	14.14	4.37	14.14	3.97	14.54	0.805	3.615	14.895	3.785	14.725
BH9	323228.607	260846.34	18.82	19.1	5.01	13.81	4.89	13.93	4.78	14.04	4.47	14.35	0.54	4.09	14.73	4.245	14.575
BH10	323242.576	260840.602	18.92	19.28	5.225	13.695	4.94	13.98	4.96	13.96	4.565	14.355	0.66	4.32	14.6	4.41	14.51
BH11	323260.328	260825.224	19.22	19.47	5.554	13.666	5.32	13.9	5.31	13.91	4.9	14.32	0.654	4.64	14.58	4.76	14.46
BH12	323277.383	260820.656	19.18	19.35	5.5	13.68	5.25	13.93	5.24	13.94	4.88	14.3	0.62	4.64	14.54	4.745	14.435
BH13	323266.339	260856.122	16.22	16.32	2.6	13.62	2.33	13.89	2.34	13.88	1.92	14.3	0.68	1.685	14.535	1.77	14.45
BH14	323246.056	260906.42	15.56	15.89	-	-	2.68	12.88	2.72	12.84	2.72	12.84	-	2.54	13.02	2.71	12.85
BH15	323290.92	260834.55	16.4	16.73	-	-	-	-	-	-	-	-		-	-	-	-
BH16	323308.21	260870.6	15.925	16.2	-	-	-	-	-	-	-	-		-	-	-	-
BH17	323268.25	260803.38	19.43	19.68	-	-	-	-	-	-	-	-		-	-	-	-

Table A11.1 Groundwater Levels Recorded from Boreholes at Barnageeragh Cove, Skerries, Co. Dublin

BOREHOLE NO.	EASTING	NORTHING	ELEVATION (TOP OF STANDPIPE) (mAOD)	ELEVATION (TOP OF CASING) (mAOD)	GROUNDWATER LEVEL (m BGL) 31st JANUARY 2018	GROUNDWATER LEVEL (mAOD) 31st JANUARY 2018	GROUNDWATER LEVEL (m BGL) 1st FEBRUARY 2018	GROUNDWATER LEVEL (mAOD) 1st FEBRUARY 2018	GROUNDWATER LEVEL (m BGL) 2ND FEBRUARY 2018	GROUNDWATER LEVEL (mAOD) 2ND FEBRUARY 2018	GROUNDWATER LEVEL (m BGL) 20TH FEBRUARY 2018	GROUNDWATER LEVEL (mAOD) 20TH FEBRUARY 2018	GROUNDWATER LEVEL (m BGL) 4TH MAY 2018	GROUNDWATER LEVEL (mAOD) 4TH MAY 2018	GROUNDWATER LEVEL (m BGL) 18TH MAY 2018	GROUNDWATER LEVEL (mAOD) 18TH MAY 2018	GROUNDWATER LEVEL (m BGL) 23RD MAY 2018
BH1	323179.2	260811.8	25.06	25.43	10.055	15.005	10.07	14.99	10.06	15	10.2	14.86	10.355	14.705	10.43	14.63	10.44
BH2	323121.42	260847.85	25.28	25.6	9.89	15.39	9.88	15.4	9.875	15.405	9.94	15.34	10	15.28	10.07	15.21	10.1
BH3	323180.78	260844.73	22.73	23.13	7.37	15.36	7.335	15.395	7.34	15.39	7.4	15.33	7.46	15.27	7.535	15.195	7.535
BH4	323230.77	260838.7	18.97	19.28	3.77	15.2	4.445	14.525	4.445	14.525	4.65	14.32	4.765	14.205	4.85	14.12	4.87
BH8	323215.389	260853.182	18.51	18.79	4.25	14.26	3.83	14.68	3.84	14.67	4.03	14.48	4.09	14.42	4.16	14.35	4.19
BH9	323228.607	260846.34	18.82	19.1	4.42	14.4	4.305	14.515	4.33	14.49	4.53	14.29	4.62	14.2	4.69	14.13	4.71
BH10	323242.576	260840.602	18.92	19.28	4.425	14.495	4.45	14.47	4.46	14.46	4.67	14.25	4.77	14.15	4.84	14.08	4.87
BH11	323260.328	260825.224	19.22	19.47	4.775	14.445	4.79	14.43	4.8	14.42	5	14.22	5.1	14.12	5.17	14.05	5.2
BH12	323277.383	260820.656	19.18	19.35	4.775	14.405	4.775	14.405	4.795	14.385	4.96	14.22	5.075	14.105	5.14	14.04	5.17
BH13	323266.339	260856.122	16.22	16.32	1.78	14.44	1.8	14.42	1.82	14.4	2	14.22	2.1	14.12	2.17	14.05	2.19
BH14	323246.056	260906.42	15.56	15.89	2.69	12.87	2.75	12.81	2.77	12.79	2.83	12.73	2.86	12.7	2.89	12.67	2.89
BH15	323290.92	260834.55	16.4	16.73	-	-	-	-	-	-	-	-	-	-	2.43	13.97	2.46
BH16	323308.21	260870.6	15.925	16.2	-	-	-	-	-	-	-	-	-	-	2.95	12.975	2.95
BH17	323268.25	260803.38	19.43	19.68	-	-	-	-	-	-	-	-	-	-	5.39	14.04	5.41

Table A11.1 Groundwater Levels Recorded from Boreholes at Barnageeragh Cove, Skerries, Co. Dublin

BOREHOLE NO.	EASTING	NORTHING	ELEVATION (TOP OF STANDPIPE) (mAOD)	ELEVATION (TOP OF CASING) (mAOD)	GROUNDWATER LEVEL (mAOD) 23RD MAY 2018	GROUNDWATER LEVEL (m BGL) 28TH MAY 2018	GROUNDWATER LEVEL (mAOD) 28TH MAY 2018	GROUNDWATER LEVEL (m BGL) 31ST MAY 2018	GROUNDWATER LEVEL (mAOD) 31ST MAY 2018
BH1	323179.2	260811.8	25.06	25.43	14.62	10.45	14.61	10.35	14.71
BH2	323121.42	260847.85	25.28	25.6	15.18	10.12	15.16	10.13	15.15
BH3	323180.78	260844.73	22.73	23.13	15.195	7.56	15.17	7.58	15.15
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BH13	323266.339	260856.122	16.22	16.32	14.03	2.21	14.01	2.26	13.96
BH14	323246.056	260906.42	15.56	15.89	12.67	2.89	12.67	2.91	12.65
BH15	323290.92	260834.55	16.4	16.73	13.94	2.47	13.93	2.5	13.9
BH16	323308.21	260870.6	15.925	16.2	12.975	2.96	12.965	2.96	12.965
BH17	323268.25	260803.38	19.43	19.68	14.02	5.43	14	5.455	13.975

APPENDIX 12

DETAILED QUANTITATIVE RISK ASSESSMENT (DQRA) OF
BARNAGEERAGH COVER LANDFILL
BY
HIDRIGEOLAÍOCHT UÍ CHONAIRE TEORANTA

JANUARY 2019

Detailed Quantitative Risk Assessment

of

Barnageeragh Cove Landfill

Response to Queries Plus Preferred Cap Design

January 2019

Prepared by:
Peter Conroy
On behalf of Mulroy Environmental / Winsac

HUCT
SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

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EXECUTIVE SUMMARY

Detailed Quantitative Risk Assessment (DQRA) modelling was carried out to assess the potential impact on groundwater and surface water of Substances of Concern (SOCs) that were detected in the landfill waste at the site.

The SOCs modelled were representative of the contaminant groups present in the waste and comprised DCE, ammonia, arsenic, benzo(a)pyrene, chloride, lead, mercury, naphthalene, phenol, decane and hexadecane.

The DQRA results predicted that ammonia, chloride, arsenic, DCE and naphthalene occurred at slightly elevated above background concentrations in the groundwater at the downgradient site boundary and at the surface water receptors over varying timescales.

Comparison of the model output with the observed water quality at the site showed a reasonable correlation between the predicted and observed contaminant concentrations.

In order to examine potential mitigation of the predicted elevated above background contaminant concentrations, the DQRA was revised to simulate the presence of an engineered landfill cap over the landfill area. With the engineered cap in place the DQRA predicted significantly lower but still elevated above background concentrations of ammonia, chloride, arsenic, DCE and naphthalene in the groundwater at the downgradient site boundary under minimum watertable elevation conditions. The DQRA predicted significantly lower but still elevated above background concentrations of ammonia, chloride, and arsenic in the groundwater at the downgradient site boundary/surface water receptor under maximum watertable elevation conditions. The elevated above background concentrations were predicted to occur over varying timescales. Further assessment of the predicted elevated contaminant concentrations indicated that the predicted concentrations would not result in breaches of the Groundwater or Surface Water Regulations.

The DQRA Conclusions are:

- The site HCM has been updated to account for two groundwater pathways:
  - Maximum groundwater elevation – Occurs during periods of high watertable elevation. Groundwater flow beneath the site discharges to the site eastern boundary stream.
  - Minimum groundwater elevation – Occurs during periods of low watertable elevation. Groundwater flow beneath the flows underneath the site eastern boundary stream and continues east to discharge to the Barnageeragh Stream to the east of the WWTP site.
- Under current conditions contaminant migration via the groundwater pathway may result in elevated above background concentrations of ammonia, chloride, arsenic, c-1,2-Dichloroethene and naphthalene at downgradient receptors at varying times over the 1,000 year model period.
- If an engineered landfill cap is installed over the landfill, contaminant concentrations in groundwater at downgradient receptors are predicted to be mitigated such that the contaminant concentrations do not result in breaches of the Groundwater or Surface Water Regulations.
- Based on the interpretation of the available site data and on the outcome of the detailed groundwater quantitative risk assessment, which are presented in this report, the proposed remedial strategy is considered to be the best remedial option for the site and it is predicted that the remediated site will have no significant impact on groundwater or surface water receptors downgradient of the site.

The DQRA Recommendations are:

- The proposed LLDPE engineered landfill cap should be constructed over the landfill area to minimise infiltration through the waste. This would mitigate the potential for the elevated concentrations of substances of concern to result in breaches of the Groundwater and Surface Water Regulations at downgradient receptors.

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1 Introduction

Mulroy Environmental retained Hidrigeolaíocht Uí Chonaire Teoranta (HUCT) to carry out a hydrogeological Detailed Quantitative Risk Assessment (DQRA) of the Barnageeragh Cove Landfill, Skerries, Co. Dublin.

A report on the DQRA was submitted to Fingal County Council in March 2018. Following review of the DQRA report Fingal County Council raised a number of queries relating to data gaps in the site hydrogeological conceptual model (HCM) and uncertainty in the DQRA arising from the data gaps.

In order to resolve the queries raised by Fingal County Council, additional site investigation work has been carried out to improve the site HCM and additional DQRA work has been carried out based on the improved HCM.

The queries raised by Fingal County Council are summarised in Appendix 1.

This document provides a report on the response to the queries raised by Fingal County Council with respect to the HCM and DQRA.

2 Methodology

This report draws on data from previous site investigations and reports as follows:

- Barnageeragh Phase II Landfill Gas Risk Assessment Interim Report (Mulroy Env. 2017).
  - Data on site investigation work in July and August of 2017;
- Barnageeragh Cove Landfill DQRA (HUCT, March 2018);
  - Data on further site investigation work carried out by Mulroy Environmental and sub-contractors since August 2017; and,
- AGL18018 Barnageeragh Cove Landfill Geophysical Investigation (Apex 2018).

Mulroy Environmental have carried out additional site investigation since March 2018 as follows:

- Drilling of 5 no. passive gas venting wells in the "Type 2" waste.
- Excavation of 2 no. additional trial pits in the "Type 1" waste.
- Drilling of 3 no. additional groundwater monitoring wells (BH15, 16 and 17).
- Collection and laboratory analysis of 15 no. soil samples to characterise ammonia source concentrations at the site:
  - 10 no. in Type 2 waste;
  - 2 no. in Type 1 waste; and,
  - 3 no. from natural deposits (i.e. taken from BH15, BH16 & BH17).
- Aquifer properties pumping tests on new boreholes.
- Groundwater Quality Round 3 encompassing all groundwater monitoring boreholes.
- Groundwater level monitoring rounds in May, June and July 2018.
- Topographical surveying of:
  - All additional intrusive site investigation locations; and,
  - Invert, top of streambed and water level along surface water courses in the vicinity of the site.

The site hydrogeological conceptual model (HCM) has been updated to take account of the data from the additional site investigations. The DQRA has been updated on the basis of the updated HCM.

The Tier 3 risk assessment has been carried out using the probabilistic quantitative risk assessment software package CONSIM 2.5 (Golder, 2003).

The site location is shown on Figure 1.

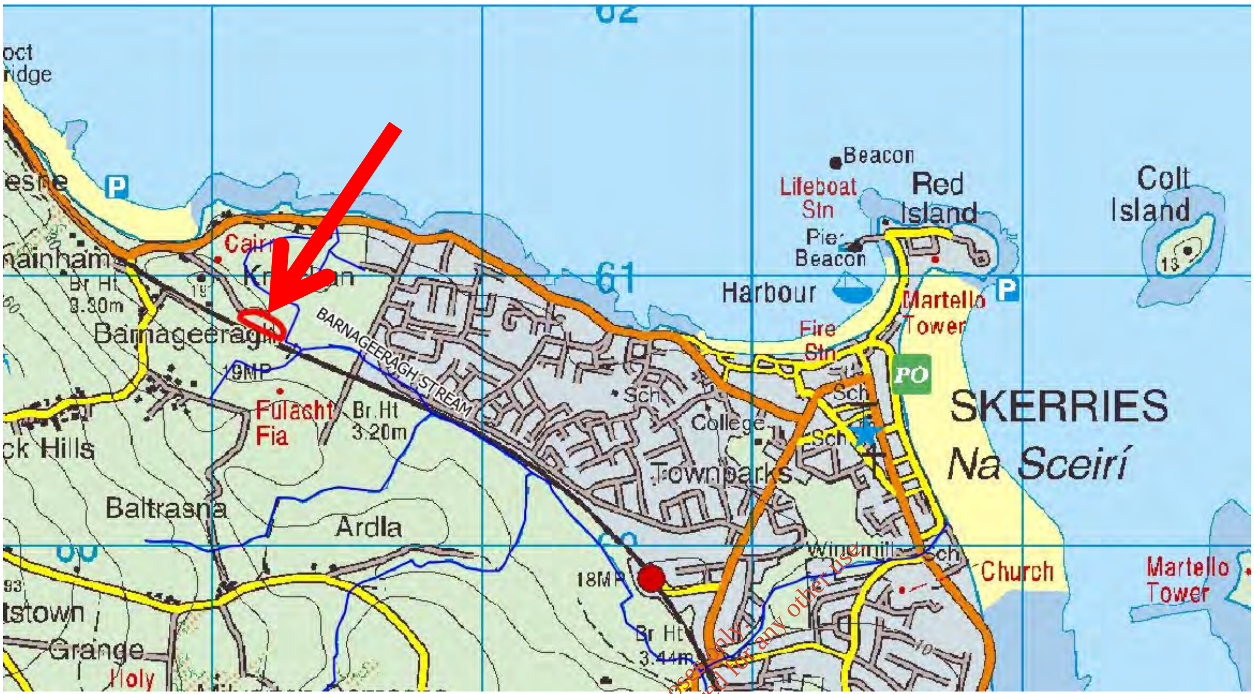


Figure 1 Site Location

3 Site Location and Description

The site is located at Barnageeragh Cove, 2 km west of Skerries along the coast. The landfill site is adjacent to the north-eastern side of the Dublin Belfast railway line. The Irish Sea lies 380 m north of the site. The landfill site is approximately 160 m long (parallel to the railway line) and 60 m wide, with an area of 7,500 m^2. The landfill is an unlined site in a former gravel pit. The waste is between approximately 20 and 50 years old.

The site layout and the locations referred to in the report are shown on Figure 2.

4 Hydrogeological Conceptual Model

4.1 Summary Hydrogeological Conceptual Model From August 2017 & March 2018

Trial pits and boreholes delineated the waste footprint at the site and identified two types of waste, classified as Type 1 and Type 2 as shown in Figure 2. Waste Type 1 was found to be predominantly contaminated by inorganic compounds and heavy metals. Waste Type 2 was found to have a significant component of organic contaminants.

The site is uncapped and unlined. Rainfall on the site infiltrates through the waste body down through the underlying unsaturated zone (where present) and reaches the watertable. Site investigation data indicate that the waste is in a SILT/CLAY matrix and is underlain by sandy GRAVEL subsoil over SILTSTONE bedrock. The GRAVEL subsoil and the underlying bedrock are considered to be in hydraulic continuity.

Figure 2. Site Layout

The site is on the eastern end of a ridge and in the vicinity of the site groundwater flow is considered to be roughly radially outward from the ridge to the north, east and south. Borehole logs indicated an area of sandstone bedrock near the eastern site boundary midpoint, which pumping tests showed to be associated with high aquifer transmissivity. This area was interpreted to be a potential preferential groundwater pathway. The site boundary stream along the eastern site boundary was considered to be the main groundwater discharge boundary for the site.

Detailed characterisation of the elevation of the base of the waste and the groundwater watertable elevations indicated that a large part of the base of the waste lies below the watertable.

Additional assessment and interpretation of data underpinning the hydrogeological conceptual model from the March 2018 report revision is shown in Appendix 2-3. In any case where the assessment and interpretation shown in Appendix 2-2 has been updated in the current report, the updated assessment and interpretation in the current report shall take precedence over the material in Appendix 2-3.

4.2 Updates to the Hydrogeological Conceptual Model for the DQRA

4.2.1 Conceptual Indicators from Regional Scale Data

The presentation of the regional scale topographic, surface water, subsoil, bedrock and aquifer map data sets has been expanded to better illustrate the wider general basis for the detailed site hydrogeological conceptual model.

Figure 3a shows the hydrogeological setting of the study area during summer when low groundwater levels are expected. The site is on the east end of a small west-northwest to east-southeast oriented ridge, which rises to above 20 mOD along the crest and drops towards 10 mOD around the base. There is high ground to the south-southwest rising to above 30 mOD and to a small hill to the north-northeast which rises to 20 mOD.

The bedrock geology map (Figure 3a inset) shows that the whole area is underlain by the Silurian Metasediments and Volcanics bedrock unit. This rock type is classified as a poor aquifer (Pl) which is generally unproductive. As such, the bedrock aquifer across the study area is considered to be a poor aquifer and generally unproductive except in local zones.

Figure 3a shows the mapped quaternary (i.e. subsoil) deposits across the study area. The high ground underlying and in the vicinity of the site is underlain by gravel deposits. The low ground in between the high areas is mapped as underlain by alluvial deposits, which may in turn be underlain by further gravel deposits. The Barnageeragh Stream is the only mapped surface water course at the 1:50,000 scale and is shown rising from the alluvial deposits to the east of the site.

The topography of the gravel deposits would lend itself towards the build-up of high groundwater levels in the gravels beneath the areas of high ground due to rainfall recharge. The resulting groundwater mounds would be expected to flow out radially and discharge to areas of low ground. The groundwater discharge together with surface runoff would lead to the development of surface water courses and the build up of alluvial deposits over time. There is potential for high transmissivity preferential groundwater flow paths in the valleys of the gravel deposits which may have acted as controls on the initial development of the geomorphology. These pathways would be expected to transmit the groundwater flow from the high ground along the valleys until the gravel and alluvial deposits can no longer transmit the available volume of groundwater. At this point the excess discharges to the Barnageeragh Stream as baseflow.

Figure 3a shows a scenario with low summer groundwater levels, where baseflow to the Barnageeragh Stream starts to occur downgradient of the site at the eastern end of the Irish Water Wastewater Treatment Plant (WWTP) and the drains closer to the site are dry. Figure 3b shows a scenario with high winter groundwater levels where baseflow occurs to the drains in the immediate vicinity of the site. Sections 4.2.6 to 4.2.8 show how the detailed site specific data fit this wider hydrogeological conceptual model.

4.2.2 Additional Monitoring Boreholes – Groundwater Level Data Gaps

The additional site investigation works included the drilling of additional groundwater monitoring boreholes. These boreholes were targeted to bridge data gaps in the groundwater level monitoring network and thereby support the conceptual model of groundwater flow outwards to the north, east and south from the ridge that forms the southern site boundary.

Boreholes BH16, BH15 and BH17 were drilled from north to south respectively along the eastern site boundary. Borehole logs are provided in Appendix 2. The borehole locations were sited to provide:

- Groundwater elevation data along the eastern boundary adjacent to the eastern boundary stream, which is considered to be a groundwater discharge boundary; and,
- Data on the geological and aquifer properties along the eastern site boundary, and in particular to investigate the extent of a high transmissivity zone observed in the vicinity of the existing boreholes BH11 and BH12.

Borehole BH17 was located as far south and as close to the eastern site boundary as possible with respect to drilling rig access.

The reference datum for each of the new boreholes and the invert levels of the surface water courses in the vicinity of the site at accessible locations were topographically surveyed. This allowed accurate comparison of groundwater and surface water elevations across the study area for the assessment of groundwater-surface water interactions.

The need for additional boreholes along the southern site boundary between BH2 and BH1, between BH1 and BH7 and in the very southeast corner of the site was considered. Additional boreholes would be of interest at these locations, however it was not possible to drill at the locations for the following reasons:

- The locations are inside the drilling exclusion zone around the WWTP rising main that passes west to east just inside the southern boundary of the site;
- The locations are underlain by waste and installing groundwater monitoring wells at these locations would potentially create preferential pathways for contaminant migration down into the aquifer; and,
- The steep slope at the southern site boundary is not suitable for drilling rig access.

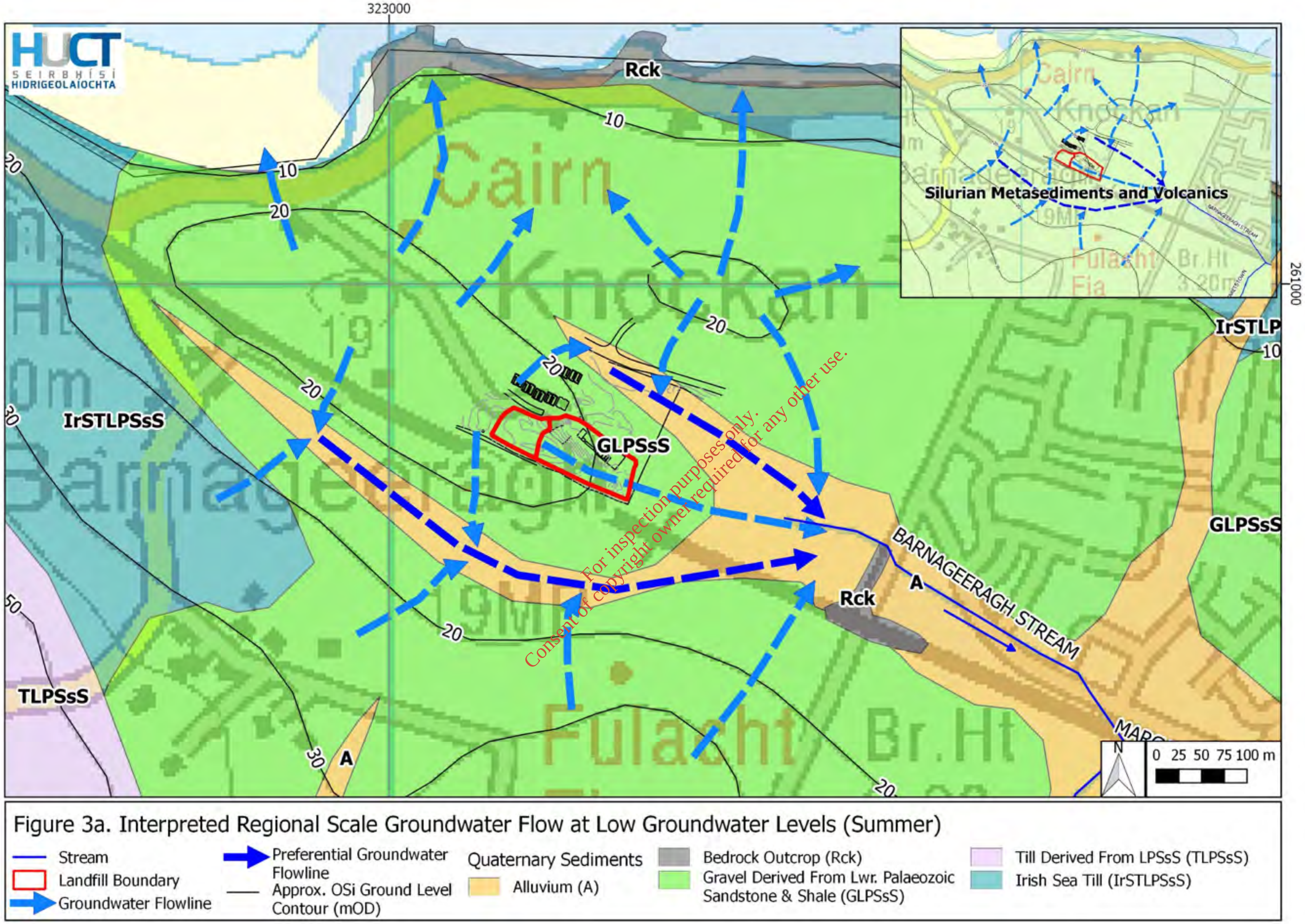


Figure 3a. Interpreted Regional Scale Groundwater Flow at Low Groundwater

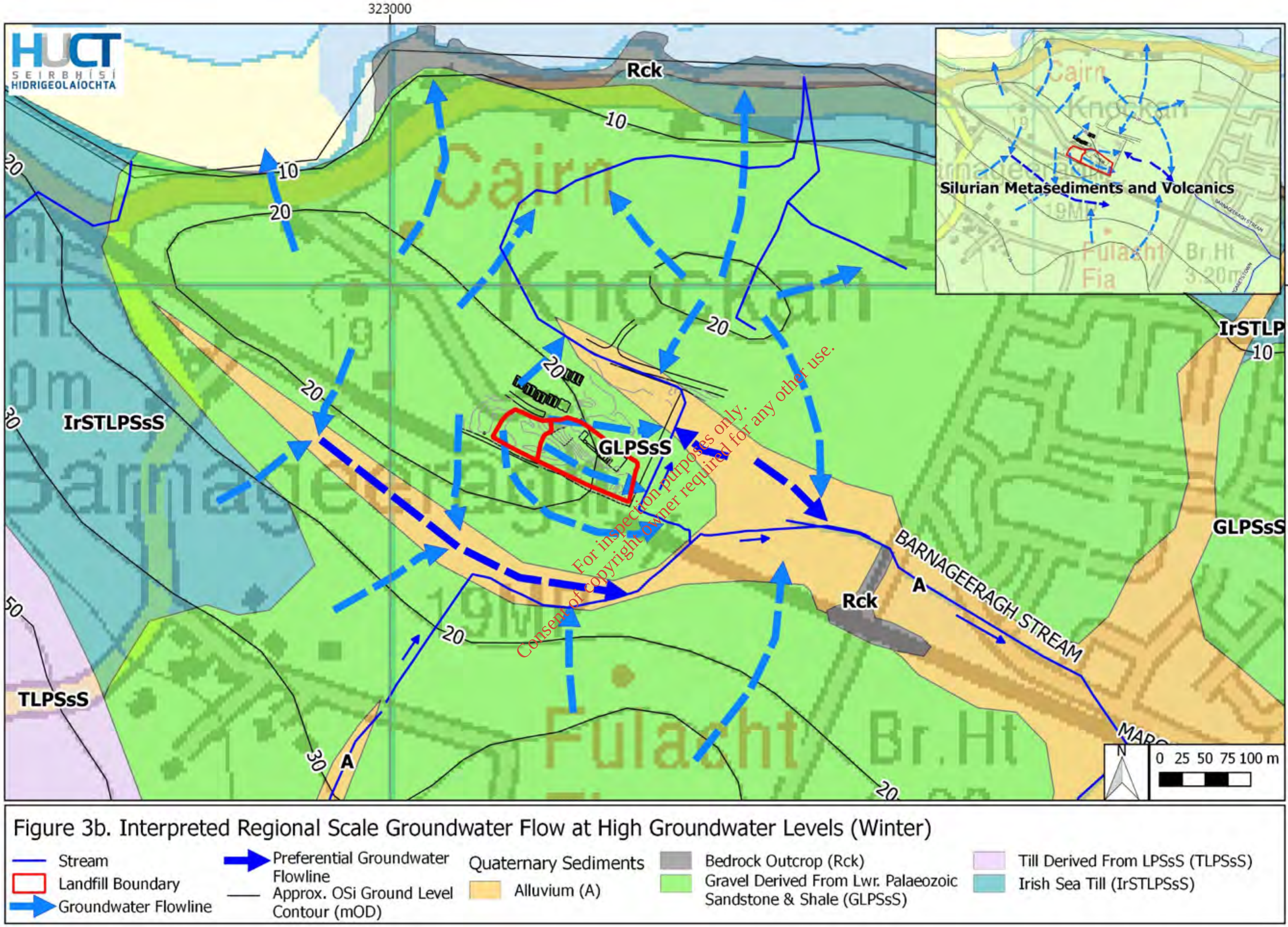


Figure 3b. Interpreted Regional Scale Groundwater Flow at High Groundwater Levels

4.2.3 Subsoil Geology

Coarse subsoils were encountered at BH15 and BH17. These extend the zone of coarse subsoil deposits previously encountered at BH11 and BH12. BH17 encountered 3.5 m of sandy SILT to silty SAND over 1.5 m of CLAY. The CLAY contained some plastic and ceramic waste. This was underlain by 2.8 m of GRAVEL. At BH15 5 m of sandy GRAVEL to GRAVEL were encountered above the bedrock.

BH16 encountered 1.5 m of silty SAND over 1.5 m of sandy CLAY/SILT. This was similar to BH13 and suggests the zone of coarse deposits observed at BH11, BH12, BH15 & BH17 does not extend as far north as BH16.

4.2.4 Bedrock Geology

Evidence from BH15 and BH17 shows the presence of a thick weathered SILTSTONE layer of 3 m and > 2 m thick respectively overlying the competent bedrock. No Sandstone was encountered at BH15 and BH17. The weathered SILTSTONE is considered to correlate with the weathered SILTSTONE and SANDSTONE encountered in boreholes BH10, BH11 and BH12.

BH16 encountered 1.2 m of weathered SILTSTONE over competent bedrock and is considered to correlate with boreholes BH13 and BH14.

4.2.5 Aquifer Properties

Short pumping tests were carried out on the new groundwater monitoring wells BH15, BH16 and BH17. Separate tests were carried out on each well. The boreholes were pumped at constant rates of 10 m^3/d, 11 m^3/d and 12 m^3/d respectively for 30 minutes. Drawdown was monitored in the pumping well and an observation well for each test. For the tests at boreholes BH15, BH16 and BH17 the observation wells used were BH12, BH15 and BH12 respectively.

High aquifer transmissivity was observed at boreholes BH15 and BH17. At BH15 analysis of the pumping well drawdown data indicated a transmissivity of approximately 210 m^2/day. Drawdown at BH12 was not detectable during the BH15 pumping test. Drawdown at BH17 and BH12 was not detectable during the BH17 pumping test. Non-detectable drawdown at BH12 and BH17 during the BH15 and BH17 pumping tests is consistent with the interpretation of high aquifer transmissivity across the BH10, BH11, BH12, BH15 and BH17 area.

The pumping test at BH16 generated 4.7 m of drawdown in the pumping well. Drawdown was slow for the initial 10 minutes of testing when a large part of the weathered rock zone between 3 m and 4 mbgl remained saturated. Analysis of the early-time drawdown and recovery data suggest a transmissivity of 5 m^2/d for the saturated weathered bedrock at BH16. The drawdown rate increased as the water level dropped into the competent bedrock suggesting much lower transmissivity in the competent rock, in the order of 0.1 m^2/d. The significant drawdown and low aquifer transmissivity observed at BH16 are consistent with the interpretation of low aquifer transmissivity in the northern part of the site in the vicinity of BH13, BH14 and BH16.

4.2.6 Groundwater Elevation

4.2.6.1 Groundwater Elevation Contours

The maximum observed groundwater elevation data for the site occurred on 30 January 2018[a] and are shown on Figure 4a.

Additional groundwater level monitoring was undertaken at BH1 to BH3 and BH8 to BH17 on 28 May, 25 June and 23 July 2018. The minimum observed groundwater elevation for the site occurred on 23 July 2018, and the corresponding groundwater elevation data and interpreted groundwater elevation contours are shown on Figure 4b.

The groundwater elevation contours show that the groundwater elevation across the site dropped by between 0.6 m and 1.75 m between January and July 2018.

Figures 4a and 4b also show the invert elevation of the surface water courses and drains in the vicinity of the site[b].

4.2.6.2 Groundwater Elevation Versus the Base of the Waste

Figure 5 shows the elevation of the base of the waste across the site compared to the groundwater elevation on 28 May, 25 June and 23 July 2018. The groundwater elevations on 23 July 2018 are the lowest observed for the site. The data show that on each occasion a significant component of the waste body was below the watertable. The data suggest that a significant component of the waste body is below the watertable at all times.

Figure 5(g) and Figure 5(h) show the footprint of (i.e. plan area) of waste that lies below the watertable at the observed maximum (30 January 2018) and minimum (23 July 2018) groundwater elevation respectively.

[a] The contours for 30 January 2018 are revised compared to the ones shown in the March 2018 report (HUCT, 2018). The revised contours take account of trends in the data from May to July 2018 when data from the additional groundwater monitoring locations BH15, BH16 and BH17 became available.

[b] The invert elevations shown for the stream/drain running along the eastern site boundary are derived from linear interpolation between the topographically surveyed invert elevations at locations SW1 and SW2.

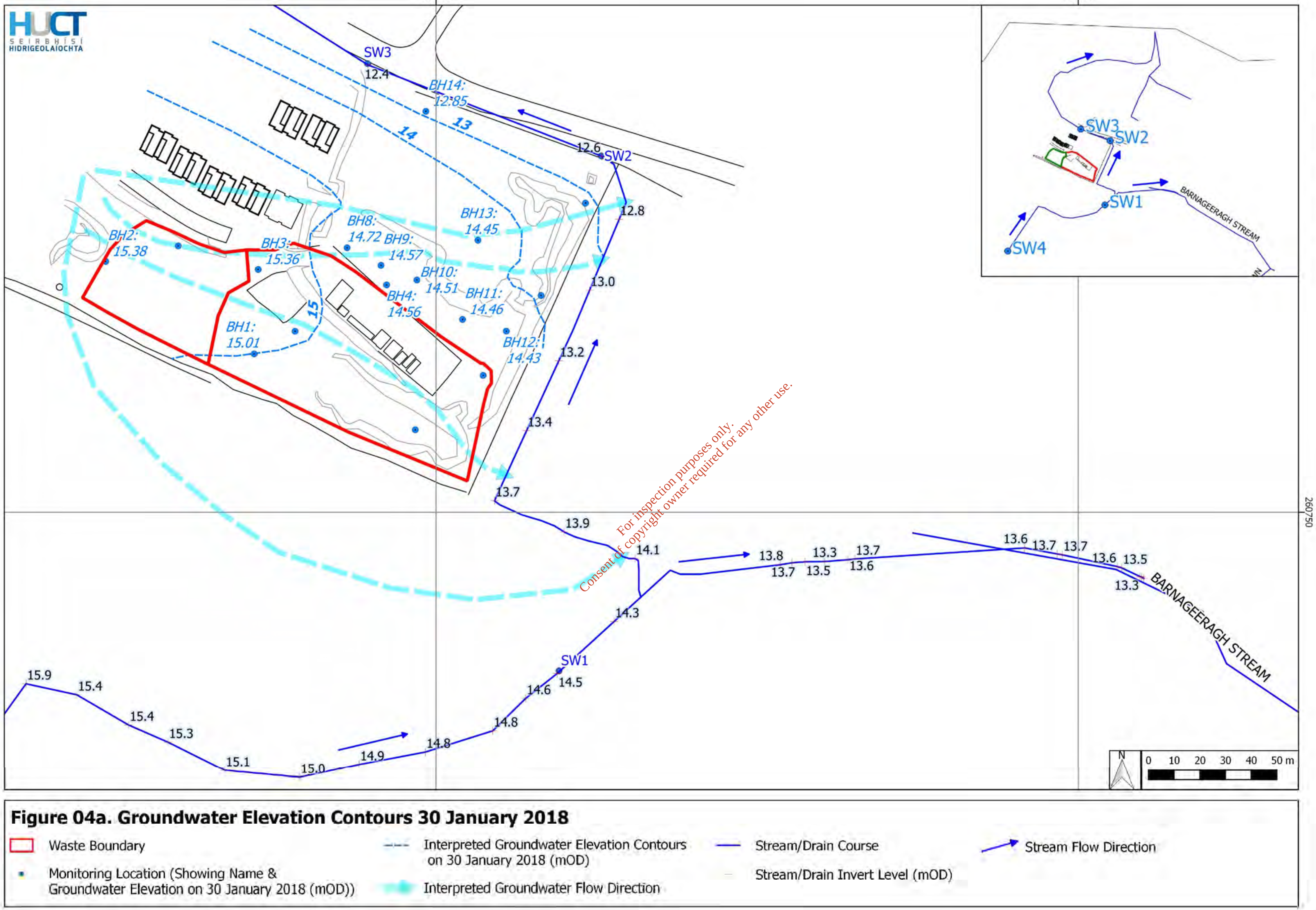


Figure 4a. Groundwater Elevations on 30 January 2018

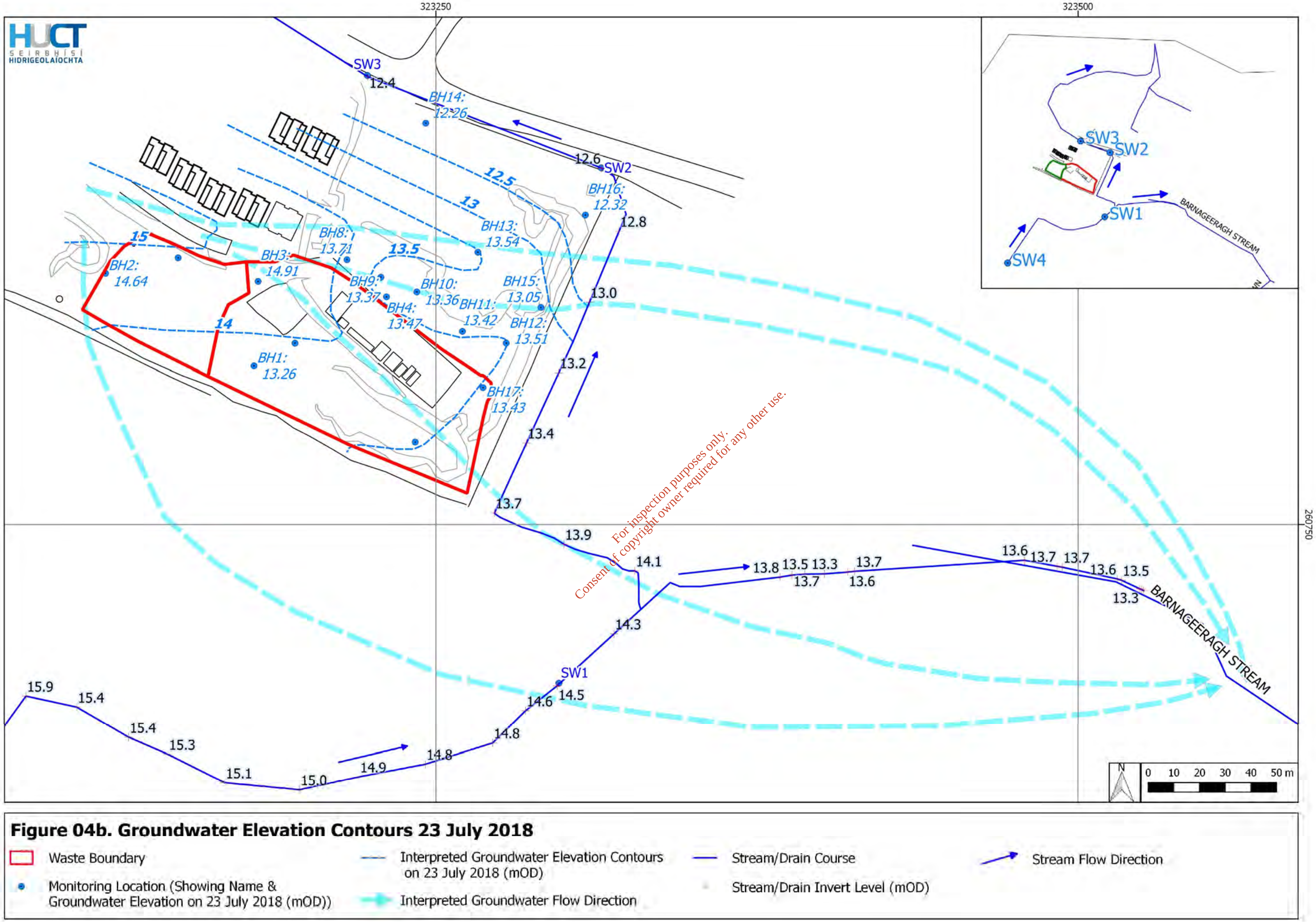


Figure 4b. Groundwater Elevations on 23 July 2018

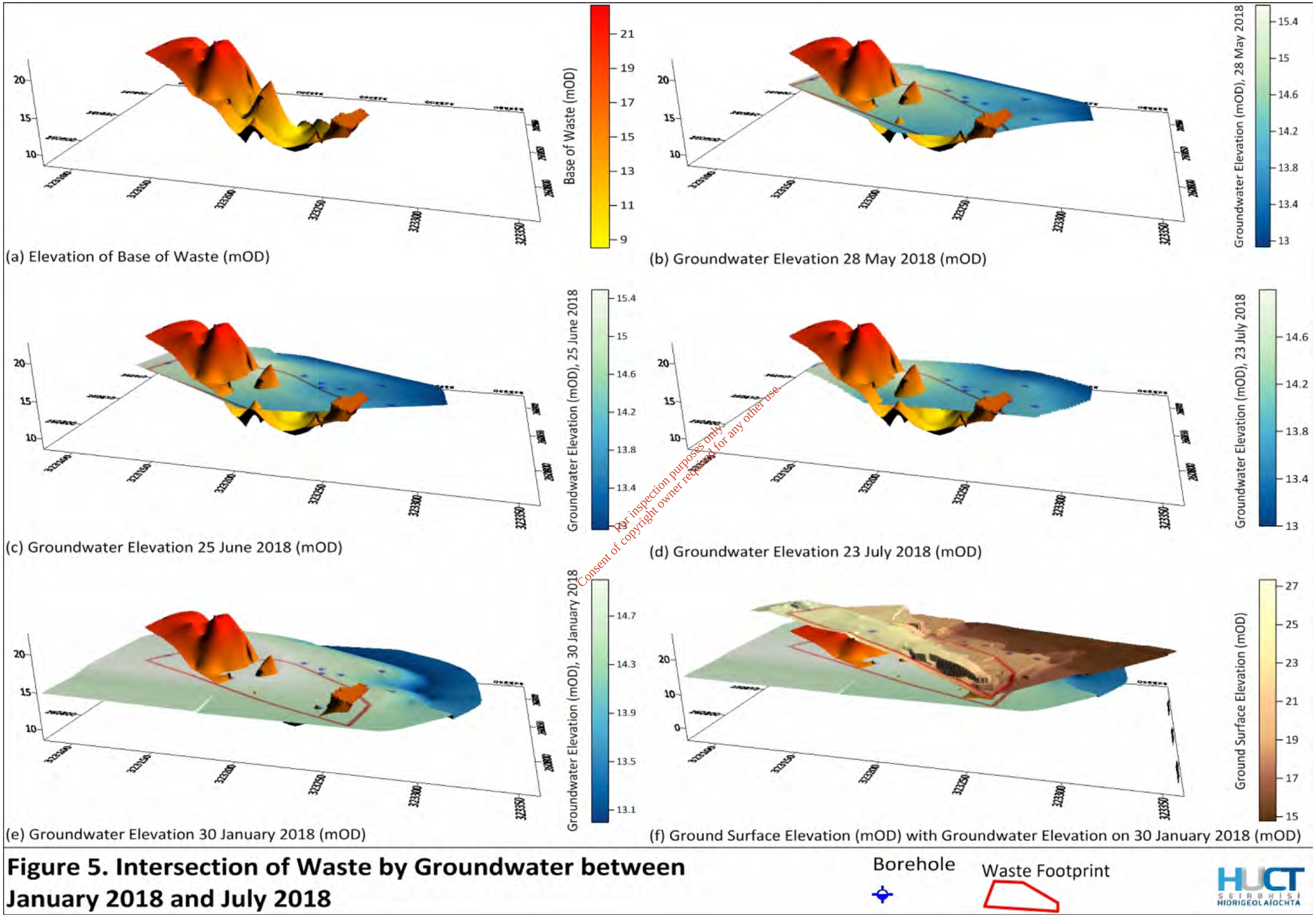


Figure 5. Intersection of Waste by Groundwater between January 2018 and July 2018

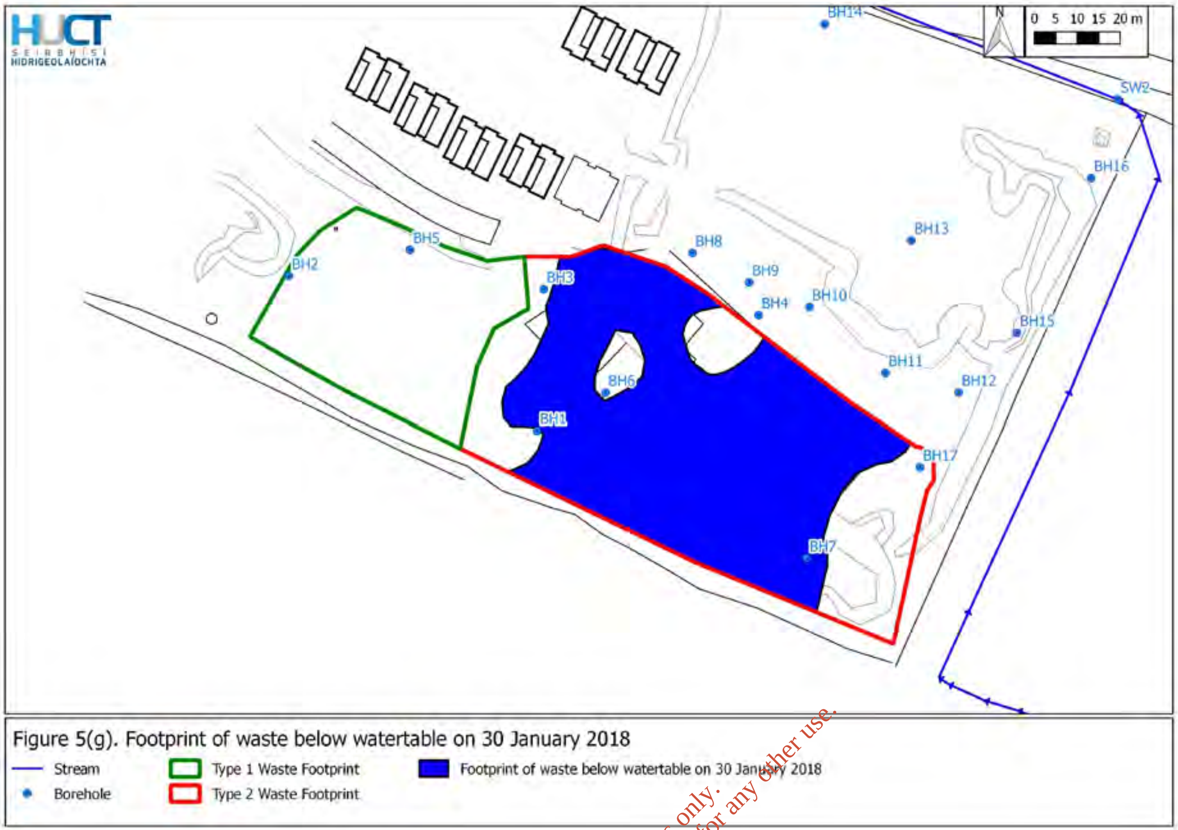


Figure 5(g). Footprint of waste below watertable on 30 January 2018

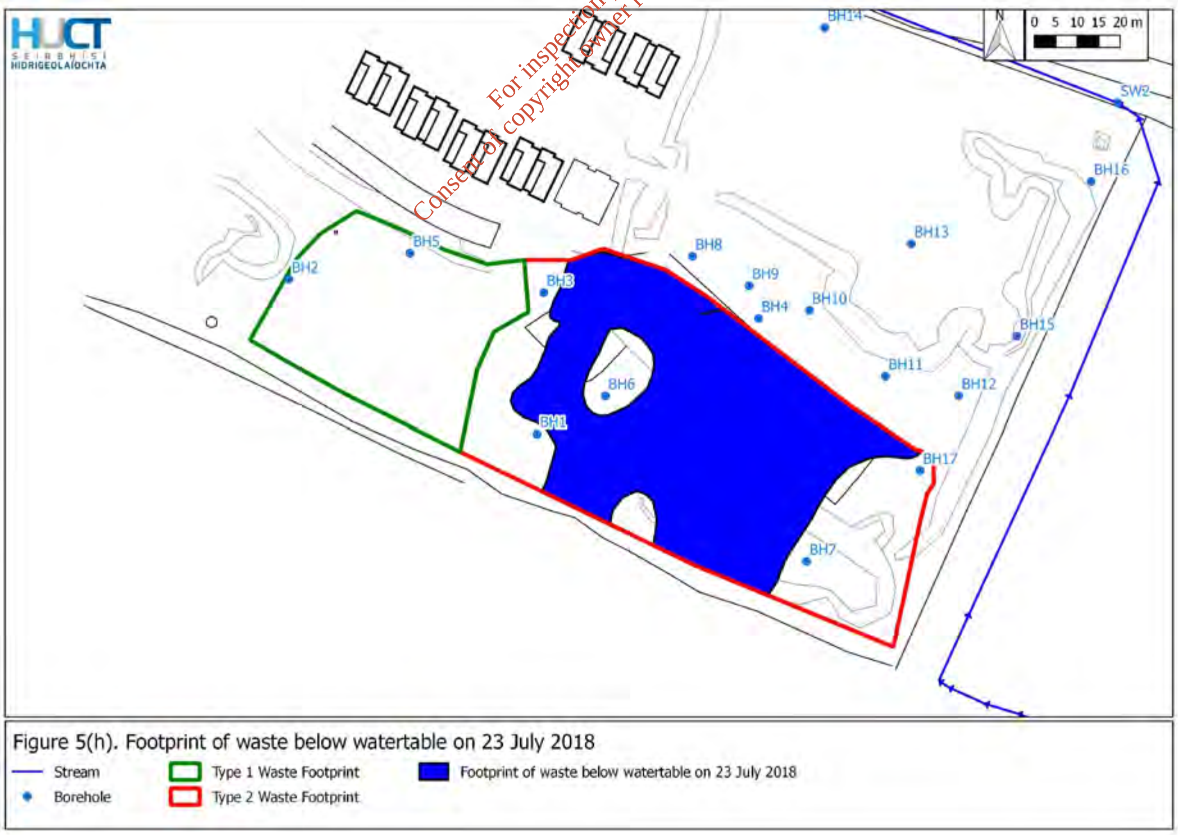


Figure 5(h). Footprint of waste below watertable on 23 July 2018

4.2.7 Groundwater Discharge

Figure 4a shows that the groundwater elevation in January 2018 is sufficiently high to allow groundwater to discharge as baseflow to the stream/culverted drain that runs from south to north along the eastern boundary of the site. The interpreted groundwater flow lines show the expected footprint of groundwater flowlines passing beneath the waste body. The figure also shows the flow lines terminating at the eastern boundary stream, indicating that the groundwater discharges to the stream as baseflow under these high groundwater elevation conditions.

Surface water monitoring by Mulroy Environmental indicates that there was flow in the eastern boundary stream at location SW2 up to 21 May 2018. This suggests that groundwater baseflow to the stream along the eastern site stream was active until that date. Further monitoring indicated that there was no flow at SW2 on 06 June 2018. This suggests that baseflow to the stream along the eastern boundary stopped at approximately the beginning of June 2018 as groundwater levels in the area dropped below the stream invert level.

Figure 4b shows that the groundwater elevation contours adjacent to the eastern boundary stream are lower than the adjacent stream invert levels. This indicates that the groundwater elevation is below the base of the stream and that baseflow cannot occur, which is in line with the onsite surface water monitoring observations. The orientation of the groundwater elevation contours and the zone of high aquifer transmissivity in the mid to southern part of the eastern boundary suggest that groundwater flow beneath the site would be eastwards across the WWTP site towards the Barnageeragh Stream under these circumstances.

The interpreted groundwater flow lines on Figure 4b show the expected footprint of groundwater flowlines passing beneath the waste body under these low groundwater elevation conditions. The flow lines discharge to the Barnageeragh Stream down stream to the east of the WWTP site. The groundwater elevation at the eastern site boundary varies from 12.3 mOD to 13.5 mOD, while the easternmost surveyed stream invert at the eastern end of the WWTP site is at 13.5 mOD. This means the stream is perched above the groundwater even at the eastern end of the WWTP, such that the point along the stream where baseflow discharge begins must be downstream of the WWTP site. There are no data available for groundwater or stream invert elevations east of the WWTP site. It has been conservatively assumed that groundwater discharge to the Barnageeragh stream begins immediately downstream of the WWTP site. A discharge point further downstream would allow for additional contaminant attenuation prior to groundwater discharge to the stream, compared to assuming the discharge point is immediately downstream of the WWTP.

The available groundwater elevation contour data indicate that groundwater elevations across the site were below the eastern boundary stream invert levels in June and July 2018 and in August 2017; and were above the stream invert levels in November 2017 and January and May 2018. On this basis it is interpreted that groundwater flow beneath the waste footprint discharges to the eastern boundary stream for the period October to May inclusive, and passes beneath the eastern boundary stream and discharges to the Barnageeragh Stream for the period June to September inclusive.

4.2.7.1 Estimated Groundwater Discharge Volumes at Maximum Groundwater Elevation

Figure 6 shows a simplified version of the groundwater flow beneath the site based on the groundwater elevation data for 30 January 2018. Groundwater is shown flowing roughly east directly towards the eastern boundary stream. The width of groundwater flow passing beneath the footprint of the waste body is 106 m. The distance between the 15 mOD and 13 mOD groundwater elevation contours is 112 m, indicating a hydraulic gradient of 0.018 (i.e. (15-13)/112).

The transmissivity for the aquifer between the flow lines shown on Figure 6 is estimated at 21 m^2/day. This based on data from pumping tests on boreholes BH1, BH2, BH3, BH4, BH8, BH9, BH10, BH11, BH12, BH13, BH15 and BH17, which are located within the relevant area.

The volume of groundwater passing beneath the waste footprint and discharging to the eastern boundary stream under maximum groundwater levels is therefore estimated at 40 m^3/day[c].

4.2.7.2 Estimated Groundwater Discharge Volumes at Minimum Groundwater Elevation

Figure 7 shows a simplified version of the groundwater flow beneath the site based on the groundwater elevation data for 23 July 2018. Groundwater is shown flowing roughly east-southeast beneath the WWTP site towards the Barnageeragh Stream. The width of groundwater flow passing beneath the footprint of the waste body is 75 m. The distance between the 14 mOD and 13 mOD groundwater elevation contours is 97 m, indicating a hydraulic gradient of 0.010 (i.e. (14-13)/97).

The transmissivity for the aquifer between the flow lines shown on Figure 7 is estimated at 21 m^2/day. This based on data from pumping tests on boreholes BH1, BH2, BH3, BH4, BH8, BH9, BH10, BH11, BH12, BH13, BH15 and BH17, which are located within the relevant area.

The volume of groundwater passing beneath the waste footprint and discharging to the eastern boundary stream under maximum groundwater levels is therefore estimated at 16 m^3/day[d].

[c] Discharge = Transmissivity x Hydraulic Gradient x Width of Groundwater Flow, i.e. (21 x 0.018 x 106) m^3/d.
[d] Discharge = Transmissivity x Hydraulic Gradient x Width of Groundwater Flow, i.e. (21 x 0.010 x 75) m^3/d.

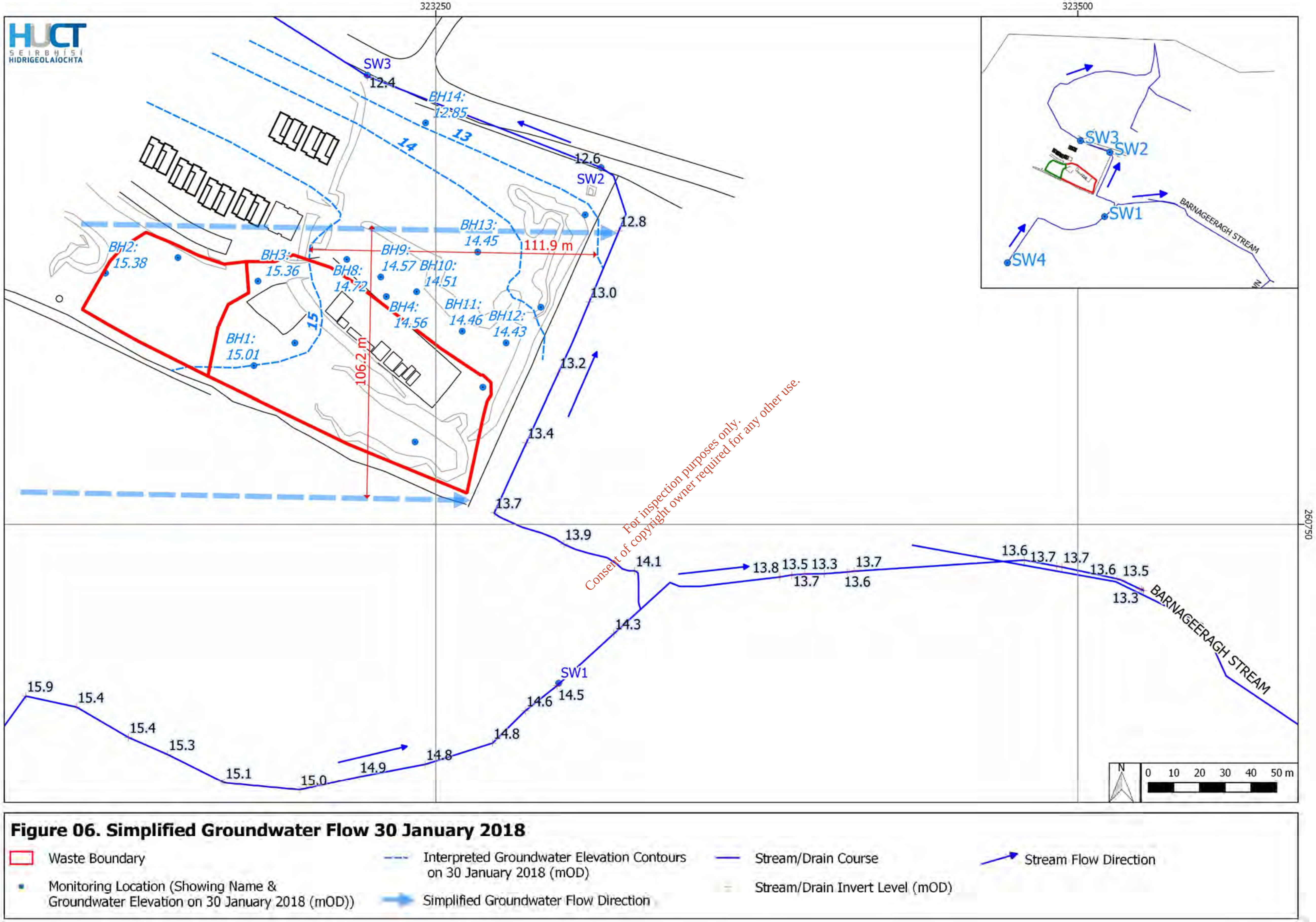


Figure 6. Simplified Groundwater Flow 30 January 2018 (Maximum Watertable Elevation)

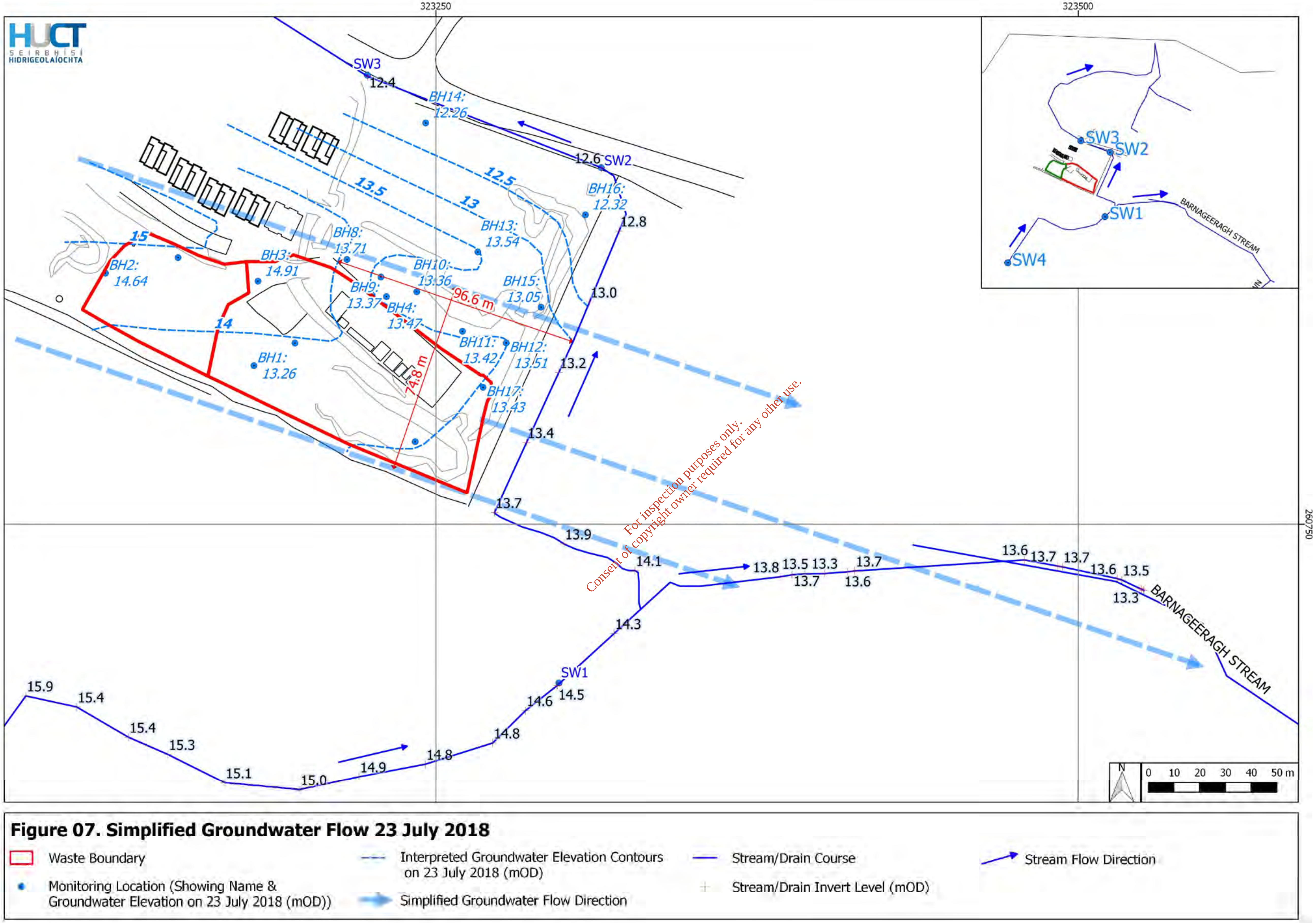


Figure 7. Simplified Groundwater Flow 23 July 2018 (Minimum Watertable Elevation)

4.2.8 Hydrogeological Conceptual Model Schematic Cross-Section Diagrams

Previous investigations identified that rainfall on the site infiltrates down through the waste body into the underlying aquifer, which is comprised of sand and gravel subsoil deposits and the underlying weathered bedrock. Groundwater in the aquifer flows outwards from the ridge containing the waste body. In the immediate vicinity of the site groundwater elevation contours indicate that groundwater flows to the northeast, east and southeast beneath the site. Groundwater flow beneath the waste body is predominantly to the east and south east.

During the high watertable period from October to May the groundwater flowing beneath the waste body discharges to the eastern boundary stream. During the low watertable period from June to September the groundwater flowing beneath the waste body passes beneath the eastern boundary stream and continues eastwards to discharge at the Barnageeragh Stream to the east of the WWTP site.

The groundwater elevation contours developed have been extrapolated in line with the hydrogeological setting and conceptual model to estimate the potential groundwater flow directions to the east of the site, between the site and the groundwater discharge boundaries.

Figures 8 and 9 show the extrapolated groundwater elevation contours and flow lines for the maximum and minimum groundwater elevation scenarios respectively. Figures 8 & 9 also show the high transmissivity GRAVEL subsoil and weathered bedrock aquifer zone encountered at boreholes BH11, BH12, BH15 and BH17 in particular. The high transmissivity zone has been extrapolated east beneath the WWTP site as far as the discharge zone to the Barnageeragh Stream.

The extrapolated contours assume that there is a recharge mound beneath the raised area between the site and the sea, with groundwater flowing outwards from the mound. As such, groundwater flow beneath the southern part of this area is expected to be southwards, i.e. towards the northern boundaries of the site and the WWTP site, with the groundwater discharging to the site boundary stream and Barnageeragh Stream. This recharge mound prevents groundwater beneath the site from flowing directly north to the sea, resulting in groundwater from the site discharging either to the site boundary stream/drain or to the Barnageeragh stream.

In Figure 8 the extrapolated contours indicate that groundwater beneath the site and groundwater beneath the western end of the WWTP site both discharge to the site eastern boundary drain. In Figure 9 the extrapolated contours indicate that groundwater flows east from beneath the waste body to discharge to the Barnageeragh Stream.

The available topographic survey data for ground surface and stream invert elevation have been used to generate a schematic cross-section from west to east across the study area to illustrate the hydrogeological conceptual model. The schematic cross-section also draws on the following datasets:

- Extrapolated groundwater elevation contours for 30 January and 23 July 2018 to show the relative maximum and minimum groundwater elevation respectively along the line of the cross-section.
- Data from borehole trial pit and geophysical investigations to show the following sub-surface features along the line of the cross-section:
    - Bottom surface of the waste body.
    - Thickness of the low transmissivity aquifer comprised of silty sand and gravel.
    - Thickness of the high transmissivity aquifer comprised of GRAVEL and weathered bedrock.

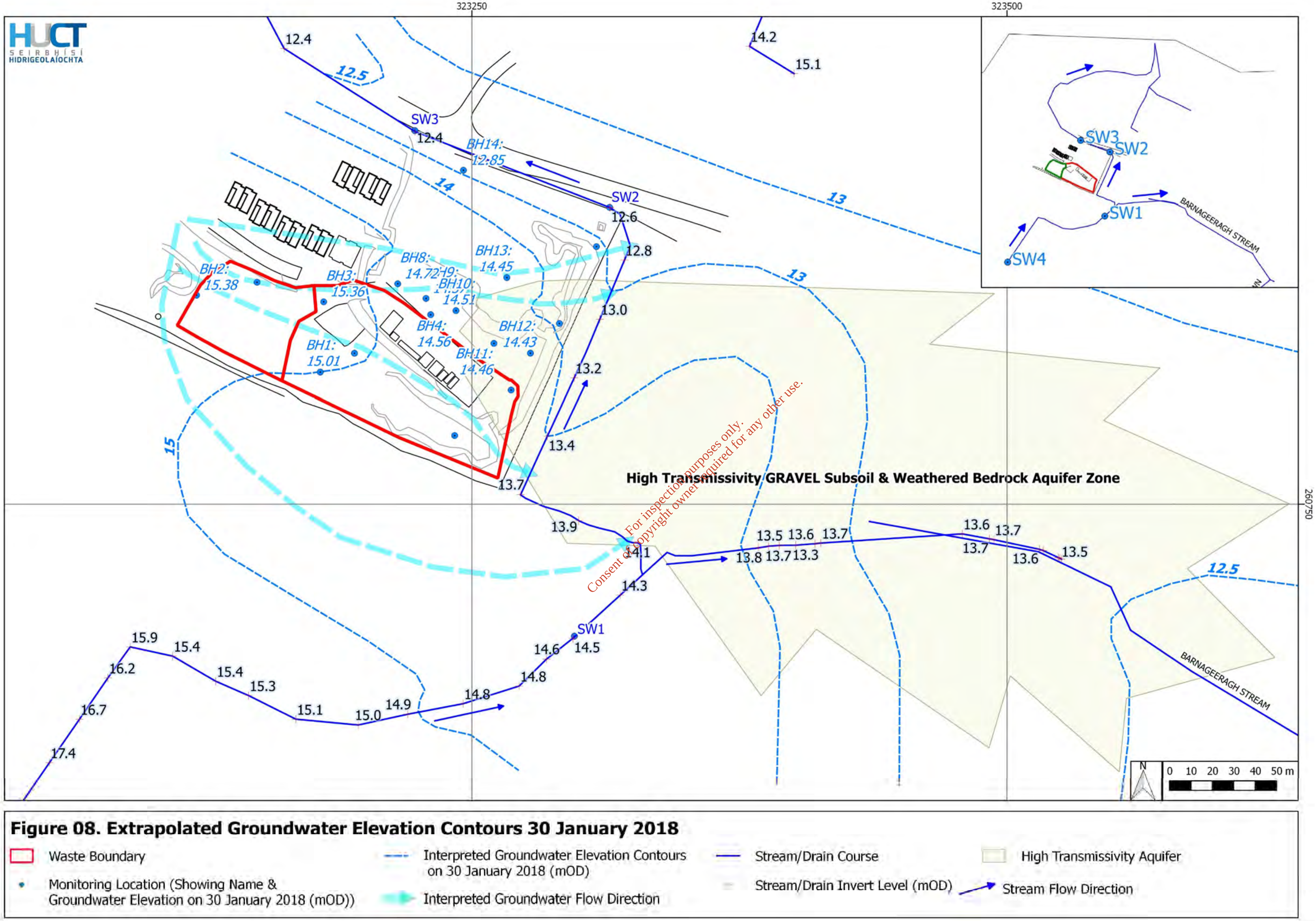


Figure 8. Extrapolated Groundwater Elevation Contours 30 January 2018 (Maximum Watertable Elevation)

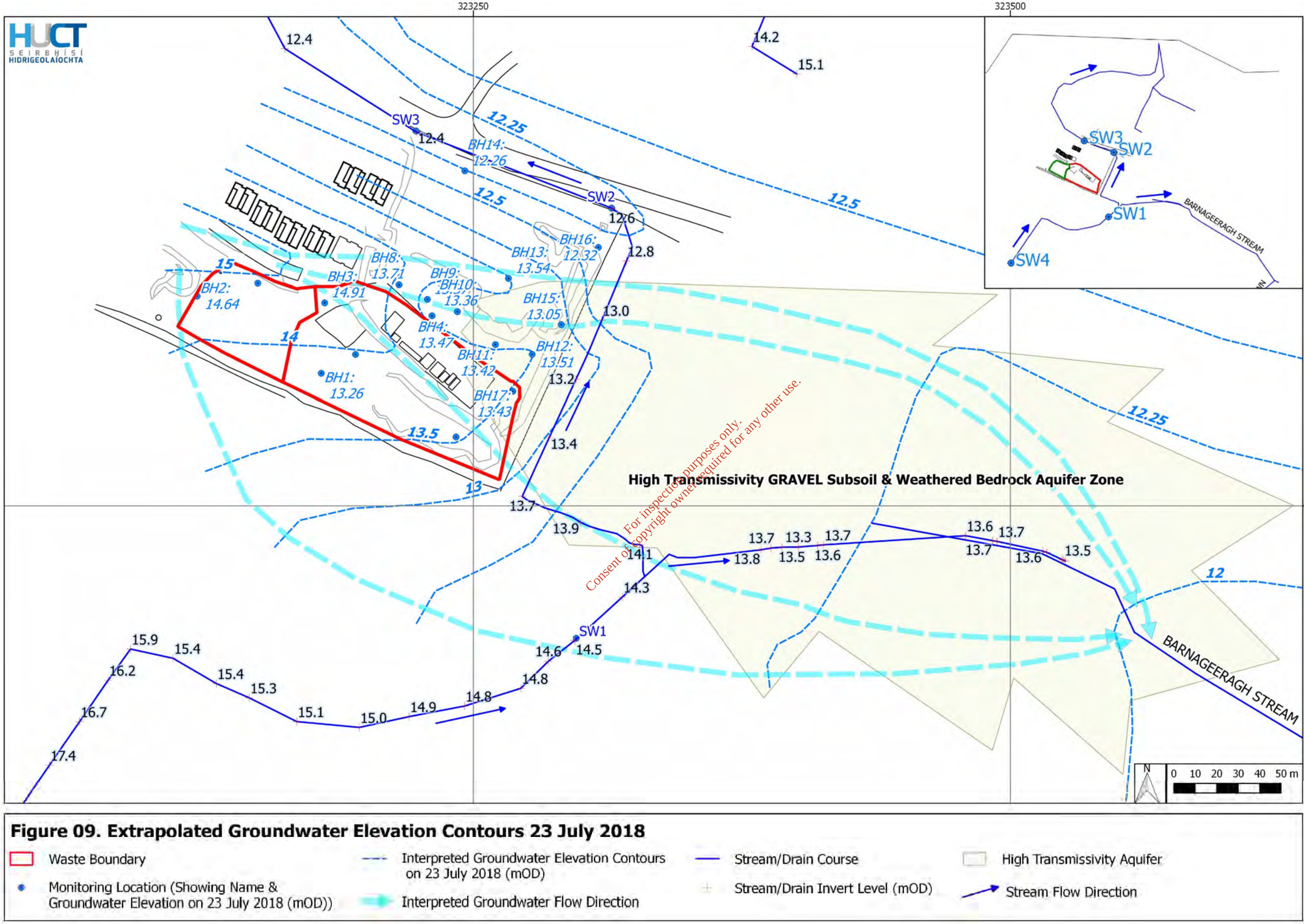


Figure 9. Extrapolated Groundwater Elevation Contours 23 July 2018 (Minimum Watertable Elevation)

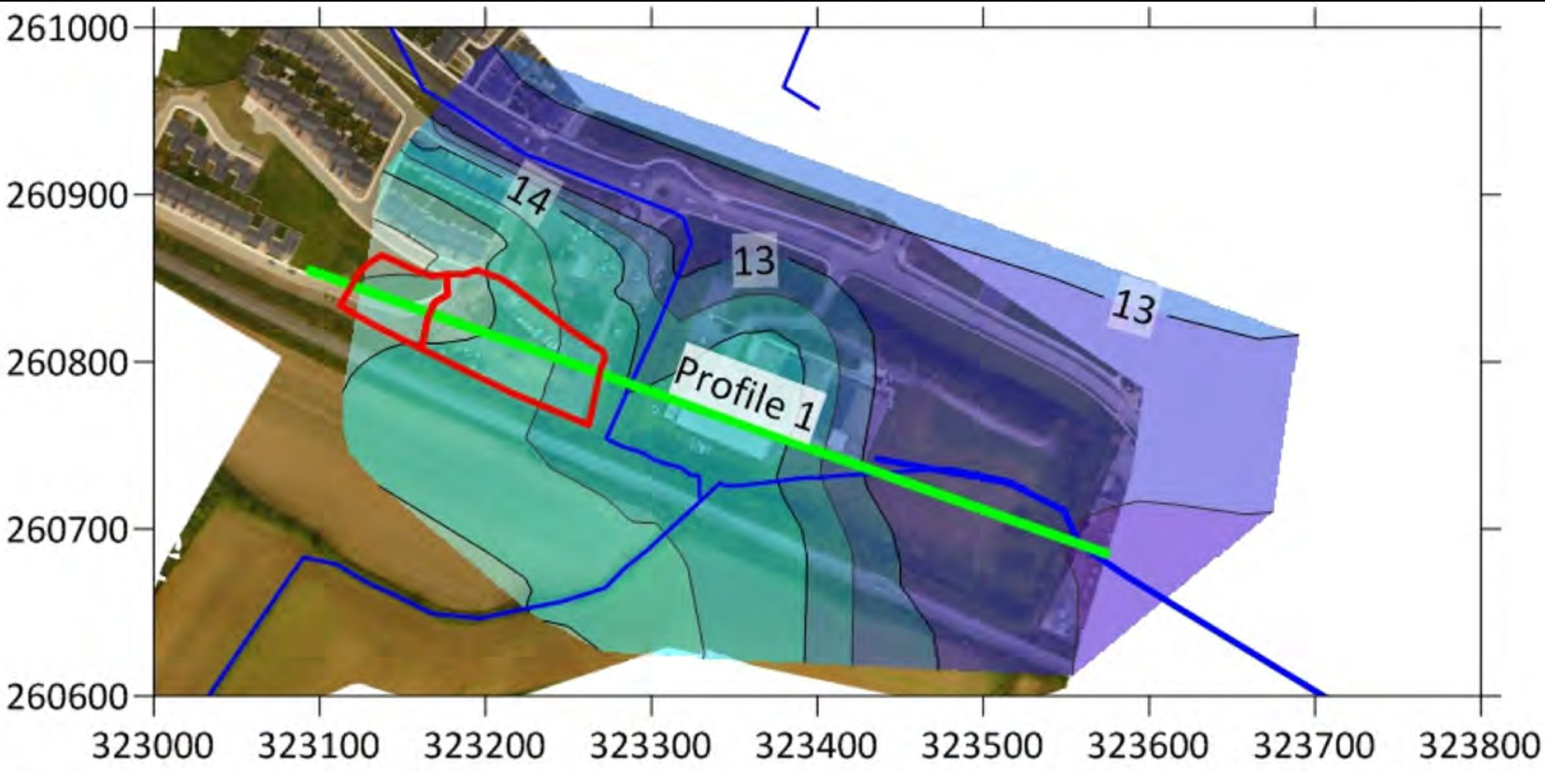
In interpolating the available point data on the thickness of the various sub-surface layers the following rules were applied:

- Where a site investigation location encountered a layer but did not penetrate the full depth of the layer, the full depth of the layer is assumed to be equal the depth encountered in the borehole. As such, the cross section shows the minimum known thickness of each layer.
- The low transmissivity aquifer material comprises the SILT/CLAY, and silty to sandy GRAVEL encountered in the trial pits and boreholes, and the silty gravelly SAND identified by the geophysical surveys.
- The high transmissivity aquifer material comprises the GRAVEL, and weather bedrock encountered in the trial pits and boreholes, and the "gravelly sand boulders / completely weathered rock" and "weathered SILTSTONE/SANDSTONE" identified by the geophysical surveys.
- The interpolated surface representing the base of the waste used data from intrusive investigations and geophysical surveys that penetrated the full thickness of the waste only.

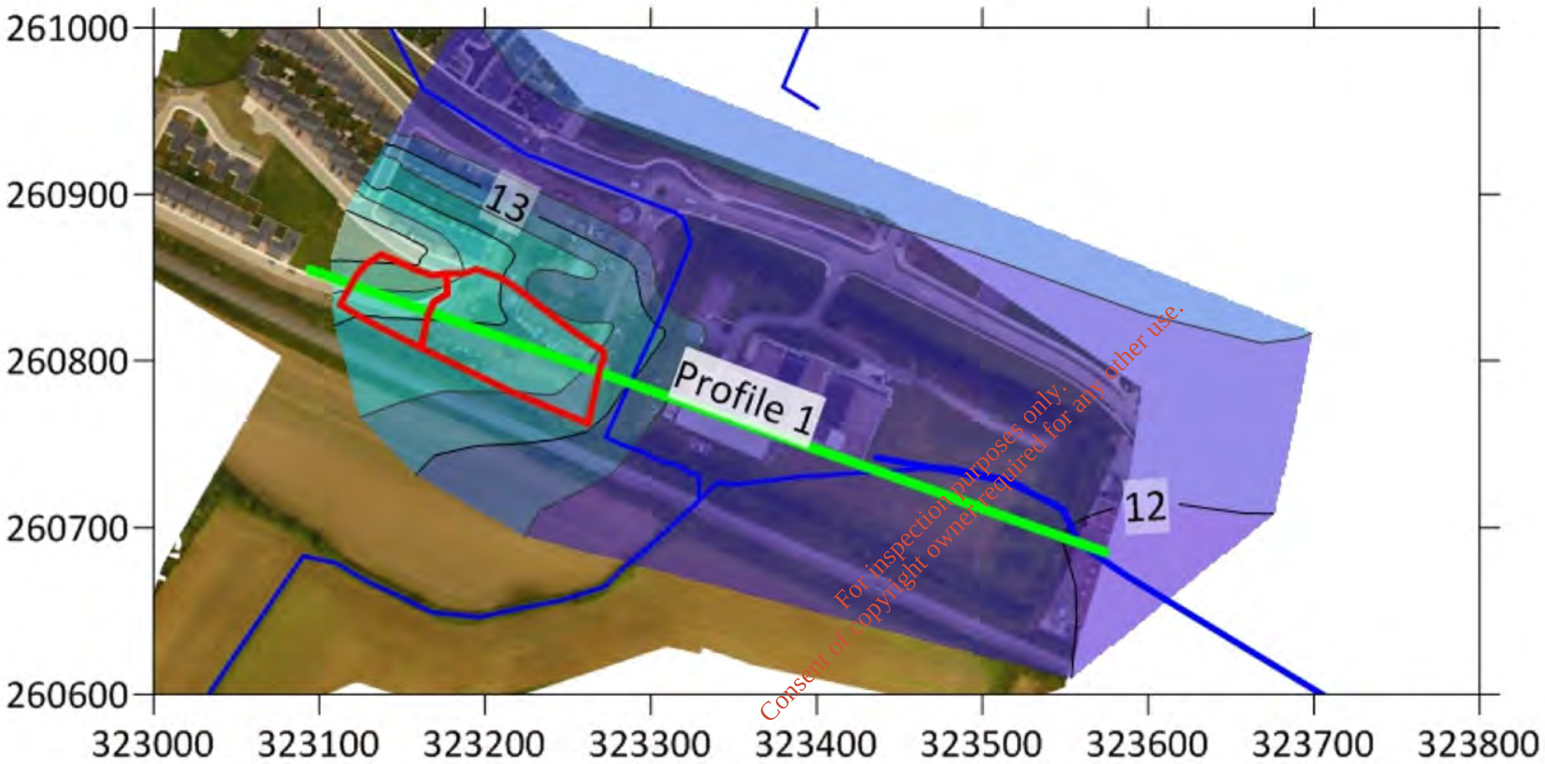
Figure 10 shows plan views (a) and (b) which illustrate the line of the cross-section in relation to the 30 January and 23 July 2018 extrapolated groundwater elevation contours; and the cross-section diagram (c). Figure 11 shows an enlarged and annotated version of the cross-section diagram. Figure 12 shows two further cross-sections through the site, (a) which follows a line west to east through the northern part of the waste body and intersects the northern end of the site boundary stream, and (b) which follows a line from south to north across the eastern end of the site and waste body.

Overall the conceptual model figures illustrate that:

- A proportion of the waste is below the water table at all times;
- During periods of high water table groundwater flow beneath the waste discharges to the site eastern boundary stream; and,
- During periods of low water table groundwater flow beneath the site passes beneath the site eastern boundary stream and flow east to discharge to the Barnageeragh stream downgradient to the east of the WWTP site.



(a) Plan view showing groundwater elevation contours on 30 January 2018 extrapolated beyond the site boundary (maximum groundwater elevation)



(b) Plan view showing groundwater elevation contours on 23 July 2018 extrapolated beyond the site boundary (minimum groundwater elevation)

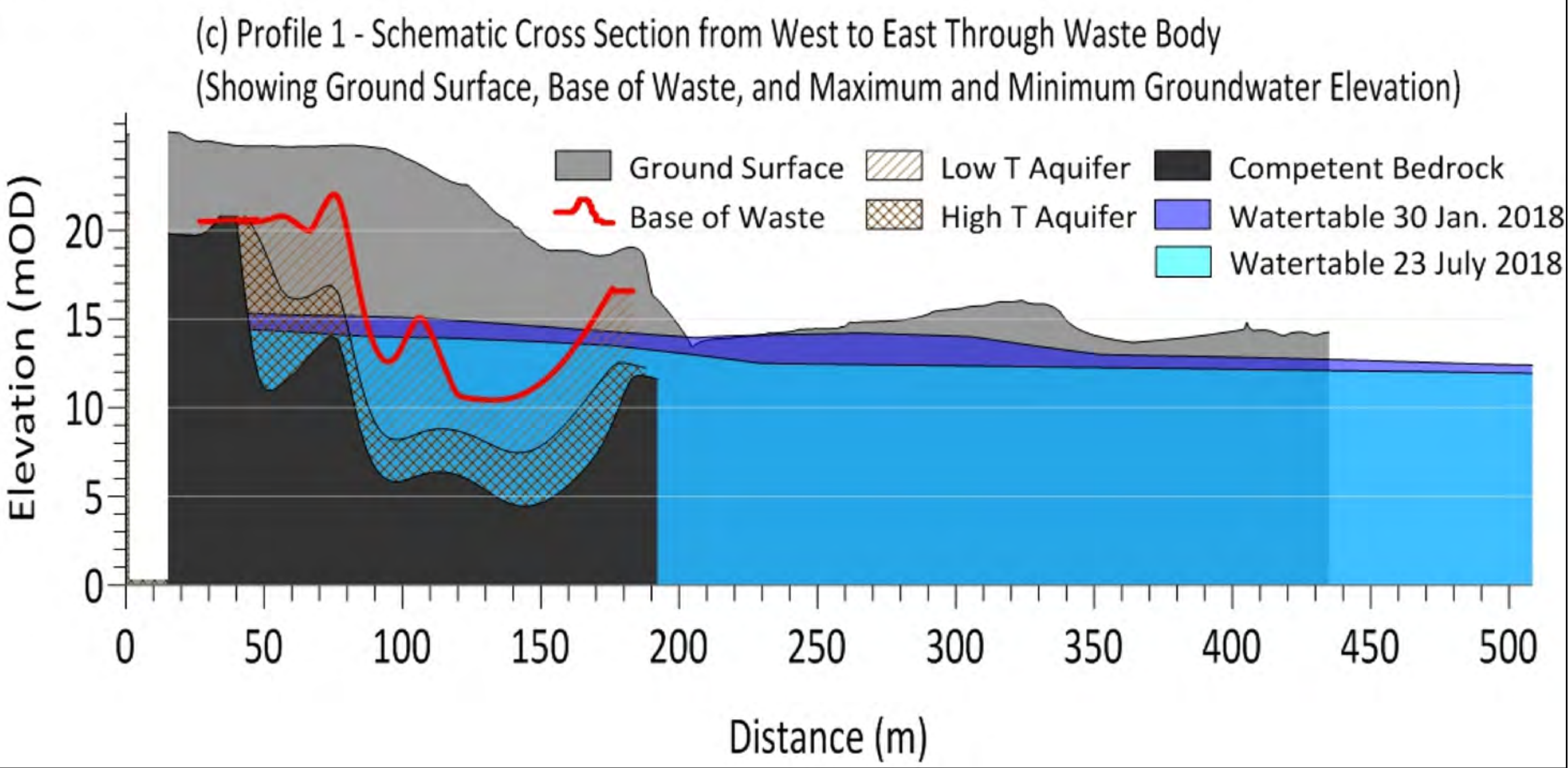


Figure 10. Schematic Hydrogeological Conceptual Model In Plan & Cross Section

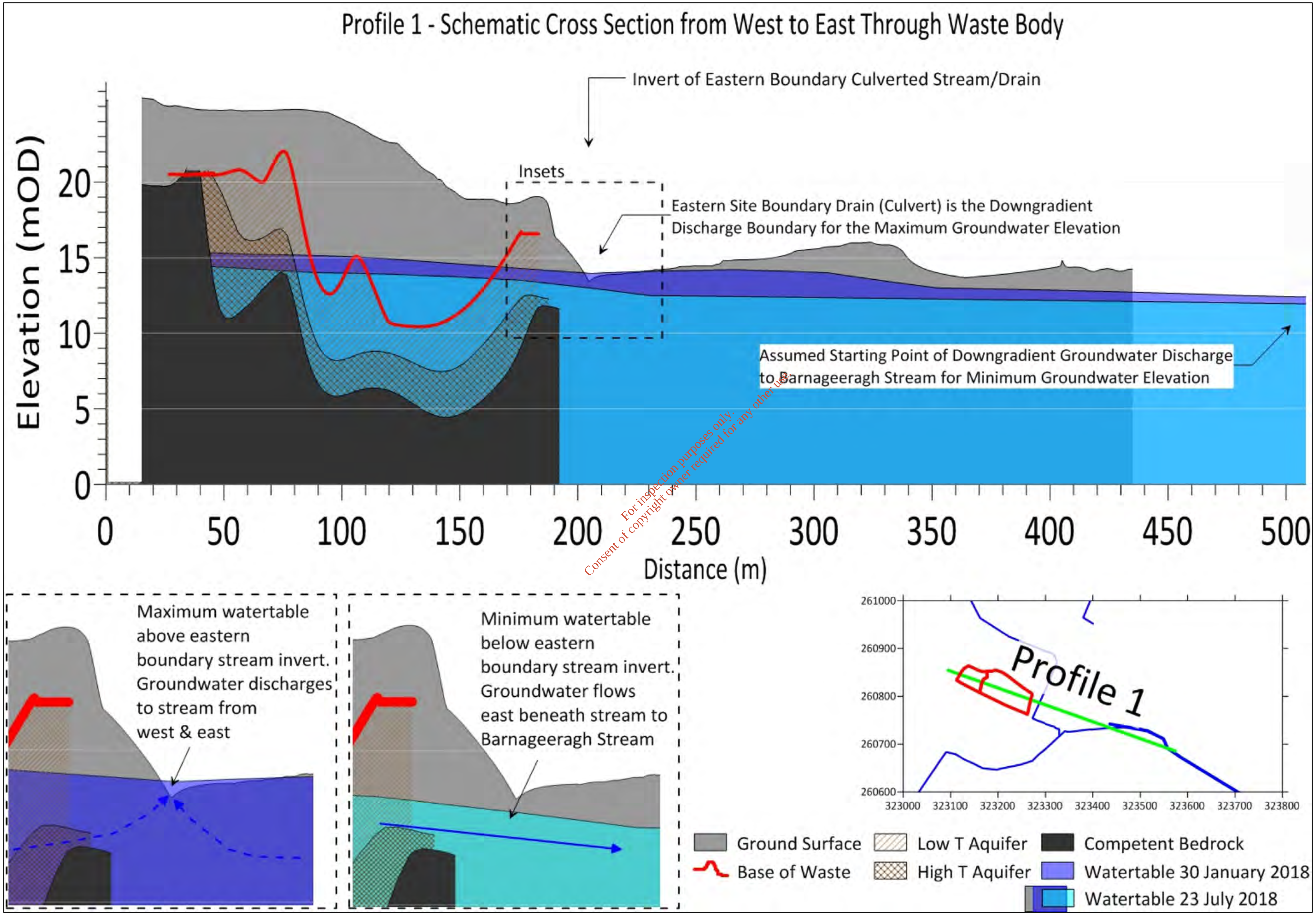


Figure 11. Detailed Schematic Hydrogeological Conceptual Model Cross Section

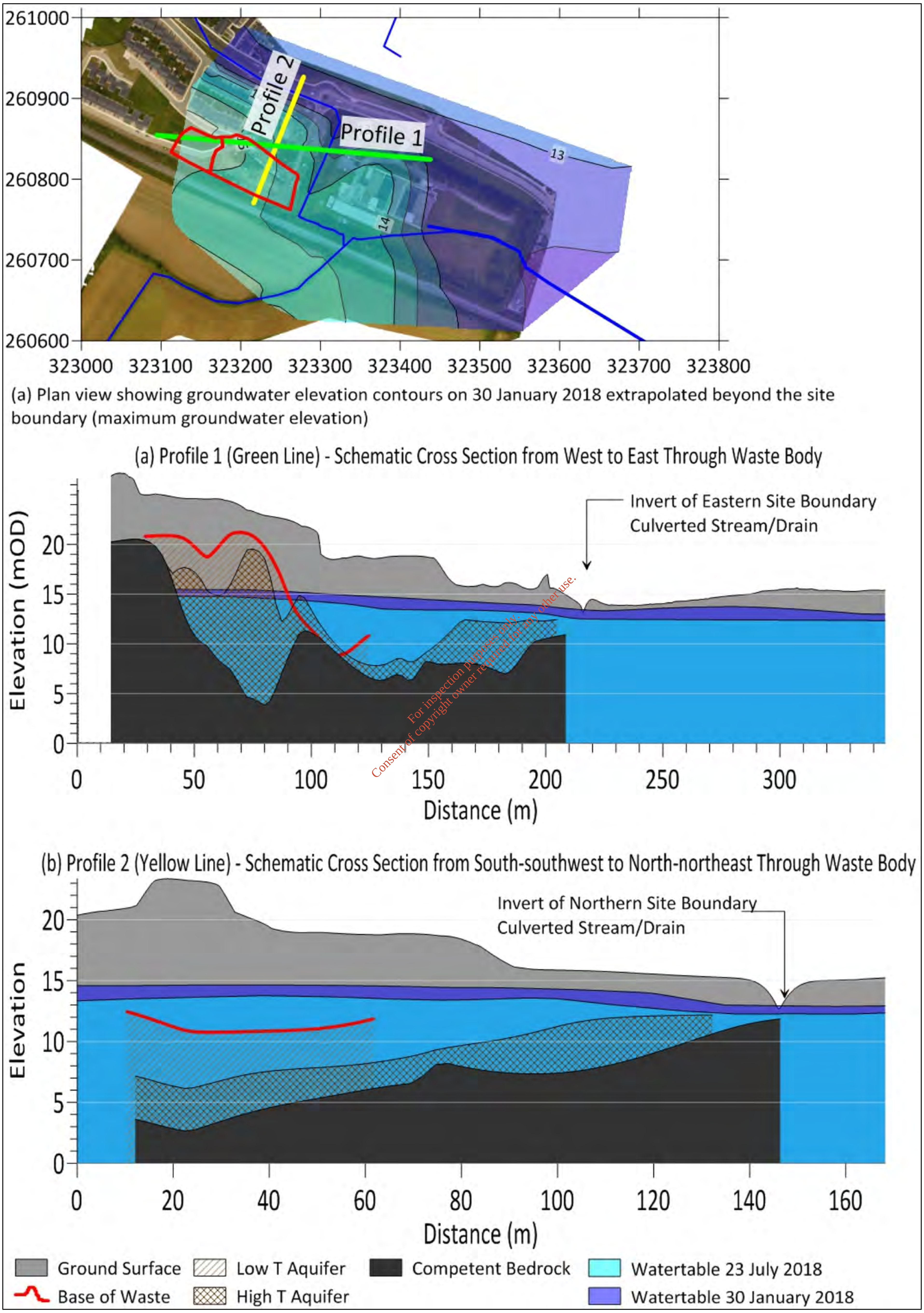


Figure 12. Additional Schematic Hydrogeological Conceptual Model Cross Sections

4.2.9 Water Quality Data

Surface water quality data are available for 18 January 2018, which is during the period of high groundwater elevation with groundwater flowing beneath the waste expected to discharge to the eastern boundary stream between SW1 and SW2.

The data show that ammonia concentrations were below detection at SW1, SW2 and SW3 in January 2018. The closest comparable groundwater quality data derive from November 2017 and show elevated ammonia concentrations in the groundwater at boreholes BH1, BH11 and BH12. This suggests that any ammonia loading in the baseflow discharge to the stream is being quickly attenuated by volatilisation and oxidation.

In the January 2018 surface water and November 2017 groundwater samples nitrite was detectable at BH1 and SW1 and non-detectable at BH11, BH12, SW2 and SW3. Nitrite occurs as an intermediary in the oxidation of ammonia to nitrate. Nitrate was above background in SW1 and at or below background concentrations in BH1, BH11, BH12, SW2 and SW3. Chloride and sulphate were elevated above background at BH1 and less elevated at BH11 and BH12. Chloride was above background at SW1 and at background concentrations at SW2 and SW3. Sulphate was at background concentrations at SW1, SW2 and SW3. Electrical conductivity was elevated at BH1, BH11 and BH12 and at background levels at SW1, SW2 and SW3.

The available data suggest that during the high groundwater level period where groundwater discharges to the site boundary stream, contaminants that are present at elevated above background concentrations in boreholes BH1, BH11 and BH12 (i.e. near to the stream on flow lines that pass beneath the waste and discharge to the stream) are quickly attenuated to background surface water concentrations after the baseflow discharges to the stream.

The groundwater quality monitoring round from May 2018 monitored water quality at the full set of groundwater monitoring boreholes, i.e. the existing boreholes BH1 to BH3 and BH8 to BH14, and the additional boreholes BH15 to BH17. The data show that the highest groundwater contaminant concentrations occur at BH1, which is directly beneath the southwestern part of the Type 2 waste, and in BH11, BH12, BH15 and BH17, which are in the area of high aquifer transmissivity. Ammonia, chloride, sulphate and electrical conductivity are generally elevated above background at these locations and suggest that contaminant transport in groundwater is concentrated in the zone of high aquifer transmissivity.

4.2.10 Additional Monitoring Boreholes – Groundwater Quality Data Gaps

The Type 1 waste area is considered to be homogenous. As such, the groundwater water flow lines recharged by contaminated infiltration from Type 1 waste are considered to receive equivalent contaminated recharge loadings whether the flow line travels northeast, east or southeast from the site. The same is considered to apply to flow lines receiving contaminated infiltration from Type 2 waste. Overall, the contaminant loading on groundwater flow lines travelling outwards from the site from a particular waste type footprint is considered to be equivalent irrespective of the direction in which the flow line is traveling.

Figures 3a and 3b show that the radial groundwater flow outwards from the ridge underlying the site flow along equivalent groundwater pathways to the north, east and west, i.e. infiltration through gravel deposits followed by lateral groundwater flow through the gravel deposits and weathered bedrock to preferential groundwater pathways comprised of gravel and weathered bedrock, and onwards along the preferential pathways to discharge to surface water.

Groundwater flow is likely to be focused on the preferential pathways. Groundwater quality data for boreholes BH11, BH12, BH15 and BH17 suggest that contaminated groundwater flowing east-northeast from the landfill flows preferentially into the high transmissivity gravel and weathered bedrock preferential pathway intersected by these boreholes.

It is considered that any contaminated groundwater flowing south or southeast from the landfill will follow pathways through the typical gravel and weathered bedrock deposits to flow into a high transmissivity preferential pathway equivalent to (and potentially contiguous with) the one intersected by boreholes BH11, BH12, BH15 and BH17. These groundwater flow paths are passing through the same material and subject to the same processes as the monitored flow paths through boreholes BH11, BH12, BH15 and BH17 to the northeast.

As such, the water quality data from boreholes BH11, BH12, BH15 and BH17 are considered to be on a representative flow path from the contaminant source to the receptor and are considered to provide a representative picture of groundwater quality along any equivalent flow path that may be in a different direction through equivalent materials.

This is equivalent to the regional groundwater monitoring approach whereby monitoring of representative catchments in a groundwater body are expected to provide a representative picture of water quality across the GWB area, including catchments that do not have any actual direct monitoring.

Overall therefore it is considered that the current groundwater monitoring network including the additional monitoring boreholes is representative of groundwater quality beneath the site as a whole, and additional groundwater boreholes monitoring groundwater quality along the southern site boundary between BH1 and BH2 and between BH1 and BH7 are not required.

5 Source-Pathway-Receptor Framework

The current standard approach to assessing the potential environmental risk associated with a source of contaminants is through the source – pathway – receptor (SPR) framework. This approach identifies the potential *sources* of contamination which might be present in or impact on a study area. *Pathways* by which the contaminants could migrate from the source into the greater environment are subsequently identified. Finally environmental *receptors* in the study area, which could suffer negative impacts as a result of exposure to the contaminants are identified.

The source-pathway-receptor (SPR) framework for the site is set out in this section.

5.1 Potential sources of contamination

5.1.1 Contaminant Source Data

The Barnageeragh Cove Landfill is the contaminant source of interest for this DQRA. The landfill waste footprint is shown in Figure 2. The site HCM indicates that the waste body comprises two waste types, i.e. Type 1 and Type 2.

The available soil quality data were assessed to characterise the chemical composition of the Type 1 and Type 2 waste. The soil quality data derive from trial pit soil samples from July/August 2017 (Mulroy Env. 2017) and from borehole soil samples collected during the construction of a sewage rising main across the site in 2005. The trial pit data including direct experience of the site investigation, trial pit logs and photos, and soil laboratory analytical data were used by Mulroy Environmental to determine the footprint of the two waste types at the site. Each trial pit sample was then classified as pertaining to a particular waste type (or else to indigenous soil/waste free fill). For each waste type the soil laboratory analysis data for the relevant set of soil samples was used to determine the range of concentration of each analysed parameter with respect to the waste type. Soil ammonia concentrations were not determined during the 2005 and 2017 investigations.

The calculated soil concentration range for each parameter based on the 2005 and 2017 soil samples is shown in Table A2.1 in Appendix 2.

Additional soil samples were collected during the drilling of gas venting wells in the Type 2 waste in April and May 2018 and from two additional trial pits excavated in the Type 1 waste in June 2018. The additional samples were subjected to laboratory analysis to directly determine the ammonia, chloride and sulphate content of the Type 1 and Type 2 wastes. The soil ammonia, chloride and sulphate concentrations determined from the samples are shown in Table 1.

These data have been used in preference to the indirect data from groundwater quality samples and leachate tests that were used to characterise these parameters in the initial version of the DQRA. In the case of ammonia, the sum of the mass of ammonia and organic nitrogen in the soil has been used to assess ammonia migration from the waste source, as the organic nitrogen is likely to be mobilised as ammonia as the organic matter biodegrades.

5.1.2 Selection of Substances of Concern

Table 2 shows the categories of compounds and the individual compounds (or TPH groupings) analysed for in the Type 1 and Type 2 waste at Barnageeragh and indicates which compounds were detected. Table 3 summarises the compounds which were analysed for but were not detected.

In general SOCs were selected based on their contaminant category, their mobility in the subsurface and their toxicity. Only contaminants detected in the Type 1 and Type 2 waste were considered for selection as SOCs.

Table 1. Soil Ammonia, Chloride and Sulphate Concentrations from 2018 Soil Samples

	Locations	Units	Min	Max	Mean
Ammonia					
Type 1 Waste	TP49 & TP50	mg/kg as NH_4	528	1092	810
Type 2 Waste	GV1 to GV5 & BH17		1543	7586	3331
Native Soil	BH15 & BH16		1157	1414	1286
Chloride					
Type 1 Waste	TP49 & TP50	mg/kg	37	84	61
Type 2 Waste	GV1 to GV5 & BH17	mg/kg	13	521	193
Native Soil	BH15 & BH16	mg/kg	14	43	29
Sulphate					
Type 1 Waste	TP49 & TP50	mg/kg	18	41	29
Type 2 Waste	GV1 to GV5 & BH17	mg/kg	10	4505	1752
Native Soil	BH15 & BH16	mg/kg	<3	344	174

Table 2. Compounds Detected in Barnageeragh Waste Soil Samples

Contaminant Category	Type 1	Type 2
Aliphatic	None detected	EC 10-12, 12-16, 16-35, 35-C40
Aromatic	(generic TPH detected in some WWTP BH soil samples from 2005)	EC 10-12, 12-16, 16-21, 21-35, 35-44
PAH	All 17: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene,Chrysene, Benzo(bk)fluoranthene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(123cd)pyrene, Dibenzo(ah)anthracene, Benzo(ghi)perylene	
Other Organics	Total Phenols	Total Phenols, c-1,2-Dichloroethene, Vinyl Chloride
Metal	Antimony, Arsenic, Barium, Cadmium, Total Chromium, Chromium (III), Copper, Lead, Nickel, Molybdenum, Mercury, Zinc	Antimony, Arsenic, Barium, Cadmium, Total Chromium, Chromium (III), Copper, Lead, Nickel, Molybdenum, Mercury, Selenium, Zinc
Inorganic	Sulphate, Chloride, Ammonia	

Table 3. Compounds analysed for but not detected in Barnageeragh Waste Soil Samples

Contaminant Category	Type 1	Type 2
Aliphatic	EC: 5-6, 6-8, 8-10	
Aromatic	EC: 5-7, 7-8, 8-10, BTEX	
PAH	Coronene	
Other Organic	PCB (Total 7 Congeners)	
Metal	Cr(IV), Selenium	Cr(IV)
Inorganic	n/a	n/a

Table 4 provides details on the mobility and toxicity of the contaminants detected in the waste, as listed in Table 2. The selected SOCs are highlighted in Table 4. The detailed justification for the selection of each contaminant is shown in Table 5.

Table A2.2 in Appendix 2 shows the SOCs detected in the Type 1 and Type 2 waste at Barnageeragh, and provides details on the parameters controlling the migration of each contaminant in groundwater. The information in Table A2.2 in Appendix 2 was used to support the selection of SOCs and for SOC parameterisation in the subsequent detailed quantitative risk assessment (DQRA) modelling.

5.1.3 Other Detected Compounds

The remaining detected compounds not listed in Table 5 were not selected as substances of concern.

In general, the selected SOCs are considered to represent the worst case scenario for the site with respect to contaminant migration by substances within each contaminant category listed in Table 3. The contaminants that were not selected as SOCs, if modelled, would be expected to fall within the ranges of peak concentration, and minimum and maximum travel times determined from the modelled SOCs. As such, modelling of the unselected compounds would be superfluous.

Table 4. Mobility and Toxicity Characteristics of the Contaminants Detected in Type 1 and Type 2 Waste

Contaminant Category	Specific Example Compound for PubChem Parameter Search	LQM Log Koc (Consim)	LQM Koc (Consim)	Pubchem Koc	Pubchem Mobility Classification (Swann et al 1983)	Human Toxicity	Human Tox Data Source	Ecotoxicity	Eco Tox Data Source	Soil Threshold LQM Residential 2.5% SOM (mg/kg)	Groundwater Threshold SI366 of 2016 (ug/l)	Surface Water Threshold SI386 of 2015 (ug/l)
Aliphatic EC 10-12	n-Decane	5.38	239883	1500	Low mobility	Carcinogenic (Mineral Oil)	LQM	n-Decane harmful to aquatic organisms	PubChem	230	7.5	
Aliphatic EC 12-16	Dodecane	6.73	5370318	4800	Slight mobility	Carcinogenic (Mineral Oil)	LQM	na	PubChem	1700	7.5	
Aliphatic EC 16-35	n-HexaDecane	8.76	575439937	53000	Immobile	Carcinogenic (Mineral Oil)	LQM	Possibly not toxic	PubChem	64000	7.5	
Aromatic EC 10-12	Naphthalene	3.4	2512	112 to 9333	High to no mobility	Contains Possible Carcinogens (Napthalene)	LQM	Naphthalene toxic to aquatic organisms. Bioaccumulation	PubChem	160	7.5	
Aromatic EC 12-16	Acenaphthene	3.7	5012	3890	Slight to no mobility	-	LQM	Acenapthene very toxic to aquatic organisms	PubChem	310	7.5	
Aromatic EC 16-35	Benzo(a)pyrene	4.15	14125	3,760 to 1.3E6		Contains Carinogens (Benzo(a)pyrene	LQM	Benzo(a)pyrene very toxic to aquatic organisms. Possible bioaccumulation	PubChem	480	7.5	
Chlorinated Hydrocarbon	c-1,2-Dichloroethene	-	-	49	Very High	-	-	na	PubChem	-	0.375	
Chlorinated Hydrocarbon	Vinyl Chloride	1.22	17	57	High	Genotoxic Carcinogen	LQM	Possibly hazardous to the environment	PubChem	0.00064	0.375	
PAH	Naphthalene	2.81	646	112 to 9333	High to no mobility	Possible Carcinogen	LQM	Toxic to aquatic organisms. Bioaccumulation	PubChem	3.7	0.075	2
PAH	Acenaphthylene	3.26	1820	5620	Immobile	Questionable Genotoxin	LQM	na	PubChem	400	0.075	
PAH	Acenaphthene	3.37	2344	3890	Slight to no mobility	Questionable Genotoxic Carcinogen	LQM	Very toxic to aquatic organisms	PubChem	480	0.075	
PAH	Fluorene	3.45	2818	5011 to 16218	Immobile	-	LQM	na	PubChem	380	0.075	
PAH	Phenanthrene	3.74	5495	9180 to >31000	Immobile	Questionable Genotoxic Carcinogen	LQM	Possible aquatic biaccumulation and possible toxicity to aquatic organisms.	PubChem	200	0.075	
PAH	Anthracene	3.75	5623	2600 to 7E+05	Slight to no mobility	-	LQM	Very toxic to aquatic organisms	PubChem	4900	0.075	0.1
PAH	Fluoranthene	4.26	18197	2600 to 3E+05	Immobile	Genotoxic Carcinogen	LQM	Possibly toxic un UV light conditions	PubChem	460	0.075	0.1
PAH	Pyrene	4.21	16218	15,000 to 6E+06	Immobile	Questionable Genotoxic Carcinogen	LQM	Bioaccumulation. Toxic to aquatic organisms .	PubChem	1000	0.075	
PAH	Benzo(a)anthracene	4.89	77625	5E+05 to1.9E+6	Immobile	Genotoxic Carcinogen	LQM	Very toxic to aquatic organisms. Bioaccumulation	PubChem	4.7	0.075	
PAH	Chrysene	4.74	54954	5E+05 to 6E+07	Immobile	Genotoxic Carcinogen	LQM	Very toxic to aquatic organisms. Bioaccumulation	PubChem	8	0.075	
PAH	Benzo(b)fluoranthene	5.02	104713	4E+05 to 3E+08	Immobile	Genotoxic Carcinogen	LQM	Possibly hazardous to the environment	PubChem	6.5	0.075	0.03
PAH	Benzo(k)fluoranthene	5.17	147911	1E+06 to 8E+07	Immobile	Genotoxic Carcinogen	LQM	Possibly hazardous to the environment. Possible bioaccumulation.	PubChem	9.6	0.075	0.03
PAH	Benzo(a)pyrene	5.11	128825	3,760 to 1.3E6	Slight to no mobility	Genotoxic Carcinogen	LQM	Very toxic to aquatic organisms. Possible bioaccumulation	PubChem	0.94	0.0075	0.00017
PAH	Indeno(123cd)pyrene	4.94	87096	1.90E+06	Immobile	Genotoxic Carcinogen	LQM	Possibly hazardous to the environment. Possible aquatic bioaccumulation.	PubChem	3.9	0.075	0.002
PAH	Dibenzo(ah)anthracene	5.27	186209	6E+05 to 5E+07	Immobile	Genotoxic Carcinogen	LQM	Very toxic to aquatic organisms. Possible bioaccumulation	PubChem	0.86	0.075	

Table 4. Mobility and Toxicity Characteristics of the Contaminants Detected in Type 1 and Type 2 Waste

Contaminant Category	Specific Example Compound for PubChem Parameter Search	LQM Log Koc (Consim)	LQM Koc (Consim)	Pubchem Koc	Pubchem Mobility Classification (Swann et al 1983)	Human Toxicity	Human Tox Data Source	Ecotoxicity	Eco Tox Data Source	Soil Threshold LQM Residential 2.5% SOM (mg/kg)	Groundwater Threshold SI366 of 2016 (ug/l)	Surface Water Threshold SI386 of 2015 (ug/l)
PAH	Benzo(ghi)perylene	5.62	416869	4E+04 to 8E+08	Immobile	Genotoxic	LQM	Possibly hazardous to the environment	PubChem	46	0.075	0.002
Phenol	Total Phenols	1.46	28.8	16 to 91	Very High	Genotoxic	LQM	Toxic to aquatic organisms	PubChem	390		8
Inorganic			**Kd: LQM (L/kg) or Consim (ml/g)**	**Pubchem Kd**								
Metal	Antimony		-			Skin & mucous membrane irritant	PubChem	na	PubChem			
Metal	Arsenic		117			Carcinogenic	PubChem	Toxic to aquatic organisms	PubChem		7.5	25
Metal	Barium		17			Acute toxicity - gastrointestinal	PubChem	na	PubChem			
Metal	Cadmium		110 3.7-74-1500 SAND			Genotoxic Carcinogen	LQM	na	PubChem	3		0.25
Metal	Total Chromium		1-67-4400 SAND;			Cr (VI) acute toxicity & carcinogenic	PubChem	na	PubChem		37.5	
Metal	Chromium (III)		4800			Irritant	LQM	na	PubChem	3000		4.7
Metal	Copper		100 295			Irritation, lung damage	LQM	Very toxic to aquatic organisms. Bioaccumulation	PubChem	2330		30
Metal	Lead		27-270-2.7E4 SAND			neurotoxicity, neurodevelopmental defects, gastrointestinal, kidney and bone marrow toxicity	PubChem	Bioaccumulation	PubChem		7.5	1.2
Metal	Nickel		-			Carcinogenic & allergen	PubChem	Harmful to aquatic organisms	PubChem			4
Metal	Molybdenum		110			Irritant	PubChem	na	PubChem			
Metal	Mercury		450			Acute and chronic toxicity to CNS	PubChem	Very toxic to aquatic organisms. Bioaccumulation	PubChem		0.75	0.07
Metal	Zinc		38 1.1-200-3.6E4 SAND;			Not toxic	LQM	Very toxic to aquatic organisms	PubChem	3750	75	100
Major Ion	Sulphate		-	-		Laxative effect	EPA	na			187500	
Major Ion	Chloride		0			Palatability issues at >250 to 2000 mg/l	EPA	na			187500	
Major Ion	Ammonia (as N)		0.4 to 0.9			Non-toxic	PubChem	Toxic to aquatic organisms	PubChem		175	65 (mean) or 140 (95%ile)

Table 5. Selection of Substances of Concern

Contaminant Category	Substance of Concern	Justification for Selection
Inorganic Major Ion	Chloride	Chloride is fully mobile in the sub-surface (i.e. it does not undergo retardation by adsorption on to soil or by biodegradation). It has a soil:water partition coefficient (k_d) value of zero, which means it is not expected to adsorb onto the soil at all. It is also not expected to biodegrade or undergo any other chemical transformations which would decrease its groundwater concentration. It migrates at the same velocity as the groundwater (i.e. advective transport) and its concentration is only affected by dilution and dispersion. It is regarded as an indicator parameter for contaminant migration trends. • It indicates the un-retarded travel time for contaminants to reach receptors of interest. Retarded contaminants will arrive later than chloride. • It indicates the peak concentration at the receptor relative to the initial soil concentrations. Retarded contaminants will have lower peak concentrations relative to their initial soil concentrations. Chloride is not considered to be toxic. It has drinking water palatability issues above 250 mg/l, however water with chloride concentrations up to 2,000 mg/l are used for water supply in some arid areas (EPA, 2001). Chloride was detected at high concentrations in soil samples from Type 1 and Type 2 waste (up to 16,000 and 2,200 mg/kg respectively). **Overall**, chloride is non-toxic and was selected due to its high mobility which renders it a useful baseline indicator against which to compare the behaviour of other contaminants.
Inorganic Major Ion	Ammonia	Ammonia has high mobility with a k_d value of less than one. Its migration in the groundwater is slowed by adsorption onto soil particles due to cation exchange. It is subject to biodegradation in groundwater, typically by nitrification (microbial transformation to nitrate), which reduces its groundwater concentration over time. Ammonia has a typical biodegradation half life of 1 to 6 years in groundwater (Buss et al 2004). Higher biodegradation rates have also been reported, with a half life of 13 days for ammonia transport through shallow unsaturated sandy soil from initial concentrations of 27 mg/l NH_4 as N. These high rates are only considered to be relevant in relatively shallow subsoils where high biological growth rates can be supported by the contaminants in the plume (Buss et al 2004). Ammonia is considered to be non-toxic to humans and drinking water quality standards related to ammonia are generally based on using ammonia as a potential indicator of the presence of substances which may be toxic or pathogenic. Ammonia is toxic to aquatic organisms and as such, surface water quality standards for ammonia are more stringent than drinking water targeted standards. Ammonia was detected at concentrations of up to 1,100 and 7,600 mg/kg respectively in the Type 1 and Type 2 waste soil samples collected in 2018. Elevated concentrations of ammonia were detected in downgradient groundwater and in a water sample collected from BH7, which is screened within the waste.

Contaminant Category	Substance of Concern	Justification for Selection
		Overall, ammonia was selected due to its high mobility and its toxicity to aquatic organisms. The DQRA objective for ammonia is to assess the potential to exceed environmental quality standards for ammonia (EQSs) at the downgradient surface water receptors. The ammonia concentrations are not of concern from a human toxicity perspective. The Barnageeragh aquifer is comprised of shallow subsoils and shallow very weathered rock which would receive aerobic recharge from parts of the site outside the waste footprint. The groundwater beneath the site has a high concentration of dissolved inorganic carbon (as indicated by alkalinity data) to support microbial synthesis and high concentrations of the essential nutrient potassium. Phosphorous is another essential nutrient and is present in high concentrations beneath the waste footprint. As such, it is considered that high nitrification rates may be possible in the groundwater in the vicinity of the site. A biodegradation half life range of 13 days to 6 years is assumed for the DQRA.
Inorganic Metal	Arsenic	Arsenic mobility is complex and is highly influenced by the prevailing groundwater pH and redox conditions. Arsenic often occurs naturally bound up in iron oxide minerals, which are ubiquitous in subsoil. In aerobic environments where iron oxide minerals are stable and the pH is >4.1, elevated concentrations of arsenic would not be expected to occur. In anaerobic environments, iron oxide particles containing arsenic impurities are likely to dissolve and release the arsenic. The arsenic will likely occur as arsenite (+3 redox state) in the anaerobic environment. If sulphide is present in the groundwater, the dissolved iron and arsenite are expected to precipitate as iron and arsenic sulphide respectively. In anaerobic conditions where sulphide is absent the dissolved arsenite would be expected to be stable in the groundwater from redox and mineral equilibrium perspectives. Under these conditions pH dependant sorption of arsenite onto other soil mineral surfaces could still be expected. The ConSim contaminant reference inventory indicates that research focused on landfills and contaminated land sites has found that a K_d value of 117 can be attributed to arsenic. It is assumed (here) that as the work relates to conditions beneath landfills, the arsenic K_d value of 117 relates to sorbtion of arsenite under anaerobic conditions with pH >4.1 in the absence of sulphide, which is equivalent to the conditions beneath the Barnageeragh site. The soil data in Appendix 2 show that arsenic concentrations in indigenous and waste free soil at the site have a similar range to that found in the Type 1 and Type 2 waste. Arsenic was detected at elevated concentrations in some soil samples in the Type 1 and Type 2 soils, and in the indigenous / waste free soil. The groundwater quality data for the site indicate anaerobic conditions with a general absence of sulphide in the boreholes downgradient of the waste. These conditions are suitable for the mobilisation of naturally occurring arsenic in the waste and in the native subsoil. Arsenic was detected at slightly elevated concentrations in groundwater at BH4 in August 2017 and BH1 in November 2017. It is possible that the elevated concentrations of arsenic detected in the groundwater derive from mobilisation of naturally occurring arsenic, albeit driven by the anaerobic plume generated by the waste. Arsenic is highly toxic and carcinogenic to humans and is toxic to aquatic organisms.

Contaminant Category	Substance of Concern	Justification for Selection
		Overall, arsenic was selected due to its toxicity, and because it is moderately mobile and was detected in soil samples in combination with elevated concentrations in the groundwater downgradient of the site. The DQRA representation of arsenic will be **highly conservative** as it takes no account of the freshening of the plume of contaminated groundwater downgradient of the site. As the plume mixes with aerobic downgradient groundwater and becomes increasingly aerobic, the arsenite will oxidise to arsenate and become strongly sorbed onto stable existing iron oxides as well as being captured in precipitating dissolved iron.
Inorganic Metal	Mercury	Mercury has low to moderate mobility with a K_d value of 450. Most inorganic mercury compounds have low solubility. Mercury is known to be more soluble in groundwater in the presence of chloride, due to the formation of the $HgCl_2$ complex. In addition methane generating bacteria can convert metallic mercury to organic forms, such as methyl mercury which is soluble in water. Mercury is highly toxic to humans and to aquatic organisms and undergoes bioaccumulation. Mercury was detected at slightly elevated concentrations in groundwater at BH1, BH3 and BH11 in August 2017; in BH10 in November 2017 and in BH11 in May 2018. The Dutch Target Value (TV) for soils of 0.3 mg/kg was exceeded by soil mercury concentrations in some samples of Type 1 and Type 2 waste, but not by samples of indigenous soil / waste free fill. This suggests the mercury detected in groundwater could derive from the waste source. It is possible that the slight gas generation within the waste and the high chloride concentrations observed in the groundwater within the waste (e.g. at BH1) may be mobilising the occasional above TV concentrations of mercury that occur in the waste soils, resulting in the observed elevated mercury detections in the groundwater. **Overall**, mercury was selected due to its toxicity and due to its detection in the downgradient groundwater which indicates that it has some mobility beneath the site.
Inorganic Metal	Lead	Lead has low to high mobility, with a typical K_d value of 270 and a range of 27 to 27,000. Lead is highly toxic to humans and bioaccumulates. The Dutch Intervention Value (IV) for soils of 530 mg/kg was exceeded by soil lead concentrations in some samples of Type 1 and Type 2 waste, but not by samples of indigenous soil / waste free fill. The detected lead concentration range is the highest of the Inorganic Metal category, except for Zinc which had concentrations approximately twice those of lead. Lead has not been detected in the groundwater beneath the site to date. The Environmental Quality Standards (EQSs) for groundwater and surface water for lead are approximately a factor of 10 lower than those for Zinc.

Contaminant Category	Substance of Concern	Justification for Selection
		Overall, lead was selected due to its typically moderate mobility, toxicity to humans, and occasional elevated concentrations in the waste soil. Although elevated groundwater concentrations have not been observed to date **it is considered conservative** to examine the behaviour of a moderately mobile metal with relatively high concentrations to see if elevated concentrations could be expected at receptors in future. Although soil lead concentrations are half those of zinc, its 10 times lower EQSs make it the more conservative parameter to model as a check against parameters not detected in the groundwater.
TPHCWG Aliphatic Fractions	EC>C10 to C12 and EC> C16 to C35	The TPHCWG aliphatic fractions vary from low mobility for the lightest compounds (EC>C10 to C12) to immobile for the heaviest compounds (EC>C16 to C35). The TPH compounds are likely to be toxic to humans including carcinogenic while the lighter end compounds may be toxic to aquatic life. The TPHCWG Aliphatic Fractions EC>C10 to C12, and EC> C16 to C35 were detected in some soil samples from Type 2 waste. No TPHCWG compounds were detected in groundwater beneath the site. The EC>C10 to C12 soil concentrations were low. **Overall**, in spite of the low concentrations, n-Decane was selected as an indicator of the mobile end of the EC>C10 to C12 range. The EC>C16 to C35 soil concentrations were the highest detected concentrations of compounds from the aliphatic hydrocarbons. **Overall**, n-Hexadecane was selected as an indicator of the mobile end of the EC> C16 to C35 range (although this is still considered to be relatively immobile). The assessment conservatively assumes all of the detected concentration of EC>C10 to C12 and EC>C16 to C35 compounds, apply to the respective individual indicator compounds.
TPHCWG Aromatic Fractions	EC>C10 to C12 and EC> C16 to C35	The TPHCWG aromatic fractions vary from high mobility to immobile for the lightest compounds (EC>C10 to C12) to immobile for the heaviest compounds (EC>C16 to C35). The TPH compounds are likely to be toxic to humans including carcinogenic and toxic to aquatic life. The TPHCWG Aromatic Fractions EC>C10 to C12 and EC> C16 to C35 were detected in some soil samples from Type 1 and Type 2 waste. No TPHCWG compounds were detected in groundwater beneath the site. The EC>C10 to C12 soil concentrations were low. **Overall**, in spite of the low concentrations, Naphthalene was selected as an indicator of the mobile end of the EC>C10 to C12 range. Naphthalene was detected in Type 1 and Type 2 waste in specific analysis for PAHs. The EC> C16 to C35 soil concentrations were the highest detected concentrations of compounds from the aromatic hydrocarbons. **Overall,** Benzo(a)pyrene was selected as an indicator of the mobile end of the EC> C16 to C35 range (although this is still considered to be relatively immobile). Benzo(a)pyrene was detected in Type 1 and Type 2 waste in specific analysis for PAHs.

Contaminant Category	Substance of Concern	Justification for Selection
		The assessment conservatively assumes all of the detected concentration of EC>C10 to C12 and EC>C16 to C35 compounds, apply to the respective individual indicator compounds. It is noted that the absence of lighter aliphatic and aromatic hydrocarbons, (e.g. BTEX, n-hexane) suggests that the TPH contamination is old and highly weathered, with the lighter fractions already removed through volatilisation and leaching.
PAH	Naphthalene	Naphthalene mobility ranges from high to no mobility. Naphthalene is a possible carcinogen and is toxic to aquatic organisms and bioaccumulates. It is identified as a priority substance in the Surface Water Regulations SI 386 of 2015. Naphthalene was detected at low concentrations in the Type 1 and Type 2 waste soil samples. No PAH compounds were detected in the groundwater beneath the site. **Overall**, Napthalene was selected as it is the most mobile compound in the PAH group, due to its human and aquatic toxicity, and because it was detected in the waste soils (albeit at low concentrations). In addition it represents the behaviour of the TPHCWG aromatic EC>C10 to C12 group.
PAH	Benzo(a)pyrene	Benzo(a)pyrene mobility ranges from slight to no mobility. Benzo(a)pyrene is a genotoxic carcinogen and is very toxic to aquatic organisms. It is identified as a priority hazardous substance in the Surface Water Regulations SI 386 of 2015. Benzo(a)pyrene was detected in the Type 1 and Type 2 waste soil samples and the observed concentrations were at the higher end of the range for the PAH group detections at the site. The maximum soil concentrations in the Type 2 waste exceeded the LQM residential threshold of 0.94 mg/kg for soil with 2.5% organic matter. No PAH compounds were detected in the groundwater beneath the site. **Overall**, Benzo(a)pyrene was selected as it is one of the most toxic compounds in the PAH group, with respect to humans and the aquatic environment, and because it was detected in the waste soils (albeit at low concentrations). As such even though it has only slight to no mobility extremely trace quantities would in water would be sufficient to breach very stringent groundwater and surface water thresholds. In addition it represents the behaviour of the TPHCWG aromatic EC>C16 to C35 group.

Contaminant Category	Substance of Concern	Justification for Selection
Chlorinated Hydrocarbon	c-1,2-Dichloroethene	c-1,2-Dichloroethene has very high mobility. c-1,2-Dichloroethene is not considered to be toxic; however it is a precursor to the carcinogenic compound vinyl chloride in the biodegradation of chlorinated alkenes. c-1,2-Dichloroethene was detected at low concentrations in one soil sample from the Type 2 waste. Vinyl Chloride was also detected in one sample but at lower concentrations than c-1,2-Dichloroethene. No chlorinated hydrocarbon compounds were detected in the groundwater beneath the site. **Overall,** c-1,2-Dichloroethene was selected as it has slightly higher mobility than vinyl chloride and had slightly higher concentrations. It is also more persistent in aerobic groundwater. As such c-1,2-Dichloroethene was selected to model as an indicator of the risk to groundwater from more toxic chlorinated hydrocarbons such as vinyl chloride.
Total Phenols	Phenol	Phenol has very high mobility. Phenol is genotoxic to humans and is toxic to aquatic organisms. Total phenols were detected at low concentrations in the Type 1 and Type 2 waste soil samples. No phenolic compounds were detected in the groundwater beneath the site. **Overall,** phenol was selected as it is highly mobile and toxic to humans and the aquatic environment and was detected at low concentrations in the waste soils on site. The assessment conservatively assumes all of the detected total phenol concentration applies to the individual phenol compound.

5.1.3.1 Sulphate Contamination

Fingal County Council specifically requested clarification of the decision not to select sulphate as a SOC. Elevated above background concentrations of sulphate were detected in the Type 1 and Type 2 waste soil samples. Sulphate concentrations in groundwater exceeded the SI 366 of 2016 threshold for sulphate in groundwater at boreholes BH1, BH3, BH8, BH11, BH12 and BH15.

Sulphate is considered to be highly mobile in the subsurface and, similarly to chloride, would not be expected to be retarded by adsorption onto the soil. In strongly anaerobic environments sulphate may be used as an oxidising agent by microbes and reduced to sulphide. If hydrogen sulphide occurs in the presence of iron then pyrite precipitation may occur and act as a sink for the sulphide (Fetter 1999). No sulphide was detected in the groundwater beneath the site.

Sulphate is not considered to be toxic to humans, but has a laxative effect at concentrations above the drinking water standard of 250 mg/l. It is not considered to have significant ecotoxicity. As such, similar to chloride, elevated sulphate concentrations in groundwater have only mild consequences from a drinking water perspective.

The hydrochemical modelling software Phreeqc was used to simulate the hydrochemical composition of the groundwater samples from May 2018. The software calculates the activity (i.e. effective concentration) of each element in solution and the saturation indices of all the likely soil minerals that could be equilibrating with the observed sample composition. The results of the exercise indicated that the samples with elevated above background sulphate concentrations (i.e. BH1, BH3, BH11, BH12 and BH15) were all close to equilibrium with dissolution of the mineral calcium sulphate (i.e. almost saturated with respect to gypsum), with saturation index values of >-1. The results showed that all of the samples were very under-saturated with respect to the mineral pyrite. This would suggest that the elevated above background concentrations of sulphate observed in the groundwater beneath the site derive from dissolution of gypsum in the waste soil. It would also suggest that reduction of sulphate to sulphide under strongly anaerobic conditions and masking of the sulphide production by precipitation of the sulphide as pyrite does not occur, as otherwise the groundwater would be expected to be close to equilibrium with the mineral pyrite. As such, the data suggest that the sulphate present in the groundwater is stable under the prevailing conditions and is likely to be highly mobile in the groundwater, similar to chloride.

Sulphate concentrations in the Type 1 and Type 2 waste ranged from 18 to 41 mg/kg and 10 to 4505 mg/kg respectively. Chloride concentrations in the the Type 1 and Type 2 waste ranged from 37 to 84 mg/kg and 13 to 521 mg/kg respectively.

Overall, available data suggest that chloride and sulphate are likely to behave in a similar highly mobile way in groundwater beneath the site. Both compounds are non-toxic and their environmental quality standards are related to minimising negative cosmetic aspects of drinking water supply. There are no groundwater abstractions in the vicinity of the site. As such, the elevated concentrations of chloride and sulphate observed in the groundwater are not considered to have a significant negative environmental impact.

In terms of DQRA modelling the compounds are only significant as highly mobile indicator compounds indicating the earliest likely contaminant break-through time and expected peak concentrations at receptor relative to the initial source concentration. In the DQRA both compounds would be modelled with a k_d value of zero and with similar source concentration ranges, such that the modelling results of the two compounds would largely duplicate each other. To avoid this duplication chloride was selected as a SOC for DQRA modelling ahead of sulphate as it is ultimately more stable in the groundwater than sulphate and is typically the default compound used to indicate the behaviour of a stable, highly mobile indicator parameter in a DQRA.

5.2 Pathways

The pathway of interest with respect to migration of contaminants from the waste source is the groundwater pathway. This pathway begins with infiltration of rain water through the waste. The infiltrating water (recharge) encounters and dissolves the source contaminants within the waste. The recharge continues to infiltrate vertically through the subsoil below the landfill until it reaches the groundwater table. At this point the contaminated groundwater builds up to form a "recharge mound" below the topographic ridge formed by the landfill and surrounding area and begins to flow out laterally, radially from the mound to the south, east and north-northeast. Some contaminants may be subject to attenuation along the migration pathway by processes such as sorption and biodegradation. The site itself forms the "headwaters" of the groundwater flow in the aquifer underlying the site, so there is no lateral inflow of clean groundwater from upgradient. Further infiltration down through to the deep bedrock aquifer is considered to be negligible as any flow in the deep bedrock aquifer is likely to occur under an upward gradient driving coastal groundwater discharge. It is assumed that as lateral groundwater flow occurs, the contaminant loading becomes fully mixed into and diluted by groundwater deriving from clean recharge to parts of the site away from the landfill.

5.2.1 DQRA Pathway Conceptual Issues

5.2.1.1 Groundwater Flow in the DQRA

The CONSIM software enforces the simulation of groundwater flow from upgradient to downgradient beneath the site, such that contaminated infiltration mixes into the underlying groundwater flow. This is not strictly representative of the Barnageeragh Cove site, which is situated over a groundwater mound and does not have influent groundwater flow from upgradient.

In the DQRA the groundwater "through-flow" has been modelled based on the site data for hydraulic gradient and hydraulic conductivity. The resulting modelled groundwater flows are broadly similar to the volume of recharge to the site area outside the waste footprint. In reality the contaminated recharge from the landfill footprint will be diluted by the clean recharge from out side the landfill footprint. In the DQRA the contaminated recharge from the landfill footprint is diluted by the groundwater "through-flow". As the clean recharge volume and the groundwater "through-flow" volumes are similar the DQRA is considered to be representative of the real aquifer, in spite of the conceptual hurdle. The calculations for the comparison of recharge volumes versus Darcian groundwater flow are shown in Table 6.

5.2.1.2 Pathway Variation with Groundwater Level

The updated hydrogeological conceptual model shows that the groundwater pathway beneath the site varies depending on the watertable elevation.

During periods of high watertable elevation, groundwater flow beneath the site is directed towards and discharges to the site eastern boundary stream (Figure 4a). In the DQRA this has been represented as a "Maximum Watertable Pathway" as set out in Figure 6 and Section 4.2.7.1.

During periods of low watertable elevation, the watertable lies below the invert level of the site eastern boundary stream. The groundwater flows eastward beneath the site boundary stream and adjacent WWTP site and eventually discharges to the Barnageeragh Stream to the east of the WWTP site (Figure 4b). In the DQRA this has been represented as a "Minimum Watertable Pathway" set out in Figure 7 and Section 4.2.7.2.

5.2.1.3 Type 2 waste present below the watertable.

Figure 5 shows that a component of the Type 2 waste is permanently submerged beneath the watertable. The footprint of the submerged area under maximum and minimum groundwater elevation conditions is shown in Figures 5(g) and 5(h). For the submerged waste contaminant mobilisation is effected by horizontal seepage of groundwater through the waste. This is in contrast to the above watertable waste for which contaminant mobilisation is effected by vertical infiltration of rainfall through the waste.

CONSIM does not simulate contaminant mobilisation by horizontal seepage of groundwater through the waste. In order to approximate this process in the CONSIM model the volume of groundwater seepage through the submerged waste was estimated for maximum and minimum groundwater elevation conditions based on Darcy's law using:

- The groundwater hydraulic gradient specific to the groundwater elevation conditions;
- The thickness of submerged waste specific to the groundwater elevation conditions;
- The width of submerged waste perpendicular to the groundwater flow direction for the specific groundwater elevation conditions; and,
- The hydraulic conductivity of the submerged waste. The UK landfill aftercare decision support system database (LANDSS) gives a range of 1E-03 m/s to 1E-09 m/s for the saturated hydraulic conductivity of landfilled municipal solid waste, with values typical between 1E-05 m/s and 1E-06 m/s. LANDSS information indicates that for conditions where flowing landfill gas results in unsaturated conditions (i.e. part of the pore space occupied by landfill gas) the resulting unsaturated hydraulic conductivity will be about 0.1 times the saturated value. As such the waste hydraulic conductivity value for the Darcy flow calculation was assumed to be 1 e-07 m/s.

The estimated volume of groundwater flow was then converted to an equivalent infiltration rate by dividing the flow volume by the plan area of the submerged waste. The infiltration rate was then applied to the model source representing the submerged waste.

In this way the contaminant mobilisation resulting from horizontal groundwater flow through waste on the real site, was simulated as an equivalent volume of vertical infiltration through the waste. The vertical infiltration and the contaminants mobilised subsequently passed directly into the aquifer pathway. This is considered to be generate the same contaminant loading on the aquifer pathway as the the real situation where the contaminants are mobilised by the horizontal groundwater flow.

The modelled groundwater flow beneath the site was reduced by the volume of "equivalent-infiltration" in order to avoid double-accounting of the volume of "groundwater" flow through the submerged waste source. Maintaining the water balance integrity in this way meant that degree of modelled contaminant dilution by groundwater flow was maintained in line with the site conceptual model.

5.2.1.4 Pathway Remedial Options

The effectiveness of an engineered landfill cap for preventing groundwater pollution at the site has been examined as part of the DQRA. An engineered landfill cap changes the pathway component of the site SPR model by reducing the infiltration rate through the waste.

In its current state the contaminant source has a cap of varying thickness comprised of subsoils imported from the surrounding area. Infiltration through the existing cap is estimated at 239 mm/yr (Table 6).

Table 6.
ConSim Model Parameterisation

Details	Units	Distribution	Min or Best	Max	Median	Justification
Scenario 01						**Maximum Watertable Elevation (as represented by 30/01/2018)**
Waste Source						
Name		Barnageeragh LF				Waste material predominantly logged as SILT/CLAY.
Fraction of Organic Carbon	%	Uniform	0.34	2.7		Site specific data for soil samples from indigenous subsoil and waste free soil (FILL). Values from samples containing waste excluded due to contamination from waste organic matter. Inclusion of waste organic matter in the Foc would overestimate the Foc available in the SILT/CLAY matrix to adsorb organic contaminants released by the waste material.
Dry Bulk Density	g/cm3	Single	1.4			Consim help file --> SILT: 1.82 to 2.15; SAND 1.3 to 1.8; Gravel 1.36 to 2.19 Modelled value calibrated in association with Particle density within typical ranges, to allow model to run with the site specific Moisture Content range, without resulting in error whereby waste saturation exceeds 100%
Calculate Porosities	yes/no	Yes	0.54			ConSim calculates porosity as bulk density/particle density
Moisture Content Type 1 waste	%	Uniform	8	25		Moisture Content data for Type 1 Waste soil sample laboratory analyses.
Moisture Content Type 2 waste	%	Uniform	8.9	21		Moisture Content data for Type 2 Waste soil sample laboratory analyses.
Particle Density	g/cm3	Single	2.6			Modelled vlaue calibrated in association with Particle density within typical ranges, to allow model to run with the site specific Moisture Content range, without resulting in error whereby waste saturation exceeds 100%
Air Filled Porosity	fraction		*45.8*	*28.8*		Calculated porosity minus water filled porosity
Water Filled Porosity	fraction		*8.00*	*25.00*		Assume equal to moisture content
Thickness (Overall Waste Thickness)	m	Triangular	0.03	12.36	6.58	From Waste Thickness grid statistics from Surfer grid file. Grid file generated as follows: Create grid (A) of ground surface from topographic survey ground level contour data Create grid (B) of bottom surface of waste from geophysical survey data and borehole data Create grid of waste thickness by subtraction, i.e. Grid A - Grid B Subtract 1 m from Max and Median thicknesses to allow for 1 m of soil cap over the waste Separate ranges entered for Type 1 and Type 2 waste sources based on relevant subset of overall thickness (see below).
Centre Definition		Random Sampling				Consim help file recommendation. Eliminates bias
Declining Source		Consim Calc				CONSIM calculates decline of source concentration based on kappa values, which are derived from the inverse of the contaminant Kd, i.e. 1/Kd
Infiltration	mm/yr	Single	239			MetIE data: PPT Skerries Miverton 1981 to 2006 = 760mm/yr; PE Dublin Airport 1981 to 2000 = 548/yr; Assume AE = 095*PE = 521 mm/yr; Infiltration = 239 mm/yr
Infiltration for Engineered Landfill Cap	mm/yr	Single	31			Cap with 1.0E-09 m/s vertical hydraulic conductivity with a vertical hydraulic gradient of 1 across the cap.
Infiltration for Bio Window	mm/yr	Single	120			Permeable area of cap for gas venting. Evapotranspiration and reduced hydraulic conductivity due to gas flow result in 50% decrease in+G2 infiltration rate compared to uncapped areas.

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Table 6.
ConSim Model Parameterisation

Details	Units	Distribution	Min or Best	Max	Median	Justification
Groundwater flow through submerged waste simulated as an equivalent volume of infiltration	mm/yr	Triangular				CONSIM only simulates above watertable contaminant sources. A component of the type 2 waste is always below the watertable. In order to simulate the areas where a component of waste column is submerged the footprint of the submerged waste was set up as 2 individual sources on the same model footprint. One of the sources represented waste above the watertable and was given the appropriate uncapped/bio-window/capped infiltration rate depending on the scenario. The other source represented the submerged waste with horizontal groundwater flow seeping through it. Based on the width, thickness and hydraulic conductivity of the submerged waste, and the site hydraulic gradient, the volume of groundwater flow through the waste under maximum and minimum groundwater elevation conditions was estimated. The resulting volume was converted to an infiltration rate by dividing by the plan area of the source. In this way the contaminant mobilisation resulting from groundwater flow through waste on the real site, was simulated as vertical infiltration through the waste which subsequently passed directly into the aquifer pathway. The modelled groundwater flow was reduced by the volume of "equivalent-infiltration" in order to avoid doubling the volume of "groundwater" flow through the submerged waste source.
Source Area						
Type 1 Waste Footprint	.shp	ME shapefile				Digitised waste Type 1 footprint interpreted from site specific site investigation experience, trial pit and borehole logs, and from soil quality data from laboratory analyses.
Type 1 Thickness	m	Triangular	0.84	8.18	3.41	Waste thickness grid for the full waste body clipped to the Type 1 waste footprint. Resulting surfer grid file used to generate thickness statistics for the Type 1 waste. Subtract 1 m from thicknesses to allow for 1 m of soil cap over the waste. Triangular distribution using Min, Median and Max values from grid
Type 2 Waste Footprint	.shp	ME shapefile				Digitised waste Type 2 footprint interpreted from site specific site investigation experience, trial pit and borehole logs, and from soil quality data from laboratory analyses.
Type 2 Thickness	m	Triangular	0.03	12.36	7.74	Waste thickness grid for the full waste body clipped to the Type 2 waste footprint. Resulting surfer grid file used to generate thickness statistics for the Type 2 waste. Subtract 1 m from thicknesses to allow for 1 m of soil cap over the waste. Triangular distribution usin Min, Median and Max values from grid
Simulation of Thickness and Unsaturated Zone for areas with submerged waste and with Capped Landfill	m	Triangular				In order to simulate areas with different characteristics across the waste footprint, the waste thickness unsaturated zone distributions relating to each individual area was extracted from the relevant overall waste thickness and unsaturated zone datasets and the relevant area subsequently set up in CONSIM as an individual source with it's own footprint specific thickness and unsaturated zone characteristics. The areas separated out are Type 1 capped, Type 1 Soil Cover (uncapped), Type 2 Capped with all waste above the water table, Type 2 Capped with waste partially below watertable, Type 2 waste with Biowindow cap. The Type 2 partially submerged and Biowindow areas were sub-divided vertically into 2 sources each, i.e. an upper source where the waste is above the watertable, and a lower source where the waste is below the watertable.

Table 6.
ConSim Model Parameterisation

Details	Units	Distribution	Min or Best	Max	Median	Justification
Unsaturated Zone						
Type 1 waste source UZ Overall Thickness	m	Triangular	0.65	7.64	5.4	From Unsaturated Zone Thickness grid statistics from Surfer grid file. Grid file generated as follows: Create grid (A) of bottom surface of waste from geophysical survey data and borehole data Create grid (B) of maximum groundwater elevation from interpreted groundwater elevation contours on 30/01/2018 (maximum known groundwater elevation beneath waste) Create grid of UZ thickness by subtraction, i.e. Grid A - Grid B Clip grid to Waste Type 1 Footprint
Type 2 waste source UZ Overall Thickness	m	Triangular	0	7.73	0	From Unsaturated Zone Thickness grid statistics from Surfer grid file. Grid file generated as follows: Create grid (A) of bottom surface of waste from geophysical survey data and borehole data Create grid (B) of maximum groundwater elevation from interpreted groundwater elevation contours on 30/01/2018 (maximum known groundwater elevation beneath waste) Create grid of UZ thickness by subtraction, i.e. Grid A - Grid B Clip grid to Waste Type 2 Footprint
Water Filled Porosity	fraction	Uniform	0.24	0.38		BH logs and Geophysical data suggest the waste is underlain by sandy GRAVEL to GRAVEL Consim help file --> SAND: 0.26 to 0.53; GRAVEL: 0.24 to 0.38
Dry Bulk Density	g/cm3	Uniform	1.36	2.19		BH logs and Geophysical data suggest the waste is underlain by sandy GRAVEL to GRAVEL Consim help file --> gravelly SAND: 1.37 to 1.81; GRAVEL: 1.36 to 2.19
Saturated Hydraulic Conductivity (Ks)	m/s	Log Triangular	1.02E-06	9.27E-05	2.63E-06	Unsaturated zone comprises GRAVEL subsoils. Site specific pumping test data suggest K values for sand and gravel deposits at the site range from 0.09 to 8.0 m/d with geometric mean of 0.2 m/d. Hydraulic conductivity generally expected to have a log normal distribution, however there are insufficient data to support calculation of geometric mean and standard deviation. Input data as log triangular distribution. CONSIM help file indicates that When parameter values vary by orders of magnitude, the specification of a log triangular distribution (triangular distribution of the logs of values) avoids skewing the distribution towards the upper or lower values. This approach is applicable to hydraulic conductivity data.
UZ Moisture Content	%	Uniform	4.6	14		Site specific data for soil samples from indigenous subsoil beneath waste and waste free soil (FILL) outside waste footprint where logged soil type is SAND or GRAVEL (2 no.), or predominantly SAND or GRAVEL (1 no.), or SILT/CLAY with a significant sand and gravel component (1 no.)
UZ effective saturation (Se)	[-]	Uniform	0.18			(θ - θr)/(θs - θr)where, θ = average site specfici UZ moisture content = 0.093 θs = average of water filled porosity for UZ deposits = 0.31 θr = minimum (irreducible) moisture content = 0.045 for SAND (from Fetter 1990, Table 4.1, p180)
Van Genuchten Soil Parameter (m)	[-]	Uniform	0.63			m = (1-1/n), where n = 2.68 for SAND (from Fetter 1990, Table 4.1, p180)
Unsaturated Hydraulic Conductivity (Kθ)	m/s	Log Triangular	7.50E-10	6.82E-08	1.93E-09	K(θ) = Ks*Se^0.5*[1-(1-Se^(1/m))^m]^2
Vertical Dispersivity Type 1 waste	m	Triangular	0.065	0.764	0.54	Estimated as 0.1 x Unsaterated Zone thickness
Vertical Dispersivity Type 2 waste	m	Triangular	0	0.773	0.773	Estimated as 0.1 x Unsaterated Zone thickness

Table 6.
ConSim Model Parameterisation

Details	Units	Distribution	Min or Best	Max	Median	Justification
Aquifer Pathway						
Thickness	m	Triangular	2	7.5	5.1	Based on site specific data for subsoil and bedrock thicknesses from boreholes that penetrate the bedrock. Aquifer thickness at each borehole taken as: The thickness of sandy GRAVEL deposits encountered; Plus, For boreholes with SILTSTONE bedrock only and no water strike recorded in the SILTSTONE, the bedrock aquifer is assumed to be an upper weathered zone 2 m thick. For boreholes with SANDSTONE Bedrock, the bedrock aquifer component is assumed to be equal to the thickness of SANDSTONE encountered or 2m, whichever is greater.
Dry Bulk Density	g/cm3		1.36	2.68		Consim help file: Gravelly Sand: 1.37 to 1.87 Gravel: 1.36 to 2.19 SANDSTONE: 1.6 to 2.68
Mixing Zone Thickness	m	Triangular	2	7.5	5.1	Conceptual model considers that all flow in the saturated subsoils derives from infiltration to the site. As such the infiltration is assumed to be fully mixed into the groundwater flow in the saturated subsoil beneath the site.
Hydraulic Conductivity	m/s	Log Triangular	2.9E-07	9.9E-04	3.2E-05	Saturated zone comprises GRAVEL subsoils underlain by SILTSTONE and SANDSTONE bedrock. HCM considers highest K values relate to SANDSTONE/very weathered SILTSTONE while values in SAND & GRAVEL and weathered SILTSTONE are similar to each other. Full dataset of K values used to derive minimum, maximum and geometric mean values for aquifer hydraulic conductivity. Hydraulic conductivity generally expected to have a log normal distribution, however there are insufficient data to support calculation of geometric mean and standard deviation. Input data as log triangular distribution. CONSIM help file indicates that When parameter values vary by orders of magnitude, the specification of a log triangular distribution (triangular distribution of the logs of values) avoids skewing the distribution towards the upper or lower values. This approach is applicable to hydraulic conductivity data.
Effective Porosity	fraction	Uniform	0.05	0.41		Aquifer comprises Sandy GRAVEL toGRAVEL deposits underlain by SILTSTONE & SANDSTONE bedrock. Consim help file: GRAVEL: 0.24 to 0.38; SILTSTONE: 0.21 to 0.41; SANDSTONE: 0.05 to 0.3
Hydraulic Gradient		Single	0.018			Calculated based on simplified groundwater flow regime from Site GWL data for 30/01/2018: Head difference between 15 mOD & 13 mOD groundwater elevation contours = 2 m. Distance between 15 mOD & 13 mOD groundwater elevation contours is 112 m. Hydraulic gradient = head difference / distance
Groundwater Flow Direction	degrees	Single	90			Groundwater flow direction of 90 degrees towards the eastern boundary stream, along a simplified flow path through the aquifer.
Longitudinal Dispersivity	m	Uniform	0.5	9.2		Consim Help file: 0.1 of pathway length. Path length from waste boundary to eastern boundary stream in direction of groundwater flow varies from 5 m to 92 m
Lateral Dispersivity	m	Uniform	0.15	2.76		Consim Help file: 0.3 of Longitudinal Dispersivity
Fraction of Organic Carbon	%	Uniform	0.34	2.7		Site specific data for soil samples from indigenous subsoil and waste free soil (FILL)

Table 6.
ConSim Model Parameterisation

Details	Units	Distribution	Min or Best	Max	Median	Justification
Darcy Flow Est						Conceptually, lateral groundwater flow in the subsoil beneath the site (i.e. the modelled aquifer pathway) derives 100% from recharge through the site. The maximum surface area underlain by waste source material is (Type 1 = 2041m2 + Type 2 = 5643m2) 7684 m2. Site area upgradient of the waste body is 0 m2. There is 11,474 m2 downgradient of the waste between the waste and the eastern boundary stream. All recharge to this area will contribute to diluting any leachate prior to its discharge at the Recptor. A basic estimate of the average potential recharge-groundwater flow is therefore [Infiltration 0.239m/yr x area [11474m2]]= 2742 m3/yr (7.5m3/d). This dilution is represented in CONSIM by using the groundwater flow calculation in the aquifer pathway. This compares to 40m3/d calculated by ConSim for groundwater flow in the aquifer pathway under the maximum groundwater elevation conditions.
Source Width	m	106				Maximum site width perpendicular to the GW flow direction of 90 degrees from east of north
Discharge	m3/d				40	The darcy flow calc for the simplified maximum watertable elevation scenario based on the SI values for Transmissivity (aquifer thickness (7.5m) x K (2.8m/d) = 21m2/d), Width (106m), and i (0.018) are close to the water balance value calulated using the average & median values, i.e. Darcy average = 40 m3/d, Mass bal from recharge = 7.5 m3/d.
Receptors						
Receptor 01						X: 323276 Y:260762. Receptor located on the eastern boundary stream at the closest point (15m separation) on the stream that is directly downgradient of the waste body, for a simplified groundwater flow direction 90 degrees east of north.
Receptor 02						X: 323301 Y:260816. Receptor located on the eastern boundary stream 50 m directly downgradient of the waste body. The groundwater flow along this line passes beneath the maximum length of the contaminant source parallel to the flow direction and therefore receives the maximum amount of contaminated infiltration. Out of the set of flow lines that receive the maximum amount of contaminated infiltration, Receptor 2 is downgradient of the line with the shortest separation distance between the downgradient boundary of the waste and the stream, such that it represents the worst case scenario for discharge of contaminated baseflow to the stream.
Receptors 01 & 02 - Groundwater						As receptors 1 and 2 also coincide with the site boundary they also indicate the groundwater quality at the site boundary under the maximum watertable scenario.
Receptor 05						X: 323259 Y:260825: Receptor located at groundwater borehole BH11 in order to represent BH11 under the Maximum Watertable Scenario. The model results for Receptor 5 will be compared to the water quality data for BH11 in November 2017

Table 6.
ConSim Model Parameterisation

Details	Units	Distribution	Min or Best	Max	Median	Justification
Scenario 02						**Minimum Watertable Elevation (as represented by 23/07/2018)**
						Parameters that differ from Scenario 01 only. The footprint of the submerged waste and the associate above and below watertable waste thicknesses, plus the unsaturated zone thickness beneath the areas with no waste below the watertable were all recalculated to provide input data specific to the minimum watertable elevation model.
Unsaturated Zone						
Type 1 waste source UZ Overall Thickness	m	Triangular	1.75	8.53	5.86	From Unsaturated Zone Thickness grid statistics from Surfer grid file. Grid file generated as follows: Create grid (A) of bottom surface of waste from geophysical survey data and borehole data Create grid (B) of maximum groundwater elevation from interpreted groundwater elevation contours on 23/07/2018 (maximum known groundwater elevation beneath waste) Create grid of UZ thickness by subtraction, i.e. Grid A - Grid B Clip grid to Waste Type 1 Footprint
Type 2 waste source UZ Overall Thickness	m	Triangular	0	8.64	0	From Unsaturated Zone Thickness grid statistics from Surfer grid file. Grid file generated as follows: Create grid (A) of bottom surface of waste from geophysical survey data and borehole data Create grid (B) of maximum groundwater elevation from interpreted groundwater elevation contours on 23/07/2018 (maximum known groundwater elevation beneath waste) Create grid of UZ thickness by subtraction, i.e. Grid A - Grid B Clip grid to Waste Type 2 Footprint
Vertical Dispersivity Type 1 waste	m	Triangular	0.175	0.853	0.586	Estimated as 0.1 x Unsaterated Zone thickness
Vertical Dispersivity Type 2 waste	m	Triangular	0	0.864	0	Estimated as 0.1 x Unsaterated Zone thickness
Aquifer Pathway						
Hydraulic Gradient		Single	0.010			Calculated based on simplified groundwater flow regime from Site GWL data for 23/07/2018: Head difference between 14 mOD & 13 mOD groundwater elevation contours = 1 m. Distance between 14 mOD & 13 mOD groundwater elevation contours is 97 m. Hydraulic gradient = head difference / distance
Groundwater Flow Direction	degrees	Single	108			Groundwater flow direction of 108 degrees towards the Barnageeragh Stream downgradient of the WWTP site, along a simplified flow path through the aquifer.
Longitudinal Dispersivity	m	Uniform	30			Consim Help file: 0.1 of pathway length. Path length from waste boundary to discharge point on Barnageeragh Stream downgradient of the WWTP Site is 300 m
Lateral Dispersivity	m	Uniform	9			Consim Help file: 0.3 of Longitudinal Dispersivity

Table 6.
ConSim Model Parameterisation

Details	Units	Distribution	Min or Best	Max	Median	Justification
Darcy Flow Est						Conceptually, lateral groundwater flow in the subsoil beneath the site (i.e. the modelled aquifer pathway) derives 100% from recharge through the site. The maximum surface area underlain by waste source material is (Type 1 = 2041m2 + Type 2 = 5643m2) 7684 m2. Site area upgradient of the waste body is 0 m2. There is (63165m2-7684m2) =55,481 m2 downgradient of the waste between the waste and the point of discharge to the Barnageeragh stream. All recharge to this area will contribute to diluting any leachate prior to or at its point of discharge at the Recptor. As this is a low watertable, summer scenario infiltration is set at 25% of the annual average, i.e. 0.06m/yr for the calculation. A basic estimate of the average potential recharge-groundwater flow is therefore [Infiltration 0.06m/yr x area [55481m2]]= 3315 m3/yr (9.1m3/d). This dilution is represented in CONSIM by using the groundwater flow calculation in the aquifer pathway.
Source Width	m	75				Maximum site width perpendicular to the GW flow direction of 90 degrees from east of north
Discharge	m3/d				16	The darcy flow calc for the simplified minimum watertable elevation scenario based on the SI values for Transmissivity (aquifer thickness (7.5m) x K (2.8m/d) = 21m2/d), Width (75m), and i (0.01) are close to the water balance value at when using the average & median values, i.e. Darcy average = 16 m3/d, Mass bal from recharge = 9.1 m3/d.
Receptors						
Receptor 03						X: 323558 Y:260689: Receptor 3 is positioned at the closest point on the Barnageeragh Stream to the site that is likely to receive groundwater baseflow under the minimum watertable conditions. Based on the simplified groundwater flow scenario shown in Figure 7 the receptor is positioned 300 m downgradient of the downgradient boundary of the contaminant source (i.e. the waste body). The receptor is also on a flowline that passes beneath the maximum length of contaminant source parallel to the flow direction and therefore receives the maximum amount of contaminated infiltration. It represents the worst case scenario for discharge of contaminated baseflow to the Barnageeragh stream under the minimum watertable scenario
Receptor 04						X: 323287 Y:260784: Receptor 4 is positioned at the eastern site boundary along the groundwater flowline between the site and Receptor 3 (Figure 13(b)). It represents the worst case scenario for groundwater contamination at the site boundary under the minimum watertable scenario.
Receptor 06						X: 323268 Y:260803: Receptor 6 has been placed on the flow line to Receptor 3 (Figure (13b)) in order to represent BH17 under the Minimum Watertable Scenario. The model results for Receptor 6 will be compared to the water quality data for BH17 in May 2018.

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An engineered landfill cap would include a barrier layer, which would be expected to be equivalent to a 0.6 m thick compacted mineral layer with a hydraulic conductivity of 1×10^{-9} m/s or less (EPA 2000). A drainage layer directly above the barrier would prevent the build-up of a head of water above the barrier. As such the maximum head of water acting on the base of the barrier would be 0.6 m, i.e. when the barrier is fully saturated. This would be equivalent to a vertical hydraulic gradient of 1 (i.e. 0.6 m head of water/0.6m vertical length across the barrier). Based on Darcy's Law the infiltration rate across 1 m^2 surface area of the barrier under these conditions would be:

$$\text{Infiltration} = \text{Hydraulic Conductivity} \times \text{Hydraulic Gradient} \times \text{Area}$$

$$\text{Infiltration} = 1 \times 10^{-9}\ \text{m/s} \times 1 \times 1\ \text{m}^2$$

The resulting infiltration rate of 1×10^{-9} m/s is equivalent to 31.5 mm/yr. This amounts to an 87% reduction in infiltration compared to the current infiltration rate of 239 mm/yr, i.e. a runoff rate of 207.5 mm/yr.

AGL (2019) sets out a cap design which meets the requirements of the EPA (2000) and gives a calculated cap infiltration rate of 31.5 mm/yr, i.e.:

- A 1.0 mm thick LLDPE geomembrane liner with a hydraulic conductivity of less than 1×10^{-9} m/s;
- An overlying geocomposite drainage layer with a hydraulic conductivity of greater than 1×10^{-4} m/s); and,
- 1.0 m of cover soil comprised of 0.85 m of subsoil and 0.15 m of topsoil.

In order to prevent potential uncontrolled lateral gas migration driven by a build up of gas pressure beneath an engineered cap the cap design will include a bio-window. The detailed bio-window design is presented in the cap design report (AGL 2019). The bio-window will be located over the gas producing hotspot around borehole BH4. The bio-window comprises a permeable window in the cap through which gas can be oxidised as it vents to the atmosphere. The uncapped areas will be backfilled with a mix of compost, topsoil and waste wood fragments (or similar). This will ensure that the bio-window will always act as a higher permeability (more open) pathway for the gas to escape outwards and oxygen to diffuse inwards. Trees will be planted in the bio-window area and the tree roots will maintain the open structure of the soil.

The permeable structure of the bio-window allow a higher infiltration rate than the rest of engineered cap. Nonetheless, the bio-window infiltration rate will be less than the infiltration rate for the uncapped site. The following factors contribute to a reduced infiltration rate compared to the uncapped site:

- Trees planted in the bio-window area enhance evapotranspiration/reduce infiltration.
- Gas diffusing out through the bio-window occupies part of the interconnected pore space available for water infiltration, i.e. the bio-window matrix will be unsaturated with respect to water. This reduces the hydraulic conductivity of the matrix, which in turn reduces the infiltration rate.
- The gas itself will be warm and typically contains 100% humidity, thus transporting some moisture to atmosphere.

An infiltration rate equal to 50% of the rate for the uncapped areas is considered to be representative of the bio-window infiltration rate (personal communication, Tom Parker January 2019). This amounts to a bio-window infiltration rate of 119.5 mm/yr.

The preferred layout for areas capped with impermeable materials, the bio-window area, and uncapped areas, with infiltration rates of 31.5 mm/yr, 119.5 mm/yr and 239 mm/yr respectively, is shown in Figure 13(c). The types of capping material proposed for different parts of each area are shown in Figure 13 (d).

The runoff drained from above the barrier would be discharged locally to surface water. Based on a waste footprint of 7,544 m^2, this would amount to 1,565 m^3/yr or 4.3 m^3/d.

5.3 Receptors

The receptors identified in the vicinity of the landfill site are:

- **Surface water bodies** in the vicinity of the site depending on the watertable elevation:
    - Maximum Watertable Pathway – the site eastern boundary stream is the surface water receptor (Figure 6). For the purposes of the DQRA two receptor positions have been considered as follows (Figure 13(a)):
        - **Receptor 1** is located on the stream 15 m directly downgradient of the southeast corner of the waste body. This is the closest point on the stream downgradient of the waste body.
        - **Receptor 2** is located on the stream 50 m directly downgradient of the waste body. The groundwater flow along this line passes beneath the maximum length of the contaminant source parallel to the flow direction and therefore receives the maximum amount of contaminated infiltration. Out of the set of flow lines that receive the maximum amount of contaminated infiltration, Receptor 2 is downgradient of the line with the shortest separation distance between the downgradient boundary of the waste and the stream.
    - Minimum Watertable Pathway – the Barnageeragh Stream to the east of the WWTP site is the surface water receptor (Figure 7). For the purposes of the DQRA one receptor position has been considered as follows (Figure 13(b)):
        - **Receptor 3** is positioned at the closest point on the Barnageeragh Stream to the site that is likely to receive groundwater baseflow under the minimum watertable conditions. Based on the simplified groundwater flow scenario shown in Figure 7 the receptor is positioned 300 m downgradient of the downgradient boundary of the contaminant source (i.e. the waste body). The receptor is also on a flowline that passes beneath the maximum length of contaminant source parallel to the flow direction and therefore receives the maximum amount of contaminated infiltration. It represents the worst case scenario for discharge of contaminated baseflow to the Barnageeragh stream under the minimum watertable scenario.
- **Groundwater underlying the site**:
    - Maximum Watertable Pathway – As receptors 1 and 2 also coincide with the site boundary they also indicate the groundwater quality at the site boundary under the maximum watertable scenario.
    - Minimum Watertable Pathway –
        - **Receptor 4** is positioned at the eastern site boundary along the groundwater flowline between the site and Receptor 3 (Figure 13(b)). It represents the worst case scenario for groundwater contamination at the site boundary under the minimum watertable pathway.
- **Model Representativeness** –
        - **Receptor 5** has been placed on the flow line to Receptor 2 (Figure 13(a)) in order to represent BH11 under the Maximum Watertable Pathway. The model results for Receptor 5 will be compared to the water quality data for BH11 in November 2017.
        - **Receptor 6** has been placed on the flow line to Receptor 3 (Figure (13b)) in order to represent BH17 under the Minimum Watertable Pathway. The model results for Receptor 6 will be compared to the water quality data for BH17 in May 2018.
        - The CONSIM help file indicates that "*generally, if "real" and modelled results compare between the 40 and 60 percentile, this is a very good fit. Comparison of results between the 20 and 80 percentile shall be regarded as reasonable.*"

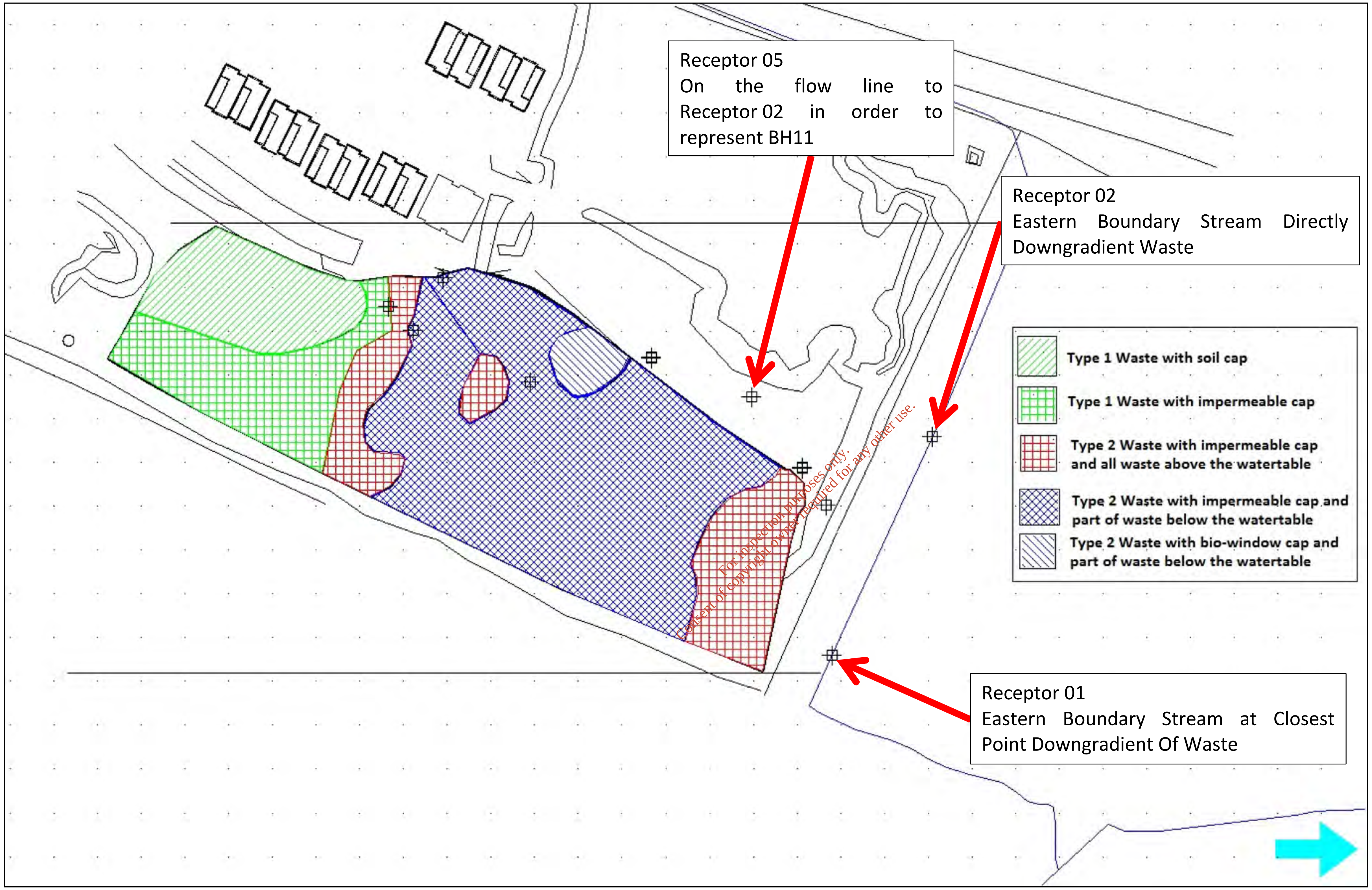


Figure 13. CONSIM Model Domain For Maximum Watertable Pathway

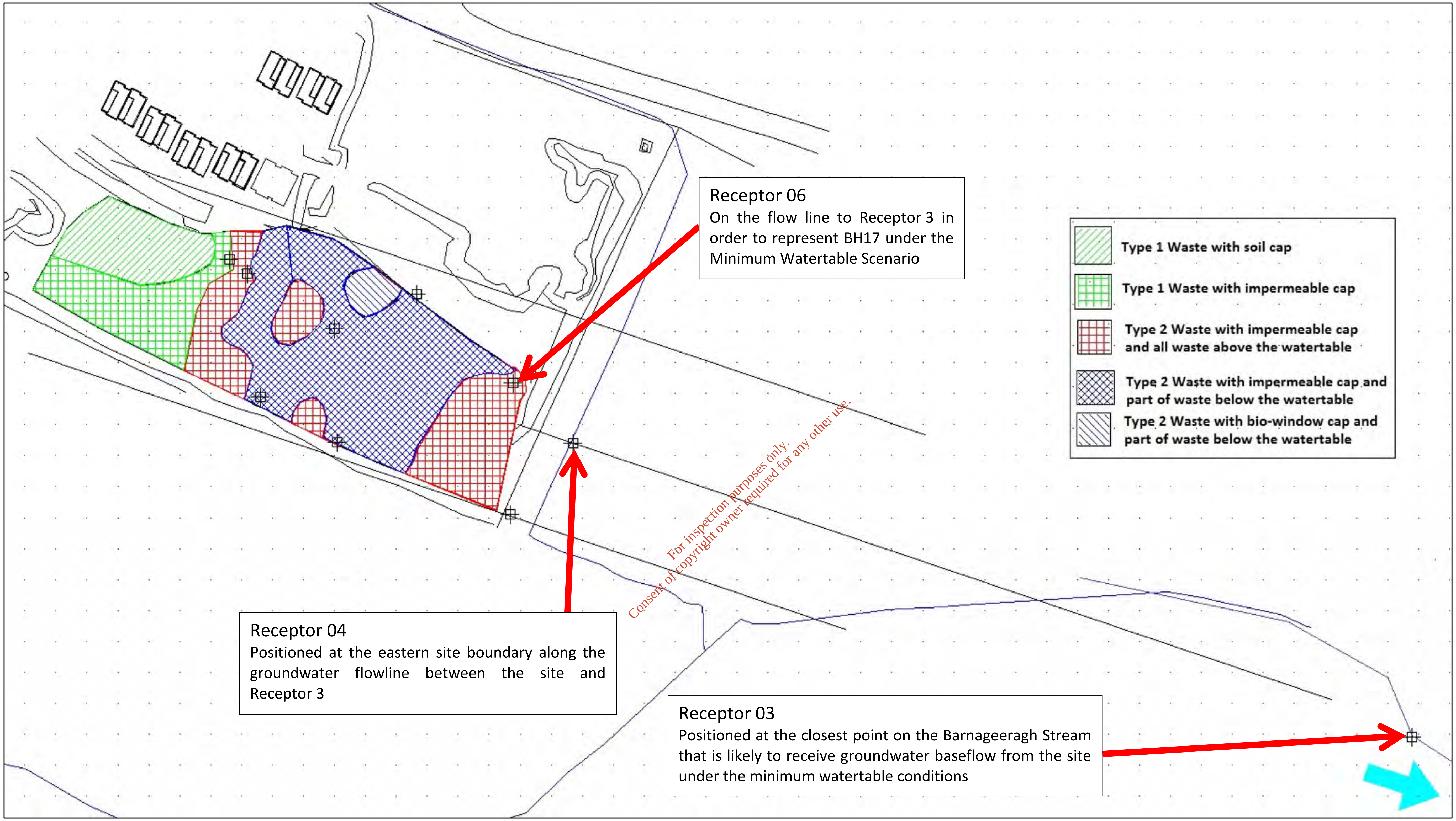


Figure 13(b). CONSIM Model Domain For Minimum Watertable Pathway

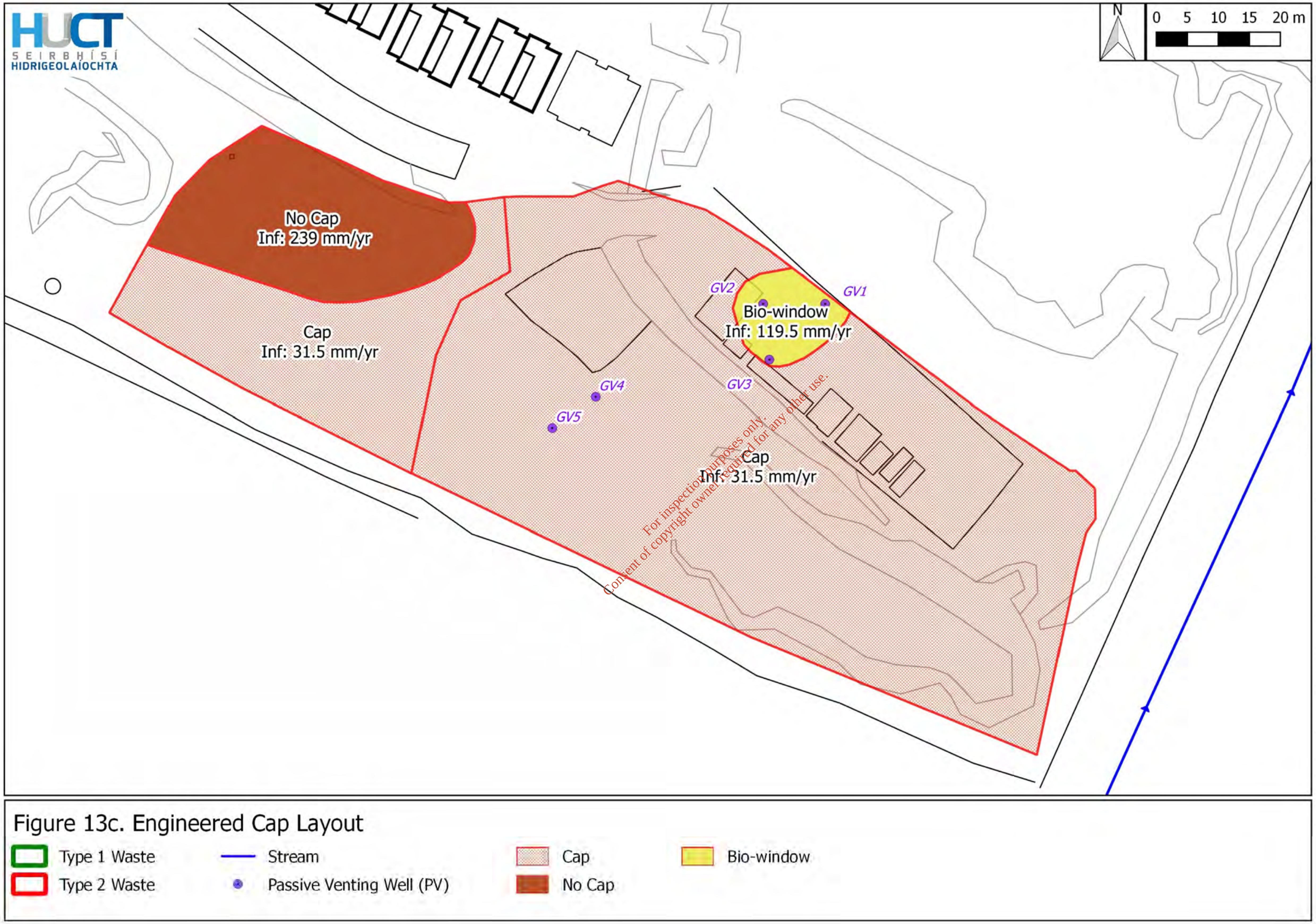


Figure 13(c). Layout of cap infiltration rates for preferred Engineered Cap Design

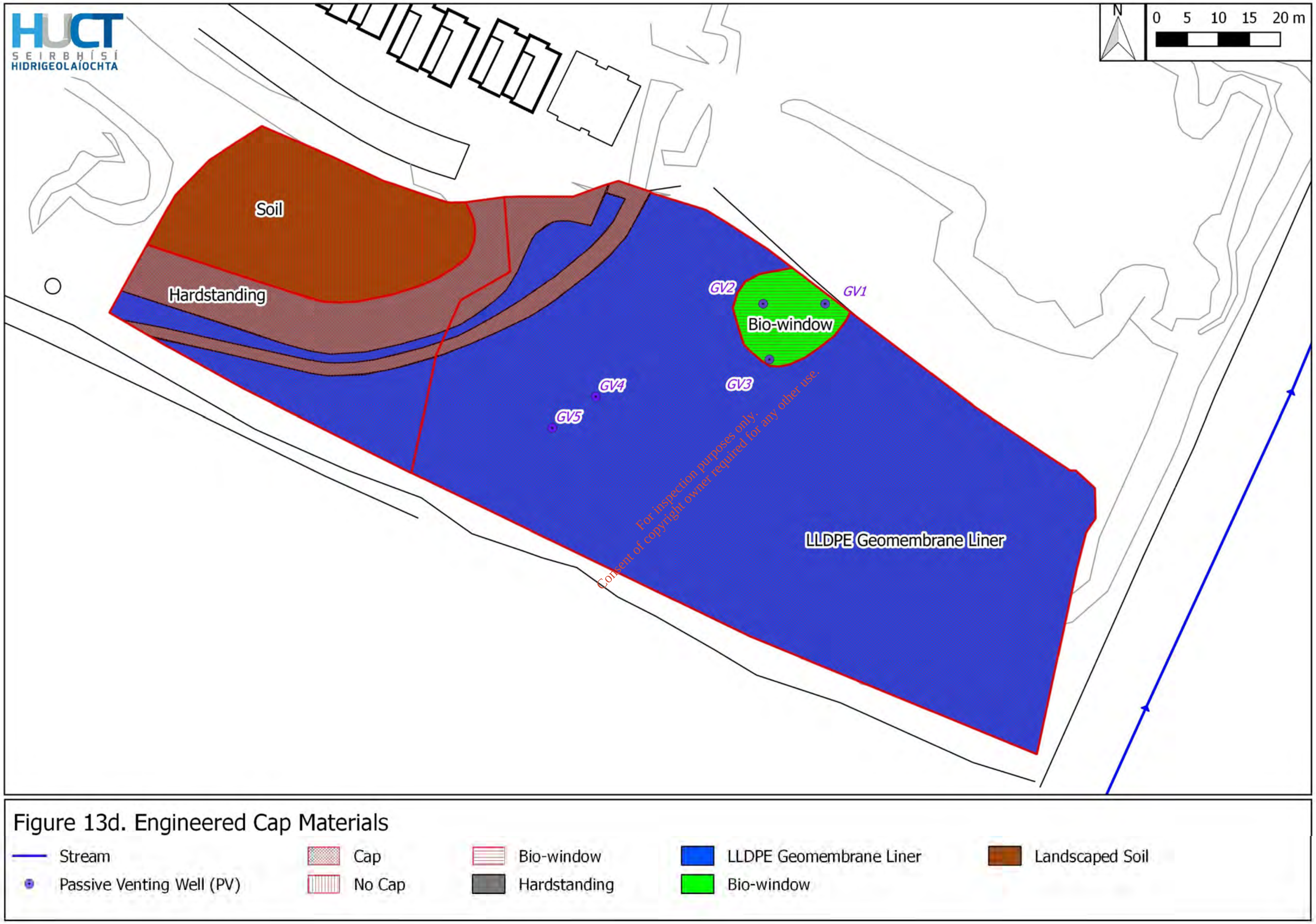


Figure 13(d). Layout of capping materials for the Preferred Engineered Cap Design

6 Detailed Quantitative Risk Assessment

In the DQRA the SPR linkages relating to the site are assessed quantitatively to predict whether or not the contaminant sources identified will have a negative impact on the identified receptors.

The quantitative risk assessment software package ConSim has been used to carry out the detailed quantitative risk assessment.

6.1 ConSim Quantitative Risk Assessment Software Package

CONSIM has been developed on behalf of the UK Environment Agency. The full title of the software is "Contamination Impact on Groundwater: Simulation by Monte Carlo Method". CONSIM is a probabilistic model that uses the Monte Carlo simulation technique to select values randomly from each parameter range for use in the calculations. Repeating the calculations many times gives a range of output values, the distribution of which reflects the uncertainty inherent in the input values.

CONSIM follows a tiered approach, based on that outlined by the R&D 20 (Environment Agency 1999). The tiers in CONSIM are not directly equivalent to those described in R&D 20, and they have therefore been termed 'levels' to avoid confusion.

The ConSim levels of assessment may be summarised as follows:

Level 1 produces contaminant concentrations in porewater within the contaminated soil. The output of this stage comprises contaminant concentrations (e.g. in units of mg/l) in the infiltration passing down through the contaminant sources into the underlying unsaturated zone.

A Level 2 assessment builds upon the Level 1 output as follows:

- It assesses the time required for contaminants to migrate from the contaminated soil to the water table (i.e. down through the unsaturated zone);
- It assesses the concentration of contaminants at the water table (base of the unsat. zone);
- It assesses the concentration of contaminants at the point of maximum dilution in the aquifer (i.e. the diluted contaminant concentration once the infiltration is fully mixed into the modelled upgradient groundwater flow); and,
- It assesses the effects of biodegradation/decay and retardation on contaminant concentrations along the unsaturated pathway.

A Level 3 assessment builds on the Level 1 and 2 assessments as follows:

- It assesses the time for contaminants to reach a receptor at some distance from the site, via saturated zone transport, and the concentrations of contaminants to be expected.
- It assesses the attenuating effects of biodegradation/decay, retardation and dispersion along the saturated pathway.

6.2 Conceptual Approach to the Risk Assessment

The ConSim software is built upon an internal hydrogeological model that is a good match for the study site. A level 3 assessment has been carried out for the purpose of this risk assessment. The model considers vertical infiltration over a specified area of source contaminants. The infiltrating water discharges through the base of the unsaturated zone carrying a mass of contaminants into the underlying saturated aquifer. The contaminants then migrate laterally to the receptor via the saturated groundwater flow.

6.2.1 Model Setup and Parameterisation.

Due to the variation in the groundwater pathway depending on the watertable elevation two distinct model pathways have been developed to represent the site hydrogeological conceptual model under the Maximum Watertable Pathway and the Minimum Watertable Pathway.

The model domains for maximum and minimum watertable pathways are shown in Figures 13 (a) and (b) respectively. The modelled groundwater flow direction is indicated by the turquoise arrow in the bottom right of each figure. The Type 1 waste area is on the left site of the landfill area and is shown with green hatching. The Type 2 waste area is on the right side of the waste area and is shown with blue hatching. The three modelled receptors for each pathway are indicated by the red arrows.

For each pathway two main scenarios were modelled.

- **Scenario 01** – Representing the Current Site Conditions.
- **Scenario 02** – Representing the site following the installation of an Engineered Landfill Cap.

The modelled contaminants are listed in Table 5. The active processes in the model are summarised in Table 7.

Table 7. Summary of Active Processes in the Model

Active Process	Details
Retarded Travel in the Unsaturated Zone	All SOCs
Retarded Travel in the Aquifer	All SOCs
Biodegradation in the Unsaturated Zone Biodegradation in the Aquifer	Ammonia: Half life of 13 days to 6 years (Buss et al 2003). Biodegradation in dissolved and sorbed phases. Organic Contaminants: Half lives as shown in Table A2.2. Biodegradation in dissolved phase only. Metals & Major Ions: Half-life of 9.9E+11 years (i.e. no biodegradation).
Calculated Declining Source Term	All SOCs. Rate of source decline calculated by CONSIM based on input parameters.

The parameterisation of the modelled contaminants in terms of the Kd and Koc parameters, which relate to mobility in the subsurface are shown in Table 4.

The parameterisation of the modelled contaminants in terms of the concentration range, solubility, dimensionless Henry's Law Constant, and biodegradation half-life and the justification/source of the parameter values are shown in Table A2.2 in Appendix 2.

The parameterisation of the physical characteristics of the Waste Source, the unsaturated zone pathway and the aquifer pathway and the justification/source of the parameter values are shown in Table 6. The CONSIM "Model Printout" with time and date stamp matching the CONSIM "Model Results Printout" is shown in Appendix 3.

6.2.2 Setup of Contaminant Sources Within the Consim Model

In order to represent the complexity of the site hydrogeological conceptual model as accurately as possible in CONSIM, the Type 1 and Type 2 waste areas were subdivided into a number of individual contaminant sources in the model. Each source had the contaminant characteristics of its parent Type 1 or Type 2 source.

All of the Type 1 waste is always above the watertable. In order to represent the preferred capping layout for the Type 1 area, the Type 1 waste was setup as two contaminant sources in CONSIM as shown in Figures 13a and 13b.

The Type 2 waste was divided into three categories, i.e. areas where all of the waste is above the watertable, an area where part of the waste column is submerged below the watertable, and a biowindow area. The waste column in the biowindow area is also partly submerged. The boundary between the areas with all waste above the watertable and with part of the waste column submerged changes as the watertable rises and falls. The areal distribution of the Type 2 waste categories is shown in Figures 13a and 13b for the maximum and minimum groundwater elevation pathways respectively.

Each individual waste polygon shown in Figures 13a and 13b was setup as an individual contaminant source in the CONSIM model. Each model contaminant source had waste thickness and unsaturated zone thickness distributions in accordance with the conditions beneath the footprint of the particular source area.

The surface infiltration rate for each of the sources is shown in Figure 13c.

For each area where part of waste column is submerged beneath the watertable two contaminant sources with identical footprints were modelled. One of the sources was setup to represent the part of the waste column above the watertable, i.e. it was given waste thickness equivalent to the component of the waste column above the watertable at that location, and infiltration appropriate to the type of capping material overlying the footprint. The other source was setup to represent the part of the waste column below the watertable, i.e. it was given waste thickness equivalent to the component of the waste column below the watertable at that location, and infiltration equivalent to the volume of horizontal groundwater seepage through the submerged waste. In both cases in each area the unsaturated zone was set as close to zero as allowed by the software (i.e. UZ thickness given a single value of 1E-30 m with no sorbtion or biodegradation).

6.3 Model Assessment Criteria

The predicted contaminant concentrations at the receptor have been compared to appropriate environmental quality standards (EQS). The relevant EQSs are shown in Table 8.

A model scenario is considered to have failed the assessment criteria if the predicted contaminant concentration at a receptor exceeds the relevant criterion during the 1000 year modelled period.
A model scenario is considered to have passed the assessment criteria if the predicted contaminant concentration at a receptor does not exceed the relevant criterion during the 1000 year modelled period.

Table 8. Model Assessment Criteria

		Groundwater Regulations		Drinking Water Regulations	Surface Water Regulations		
		SI 366 of 2016		SI122 of 2014	SI272 of 2009 & SI 378 of 2015		
		Min of Test1, 3 or 4	Test2 - SW Impacts		Inland SW		Inland SW
Parameter		Annual Mean	Annual Mean	MAC	MAC	95%ile or not specified	Annual Mean
Chloride	mg/l	187.5		250			-
Ammonia	ug/l as N	175	65	233		140	65
Arsenic	ug/l	7.5		10			25
Mercury	ug/l	0.75		1	0.07		
Lead	ug/	7.5		10	14		1.2
n-Decane (Aliphatic EC 10-12)	ug/l	7.5 (TPH EQS)		-			-
n-HexaDecane (Aliphatic EC 16-35)	ug/l	7.5 (TPH EQS)		-			-
Naphthalene (Aromatic EC 10-12)	ug/l	0.075 (Total PAH EQS)		0.1 (Total PAH DWS)	130		2
Benzo(a)pyrene (Aromatic EC 16-21)	ug/l	0.0075		0.01	0.27		0.00017
c-1,2-Dichloroethene	ug/l	0.375		10			-
Phenol	ug/l	-		-	8		46

6.4 Model Results and Trends

The model results are summarised in Table 9 and Table 10. The CONSIM "Model Results Printout" with time and date stamp matching the CONSIM "Model Printout" is shown in Appendix 4. The CONSIM results are equivalent to mean annual average concentrations. The probabilistic output of the model reflects the probability of a particular mean annual average result occurring on any particular year of the modelled time period.

Table 9a shows the predicted 95th-Percentile (95%ile) concentrations for each SOC in Scenario 01 (Current Site Conditions) at Receptors 01, 02, 03 and 04.

Table 9b shows the predicted 95th-Percentile (95%ile) concentrations for each SOC in Scenario 02 (Engineered Cap) at Receptors 01, 02, 03 and 04. Table 9b only shows results for parameters that had predicted elevated concentrations in Table 9a.

The model assessment criteria are shown at the top of Tables 9a and 9b, with individual formatting to distinguish each criterion and to highlight corresponding elevated concentrations in the tables.

Table 10 summarises the exceedances highlighted in Table 9a and Table 9b for each parameter at each receptor.

Parameter				n-Decane (Aliphatic EC 10-12)	n-HexaDecane (Aliphatic EC 16-35)	Naphthalene (Aromatic EC 10-12)	Benzo(a)pyrene (Aromatic EC 16-21)	c-1,2-Dichloroethene	Phenol	Ammonia	Arsenic	Chloride	Lead	Mercury
Legislation				ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l as N	ug/l	mg/l	ug/l	ug/l
	SI 366 of 2016	Min of Test1, 3 or 4	Annual Mean	7.5 (TPH EQS)	7.5 (TPH EQS)	0.075 (Total PAH EQS)	7.50E-03	0.375	1E+12	0.175	7.5	24		0.75
Groundwater Regulations	**SI 366 of 2016**	Test2 - SW Impacts	Annual Mean			1E+12	1E+12	1E+12	1E+12	0.065	1E+12			1E+12
Drinking Water Regulations	**SI122 of 2014**		*MAC*			*0.1 (Total PAH DWS)*	*0.01*	*10*	*1E+12*	*0.233*	*10*	*250*		*1*
	SI272 of 2009 &SI 378 of 2015	Inland SW	MAC			130	0.27	1E+12	46	1E+12	1E+12	1E+12		0.07
	SI272 of 2009 &SI 378 of 2015		95%ile			1E+12	1E+12	1E+12	1E+12	0.14	1E+12	1E+12		1E+12
Surface Water Regulations	SI272 of 2009 &SI 378 of 2015	Inland SW	**Annual Mean**			**2**	**1.70E-04**	1E+12	**8**	**0.065**	**25**	1E+12		**0.05**
Pathway	**Receptor**	Model Yr	Statistic											
Maximum	Receptor 01	1	95%ile	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.0	173	0.0	0.00
Maximum	Receptor 01	5	95%ile	0.00	0.00	0.00	0.00	0.40	4.60	0.000	0.0	641	0.0	0.00
Maximum	Receptor 01	10	95%ile	0.00	0.00	0.00	0.00	1.00	4.20	0.850	0.0	560	0.0	0.00
Maximum	Receptor 01	25	95%ile	0.00	0.00	0.00	0.00	1.50	2.10	4.300	0.0	434	0.0	0.00
Maximum	Receptor 01	50	95%ile	0.01	0.00	0.00	0.00	1.10	1.20	4.250	0.0	197	0.0	0.00
Maximum	Receptor 01	100	95%ile	0.24	0.00	0.01	0.00	0.50	0.24	3.650	0.0	99	0.0	0.00
Maximum	Receptor 01	150	95%ile	0.30	0.00	1.70	0.00	0.20	0.12	2.940	1.2	78	0.0	0.00
Maximum	Receptor 01	200	95%ile	0.35	0.00	2.10	0.00	0.18	0.10	1.760	7.1	57	0.0	0.00
Maximum	Receptor 01	500	95%ile	0.38	0.00	0.37	0.00	0.04	0.02	0.350	47.6	20	0.0	0.00
Maximum	Receptor 01	1000	95%ile	0.38	0.00	0.23	0.00	0.02	0.01	0.230	112.0	5	0.0	0.00
Maximum	Receptor 02	1	95%ile	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.0	153	0.0	0.00
Maximum	Receptor 02	5	95%ile	0.00	0.00	0.00	0.00	0.40	1.40	0.000	0.0	832	0.0	0.00
Maximum	Receptor 02	10	95%ile	0.00	0.00	0.00	0.00	0.80	2.00	0.000	0.0	970	0.0	0.00
Maximum	Receptor 02	25	95%ile	0.00	0.00	0.00	0.00	1.20	1.50	1.790	0.0	755	0.0	0.00
Maximum	Receptor 02	50	95%ile	0.00	0.00	0.00	0.00	1.10	0.70	2.320	0.0	450	0.0	0.00
Maximum	Receptor 02	100	95%ile	0.02	0.00	0.01	0.00	0.70	0.30	1.390	0.0	299	0.0	0.00
Maximum	Receptor 02	150	95%ile	0.08	0.00	0.09	0.00	0.35	0.10	1.100	0.0	178	0.0	0.00
Maximum	Receptor 02	200	95%ile	0.11	0.00	0.11	0.00	0.22	0.08	0.640	0.9	160	0.0	0.00
Maximum	Receptor 02	500	95%ile	0.17	0.00	0.19	0.00	0.05	0.04	0.176	28.6	48	0.0	0.00
Maximum	Receptor 02	1000	95%ile	0.17	0.00	0.16	0.00	0.02	0.01	**0.112**	96.1	13	0.0	0.00
Minimum	Receptor 03	1	95%ile	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.0	18	0.0	0.00
Minimum	Receptor 03	5	95%ile	0.00	0.00	0.00	0.00	0.00	0.10	0.000	0.0	137	0.0	0.00
Minimum	Receptor 03	10	95%ile	0.00	0.00	0.00	0.00	0.10	0.19	0.000	0.0	203	0.0	0.00
Minimum	Receptor 03	25	95%ile	0.00	0.00	0.00	0.00	0.13	0.10	0.018	0.0	143	0.0	0.00
Minimum	Receptor 03	50	95%ile	0.00	0.00	0.00	0.00	0.10	0.05	**0.114**	0.0	103	0.0	0.00
Minimum	Receptor 03	100	95%ile	0.00	0.00	0.00	0.00	0.07	0.02	**0.085**	0.0	43	0.0	0.00
Minimum	Receptor 03	150	95%ile	0.00	0.00	0.00	0.00	0.05	0.01	0.056	0.0	16	0.0	0.00
Minimum	Receptor 03	200	95%ile	0.00	0.00	0.00	0.00	0.03	0.00	0.037	0.0	8	0.0	0.00
Minimum	Receptor 03	500	95%ile	0.03	0.00	0.02	0.00	0.00	0.00	0.008	4.3	0	0.0	0.00
Minimum	Receptor 03	1000	95%ile	0.02	0.00	0.02	0.00	0.00	0.00	0.001	10.0	0	0.0	0.00
Minimum	Receptor 04	1	95%ile	0.00	0.00	0.00	0.00	0.28	4.80	2.390	0.0	410	0.0	0.00
Minimum	Receptor 04	5	95%ile	0.00	0.00	0.00	0.00	1.35	**9.80**	15.200	0.0	693	0.0	0.00
Minimum	Receptor 04	10	95%ile	0.13	0.00	0.00	0.00	2.52	**9.50**	19.100	0.0	577	0.0	0.00
Minimum	Receptor 04	25	95%ile	0.61	0.00	0.13	0.00	2.12	4.90	19.900	3.1	292	0.0	0.00
Minimum	Receptor 04	50	95%ile	0.95	0.00	0.32	0.00	1.38	2.00	15.400	7.2	126	0.0	0.00
Minimum	Receptor 04	100	95%ile	1.35	0.00	0.56	0.00	0.70	0.68	9.220	24.7	30	0.0	0.00
Minimum	Receptor 04	150	95%ile	1.48	0.00	0.57	0.00	0.44	0.34	6.880	38.9	6	0.0	0.00
Minimum	Receptor 04	200	95%ile	1.82	0.00	0.61	0.00	0.27	0.17	5.550	50.8	2	0.0	0.00
Minimum	Receptor 04	500	95%ile	1.90	0.00	0.48	0.00	0.05	0.02	1.820	131.0	0	0.0	0.02
Minimum	Receptor 04	1000	95%ile	2.01	0.00	0.45	0.00	0.01	0.00	0.360	226.0	0	0.0	0.04

Parameter				n-Decane (Aliphatic EC 10-12)	n-HexaDecane (Aliphatic EC 16-35)	Naphthalene (Aromatic EC 10-12)	Benzo(a)pyrene (Aromatic EC 16-21)	c-1,2-Dichloroethene	Phenol	Ammonia	Arsenic	Chloride	Lead	Mercury
Legislation				ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l as N	ug/l	mg/l	ug/l	ug/l
	SI 366 of 2016	Min of Test1, 3 or 4	Annual Mean	7.5 (TPH EQS)	7.5 (TPH EQS)	0.075 (Total PAH EQS)	7.50E-03	0.375		0.175	7.5	24		0.75
Groundwater Regulations	**SI 366 of 2016**	Test2 - SW Impacts	Annual Mean							0.065				
Drinking Water Regulations	**SI122 of 2014**		*MAC*			*0.1 (Total PAH DWS)*	*0.01*	*10*		*0.233*	*10*	*250*		*1*
	SI272 of 2009 &SI 378 of 2015	Inland SW	MAC			130	0.27		46					0.07
	SI272 of 2009 &SI 378 of 2015		95%ile							0.14				
Surface Water Regulations	**SI272 of 2009 &SI 378 of 2015**	Inland SW	**Annual Mean**			**2**	**1.70E-04**		**8**	**0.065**	**25**			**0.05**
Pathway (Max or Min GW Elevation)	**Receptor**	Model Yr	Statistic											
Maximum	Receptor 01	1	95%ile			0.00		0.00		0.000	0.0	19		
Maximum	Receptor 01	5	95%ile			0.00		0.07		0.000	0.0	160		
Maximum	Receptor 01	10	95%ile			0.00		0.19		0.033	0.0	292		
Maximum	Receptor 01	25	95%ile			0.00		0.31		0.177	0.0	540		
Maximum	Receptor 01	50	95%ile			0.00		0.30		0.254	0.0	475		
Maximum	Receptor 01	100	95%ile			0.01		0.28		0.317	0.0	254		
Maximum	Receptor 01	150	95%ile			0.03		0.24		0.298	0.0	133		
Maximum	Receptor 01	200	95%ile			0.05		0.21		0.280	1.1	77		
Maximum	Receptor 01	500	95%ile			0.05		0.07		0.199	8.8	17		
Maximum	Receptor 01	1000	95%ile			0.05		0.03		**0.125**	27.9	3		
Maximum	Receptor 02	1	95%ile			0.00		0.00		0.000	0.0	26		
Maximum	Receptor 02	5	95%ile			0.00		0.10		0.000	0.0	191		
Maximum	Receptor 02	10	95%ile			0.00		0.20		0.000	0.0	364		
Maximum	Receptor 02	25	95%ile			0.00		0.30		0.025	0.0	631		
Maximum	Receptor 02	50	95%ile			0.00		0.30		0.187	0.0	769		
Maximum	Receptor 02	100	95%ile			0.00		0.25		**0.150**	0.0	535		
Maximum	Receptor 02	150	95%ile			0.03		0.24		**0.116**	0.0	342		
Maximum	Receptor 02	200	95%ile			0.05		0.17		**0.092**	0.0	248		
Maximum	Receptor 02	500	95%ile			0.05		0.07		0.053	8.5	45		
Maximum	Receptor 02	1000	95%ile			0.06		0.03		0.034	24.9	8		
Minimum	Receptor 03	1	95%ile			0.00		0.00	0.00	0.000	0.0	1		
Minimum	Receptor 03	5	95%ile			0.00		0.00	0.01	0.000	0.0	16		
Minimum	Receptor 03	10	95%ile			0.00		0.00	0.02	0.000	0.0	29		
Minimum	Receptor 03	25	95%ile			0.00		0.02	0.02	0.000	0.0	90		
Minimum	Receptor 03	50	95%ile			0.00		0.03	0.02	0.006	0.0	119		
Minimum	Receptor 03	100	95%ile			0.00		0.03	0.01	0.012	0.0	112		
Minimum	Receptor 03	150	95%ile			0.00		0.02	0.01	0.011	0.0	71		
Minimum	Receptor 03	200	95%ile			0.00		0.02	0.01	0.010	0.0	60		
Minimum	Receptor 03	500	95%ile			0.00		0.01	0.00	0.006	0.0	7		
Minimum	Receptor 03	1000	95%ile			0.00		0.00	0.00	0.004	0.3	2		
Minimum	Receptor 04	1	95%ile			0.00		0.02	0.49	0.000	1.4	47		
Minimum	Receptor 04	5	95%ile			0.00		0.22	1.30	1.220	0.0	215		
Minimum	Receptor 04	10	95%ile			0.00		0.32	1.50	2.170	0.0	344		
Minimum	Receptor 04	25	95%ile			0.00		0.51	1.30	2.900	0.0	426		
Minimum	Receptor 04	50	95%ile			0.04		0.50	1.10	2.960	0.3	389		
Minimum	Receptor 04	100	95%ile			0.05		0.45	0.79	2.770	2.3	183		
Minimum	Receptor 04	150	95%ile			0.06		0.41	0.59	2.600	3.6	88		
Minimum	Receptor 04	200	95%ile			0.06		0.33	0.44	2.430	4.9	53		
Minimum	Receptor 04	500	95%ile			0.14		0.11	0.10	1.680	17.0	9		
Minimum	Receptor 04	1000	95%ile			0.14		0.04	0.04	1.080	29.0	3		

Table 10a. Summary of Predicted 95th Percentile Concentrations at Receptors 01 and 02 (Maximum Watertable Groundwater Pathway) and Receptors 03 and 04 (Minimum Watertable Groundwater Pathway) under Scenario 01 Current Site Conditions

Receptor	c-1,2-Dichloroethene	Other Organic Parameter Exceedances	Ammonia	Chloride	Arsenic	Lead & Mercury
01 Maximum Watertable	Exceeds GW Regs Annual Mean EQS between 5 yr and 100 yr.	Exceeds **Naphthalene** GW Regs Annual Mean EQS between 150 yr and 1000 yr.	Exceeds GW Regs Annual Mean EQS between 10 yr and 1000 yr.	Exceeds GW Regs Annual Mean EQS between 1 yr and 200 yr.	Exceeds GW Regs Annual Mean EQS after 500 yr.	No exceedances.
02 Maximum Watertable	Exceeds GW Regs Annual Mean EQS between 5 yr and 100 yr.	Exceeds **Naphthalene** GW Regs Annual Mean EQS between 150 yr and 1000 yr.	Exceeds GW Regs Annual Mean EQS between 25 yr and 500 yr. Exceeds GW Regs Annual Mean EQS for Surface Water Impacts in year 1000.	Exceeds GW Regs Annual Mean EQS between 1 yr and 500 yr.	Exceeds GW Regs Annual Mean EQS after 500 yr.	No exceedances.
03 Minimum Watertable	No Exceedances	None.	Exceeds GW Regs Annual Mean EQS for Surface Water Impacts from yr 50 to yr 100.	Exceeds GW Regs Annual Mean EQS between 5 yr and 100 yr.	Exceeds GW Regs Annual Mean EQS after 1000 yr.	No exceedances.
04 Minimum Watertable	Exceeds GW Regs Annual Mean EQS from 5 to 150 yrs.	Exceeds **Naphthalene** GW Regs Annual Mean EQS between 150 yr and 1000 yr. Exceeds **Phenol** Inland SW Regs Annual Mean EQS between 5 yr and 10 yr.	Exceeds GW Regs Annual Mean EQS between 1 yr and 1000 yr.	Exceeds GW Regs Annual Mean EQS between 1 yr and 50 yr.	Exceeds GW Regs Annual Mean EQS after 100 yr.	No exceedances.

Table 10b. Summary of Predicted 95th Percentile Concentrations at Receptors 01 and 02 (Maximum Watertable Groundwater Pathway) and Receptors 03 and 04 (Minimum Watertable Groundwater Pathway) under Scenario 02 Engineered Cap Conditions

Receptor	Organic Parameters	Ammonia	Chloride	Arsenic	Lead & Mercury
01 Maximum Watertable	No exceedances	Exceeds GW Regs Annual Mean EQS between 25 yr and 500 yr. Peak Value = 0.317 mg/l at Yr 100	Exceeds GW Regs Annual Mean EQS between 5 yr and 200 yr.	Exceeds GW Regs Annual Mean EQS after 500 yr.	No exceedances.
02 Maximum Watertable	No exceedances	Exceeds GW Regs Annual Mean EQS in Yr 50. Exceeds GW Regs Annual Mean EQS for Surface Water Impacts between Yrs 100 and 200. Peak Value = 0.187 mg/l at Yr 50	Exceeds GW Regs Annual Mean EQS between 1 yr and 500 yr.	Exceeds GW Regs Annual Mean EQS after 500 yr.	No exceedances.
03 Minimum Watertable	No Exceedances	No Exceedances	Exceeds GW Regs Annual Mean EQS between 10 yr and 200 yr.	No exceedances.	No exceedances.
04 Minimum Watertable	Exceeds **c-1,2-Dichloroethene** GW Regs Annual Mean EQS between 25 yr and 150 yr. Exceeds **Naphthalene** GW Regs Annual Mean EQS between 500 yr and 1000 yr.	Exceeds GW Regs Annual Mean EQS between 5 yr and 1000 yr.	Exceeds GW Regs Annual Mean EQS between 1 yr and 200 yr.	Exceeds GW Regs Annual Mean EQS between 500 yr and 1000 yr.	No exceedances.

<u>Predicted trends for ammonia and chloride for the maximum watertable pathway at Receptor 01 for Scenario 01 (current site conditions) and Scenario 02 (engineered cap conditions).</u>

The trends are shown in Figures 14 to 17. Receptor 01 is directly downgradient of the waste under maximum water table conditions and is located at the site boundary and adjacent to the surface water receptor. The predicted ammonia and chloride concentrations at Receptor 01 were higher than at the other maximum watertable, surface water receptor, i.e. Receptor 02.

The **trends for Receptor 01** (Max. Watertable) show that at the 95th percentile confidence level:

- Ammonia:
  - In Scenario 1 (Current Conditions) ammonia is above the 0.175 mg/l as N GW EQS between 10 years and 1000 years and peaks at 4.3 mg/l as N at 25 years.
  - In Scenario 2 (Engineered Cap) ammonia is above the 0.175 mg/l as N GW EQS between 25 years and 500 years and peaks at 0.32 mg/l as N at 100 years.
- Chloride:
  - In Scenario 1 (Current Conditions) chloride is above 24 mg/l between 1 year and 200 years and peaks at 641 mg/l after 5 years;
  - Scenario 2 (Engineered Cap) chloride is above 24 mg/l between 5 years and 200 years and peaks at 540 mg/l after 25 years

<u>Predicted trends for ammonia and chloride for the minimum watertable pathway at Receptors 03 and 04 for Scenario 01 (current site conditions) and Scenario 02 (engineered cap conditions).</u>

The trends are shown in Figures 18 to 25. Receptors 03 and 04 are directly downgradient of the waste under minimum water table conditions and are located adjacent to the surface water receptor and at the site boundary respectively.

The **trends for the Receptor 03** (Minimum Watertable, Adjacent to Surface Water Receptor) show that at the 95th percentile confidence level:

- Ammonia:
  - In Scenario 1 (Current Conditions) ammonia is above the 0.065 mg/l as N SW EQS between 50 years and 100 years and peaks at 0.114 mg/l as N at 50 years.
  - In Scenario 2 (Engineered Cap) ammonia is below 0.065 mg/l as N throughout the model period.
- Chloride:
  - In Scenario 1 (Current Conditions) chloride is above 24 mg/l between 5 years and 100 years and peaks at 203 mg/l after 10 years;
  - Scenario 2 (Engineered Cap) chloride is above 24 mg/l between 10 years and 200 years and peaks at 119 mg/l after 50 years

The **trends for the Receptor 04** (Minimum Watertable, At Site Boundary) show that at the 95th percentile confidence level:

- Ammonia:
  - In Scenario 1 (Current Conditions) ammonia is above 0.175 mg/l as N GW EQS between 1 year and 1000 years and peaks at 19.9 mg/l as N at 25 years.
  - In Scenario 1 (Current Conditions) ammonia is above 0.175 mg/l as N GW EQS between 5 year and 1000 years and peaks at 3.0 mg/l as N at 50 years.
- Chloride:
  - In Scenario 1 (Current Conditions) chloride is above 24 mg/l between 1 years and 100 years and peaks at 693 mg/l after 5 years;
  - Scenario 2 (Engineered Cap) chloride is above 24 mg/l between 1 years and 200 years and peaks at 426 mg/l after 25 years.

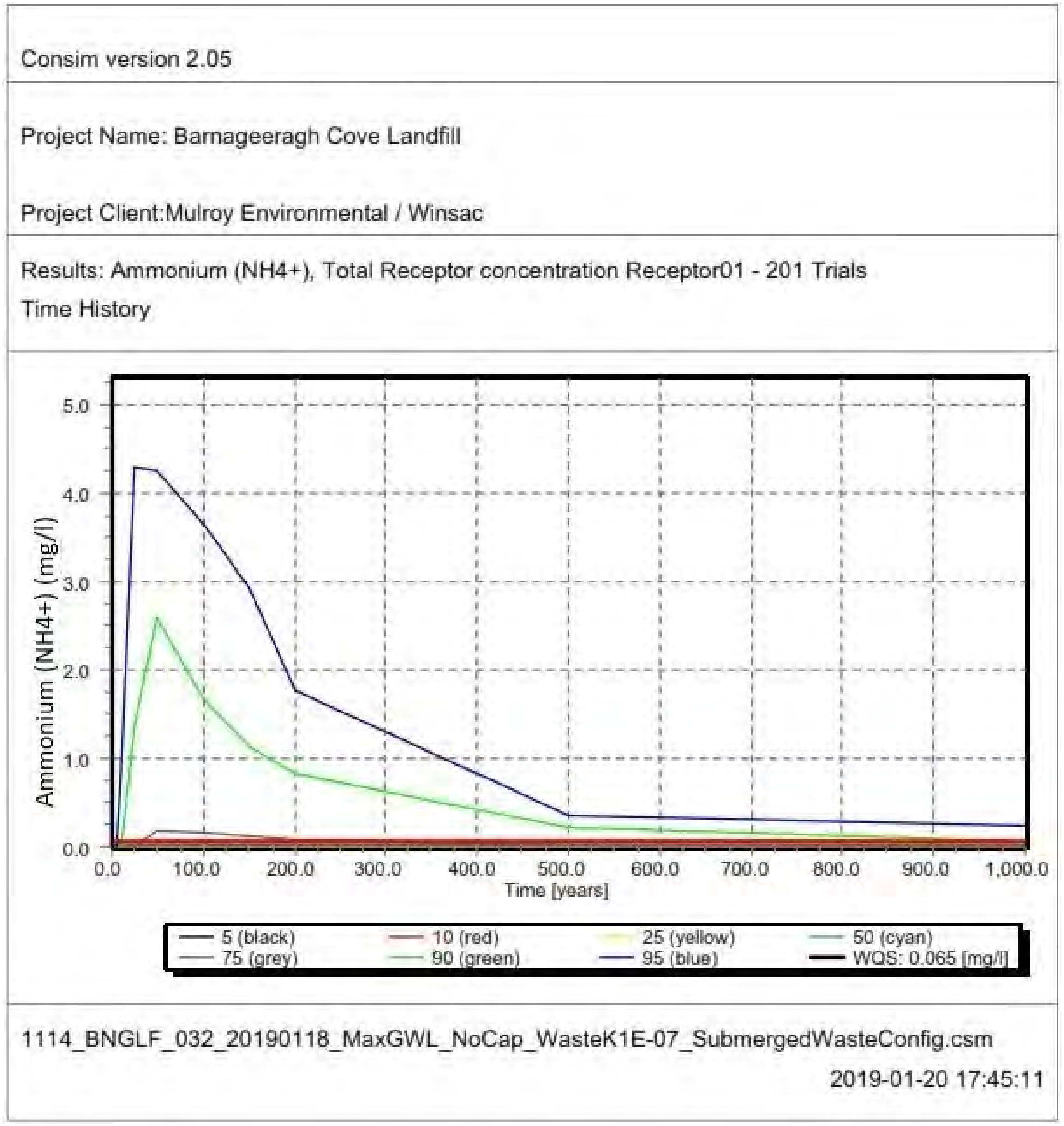


Figure 14. Predicted Ammonia Concentration (mg/l N) vs. Time at Receptor 01, Scenario 01 (Current Site Conditions)

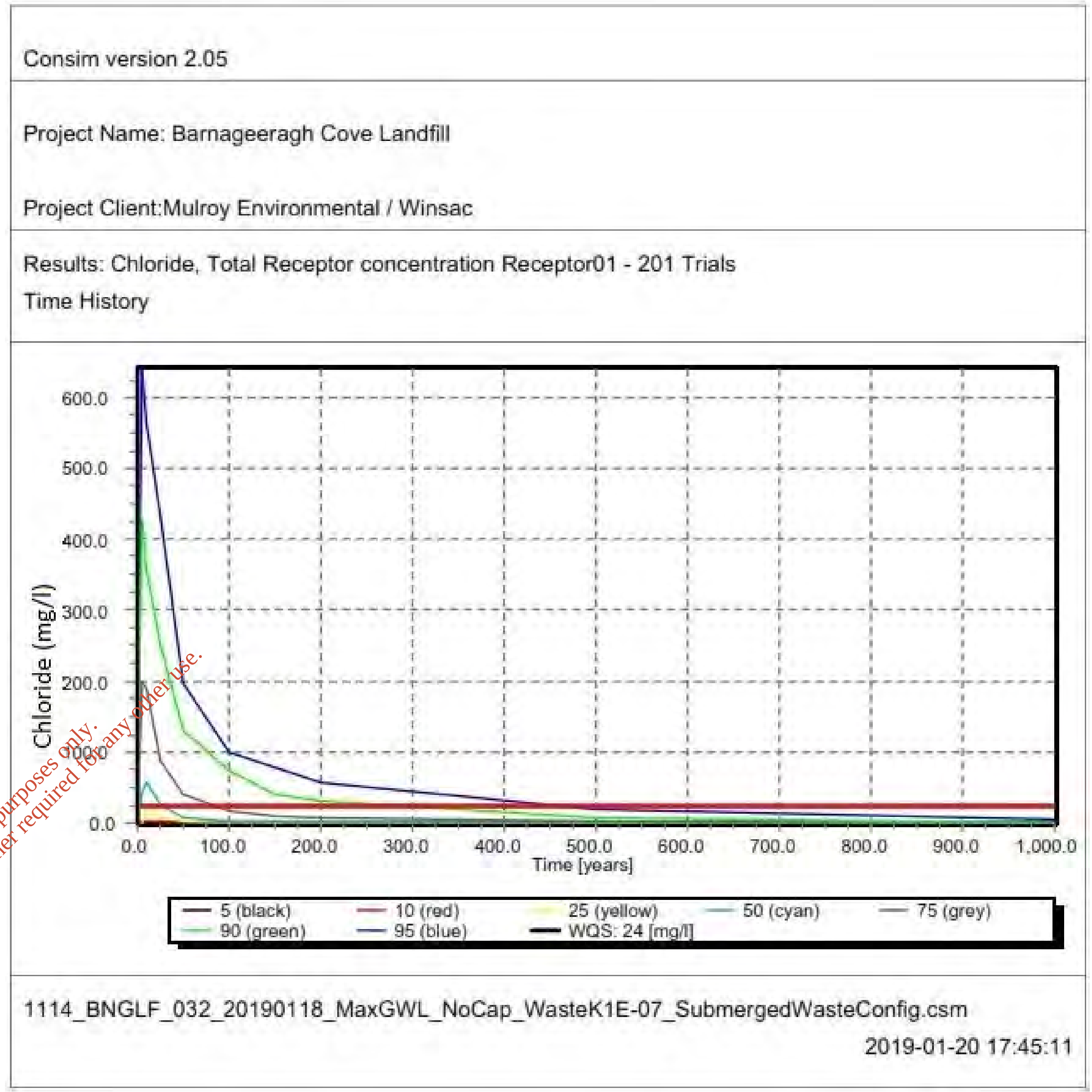


Figure 15. Predicted Chloride Concentration (mg/l) vs. Time at Receptor 01, Scenario 01 (Current Site Conditions)

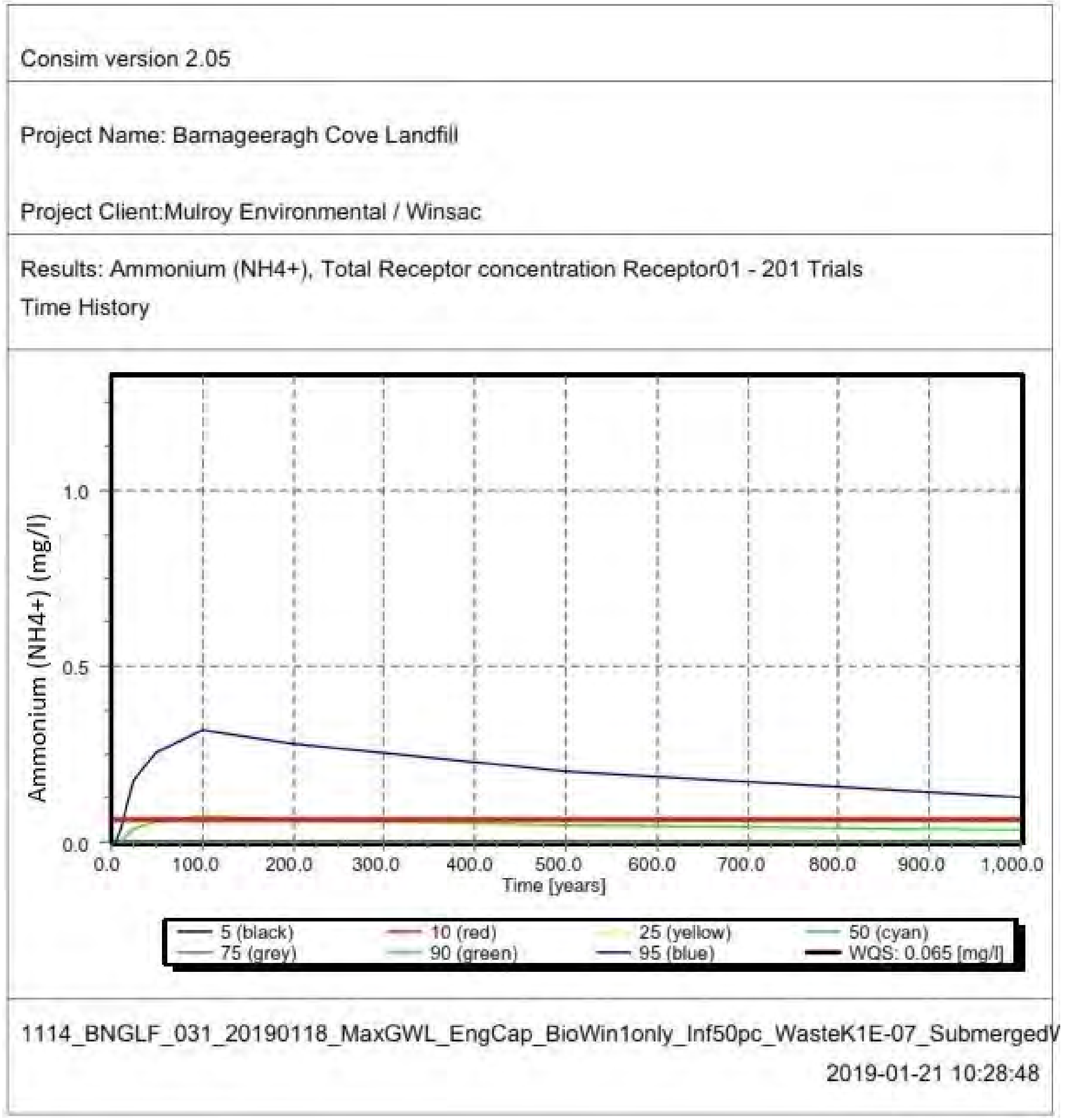


Figure 16. Predicted Ammonia Concentration (mg/l N) vs. Time at Receptor 01, Scenario 02 (Engineered Cap Conditions)

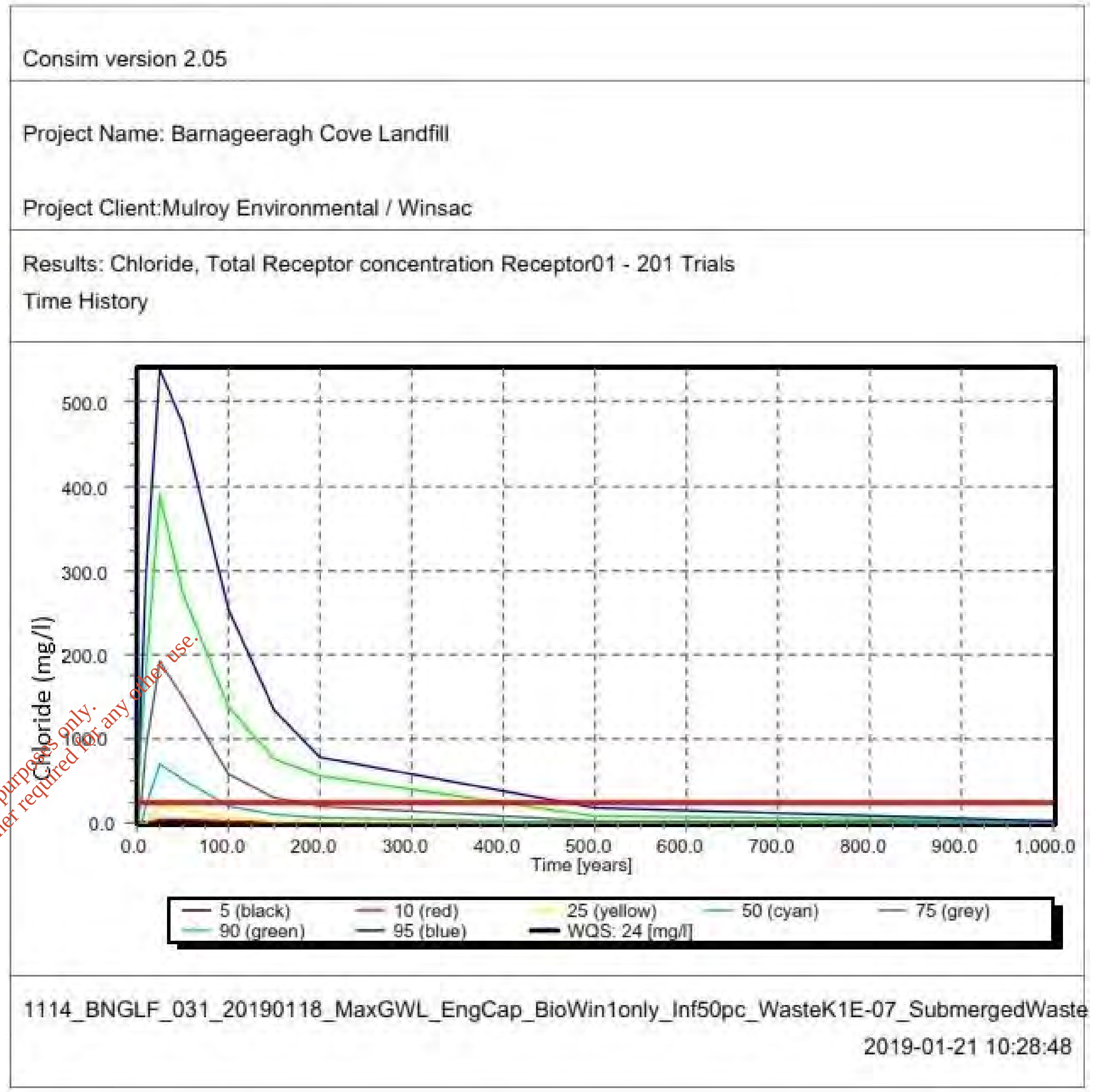


Figure 17. Predicted Chloride Concentration (mg/l) vs. Time at Receptor 01, Scenario 02 (Engineered Cap Conditions)

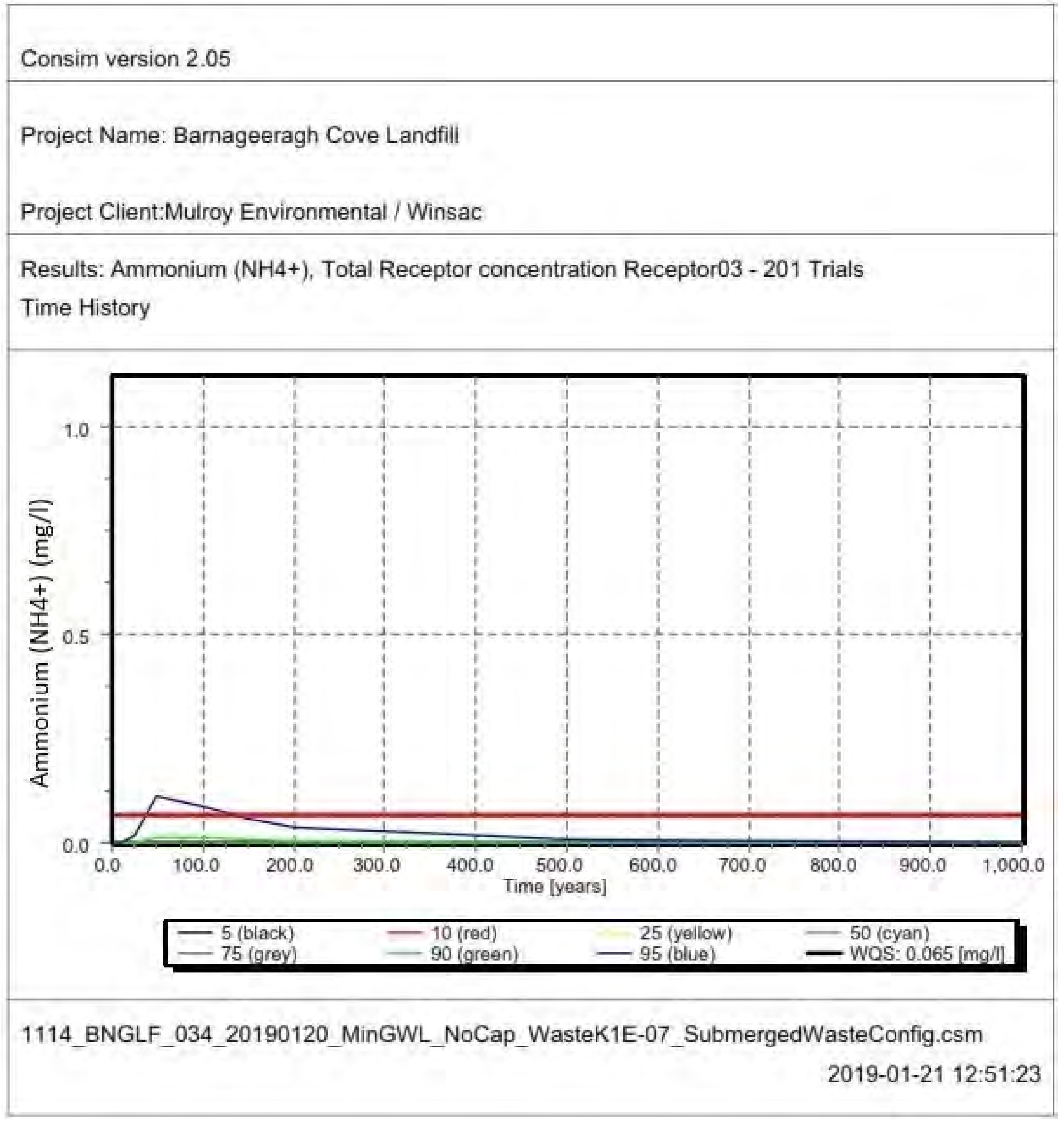


Figure 18. Predicted Ammonia Concentration (mg/l N) vs. Time at Receptor 03, Scenario 01 (Current Site Conditions)

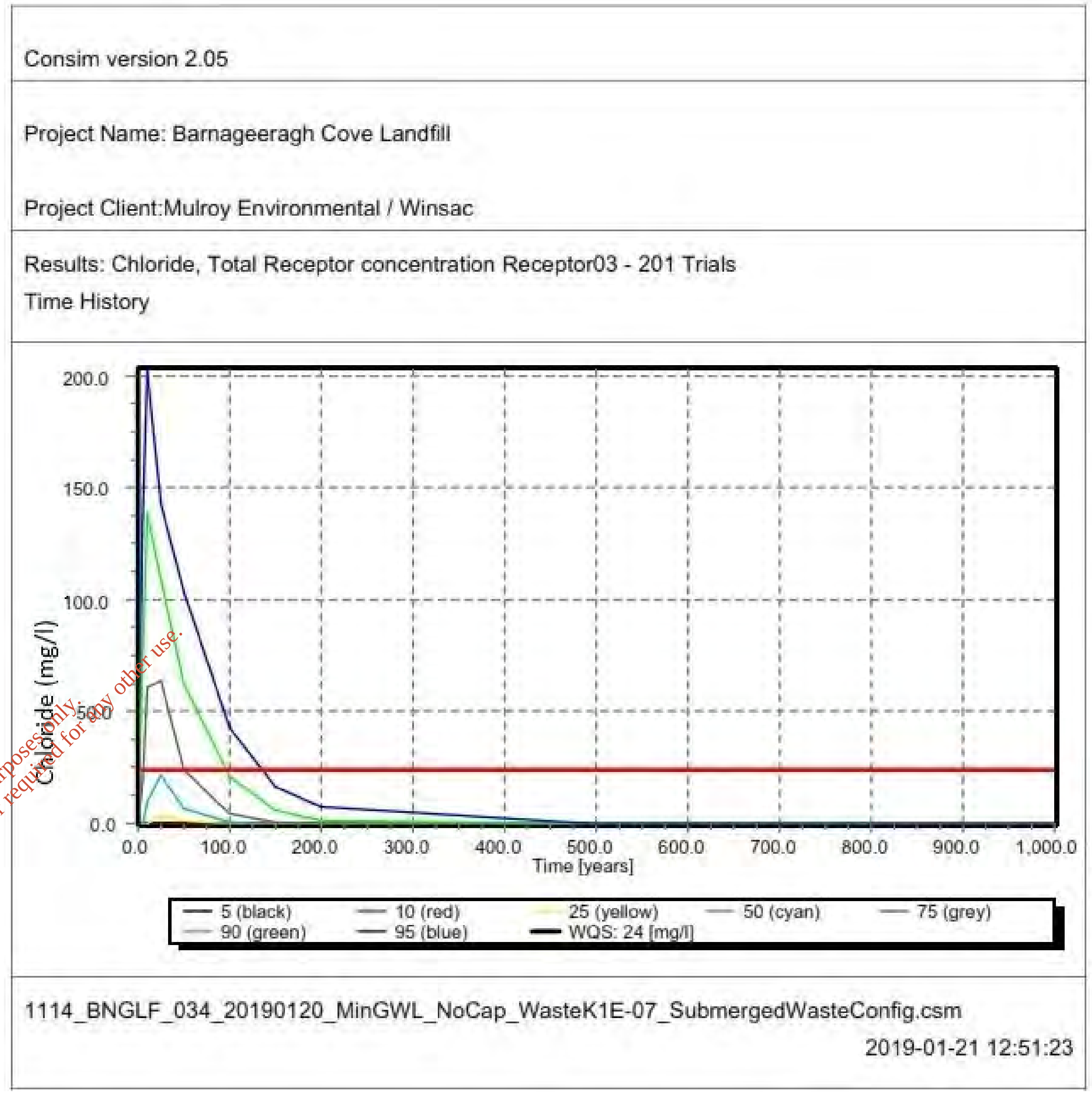


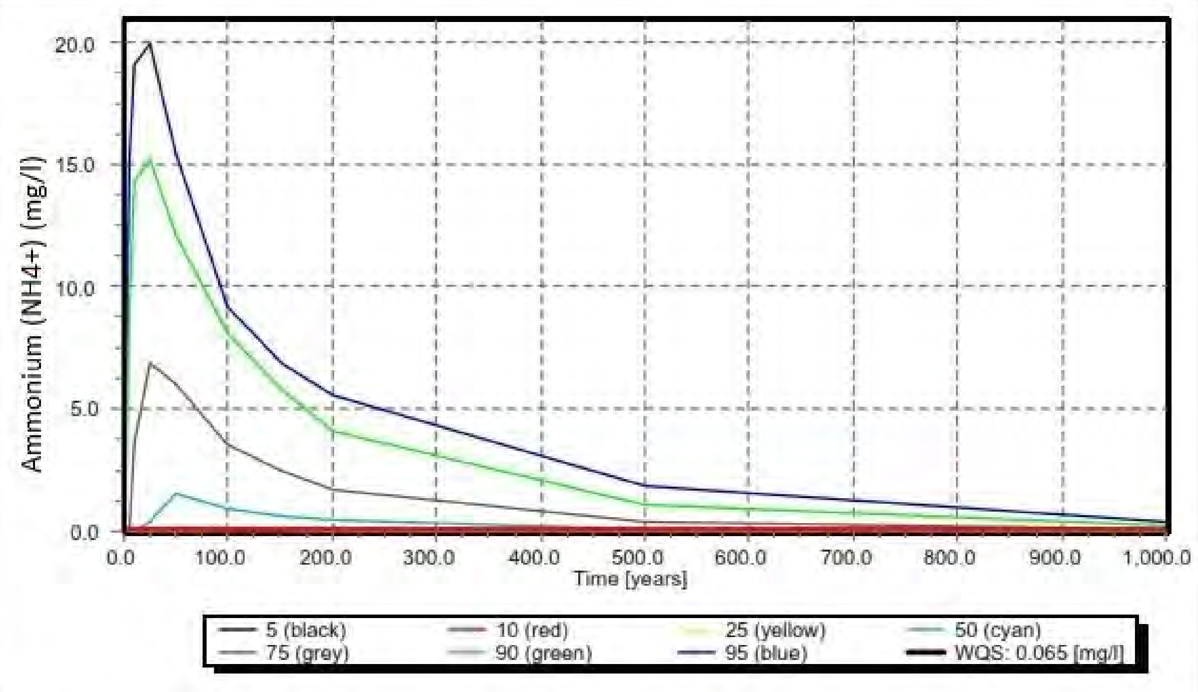
Figure 19. Predicted Chloride Concentration (mg/l) vs. Time at Receptor 03, Scenario 01 (Current Site Conditions)

Consim version 2.05

Project Name: Barnageeragh Cove Landfill

Project Client:Mulroy Environmental / Winsac

Results: Ammonium (NH4+), Total Receptor concentration Receptor04 - 201 Trials
Time History



1114_BNGLF_034_20190120_MinGWL_NoCap_WasteK1E-07_SubmergedWasteConfig.csm
2019-01-21 12:51:23

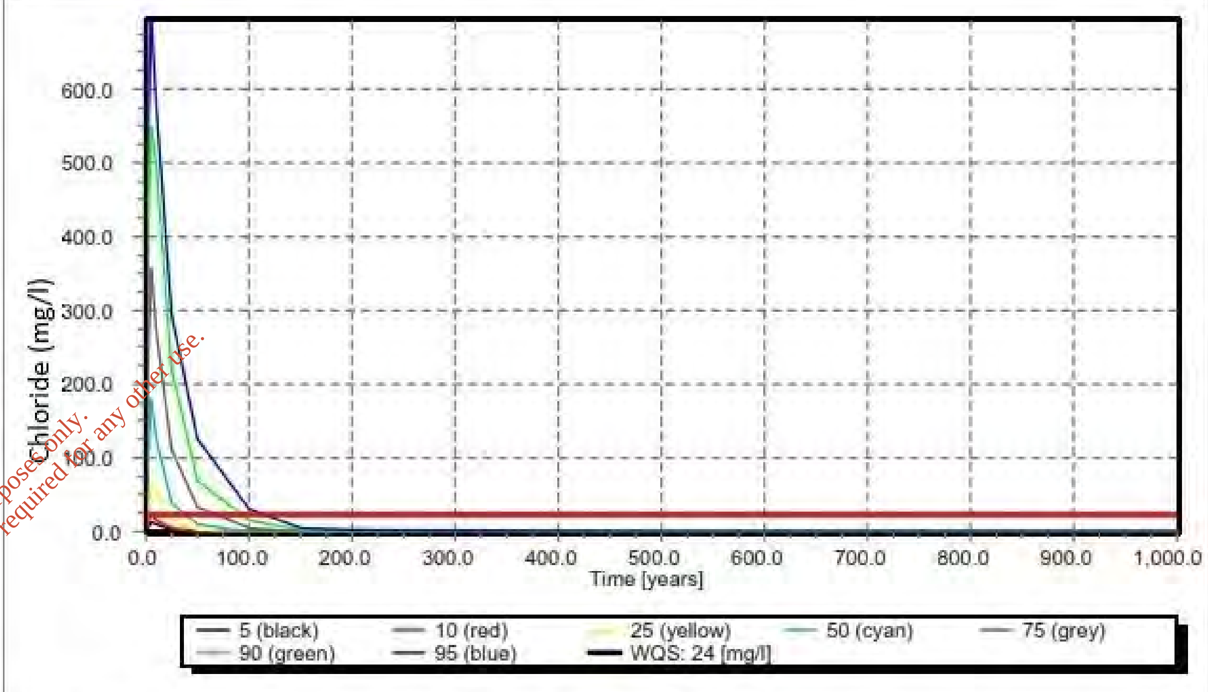
Figure 20. Predicted Ammonia Concentration (mg/l N) vs. Time at Receptor 04, Scenario 01 (Current Site Conditions)

Consim version 2.05

Project Name: Barnageeragh Cove Landfill

Project Client:Mulroy Environmental / Winsac

Results: Chloride, Total Receptor concentration Receptor04 - 201 Trials
Time History



1114_BNGLF_034_20190120_MinGWL_NoCap_WasteK1E-07_SubmergedWasteConfig.csm
2019-01-21 12:51:23

Figure 21. Predicted Chloride Concentration (mg/l) vs. Time at BH11 Receptor 04, Scenario 01 (Current Site Conditions)

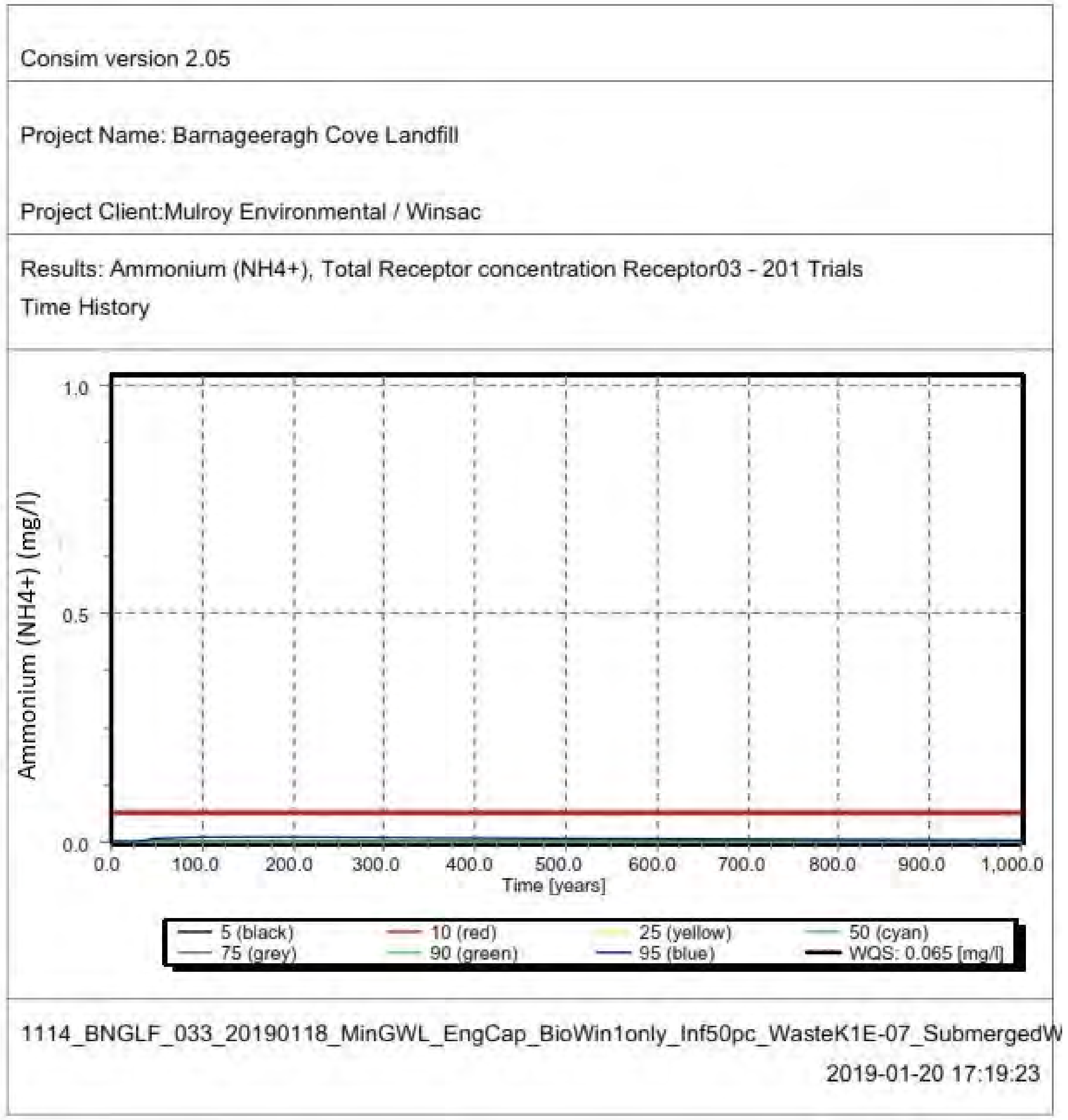


Figure 22. Predicted Ammonia Concentration (mg/l N) vs. Time at Receptor 03, Scenario 02 (Engineered Cap Conditions)

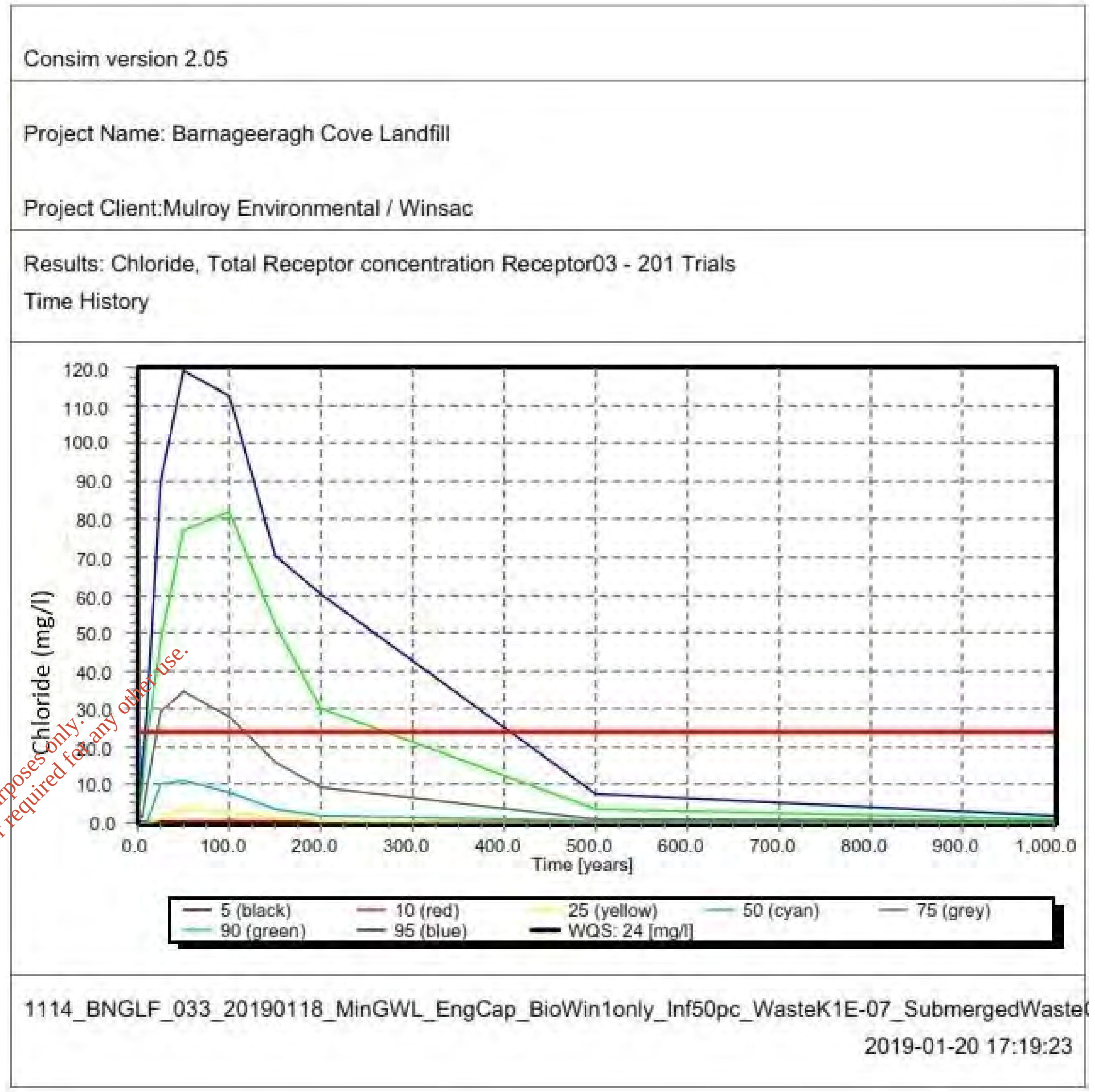


Figure 23. Predicted Chloride Concentration (mg/l) vs. Time at Receptor 03, Scenario 02 (Engineered Cap Conditions)

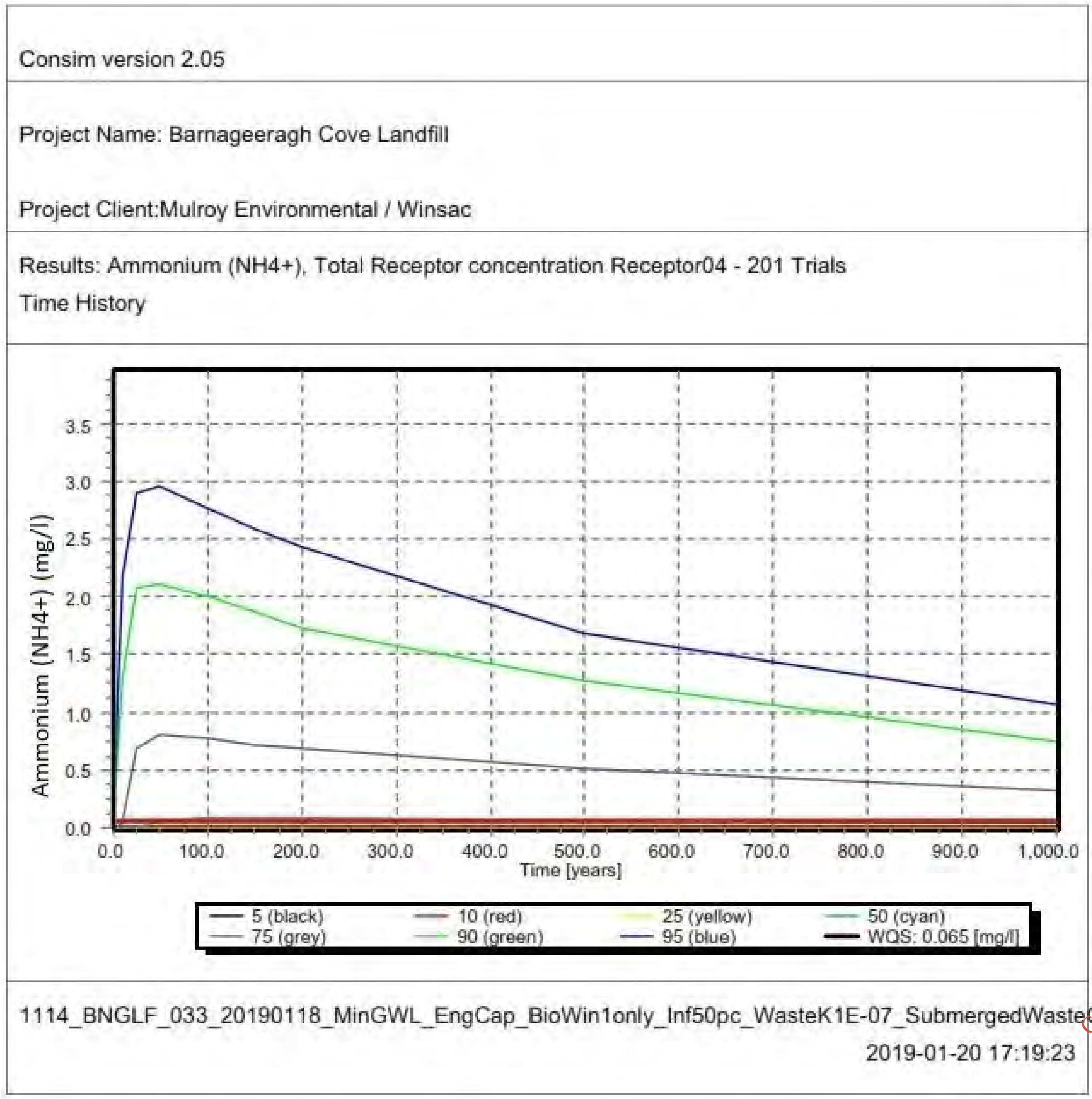


Figure 24. Predicted Ammonia Concentration (mg/l N) vs. Time at Receptor 04, Scenario 02 (Engineered Cap Conditions)

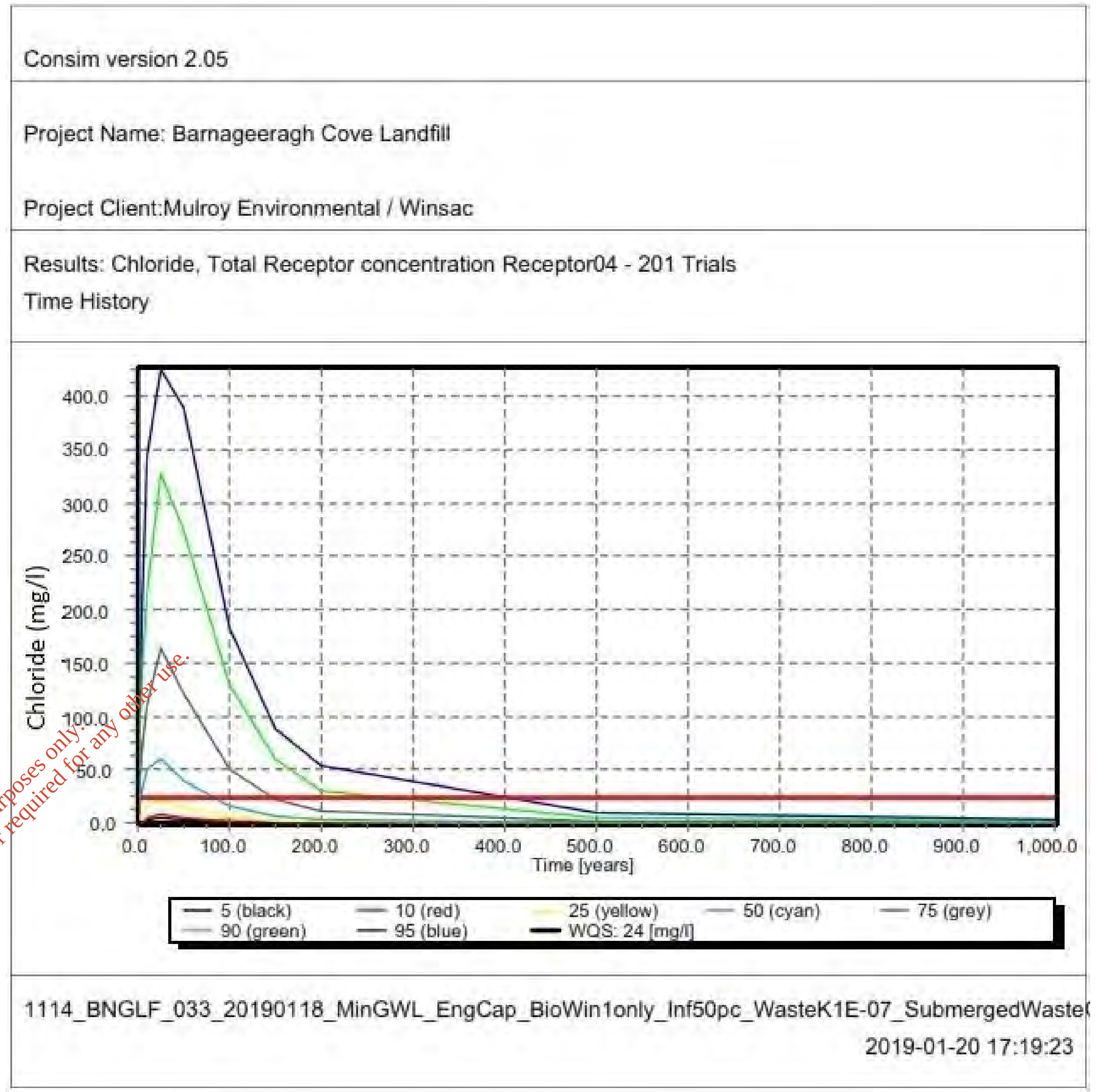


Figure 25. Predicted Chloride Concentration (mg/l) vs. Time at Receptor 04, Scenario 02 (Engineered Cap Conditions)

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6.5 Sensitivity Analysis

The most sensitive model input for the key parameter ammonia is the biodegradation half-life in the unsaturated and saturated pathways plus the simulation of ammonia biodegradation in the sorbed phase as well as in the dissolved phase. Ammonia biodegradation in the model was simulated in both the sorbed and dissolved phases, in the unsaturated zone and aquifer pathways. An ammonia biodegradation half-life of triangular distribution from 13 days to 1 yr to 6 yr was used, in line with half-lives reported in UK guidance (Buss et al, 2003).

Modelling biodegradation removes contaminant mass from the model and directly reduces the quantity of contaminant that ultimately reaches the receptor.

Figures 26 and 27 show the predicted ammonia concentrations at Receptor 01, for Scenario 01 (current site conditions) and Scenario 02 (engineered cap conditions), with no biodegradation in the sorbed phase, and the ammonia half life modelled as a uniform distribution of 1 yr to 6 yr. These graphs correspond to the graphs in Figures 14 and 16 respectively. Comparison of the pairs of graphs illustrates the sensitivity of the model to the ammonia biodegradation parameterisation.

Receptor 01 is directly downgradient of the waste under maximum water table conditions and is located at the site boundary and adjacent to the surface water receptor

The trends for Receptor 01 show that at the 95th percentile confidence level:

- For Scenario 01 Ammonia is above 0.175 mg/l as N between 10 years and 1,000 years and peaks at 291 mg/l as N at 100 years, before declining to 32 mg/l as N by 1,000 years.
- For Scenario 02 Ammonia is above 0.175 mg/l as N between 10 years and 1,000 years and peaks at 95 mg/l as N at 500 years, before declining to 62 mg/l as N by 1,000 years.
- These results are significantly higher than the comparable results with simulation of ammonia biodegradation in the sorbed phase as well as in the dissolved phase and an ammonia biodegradation half-life of triangular distribution from 13 days to 1 yr to 6 yr.

The biodegradation half life parameter distributions used in the model are based on literature values for conditions representative of those encountered at the site, i.e. relatively shallow subsoils and where high biological growth rates can be supported by the contaminants in the contaminant plume. As such, while the model is sensitive to the biodegradation parameterisation, it is considered that the parameterisation used is valid and representative of the site conditions. This is discussed further in Section 6.6 on model representativeness.

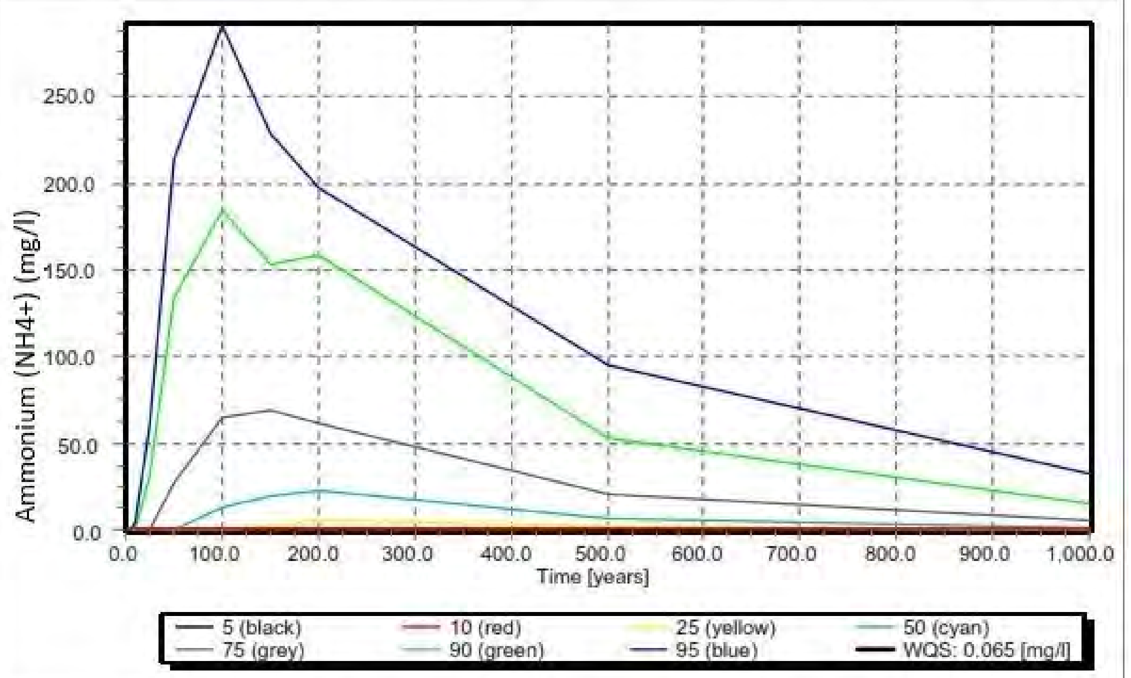
Similarly, all other parameter distributions used are considered to be valid and representative of the site conditions.

Consim version 2.05

Project Name: Barnageeragh Cove Landfill

Project Client:Mulroy Environmental / Winsac

Results: Ammonium (NH4+), Total Receptor concentration Receptor01 - 201 Trials
Time History



1114_BNGLF_035_20190120_MaxGWL_NoCap_WasteK1E-07_SubmergedWasteConfig_Sensitivity
2019-01-20 18:16:00

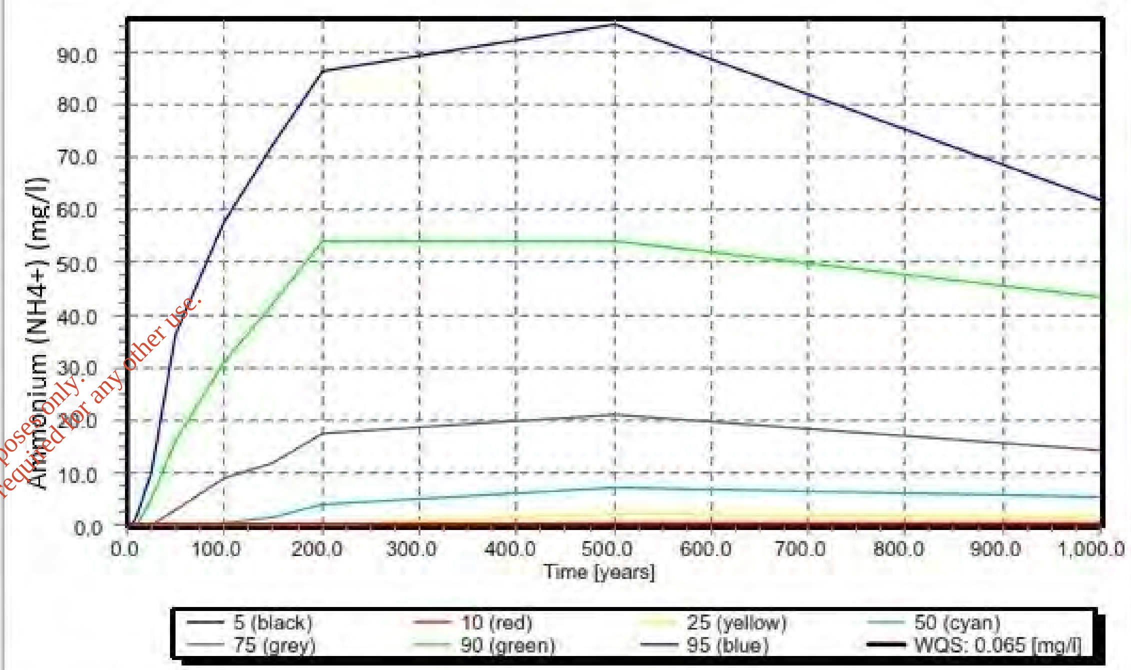
Figure 26. Predicted Ammonia Concentration (mg/l N) vs. Time at Receptor 01, Scenario 01 – Sensitivity Analysis
(Current Site Conditions), with no biodegradation in sorbed phase and uniform half life distribution of 1 to 6 years

Consim version 2.05

Project Name: Barnageeragh Cove Landfill

Project Client:Mulroy Environmental / Winsac

Results: Ammonium (NH4+), Total Receptor concentration Receptor01 - 201 Trials
Time History



1114_BNGLF_036_20190120_MaxGWL_EngCap_BioWin1only_Inf50pc_WasteK1E-07_Submerged\
2019-01-20 18:18:22

Figure 27. Predicted Ammonia Concentration (mg/l N) vs. Time at Receptor 01, Scenario 02 – Sensitivity Analysis
(Engineered Cap Conditions), with no biodegradation in sorbed phase and uniform half life distribution of 1 to 6 years.

6.6 Model Representativeness

Receptors 05 and 06 represent the modelled groundwater quality at boreholes BH11 and BH17 under maximum and minimum watertable conditions respectively. The observed groundwater quality data from the groundwater monitoring regime can be compared to the actual groundwater quality data for BH11 and BH17 as a measure of how representative the model is of the real aquifer.

The CONSIM help file indicates that "*generally, if "real" and modelled results compare between the 40 and 60 percentile, this is a very good fit. Comparison of results between the 20 and 80 percentile shall be regarded as reasonable.*"

Table 11 shows the measured range of chloride and ammonia concentrations at BH10, BH11, BH12, BH15 and BH17 for the groundwater quality samples collected in August 2017, November 2017 (high watertable) and May 2018 (low watertable).

Table 11. Comparison of Predicted and Measured Ammonia and Chloride Concentrations

Waste Age: 25 to 50 years	**Ammonia (mg/l as N)**	**Chloride (mg/l)**
BH10	0.45 to 0.93	47 to 62
BH11	11 to 23	110 to 180
BH12	2 to 3.4	71 to 86
BH15 (May 2018 only)	5.28	80
BH17 (May 2018 only)	0.49	44
Model Predicted Concentrations at 25 years to 50 years to 100 years, for Scenario 01 (Current Site Conditions)		
Receptor 05 95 %ile (BH11)	32 to 26 to 17.5	737 to 608 to 337
Receptor 05 90 %ile (BH11)	*15 to 12 to 8.8*	583 to 325 to 209
Receptor 05 75 %ile (BH11)	1.9 to 3.0 to 2.5	*308 to 169 to 78*
Receptor 05 50 %ile (BH11)	0 to 0.01 to 0.05	123 to 51 to 19
Receptor 06 95 %ile (BH17)	77 to 64 to 44	339 to 120 to 27
Receptor 06 90 %ile (BH17)	60 to 49 to 32	225 to 83 to 16
Receptor 06 75 %ile (BH17)	24 to 20 to 14	*103 to 32 to 4.7*
Receptor 06 50 %ile (BH17)	10 to 8 to 4.7	39 to 10 to 1.2
Receptor 06 25 %ile (BH17)	*0.76 to 1.2 to 0.82*	16 to 3.3 to 0.3
Sensitivity Model Predicted Concentrations at 25 years to 50 years to 100 years, for Scenario 01 (Current Site Conditions)		
Receptor 05 95 %ile (BH11)	310 to 357 to 435	
Receptor 05 90 %ile (BH11)	136 to 232 to 336	
Receptor 05 75 %ile (BH11)	32 to 109 to 178	
Receptor 05 50 %ile (BH11)	0 to 21 to 65	
Receptor 05 25 %ile (BH11)	0 to 0 to 5.3	

The data in Table 10 indicate that the predicted ammonia and chloride concentrations at Receptors 05 and 06 in the model:

- Show a reasonable fit for chloride at the 75th percentile level for the range of chloride data at BH11 and BH17 and at the other boreholes on the high transmissivity pathway downgradient of the site, i.e. at BH10, BH12, BH15.
- Show a reasonable fit for ammonia Receptor 06 at the 25th percentile level in comparison with BH17.
- Receptor 05 underestimates ammonia at the 75th percentile level but shows a good match at the 90th and 95th percentile levels.

In the sensitivity analysis model the predicted ammonia concentrations from the 70th percentile level upwards for Receptor 05 overestimate the observed ammonia concentrations at the 25, 50 and 100 year timeslices, and overestimate it at the 50 and 100 year timeslices at the 50th percentile level.

Overall the data show that:

- The model provides a reasonable fit for chloride predictions versus observed data.
- The model provides a reasonable fit for ammonia predictions versus observed data for the minimum groundwater pathway,
- The model provides a good match between the ammonia predictions at the 95th and 90th percentile levels and the observed data for the maximum groundwater pathway.
- The sensitivity model with no ammonia biodegradation in the sorbed phase and with a longer ammonia biodegradation half life overestimated the ammonia concentrations compared to the observed site monitoring data.
- As such, the simulation of ammonia with biodegradation in the sorbed phase, and a with half life with triangular distribution from 13 days to 1 yr to 6 years appears to be reasonable.

6.7 Significance of the Model Results

Chloride

The site groundwater quality monitoring data show elevated above background chloride concentrations at various locations as discussed in Section 4.2.9.

The DQRA model predicts elevated chloride concentrations to varying degrees at the modelled receptors under the current site conditions between 1 year and up to 500 years (Table 10a).

Modelling of the engineered cap remedial option predicts reduced elevated above background concentrations at the modelled receptors over a similar period (Table 10b).

Table 4 indicates that chloride is non-toxic and was selected as a SOC due to its high mobility which renders it a useful baseline indicator against which to compare the behaviour of other contaminants. There are no existing or planned groundwater abstractions in the study area which could be affected by chloride palatability issues. As such, the elevated chloride concentrations are not considered to be of environmental significance. The chloride data serve only to indicate the presence of a source of contamination, which is known to be the Barnageeragh Landfill.

Overall, the elevated above background observed and predicted chloride groundwater concentrations are not considered to be significant.

Ammonia

The site groundwater quality monitoring data show elevated ammonia concentrations at various locations as discussed in Section 4.2.9.

The DQRA model for current site conditions predicts elevated ammonia concentrations under maximum watertable conditions at Receptors 01 and 02 adjacent to the eastern site boundary drain surface water receptor. It also predicts elevated ammonia concentrations under minimum watertable conditions at Receptor 03 adjacent to the Barnageeragh Stream surface water receptor and in groundwater migrating offsite at Receptor 4 at the eastern site boundary. The predicted concentrations are likely to result in negative impacts on surface water receptors under current conditions.

Remediation of the site by capping of the waste is the preferred method for breaking the current SPR linkage between the waste and the surface water receptors.

The DQRA model for the capped site conditions predicts:

- Slightly elevated above background ammonia concentrations (up to 0.32 mg/l as N) under maximum watertable conditions in groundwater at Receptor 1 adjacent to the eastern site boundary drain surface water receptor;
- Slightly elevated above background ammonia concentrations (up to 0.19 mg/l as N) under maximum watertable conditions in groundwater at Receptor 2 adjacent to the eastern site boundary drain surface water receptor;
- No elevated ammonia concentrations under minimum watertable conditions at Receptors 03 adjacent to the Barnageeragh Stream surface water receptor; and,
- Slightly elevated above background ammonia concentrations (up to 2.96 mg/l as N) under minimum watertable conditions in groundwater at Receptor 4 at the eastern site boundary;

Table 4 indicates that ammonia was selected as a SOC due to its high mobility and its toxicity to aquatic organisms in surface water receptors.

The predicted elevated above background ammonia concentrations in groundwater adjacent to the surface water Receptors 01 and 02, under capped landfill conditions indicate the potential for a negative environmental impact on the surface water receptors due to groundwater discharge to the receptors. Following discharge of the ammonia into the surface water, volatilisation and dilution of the ammonia are likely to immediately reduce the ammonia concentrations to below the surface water ammonia EQS. Section 6.8 below confirms the ability of the surface water receptors to receive and dilute the contaminated groundwater discharge without resulting in a breach of the Groundwater or Surface Water Regulations.

Elevated above background ammonia concentrations in groundwater serve as a potential indicator for other substances that may have a negative impact on groundwater use. There are no groundwater uses in the vicinity of the site. In terms of an indicator of nearby groundwater pollution the ammonia concentrations are known to relate to the adjacent landfill. Therefore the elevated above background concentrations of ammonia at Receptor 04 at the site downgradient boundary under capped conditions at minimum watertable elevation are not considered to be significant. In particular the predicted concentrations at the downgradient site boundary do not subsequently result in elevated above background ammonia concentrations in groundwater adjacent to surface water Receptor 03 located further downgradient.

Arsenic

The DQRA predicts no exceedances of the arsenic EQS in groundwater at the site downgradient boundary or adjacent to downgradient surface water receptors under maximum and minimum watertable scenarios until at least a 500 year period has elapsed. This indicates that the current observed occasional slightly elevated above background arsenic concentrations in the groundwater downgradient of the waste are unlikely to derive from arsenic mobilised within the waste body. It is more likely that the observed arsenic in groundwater derives from naturally occurring arsenic in the subsoil deposits that has been mobilised by the plume of reducing groundwater emanating from beneath the waste, as discussed in Table 4.

The DQRA predicts a significant improvement in water quality beneath the site in terms of ammonia and chloride following the installation of an engineered cap. This would be expected to result in groundwater with a higher redox potential beneath and in the vicinity of the waste, such that dissolved arsenic would not be expected to occur.

Mercury

The DQRA predicts no exceedances of the mercury EQS in groundwater at the site downgradient boundary or adjacent to downgradient surface water receptors under maximum and minimum watertable scenarios. It is possible that the occasional slightly elevated above background mercury concentrations observed in groundwater in boreholes BH1 and BH11 have been mobilised by high groundwater chloride concentrations.

The DQRA predicts a significant improvement in water quality beneath the site in terms of chloride following the installation of an engineered cap. Following a significant reduction in chloride concentrations dissolved mercury concentrations would not be expected to occur.

Organic Contaminants

The DQRA predicts very slight exceedances of the EQSs for naphthalene and c-1,2-Dichloroethene in groundwater at Receptor 04 at the site downgradient boundary under minimum watertable scenarios following the installation of an engineered cap at the site. No exceedances are predicted at any of the other modelled receptors.

The c-1,2-Dichloroethene exceedance occurs between 25 and 200 years and peaks at 0.51 ug/l, which is only slightly above the Groundwater Regulations limit of 0.375 ug/l for protection of the use of groundwater by humans. There is no use of groundwater by humans in the vicinity of the site. The maximum predicted concentration is well below the drinking water limit for c-1,2-Dichloroethene of 10 ug/l. Therefore, the predicted slight exceedance of the c-1,2-Dichloroethene EQS at Receptor 04 is not considered to be significant.

The naphthalene exceedance occurs between 500 and 1000 years and peaks at 0.14 ug/l, which is only slightly above the Groundwater Regulations limit of 0.075 ug/l for protection of the use of groundwater by humans and the drinking water limit for total PAH of 0.1 ug/l. There is no use of groundwater by humans in the vicinity of the site. Therefore the predicted slight exceedance of the Napthalene EQS at Receptor 04 at a distant time period under minimum water table conditions only is not considered to be significant.

Site Impact on Groundwater at the Scale of the Regional Aquifer

The DQRA predicts that following the installation of an engineered cap at the site there will be exceedances of EQS criteria for chloride, ammonia, arsenic, mercury, c-1,2-Dichloroethene and naphthalene. As discussed above there is no significant environmental impact associated with the predicted exceedances. As such, following installation of an engineered cap the site is not expected to have a significant impact on groundwater quality at the scale of the regional aquifer and groundwater body.

6.8 Surface Water Dilution Assessment

The DQRA predicted elevated groundwater ammonia concentrations at the eastern site boundary surface water Receptors 01 and 02 under maximum groundwater elevation conditions for the preferred landfill cap layout. The peak predicted 95th percentile concentrations were

0.32 mg/l as N after 100 years at Receptor 01, and 0.19 mg/l as N at after 50 years at Receptor 02. The predicted concentrations exceed the Groundwater Regulations (SI 9 of 2010 as amended) Test 2 threshold of 0.065 mg/l as N. Groundwater ammonia concentrations above this level could result in negative impacts on surface water bodies into which the contaminated groundwater discharges. The Surface Water Regulations (SI 272 of 2009 as amended) annual mean threshold for ammonia concentrations in inland surface waters is also 0.065 mg/l as N.

The diluted concentration of ammonia in surface water following mixing of the groundwater discharge into the surface water flow was calculated to see if the predicted ammonia concentrations would result in a breach of either the Groundwater or Surface Water Regulations associated with the EQS.

The surface water catchment of the eastern boundary drain was delineated based on the Ordnance Survey of Ireland (OSi) 10 m topographic elevation contours in the vicinity of the site (Figure 28). The catchment area was determined to be 1.3 km^2.

The Ballaghveny Stream is a tributary of the Mill Stream, which occupies the immediately adjacent surface water catchment to the east of the site. The National Hydrometric Gauging Network station 08014 is located on the Mill Stream in Skerries town centre. Data from the "95 percentile flow statistics at hydrometric stations.xls" spreadsheet and the "Register of Hydrometric Stations in Ireland 2017.xlsx" spreadsheet, maintained by the EPA, indicate that Station 08014 has a catchment area of 8.2 km^2 and dry weather flow, 95^{th} percentile and 50^{th} percentile flow rates of 0.002 m^3/s, 0.007 m^3/s, and 0.049 m^3/s respectively.

The Mill Stream catchment is considered to be a suitable proxy for the catchment of site's eastern boundary drain due to the location two catchments adjacent to each other and their equivalent topographical and geological settings. The flow characteristics of the site eastern boundary drain were estimated by a pro rata reduction of the Mill Stream flow values based on the ratio 0.16:1 of the respective catchment areas (i.e. 1.3 km^2/8.2 km^2). The resulting dry weather flow, 95^{th} percentile and 50^{th} percentile flow rates for the site's eastern boundary drain were calculated as 0.0003 m^3/s, 0.0011 m^3/s, and 0.0077 m^3/s respectively.

The predicted elevated ammonia concentrations occur during the winter in the period of maximum groundwater elevation. As such, the 50^{th} percentile stream flow rate is considered to be the most appropriate flow rate to use in estimating the ammonia concentration in surface water following mixing of the contaminated groundwater discharge into the surface water.

The diluted ammonia concentration in the surface water was calculated as follows:

Groundwater Discharge to Eastern Boundary Stream (EBS) Maximum Watertable Pathway		**Litres/yr**
GW discharge passing beneath waste footprint to EBS (**m^3/d**)	40	14600000
Peak 95%ile ammonia conc (**mg/l**) (occurs at R01 at 100 yrs)	0.320	
Mass of ammonia in GW discharge (**mg/yr**)	4672000	
EBS 50^{th} percentile flow (**m^3/s**)	0.0077	243661750
Concentration of ammonia in surface water after mixing with EBS 50^{th} percentile flow **(mg/l)**	**0.019**	

The peak predicted groundwater ammonia concentration of 0.32 mg/l at Receptor 01 is therefore calculated to result in a diluted surface water ammonia concentration of 0.019 mg/l.

This is less than the Surface Water Regulations (SI 272 of 2009 as amended) annual mean threshold for ammonia concentrations in inland surface waters is also 0.065 mg/l as N. As such

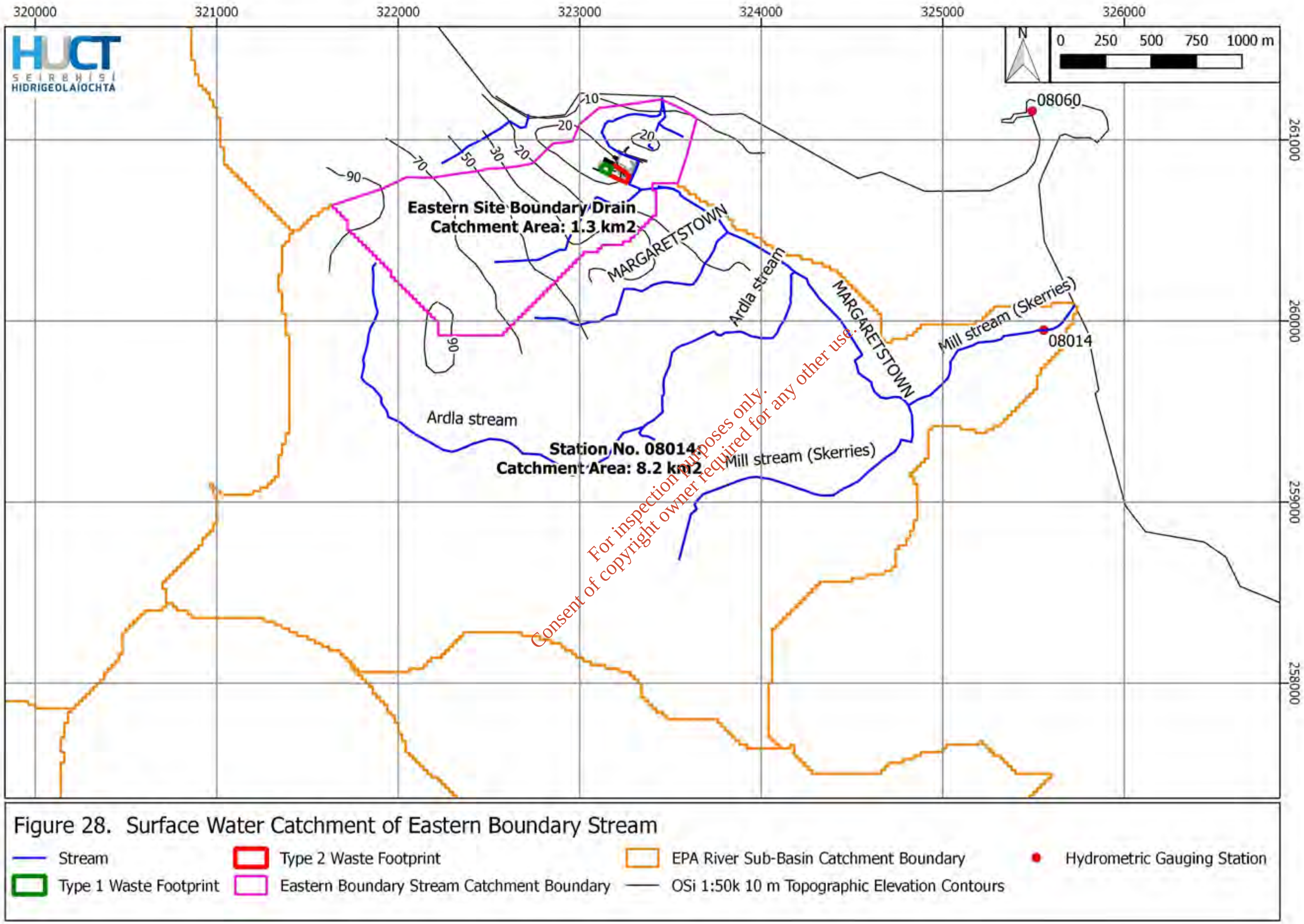


Figure 28. Surface Water Catchment of Eastern Boundary Stream

the predicted groundwater ammonia concentrations at Receptors 01 and 02 for the capped site are not considered to result in a breach of the Surface Water Regulations.

The calculated diluted ammonia concentration in surface water also amounts to less than 50% of the value of the Surface Water Regulations (SI 272 of 2009 as amended) annual mean threshold for ammonia concentrations in inland surface waters of 0.065 mg/l as N. As such, even though the predicted peak groundwater ammonia concentration of 0.32 mg/l as N at Receptors 01 and 02 exceeds the Groundwater Regulations (SI 9 of 2010 as amended) Test 2 threshold of 0.065 mg/l as N, it does not breach the follow on criterion for Test 2, and therefore it does not result in a breach of the Groundwater Regulations.

Overall therefore, the predicted ammonia concentrations in groundwater, following remediation of the site by constructing the proposed Engineered Landfill Cap over the waste, do not breach the Groundwater or Surface Water Regulations.

7 Remedial Strategy

Following completion of the DQRA the following remedial strategy has been selected to address the potential groundwater impact of the Barnageeragh Landfill:

- Installation of an Engineered Landfill Cap
    - An engineered cap including a LLDPE geomembrane liner with hydraulic conductivity less than 1 x 10^{-9} m/s, and equivalent to a 0.6 m thick layer of compacted mineral soil with a hydraulic conductivity of 1 x 10^{-9} m/s shall be installed over the waste footprint as indicated in Figure 13d.
    - The engineered cap will reduce the magnitude of groundwater recharge directly beneath the cap. The impact of this localised reduction in recharge on groundwater levels and flow patterns beneath the site is considered to be negligible and is considered to be covered by the the modelled ranges used in the DQRA model.
- DQRA predictions in respect of the Engineered Landfill Cap
    - DQRA modelling predicts that following the installation of an engineered cap at the site there will be concentrations of some SOCs which exceed their respective groundwater EQSs at different times in the 1,000 year period of the model. The SOCs in question are chloride, ammonia, arsenic, mercury, c-1,2-Dichloroethene and Naphthalene. There is no significant environmental impact associated with the predicted elevated SOC concentrations as set out in detail in Section 6.7.
- Monitoring to confirm the efficacy of the Engineered Landfill Cap
    - Following the installation of the engineered cap, one year of quarterly groundwater monitoring will be carried out at boreholes BH10, BH11, BH12, BH15 and BH17 to determine if any elevated concentrations of SOCs occur in the groundwater post capping. The observed concentrations will be compared with the DQRA predicted concentrations and to assess if the observed data are in line with the DQRA predictions.
    - Following completion of the monitoring programme a report on the outcome of the monitoring will be presented to Fingal County Council. At this point, presuming a satisfactory outcome to the monitoring programme Fingal County Council will be requested to confirm that the remedial work has been successful and that the monitoring can cease. In the event that the outcome to the monitoring programme is not satisfactory the appropriate follow on steps will depend on the interpretation of the monitoring data and shall be discussed with Fingal County Council should the need arise.

Waste Beneath the Watertable

Section 4.2.6.2 identified that part of the Type 2 waste body is constantly located beneath the watertable. Where this occurs the submerged waste will be discharging contaminants directly to the groundwater.

The DQRA has addressed this issue as set out in detail in Sections 5.2.1.3 and 6.2.2.

On this basis the DQRA is considered to be representative of the impact of the waste that resides below the watertable on groundwater beneath the site. As discussed in Section 6 the DQRA results predict that following the installation of an engineered landfill cap the waste body, including the waste below the watertable, will not result in groundwater concentrations of SOCs that will have a significant impact on groundwater quality at the site boundary or adjacent to downgradient surface water receptors.

As such, the proposed remedial strategy is considered to fully mitigate any potential impacts that may be associated with the presence of waste below the watertable at the site.

Groundwater Quality Monitoring Targets for Remedial Validation

Following installation of the engineered landfill cap a one year programme of quarterly groundwater monitoring will be implemented at BH10, BH11, BH12, BH15 and BH17.

The proposed groundwater quality monitoring targets for remedial validation are as follows:

- Chloride concentrations between 78 and 300 mg/l at borehole BH11 and between 4.7 and 103 mg/l at BH17.
- Ammonia concentrations between 8.8 and 15 mg/l at borehole BH11 and between 0.76 and 1.2 mg/l at BH17.
- Concentrations of the remaining SOCs to be compared to assess their conformance with DQRA predictions.

Implementation of Remedial Strategy

The remedial strategy will be implemented by Mulroy Environmental on behalf of Winsac.

Winsac and Mulroy Environmental will agree a timeline for implementation of the remedial strategy with Fingal County Council.

Overall Conclusion with respect to the Remedial Strategy

Based on the interpretation of the available site data and on the outcome of the detailed groundwater quantitative risk assessment, which are presented in this report, the proposed remedial strategy is considered to be the best remedial option for the site and it is predicted that the remediated site will have no significant impact on groundwater or surface water receptors downgradient of the site.

8 Conclusions

The DQRA Conclusions are:

- The site HCM has been updated to account for two groundwater pathways:
  - Maximum groundwater elevation – Occurs during periods of high watertable elevation. Groundwater flow beneath the site discharges to the site eastern boundary stream.
  - Minimum groundwater elevation – Occurs during periods of low watertable elevation. Groundwater flow beneath the flows underneath the site eastern boundary stream and continues east to discharge to the Barnageeragh Stream to the east of the WWTP site.
- Under current conditions contaminant migration via the groundwater pathway may result in elevated above background concentrations of ammonia, chloride, arsenic, c-1,2-Dichloroethene and naphthalene at downgradient receptors at varying times over the 1,000 year model period.
- If an engineered landfill cap is installed over the landfill, contaminant concentrations in groundwater at downgradient receptors are predicted to be mitigated such that the contaminant concentrations do not result in breaches of the Groundwater or Surface Water Regulations.
- Based on the interpretation of the available site data and on the outcome of the detailed groundwater quantitative risk assessment, which are presented in this report, the proposed remedial strategy is considered to be the best remedial option for the site and it is predicted that the remediated site will have no significant impact on groundwater or surface water receptors downgradient of the site.

9 Recommendations

The DQRA Recommendations are:

- The proposed engineered landfill cap should be constructed over the landfill area to minimise infiltration through the waste. This would mitigate the potential for the elevated concentrations of substances of concern to result in breaches of the Groundwater and Surface Water Regulations to occur at downgradient receptors due to contaminant migration from the waste.

10 References

AGL Consulting, 2019. Preliminary Technical Proposal for the Proposed Capping Layer for an Historic Landfill at Barnageeragh Cove, Skerries, Co. Dublin. AGL Consulting 30/01/2019, Final Draft, Rev 2.

Apex Geoservices, 2018. Report on the phase 1 & phase 2 geophysical investigation at Barnageeragh cove landfill, co. Dublin for Mulroy Environmental. AGL18018 01

Buss, S. R. Herbert, A. W. Morgan P. & Thornton, S. F., 2003. Review of ammonium attenuation in soil and groundwater. National Groundwater and Contaminated Land Centre. NGWCLC report NC/02/49

EA, 1999. Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources. Environment Agency UK. R&D 20.

EPA, 2000. Landfill Manuals – Landfill Site Design. Environmental Protection Agency, Ireland.

HUCT, 2018. Barnageeragh Cove Landfill Detailed Quantitative Risk Assessment. Hidrigeolaíocht Uí Chonaire Teoranta.

Fetter, C. W., 1994. Applied Hydrogeology. Third Edition, Pearson Prentice Hall.

Golder, 2003. ConSim: Contamination Impact on Groundwater: Simulation by Monte Carlo Method. Developed by Golder Associates on behalf of the UK Environment Agency.

Mulroy Environmental, 2017. Winsac Ltd Residential Development, Barnageeragh Cove, Skerries. Phase II Site Investigation/GQRA & Landfill Gas Survey. Interim Report 277.29.08.17

PHREEQC (Version 3)--A Computer Program for Speciation, Batch-Reaction, One-Dimensional Transport, and Inverse Geochemical Calculations. USGS.

Pubchem. National Center for Biotechnology Information. PubChem Compound Database. https://pubchemdocs.ncbi.nlm.nih.gov/citation-guidelines.

Parker, T., 2019. Personnal Communication from Tom Parker of Argentum Fox, Environmental Land Assessment Services, UK. http://www.argentumfox.co.uk/

APPENDIX 1

- Fingal County Council Queries

Type	PH Item #	P. Heaney Comment (28/03/2018)	P. Conroy Comment (10/05/2018)
General	5	On numerous instances throughout the meeting it was articulated that the work which was completed was “worst case”, “conservative” or would “over-estimate concentration”. Where appropriate in the report it would be good to highlight this fact.	The conservative nature of the DQRA will be emphasised in the revised report.
Source Character-isation	4	Consider including commentary in the report regarding the nature of the substances of concern. At the meeting it was articulated that these “contaminants” where not that harmful (i.e. not heavy hydrocarbons, etc.). Providing some more context around the toxicity of the predicted SOC may be beneficial in support of an MNA approach.	Add text on SOC selection to say clearly that the selected SOCs are representative. • Include comments on relative levels of toxicity. Clarify that the other compounds (incl SO_4) do not need to be modelled because: • Their concentrations and attenuation properties (Kd) fall within the ranges of the SOCs modelled • As such, model predictions for additional compounds would fall within the ranges of peak concentrations, and minimum and maximum travel times already modelled. • As such, it is considered that the modelled SOCs represent a conservative, worst case scenario for the site. Carry out soil sampling to characterise soil ammonia concentrations in the waste body during the proposed gas venting drilling. • This will allow for an improved representation of ammonia in the DQRA compared to the current conservative representation based on a single high concentration of ammonia in a leachate sample, which may have had a significant component of ammonia from a recent, short-term septic tank discharging to the waste body that is now decommissioned. • Further characterisation of soil ammonia concentrations across the waste body may indicate that the ammonia source concentrations are lower than currently modelled, which would reduce the predicted impact of ammonia on groundwater. o The QRA will be re-run for ammonia once the waste-soil ammonia concentrations have been characterised in detail. o The modelled half-life for ammonia is 1 to 6 years based on UK guidance; however ammonia half lives as short as 13-days have been reported. As such, it is possible that the site specific half-life for ammonia could be significantly shorter than the range used in the QRA.
Modelling SO_4 in DQRA	11	There were discussions regarding whether it may be beneficial to also look at modelling sulphate, as it had previously been detected at elevated concentrations. Although it was discussed that it may have a very similar Kd to the chloride which was modelled.	
Ammonia Modelling in DQRA	n/a		

GW Pathway	9	Review the need for any additional monitoring boreholes – particularly along the southern and south-eastern site boundaries [between BH2 and BH1; and between BH1 and BH7(no data); and between BH7(no data) and BH12].
		If (as articulated at the meeting), that there is no access in this area and no space between the waste and the site boundary to install extra boreholes then comment on this in the report….as this may be something which would be identified as a gap in the future.
		If (as articulated at the meeting), that while there are a limited number of boreholes in these locations, it is believed that the groundwater migrating to the south and southeast of the waste body would be no different in water quality to that migrating northwards (as defined by the boreholes north of the waste body), then consider including this comment in the report and provide back-up support for this conclusion (e.g. trial pitting results, waste all very similar, waste not expected to be any different, etc.).
			Additional boreholes to monitor southerly and easterly groundwater flow paths:
			• A borehole has been proposed between BH7 & BH12 to be located as close to the stream and as far south as possible given the waste boundary and access restrictions.
			o Update revised report to account for the new data.
			Additional clarifications (with relevant supporting material) to include in Report :
			• Physically there is no space to install MWs downgradient of the waste inside the site boundary to the south of the waste (i.e. between BH7 to BH1 to BH2). Waste is effectively up to site boundary in south and sewage main is an additional obstruction.
			• The Type 1 & Type 2 waste areas are considered to be largely homogeneous in themselves. This means that the waste encountered by infiltration feeding groundwater flowpaths heading east and south from the landfill area is considered to be the same as the waste encountered by infiltration feeding the flowpaths heading north past the existing groundwater monitoring wells. Hotspots of contaminated material different to the general waste types and that only occur in areas recharging eastern and/or southern flowpaths are not expected to occur.
			• Geological setting to east and south is considered to be similar to that investigated on site to the north of the landfill. GSI mapping shows the same subsoil body and bedrock underlying the whole area downgradient of the landfill to the stream discharge boundary to the north, east and south of the landfill area. As such, we expect the groundwater flow and contaminant transport conditions monitored in the existing boreholes on site to be representative of conditions along other flowpaths to the east and south where it is not possible to install monitoring wells.

GW Pathway	n/a		Two additional boreholes to be installed in the bedrock northeast of GW12 to further characterise the nature and extent of the potential sandstone bedrock preferential pathway. • Carry out pumping tests on the new MWs.

Type	PH Item #	P. Heaney Comment (28/03/2018)	P. Conroy Comment (10/05/2018)
Modelling Impact on GW in DQRA	10	The report evaluates water quality at a representative location (BH4) which is approx. 10m from the boundary of the waste. There does not appear to be any comment in the report regarding groundwater quality at further away locations. It was articulated in the meeting that groundwater quality would improve further from the waste body, due to natural attenuation, if this is the belief then inclusion of this comment in the report may be beneficial.	Additional discussion and modelling results to be presented on this issue in revised report.
GW Receptor	3	Consider inclusion within the report comments regarding the predicted impact on groundwater quality on a more regional aquifer basis (as articulated in the meeting) e.g. with regard to the status of the groundwater body etc.	Additional discussion to be included in the report on this issue. This will be in terms of assessment of the annual mean groundwater quality of the Groundwater Body in line with the GW Regs requirements, taking account of the observed groundwater contaminant concentrations at the site.

SW Receptor	1	The stream surrounding the site has been identified as the primary receptor for the DQRA.
		It would be beneficial to include a cross section in the conceptual model section of the report to illustrate this and if possible to include some actual elevations (both groundwater and surface water) to demonstrate a hydraulic gradient from the groundwater to the surface water
		(i.e. demonstrate that they are in hydraulic continuity in both summer and winter; and that the stream is not perched above groundwater).
			Clarify HCM with respect to the boundary stream as the groundwater discharge boundary for the site.
			• Add figure showing natural stream course (from 25" historical map) and current culverted stream course, overlaid on subsoil map and with GW elevations contours and stream invert & water elevations; and annotated to explain that groundwater discharges to the stream.
			• Add row to HCM table stating data on:
			  o Groundwater levels (winter & summer) adjacent to the boundary stream (BH14 levels, GW Contour elevations).
			  o Surface water elevation and stream invert elevation at SW2 & SW3 (& SW1 if available).
			    ▪ Additional topographic survey of stream invert and water level if necessary.
			  o Highlight that GW elevation > Surface water elevation and that hydraulic gradient is from the GW into the stream, such that the stream acts as a discharge boundary for the site.
			• **Add HCM Cross-Section in line with PH comment #1.**
			Follow-on that as a result groundwater contamination does not migrate offsite by the groundwater pathway because it discharges to the stream at the site boundary.
			• Note that along the southern boundary the groundwater will flow a short distance offsite, under the railway as far as the stream.

SW Receptor	6	Consider taking this study to the next level. Now that the model has provided predictive concentrations in groundwater discharging to the identified surface water receptors, consider assessing:
		a. the loadings discharging to the receptors and
		b. the assimilative capacity of these receptors.
		c. Then based on these results comment on the implications…
		  o again, does this support an MNA approach or mean that an alternative remedial measure is required.
			Quantify contaminant concentrations in the stream via the following steps:
			• Estimation of the magnitude of groundwater baseflow to the stream and the contaminant load discharged to the stream.
			  o Take account of data from new boreholes in assessing contribution from potential preferential sandstone pathway.
			• Modelling of the surface water body to determine the range of flow expected in the stream
			• Estimation of the final contaminant concentration in the stream following mixing and dilution.
			  o Potentially take account of ongoing nitrification of ammonia in the stream.
			• Compare estimated stream concentrations to relevant surface water quality EQSs.
			• Comment on how representative the estimated surface water contaminant concentrations are with respect to the observed concentrations from Surface Water Quality monitoring.
			• Follow on to estimate contaminant concentrations in stream at marine discharge – further dilution and nitrification (consider nitrates)
			  o Compare estimated concentrations to relevant marine EQSs.
			  o If necessary (i.e. if concs at outfall exceed any marine EQSs), proceed to estimation of final marine contaminant concentrations following mixing and dilution etc.
			Carry out the following additional investigations in support of the surface water assessment:
			• Establish an upstream surface water monitoring location if possible.
			• An additional round of surface water quality monitoring

SW Receptor	7	The surface water receptors ultimately discharge to the sea not far from the site, consider assessing the risk to the marine environment from the discharge of these streams to the sea. In order to demonstrate that this has been considered and (if appropriate) then dismissed as "no impact"…again supporting the MNA case.	

<table>
<tr><th>Type</th><th>PH Item #</th><th>P. Heaney Comment (28/03/2018)</th><th>P. Conroy Comment (10/05/2018)</th></tr>
<tr><td>Remedial Strategy</td><td>2</td><td>Consider inclusion within the report of a specific section which provides a compelling case (as articulated during meeting) to support the proposed MNA proposal (if you believe appropriate).
a) In particular, address the issues which may conflict with an MNA approach (e.g. existence of waste below the groundwater table, direct discharge to groundwater, hazardous substances, above EQS/DW standards, effect on receptors, long timescales, long duration period of monitoring, etc.).
b) Discuss why other remedial options are not justified or required.</td><td rowspan="2">Report Section on Monitored Natural Attenuation Remedial Strategy including:
• Summarise contaminant source setting, i.e. existence of waste below the groundwater table, direct discharge to groundwater, hazardous substances, contaminant concentrations in groundwater above EQS/DW standards, effect on receptors.
• Summarise natural attenuation processes which act on an ongoing basis to mitigate the groundwater contamination by
o diminishing the source concentrations through leaching and biodegradation,
o attenuating the contaminants as they migrate through the unsaturated zone (where present beneath waste) and saturated zone by retardation, dispersion, dilution and biodegradation
o attenuating the contaminants following groundwater baseflow discharge to surface water by dilution and biodegradation
• Set out timescales for measuring degree of natural attenuation of the contaminants:
o Predicted trends in the QRA CONSIM model suggest that chloride and ammonia contaminant concentrations in groundwater will peak and then decline to background levels over an extended time period.
o For chloride the peak is expected to occur approximately 10 years from now, based on current source contaminant concentrations and only taking account of contamination from the present day onwards.
o It is feasible therefore to monitor chloride trends over a moderate timescale to confirm the predicted occurrence of a peak and subsequent decline.
o Criteria for evaluating success of the MNA regime would be that chloride concentrations peak within a 10 to 15 year period and decline steadily thereafter.
o Assuming that the observed chloride trends confirm the model predictions for chloride, the longer-term trends for ammonia attenuation would attain a greater degree of confidence.
• Set out the proposed monitoring regime.
o Contaminant migration is via the groundwater pathway to the site boundary stream, such that monitoring of groundwater quality in onsite boreholes downgradient of the waste and of surface water in the site boundary stream will provide representative data against which to measure the progress of natural attenuation.
Discount other potential Remedial Strategies:
• The observed contaminant source concentrations and the observed contaminant concentrations in groundwater and surface water are lower than those observed at numerous other unlined historical landfills across the country.
o Many of these sites are in public ownership and form parts of EPA licensed landfill site (examples can be stated if required).
o In all cases it is the experience of the authors that the unlined waste bodies have been left in situ and Monitored Natural Attenuation has been adopted as the remedial strategy.
• Capping is not a desirable approach due to the potential to build up landfill gas pressure beneath the cap and result in undesirable sub-surface landfill gas migration.</td></tr>
<tr><td>Remedial Strategy</td><td>8</td><td>Consider deriving target values and/or target observations for the proposed MNA approach, so that it can be “objectives based” and “measurable” (i.e. to demonstrate/confirm that in the future we are seeing results which are consistent with predicted concentrations, water quality is improving, there is no unexpected increase in substances of concern, there are no new substances of concern, etc.).</td></tr>
</table>

Peter Conroy

From:	Paul Heaney <paul.heaney@rpsgroup.com>
Sent:	31 Bealtaine 2018 12:06
To:	peterconroy@groundwater.ie
Cc:	Mortimer Loftus <Mortimer.Loftus@fingal.ie> (Mortimer.Loftus@fingal.ie); Conrad Wilson; Padraic Mulroy; Patrick McCabe
Subject:	RPS Response comments to Peter Conway DQRA Assessment Response 10/05/18
Attachments:	1114_Meeting20180322_FollowUpDiscussionSummary.pdf

Hi Peter,

Many thanks for your email and the table you generated which really helps to clearly present all the various discussion points from the 21/3/18 meeting and the proposed way forward.

I provide the below further comments in response to your email and the attached table:

- Many thanks for confirming that the comments we provided after the meeting (RPS email 28/03/18) accurately reflected the discussions held at the meeting.
- Many thanks also for developing the table which clearly addresses each of the comments in turn and also for the inclusion of the additional two comments (relating to ammonia characterisation/modelling and additional borehole drilling/testing) for which you also provide an approach to progressing.
- We suggest that further consideration be given to the following points (although we acknowledge that feedback may need to come from Mulroy in addressing some of the below):
  - **Remedial Strategy PH Item 2 & 8:** The response states that timelines will be established for the MNA strategy. It is also stated that chloride concentration peaks are expected to occur within 10 to 15 years. While the MNA monitoring timelines are not presented, as yet, it is worth noting that there may be a long term monitoring requirement associated with an MNA approach.
    - Who will be responsible for the implementation and costs of the on-going relatively long term water monitoring programme.
  - **Remedial Strategy PH Item 2 & 8:** The response suggests that "*Capping is not a desirable approach due to the potential to build up landfill gas pressure beneath the cap and result in undesirable sub-surface landfill gas migration*."
    - Have the hydrogeological implications (or advantages) of a capping layer been tested/modelled?
    - Is it required from a groundwater perspective?
    - Rather than dismissing it on a "gas" focussed basis it might be better to firstly address whether it is required or the benefit offered from a groundwater perspective.
  - **Remedial Strategy PH Item 2 & 8:** The response sets out a comprehensive approach to supporting an MNA remedial strategy and then to discussing other remedial strategy options. The EPA Code of Practice for Environmental Risk Assessment for Unregulated Waste Disposal Sites suggests an approach where, by default, the waste should be removed and that only where it can be demonstrated that an alternative solution provides "*greater protection to the environment and the health of the local population*" should the waste remain in place.
    - Is MNA the "best" remedial strategy?
    - Would it be acceptable to the EPA, given the CoP direction described above?
- The only other comment we would raise is that it appears that hydrogeological field investigations and data gathering is still on-going at site, on completion of the field programme there is still a significant amount of data analysis, modelling and result interpretation to complete. Can an estimate be provided of the likely completion of the DQRA, interpretation of the results and presentation of an appropriate remedial strategy (with adequate supporting information)?

Please don't hesitate to come back to me with any comments or further queries.

Many thanks and kind regards

Paul

From: Peter Conroy [mailto:peterconroy@groundwater.ie]
Sent: 10 May 2018 16:26
To: Paul Heaney
Cc: Padraic Mulroy; Patrick McCabe
Subject: [EXT] FW: Barnageeragh - Notes on DQRA Assessment

Hi Paul,

I am finally getting back to you in reply to your email below summarising your notes on the discussion of the Groundwater DQRA at the Winsac/Fingal CoCo meeting of 21 March 2018.

As it happens, I had drafted my own set of notes the morning after the meeting. I have categorised your notes (into categories like "Source Characterisation", "Remedial Strategy", etc.) and tabulated them. I have then collated my own comments adjacent to your notes to indicate agreement and how we intend to proceed to address the issues in your notes. The resulting table is attached in .docx and .pdf formats.

Overall we are happy with your comments and consider that they accurately reflect the meeting.

There were only a few additional items that I added in on top of your comments, i.e.

- Improving the ammonia characterisation and DQRA modelling by collecting additional data on soil ammonia concentrations.
- Drilling additional boreholes and carrying out pumping tests on same to characterise the potential sandstone bedrock preferential pathway.

In general Mulroy Environmental have been progressing the work since the meeting in March.

As far as I am aware the following work is currently underway or completed:

- Drilling of passive gas venting wells and associated soil sampling to characterise source ammonia concentrations.
- Drilling of 3 no. additional groundwater monitoring boreholes along the eastern site boundary.
- Topographic Survey of site boundary stream.
- Surface water quality monitoring round.

Once all of the data from the additional site investigations become available we will progress the additional interpretative and DQRA work.

If you have any questions please do not hesitate to contact me.

Le dea-mheas,
Peter

Peter Conroy
EurGeol, PGeo, B.Sc., M.Sc.
Stiúrthóir.

HUCT
SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

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APPENDIX 2

Supporting Data

- Appendix 2-1: Table A.2.1 Concentration Ranges For Soil Contaminant Parameters
- Appendix 2-2: Table A2.2. Summary of Physical and Chemical Properties of Contaminants in Type 1 and Type 2 Waste
- Appendix 2-3. Hydrogeological data and assessment underpinning the hydrogeological conceptual model from the March 2018 report revision
- (Note: For Borehole Logs See Mulroy Environmental Main Report)

				Antimony Low Level CEN 10:1 Leachate	Arsenic Low Level CEN 10:1 Leachate	Barium Low Level CEN 10:1 Leachate	Cadmium Low Level CEN 10:1 Leachate	Chromium Low Level CEN 10:1 Leachate	Copper Low Level CEN 10:1 Leachate	Lead Low Level CEN 10:1 Leachate	Mercury Low Level CEN 10:1 Leachate	Molybdenum Low Level CEN 10:1 Leachate	Nickel Low Level CEN 10:1 Leachate	Selenium Low Level CEN 10:1 Leachate	Zinc Low Level CEN 10:1 Leachate	Sulphate CEN 10:1 Leachate
Waste Type	**SOURCE**	**SAMPLE ID**	**DEPTH (mbgl)**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
	DUTCH CRITERIA	**Dutch Intervention Levels (IV)**		**15**	**55**	**625**	**12**	**380**	**190**	**530**	**10**	**200**	**210**	-	**720**	-
		Dutch Target Level (TV)		**3**	**29**	**160**	**0.8**	**100**	**36**	**85**	**0.3**	**3**	**35**	-	**140**	-
	LQM/CIEH GENERIC ASSESS	**Residential**		-	-	-	**3**	-	**2330**	-	-	-	-	-	**3750**	
		Allotment		-	-	-	**0.53**	-	**524**	-	-	-	-	-	**618**	
		Commercial		-	-	-	**348**	-	**71700**	-	-	-	-	-	**665000**	
	CLEA SOIL GUIDELINE VALU	**Calculated SGV**		-	-	-	**5.28**	**132.2**	**NA**	**450**	**8.003**	-	**ND**	**ND**	**NA**	-
		Published SGV		-	**20**	-	**2**	**130**	-	**450**	**8**	-	**50**	**35**	-	-
	WALSHESTOWN RESTORAT	**WAC Values**	**INERT WASTE**	**0.06**	**0.5**	**20**	**0.04**	**0.5**	**2**	**0.5**	**0.01**	**0.5**	**0.4**	**0.1**	**4**	**1000**
	MURPHY ENVIRONMENTAL	**WAC Values**	**SOIL & SUBSOIL'**	**0.03**	**0.25**	**10**	**0.02**	**0.25**	**1**	**0.25**	**0.005**	**0.25**	**0.2**	**0.05**	**2**	**500**
	WASTE FRAMEWORK DIREC	**WAC Values**	**STABLE NON-REACTIV**	**0.7**	**2**	**100**	**1**	**10**	**50**	**10**	**0.2**	**10**	**10**	**0.5**	**50**	**20000**
	WASTE FRAMEWORK DIREC	**WAC Values**	**HAZARDOUS WASTE**	**5**	**25**	**300**	**5**	**70**	**100**	**50**	**2**	**30**	**40**	**7**	**200**	**50000**
Waste Type	**SOURCE**	**SAMPLE ID**	**DEPTH (mbgl)**													
2	TP1	SO-TP1-01	0 - 3.0	0.031	< 0.050	< 0.50	< 0.010	< 0.050	0.067	< 0.010	0.0052	0.069	< 0.050	< 0.010	< 0.50	530
2	TP1	SO-TP1-02	3.0 - 3.5	< 0.010	< 0.050	< 0.50	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	< 0.050	< 0.050	< 0.010	< 0.50	81
2	TP2	SO-TP2-01	0 - 4.0	0.027	< 0.050	0.52	< 0.010	0.24	0.10	0.032	< 0.0050	0.13	0.050	0.011	< 0.50	2000
1	TP3	SO-TP3-01	1.0 - 4.2	0.046	< 0.050	0.55	< 0.010	< 0.050	0.061	< 0.010	0.0055	0.15	< 0.050	0.020	< 0.50	5600
1	TP4	SO-TP4-01	1.0 - 4.4	0.056	< 0.050	0.53	< 0.010	< 0.050	< 0.050	0.028	0.0054	0.10	< 0.050	0.065	0.65	7600
1	TP5	SO-TP5-01	1.2 - 3.5	0.012	< 0.050	< 0.50	< 0.010	0.11	< 0.050	< 0.010	0.0058	0.10	< 0.050	0.026	< 0.50	4400
1	TP6	SO-TP6-01	2.5 - 4.3	0.031	< 0.050	< 0.50	< 0.010	0.13	0.051	< 0.010	< 0.0050	0.11	< 0.050	0.048	0.96	14000
2	TP7	SO-TP7-01	1.6 - 4.6	0.12	< 0.050	0.70	< 0.010	< 0.050	< 0.050	0.016	< 0.0050	0.76	< 0.050	0.033	< 0.50	1300
2	TP8	SO-TP8-01	1.5 - 4.1	0.082	0.063	1.4	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.34	0.058	0.029	< 0.50	2700
1	TP9	SO-TP9-01	0.3 - 2.2	0.021	< 0.050	< 0.50	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.22	< 0.050	0.029	< 0.50	1300
1	TP10	SO-TP10-01	1.0 - 4.5	0.098	< 0.050	< 0.50	< 0.010	0.37	< 0.050	< 0.010	0.0068	0.18	< 0.050	0.079	1.4	30
1	TP11	SO-TP11-01	1.2 - 4.4	0.040	< 0.050	< 0.50	< 0.010	< 0.050	< 0.050	< 0.010	0.0064	0.20	< 0.050	0.065	0.58	16000
2	TP12	SO-TP12-01	0 - 2.7	0.027	< 0.050	< 0.50	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.15	< 0.050	0.028	< 0.50	700
2	TP12	SO-TP12-02	2.7 - 4.6	0.034	< 0.050	0.56	< 0.010	< 0.050	0.066	< 0.010	< 0.0050	0.15	< 0.050	0.053	< 0.50	13000
2	TP13	SO-TP13-01	1.5 - 4.0	0.064	< 0.050	0.87	< 0.010	0.69	< 0.050	< 0.010	< 0.0050	0.25	< 0.050	0.023	< 0.50	1900
2	TP14	SO- TP14-01	1.0 - 2.3	0.420	< 0.050	0.82	< 0.010	< 0.050	0.056	< 0.010	< 0.0050	0.22	< 0.050	0.023	< 0.50	1300
2	TP14	SO- TP14-02	2.3 - 4.4	0.200	0.051	1.5	< 0.010	1.3	< 0.050	0.011	< 0.0050	0.32	0.13	0.030	< 0.50	4000
2	TP15	SO- TP15-01	1.0 - 3.2	0.067	0.11	1.0	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.61	0.10	0.047	< 0.50	3200
2	TP15	SO- TP15-02	3.2 - 4.1	0.043	0.075	< 0.50	< 0.010	< 0.050	0.068	< 0.010	< 0.0050	0.23	< 0.050	0.033	< 0.50	1100
2	TP16	SO- TP16-01	2.4 - 4.6	0.140	< 0.050	0.72	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.26	< 0.050	0.025	< 0.50	2400
2	TP17	SO-TP17-01	2.5 - 4.1	< 0.010	< 0.050	< 0.50	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	< 0.050	< 0.050	0.013	< 0.50	22
2	TP18	SO-TP18-01	0 - 4.1	0.021	< 0.050	< 0.50	< 0.010	< 0.050	0.057	< 0.010	< 0.0050	0.061	< 0.050	< 0.010	< 0.50	630
1	TP19	SO-TP19-01	0.9 - 3.5	0.017	< 0.050	< 0.50	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.16	< 0.050	0.058	0.620	16000
1	TP19	SO-TP19-02	3.5 - 4.0	0.032	< 0.050	< 0.50	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.10	< 0.050	0.025	< 0.50	3100
1	TP20	SO-TP20-01	1.3 - 4.0	0.041	< 0.050	0.50	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.097	< 0.050	0.015	< 0.50	1300
1	TP20	SO-TP20-02	4.0 - 4.3	< 0.010	< 0.050	< 0.50	< 0.010	1.3	0.096	< 0.010	< 0.0050	< 0.050	< 0.050	0.017	< 0.50	360
2	TP21	SO-TP21-01	1.3 - 4.0	0.095	< 0.050	0.83	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.45	0.054	0.027	< 0.50	2300
2	TP22	SO-TP22-01	1.6 - 4.2	0.10	0.055	< 0.50	< 0.010	< 0.050	< 0.050	0.011	< 0.0050	0.49	< 0.050	0.026	< 0.50	380
2	TP23	SO-TP23-01	3.5 - 4.0	0.065	< 0.050	< 0.50	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.16	< 0.050	< 0.010	< 0.50	650
3	TP25	SO-TP25-01	0.5 - 3.6	0.022	< 0.050	< 0.50	< 0.010	< 0.050	0.12	0.016	< 0.0050	0.087	< 0.050	0.018	< 0.50	93
3	TP27	SO-TP27-01	0.5 - 3.5	0.023	0.084	< 0.50	< 0.010	< 0.050	0.13	0.014	< 0.0050	0.11	< 0.050	0.020	< 0.50	160
2	TP28	SO-TP28-01	2.2 - 4.0	0.027	< 0.050	< 0.50	< 0.010	< 0.050	0.055	< 0.010	< 0.0050	0.074	< 0.050	0.011	< 0.50	260
3	TP29	SO-TP29-01	1.9 - 4.2	0.040	< 0.050	< 0.50	< 0.010	< 0.050	0.097	0.022	< 0.0050	0.066	< 0.050	0.016	< 0.50	110
2	TP31	SO-TP31-01	0 - 3.8	< 0.010	< 0.050	< 0.50	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.059	< 0.050	< 0.010	< 0.50	100
3	TP33	SO-TP33-01	0 - 2.3	< 0.010	< 0.050	< 0.50	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	< 0.050	< 0.050	< 0.010	< 0.50	200
2	TP36	SO-TP36-01	0.2 - 3.2	0.016	< 0.050	1.1	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.089	< 0.050	< 0.010	< 0.50	1200
2	TP37	SO-TP37-01	0.2 - 3.7	0.11	0.053	0.84	< 0.010	0.097	0.13	< 0.010	< 0.0050	0.29	0.12	0.019	< 0.50	440
2	TP38	SO-TP38-01	0.2 - 3.6	0.032	< 0.050	0.75	< 0.010	< 0.050	0.61	< 0.010	< 0.0050	0.073	0.16	< 0.010	< 0.50	4300
3	TP48	SO-TP48-01	1.7 - 2.4	0.023	< 0.050	< 0.50	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.32	< 0.050	0.017	< 0.50	180
3	SP1	SO-SP1-01	-	0.035	< 0.050	0.52	< 0.010	< 0.050	< 0.050	< 0.010	< 0.0050	0.14	< 0.050	0.020	< 0.50	530
2	WWTPPipe_BH1		5	0.090	0.06	2.48	<0.01	0.02	0.26	<0.01	<0.0005	0.44	0.13	0.080	0.66	15824
2	WWTPPipe_BH2		1	0.100	0.040	2.26	<0.01	0.02	0.29	<0.01	<0.0005	0.17	0.05	0.030	0.99	578
2	WWTPPipe_BH2		8	0.100	0.030	2.69	<0.01	0.02	0.25	<0.01	<0.0005	0.30	0.04	<0.01	0.42	9144
1	WWTPPipe_BH3		2	0.030	0.010	2.57	<0.01	0.02	0.21	<0.01	<0.0005	0.09	0.02	<0.01	0.37	1967
1	WWTPPipe_BH3		7	0.070	0.120	3	<0.01	0.03	1.22	<0.01	<0.0005	0.91	0.19	0.020	0.56	1635
1	WWTPPipe_BH4		5	0.090	0.06	2.54	<0.01	0.03	0.87	<0.01	<0.0005	0.57	0.12	0.030	0.45	909
ME	MIN		ME	0.012	0.051	0.5	0	0.097	0.051	0.011	0.0052	0.059	0.05	0.011	0.58	22
ME	MAX			0.42	0.11	1.5	-1	1.3	0.61	0.032	0.0068	0.76	0.16	0.079	1.4	16000
ME	COUNT DETECTIONS			35	7	17	0	8	15	8	6	36	7	31	5	40
ALL	MIN		All	0.012	0.01	0.5	0	0.02	0.051	0.011	0.0052	0.059	0.02	0.011	0.37	22
ALL	MAX			0.420	0.120	3.000	-1.000	1.300	1.220	0.032	0.007	0.910	0.190	0.080	1.400	16000.000
ALL	COUNT DETECTIONS			41	13	23	0	14	21	8	6	42	13	35	11	46
1	MIN			0.01	0.01	0.50	0.00	0.02	0.05	0.03	0.01	0.09	0.02	0.02	0.37	30.00
1	MAX			0.10	0.12	3.00	0.00	0.37	1.22	0.03	0.01	0.91	0.19	0.08	1.40	16000.00
1	COUNT DETECTIONS			13.00	3.00	7.00	0.00	6.00	5.00	1.00	5.00	13.00	3.00	12.00	8.00	13.00
2	MIN			0.02	0.03	0.52	0.00	0.02	0.06	0.01	0.01	0.06	0.04	0.01	0.42	22.00
2	MAX			0.42	0.11	2.69	0.00	1.30	0.61	0.03	0.01	0.76	0.16	0.08	0.99	15824.00
2	COUNT DETECTIONS			23.00	9.00	16.00	0.00	7.00	12.00	4.00	1.00	24.00	10.00	18.00	3.00	25.00
3	MIN			0.02	0.08	0.00	0.00	1.30	0.10	0.01	0.0000	0.066	0.00	0.02	0.00	81.00
3	MAX			0.040	0.08	0.00	0.00	1.30	0.13	0.02	0.0000	0.32	0.00	0.03	0.00	3100.00
3	COUNT DETECTIONS			5.00	1.00	0.00	0.00	1.00	4.00	3.00	0.00	5.00	0.00	5.00	0.00	8.00

				Fluoride in CEN 10:1 Leachate	Chloride in CEN 10:1 Leachate	Total Dissolved Solids	Total Phenols	Dissolved Organic Carbon	Total Organic Carbon (%)	EC C5-C6	EC>C6-C8	EC>C8-C10	EC>C10-C12	EC>C12-C16	EC>C16-C21	EC>C21-C35	EC>C16-C35
Waste Type	**SOURCE**	**SAMPLE ID**	**DEPTH (mbgl)**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**%**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
	DUTCH CRITERIA	**Dutch Intervention Levels (IV)**		-	-	-	**40**	-	-	-	-	-	-	-	-	-	-
		Dutch Target Level (TV)		-	-	-	**0.05**	-	-	-	-	-	-	-	-	-	-
	LQM/CIEH GENERIC ASSESS	**Residential**								**110**	**370**	**110**	**540 (283)vap**	**3000 (142)sol**	**76000**	-	**76000**
		Allotment								**3900**	**13000**	**1700**	**7300**	**13000**	**270000**	-	**270000**
		Commercial								**13000 (1150)sol**	**42000 (736)sol**	**12000 (451)vap**	**49000 (283)vap**	**91000 (142)sol**	**1800000**	-	**1800000**
	CLEA SOIL GUIDELINE VALU	**Calculated SGV**		-	-	-	-	-	-	-	-	-	-	-	-	-	
		Published SGV		-	-	-	**280**	-	-	-	-	-	-	-	-	-	
										-	-	-	-	-	-	-	
	WALSHESTOWN RESTORAT	**WAC Values**	**INERT WASTE**	**10**	**800**	**4000**	**1**	**500**	**3**	-	-	-	-	-	-	-	
	MURPHY ENVIRONMENTAL	**WAC Values**	**SOIL & SUBSOIL'**	**5**	**400**	**2000**	**0.5**	**250**	**1.5**	-	-	-	-	-	-	-	
	WASTE FRAMEWORK DIREC	**WAC Values**	**STABLE NON-REACTIV**	**150**	**15000**	**60000**	**0**	**800**	**5**								
	WASTE FRAMEWORK DIREC	**WAC Values**	**HAZARDOUS WASTE**	**500**	**25000**	**100000**	**0**	**1000**	**6**	-	-	-	-	-	-	-	
Waste Type	**SOURCE**	**SAMPLE ID**	**DEPTH (mbgl)**														
2	TP1	SO-TP1-01	0 - 3.0	1.9	18	1000	< 0.30	130	1.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP1	SO-TP1-02	3.0 - 3.5	1.6	12	1000	< 0.30	120	0.34	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP2	SO-TP2-01	0 - 4.0	1.8	67	3400	< 0.30	260	3.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1	TP3	SO-TP3-01	1.0 - 4.2	1.0	21	10000	< 0.30	120	4.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1	TP4	SO-TP4-01	1.0 - 4.4	1.0	18	12000	< 0.30	110	22.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1	TP5	SO-TP5-01	1.2 - 3.5	1.4	37	4900	< 0.30	76	0.22	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1	TP6	SO-TP6-01	2.5 - 4.3	< 1.0	49	14000	< 0.30	100	4.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP7	SO-TP7-01	1.6 - 4.6	2.0	380	3400	< 0.30	140	5.1	< 1.0	< 1.0	< 1.0	7.2	17	72	410	482
2	TP8	SO-TP8-01	1.5 - 4.1	2.3	230	4600	< 0.30	200	4.2	< 1.0	< 1.0	< 1.0	7.5	57	170	810	980
1	TP9	SO-TP9-01	0.3 - 2.2	1.3	41	2100	< 0.30	90	1.7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1	TP10	SO-TP10-01	1.0 - 4.5	< 1.0	16000	16000	< 0.30	87	7.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1	TP11	SO-TP11-01	1.2 - 4.4	< 1.0	39	16000	< 0.30	99	1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP12	SO-TP12-01	0 - 2.7	2.9	26	1500	< 0.30	100	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP12	SO-TP12-02	2.7 - 4.6	< 1.0	440	13000	< 0.30	110	4.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP13	SO-TP13-01	1.5 - 4.0	1.9	110	3300	< 0.30	150	3.7	< 1.0	< 1.0	< 1.0	3.5	20	60	270	330
2	TP14	SO- TP14-01	1.0 - 2.3	2.3	77	2900	< 0.30	140	1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP14	SO- TP14-02	2.3 - 4.4	1.8	250	6000	< 0.30	220	5.3	< 1.0	< 1.0	< 1.0	8.9	47	110	810	920
2	TP15	SO- TP15-01	1.0 - 3.2	1.9	610	6500	< 0.30	350	5.5	< 1.0	< 1.0	< 1.0	2.9	37	92	430	522
2	TP15	SO- TP15-02	3.2 - 4.1	2.6	130	2500	< 0.30	160	2.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP16	SO- TP16-01	2.4 - 4.6	1.8	64	4100	< 0.30	150	2.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP17	SO-TP17-01	2.5 - 4.1	2.8	15	880	< 0.30	97	1.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4.3	88	92
2	TP18	SO-TP18-01	0 - 4.1	2.3	28	1800	< 0.30	160	1.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7	84	86
1	TP19	SO-TP19-01	0.9 - 3.5	<1.0	19	16000	< 0.30	120	0.98	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1	TP19	SO-TP19-02	3.5 - 4.0	1.3	14	3400	< 0.30	77	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1	TP20	SO-TP20-01	1.3 - 4.0	1.9	28	2500	< 0.30	96	1.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1	TP20	SO-TP20-02	4.0 - 4.3	1.9	17	900	< 0.30	140	1.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP21	SO-TP21-01	1.3 - 4.0	1.8	160	4300	< 0.30	150	4.3	< 1.0	< 1.0	< 1.0	5.2	58	110	200	310
2	TP22	SO-TP22-01	1.6 - 4.2	2.3	230	2400	< 0.30	220	4.3	< 1.0	< 1.0	< 1.0	< 1.0	4.3	39	180	219
2	TP23	SO-TP23-01	3.5 - 4.0	2.0	50	2000	< 0.30	190	2.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	9.7	150	160
3	TP25	SO-TP25-01	0.5 - 3.6	7.7	37	730	< 0.30	150	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	42	42
3	TP27	SO-TP27-01	0.5 - 3.5	6.8	45	810	< 0.30	210	0.88	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP28	SO-TP28-01	2.2 - 4.0	3.3	28	1300	< 0.30	130	2.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	63	63
3	TP29	SO-TP29-01	1.9 - 4.2	6.7	38	860	< 0.30	170	1.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP31	SO-TP31-01	0 - 3.8	6.1	20	950	< 0.30	160	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	9.7	260	270
3	TP33	SO-TP33-01	0 - 2.3	3.6	23	630	< 0.30	120	2.7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP36	SO-TP36-01	0.2 - 3.2	6.1	20	3600	< 0.30	83	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP37	SO-TP37-01	0.2 - 3.7	3.7	29	2000	< 0.30	140	4.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	TP38	SO-TP38-01	0.2 - 3.6	1.6	150	6600	< 0.30	230	2.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
3	TP48	SO-TP48-01	1.7 - 2.4	2.1	54	1100	<0.30	130	0.73	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
3	SP1	SO-SP1-01	-	1.9	55	1100	< 0.30	99	2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2	WWTPPipe_BH1		5		2211		0.12										
2	WWTPPipe_BH2		1		54		<0.01										
2	WWTPPipe_BH2		8		1060		<0.01										
1	WWTPPipe_BH3		2		659		0.05										
1	WWTPPipe_BH3		7		580		<0.01										
1	WWTPPipe_BH4		5		126		<0.01										
ME	MIN		ME	1	12	630	0	76	0.22	0	0	0	2.9	4.3	1.7	42	42
ME	MAX			7.7	16000	16000	-1	350	22	-1	-1	-1	8.9	58	170	810	980
ME	COUNT DETECTIONS			35	38	40	0	40	40	0	0	0	6	7	11	13	13
ALL	MIN		All	1	12	630	0.05	76	0.22	0	0	0	2.9	4.3	1.7	42	42
ALL	MAX			7.700	16000.000	16000	0.12	350	22	-1	-1	-1	8.9	58	170	810	980
ALL	COUNT DETECTIONS			35	44	40	2	40	40	0	0	0	6	7	11	13	13
1	MIN			1.00	18.00	1100.00	0.05	76.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	MAX			1.90	16000.00	16000.00	0.05	120.00	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	COUNT DETECTIONS			6.00	11.00	10.00	1.00	10.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	MIN			1.60	15.00	880.00	0.12	83.00	1.10	0.00	0.00	0.00	2.90	4.30	1.70	63.00	63.00
2	MAX			6.10	2211.00	13000.00	0.12	350.00	5.50	0.00	0.00	0.00	8.90	58.00	170.00	810.00	980.00
2	COUNT DETECTIONS			21.00	25.00	22.00	1.00	22.00	22.00	0.00	0.00	0.00	6.00	7.00	11.00	12.00	12.00
3	MIN			1.30	12.00	630.00	0.00	77.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	42.00	42.00
3	MAX			7.70	54.00	3400.00	0.00	210.00	2.70	0.00	0.00	0.00	0.00	0.00	0.00	42.00	42.00
3	COUNT DETECTIONS			8.00	8.00	8.00	0.00	8.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00

				EC>C35-C40	Total Aliphatics	EC C5-C7 WWWTP PRO C5 to C9	EC>C7-C8	EC>C8-C10	EC>C10-C12 WWTP PRO C10 to C12	EC>C12-C16	EC>C16-C21	EC>C21-C35	EC>C35-C44	Total Aromatics	Total Petroleum Hydrocarbons (DRO For WWTP)	Mineral Oil	Benzene	Toluene
Waste Type	**SOURCE**	**SAMPLE ID**	**DEPTH (mbgl)**	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µg/kg
	DUTCH CRITERIA	**Dutch Intervention Levels (IV)**		-	**5000**	-	-	-	-	-	-	-	-	-	-	**5000**	**1000**	**130000**
		Dutch Target Level (TV)		-	-	-	-	-	-	-	-	-	-	-	-	**50**	**10**	**10**
	LQM/CIEH GENERIC ASSESS	**Residential**		**76000**	-	**280**	**611**	**151**	**346**	**593**	**770**	**1230**	**1230**	-	-	-	-	-
		Allotment		**270000**	-	**57**	**120**	**51**	**74**	**130**	**260**	**1600**	**1600**	-		-	-	-
		Commercial		**1800000**	-	**90000 (4710)sol**	**190000 (4360)vap**	**18000 (3580)vap**	**34500 (2150)sol**	**37800**	**28000**	**28000**	**28000**	-	-	-	-	-
	CLEA SOIL GUIDELINE VALU	**Calculated SGV**		-	-	-	-	-	-	-	-	-	-	-	-	-	**96600000**	**1.88E+11**
		Published SGV		-	-	-	-	-	-	-	-	-	-	-			**330**	**610000**
				-	-	-	-	-	-	-	-	-	-	-			**70**	**120000**
	WALSHESTOWN RESTORAT	**WAC Values**	**INERT WASTE**	-	-	-	-	-	-	-	-	-	-	-	-	-	**95000**	**4400000**
	MURPHY ENVIRONMENTAL	**WAC Values**	**SOIL & SUBSOIL'**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**14,000**
	WASTE FRAMEWORK DIREC	**WAC Values**	**STABLE NON-REACTIV**															
	WASTE FRAMEWORK DIREC	**WAC Values**	**HAZARDOUS WASTE**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**680,000**
Waste Type	**SOURCE**	**SAMPLE ID**	**DEPTH (mbgl)**															
2	TP1	SO-TP1-01	0 - 3.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	11	38	< 1.0	49	49	< 10	< 1.0	< 1.0
2	TP1	SO-TP1-02	3.0 - 3.5	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP2	SO-TP2-01	0 - 4.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
1	TP3	SO-TP3-01	1.0 - 4.2	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
1	TP4	SO-TP4-01	1.0 - 4.4	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
1	TP5	SO-TP5-01	1.2 - 3.5	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
1	TP6	SO-TP6-01	2.5 - 4.3	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP7	SO-TP7-01	1.6 - 4.6	1.4	510	< 1.0	< 1.0	< 1.0	< 1.0	1.5	2.7	120	< 1.0	120	630	510	< 1.0	< 1.0
2	TP8	SO-TP8-01	1.5 - 4.1	190	1200	< 1.0	< 1.0	< 1.0	2.1	35	210	1200	110	1600	2800	1200	< 1.0	< 1.0
1	TP9	SO-TP9-01	0.3 - 2.2	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
1	TP10	SO-TP10-01	1.0 - 4.5	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
1	TP11	SO-TP11-01	1.2 - 4.4	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP12	SO-TP12-01	0 - 2.7	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP12	SO-TP12-02	2.7 - 4.6	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP13	SO-TP13-01	1.5 - 4.0	10	360	< 1.0	< 1.0	< 1.0	< 1.0	1.3	40	370	< 1.0	410	770	360	< 1.0	< 1.0
2	TP14	SO- TP14-01	1.0 - 2.3	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP14	SO- TP14-02	2.3 - 4.4	120	1100	< 1.0	< 1.0	< 1.0	< 1.0	16	33	220	4.3	280	1400	1100	< 1.0	< 1.0
2	TP15	SO- TP15-01	1.0 - 3.2	38	600	< 1.0	< 1.0	< 1.0	< 1.0	6.7	59	380	8.3	460	1100	600	< 1.0	< 1.0
2	TP15	SO- TP15-02	3.2 - 4.1	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP16	SO- TP16-01	2.4 - 4.6	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP17	SO-TP17-01	2.5 - 4.1	< 1.0	92	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	170	< 1.0	170	260	92	< 1.0	< 1.0
2	TP18	SO-TP18-01	0 - 4.1	< 1.0	86	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.4	90	< 1.0	93	180	86	< 1.0	< 1.0
1	TP19	SO-TP19-01	0.9 - 3.5	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
1	TP19	SO-TP19-02	3.5 - 4.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
1	TP20	SO-TP20-01	1.3 - 4.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
1	TP20	SO-TP20-02	4.0 - 4.3	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP21	SO-TP21-01	1.3 - 4.0	< 1.0	370	< 1.0	< 1.0	< 1.0	< 1.0	5.1	14	120	< 1.0	140	510	370	< 1.0	< 1.0
2	TP22	SO-TP22-01	1.6 - 4.2	< 1.0	220	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	8.0	120	< 1.0	130	350	220	< 1.0	< 1.0
2	TP23	SO-TP23-01	3.5 - 4.0	5.2	160	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.9	110	< 1.0	110	270	160	< 1.0	< 1.0
3	TP25	SO-TP25-01	0.5 - 3.6	< 1.0	42	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	17	< 1.0	17	59	42	< 1.0	< 1.0
3	TP27	SO-TP27-01	0.5 - 3.5	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP28	SO-TP28-01	2.2 - 4.0	< 1.0	63	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4.2	90	< 1.0	94	160	63	< 1.0	< 1.0
3	TP29	SO-TP29-01	1.9 - 4.2	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP31	SO-TP31-01	0 - 3.8	< 1.0	260	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	38	< 1.0	38	300	260	< 1.0	< 1.0
3	TP33	SO-TP33-01	0 - 2.3	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP36	SO-TP36-01	0.2 - 3.2	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	TP37	SO-TP37-01	0.2 - 3.7	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.1	23	3.9	32	32	< 10	< 1.0	< 1.0
2	TP38	SO-TP38-01	0.2 - 3.6	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	3.3	7.6	< 1.0	11	11	< 10	< 1.0	< 1.0
3	TP48	SO-TP48-01	1.7 - 2.4	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
3	SP1	SO-SP1-01	-	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0	< 10	< 10	< 1.0	< 1.0
2	WWTPPipe_BH1		5			<10			<10						46	<1	<10	<10
2	WWTPPipe_BH2		1			<10			<10						84	<1	<10	<10
2	WWTPPipe_BH2		8			<10			<10						27	<1	<10	<10
1	WWTPPipe_BH3		2			<10			<10						80	16	<10	<10
1	WWTPPipe_BH3		7			<10			<10						25	<1	<10	<10
1	WWTPPipe_BH4		5			<10			<10						31	<1	<10	<10
ME	MIN		ME	1.4	42	0	0	0	2.1	1.3	1.2	7.6	3.9	11	11	42	0	0
ME	MAX			190	1200	-1	-1	-1	2.1	35	210	1200	110	1600	2800	1200	-1	-1
ME	COUNT DETECTIONS			6	13	0	0	0	1	6	14	16	4	16	16	13	0	0
ALL	MIN		All	1.4	42	0	0	0	2.1	1.3	1.2	7.6	3.9	11	11	16	0	0
ALL	MAX			190	1200	-1	-1	-1	2.1	35	210	1200	110	1600	2800	1200	-1	-1
ALL	COUNT DETECTIONS			6	13	0	0	0	1	6	14	16	4	16	22	14	0	0
1	MIN			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.00	16.00	0.00	0.00
1	MAX			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.00	16.00	0.00	0.00
1	COUNT DETECTIONS			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	1.00	0.00	0.00
2	MIN			1.40	63.00	0.00	0.00	0.00	2.10	1.30	1.20	7.60	3.90	11.00	11.00	63.00	0.00	0.00
2	MAX			190.00	1200.00	0.00	0.00	0.00	2.10	35.00	210.00	1200.00	110.00	1600.00	2800.00	1200.00	0.00	0.00
2	COUNT DETECTIONS			6.00	12.00	0.00	0.00	0.00	1.00	6.00	14.00	15.00	4.00	15.00	18.00	12.00	0.00	0.00
3	MIN			0.00	42.00	0.00	0.00	0.00	0.00	0.00	0.00	17.00	0.00	17.00	59.00	42.00	0.00	0.00
3	MAX			0.00	42.00	0.00	0.00	0.00	0.00	0.00	0.00	17.00	0.00	17.00	59.00	42.00	0.00	0.00
3	COUNT DETECTIONS			0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00

				Ethylbenzene	o-xylene	m-xylene	p-xylene	Total Xylene	TOTAL BTEX	Naphthalene C10	Acenaphthylene C12	Acenaphthene C12	Fluorene C13	Phenanthrene C14	Anthracene C14	Fluoranthene C16	Pyrene C16	Benzo(a)anthracene
Waste Type	**SOURCE**	**SAMPLE ID**	**DEPTH (mbgl)**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
	DUTCH CRITERIA	**Dutch Intervention Levels (IV)**		**50000**	-	-	-	**25000**	-	-	-	-	-	-	-	-	-	-
		Dutch Target Level (TV)		**30**	-	-	-	**100**	-	-	-	-	-	-	-	-	-	-
	LQM/CIEH GENERIC ASSESS	**Residential**		-	-	-	-	-	-	**8.7**	**850**	**1000**	**780**	**380**	**9200**	**670**	**1600**	**5.9**
		Allotment		-	-	-	-	-	-	**23**	**160**	**200**	**160**	**90**	**2200**	**290**	**620**	**10**
		Commercial		-	-	-	-	-	-	**1100 (432)sol**	**100000**	**100000**	**71000**	**23000**	**540000**	**23000**	**54000**	**97**
	CLEA SOIL GUIDELINE VALU	**Calculated SGV**		**63700000000**	-		-	**95100000000**	**3.854E+11**	-	-	-	-	-	-	-	-	-
		Published SGV		**350000**	**250000**	**240000**	**230000**	**720000**	-	-	-	-	-	-	-	-	-	-
				90000	**160000**	**180000**	**160000**	**500000**	-	-	-	-	-	-	-	-	-	-
	WALSHESTOWN RESTORAT	**WAC Values**	**INERT WASTE**	**2800000**	**2600000**	**3500000**	**3200000**	**9300000**	-	-	-	-	-	-	-	-	-	-
	MURPHY ENVIRONMENTAL	**WAC Values**	**SOIL & SUBSOIL'**	**41,000**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WASTE FRAMEWORK DIREC	**WAC Values**	**STABLE NON-REACTIV**															
	WASTE FRAMEWORK DIREC	**WAC Values**	**HAZARDOUS WASTE**	**48,000,000**	-	-	-	**93000000**	-	-	-	-	-	-	-	-	-	-
Waste Type	**SOURCE**	**SAMPLE ID**	**DEPTH (mbgl)**															
2	TP1	SO-TP1-01	0 - 3.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	0.11	< 0.10	< 0.10	< 0.10	1.2	0.33	3.1	2.8	0.95
2	TP1	SO-TP1-02	3.0 - 3.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2	TP2	SO-TP2-01	0 - 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
1	TP3	SO-TP3-01	1.0 - 4.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	0.19	< 0.10	0.67	0.74	0.30
1	TP4	SO-TP4-01	1.0 - 4.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	0.43	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
1	TP5	SO-TP5-01	1.2 - 3.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
1	TP6	SO-TP6-01	2.5 - 4.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2	TP7	SO-TP7-01	1.6 - 4.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2	TP8	SO-TP8-01	1.5 - 4.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	0.32	< 0.10	< 0.10	0.10	2.3	0.57	6.5	5.3	3.4
1	TP9	SO-TP9-01	0.3 - 2.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
1	TP10	SO-TP10-01	1.0 - 4.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
1	TP11	SO-TP11-01	1.2 - 4.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2	TP12	SO-TP12-01	0 - 2.7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2	TP12	SO-TP12-02	2.7 - 4.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2	TP13	SO-TP13-01	1.5 - 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2	TP14	SO- TP14-01	1.0 - 2.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	0.32	1.0	0.90	< 0.10	< 0.10
2	TP14	SO- TP14-02	2.3 - 4.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	0.15	0.85	0.10	0.89	0.69	< 0.10
2	TP15	SO- TP15-01	1.0 - 3.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	0.11	0.86	0.23	2.5	2.2	0.79
2	TP15	SO- TP15-02	3.2 - 4.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	0.13	< 0.10	0.30	0.31	< 0.10
2	TP16	SO- TP16-01	2.4 - 4.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	0.32	0.11	0.73	0.47	< 0.10
2	TP17	SO-TP17-01	2.5 - 4.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	0.16	< 0.10	< 0.10	< 0.10	0.47	< 0.10	0.79	0.80	< 0.10
2	TP18	SO-TP18-01	0 - 4.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
1	TP19	SO-TP19-01	0.9 - 3.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
1	TP19	SO-TP19-02	3.5 - 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
1	TP20	SO-TP20-01	1.3 - 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	0.16	< 0.10	0.27	0.29	< 0.10
1	TP20	SO-TP20-02	4.0 - 4.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2	TP21	SO-TP21-01	1.3 - 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	0.30	< 0.10	0.95	0.92	0.29
2	TP22	SO-TP22-01	1.6 - 4.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	0.10	< 0.10	< 0.10	< 0.10	0.60	< 0.10	1.1	0.88	< 0.10
2	TP23	SO-TP23-01	3.5 - 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
3	TP25	SO-TP25-01	0.5 - 3.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
3	TP27	SO-TP27-01	0.5 - 3.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2	TP28	SO-TP28-01	2.2 - 4.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	0.81	0.16	2.0	1.8	0.59
3	TP29	SO-TP29-01	1.9 - 4.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2	TP31	SO-TP31-01	0 - 3.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
3	TP33	SO-TP33-01	0 - 2.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2	TP36	SO-TP36-01	0.2 - 3.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2	TP37	SO-TP37-01	0.2 - 3.7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.34	0.25	< 0.10
2	TP38	SO-TP38-01	0.2 - 3.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
3	TP48	SO-TP48-01	1.7 - 2.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
3	SP1	SO-SP1-01	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.010	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.12	< 0.10	< 0.10
2	WWTPPipe_BH1		5	<10				<10		0.152	0.007	0.027	0.108	0.226	0.072	0.10	0.137	0.078
2	WWTPPipe_BH2		1	<10				<10		0.066	0.053	0.026	0.035	0.224	0.156	0.60	0.545	0.359
2	WWTPPipe_BH2		8	<10				<10		0.05	0.019	0.023	0.018	0.079	0.06	0.18	0.17	0.125
1	WWTPPipe_BH3		2	<10				<10		0.044	0.032	0.028	0.031	0.094	0.07	0.30	0.289	0.208
1	WWTPPipe_BH3		7	<10				<10		0.195	0.081	0.174	0.236	2.389	0.798	3.87	2.728	1.199
1	WWTPPipe_BH4		5	<10				<10		0.068	0.031	0.022	0.037	0.164	0.071	0.32	0.27	0.099
ME	MIN		ME	0	0	0	0	0	0	0.1	0	0	0.1	0.13	0.1	0.12	0.25	0.29
ME	MAX			-1	-1	-1	-1	-1	-1	0.43	-1	-1	0.15	2.3	1	6.5	5.3	3.4
ME	COUNT DETECTIONS			0	0	0	0	0	0	5	0	0	3	13	7	15	13	6
ALL	MIN		All	0	0	0	0	0	0	0.044	0.007	0.022	0.018	0.079	0.06	0.099	0.137	0.078
ALL	MAX			-1	-1	-1	-1	-1	-1	0.43	0.081	0.174	0.236	2.389	1	6.5	5.3	3.4
ALL	COUNT DETECTIONS			0	0	0	0	0	0	11	6	6	9	19	13	21	19	12
1	MIN			0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.03	0.02	0.03	0.09	0.07	0.12	0.27	0.10
1	MAX			0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.08	0.17	0.24	2.39	0.80	3.87	2.73	1.20
1	COUNT DETECTIONS			0.00	0.00	0.00	0.00	0.00	0.00	4.00	3.00	3.00	3.00	5.00	3.00	6.00	5.00	4.00
2	MIN			0.00	0.00	0.00	0.00	0.00	0.00	0.050	0.0070	0.02	0.02	0.08	0.06	0.10	0.14	0.08
2	MAX			0.00	0.00	0.00	0.00	0.00	0.00	0.320	0.0530	0.03	0.15	2.30	1.00	6.50	5.30	3.40
2	COUNT DETECTIONS			0.00	0.00	0.00	0.00	0.00	0.00	7.000	3.0000	3.00	6.00	14.00	10.00	15.00	14.00	8.00
3	MIN			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	MAX			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	COUNT DETECTIONS			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

				Chrysene	Benzo(bk)fluoranthene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene C20	Indeno(123cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	Coronene	Total 17 EPA PAHs (WWTP BHs 16 PAHs)	PCB Total of 7 Congeners		Natural moisture content	Antimony Low Level	Arsenic Low Level
Waste Type	**SOURCE**	**SAMPLE ID**	**DEPTH (mbgl)**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**pH Units**	**%**	**mg/kg**	**mg/kg**
	DUTCH CRITERIA	**Dutch Intervention Levels (IV)**		-	-	-	-	-	-	-	-	-	-	-	-	-	**15**	**55**
		Dutch Target Level (TV)		-	-	-	-	-	-	-	-	-	-	-	-	-	**3**	**29**
	LQM/CIEH GENERIC ASSESS	**Residential**		**9.3**	**7**	-	**10**	**1**	**4.2**	**0.9**	**47**	-	-	-	-		-	-
		Allotment		**12**	**13**		**23**	**2.1**	**7.1**	**2.3**	**160**	-	-	-	-		-	-
		Commercial		**140**	**100**	-	**140**	**14**	**62**	**13**	**660**	-	-	-	-	-	-	-
	CLEA SOIL GUIDELINE VALU	**Calculated SGV**		-			-	-	-	-	-	-	-	-			-	-
		Published SGV		-			-	-	-	-	-	-	-	-	-		-	**32**
				-	-		-	-	-	-	-	-	-	-	-		-	**43**
	WALSHESTOWN RESTORAT	**WAC Values**	**INERT WASTE**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**640**
	MURPHY ENVIRONMENTAL	**WAC Values**	**SOIL & SUBSOIL'**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**20**
	WASTE FRAMEWORK DIREC	**WAC Values**	**STABLE NON-REACTIV**														-	-
	WASTE FRAMEWORK DIREC	**WAC Values**	**HAZARDOUS WASTE**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waste Type	**SOURCE**	**SAMPLE ID**	**DEPTH (mbgl)**															
2	TP1	SO-TP1-01	0 - 3.0	0.72	1.5	1.2	0.25	0.82	0.51	< 0.10	0.56	< 0.10	13	<0.10	8.0	8.9	2.6	19
2	TP1	SO-TP1-02	3.0 - 3.5	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8.4	4.6	< 2.0	16
2	TP2	SO-TP2-01	0 - 4.0	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.8	19.0	2.2	21
1	TP3	SO-TP3-01	1.0 - 4.2	0.31	1.4	1.0	0.39	0.52	0.91	< 0.10	1.0	< 0.10	6.0	<0.10	7.5	13.0	17	35
1	TP4	SO-TP4-01	1.0 - 4.4	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.3	25.0	13	59
1	TP5	SO-TP5-01	1.2 - 3.5	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.9	14.0	9.9	24
1	TP6	SO-TP6-01	2.5 - 4.3	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8.0	16.0	9.8	31
2	TP7	SO-TP7-01	1.6 - 4.6	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8.5	15.0	13	30
2	TP8	SO-TP8-01	1.5 - 4.1	3.0	7.3	5.4	1.9	4.1	2.5	0.47	2.2	< 0.10	38	<0.10	8.2	16.0	6.2	23
1	TP9	SO-TP9-01	0.3 - 2.2	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.7	8.5	6.4	24
1	TP10	SO-TP10-01	1.0 - 4.5	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.5	25	22	61
1	TP11	SO-TP11-01	1.2 - 4.4	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8	23	17	46
2	TP12	SO-TP12-01	0 - 2.7	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8.1	13	3.2	24
2	TP12	SO-TP12-02	2.7 - 4.6	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8.1	13	9.7	33
2	TP13	SO-TP13-01	1.5 - 4.0	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8.3	13	4.5	23
2	TP14	SO- TP14-01	1.0 - 2.3	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	2.2	<0.10	8	13	39	19
2	TP14	SO- TP14-02	2.3 - 4.4	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	2.7	<0.10	8	20	20	25
2	TP15	SO- TP15-01	1.0 - 3.2	0.56	1.10	0.78	0.32	0.76	0.50	< 0.10	0.49	< 0.10	10	<0.10	8	20	4.1	22
2	TP15	SO- TP15-02	3.2 - 4.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.7	19	3.4	15
2	TP16	SO- TP16-01	2.4 - 4.6	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8.1	18	14	23
2	TP17	SO-TP17-01	2.5 - 4.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	2.2	<0.10	8.1	13	2.5	18
2	TP18	SO-TP18-01	0 - 4.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8.2	12	2.1	16
1	TP19	SO-TP19-01	0.9 - 3.5	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.7	14	6.8	27
1	TP19	SO-TP19-02	3.5 - 4.0	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.7	14	7.2	32
1	TP20	SO-TP20-01	1.3 - 4.0	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8.1	9.9	12	45
1	TP20	SO-TP20-02	4.0 - 4.3	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8	12	2.4	22
2	TP21	SO-TP21-01	1.3 - 4.0	0.25	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	2.7	<0.10	8.3	18	3.5	29
2	TP22	SO-TP22-01	1.6 - 4.2	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	2.7	<0.10	8	18	4.2	25
2	TP23	SO-TP23-01	3.5 - 4.0	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.9	14	3.1	26
3	TP25	SO-TP25-01	0.5 - 3.6	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.4	15	< 2.0	13
3	TP27	SO-TP27-01	0.5 - 3.5	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.5	13	< 2.0	13
2	TP28	SO-TP28-01	2.2 - 4.0	0.64	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	6.0	<0.10	8.2	17	2.4	17
3	TP29	SO-TP29-01	1.9 - 4.2	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.5	17	< 2.0	15
2	TP31	SO-TP31-01	0 - 3.8	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8	10	< 2.0	22
3	TP33	SO-TP33-01	0 - 2.3	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8.5	13	6.3	24
2	TP36	SO-TP36-01	0.2 - 3.2	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8.2	17	2.5	22
2	TP37	SO-TP37-01	0.2 - 3.7	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.8	21	2.7	21
2	TP38	SO-TP38-01	0.2 - 3.6	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.7	15	3.9	22
3	TP48	SO-TP48-01	1.7 - 2.4	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	7.8	17	<2.0	28
3	SP1	SO-SP1-01	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 2.0	<0.10	8.3	8	6.9	36
2	WWTPPipe_BH1		5	0.399	0.037			0.046	0.022	0.038	0.09		1.538		8.13	9		57
2	WWTPPipe_BH2		1	0.412	0.048			0.283	0.313	0.098	0.287		3.506		7.87	15.5		<1
2	WWTPPipe_BH2		8	0.151	0.11			0.066	0.061	0.021	0.086		1.219		7.89	16.1		<1
1	WWTPPipe_BH3		2	0.214	0.229			0.168	0.202	0.077	0.232		2.213		7.82	24.1		<1
1	WWTPPipe_BH3		7	1.358	0.083			0.781	0.7	0.261	0.712		15.569		7.73	23.3		<1
1	WWTPPipe_BH4		5	0.202	0.158			0.12	0.119	0.042	0.127		1.852		8.04	13.5		<1
ME	MIN		ME	0.25	1.1	0.78	0.25	0.52	0.5	0.47	0.49	0	2.2	0	7.3	4.6	2.1	13
ME	MAX			3	7.3	5.4	1.9	4.1	2.5	0.47	2.2	-1	38	-1	8.5	25	39	61
ME	COUNT DETECTIONS			6	4	4	4	4	4	1	4	0	10	0	40	40	34	40
ALL	MIN		All	0.151	0.037	0.78	0.25	0.046	0.022	0.021	0.086	0	1.219	0	7.3	4.6	2.1	13
ALL	MAX			3	7.3	5.4	1.9	4.1	2.5	0.47	2.2	-1	38	-1	8.5	25	39	61
ALL	COUNT DETECTIONS			12	10	4	4	10	10	7	10	0	16	0	46	46	34	41
1	MIN			0.20	0.08	1.00	0.39	0.12	0.12	0.04	0.13	0.00	1.85	0.00	7.30	8.00	6.40	24.00
1	MAX			1.36	1.39	1.00	0.39	0.78	0.91	0.26	1.00	0.00	15.57	0.00	8.30	25.00	22.00	61.00
1	COUNT DETECTIONS			4.00	4.00	1.00	1.00	4.00	4.00	3.00	4.00	0.00	4.00	0.00	13.00	13.00	10.00	10.00
2	MIN			0.15	0.04	0.78	0.25	0.05	0.02	0.02	0.09	0.00	1.22	0.00	7.70	8.90	2.10	15.00
2	MAX			3.00	7.30	5.40	1.90	4.10	2.50	0.47	2.20	0.00	38.00	0.00	8.50	21.00	39.00	57.00
2	COUNT DETECTIONS			8.00	6.00	3.00	3.00	6.00	6.00	4.00	6.00	0.00	12.00	0.00	25.00	25.00	21.00	23.00
3	MIN			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	4.60	2.40	13.00
3	MAX			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.50	17.00	7.20	32.00
3	COUNT DETECTIONS			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	8.00	3.00	8.00

				Barium Low Level	Cadmium Low Level	Total Chromium Low Level	Chromium (III) Low Level	Chromium (IV) Low Level	Copper Low Level	Lead Low Level	Nickel Low Level	Molybdenum Low Level	Mercury Low Level	Selenium Low Level	Zinc Low Level
Waste Type	**SOURCE**	**SAMPLE ID**	**DEPTH (mbgl)**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
	DUTCH CRITERIA	**Dutch Intervention Levels (IV)**		**625**	**12**	**380**	**-**	**-**	**190**	**530**	**210**	**200**	**10**	**100**	**720**
		Dutch Target Level (TV)		**160**	**0.8**	**100**	**-**	**-**	**36**	**85**	**35**	**3**	**0.3**	**0.7**	**140**
	LQM/CIEH GENERIC ASSESS	**Residential**		**-**	**3**	**-**	**3000**	**4.3**	**2330**	**-**	**-**	**-**	**-**	**-**	**3750**
		Allotment		**-**	**0.53**	**-**	**34600**	**2.1**	**524**	**-**	**-**	**-**	**-**	**-**	**618**
		Commercial		**-**	**348**	**-**	**30400**	**35**	**71700**	**-**	**-**	**-**	**-**	**-**	**665000**
	CLEA SOIL GUIDELINE VALU	**Calculated SGV**		**-**	**5.28**	**132.2**			**NA**	**450**	**ND**	**-**	**8.003**	**ND**	**NA**
		Published SGV		**-**	**10**	**-**	**-**	**-**	**-**	**-**	**130**	**-**	**1**	**350**	**-**
				-	**1.8**	**-**	**-**	**-**	**-**	**-**	**230**	**-**	**26 2**	**120**	**-**
	WALSHESTOWN RESTORAT	**WAC Values**	**INERT WASTE**	**-**	**230**	**-**	**-**	**-**	**-**	**-**	**1800**	**-**	**26 2**	**13000**	**-**
	MURPHY ENVIRONMENTAL	**WAC Values**	**SOIL & SUBSOIL'**	**-**	**2**	**130**			**-**	**450**	**50**	**-**	**15**	**35**	**-**
	WASTE FRAMEWORK DIREC	**WAC Values**	**STABLE NON-REACTIV**	**-**	**-**	**-**			**-**	**-**	**5000**	**-**	**480**	**-**	**-**
	WASTE FRAMEWORK DIREC	**WAC Values**	**HAZARDOUS WASTE**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Waste Type	**SOURCE**	**SAMPLE ID**	**DEPTH (mbgl)**												
2	TP1	SO-TP1-01	0 - 3.0	250	0.49	36	36	< 0.50	67	110	45	< 2.0	0.17	< 0.20	210
2	TP1	SO-TP1-02	3.0 - 3.5	56	0.32	20	20	< 0.50	24	32	32	< 2.0	< 0.10	< 0.20	72
2	TP2	SO-TP2-01	0 - 4.0	190	0.48	33	33	< 0.50	52	130	46	2.7	0.20	< 0.20	690
1	TP3	SO-TP3-01	1.0 - 4.2	770	1.6	64	64	< 0.50	270	640	79	8.1	0.33	< 0.20	940
1	TP4	SO-TP4-01	1.0 - 4.4	490	1.2	53	53	< 0.50	260	740	90	14	0.80	< 0.20	1100
1	TP5	SO-TP5-01	1.2 - 3.5	410	2.7	56	56	< 0.50	810	1100	86	5.6	0.16	< 0.20	650
1	TP6	SO-TP6-01	2.5 - 4.3	430	5.3	49	49	< 0.50	630	380	120	7.7	0.41	< 0.20	730
2	TP7	SO-TP7-01	1.6 - 4.6	470	2.0	39	39	< 0.50	200	310	57	4.9	0.42	< 0.20	560
2	TP8	SO-TP8-01	1.5 - 4.1	510	1.1	57	57	< 0.50	100	260	59	3.1	0.76	< 0.20	540
1	TP9	SO-TP9-01	0.3 - 2.2	300	2.9	48	48	< 0.50	80	260	59	4.3	0.73	< 0.20	570
1	TP10	SO-TP10-01	1.0 - 4.5	300	2.6	68	68	< 0.50	390	980	120	16	0.48	< 0.20	1300
1	TP11	SO-TP11-01	1.2 - 4.4	360	3.9	71	71	< 0.50	560	1700	96	14	0.36	< 0.20	1500
2	TP12	SO-TP12-01	0 - 2.7	130	0.39	36	36	< 0.50	44	40	50	2.3	0.17	< 0.20	97
2	TP12	SO-TP12-02	2.7 - 4.6	410	2.7	51	51	< 0.50	200	390	85	6.5	0.24	< 0.20	770
2	TP13	SO-TP13-01	1.5 - 4.0	230	0.70	37	37	< 0.50	110	140	51	3.2	0.28	< 0.20	340
2	TP14	SO- TP14-01	1.0 - 2.3	160	0.36	36	36	< 0.50	52	81	41	2.1	0.19	< 0.20	200
2	TP14	SO- TP14-02	2.3 - 4.4	310	0.72	40	40	< 0.50	120	260	50	3.5	0.32	< 0.20	320
2	TP15	SO- TP15-01	1.0 - 3.2	240	0.54	41	41	< 0.50	75	170	49	3.4	0.25	< 0.20	210
2	TP15	SO- TP15-02	3.2 - 4.1	110	0.28	34	34	< 0.50	34	46	42	< 2.0	0.12	< 0.20	110
2	TP16	SO- TP16-01	2.4 - 4.6	260	0.91	40	40	< 0.50	65	150	53	3.0	0.42	< 0.20	420
2	TP17	SO-TP17-01	2.5 - 4.1	150	1.7	35	35	< 0.50	60	100	45	2.2	0.15	< 0.20	260
2	TP18	SO-TP18-01	0 - 4.1	150	0.39	35	35	< 0.50	80	97	50	< 2.0	0.33	< 0.20	220
1	TP19	SO-TP19-01	0.9 - 3.5	320	2.3	44	44	< 0.50	120	180	82	5.0	0.13	< 0.20	750
1	TP19	SO-TP19-02	3.5 - 4.0	290	2.6	58	58	< 0.50	170	270	80	5.5	0.11	< 0.20	640
1	TP20	SO-TP20-01	1.3 - 4.0	250	2.5	42	42	< 0.50	110	230	68	4.3	0.12	< 0.20	3600
1	TP20	SO-TP20-02	4.0 - 4.3	160	0.72	48	48	< 0.50	51	60	57	2.3	< 0.10	< 0.20	220
2	TP21	SO-TP21-01	1.3 - 4.0	260	0.60	37	37	< 0.50	160	230	51	3.2	0.20	< 0.20	260
2	TP22	SO-TP22-01	1.6 - 4.2	360	0.89	38	38	< 0.50	90	1100	53	3.3	0.34	< 0.20	300
2	TP23	SO-TP23-01	3.5 - 4.0	290	1.2	38	38	< 0.50	66	130	51	2.5	0.65	< 0.20	1100
3	TP25	SO-TP25-01	0.5 - 3.6	72	< 0.10	31	31	< 0.50	24	24	34	< 2.0	< 0.10	< 0.20	62
3	TP27	SO-TP27-01	0.5 - 3.5	83	< 0.10	36	36	< 0.50	27	29	38	< 2.0	0.10	< 0.20	72
2	TP28	SO-TP28-01	2.2 - 4.0	650	0.46	49	49	< 0.50	39	600	46	2.1	0.17	< 0.20	470
3	TP29	SO-TP29-01	1.9 - 4.2	95	0.18	32	32	< 0.50	25	44	36	< 2.0	< 0.10	< 0.20	84
2	TP31	SO-TP31-01	0 - 3.8	110	0.27	39	39	< 0.50	28	30	47	< 2.0	< 0.10	< 0.20	84
3	TP33	SO-TP33-01	0 - 2.3	180	3.8	43	43	< 0.50	68	110	51	6.3	0.15	< 0.20	240
2	TP36	SO-TP36-01	0.2 - 3.2	120	0.73	26	26	< 0.50	47	45	47	2.1	0.71	0.70	110
2	TP37	SO-TP37-01	0.2 - 3.7	160	1.7	26	26	< 0.50	48	74	40	2.7	0.24	0.73	210
2	TP38	SO-TP38-01	0.2 - 3.6	210	1.4	41	41	< 0.50	97	140	53	3.1	0.44	0.93	500
3	TP48	SO-TP48-01	1.7 - 2.4	100	1.0	43	43	< 0.50	28	23	47	3.1	< 0.10	1.40	74
3	SP1	SO-SP1-01	-	480	1.8	48	48	< 0.50	430	520	71	4.9	0.22	< 0.20	560
2	WWTPPipe_BH1		5		<1	26		<0.1	183	211	72		<1	<1	845
2	WWTPPipe_BH2		1		<1	24		<0.1	34	68	31		<1	<1	823
2	WWTPPipe_BH2		8		<1	44		<0.1	355	335	49		<1	<1	991
1	WWTPPipe_BH3		2		<1	47		<0.1	78	343	45		<1	<1	525
1	WWTPPipe_BH3		7		<1	46		<0.1	155	157	67		<1	<1	461
1	WWTPPipe_BH4		5		<1	52		<0.1	130	317	56		<1	<1	598
ME	MIN		ME	56	0.18	20	20	0	24	23	32	2.1	0.1	0.7	62
ME	MAX			770	5.3	71	71	-1	810	1700	120	16	0.8	1.4	3600
ME	COUNT DETECTIONS			40	38	40	40	0	40	40	40	32	34	4	40
ALL	MIN		All	56	0.18	20	20	0	24	23	31	2.1	0.1	0.7	62
ALL	MAX			770	5.3	71	71	-1	810	1700	120	16	0.8	1.4	3600
ALL	COUNT DETECTIONS			40	38	46	40	0	46	46	46	32	34	4	46
1	MIN			250.00	1.20	42.00	42.00	0.00	78.00	157.00	45.00	4.30	0.12	0.00	461.00
1	MAX			770.00	5.30	71.00	71.00	0.00	810.00	1700.00	120.00	16.00	0.80	0.00	3600.00
1	COUNT DETECTIONS			10.00	10.00	13.00	10.00	0.00	13.00	13.00	13.00	10.00	10.00	0.00	13.00
2	MIN			110.00	0.27	24.00	26.00	0.00	28.00	30.00	31.00	2.10	0.12	0.70	84.00
2	MAX			650.00	2.70	57.00	57.00	0.00	355.00	1100.00	85.00	6.50	0.76	0.93	1100.00
2	COUNT DETECTIONS			22.00	22.00	25.00	22.00	0.00	25.00	25.00	25.00	18.00	21.00	3.00	25.00
3	MIN			56.00	0.18	20.00	20.00	0.00	24.00	23.00	32.00	2.30	0.10	1.40	62.00
3	MAX			290.00	3.80	58.00	58.00	0.00	170.00	270.00	80.00	6.30	0.15	1.40	640.00
3	COUNT DETECTIONS			8.00	6.00	8.00	8.00	0.00	8.00	8.00	8.00	4.00	3.00	1.00	8.00

Parameter	(Aliphatic EC 6-8)	(Aliphatic EC 10-12)	EC 12-16	(Aliphatic EC 16-35)	Benzene (Aromatic EC 5-7)	Naphthalene (Aromatic EC 10-12)
Kd						
Site Soil Sample pH Range	7.3 to 8.5					
Site GW pH Range	7.5 to 8.2 Aug 2017; 7.2 to 7.9 Nov 2017					7.5 to 8
Site Subsoil TOC Range	0.34 to 3.7%					
Whole Site Soil Conentration Range (mg/kg)	Not Detected	2.9 to 8.9		42 to 980	Not Detected	0.1 to 0.43
Trial Pits with Soil Detection	None	TP: 7, 8, 13, 14, 15, 21		TP: 7, 8, 13, 14, 15, 17, 18, 21, 22, 23, 25, 28, 31	None	TP: 1, 4, 8, 17, 22
Whole Site Leaching Test Concentration Range (mg/kg)	n/a	n/a		n/a	n/a	n/a
Trial Pits with Leaching Test Detection	n/a	n/a		n/a	n/a	n/a
Type 1 Waste (ME_TP: 3, 4, 5, 6, 9, 10, 11, 19, 20) (WWTPPipe_BH: 3, 4)						
Type 1 Soil Min (mg/kg)	0.000	0.000		0.000	0.000	0.044
Type 1 Soil Max (mg/kg	0.000	0.000		0.000	0.000	0.430
Type 1 No. of Soil Detections	0.000	0.000		0.000	0.000	4.000
Type 1 Soil Leaching Min (mg/kg)						
Type 1 Soil Leaching Max (mg/kg)						
Type 1 No. of Soil Leaching Detections						
Type 2 Waste (ME_TP: 1, 2, 7, 8, 12, 13, 14, 15, 16, 17, 18, 21, 22, 23, 28, 31, 36, 37, 38) (WWTPPipe_BH: 1, 2)						
Type 2 Soil Min (mg/kg)	0.000	2.900		63.000	0.000	0.050
Type 2 Soil Max (mg/kg	0.000	8.900		980.000	0.000	0.320
Type 2 No. of Soil Detections	0.000	6.000		12.000	0.000	7.000
Type 2 Soil Leaching Min (mg/kg)						
Type 2 Soil Leaching Max (mg/kg)						
Type 2 No. of Soil Leaching Detections						
Inert or Natural Soil (ME_TP: TP1, TP4, TP25, TP27, TP29, TP33, TP48, SP1)						
Inert or Natural Soil Min (mg/kg)	0.000	0.000		42.000	0.000	0.000
Inert or Natural Soil Max (mg/kg	0.000	0.000		42.000	0.000	0.000
Inert or Natural No. of Soil Detections	0.000	0.000		1.000	0.000	0.000
Inert or Natural Soil Leaching Min (mg/kg)						
Inert or Natural Soil Leaching Max (mg/kg)						
Inert or Natural No. of Soil Leaching Detections						
Site Groundwater Concentration Range	Not Detected				Not Detected	
Monitoring Wells with Detection	None				None	
Kd for Barnageeragh SAND/GRAVEL subsoil						
Kd source						
Koc (ml/g)	3802	239883	5370318	575439937	68	2512
Log Koc	3.58	5.38	6.73	8.76	1.83	3.4
Koc source	LQM	LQM	LQM	LQM	LQM	LQM
Koc	130	1500	4800	53000	85	112 to 9333
Koc source	PubChem (High Mobility)	PubChem (Low mobility)	PubChem (Slight mobility)	PubChem (immobile)	Koc Pubchem (high Mobility); LogKoc Fetter Table 3.3	Koc Pubchem (high to no mobility); Log Koc Fetter Table 3.4
Foc (assume = 0.01)						
Kow					135	2350
LogKow	3.9	5.01		8.2	2.13	3.3
Kow Source	PubChem	PubChem		PubChem	Kow Fetter Table 3.1; LogKow Pubchem	Kow Fetter Table 3.1; LogKow Pubchem
Solubility in Water mg/l at 20C					no data	No Data
Solubility in Water mg/l at 25C	9.50E+00	5.20E-02		2.10E-05	1790	31
Solubility in Water source	PubChem	PubChem		PubChem	PubChem	
Biodegradation Aerobic Half Life (Days)	Biodegradation of n-hexane, present at 7% weight as part of a mixture of 13 volatile fuel compounds including MTBE, was studied in large-scale lysimeter representing depth of a 2.3 m thick sandy unsaturated zone over a gravel aquifer and studied for 70 days. A first-order rate constant of 0.40/day was reported at day 7(1), corresponding to a half-life of 2 days(SRC). The compound was not detected by day-13(1).	Volatilization more important removal process than biodegradation. 77-85.5% of Theoretical BOD reached in 28-38 days indicating readily biodegradable and that biodegradation is an important environmental fate process in soil and water.		Biodegradation half-life of hexadecane in a groundwater decreased from 77 days in nutrient-supplemented water to 22 days in water supplemented with nutrients and acclimated microbes(7).	Soil:24% 1 wk; 44% 5 weeks; 47% 10 weeks. 40% 2 weeks water; Rxn with OH in water (makes phenol) T-half = 103d; Thalf GW 16 to 28 day; 100% in 16d GW@20C	Soil: 2 to 18days. Water: 0.8 to 43 days. Rate increase as conc increases. 100% removal in 8 days in Gas oil sat groundwater
Biodegradation Anaerobic Half Life (Days)					Most test no biodeg; 1 test converted to phenol under methanogenic conditions	Shown in Fe Red GW; 100% removal in 45 days after 2 week lag in NO3 Red conditions
Biodegradation Half Life Source					PubChem	
Henrys Law Coeff (dimensionless @ 15C)	7.61E+01	2.18E+02		8.88E+02	2.35E-01	1.86E-02
Henry's Law Coeff (atm.m3water/mol)	1.80E+00	5.15E+00		2.10E+01	5.56E-03	4.40E-04
Henry's Law Coeff Source	PubChem; Dimensionless Conversion Factor from CONSIM	PubChem; Dimensionless Conversion Factor from CONSIM		PubChem; Dimensionless Conversion Factor from CONSIM	PubChem; Dimensionless Conversion Factor from CONSIM	PubChem; Dimensionless Conversion Factor from CONSIM
Volatilization from Water Half Life (Days)	n-hexane is expected to volatilize rapidly from water surfaces. Volatilization from moist soil surfaces may occur. Potential for volatilization of n-hexane from dry soil surfaces.	Expected to volatilize rapidly from water surfaces. Volatilization half-life from a model river as 3.5 hours; model lake estimated as 4.7 days(SRC). Volatilization from moist soil surfaces may occur; expected to volatilize from dry soil surfaces. Volatilization to be a more important removal process than biodegradation for n-decane		Expected to volatilize rapidly from water surfaces; however, volatilization expected to be attenuated by adsorption to suspended solids and sediment in the water column. Estimated volatilization half-life from a model pond is approximately 24 months if adsorption is considered(4). Volatilization from moist soil surfaces may occur(SRC). Not expected to volatilize from dry soil surfaces.	2.7hr (river) 3.5day(lake)	6hr (river) 5day(lake)
Volatilization from Water Half Life Source	PubChem	PubChem		PubChem	PubChem	

Parameter	Aromatic EC 12-16	Benzo(a)pyrene (Aromatic EC 16-21)	c-1,2-Dichloroethene	Vinyl Chloride	Ammonia	Antimony	Arsenic	Barium	Boron	Cadmium
Kd					0.4 to 0.9 Sand & Gravel, clayey 2 to 4 Glacial Till (Buss et al 2004)		117 (unspef), 249.6 (till), pH4.9,TOC11% = 25 pH6.8,TOC11% = 29 pH8,TOC11% = 31	pH4.9,TOC11% = 0.6 pH6.8,TOC11% = 1.4 pH8,TOC11% = 17		240 (unspef); 3.7-74-1500 SAND; 222.2 (till), 1.6-40-990 LOAM; pH4.9,TOC11% = 0.9 pH6.8,TOC11% = 120 pH8,TOC11% = 4500
Site Soil Sample pH Range	7.3 to 8.5		7.3 to 8.5		7.3 to 8.5					
Site GW pH Range	.2 Aug 2017; 7.2 to 7.9 Nov 2017		7.5 to 8.2 Aug 2017; 7.2 to 7.9 Nov 2017		7.5 to 8.2 Aug 2017; 7.2 to 7.9 Nov 2017					
Site Subsoil TOC Range	0.34 to 3.7%		0.34 to 3.7%		0.34 to 3.7%					
Whole Site Soil Conentration Range (mg/kg)		0.52 to 4.1	0.011	0.0021	n/a	2.1 to 39	13 to 61	56 to 770	n/a	0.18 to 5.3
Trial Pits with Soil Detection		TP: 1, 3, 8, 15	TP: 21	TP: 21	n/a	29 no. TP (34 no. samples)	34 no. TP (40 no. samples)	34 no. TP (40 no. samples)	n/a	32 no. TP (38 no. samples)
Whole Site Leaching Test Concentration Range (mg/kg)		n/a	n/a	n/a	n/a	0.012 to 0.42	0.11	0.5 to 1.5	n/a	Not detected
Trial Pits with Leaching Test Detection		n/a	n/a	n/a	n/a	31 no. TP (35 no. samples)	6 no. TP (7 no. samples)	15 no. TP (17 no. samples)	n/a	None
Type 1 Waste (ME_TP: 3, 4, 5, 6, 9, 10, 11, 19, 20) (WWTPPi										
Type 1 Soil Min (mg/kg)		0.120	#N/A	#N/A	#N/A	6.400	24.000	250.000	#N/A	1.200
Type 1 Soil Max (mg/kg		0.781	#N/A	#N/A	#N/A	22.000	61.000	770.000	#N/A	5.300
Type 1 No. of Soil Detections		4.000	#N/A	#N/A	#N/A	10.000	10.000	10.000	#N/A	10.000
Type 1 Soil Leaching Min (mg/kg)						0.012	0.010	0.500	#N/A	0.000
Type 1 Soil Leaching Max (mg/kg)						0.098	0.120	3.000	#N/A	0.000
Type 1 No. of Soil Leaching Detections						13.000	3.000	7.000	#N/A	0.000
Type 2 Waste (ME_TP: 1, 2, 7, 8, 12, 13, 14, 15, 16, 17, 18, 2										
Type 2 Soil Min (mg/kg)		0.046	0.011	0.002	#N/A	2.100	15.000	110.000	#N/A	0.270
Type 2 Soil Max (mg/kg		4.100	0.011	0.002	#N/A	39.000	57.000	650.000	#N/A	2.700
Type 2 No. of Soil Detections		6.000	1.000	1.000	#N/A	21.000	23.000	22.000	#N/A	22.000
Type 2 Soil Leaching Min (mg/kg)						0.016	0.030	0.520	#N/A	0.000
Type 2 Soil Leaching Max (mg/kg)						0.420	0.110	2.690	#N/A	0.000
Type 2 No. of Soil Leaching Detections						23.000	9.000	16.000	#N/A	0.000
Inert or Natural Soil (ME_TP: TP1, TP4, TP25, TP27, TP29, TP										
Inert or Natural Soil Min (mg/kg)		0.000	#N/A	#N/A	#N/A	2.400	13.000	56.000	#N/A	0.180
Inert or Natural Soil Max (mg/kg		0.000	#N/A	#N/A	#N/A	7.200	32.000	290.000	#N/A	3.800
Inert or Natural No. of Soil Detections		0.000	#N/A	#N/A	#N/A	3.000	8.000	8.000	#N/A	6.000
Inert or Natural Soil Leaching Min (mg/kg)						0.022	0.084	0.000	#N/A	0.000
Inert or Natural Soil Leaching Max (mg/kg)						0.040	0.084	0.000	#N/A	0.000
Inert or Natural No. of Soil Leaching Detections						5.000	1.000	0.000	#N/A	0.000
Site Groundwater Concentration Range										
Monitoring Wells with Detection										
Kd for Barnageeragh SAND/GRAVEL subsoil					2 to 4		29 to 31 to 117	1.4 to 17		3.7-74-1500 SAND
Kd source					(Buss et al 2004)		Consim	Consim		Consim
Koc (ml/g)	5012	14125								
Log Koc	3.7	4.15								
Koc source	LQM	LQM	PubChem	PubChem						
Koc	Acenaphthene Koc = 3890 Acenaphthylene Koc = 5620 Fluorene Koc = 5011 to 16218 Phenanthrene Koc = 9180 to >31000	3,760 to 1.3E6	49	57						
Koc source	PubChem: Acenaphthene (Slight to no mobility) Acenaphthylene (Immobile) Fluorene (Immobile) Phenanthrene (Immobile)	PubChem	PubChem	PubChem						
Foc (assume = 0.01)										
Kow										
LogKow		6.13	1.86	1.62						
Kow Source		PubChem	PubChem	PubChem						
Solubility in Water mg/l at 20C			800	1.1						
Solubility in Water mg/l at 25C		1.60E-03	6410	8800	8.99E+05		4.41E+05			6.51E+05
Solubility in Water source		PubChem	20C Fetter Table 7.6; 25C Pubchem	20C Fetter Table 7.6; 25C Pubchem	Consim		Consim			Consim
Biodegradation Aerobic Half Life (Days)		Soil: 309 and 229 days in sandy loam soils (PAHs with >=4 rings, e.g benzo(a)pyrene, generally resistant to biodeg.) Water: Expected to adsorb to susp. solids and sediment. Very slow in natural waters. Mineralization half-lives >200 weeks in sed/water microcosm studies. Faster rates can occur in acclimated media. Half-lives of 12-23 days, river water/sed from PAH polluted Yellow River, China CONSIM Help = 100 to 300 days	Chlorinated ethenes generally resist aerobic biodeg; 54%in 10d with 34% Volat in 10days. >98% in 16 to 40 weeks in methanogenic bottle of landfill aquifer seds; 100% in 50hrs methane bact; 50% in 204 days; 20-35% in 97d; 40% in 274d	3 to 16% in 28 days; >99% in 204to274days;half life 28days;	(1 to 6 years in groundwater.) 1.4 days in surface water.					
Biodegradation Anaerobic Half Life (Days)		25% biodeg in contam soils after 1 month; Contam Soils Canada & Sweden after 90 days, % removal of 10 - 26 at 20degC & 6 to 26 at 7 deg C	2 months to 9.9 yrs; 2.4mth to 1.3yr;	50% in 4 weeks + 100% in 11 weeks in sand + Meth; 20% in 4 weeks + 55% in 11 weeks in NO sand + Meth; Half life 112 to 722days;						
Biodegradation Half Life Source		PubChem	PubChem	PubChem	(Buss et al 2004); PubChem					
Henrys Law Coeff (dimensionless @ 15C)		1.93E-05	1.73E-01	1.18E+00	0.008					
Henry's Law Coeff (atm.m3water/mol)		4.57E-07	4.08E-03	2.78E-02	3.28E-04					
Henry's Law Coeff Source		PubChem; Dimensionless Conversion Factor from CONSIM	PubChem; Dimensionless Conversion Factor from CONSIM	PubChem; Dimensionless Conversion Factor from CONSIM						
Volatilization from Water Half Life (Days)		Essentially nonvolatile from water surfaces; Volatilization from moist soil surfaces may not occur; Not expected to volatilize from dry soil surfaces(SRC) based upon an extrapolated vapor pressure of 5.49X10-9 mm Hg	3hr (river) 4day(lake)	0.2d in soil @ 1cmdepth; 0.5d @ 10cm depth. 2hr (river) 3day(lake)						
Volatilization from Water Half Life Source		PubChem	PubChem	PubChem						

Parameter	Chloride	Chromium	Copper	Lead	Mercury	Molybdenum	Selenium	Zinc
Kd	0 Till	35 (unspef); 1-67-4400 SAND; 965.6 (till), 0.091-30-990 LOAM; pH4.9,TOC11% = 31 pH6.8,TOC11% = 19 pH8,TOC11% = 14	295 (unspef); 126.8 (till); pH4.9,TOC11% = 40 pH6.8,TOC11% =10000 pH8,TOC11% = 27500	27-270-2.7E4 SAND 990-1.6E4-2.7E5 LOAM 434.6 TILL	450 SAND; 3835 Till; 1500 LOAM; pH4.9,TOC11% = 0.1 pH6.8,TOC11% = 145 pH8,TOC11% = 209	110	9.5 Unspef; pH4.9,TOC11% = 2.2 pH6.8,TOC11% = 5 pH8,TOC11% = 18	26 Unspef; 1.1-200-3.6E4 SAND; 20.7 Till; 11-1300-1.6E5 LOAM; pH4.9,TOC11% = 1.6 pH6.8,TOC11% = 420 pH8,TOC11% =160000
Site Soil Sample pH Range	7.3 to 8.5							
Site GW pH Range	7.5 to 8.2 Aug 2017; 7.2 to 7.9 Nov 2017							
Site Subsoil TOC Range	0.34 to 3.7%							
Whole Site Soil Conentration Range (mg/kg)	n/a	20 to 71	24 to 810	23 to 1700	0.1 to 0.8	2.1 to 16	0.7 to 1.4	62 to 3600
Trial Pits with Soil Detection	n/a	34 no. TP (40 no. samples)	34 no. TP (40 no. samples)	34 no. TP (40 no. samples)	30 no. TP (34 no. samples)	28 no. TP (32 no. samples)	4 no. TP (4 no. samples)	34 no. TP (40 no. samples)
Whole Site Leaching Test Concentration Range (mg/kg)	12 to 16,000	0.097 to 1.3	0.051 to 0.61	0.011 to 0.032	0.0052 to 0.0068	0.059 to 0.76	0.011 to 0.079	0.58 to 1.4
Trial Pits with Leaching Test Detection	34 no. TP (38 no. samples)	8 no. TP (8 no. samples)	12 no. TP (15 no. samples)	8 no. TP (8 no. samples)	6 no. TP (6 no. samples)	32 no. TP (36 no. samples)	27 no. TP (31 no. samples)	5 no. TP (5 no. samples)
Type 1 Waste (ME_TP: 3, 4, 5, 6, 9, 10, 11, 19, 20) (WWTPPi								
Type 1 Soil Min (mg/kg)	#N/A	42.000	78.000	157.000	0.120	4.300	0.000	461.000
Type 1 Soil Max (mg/kg	#N/A	71.000	810.000	1700.000	0.800	16.000	0.000	3600.000
Type 1 No. of Soil Detections	#N/A	13.000	13.000	13.000	10.000	10.000	0.000	13.000
Type 1 Soil Leaching Min (mg/kg)	18.000	0.020	0.051	0.028	0.005	0.090	0.015	0.370
Type 1 Soil Leaching Max (mg/kg)	16000.000	0.370	1.220	0.028	0.007	0.910	0.079	1.400
Type 1 No. of Soil Leaching Detections	11.000	6.000	5.000	1.000	5.000	13.000	12.000	8.000
Type 2 Waste (ME_TP: 1, 2, 7, 8, 12, 13, 14, 15, 16, 17, 18, 2								
Type 2 Soil Min (mg/kg)	#N/A	24.000	28.000	30.000	0.120	2.100	0.700	84.000
Type 2 Soil Max (mg/kg	#N/A	57.000	355.000	1100.000	0.760	6.500	0.930	1100.000
Type 2 No. of Soil Detections	#N/A	25.000	25.000	25.000	21.000	18.000	3.000	25.000
Type 2 Soil Leaching Min (mg/kg)	15.000	0.020	0.055	0.011	0.005	0.059	0.011	0.420
Type 2 Soil Leaching Max (mg/kg)	2211.000	1.300	0.610	0.032	0.005	0.760	0.080	0.990
Type 2 No. of Soil Leaching Detections	25.000	7.000	12.000	4.000	1.000	24.000	18.000	3.000
Inert or Natural Soil (ME_TP: TP1, TP4, TP25, TP27, TP29, TP								
Inert or Natural Soil Min (mg/kg)	#N/A	20.000	24.000	23.000	0.100	2.300	1.400	62.000
Inert or Natural Soil Max (mg/kg	#N/A	58.000	170.000	270.000	0.150	6.300	1.400	640.000
Inert or Natural No. of Soil Detections	#N/A	8.000	8.000	8.000	3.000	4.000	1.000	8.000
Inert or Natural Soil Leaching Min (mg/kg)	12.000	1.300	0.096	0.014	0.000	0.066	0.016	0.000
Inert or Natural Soil Leaching Max (mg/kg)	54.000	1.300	0.130	0.022	0.000	0.320	0.025	0.000
Inert or Natural No. of Soil Leaching Detections	8.000	1.000	4.000	3.000	0.000	5.000	5.000	0.000
Site Groundwater Concentration Range								
Monitoring Wells with Detection								
Kd for Barnageeragh SAND/GRAVEL subsoil	0	1-67-4400 SAND	10000 to 27500	27-270-2.7E4 SAND	450 SAND	110	5 to 18	1.1-200-3.6E4 SAND
Kd source	Consim	Consim	Consim	Consim	Consim	Consim	Consim	Consim
Koc (ml/g)								
Log Koc								
Koc source								
Koc								
Koc source								
Foc (assume = 0.01)								
Kow								
LogKow								
Kow Source								
Solubility in Water mg/l at 20C								
Solubility in Water mg/l at 25C	36000	1.67E+05	2.93E+05		690	2450	3.41E+05	6.06E+05
Solubility in Water source	Pubchem [NaCl]	Consim	Consim		Pubchem (Hg(II)Cl2)	Consim	Consim	Consim
Biodegradation Aerobic Half Life (Days)								
Biodegradation Anaerobic Half Life (Days)								
Biodegradation Half Life Source								
Henrys Law Coeff (dimensionless @ 15C)								
Henry's Law Coeff (atm.m3water/mol)								
Henry's Law Coeff Source								
Volatilization from Water Half Life (Days)								
Volatilization from Water Half Life Source								

APPENDIX 2-3 - Hydrogeological data and assessment underpinning the hydrogeological conceptual model from the March 2018 report revision

4.1 Summary Hydrogeological Conceptual Model From August 2017

Trial pit and boreholes delineated the waste footprint at the site and identified two types of waste, classified Type 1 and Type 2 as shown in Figure 2. Waste Type 1 was found to be predominantly contaminated by inorganic compounds and heavy metals. Waste Type 2 was found to have a significant component of organic contaminants.

The site is uncapped and unlined. Rainfall on the site infiltrates through the waste body down through the underlying unsaturated zone (where present) and reaches the watertable. Site investigation data indicate that the waste is in a SILT/CLAY matrix and is underlain by sandy GRAVEL subsoil over SILTSTONE bedrock. The GRAVEL subsoil and the underlying bedrock are considered to be in hydraulic continuity. Groundwater flow in the subsoil/bedrock aquifer was taken to be northwards towards the site boundary stream. The site boundary stream was considered to be the main groundwater discharge boundary for the site.

4.2 Updates to the Hydrogeological Conceptual Model for the DQRA

Key updates to the site hydrogeological conceptual model are as follows:

- Groundwater level data from July/August and 15 November 2017, and 11 and 30 January 2018 were used to draw interpreted groundwater elevation contours for subsoil-bedrock aquifer underlying the site.
- The resulting groundwater contours for each date are shown in Figures 2 to 5.

Table 1. Hydrogeological conceptual model Updates

Groundwater Level And Flow Direction	• Groundwater level data from July/August and 15 November 2017, and 11 and 30 January 2018 were used to draw interpreted groundwater elevation contours for subsoil-bedrock aquifer underlying the site. • The resulting groundwater contours for each date are shown in Figures 2 to 5. • The contours indicate that recharge at the site results in a groundwater mound beneath the ridge formed by the landfill area. Groundwater flows radially outwards from the mound to the south, east and north. Groundwater flow is directed towards the small stream that surrounds the site area to the south (south of the railway), east (along the eastern site boundary) and north (along the northern site boundary). • Immediately northeast of the landfill area groundwater flow is focused on a preferential pathway interpreted from the borehole geology records and the results of the pumping tests programme. The pathway is considered to be a highly permeable SANDSTONE bed encountered in boreholes BH11 and BH12 and potentially extending east and northeast from the boreholes. The SANDSTONE is considered to act like a drain allowing groundwater to discharge preferentially to the northeast towards the boundary stream. • The groundwater elevations measured on 30 January 2018 are the highest of the currently available data.

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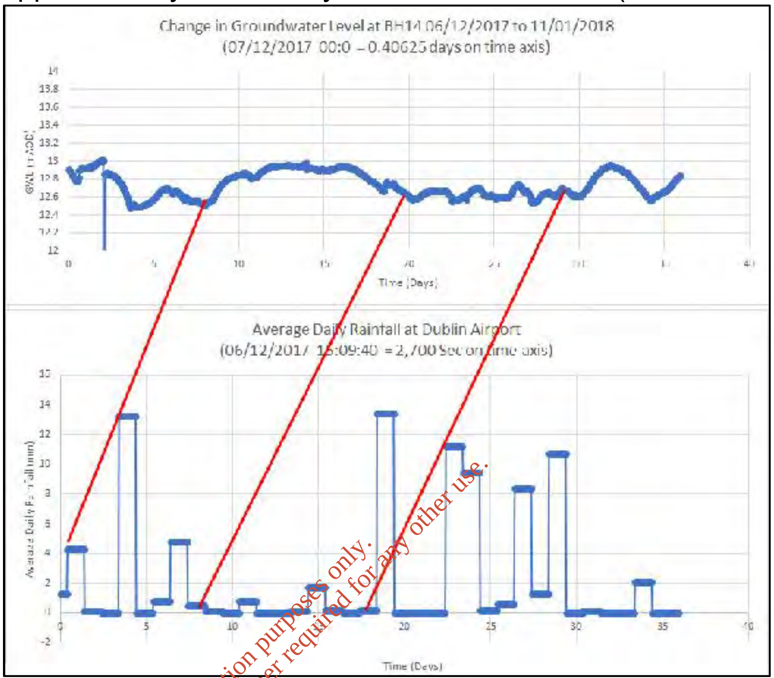
- The hydraulic gradient across the site on 30 January 2018, as inferred from the groundwater elevation contours delineated in Figure 5 ranged from 0.021 to 0.03.
- Continuous groundwater level data from BH14 for the period 06 December 2017 to 11 January 2018 tentatively suggest the groundwater level beneath the site has a response time lag of approximately 8 to 12 days after rainfall events (see inset below).



Inset 1: Time lag in groundwater level response to rainfall

- Rainfall totals at Dublin airport on 20 and 21 January 2018 of 9.2 mm and 21.1 mm respectively indicate an extreme rainfall event. This occurred at a time of generally high groundwater levels at the site as evidenced by the groundwater elevation contours for 11 January 2018 in Figure 4. Based on a recharge time lag of 8 to 12 days across the site after the extreme rainfall event, the groundwater elevation contours for 30 January 2018 shown in Figure 5 are likely to be close to maximum groundwater elevations for the site.

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<tr><td>Base of Waste below Watertable</td><td>

- Data from the geophysical surveys and from borehole logs penetrating the full waste thickness were used to characterise the elevation of the base of waste in mOD. The resulting data were used to generate a 3D-surface of the base of the waste.
- The groundwater elevation contours for the dates represented in Figures 2 to 5 were used to generate 3D surfaces of the watertable for each of the dates.
- Overlaying the watertable surfaces on the Base of Waste surface shows that a large part of the base of the waste lies below the watertable on the date of the lowest groundwater elevation, i.e. July/August 2017. The watertable then rises higher above the base of the waste on each date, reaching a maximum elevation on 30 January 2018.
- Figure 6 shows the elevation of the base of the waste and intersection of the watertable and the base of the waste for each of the groundwater elevation contour dates.

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Aquifer Properties Data	• The results of the pumping test programme are shown in Table 2. • A full interpretation of the pumping tests data is provided in Appendix 1.
Sandstone Preferential Pathway	• The high transmissivity of the aquifer at boreholes BH11 and BH12 compared to the other boreholes (see Table 2) is considered to be due to the presence of a layer of SANDSTONE bedrock at these locations. The sandstone is absent from the other boreholes. • The sandstone thickens moving east from BH11 to BH12 which suggests that the bed may extend east and/or northeast towards the site boundary stream. • This would potentially allow the sandstone to preferentially drain groundwater to the boundary stream. • A sandstone bed acting as a drain in the vicinity of BH11 and BH12 would be conceptually likely to result in a watertable depression around the drain that would match the measured groundwater levels in boreholes BH9 to BH13 and result in the groundwater elevation contours shown in Figures 2 to 5.

Table 2. Summary of Aquifer Properties Data from Pumping Test Programme.

Aquifer	K (m/d)				S (dimensionless)			
	min	max	Geomean	Count	min	max	Geomean	Count
SAND & GRAVEL (S&G)	0.09	8.0	0.2	7	3.1E-04	8.5E-04	4.5E-04	3
S&G plus SANDSTONE & SILTSTONE [possibly dominated by SANDSTONE]	34	86	61	3	na	na	na	0
S&G plus SILTSTONE	0.03	12	1.5	12	3.9E-05	3.2E-03	5.2E-04	4
S&G with minor Bedrock Component	0.07	23	2.2	14	5.7E-04	6.1E-02	3.3E-03	6
SILTSTONE	0.04	0.04	0.04	1	na	na	na	0
All Possibly Valid Data	0.03	86	1.5	37				0

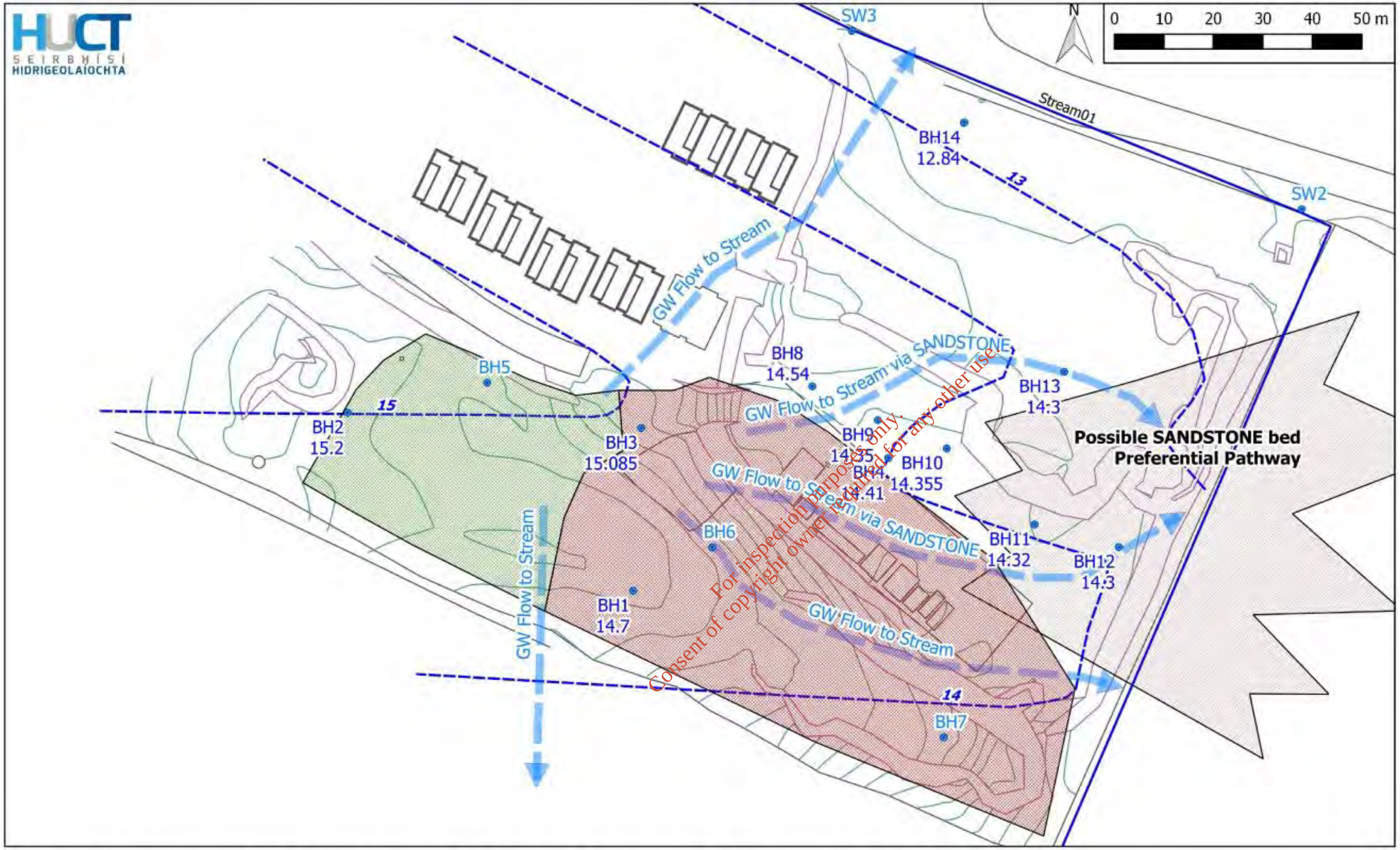


Figure 3 . Interpreted Groundwater ELevation Contours 15 November 2018

Type 1 Waste · Type 2 Waste · Stream · Possible Sandstone Bed · Monitoring Location (GW Elevation in mOD) · Possible Groundwater Flow Direction · Interpreted Groundwater Elevation Contour (15/11/2018)

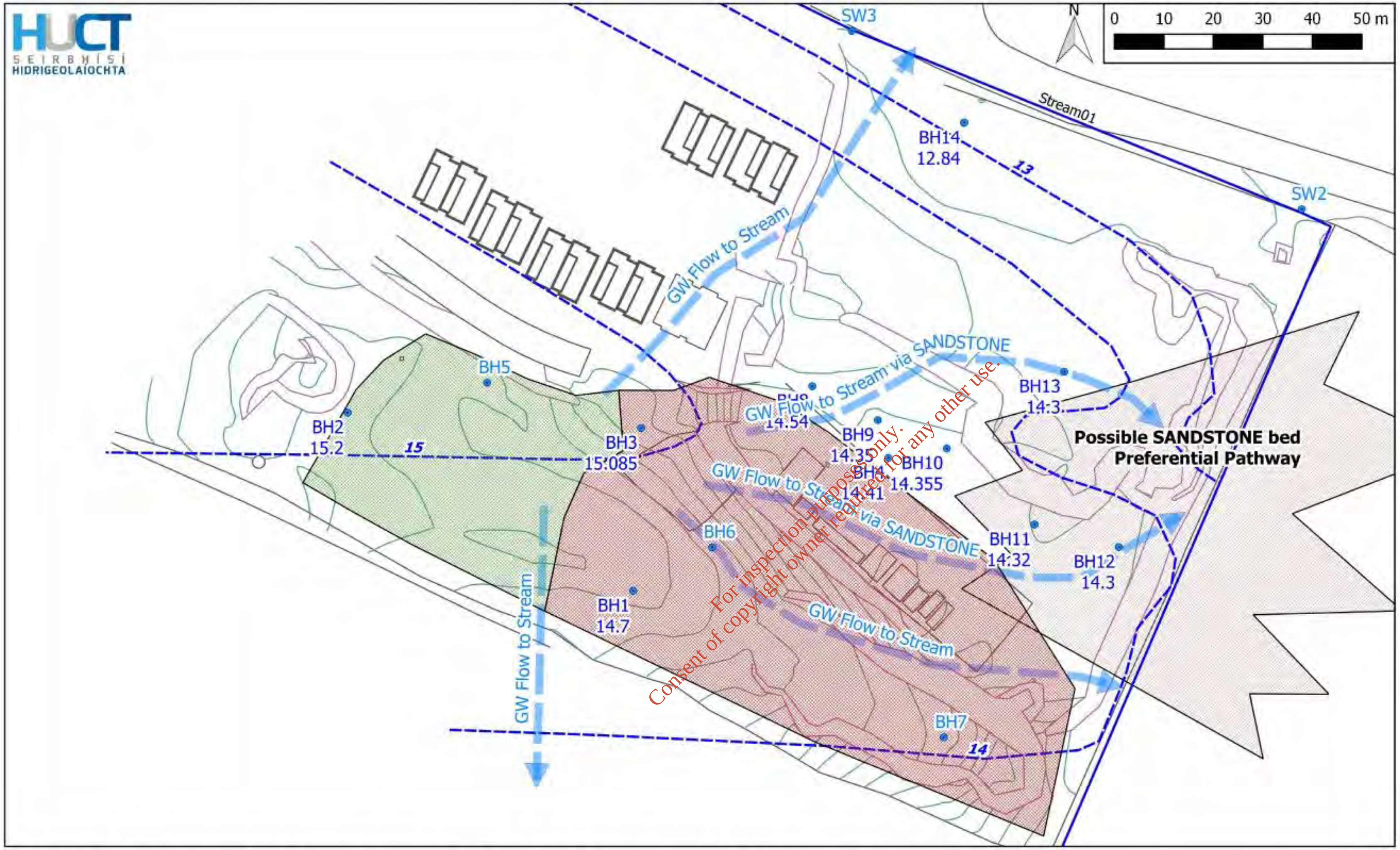


Figure 4 . Interpreted Groundwater ELevation Contours 11 January 2018

Type 1 Waste — Type 2 Waste — Stream — Possible Sandstone Bed — Monitoring Location (GW Elevation in mOD) — Possible Groundwater Flow Direction — Interpreted Groundwater Elevation Contour (11/01/2018)

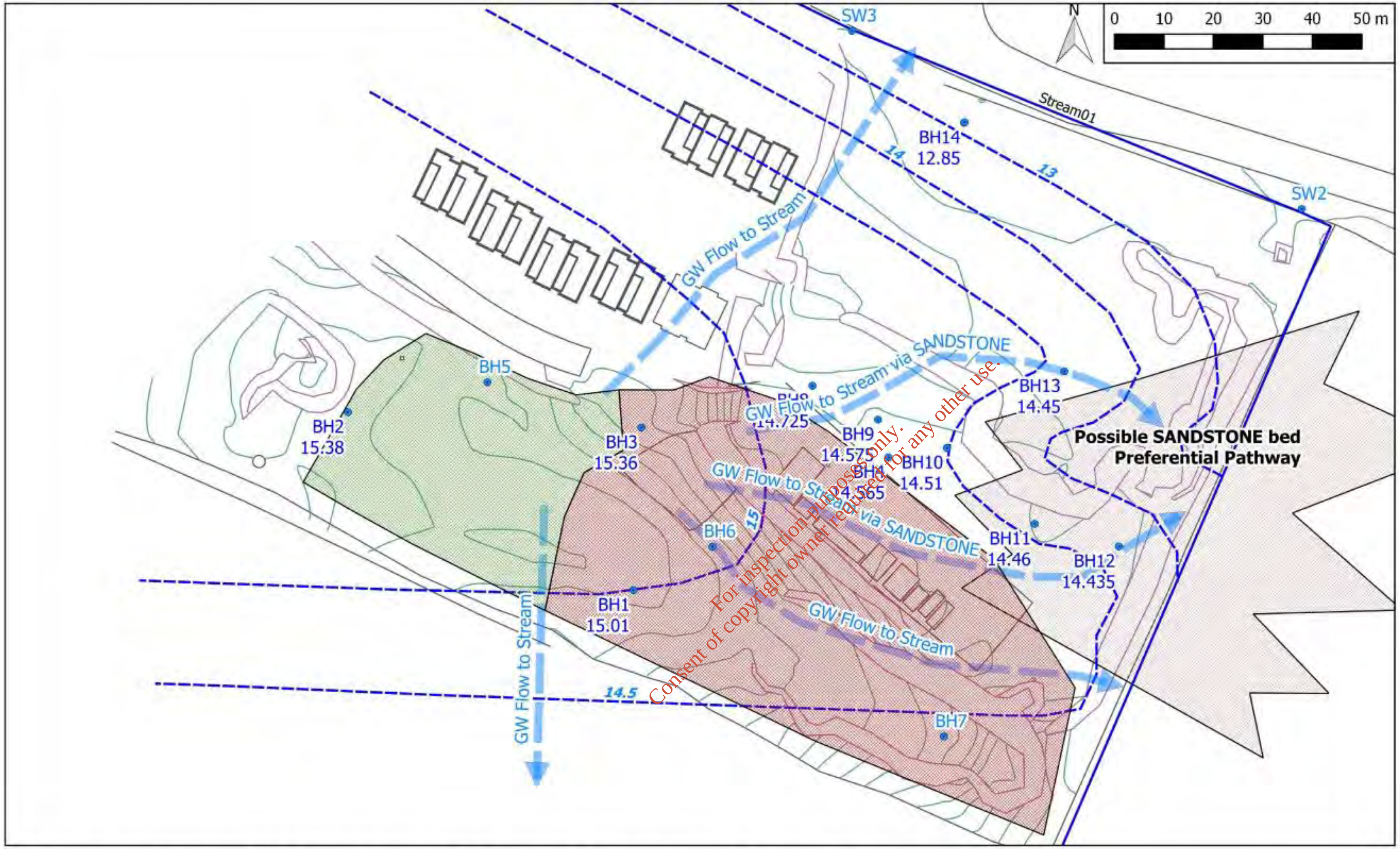
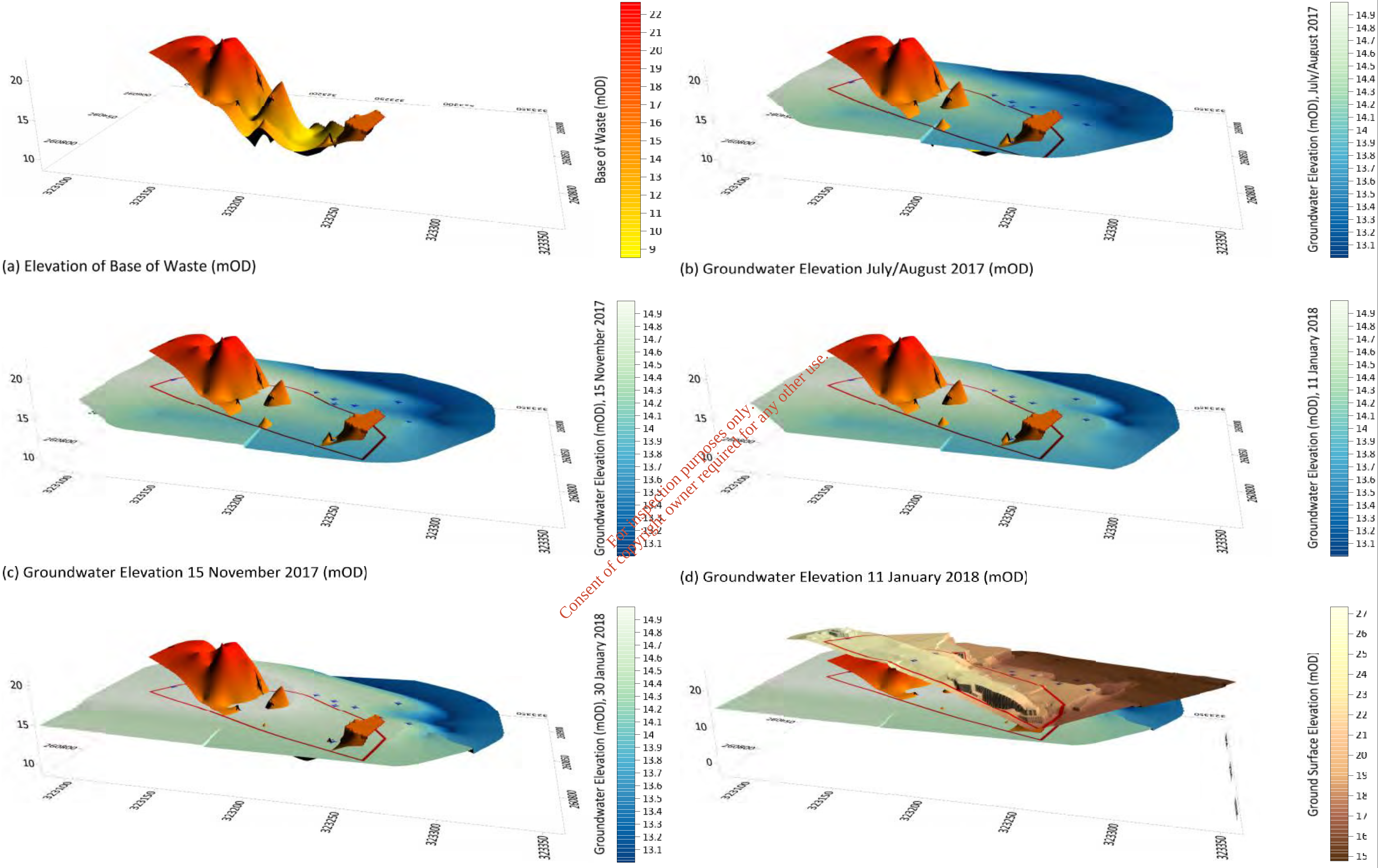


Figure 5 . Interpreted Groundwater ELevation Contours 30 January 2018

Type 1 Waste — Type 2 Waste — Stream — Possible Sandstone Bed — Monitoring Location (GW Elevation in mOD) — Possible Groundwater Flow Direction — Interpreted Groundwater Elevation Contour (30/01/2018)



(a) Elevation of Base of Waste (mOD)

(b) Groundwater Elevation July/August 2017 (mOD)

(c) Groundwater Elevation 15 November 2017 (mOD)

(d) Groundwater Elevation 11 January 2018 (mOD)

(e) Groundwater Elevation 30 January 2018 (mOD)

(f) Ground Surface Elevation (mOD) with Groundwater Elevation on 30 January 2018 (mOD)

Figure 6 . Intersection of Waste by Groundwater between Augst 2017 and February 2018

- Appendix 2-3: Pumping Test Data Interpretation

Table : Summary of Pumping Test Analysis and Interpretation

Pumping Well (PW)	Observation Well (OW)	Test Date	RWL PW mbgl	RWL OW mbgl	Pump Depth mbgl	Max PW DDN m	PWL @ Pump	Max OW DDN m	PW Screen mbgl	PW Water Strike (WS) mbgl	PW Subsoil mbgl	PW DTB mbgl	PW Rock (w = weathered)	PW Tot. Depth mbgl	OW Screen mbgl	OW Water Strike (WS) mbgl	OW Subsoil mbgl	OW DTB mbgl	OW Rock (w = weathered)	OW Tot. Depth mbgl	Analysis	Representative of undisturbed aquifer?	T m2/d	S
BH1	BH1	01/02/2018	10.07	10.07	12.00	2.75	12.82, Yes	2.750	1 m to Tot Depth	S&G	(Waste to 10.5m)/ g_SAND to s_GRAVEL to 14m/ st_s_GRAVEL	-	-	18.5	1 m to Tot Depth	S&G	(Waste to 10.5m)/ g_SAND to s_GRAVEL to 14m/ st_s_GRAVEL	-	-	18.5	Jacob - Early Time DDN	Possibly	0.5	
BH1	BH1	01/02/2018	10.07	10.07	12.00	2.75	12.82, Yes	2.750	1 m to Tot Depth	S&G	(Waste to 10.5m)/ g_SAND to s_GRAVEL to 14m/ st_s_GRAVEL	-	-	18.5	1 m to Tot Depth	S&G	(Waste to 10.5m)/ g_SAND to s_GRAVEL to 14m/ st_s_GRAVEL	-	-	18.5	Jacob - Late Time DDN	Unlikely	25.2	
BH1	BH1	01/02/2018	10.07	10.07	12.00	2.75	12.82, Yes	2.750	1 m to Tot Depth	S&G	(Waste to 10.5m)/ g_SAND to s_GRAVEL to 14m/ st_s_GRAVEL	-	-	18.5	1 m to Tot Depth	S&G	(Waste to 10.5m)/ g_SAND to s_GRAVEL to 14m/ st_s_GRAVEL	-	-	18.5	Jacob -Lohman Constant Head	Possibly	0.9	8.50E-04
BH1	BH1	01/02/2018	10.07	10.07	12.00	2.75	12.82, Yes	2.750	1 m to Tot Depth	S&G	(Waste to 10.5m)/ g_SAND to s_GRAVEL to 14m/ st_s_GRAVEL	-	-	18.5	1 m to Tot Depth	S&G	(Waste to 10.5m)/ g_SAND to s_GRAVEL to 14m/ st_s_GRAVEL	-	-	18.5	Theis Recovery	Possibly	0.5	
BH3	BH2	01/02/2018	7.34	9.88	10.00	3.03	10.365, Yes	0.013	1 m to Tot Depth	9.8	(Waste to 5.5m)/ st_g_SAND to st_s_GRAVEL	-	-	14.6	1 m to Tot Depth	11.5	st_g_SAND to st_s_GRAVEL	-	-	14.6	Jacob - Early Time DDN	Possibly	35.8	3.50E-04
BH3	BH2	01/02/2018	7.34	9.88	10.00	3.03	10.365, Yes	0.013	1 m to Tot Depth	9.8	(Waste to 5.5m)/ st_g_SAND to st_s_GRAVEL	-	-	14.6	1 m to Tot Depth	11.5	st_g_SAND to st_s_GRAVEL	-	-	14.6	Jacob - Late Time DDN	Unlikely	17.9	4.90E-04
BH3	BH3	01/02/2018	7.34	7.34	10.00	3.03	10.365, Yes	3.030	1 m to Tot Depth	9.8	(Waste to 5.5m)/ st_g_SAND to st_s_GRAVEL	-	-	14.6	1 m to Tot Depth	9.8	(Waste to 5.5m)/ st_g_SAND to st_s_GRAVEL	-	-	14.6	Jacob - Early Time DDN	Possibly	0.6	
BH3	BH3	01/02/2018	7.34	7.34	10.00	3.03	10.365, Yes	3.030	1 m to Tot Depth	9.8	(Waste to 5.5m)/ st_g_SAND to st_s_GRAVEL	-	-	14.6	1 m to Tot Depth	9.8	(Waste to 5.5m)/ st_g_SAND to st_s_GRAVEL	-	-	14.6	Jacob - Late Time DDN	Unlikely	21	
BH3	BH3	01/02/2018	7.34	7.34	10.00	3.03	10.365, Yes	3.030	1 m to Tot Depth	9.8	(Waste to 5.5m)/ st_g_SAND to st_s_GRAVEL	-	-	14.6	1 m to Tot Depth	9.8	(Waste to 5.5m)/ st_g_SAND to st_s_GRAVEL	-	-	14.6	Jacob -Lohman Constant Head	Possibly	1	3.10E-04
BH3	BH3	01/02/2018	7.34	7.34	10.00	3.03	10.365, Yes	3.030	1 m to Tot Depth	9.8	(Waste to 5.5m)/ st_g_SAND to st_s_GRAVEL	-	-	14.6	1 m to Tot Depth	9.8	(Waste to 5.5m)/ st_g_SAND to st_s_GRAVEL	-	-	14.6	Theis Recovery	Possibly	0.4	

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Pumping Well	Observation Well	Test Date	Analysis Comments	HCM Comments	Aquifer	Aquifer Thickness PW	Aquifer Thickness OW	Hydraulic Conductivity
(PW)	(OW)					m	m	m/d
BH1	BH1	01/02/2018	Analysis of early-time drawdown prior to PWL reaching the pump intake at 4.5 min.	BH1 RWL in base of waste. Very low T for confined S&G. Possible that drilling fines are resulting in decreased T near the well. PWL during test close to base of clean S&G. As such, flow to well may have been primarily through underlying silty sandy GRAVEL. If the deposits are very silty around the borehole this could account for the low T value. T value likely to represent lower end of S&G T aquifer range.	S&G	5.68	5.68	0.09
BH1	BH1	01/02/2018	Pump installed at approx. 12mbgl. Change in slope at 4.5 min (~2.75m ddn) due to water level at pump intake. The discharge rate drops steadily after 4.5mins. There is a slight increase in drawdown (approx. 0.03m) between 4.5 & 30 mins. The slight increase in drawdown is likely to comprise a very gradual drawdown across the pump intake, slight fluctuations around the pump intake, and variability from the logger accuracy (=/-5 to 10mm). However; the majority of the majority of the equilibration of the aquifer to the pumping stress after 4.5 min is reflected in the decreasing discharge rate, rather than in the drawdown. The slight drawdown after 4.5 min has been analysed against the average discharge after 4.5 min; however as the aquifer equilibration is mostly in the decreasing discharge, the analysis is likely to over-estimate the T of the aquifer (and/or drilling fines) in the vicinity of BH1. It ismore representative to analyse the data for t>4.5mins as constant head with varying Q (see BH1 Jacob-Lohman analysis)	Data discounted.	S&G	5.68	5.68	4.44
BH1	BH1	01/02/2018	Analysis of decreasing discharge versus approximately constant head after 4.5 min (i.e. after PWL reaches pump-intake). Resulting T value of 0.9m2/d corresponds well with Jacob analysis of early-time drawdown (i.e. before PWL reaches pump intake at 4.5 min). Also, estimate of S = 8.5E-04 for an assumed effective well radius (rew, i.e. a measure of well loss due to drilling fines, etc.) of 0.1 m corresponds well with the S range from analyses of observation well data at other boreholes. Note that the actual well radius is 0.025 m cf. est. of 0.1 m for rew, i.e. drilling fines potentially significant.	Very low T for confined S&G. Possible that drilling fines are resulting in decreased T near the well.	S&G	5.68	5.68	0.16
BH1	BH1	01/02/2018	T corresponds well with values from Jacob analysis of drawdown prior to 4.5min and Jacob-Lohman analysis of decreasing discharge after 4.5min.	Overall the S&G aquifer in the vicinity of BH1 appears to have a low transmissivity and may have a significant component of fine silts. HOWEVER, no viable observation well data for this test.	S&G	5.68	5.68	0.09
BH3	BH2	01/02/2018	Analysis of slight early drawdown at BH2 (0.01m). The early drawdown is likely to correspond to the initial constant discharge drawdown in BH3 prior to the PWL reaching the pump intake at 7min. Observation well data at BH2 not subject to pumping head loss affecting the pumping well drawdown data. Resulting T values should be more representative of the aquifer. Residual drilling fines in the borehole vicinity may still lead to an underestimate of the T of the undisturbed aquifer. T & S values are expected to be representative of the aquifer between BH3 & BH2.	BH2 & BH3 screened in st_g_SAND to st_s_GRAVEL. The saturated depth of well screen during the test was approx. 4.5m (similar to BH1 test). The higher T result from BH2 obs. data for BH3 test compared to the BH1 T results suggests the hydraulic conductivity of the deposits increase moving west from BH1 towards BH2. Perhaps the silt component is of lower magnitude in the BH2 area cf. the BH1 area. OR, The higher T may just reflect the absence of pumping head loss from the observation well data.	S&G	4.24	4.71	8.01
BH3	BH2	01/02/2018	After PWL at BH3 reaches pump intake at BH3 at 7 min, the BH2 water level recovers slightly after a time lag, and then draws down again. The brief recovery and second phase of drawdown are considered to relate to the period of constant head/decreasing discharge after 7 min at BH3. Analysis of the second phase of slight drawdown at BH2 (0.013m) against the average discharge after 7 mins would be expected to overestimate T (due to majority of equilibration achieved by decreasing discharge trend); however the result is lower than the result from the early-time drawdown analysis. Overall, the analysis method is unlikely to be representative of the test conditions with near constant head and decreasing discharge.	Data discounted.	S&G	4.24	4.71	4.00
BH3	BH3	01/02/2018	Analysis of early-time drawdown prior to PWL reaching the pump intake at 7 min.	BH3 RWL below base of waste. Very low T for S&G. Possible that drilling fines are resulting in decreased T near the well.	S&G	4.24	4.24	0.14
BH3	BH3	01/02/2018	Analysis of slight additional drawdown after 7 min when PWL is at the pump intake. In similar fashion to the equivalent conditions during the BH1 test, the analysis method is unlikely to be representative of the test conditions with near constant head and decreasing discharge.	Data discounted.	S&G	4.24	4.24	4.96
BH3	BH3	01/02/2018	Analysis of decreasing discharge versus approximately constant head after 7 min (i.e. after PWL reaches pump-intake). Resulting T value of 1.0 m2/d corresponds well with Jacob analysis of early-time drawdown (i.e. before PWL reaches pump intake at 4.5 min). Also, estimate of S = 3.1E-04 for an assumed effective well radius (rew, i.e. a measure of well loss due to drilling fines, etc.) of 0.1 m corresponds well with the S range from analyses of observation well data at other boreholes. Note that the actual well radius is 0.025 m cf. est. of 0.1 m for rew, i.e. drilling fines potentially significant.	Very low T for S&G. Possible that drilling fines are resulting in decreased T near the well.	S&G	4.24	4.24	0.24
BH3	BH3	01/02/2018	T corresponds well with values from Jacob analysis of BH3 drawdown prior to 7 min and Jacob-Lohman analysis of decreasing discharge at BH3 after 7 min.	Overall the T estimates from analysis of drawdown, recovery and discharge data at BH3 and BH1 are low for a S&G aquifer and much lower than the estimates from the observation well drawdown at BH2 during the BH3 pumping tests. This could mean that either aquifer T is low around BH1 & BH3 and low to moderate around BH2, or that T is moderately low across the whole area but residual drilling fines in the aquifer in the vicinity of BH1 & BH3 result in underestimated aquifer T from drawdown, recovery and discharge data from the pumping wells.	S&G	4.24	4.24	0.09

Pumping Well	Observation Well	Test Date	RWL PW	RWL OW	Pump Depth	Max PW DDN	PWL @ Pump	Max OW DDN	PW Screen	PW Water Strike (WS)	PW Subsoil	PW DTB	PW Rock	PW Tot. Depth	OW Screen	OW Water Strike (WS)	OW Subsoil	OW DTB	OW Rock	OW Tot. Depth	Analysis	Representative of undisturbed aquifer?	T	S
(PW)	(OW)		mbgl	mbgl	mbgl	m		m	mbgl	mbgl	mbgl	mbgl	(w = weathered)	mbgl	mbgl	mbgl	mbgl	mbgl	(w = weathered)	mbgl			m2/d	
BH4	BH4	30/01/2018	4.41	4.41	10.00	0.54	4.945, No	0.540	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	Birsoy Summers DDN	Possibly	14.1	3.10E-03
BH4	BH4	30/01/2018	4.41	4.41	10.00	0.54	4.945, No	0.540	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	Birsoy Summers Recovery	Possibly	52	
BH4	BH4	30/01/2018	4.41	4.41	10.00	0.54	4.945, No	0.540	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	Jacob DDN	Possibly	15.8	
BH4	BH4	30/01/2018	4.41	4.41	10.00	0.54	4.945, No	0.540	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	Theis Recovery	Possibly	49.7	
BH4	BH8	30/01/2018	4.41	3.84	10.00	0.54	4.945, No	0.070	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	Theis DDN	Possibly	14.6	4.10E-03
BH4	BH9	30/01/2018	4.41	4.31	10.00	0.54	4.945, No	0.038	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	1 m to Tot Depth	Dry	SILT/CLAY to 5m/ g_SAND to s_GRAVEL	10.5	SILTST	12	Theis DDN	Possibly	11.2	6.10E-02
BH4	BH9	30/01/2018	4.41	4.31	10.00	0.54	4.945, No	0.038	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	1 m to Tot Depth	Dry	SILT/CLAY to 5m/ g_SAND to s_GRAVEL	10.5	SILTST	12	Theis Recovery	Possibly	161.2	
BH4	BH10	30/01/2018	4.41	4.43	10.00	0.54	4.945, No	0.106	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	1 m to Tot Depth	Damp at 6m	SILT/CLAY to 6m/ g_SAND to s_GRAVEL	9.5	SILTST_w0.5	12	Jacob DDN	Possibly	22.4	3.30E-03
BH4	BH10	30/01/2018	4.41	4.43	10.00	0.54	4.945, No	0.106	1 m to Tot Depth	8	SILT/CLAY to 5.5m/ st_g_SAND to st_s_GRAVEL	10.5	Rck_w	11.5	1 m to Tot Depth	Damp at 6m	SILT/CLAY to 6m/ g_SAND to s_GRAVEL	9.5	SILTST_w0.5	12	Theis Recovery	Possibly	108.3	
BH8	BH8	02/02/2018	3.84	3.84	7.00	3.63	7.47, Yes	3.630	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	Jacob - Early Time DDN	Possibly	0.3	
BH8	BH8	02/02/2018	3.84	3.84	7.00	3.63	7.47, Yes	3.630	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	Jacob - Late Time DDN	Unlikely	2.6	
BH8	BH8	02/02/2018	3.84	3.84	7.00	3.63	7.47, Yes	3.630	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	Jacob -Lohman Constant Head	Possibly	0.55	5.70E-04
BH8	BH8	02/02/2018	3.84	3.84	7.00	3.63	7.47, Yes	3.630	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	Theis Recovery	Possibly	0.6	
BH8	BH9	02/02/2018	3.84	4.31	7.00	3.63	7.47, Yes	0.038	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	1 m to Tot Depth	Dry	SILT/CLAY to 5m/ g_SAND to s_GRAVEL	10.5	SILTST	12	Jacob DDN	Possibly	19.9	8.40E-04

Pumping Well	Observation Well	Test Date	Analysis Comments	HCM Comments	Aquifer	Aquifer Thickness PW	Aquifer Thickness OW	Hydraulic Conductivity
(PW)	(OW)					m	m	m/d
BH4	BH4	30/01/2018	Variable discharge analysis of drawdown in the pumping well (i.e. BH4). In BH4 the changes in discharge rate were generally due to changes of the 12V battery powering the pump during the test. The PWL remained above the pump intake at all times. T of 14.1 m2/d is low to moderate for a S&G aquifer. The est. rew = 0.3m (when r = 0.025m) for S = 3.1E-03 suggests the possible presence of drilling fines in the aquifer around the borehole resulting in a low T zone around the well.	The st_g_SAND to st_s_GRAVEL aquifer remained fully saturated throughout the test beneath the overlying SILT/CLAY. The borehole water strike was in the S&G. The borehole is predominantly screened in the subsoil with a approx. 1 m of weathered rock at the base. The T value is likely to mostly relate to the S&G aquifer.	S&G with minor Bedrock Component	6.56	6.56	2.15
BH4	BH4	30/01/2018	Variable discharge analysis of water level recovery in the pumping well (i.e. BH4). Without the pumping head loss component in the recovery water level response, the recovery analysis yields a higher T value compared to the drawdown analysis. T = 52 m2/d is moderate for a 4.5m thick S&G aquifer. Moderate T value may still be affected by drilling fines in the vicinity of the well and underestimate T of the undisturbed aquifer.		S&G with minor Bedrock Component	6.56	6.56	7.93
BH4	BH4	30/01/2018	Analysis of drawdown in pumping well using the average discharge rate gives a similar T result to the more detailed Birsoy-Summers variable discharge analysis of the BH4 drawdown data.		S&G with minor Bedrock Component	6.56	6.56	2.41
BH4	BH4	30/01/2018	Analysis of water level recovery in pumping well using the average discharge rate gives a similar T result to the more detailed Birsoy-Summers variable discharge analysis of the BH4 recovery data.		S&G with minor Bedrock Component	6.56	6.56	7.58
BH4	BH8	30/01/2018	Analysis of drawdown in the Observation well BH8 using the average discharge rate from BH4. T result potentially affected by drilling fines in the aquifer in the vicinity of the well and may underestimate T of undisturbed aquifer. Insufficient recovery data for recovery analysis.		S&G with minor Bedrock Component	6.56	8.09	1.99
BH4	BH9	30/01/2018	Analysis of drawdown in the Observation well BH9 using the average discharge rate from BH4. T result potentially affected by drilling fines in the aquifer in the vicinity of the well and may underestimate T of undisturbed aquifer.		S&G with minor Bedrock Component	6.56	7.66	1.58
BH4	BH9	30/01/2018	Analysis of limited water level recovery data for observation well BH9 suggests significantly higher T compared to other data sets for the test (except BH10 recovery). Value may not be reliable due to limited extent of data.	If accurate the moderate to high T value may reflect the upper end of the T range for the aquifer around BH4 and BH9.	S&G with minor Bedrock Component	6.56	7.66	22.69
BH4	BH10	30/01/2018	Analysis of drawdown in the Observation well BH10 using the average discharge rate from BH4. T result potentially affected by drilling fines in the aquifer in the vicinity of the well and may underestimate T of undisturbed aquifer.		S&G with minor Bedrock Component	6.56	7.47	3.19
BH4	BH10	30/01/2018	Analysis of somewhat-limited water level recovery data for observation well BH10 suggests significantly higher T compared to other data sets for the test (except BH9 recovery). Value may not be reliable due to somewhat-limited extent of data.	Overall the data from the BH4 pumping test suggest an increase in transmissivity in the vicinity of BH4 compared to the transmissivity observed in the south and southwest of the site at BH1, BH2 & BH3.	S&G with minor Bedrock Component	6.56	7.47	15.44
BH8	BH8	02/02/2018	Analysis of early-time drawdown prior to PWL reaching the pump intake at 3 min.	BH8 abstraction PWL in st_g_SAND to st_s_GRAVEL throughout test. Saturated depth predominantly st_g_SAND to st_s_GRAVEL, with approx. 1.5 m of weathered SILTSTONE at base. The borehole water strike was in the S&G. The T value is likely to mostly relate to the S&G aquifer. Very low T for S&G. Possible that drilling fines are resulting in decreased T near the well.	S&G with minor Bedrock Component	4.53	4.53	0.07
BH8	BH8	02/02/2018	Analysis of slight additional drawdown after 3 min when PWL is at the pump intake. In similar fashion to the equivalent conditions during the BH1 & BH3 tests, the analysis method is unlikely to be representative of the test conditions with near constant head and decreasing discharge.	Data discounted.	S&G with minor Bedrock Component	4.53	4.53	0.57
BH8	BH8	02/02/2018	Analysis of decreasing discharge versus approximately constant head after 3 min (i.e. after PWL reaches pump-intake). Resulting T value of 0.55 m2/d corresponds well with Jacob analysis of early-time drawdown (i.e. before PWL reaches pump intake at 4.5 min). Also, estimate of S = 5.7E-04 for an assumed effective well radius (rew, i.e. a measure of well loss due to drilling fines, etc.) of 0.4 m corresponds well with the S range from analyses of observation well data at other boreholes. Note that the actual well radius is 0.025 m cf. est. of 0.4 m for rew, i.e. drilling fines potentially significant.	Very low T for S&G. Possible that drilling fines are resulting in decreased T near the well.	S&G with minor Bedrock Component	4.53	4.53	0.12
BH8	BH8	02/02/2018	T corresponds well with values from Jacob analysis of BH8 drawdown prior to 3 min and Jacob-Lohman analysis of decreasing discharge at BH8 after 3 min.		S&G with minor Bedrock Component	4.53	4.53	0.13
BH8	BH9	02/02/2018	Analysis of drawdown in the Observation well BH9 using the average discharge rate from BH8. T result potentially affected by drilling fines in the aquifer in the vicinity of the well and may underestimate T of undisturbed aquifer.		S&G with minor Bedrock Component	4.53	7.66	3.27

Table : Summary of Pumping Test Analysis and Interpretation

Pumping Well	Observation Well	Test Date	RWL PW	RWL OW	Pump Depth	Max PW DDN	PWL @ Pump	Max OW DDN	PW Screen	PW Water Strike (WS)	PW Subsoil	PW DTB	PW Rock	PW Tot. Depth	OW Screen	OW Water Strike (WS)	OW Subsoil	OW DTB	OW Rock	OW Tot. Depth	Analysis	Representative of undisturbed aquifer?	T	S
(PW)	(OW)		mbgl	mbgl	mbgl	m		m	mbgl	mbgl	mbgl	mbgl	(w = weathered)	mbgl	mbgl	mbgl	mbgl	mbgl	(w = weathered)	mbgl			m2/d	
BH8	BH9	02/02/2018	3.84	4.31	7.00	3.63	7.47, Yes	0.038	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	1 m to Tot Depth	Dry	SILT/CLAY to 5m/ g_SAND to s_GRAVEL	10.5	SILTST	12	Theis Recovery	Possibly	96.5	
BH9	BH8	01/02/2018	4.31	3.84	8.00	3.75	8.055, Yes	0.042	1 m to Tot Depth	Dry	SILT/CLAY to 5m/ g_SAND to s_GRAVEL	10.5	SILTST	12	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	Jacob DDN	Possibly	11.9	4.00E-04
BH9	BH8	01/02/2018	4.31	3.84	8.00	3.75	8.055, Yes	0.042	1 m to Tot Depth	Dry	SILT/CLAY to 5m/ g_SAND to s_GRAVEL	10.5	SILTST	12	1 m to Tot Depth	7.5	SILT/CLAY to 3m/ st_g_SAND to st_s_GRAVEL	10.5	SILTST_w	12	Theis Recovery	Possibly	52.8	
BH9	BH9	01/02/2018	4.31	4.31	8.00	3.75	8.055, Yes	3.750	1 m to Tot Depth	Dry	SILT/CLAY to 5m/ g_SAND to s_GRAVEL	10.5	SILTST	12	1 m to Tot Depth	Dry	SILT/CLAY to 5m/ g_SAND to s_GRAVEL	10.5	SILTST	12	Jacob - Early Time DDN	Possibly	0.1	
BH9	BH9	01/02/2018	4.31	4.31	8.00	3.75	8.055, Yes	3.750	1 m to Tot Depth	Dry	SILT/CLAY to 5m/ g_SAND to s_GRAVEL	10.5	SILTST	12	1 m to Tot Depth	Dry	SILT/CLAY to 5m/ g_SAND to s_GRAVEL	10.5	SILTST	12	Theis Recovery	Possibly	0.4	
BH10	BH9	31/01/2018	4.43	4.31	8.00	0.32	4.745, No	0.036	1 m to Tot Depth	Damp at 6m	SILT/CLAY to 6m/ g_SAND to s_GRAVEL	9.5	SILTST_w0.5	12	1 m to Tot Depth	Dry	SILT/CLAY to 5m/ g_SAND to s_GRAVEL	10.5	SILTST	12	Jacob DDN	Possibly	53.3	3.20E-03
BH10	BH9	31/01/2018	4.43	4.31	8.00	0.32	4.745, No	0.036	1 m to Tot Depth	Damp at 6m	SILT/CLAY to 6m/ g_SAND to s_GRAVEL	9.5	SILTST_w0.5	12	1 m to Tot Depth	Dry	SILT/CLAY to 5m/ g_SAND to s_GRAVEL	10.5	SILTST	12	Theis Recovery	Unlikely	1214	
BH10	BH10	31/01/2018	4.43	4.43	8.00	0.32	4.745, No	0.320	1 m to Tot Depth	Damp at 6m	SILT/CLAY to 6m/ g_SAND to s_GRAVEL	9.5	SILTST_w0.5	12	1 m to Tot Depth	Damp at 6m	SILT/CLAY to 6m/ g_SAND to s_GRAVEL	9.5	SILTST_w0.5	12	Jacob DDN	Possibly	48.6	3.90E-05
BH10	BH10	31/01/2018	4.43	4.43	8.00	0.32	4.745, No	0.320	1 m to Tot Depth	Damp at 6m	SILT/CLAY to 6m/ g_SAND to s_GRAVEL	9.5	SILTST_w0.5	12	1 m to Tot Depth	Damp at 6m	SILT/CLAY to 6m/ g_SAND to s_GRAVEL	9.5	SILTST_w0.5	12	Theis Recovery	Possibly	30.8	
BH11	BH10	01/02/2018	4.79	4.43	8.00	0.07	4.858, No	0.004	1 m to Tot Depth	6.5	SILT/CLAY to 4m/ st_g_SAND to st_s_GRAVEL	8.5	SST/SILTST	12	1 m to Tot Depth	Damp at 6m	SILT/CLAY to 6m/ g_SAND to s_GRAVEL	9.5	SILTST_w0.5	12	Jacob DDN	Unlikely	1696	2.80E-03
BH11	BH11	01/02/2018	4.79	4.79	8.00	0.07	4.858, No	0.068	1 m to Tot Depth	6.5	SILT/CLAY to 4m/ st_g_SAND to st_s_GRAVEL	8.5	SST/SILTST	12	1 m to Tot Depth	6.5	SILT/CLAY to 4m/ st_g_SAND to st_s_GRAVEL	8.5	SST/SILTST	12	Jacob DDN	Unlikely	1734	
BH11	BH11	01/02/2018	4.79	4.79	8.00	0.07	4.858, No	0.068	1 m to Tot Depth	6.5	SILT/CLAY to 4m/ st_g_SAND to st_s_GRAVEL	8.5	SST/SILTST	12	1 m to Tot Depth	6.5	SILT/CLAY to 4m/ st_g_SAND to st_s_GRAVEL	8.5	SST/SILTST	12	Theis Recovery	Possibly	572	

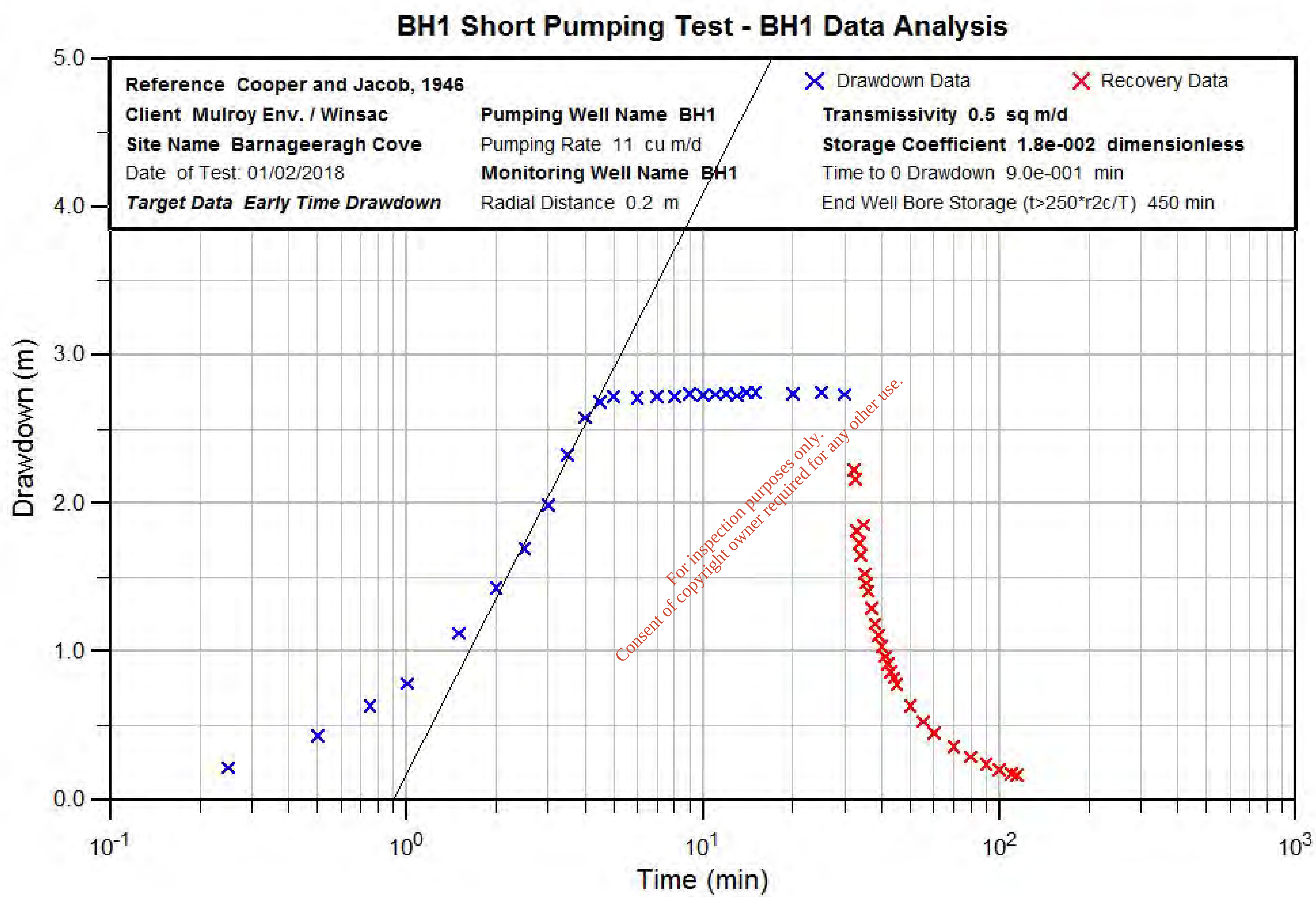
Pumping Well	Observation Well	Test Date	Analysis Comments	HCM Comments	Aquifer	Aquifer Thickness PW	Aquifer Thickness OW	Hydraulic Conductivity
(PW)	(OW)					m	m	m/d
BH8	BH9	02/02/2018	Analysis of limited water level recovery data for observation well BH9 suggests significantly higher T compared to other data sets for the test. Value may not be reliable due to limited extent of data.	If accurate the moderate to high T value may reflect the upper end of the T range for the aquifer around BH8 and BH9. Overall, taking the pair of tests {BH8 abs & BH9 obs} & {BH9 abs & BH8 obs} the data suggest low T at the boreholes when they are used for abstraction and moderate T when they are passive observation wells. This suggests a high component of pumping losses in the pumping well drawdown data, such that the pumping well data across the site are likely to significantly underestimate T. The pumping losses are over and above the aquifer & well losses experienced at the observation wells.	S&G with minor Bedrock Component	4.53	7.66	15.84
BH9	BH8	01/02/2018	Analysis of drawdown in the Observation well BH8 using the average discharge rate from BH9. Result for T & S similar to inverse test i.e. BH8 as abstraction and BH9 as observation well. T result potentially affected by drilling fines in the aquifer in the vicinity of the well and may underestimate T of undisturbed aquifer.		S&G plus SILTSTONE	3.95	8.12	1.97
BH9	BH8	01/02/2018	Analysis of limited water level recovery data for observation well BH8. Higher T than drawdown part of test, again similar to results of inverse test, i.e. BH8 abs & BH9 obs. Value may not be reliable due to limited extent of data.	The lower T values from the {BH9 abs & BH8 obs} test compared to the inverse test {BH8 abs & BH9 obs} may be a reflection of the larger component of bedrock in the saturated depth of the BH9 well screen, compared to BH8. This would suggest the SILTSTONE bedrock is less permeable than the S&G subsoil.	S&G plus SILTSTONE	3.95	8.12	8.75
BH9	BH9	01/02/2018	Analysis of early-time drawdown prior to PWL reaching the pump intake at 4 min. Discharge intermittent thereafter due to low yield of well.	BH9 abstraction PWL in g_SAND to s_GRAVEL throughout test. Saturated depth approx. 2 m of st_g_SAND to st_s_GRAVEL underlain by 2 m of SILTSTONE rock., The borehole was dry on drilling. BH log indicates SAND over the bedrock. Expect hydraulic continuity between the two. Expect inflow to BH9 from both. Test results possibly reflect mixed S&G and SILTSTONE aquifer properties. Very low T for S&G. Possible that drilling fines are resulting in decreased T near the well.	S&G plus SILTSTONE	3.95	3.95	0.03
BH9	BH9	01/02/2018	T corresponds well with values from Jacob analysis of BH9 drawdown prior to 4 min.		S&G plus SILTSTONE	3.95	3.95	0.10
BH10	BH9	31/01/2018	Steady discharge and drawdown during test. T result potentially affected by drilling fines in the aquifer in the vicinity of the well and may underestimate T of undisturbed aquifer.	BH10 abstraction PWL in g_SAND to s_GRAVEL. Saturated screen interval approx 5m g_SAND to s_GRAVEL & 2.5 m SILTSTONE. Top 0.5 m of SILTSTONE weathered. Test results possibly reflect mixed S&G and SILTSTONE aquifer properties. T value for {BH10 abs & BH9 obs} test higher significantly than T value for {BH8 abs & BH9 obs} test, suggesting T aquifer T is increasing moving east towards BH10	S&G plus SILTSTONE	7.26	7.66	7.15
BH10	BH9	31/01/2018	Very limited water level recovery data set. Value may not be reliable due to limited extent of data.		S&G plus SILTSTONE	7.26	7.66	162.80
BH10	BH10	31/01/2018	Steady discharge and drawdown during test. T result potentially affected by drilling fines in the aquifer in the vicinity of the well and may underestimate T of undisturbed aquifer.	Although drilling fines may be an issue at BH10, the T value is moderate and suggests that the issue is not as significant as at BH1, BH3, BH8 and BH9. This may suggest cleaner coarser GRAVEL around BH10 and/or a strong influence of the weathered bedrock on the transmissivity; compared to the other wells.	S&G plus SILTSTONE	7.26	7.26	6.70
BH10	BH10	31/01/2018	Short recovery data set but appears sufficient to establish the recovery trend. Corresponds well with the drawdown T value.		S&G plus SILTSTONE	7.26	7.26	4.25
BH11	BH10	01/02/2018	Very small drawdown at BH10 obs (0.007m) followed by recovery to above RWL during pumping phase and after. Suggests that the discharge from BH11 abs may have been recharging the aquifer and nullifying the drawdown. This would result in a significant overestimate of T . However the rapid recharge suggests highly permeable S&G. The T value is likely to be an overestimate, but the actual value may still be quite high.	BH11 abstraction PWL in st_g_SAND to st_s_GRAVEL. Saturated screen interval approx. 3.5 m st_g_SAND to st_s_GRAVEL and 3.5 m SANDSTONE & SILTSTONE. Test results possibly reflect mixed S&G and SANDSTONE & SILTSTONE aquifer properties. Possible that SANDSTONE bedrock gives increased bedrock transmissivity in this area.	S&G plus SANDSTONE & SILTSTONE [possibly dominated by SANDSTONE]	7.14	7.57	230.54
BH11	BH11	01/02/2018	Steady discharge throughout test. Very little drawdown in pumping well during test. Water level recovery in pumping well towards end of pumping phase. Very clear discharge throughout suggests increasing T from well development during test not an issue. Overall suggests borehole discharge recharging aquifer in vicinity of pumping well leading to reduced drawdown. However the rapid recharge suggests highly permeable S&G. The T value is likely to be an overestimate, but the actual value may still be quite high.		S&G plus SANDSTONE & SILTSTONE [possibly dominated by SANDSTONE]	7.14	7.14	242.79
BH11	BH11	01/02/2018	Short recovery data set but appears sufficient to establish the recovery trend. Corresponds well with the drawdown T value. The T value may be a better estimate of the actual aquifer value due to cessation of pumping & also the artificial recharge. However; earlier recharge will have damped the overall necessary recovery and still result in some overestimation.		S&G plus SANDSTONE & SILTSTONE [possibly dominated by SANDSTONE]	7.14	7.14	80.09

Pumping Well	Observation Well	Test Date	RWL PW	RWL OW	Pump Depth	Max PW DDN	PWL @ Pump	Max OW DDN	PW Screen	PW Water Strike (WS)	PW Subsoil	PW DTB	PW Rock	PW Tot. Depth	OW Screen	OW Water Strike (WS)	OW Subsoil	OW DTB	OW Rock	OW Tot. Depth	Analysis	Representative of undisturbed aquifer?	T	S
(PW)	(OW)		mbgl	mbgl	mbgl	m		m	mbgl	mbgl	mbgl	mbgl	(w = weathered)	mbgl	mbgl	mbgl	mbgl	mbgl	(w = weathered)	mbgl			m2/d	
BH12	BH11	02/02/2018	4.80	4.79	9.00	0.02	4.812, No	0.006	1 m to Tot Depth	5.5 & 9	SILT/CLAY to 4m/ st_g_SAND to st_s_GRAVEL	7.5	SST/SILTST	12	1 m to Tot Depth	6.5	SILT/CLAY to 4m/ st_g_SAND to st_s_GRAVEL	8.5	SST/SILTST	12	Jacob DDN	Unlikely	4046	1.90E-02
BH12	BH12	02/02/2018	4.80	4.80	9.00	0.02	4.812, No	0.017	1 m to Tot Depth	5.5 & 9	SILT/CLAY to 4m/ st_g_SAND to st_s_GRAVEL	7.5	SST/SILTST	12	1 m to Tot Depth	5.5 & 9	SILT/CLAY to 4m/ st_g_SAND to st_s_GRAVEL	7.5	SST/SILTST	12	Jacob DDN	Possibly	241	
BH12	BH12	02/02/2018	4.80	4.80	9.00	0.02	4.812, No	0.017	1 m to Tot Depth	5.5 & 9	SILT/CLAY to 4m/ st_g_SAND to st_s_GRAVEL	7.5	SST/SILTST	12	1 m to Tot Depth	5.5 & 9	SILT/CLAY to 4m/ st_g_SAND to st_s_GRAVEL	7.5	SST/SILTST	12	Theis Recovery	Possibly	616	
BH13	BH10	01/02/2018	1.80	4.43	7.00	0.87	2.67, No	0.003	1 m to Tot Depth	Dry	SILT/CLAY to 2.5m/ st_g_SAND	4.5	SILTST	10	1 m to Tot Depth	Damp at 6m	SILT/CLAY to 6m/ g_SAND to s_GRAVEL	9.5	SILTST_w0.5	12	Jacob DDN	Unlikely	3775	3.60E-03
BH13	BH13	01/02/2018	1.80	1.80	7.00	0.87	2.67, No	0.870	1 m to Tot Depth	Dry	SILT/CLAY to 2.5m/ st_g_SAND	4.5	SILTST	10	1 m to Tot Depth	Dry	SILT/CLAY to 2.5m/ st_g_SAND	4.5	SILTST	10	Jacob DDN	Possibly	30.8	
BH13	BH13	01/02/2018	1.80	1.80	7.00	0.87	2.67, No	0.870	1 m to Tot Depth	Dry	SILT/CLAY to 2.5m/ st_g_SAND	4.5	SILTST	10	1 m to Tot Depth	Dry	SILT/CLAY to 2.5m/ st_g_SAND	4.5	SILTST	10	Theis Recovery	Possibly	86.9	
BH14	BH13	31/01/2018	2.69	1.80	7.00	3.85	6.54, No	0.003	2 m to Tot Depth	3.5	vg_SAND to 2m/ g_CLAY to 3m/ vg_SAND	4.5	SILTST	15	1 m to Tot Depth	Dry	SILT/CLAY to 2.5m/ st_g_SAND	4.5	SILTST	10	Jacob DDN	Possibly	80.8	1.50E-03
BH14	BH14	31/01/2018	2.69	2.69	7.00	3.85	6.54, No	3.850	2 m to Tot Depth	3.5	vg_SAND to 2m/ g_CLAY to 3m/ vg_SAND	4.5	SILTST	15	2 m to Tot Depth	3.5	vg_SAND to 2m/ g_CLAY to 3m/ vg_SAND	4.5	SILTST	15	Jacob - Mid Time DDN	Possibly	1	
BH14	BH14	31/01/2018	2.69	2.69	7.00	3.85	6.54, No	3.850	2 m to Tot Depth	3.5	vg_SAND to 2m/ g_CLAY to 3m/ vg_SAND	4.5	SILTST	15	2 m to Tot Depth	3.5	vg_SAND to 2m/ g_CLAY to 3m/ vg_SAND	4.5	SILTST	15	Jacob - Late Time DDN	Possibly	0.3	
BH14	BH14	31/01/2018	2.69	2.69	7.00	3.85	6.54, No	3.850	2 m to Tot Depth	3.5	vg_SAND to 2m/ g_CLAY to 3m/ vg_SAND	4.5	SILTST	15	2 m to Tot Depth	3.5	vg_SAND to 2m/ g_CLAY to 3m/ vg_SAND	4.5	SILTST	15	Theis Recovery	Possibly	2.4	

Pumping Well	Observation Well	Test Date	Analysis Comments	HCM Comments	Aquifer	Aquifer Thickness PW	Aquifer Thickness OW	Hydraulic Conductivity
(PW)	(OW)					m	m	m/d
BH12	BH11	02/02/2018	Very small drawdown at BH11 obs (0.005m). The water level variation during the pumping phase fluctuates above and below the RWL, which suggests the variation may be just variation due to the logger accuracy of +/ 0.005m; however there appears to be a slight bias towards actual drawdown in the spread of the data. There does not seem to be any water level recovery during the pumping phase at BH11 obs or BH12 abs during the pumping phase, such that recharge of the abstracted water does not seem to be an issue. Due to the small magnitude of drawdown and spread of the data the analysis is not considered very reliable. The very high T value from the analysis is likely to be an over-estimate. Nonetheless, the very small drawdown does suggest that the actual T value will be quite high .	BH12 abstraction PWL in st_g_SAND to st_s_GRAVEL. Saturated screen interval approx 2.7 m st_g_SAND to st_s_GRAVEL and 4.5 m SANDSTONE & SILTSTONE. Test results possibly reflect mixed S&G and SANDSTONE & SILTSTONE aquifer properties. Possible that SANDSTONE bedrock gives increased bedrock transmissivity in this area. This well has the largest screened component of SANDSTONE of the wells onsite, while the S&G screened component is slightly shorter than average. Mulroy Env. indicate that BH12 is the most productive well on site and the T-values support this. Overall this suggests that the increased transmissivity observed at BH11 and BH12 compared to other wells at the site is due to the intersection of SANDSTONE bedrock.	S&G plus SANDSTONE & SILTSTONE [possibly dominated by SANDSTONE]	7.19	7.20	562.26
BH12	BH12	02/02/2018	Small drowdown at BH12 abstraction well (0.015m). The data spread due to logger accuracy creates some uncertainty in the accuracy of the analysis line of best fit; however the trend of increasing drawdown during pumping seems clear. The moderate to high T value is likely to be somewhat affected (i.e. underestimated) by drilling fines; however the potential analysis inaccuracy may counter this, so it is hard to say if the final result is an over or under estimate. At best it is a rough estimate.		S&G plus SANDSTONE & SILTSTONE [possibly dominated by SANDSTONE]	7.19	7.19	33.53
BH12	BH12	02/02/2018	Limited recovery dataset with small range of water level rcovery and moderate spread of data mean the analysis may not be very accurate. The moderate to high T value correlates with the other results from the BH12 pumping test and can be considered a rough estimate.		S&G plus SANDSTONE & SILTSTONE [possibly dominated by SANDSTONE]	7.19	7.19	85.70
BH13	BH10	01/02/2018	Very small drawdown (0.003 m) with trend towards recovery for majority of pumping phase. Suggests discharge from BH13 was recharging the water levels at BH10 during the test. This would lead to overestimate of T from the resulting, reduced drawdown data.		S&G plus SILTSTONE	7.33	7.57	506.64
BH13	BH13	01/02/2018	Drawdown curve shows period of strong water level recovery from 1 to 5 mins during pumping phase plus further slight fluctuation thereafter (particularly at 17 min). BH13 abs PWL remained above pump through out test. The BH13 discharge rate remained steady throughout the test. Test field notes indicate high turbidity clearing up by 6.5 mins. This suggests that significant well development occured during the test between 1 & 6.5 mins into the pumping phase. Increasing T due to well development during the test would allow water levels to recover while maintaining the steady discharge. Analysis of the drawdown trend after 7min suggests a moderate T value for the BH13 area.	BH13 abs PWL at the base of the CLAY subsoil. Saturated screen interval approx 2 m st_g_SAND and 5.5 m SILTSTONE. Test results possibly reflect mixed S&G and SILTSTONE aquifer properties.	S&G plus SILTSTONE	7.33	7.33	4.20
BH13	BH13	01/02/2018	Moderate T value higher than value from the pumping phase of the test, possibly reflects absence of pumping head loss on water level response during recovery phase, compared to the pumping phase. The well development during the pumping phase suggests that the T result is potentially affected by drilling fines in the aquifer in the vicinity of the well and may underestimate T of undisturbed aquifer.		S&G plus SILTSTONE	7.33	7.33	11.86
BH14	BH13	31/01/2018	Very small (possibly none) drawdown response at BH13 obs to pumping at BH14 abs, after time lag of approx. 25 min. Trend (if any) is very slight and analysis is not very reliable.		S&G plus SILTSTONE	8.46	8.20	9.70
BH14	BH14	31/01/2018	BH14 abs PWL starts in vg_SAND, then drops into SILTSTONE bedrock at 4.5 mbgl at approx. 10 mins. At 22 min, with water level at 5.4 mbgl (ddn = 2.75 m), the drawdown trend steepens. The final drawdown of 3.85m is approx. 0.5 m above the pump intake. The discharge at BH14 was steady throughout the test until 28.5 min when the rate droped slightly, possibly due to the PWL approaching the pump intake. No turbidity noted in discharge water. The data suggest that the steepening in the drawdown trend at 22 min is due to the SILTSTONE becoming the dominant pathway for transmitting water to the well. Analysis of the mid-time data before 22 min reflects combined SAND and SILTSTONE transmissivity. Drilling fines in the aquifer in the vicinity of the well and may underestimate T of undisturbed aquifer.	BH14 abs PWL starts in vg_SAND, then drops into SILTSTONE bedrock at 4.5 mbgl at approx. 10 mins. Overall the data suggest the early and mid-time drawdown response reflect the combined transmissivity of the SAND and SILTSTONE aquifers. The late-time drawdown response is considered to be dominated by the SILTSTONE transmissivity.	S&G plus SILTSTONE	8.46	8.46	0.12
BH14	BH14	31/01/2018	Analysis of the late-time data after 22 min reflects SILTSTONE transmissivity. Drilling fines in the aquifer in the vicinity of the well and may underestimate T of undisturbed aquifer.		SILTSTONE	8.46	8.46	0.04
BH14	BH14	31/01/2018	T value slightly higher than the values derived from the drawdown data, potentially due to the absence of pumping losses from the recovery phase data. Drilling fines in the aquifer in the vicinity of the well and may underestimate T of undisturbed aquifer.	The water level quickly recovers to above 5.4 mbgl (<2.75 m of residual drawdown), such that the recovery analysis is considered to represent the combined SAND and SILTSTONE aquifers.	S&G plus SILTSTONE	8.46	8.46	0.28

	Time (min)	BH1 Abstraction, Drawdown in BH1 (m)	Symbol
1	0.25	0.216	×
2	0.5	0.43	×
3	0.75	0.634	×
4	1	0.786	×
5	1.5	1.123	×
6	2	1.429	×
7	2.5	1.698	×
8	3	1.99	×
9	3.5	2.328	×
10	4	2.579	×
11	4.5	2.687	×
12	5	2.722	×
13	6	2.716	×
14	7	2.719	×
15	8	2.721	×
16	9	2.739	×
17	10	2.73	×
18	11	2.736	×
19	12	2.738	×
20	13	2.725	×
21	14	2.749	×
22	15	2.753	×
23	20	2.74	×
24	25	2.747	×
25	30	2.736	×
26	32.333	2.225	×
27	32.667	2.165	×
28	33	1.815	×
29	33.5	1.73	×
30	34	1.652	×
31	34.667	1.855	×
32	35	1.528	×
33	35.5	1.463	×
34	36	1.408	×
35	37	1.296	×
36	38	1.188	×
37	39	1.108	×
38	40	1.037	×
39	41	0.967	×
40	42	0.917	×
41	43	0.862	×
42	44	0.82	×
43	45	0.778	×
44	50	0.634	×
45	55	0.527	×
46	60	0.45	×
47	70	0.356	×
48	80	0.29	×
49	90	0.238	×
50	100	0.206	×

	Time (min)	BH1 Abstraction, Drawdown in BH1 (m)	Symbol
51	110	0.176	×
52	114	0.169	×

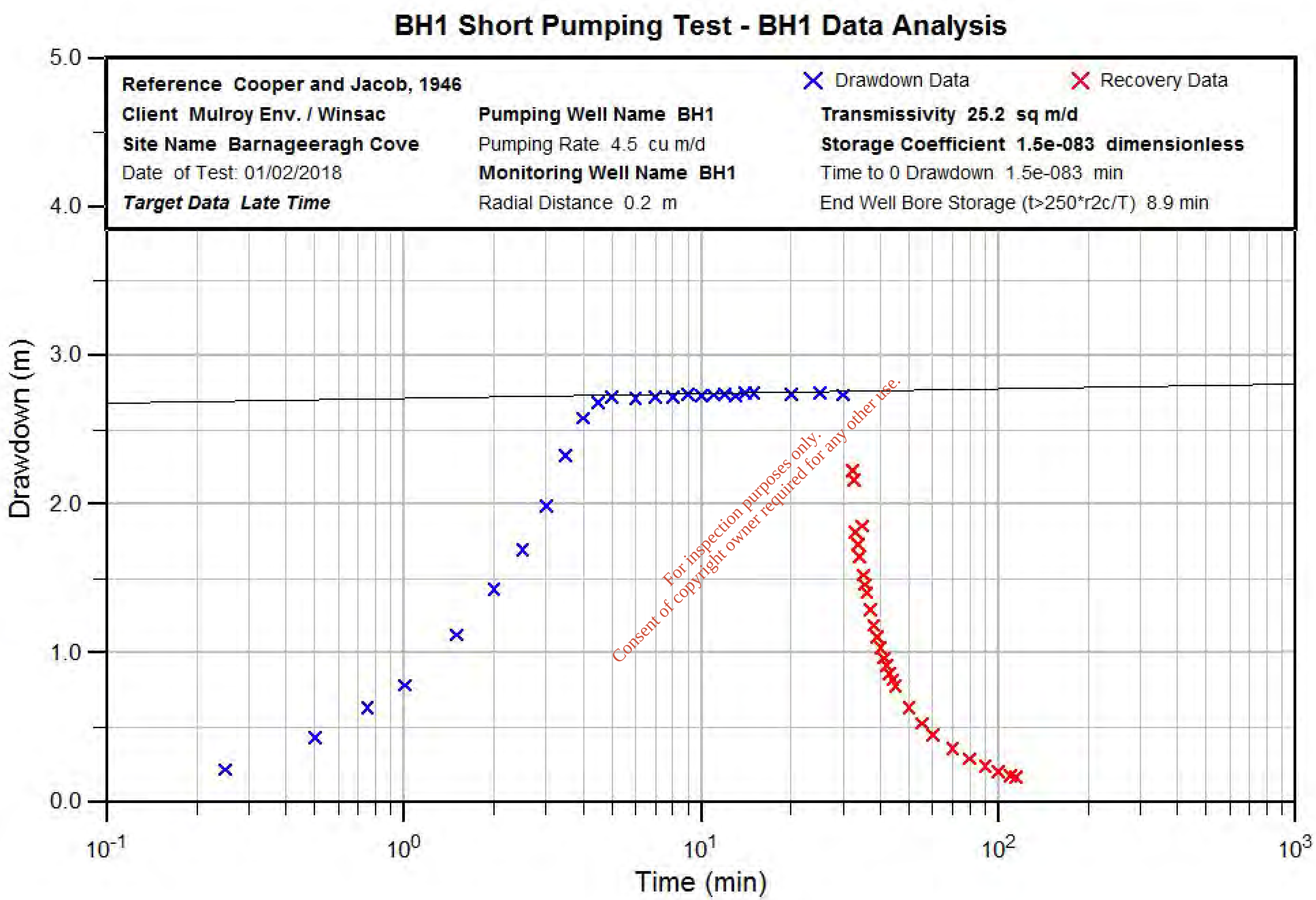


1114 Barnageeragh Cove

Winsac/Mulroy Environmental

Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



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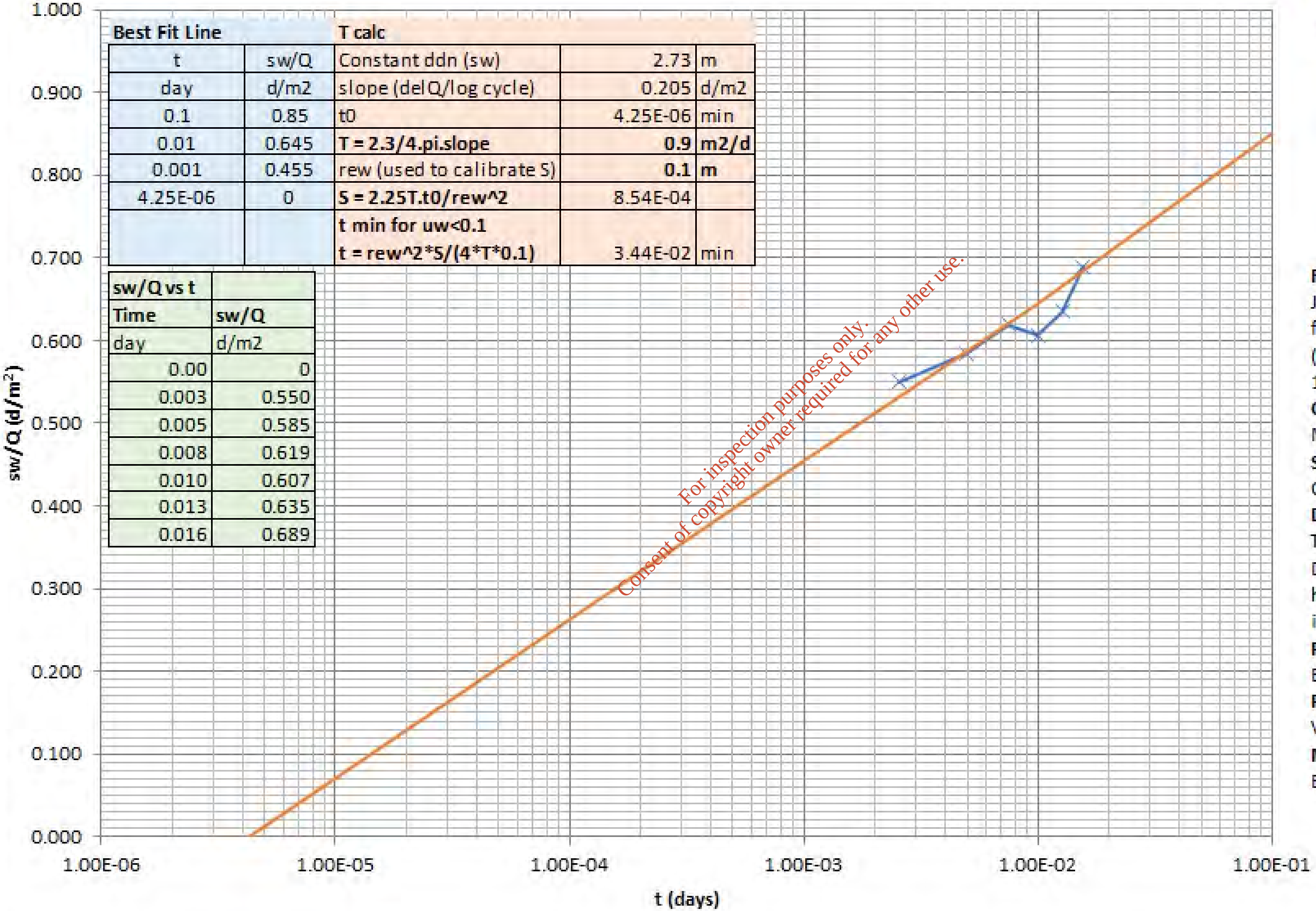
BH1 - Jacob-Lohman Analysis (sw/Q vs t) (sw constant) on BH1 Data



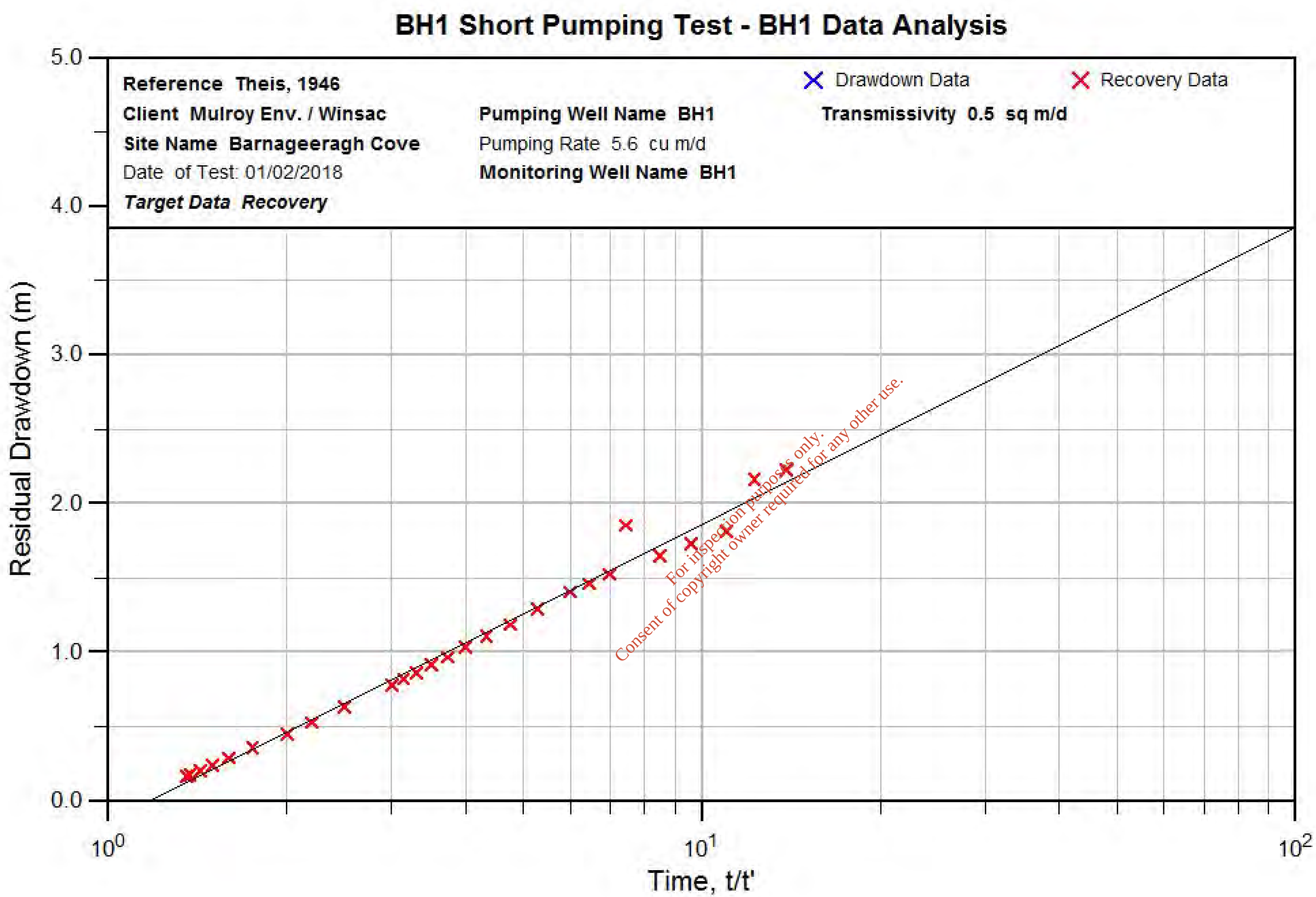
Best Fit Line	
t	sw/Q
day	d/m2
0.1	0.85
0.01	0.645
0.001	0.455
4.25E-06	0

T calc		
Constant ddn (sw)	2.73	m
slope (delQ/log cycle)	0.205	d/m2
t0	4.25E-06	min
T = 2.3/4.pi.slope	**0.9**	**m2/d**
rew (used to calibrate S)	**0.1**	**m**
S = 2.25T.t0/rew^2	8.54E-04	
t min for uw<0.1 t = rew^2*S/(4*T*0.1)	3.44E-02	min

sw/Q vs t	
Time	sw/Q
day	d/m2
0.00	0
0.003	0.550
0.005	0.585
0.008	0.619
0.010	0.607
0.013	0.635
0.016	0.689

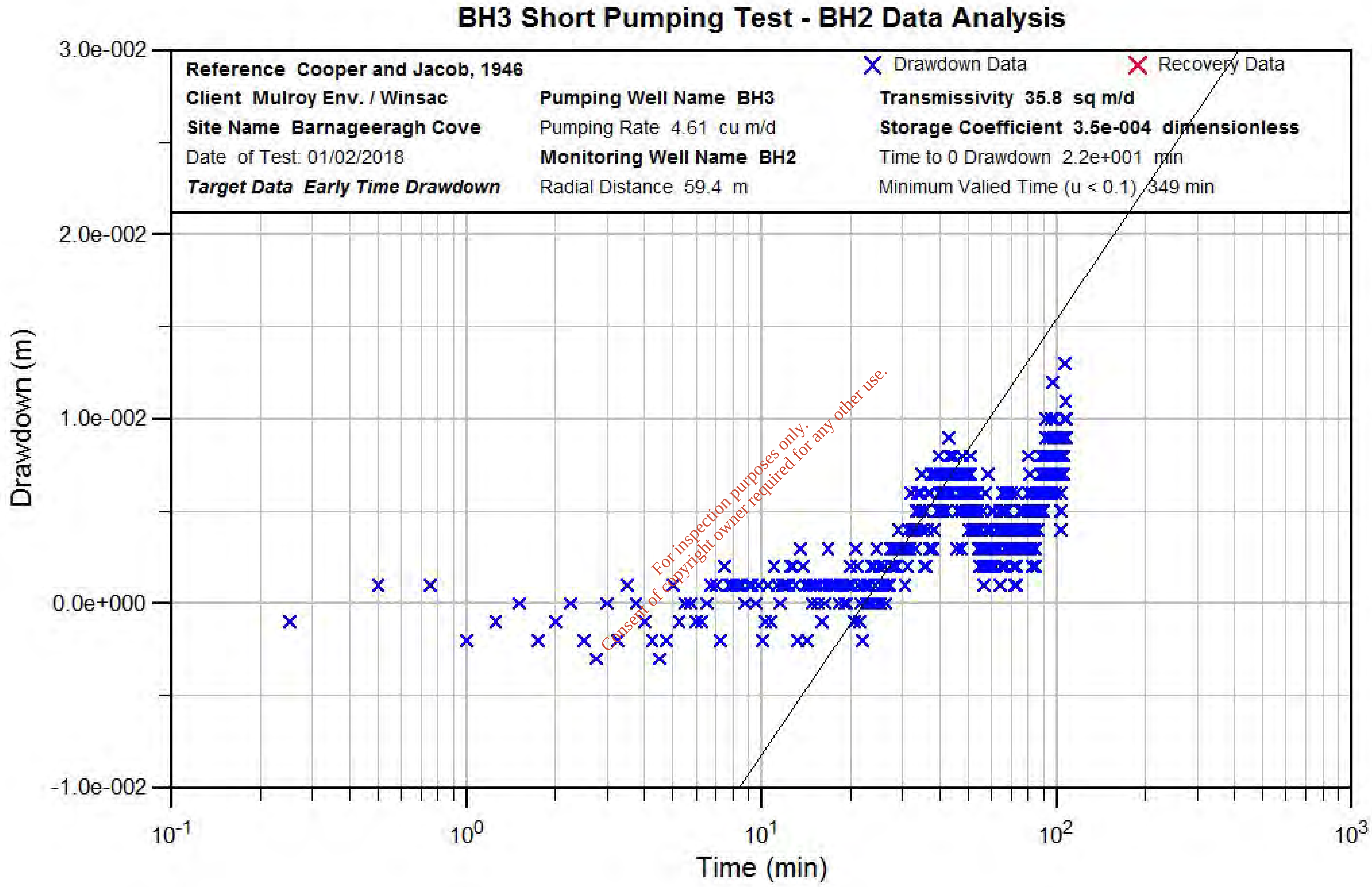
HUCT
SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

Reference: Jacob-Lohman, free-flowing confined (Kruseman & de Ridder, 1990)
Client: Mulroy Env. / Winsac
Site Name: Barnageeragh Cove
Date of Test: 01/02/2018
Target Data: Declining Discharge after head constant at pump intake
Pumping Well Name: BH3
Pumping Rate: Variable
Monitoring Well Name: BH3

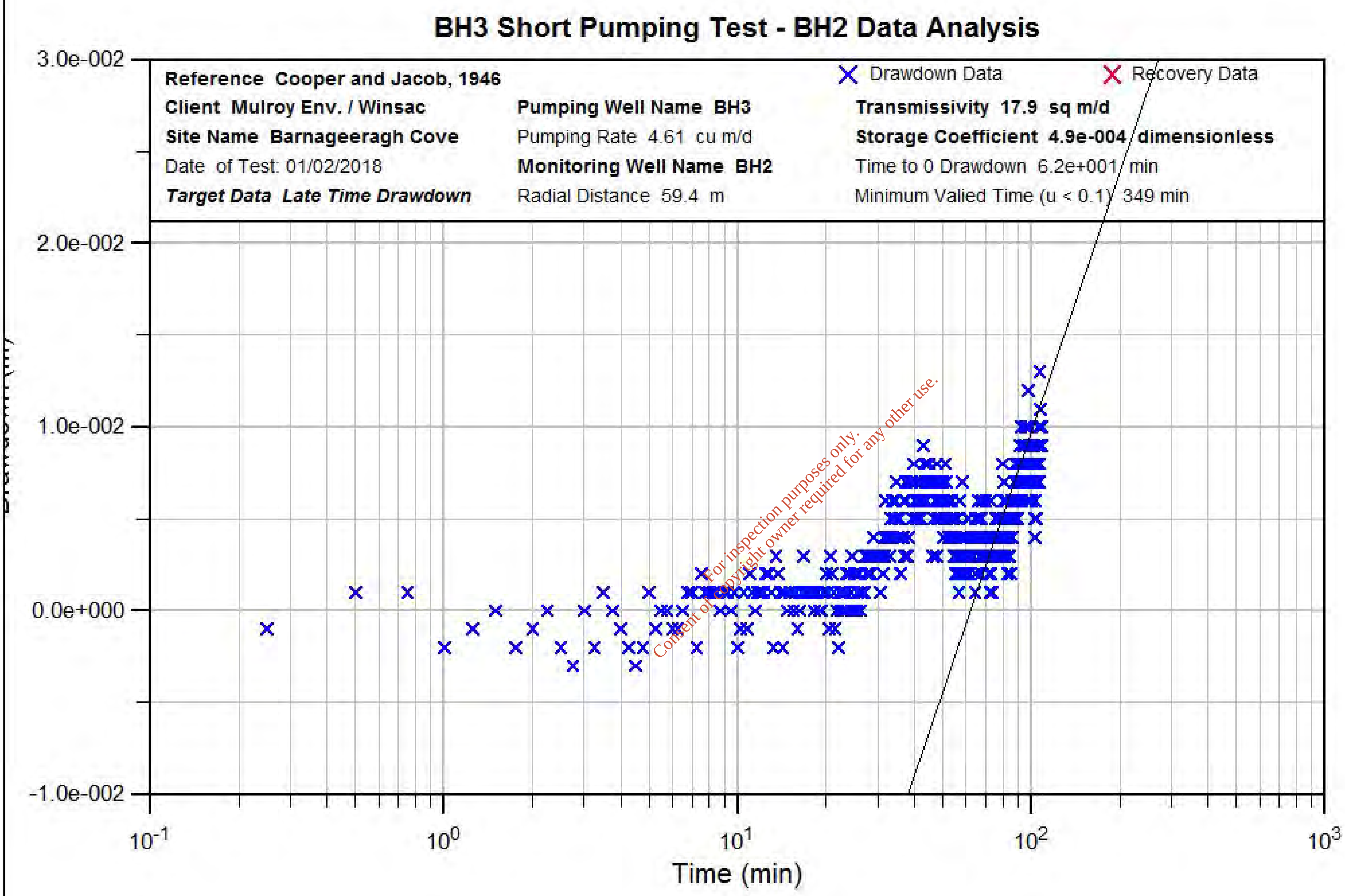


1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

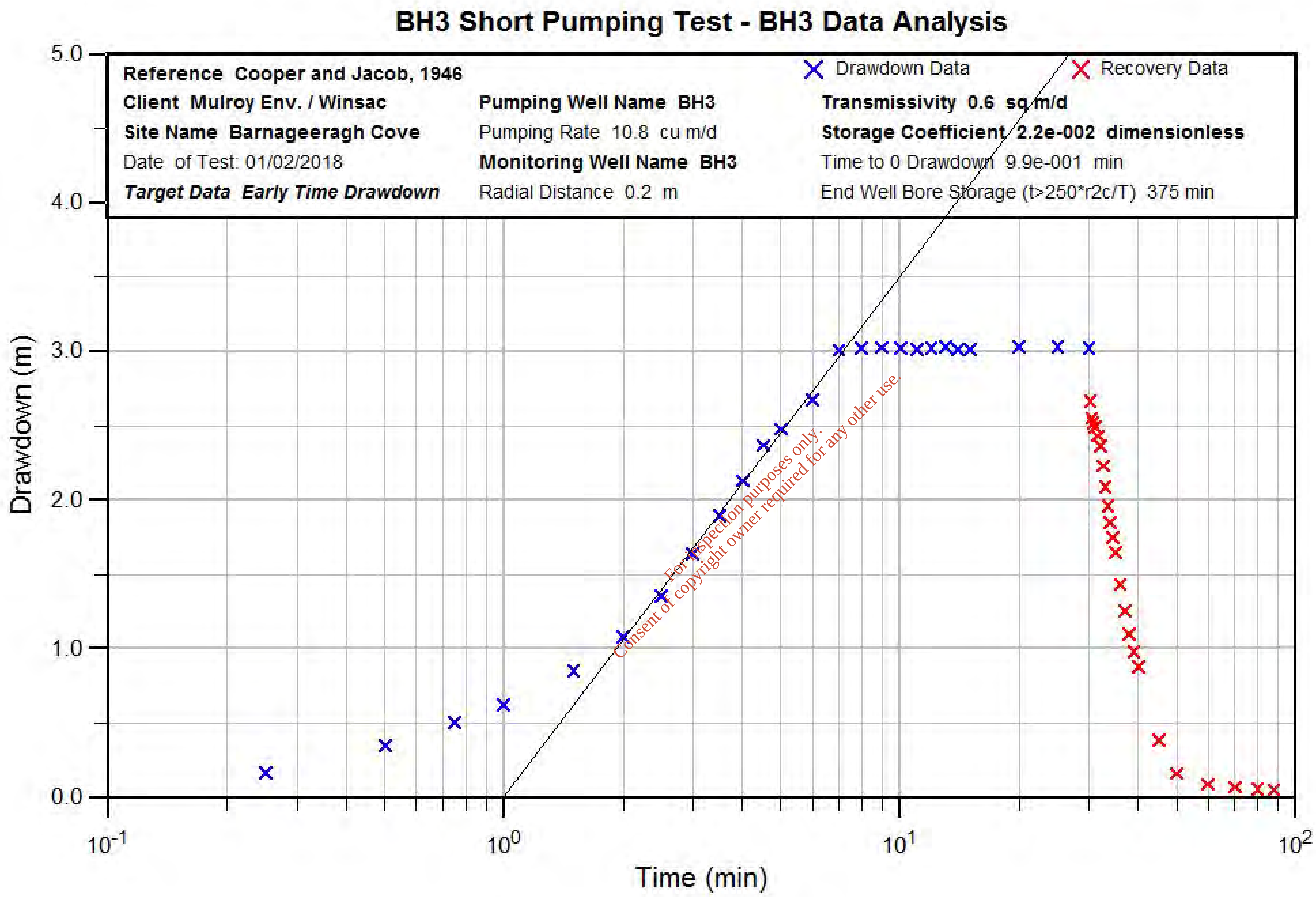


1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

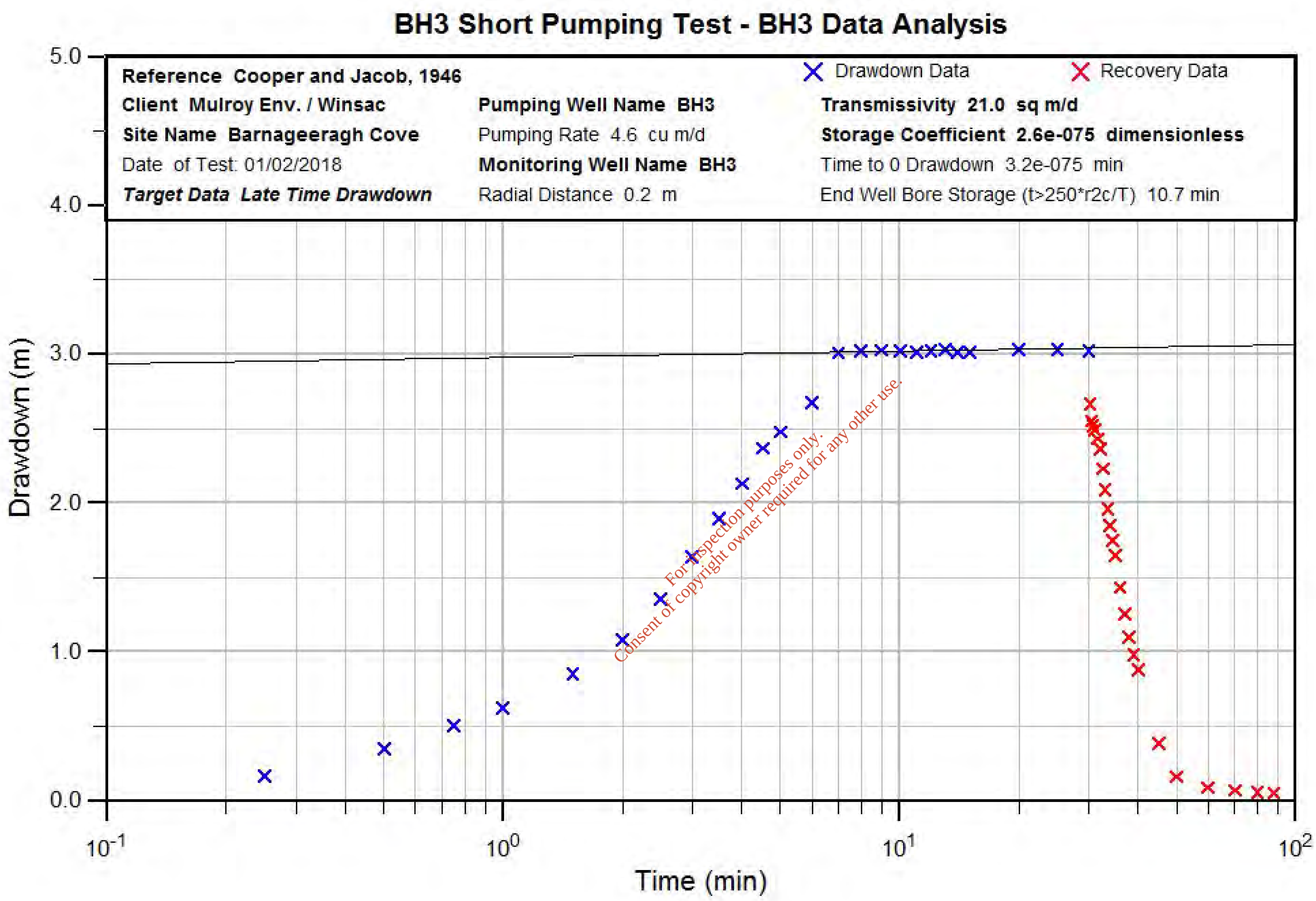
	Time (min)	BH3 Abstraction, Drawdown in BH3 (m)	Symbol
1	0.25	0.169	×
2	0.5	0.353	×
3	0.75	0.505	×
4	1	0.628	×
5	1.5	0.856	×
6	2	1.079	×
7	2.5	1.359	×
8	3	1.64	×
9	3.5	1.896	×
10	4	2.13	×
11	4.5	2.369	×
12	5	2.479	×
13	6	2.674	×
14	7	3.009	×
15	8	3.025	×
16	9	3.027	×
17	10	3.026	×
18	11	3.018	×
19	12	3.021	×
20	13	3.03	×
21	14	3.018	×
22	15	3.018	×
23	20	3.03	×
24	25	3.03	×
25	30	3.021	×
26	30.25	2.664	×
27	30.5	2.553	×
28	30.75	2.52	×
29	31	2.495	×
30	31.5	2.433	×
31	32	2.368	×
32	32.5	2.233	×
33	33	2.091	×
34	33.5	1.964	×
35	34	1.852	×

	Time (min)	BH3 Abstraction, Drawdown in BH3 (m)	Symbol
36	34.5	1.754	✕
37	35	1.65	✕
38	36	1.435	✕
39	37	1.256	✕
40	38	1.1	✕
41	39	0.98	✕
42	40	0.879	✕
43	45	0.387	✕
44	50	0.16	✕
45	60	0.088	✕
46	70	0.069	✕
47	80	0.058	✕
48	88	0.05	✕



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

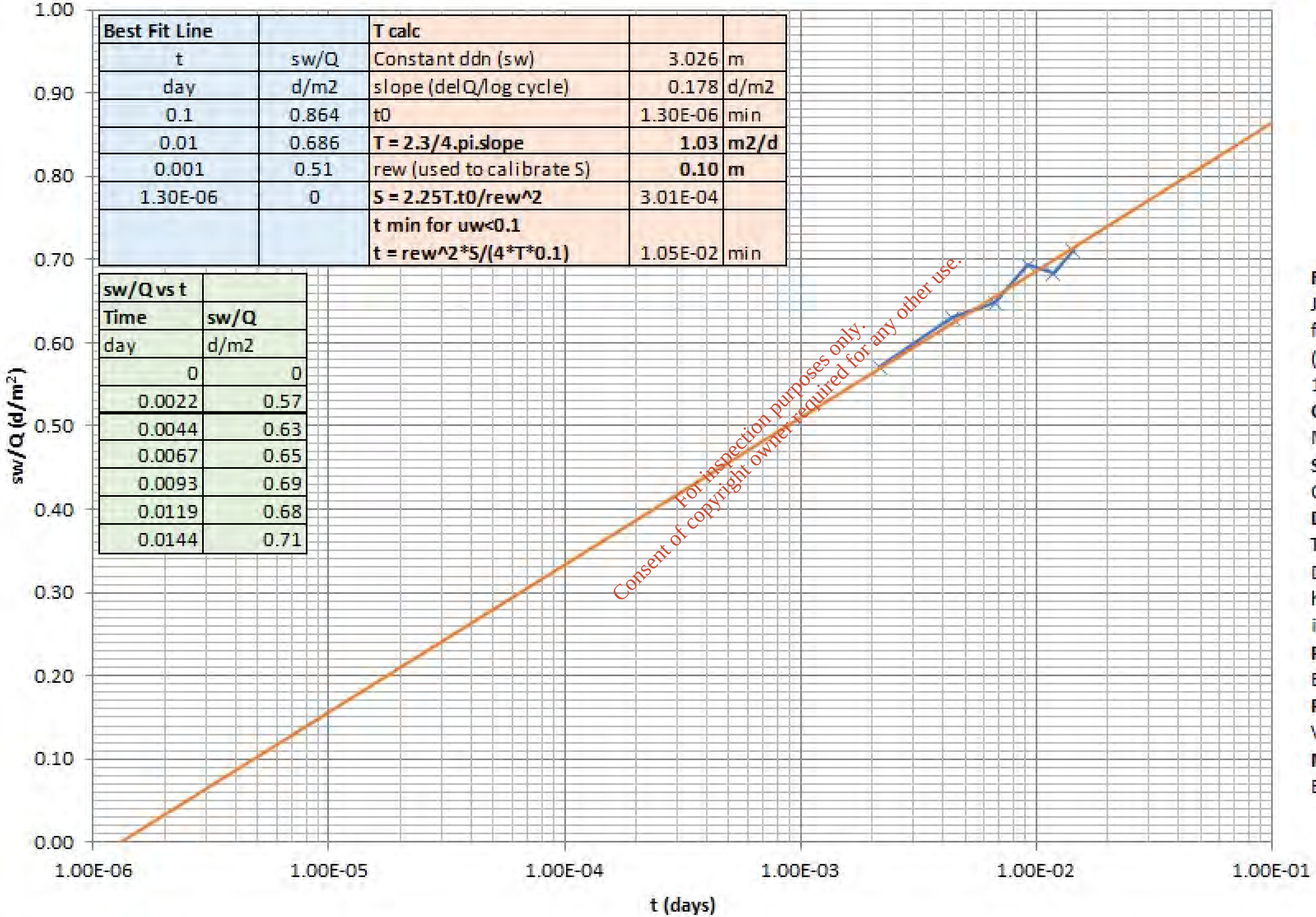
HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

BH3 - Jacob-Lohman Analysis (sw/Q vs t) (sw constant) on BH3 Data

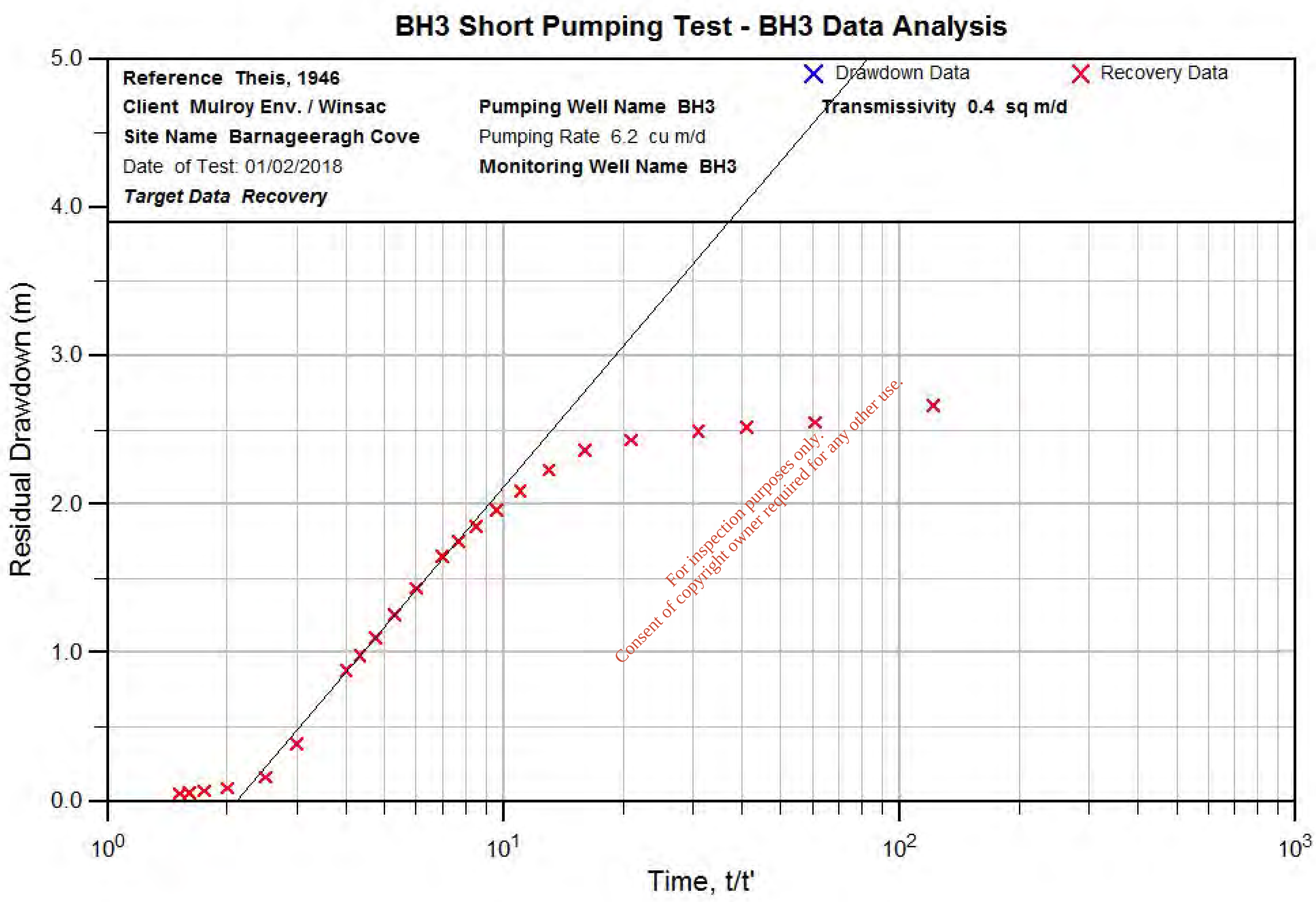
HUCT
SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



Best Fit Line		T calc		
t	sw/Q	Constant ddn (sw)	3.026	m
day	d/m2	slope (delQ/log cycle)	0.178	d/m2
0.1	0.864	t0	1.30E-06	min
0.01	0.686	**T = 2.3/4.pi.slope**	**1.03**	**m2/d**
0.001	0.51	rew (used to calibrate S)	**0.10**	**m**
1.30E-06	0	**S = 2.25T.t0/rew^2**	3.01E-04	
		t min for uw<0.1 **t = rew^2*S/(4*T*0.1)**	1.05E-02	min

sw/Q vs t	
Time	sw/Q
day	d/m2
0	0
0.0022	0.57
0.0044	0.63
0.0067	0.65
0.0093	0.69
0.0119	0.68
0.0144	0.71

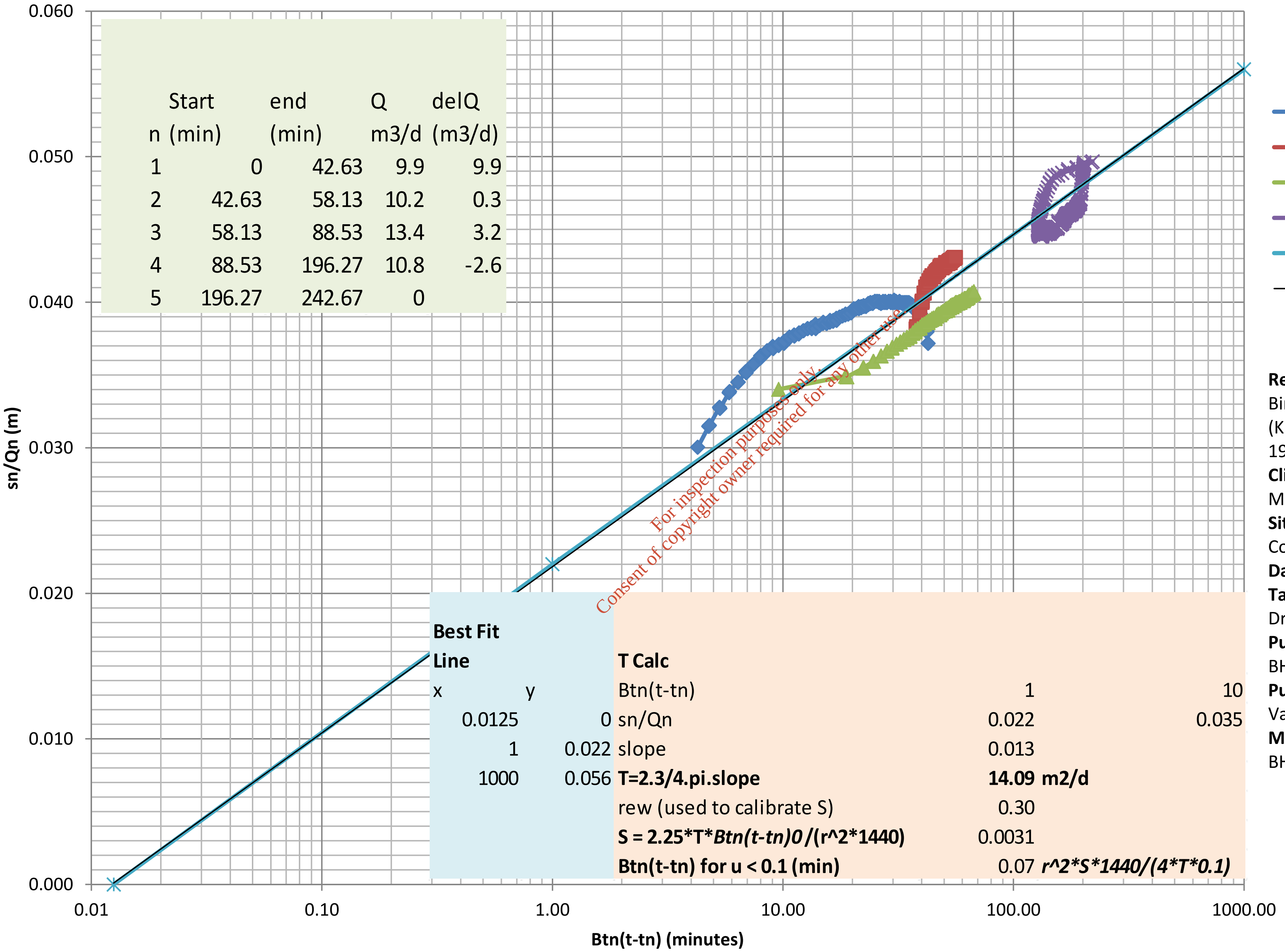
Reference: Jacob-Lohman, free-flowing confined (Kruseman & de Ridder, 1990)
Client: Mulroy Env. / Winsac
Site Name: Barnageeragh Cove
Date of Test: 31/01/2018
Target Data: Declining Discharge after head constant at pump intake
Pumping Well Name: BH3
Pumping Rate: Variable
Monitoring Well Name: BH3



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

BH4 - Birsoy Summers Analysis (sn/Qn vs Btn(t-tn)) on BH4 Data



n	Start (min)	end (min)	Q m3/d	delQ (m3/d)
1	0	42.63	9.9	9.9
2	42.63	58.13	10.2	0.3
3	58.13	88.53	13.4	3.2
4	88.53	196.27	10.8	-2.6
5	196.27	242.67	0	

Best Fit Line

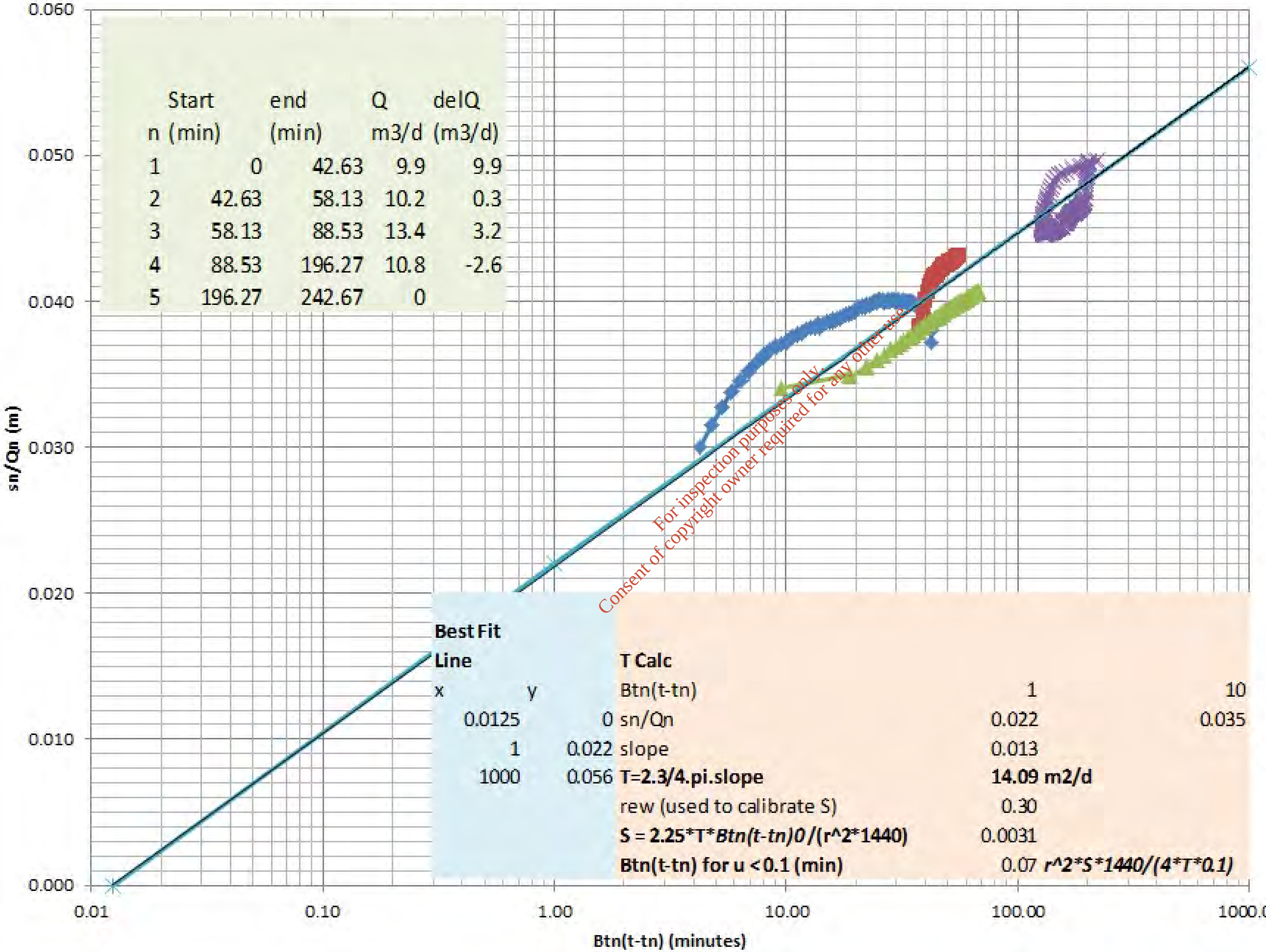
x	y
0.0125	0
1	0.022
1000	0.056

T Calc

Btn(t-tn)	1	10
sn/Qn	0.022	0.035
slope	0.013	
T=2.3/4.pi.slope	**14.09**	**m2/d**
rew (used to calibrate S)	0.30	
S = 2.25*TBtn(t-tn)0*/(r^2*1440)**	0.0031	
Btn(t-tn) for u < 0.1 (min)	0.07	***r^2*S*1440/(4*T*0.1)***

Reference:
Birsoy-Summers Method (Kruseman & de Ridder, 1990)
Client:
Mulroy Env. / Winsac
Site Name: Barnageeragh Cove
Date of Test: 30/01/2017
Target Data:
Drawdown
Pumping Well Name:
BH4
Pumping Rate:
Variable
Monitoring Well Name:
BH4

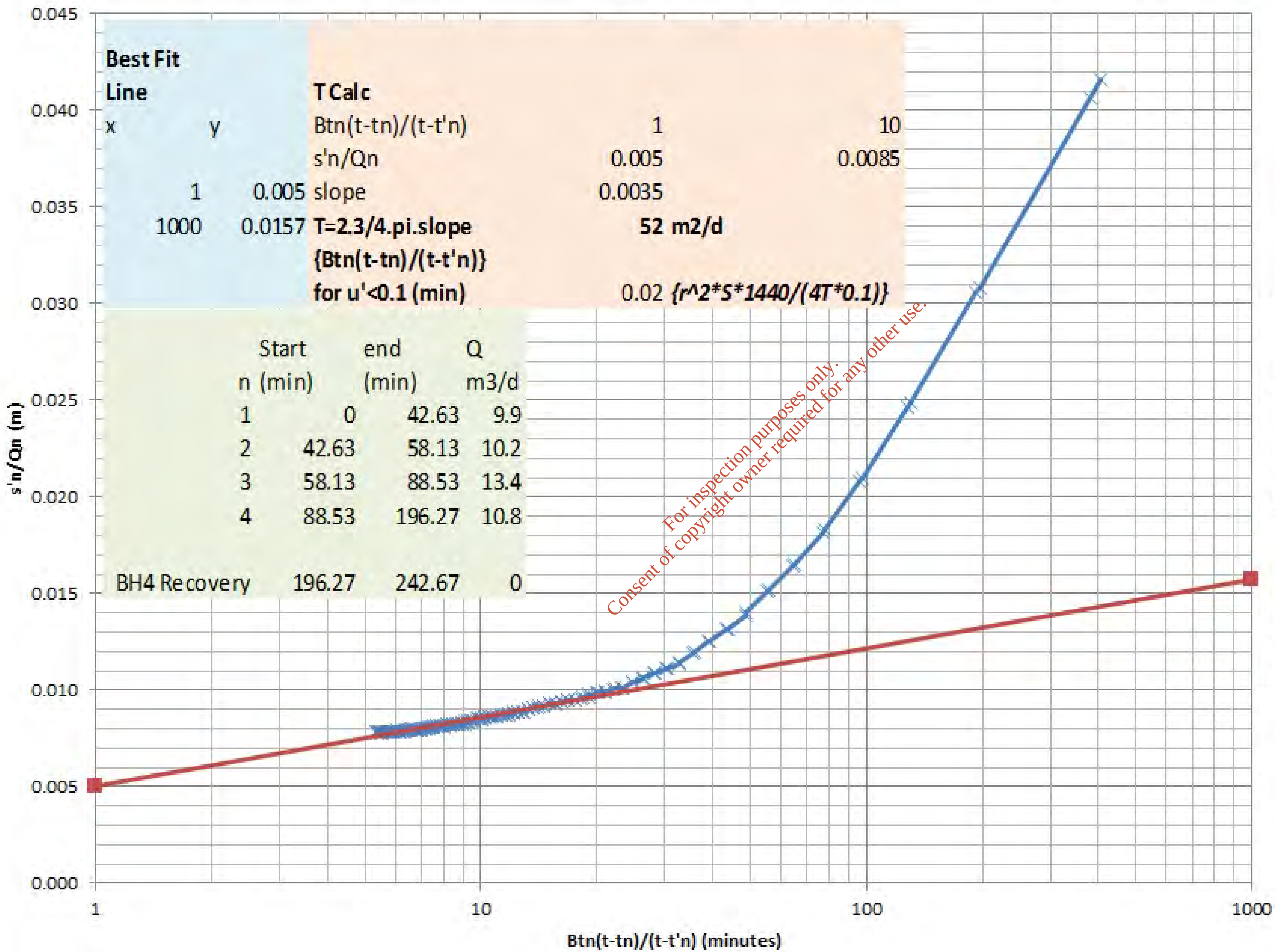
BH4 - Birsoy Summers Analysis (sn/Qn vs Btn(t-tn)) on BH4 Data



SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

Reference: Birsoy-Summers Method (Kruseman & de Ridder, 1990)
Client: Mulroy Env. / Winsac
Site Name: Barnageeragh Cove
Date of Test: 30/01/2018
Target Data: Drawdown
Pumping Well Name: BH4
Pumping Rate: Variable
Monitoring Well Name: BH4

BH4 - Birsoy Summers Analysis (s'n/Qn vs Btn(t-tn)/(t-t'n)) on BH4 Recovery Data

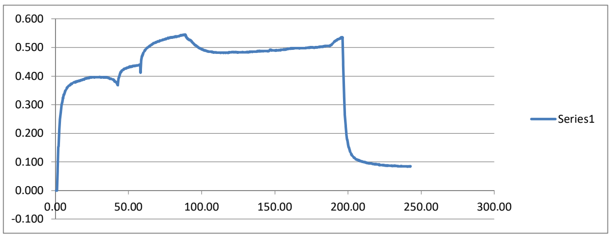


Reference: Birsoy-Summers Method (Kruseman & de Ridder, 1990)
Client: Mulroy Env. / Winsac
Site Name: Barnageeragh Cove
Date of Test: 30/01/2018
Target Data: Recovery
Pumping Well Name: BH4
Pumping Rate: Variable
Monitoring Well Name: BH4

n	Start (min)	end (min)	Q m3/d	delQ (m3/d)
1	0	42.63	9.9	9.9
2	42.63	58.13	10.2	0.3
3	58.13	88.53	13.4	3.2
4	88.53	196.27	10.8	-2.6
5	196.27	242.67	0	

Best Fit Line x	y
0.0125	0
1	0.022
1000	0.056

T Calc		
Btn(t-tn)	1	10
sn/Qn	0.022	0.035
slope	0.013	
T=2.3/4.pi.slope	**14.09 m2/d**	
S = 2.25*T**Btn(t-tn)0* /r^2	0.004 (rew = 10m)	



RWL (mb Top of Red Cover)	Rec #	Date/Time	Sensor Pressure (m H2O)		Time (min)	BH4 DDN (m)	n	Qn m3/d	sn/Qn d/m2	Btn(t-tn) days
4.7	4471	12:59:00	14.7423							
	4500	12:59:58	14.7423							
	4501	13:00:00	14.7416	0	0.00					
	4516	13:00:30	14.7416	30	0.50	0.000	1	9.9	0.00	0.50
	4517	13:00:32	14.7423	0	0.53	-0.001	1	9.9	0.00	0.53
	4532	13:01:02	14.7416	30	1.03	0.000	1	9.9	0.00	1.03
	4533	13:01:04	14.7416	0	1.07	0.000	1	9.9	0.00	1.07
	4548	13:01:34	14.6737	30	1.57	0.068	1	9.9	0.01	1.57
	4549	13:01:36	14.6659	0	1.60	0.076	1	9.9	0.01	1.60
	4564	13:02:06	14.5895	30	2.10	0.152	1	9.9	0.02	2.10
	4565	13:02:08	14.5866	0	2.13	0.155	1	9.9	0.02	2.13
	4580	13:02:38	14.5344	30	2.63	0.207	1	9.9	0.02	2.63
	4581	13:02:40	14.5316	0	2.67	0.210	1	9.9	0.02	2.67
	4596	13:03:10	14.4958	30	3.17	0.246	1	9.9	0.02	3.17
	4597	13:03:12	14.4937	0	3.20	0.248	1	9.9	0.03	3.20
	4612	13:03:42	14.4672	30	3.70	0.274	1	9.9	0.03	3.70
	4613	13:03:44	14.4657	0	3.73	0.276	1	9.9	0.03	3.73
	4628	13:04:14	14.4457	30	4.23	0.296	1	9.9	0.03	4.23
	4629	13:04:16	14.4443	0	4.27	0.297	1	9.9	0.03	4.27
	4644	13:04:46	14.43	30	4.77	0.312	1	9.9	0.03	4.77
	4645	13:04:48	14.4293	0	4.80	0.312	1	9.9	0.03	4.80
	4660	13:05:18	14.4171	30	5.30	0.325	1	9.9	0.03	5.30
	4661	13:05:20	14.4178	0	5.33	0.324	1	9.9	0.03	5.33
	4676	13:05:50	14.4071	30	5.83	0.335	1	9.9	0.03	5.83
	4677	13:05:52	14.4064	0	5.87	0.335	1	9.9	0.03	5.87
	4692	13:06:22	14.4	30	6.37	0.342	1	9.9	0.03	6.37
	4693	13:06:24	14.4	0	6.40	0.342	1	9.9	0.03	6.40
	4708	13:06:54	14.3928	30	6.90	0.349	1	9.9	0.04	6.90
	4709	13:06:56	14.3936	0	6.93	0.348	1	9.9	0.04	6.93
	4724	13:07:26	14.3878	30	7.43	0.354	1	9.9	0.04	7.43
	4725	13:07:28	14.3878	0	7.47	0.354	1	9.9	0.04	7.47
	4740	13:07:58	14.3836	30	7.97	0.358	1	9.9	0.04	7.97
	4741	13:08:00	14.3821	0	8.00	0.360	1	9.9	0.04	8.00
	4756	13:08:30	14.3793	30	8.50	0.362	1	9.9	0.04	8.50
	4757	13:08:32	14.3786	0	8.53	0.363	1	9.9	0.04	8.53
	4772	13:09:02	14.3757	30	9.03	0.366	1	9.9	0.04	9.03
	4773	13:09:04	14.3771	0	9.07	0.365	1	9.9	0.04	9.07
	4788	13:09:34	14.375	30	9.57	0.367	1	9.9	0.04	9.57
	4789	13:09:36	14.3743	0	9.60	0.367	1	9.9	0.04	9.60
	4804	13:10:06	14.3736	30	10.10	0.368	1	9.9	0.04	10.10
	4805	13:10:08	14.3722	0	10.13	0.369	1	9.9	0.04	10.13
	4820	13:10:38	14.37	30	10.63	0.372	1	9.9	0.04	10.63
	4821	13:10:40	14.3693	0	10.67	0.372	1	9.9	0.04	10.67
	4836	13:11:10	14.3679	30	11.17	0.374	1	9.9	0.04	11.17
	4837	13:11:12	14.3686	0	11.20	0.373	1	9.9	0.04	11.20
	4852	13:11:42	14.3672	30	11.70	0.374	1	9.9	0.04	11.70
	4853	13:11:44	14.3665	0	11.73	0.375	1	9.9	0.04	11.73
	4868	13:12:14	14.365	30	12.23	0.377	1	9.9	0.04	12.23
	4869	13:12:16	14.365	0	12.27	0.377	1	9.9	0.04	12.27
	4884	13:12:46	14.3636	30	12.77	0.378	1	9.9	0.04	12.77
	4885	13:12:48	14.3636	0	12.80	0.378	1	9.9	0.04	12.80
	4900	13:13:18	14.3629	30	13.30	0.379	1	9.9	0.04	13.30
	4901	13:13:20	14.3636	0	13.33	0.378	1	9.9	0.04	13.33
	4916	13:13:50	14.3607	30	13.83	0.381	1	9.9	0.04	13.83
	4917	13:13:52	14.3636	0	13.87	0.378	1	9.9	0.04	13.87
	4932	13:14:22	14.3615	30	14.37	0.380	1	9.9	0.04	14.37
	4933	13:14:24	14.3615	0	14.40	0.380	1	9.9	0.04	14.40
	4948	13:14:54	14.36	30	14.90	0.382	1	9.9	0.04	14.90
	4949	13:14:56	14.3593	0	14.93	0.382	1	9.9	0.04	14.93
	4964	13:15:26	14.36	30	15.43	0.382	1	9.9	0.04	15.43
	4965	13:15:28	14.36	0	15.47	0.382	1	9.9	0.04	15.47
	4980	13:15:58	14.3593	30	15.97	0.382	1	9.9	0.04	15.97
	4981	13:16:00	14.3579	0	16.00	0.384	1	9.9	0.04	16.00
	4996	13:16:30	14.3586	30	16.50	0.383	1	9.9	0.04	16.50
	4997	13:16:32	14.3579	0	16.53	0.384	1	9.9	0.04	16.53
	5012	13:17:02	14.3565	30	17.03	0.385	1	9.9	0.04	17.03
	5013	13:17:04	14.3579	0	17.07	0.384	1	9.9	0.04	17.07
	5028	13:17:34	14.3558	30	17.57	0.386	1	9.9	0.04	17.57
	5029	13:17:36	14.3558	0	17.60	0.386	1	9.9	0.04	17.60
	5044	13:18:06	14.355	30	18.10	0.387	1	9.9	0.04	18.10
	5045	13:18:08	14.355	0	18.13	0.387	1	9.9	0.04	18.13
	5060	13:18:38	14.3543	30	18.63	0.387	1	9.9	0.04	18.63
	5061	13:18:40	14.3536	0	18.67	0.388	1	9.9	0.04	18.67
	5076	13:19:10	14.3536	30	19.17	0.388	1	9.9	0.04	19.17
	5077	13:19:12	14.3536	0	19.20	0.388	1	9.9	0.04	19.20
	5092	13:19:42	14.3522	30	19.70	0.389	1	9.9	0.04	19.70
	5093	13:19:44	14.3529	0	19.73	0.389	1	9.9	0.04	19.73
	5108	13:20:14	14.3508	30	20.23	0.391	1	9.9	0.04	20.23
	5109	13:20:16	14.35	0	20.27	0.392	1	9.9	0.04	20.27
	5124	13:20:46	14.35	30	20.77	0.392	1	9.9	0.04	20.77
	5125	13:20:48	14.35	0	20.80	0.392	1	9.9	0.04	20.80
	5140	13:21:18	14.3486	30	21.30	0.393	1	9.9	0.04	21.30
	5141	13:21:20	14.35	0	21.33	0.392	1	9.9	0.04	21.33
	5156	13:21:50	14.3493	30	21.83	0.392	1	9.9	0.04	21.83
	5157	13:21:52	14.3486	0	21.87	0.393	1	9.9	0.04	21.87
	5172	13:22:22	14.3479	30	22.37	0.394	1	9.9	0.04	22.37
	5173	13:22:24	14.3486	0	22.40	0.393	1	9.9	0.04	22.40
	5188	13:22:54	14.3486	30	22.90	0.393	1	9.9	0.04	22.90
	5189	13:22:56	14.3479	0	22.93	0.394	1	9.9	0.04	22.93
	5204	13:23:26	14.3472	30	23.43	0.394	1	9.9	0.04	23.43
	5205	13:23:28	14.3465	0	23.47	0.395	1	9.9	0.04	23.47
	5220	13:23:58	14.3458	30	23.97	0.396	1	9.9	0.04	23.97
	5221	13:24:00	14.3465	0	24.00	0.395	1	9.9	0.04	24.00
	5236	13:24:30	14.3458	30	24.50	0.396	1	9.9	0.04	24.50
	5237	13:24:32	14.3465	0	24.53	0.395	1	9.9	0.04	24.53
	5252	13:25:02	14.3451	30	25.03	0.397	1	9.9	0.04	25.03
	5253	13:25:04	14.3451	0	25.07	0.397	1	9.9	0.04	25.07
	5268	13:25:34	14.3451	30	25.57	0.397	1	9.9	0.04	25.57
	5269	13:25:36	14.3451	0	25.60	0.397	1	9.9	0.04	25.60
	5284	13:26:06	14.3458	30	26.10	0.396	1	9.9	0.04	26.10
	5285	13:26:08	14.3451	0	26.13	0.397	1	9.9	0.04	26.13
	5300	13:26:38	14.3465	30	26.63	0.395	1	9.9	0.04	26.63
	5301	13:26:40	14.3458	0	26.67	0.396	1	9.9	0.04	26.67
	5316	13:27:10	14.3451	30	27.17	0.397	1	9.9	0.04	27.17

5317	13:27:12	14.3458	0	27.20	0.396	1	9.9	0.04	27.20
5332	13:27:42	14.3458	30	27.70	0.396	1	9.9	0.04	27.70
5333	13:27:44	14.3451	0	27.73	0.397	1	9.9	0.04	27.73
5348	13:28:14	14.3458	30	28.23	0.396	1	9.9	0.04	28.23
5349	13:28:16	14.3458	0	28.27	0.396	1	9.9	0.04	28.27
5364	13:28:46	14.3451	30	28.77	0.397	1	9.9	0.04	28.77
5365	13:28:48	14.3451	0	28.80	0.397	1	9.9	0.04	28.80
5380	13:29:18	14.3451	30	29.30	0.397	1	9.9	0.04	29.30
5381	13:29:20	14.3458	0	29.33	0.396	1	9.9	0.04	29.33
5396	13:29:50	14.3458	30	29.83	0.396	1	9.9	0.04	29.83
5397	13:29:52	14.3458	0	29.87	0.396	1	9.9	0.04	29.87
5412	13:30:22	14.3443	30	30.37	0.397	1	9.9	0.04	30.37
5413	13:30:24	14.3458	0	30.40	0.396	1	9.9	0.04	30.40
5428	13:30:54	14.3451	30	30.90	0.397	1	9.9	0.04	30.90
5429	13:30:56	14.3458	0	30.93	0.396	1	9.9	0.04	30.93
5444	13:31:26	14.3465	30	31.43	0.395	1	9.9	0.04	31.43
5445	13:31:28	14.3458	0	31.47	0.396	1	9.9	0.04	31.47
5460	13:31:58	14.3458	30	31.97	0.396	1	9.9	0.04	31.97
5461	13:32:00	14.3451	0	32.00	0.397	1	9.9	0.04	32.00
5476	13:32:30	14.3458	30	32.50	0.396	1	9.9	0.04	32.50
5477	13:32:32	14.3458	0	32.53	0.396	1	9.9	0.04	32.53
5492	13:33:02	14.3465	30	33.03	0.395	1	9.9	0.04	33.03
5493	13:33:04	14.3458	0	33.07	0.396	1	9.9	0.04	33.07
5508	13:33:34	14.3465	30	33.57	0.395	1	9.9	0.04	33.57
5509	13:33:36	14.3458	0	33.60	0.396	1	9.9	0.04	33.60
5524	13:34:06	14.3458	30	34.10	0.396	1	9.9	0.04	34.10
5525	13:34:08	14.3465	0	34.13	0.395	1	9.9	0.04	34.13
5540	13:34:38	14.3458	30	34.63	0.396	1	9.9	0.04	34.63
5541	13:34:40	14.3465	0	34.67	0.395	1	9.9	0.04	34.67
5556	13:35:10	14.3458	30	35.17	0.396	1	9.9	0.04	35.17
5557	13:35:12	14.3465	0	35.20	0.395	1	9.9	0.04	35.20
5572	13:35:42	14.3465	30	35.70	0.395	1	9.9	0.04	35.70
5573	13:35:44	14.3472	0	35.73	0.394	1	9.9	0.04	35.73
5588	13:36:14	14.3472	30	36.23	0.394	1	9.9	0.04	36.23
5589	13:36:16	14.3479	0	36.27	0.394	1	9.9	0.04	36.27
5604	13:36:46	14.3486	30	36.77	0.393	1	9.9	0.04	36.77
5605	13:36:48	14.3486	0	36.80	0.393	1	9.9	0.04	36.80
5620	13:37:18	14.3508	30	37.30	0.391	1	9.9	0.04	37.30
5621	13:37:20	14.3501	0	37.33	0.392	1	9.9	0.04	37.33
5636	13:37:50	14.3508	30	37.83	0.391	1	9.9	0.04	37.83
5637	13:37:52	14.3508	0	37.87	0.391	1	9.9	0.04	37.87
5652	13:38:22	14.3515	30	38.37	0.390	1	9.9	0.04	38.37
5653	13:38:24	14.3515	0	38.40	0.390	1	9.9	0.04	38.40
5668	13:38:54	14.3529	30	38.90	0.389	1	9.9	0.04	38.90
5669	13:38:56	14.3529	0	38.93	0.389	1	9.9	0.04	38.93
5684	13:39:26	14.3536	30	39.43	0.388	1	9.9	0.04	39.43
5685	13:39:28	14.3536	0	39.47	0.388	1	9.9	0.04	39.47
5700	13:39:58	14.3543	30	39.97	0.387	1	9.9	0.04	39.97
5701	13:40:00	14.3551	0	40.00	0.387	1	9.9	0.04	40.00
5716	13:40:30	14.3601	30	40.50	0.382	1	9.9	0.04	40.50
5717	13:40:32	14.3601	0	40.53	0.382	1	9.9	0.04	40.53
5732	13:41:02	14.3615	30	41.03	0.380	1	9.9	0.04	41.03
5733	13:41:04	14.3608	0	41.07	0.381	1	9.9	0.04	41.07
5748	13:41:34	14.3636	30	41.57	0.378	1	9.9	0.04	41.57
5749	13:41:36	14.3629	0	41.60	0.379	1	9.9	0.04	41.60
5764	13:42:06	14.365	30	42.10	0.377	1	9.9	0.04	42.10
5765	13:42:08	14.3658	0	42.13	0.376	1	9.9	0.04	42.13
5780	13:42:38	14.3736	30	42.63	0.368	1	9.9	0.04	42.63
5781	13:42:40	14.3722	0	42.67	0.369	2	10.2	0.04	
5796	13:43:10	14.3522	30	43.17	0.389	2	10.2	0.04	37.86 =((B16-B$4)^(O$2/N$3))*((B16-B$15)^(N$3/O$3))
5797	13:43:12	14.3508	0	43.20	0.391	2	10.2	0.04	37.96
5812	13:43:42	14.3415	30	43.70	0.400	2	10.2	0.04	39.14
5813	13:43:44	14.3408	0	43.73	0.401	2	10.2	0.04	39.21
5828	13:44:14	14.3336	30	44.23	0.408	2	10.2	0.04	40.09
5829	13:44:16	14.3329	0	44.27	0.409	2	10.2	0.04	40.15
5844	13:44:46	14.3272	30	44.77	0.414	2	10.2	0.04	40.91
5845	13:44:48	14.3272	0	44.80	0.414	2	10.2	0.04	40.96
5860	13:45:18	14.3229	30	45.30	0.419	2	10.2	0.04	41.66
5861	13:45:20	14.3229	0	45.33	0.419	2	10.2	0.04	41.71
5876	13:45:50	14.3208	30	45.83	0.421	2	10.2	0.04	42.37
5877	13:45:52	14.3215	0	45.87	0.420	2	10.2	0.04	42.41
5892	13:46:22	14.3186	30	46.37	0.423	2	10.2	0.04	43.04
5893	13:46:24	14.3194	0	46.40	0.422	2	10.2	0.04	43.09
5908	13:46:54	14.3172	30	46.90	0.424	2	10.2	0.04	43.70
5909	13:46:56	14.3165	0	46.93	0.425	2	10.2	0.04	43.74
5924	13:47:26	14.3151	30	47.43	0.427	2	10.2	0.04	44.33
5925	13:47:28	14.3151	0	47.47	0.427	2	10.2	0.04	44.37
5940	13:47:58	14.3158	30	47.97	0.426	2	10.2	0.04	44.96
5941	13:48:00	14.3151	0	48.00	0.427	2	10.2	0.04	45.00
5956	13:48:30	14.3137	30	48.50	0.428	2	10.2	0.04	45.57
5957	13:48:32	14.3137	0	48.53	0.428	2	10.2	0.04	45.61
5972	13:49:02	14.3122	30	49.03	0.429	2	10.2	0.04	46.18
5973	13:49:04	14.3122	0	49.07	0.429	2	10.2	0.04	46.21
5988	13:49:34	14.3115	30	49.57	0.430	2	10.2	0.04	46.77
5989	13:49:36	14.3115	0	49.60	0.430	2	10.2	0.04	46.81
6004	13:50:06	14.3108	30	50.10	0.431	2	10.2	0.04	47.37
6005	13:50:08	14.3108	0	50.13	0.431	2	10.2	0.04	47.40
6020	13:50:38	14.3094	30	50.63	0.432	2	10.2	0.04	47.95
6021	13:50:40	14.3087	0	50.67	0.433	2	10.2	0.04	47.99
6036	13:51:10	14.3087	30	51.17	0.433	2	10.2	0.04	48.54
6037	13:51:12	14.3079	0	51.20	0.434	2	10.2	0.04	48.57
6052	13:51:42	14.3094	30	51.70	0.432	2	10.2	0.04	49.11
6053	13:51:44	14.3087	0	51.73	0.433	2	10.2	0.04	49.15
6068	13:52:14	14.3079	30	52.23	0.434	2	10.2	0.04	49.69
6069	13:52:16	14.3087	0	52.27	0.433	2	10.2	0.04	49.73
6084	13:52:46	14.3079	30	52.77	0.434	2	10.2	0.04	50.26
6085	13:52:48	14.3079	0	52.80	0.434	2	10.2	0.04	50.30
6100	13:53:18	14.3058	30	53.30	0.436	2	10.2	0.04	50.83
6101	13:53:20	14.3065	0	53.33	0.435	2	10.2	0.04	50.87
6116	13:53:50	14.3065	30	53.83	0.435	2	10.2	0.04	51.40
6117	13:53:52	14.3065	0	53.87	0.435	2	10.2	0.04	51.43
6132	13:54:22	14.3065	30	54.37	0.435	2	10.2	0.04	51.96
6133	13:54:24	14.3058	0	54.40	0.436	2	10.2	0.04	52.00
6148	13:54:54	14.3051	30	54.90	0.437	2	10.2	0.04	52.53
6149	13:54:56	14.3058	0	54.93	0.436	2	10.2	0.04	52.56
6164	13:55:26	14.3058	30	55.43	0.436	2	10.2	0.04	53.09
6165	13:55:28	14.3044	0	55.47	0.437	2	10.2	0.04	53.13
6180	13:55:58	14.3044	30	55.97	0.437	2	10.2	0.04	53.65
6181	13:56:00	14.3044	0	56.00	0.437	2	10.2	0.04	53.69

6196	13:56:30	14.3037	30	56.50	0.438	2	10.2	0.04	54.21	
6197	13:56:32	14.3037	0	56.53	0.438	2	10.2	0.04	54.24	
6212	13:57:02	14.3029	30	57.03	0.439	2	10.2	0.04	54.77	
6213	13:57:04	14.3029	0	57.07	0.439	2	10.2	0.04	54.80	
6228	13:57:34	14.3022	30	57.57	0.439	2	10.2	0.04	55.32	
6229	13:57:36	14.3029	0	57.60	0.439	2	10.2	0.04	55.36	
6244	13:58:06	14.3022	30	58.10	0.439	2	10.2	0.04	55.88	
6245	13:58:08	14.3301	0	58.13	0.412	2	10.2	0.04	55.91	
6260	13:58:38	14.2872	30	58.63	0.454	3	13.4			
6261	13:58:40	14.2858	0	58.67	0.456	3	13.4	0.03	9.57	=((B16-B$4)^(O$2/N$3))*((B16-B$15)^(N$3/O$3))
6276	13:59:10	14.2737	30	59.17	0.468	3	13.4	0.03	18.68	
6277	13:59:12	14.2744	0	59.20	0.467	3	13.4	0.03	18.96	
6292	13:59:42	14.2665	30	59.70	0.475	3	13.4	0.04	22.20	
6293	13:59:44	14.2658	0	59.73	0.476	3	13.4	0.04	22.37	
6308	14:00:14	14.2601	30	60.23	0.482	3	13.4	0.04	24.64	
6309	14:00:16	14.2601	0	60.27	0.482	3	13.4	0.04	24.77	
6324	14:00:46	14.2551	30	60.77	0.486	3	13.4	0.04	26.58	
6325	14:00:48	14.2551	0	60.80	0.486	3	13.4	0.04	26.69	
6340	14:01:18	14.2508	30	61.30	0.491	3	13.4	0.04	28.23	
6341	14:01:20	14.2508	0	61.33	0.491	3	13.4	0.04	28.33	
6356	14:01:50	14.248	30	61.83	0.494	3	13.4	0.04	29.70	
6357	14:01:52	14.2473	0	61.87	0.494	3	13.4	0.04	29.78	
6372	14:02:22	14.2444	30	62.37	0.497	3	13.4	0.04	31.03	
6373	14:02:24	14.2444	0	62.40	0.497	3	13.4	0.04	31.11	
6388	14:02:54	14.2423	30	62.90	0.499	3	13.4	0.04	32.25	
6389	14:02:56	14.2423	0	62.93	0.499	3	13.4	0.04	32.33	
6404	14:03:26	14.2401	30	63.43	0.502	3	13.4	0.04	33.40	
6405	14:03:28	14.2401	0	63.47	0.502	3	13.4	0.04	33.47	
6420	14:03:58	14.2387	30	63.97	0.503	3	13.4	0.04	34.48	
6421	14:04:00	14.238	0	64.00	0.504	3	13.4	0.04	34.55	
6436	14:04:30	14.2373	30	64.50	0.504	3	13.4	0.04	35.51	
6437	14:04:32	14.2366	0	64.53	0.505	3	13.4	0.04	35.58	
6452	14:05:02	14.2344	30	65.03	0.507	3	13.4	0.04	36.50	
6453	14:05:04	14.2337	0	65.07	0.508	3	13.4	0.04	36.56	
6468	14:05:34	14.2316	30	65.57	0.510	3	13.4	0.04	37.45	
6469	14:05:36	14.233	0	65.60	0.509	3	13.4	0.04	37.51	
6484	14:06:06	14.2301	30	66.10	0.512	3	13.4	0.04	38.37	
6485	14:06:08	14.2301	0	66.13	0.512	3	13.4	0.04	38.42	
6500	14:06:38	14.2294	30	66.63	0.512	3	13.4	0.04	39.26	
6501	14:06:40	14.2287	0	66.67	0.513	3	13.4	0.04	39.31	
6516	14:07:10	14.2266	30	67.17	0.515	3	13.4	0.04	40.12	
6517	14:07:12	14.2266	0	67.20	0.515	3	13.4	0.04	40.17	
6532	14:07:42	14.2258	30	67.70	0.516	3	13.4	0.04	40.96	
6533	14:07:44	14.2258	0	67.73	0.516	3	13.4	0.04	41.02	
6548	14:08:14	14.2244	30	68.23	0.517	3	13.4	0.04	41.79	
6549	14:08:16	14.2244	0	68.27	0.517	3	13.4	0.04	41.84	
6564	14:08:46	14.223	30	68.77	0.519	3	13.4	0.04	42.60	
6565	14:08:48	14.2244	0	68.80	0.517	3	13.4	0.04	42.65	
6580	14:09:18	14.2223	30	69.30	0.519	3	13.4	0.04	43.39	
6581	14:09:20	14.2223	0	69.33	0.519	3	13.4	0.04	43.44	
6596	14:09:50	14.2216	30	69.83	0.520	3	13.4	0.04	44.16	
6597	14:09:52	14.2208	0	69.87	0.521	3	13.4	0.04	44.21	
6612	14:10:22	14.2208	30	70.37	0.521	3	13.4	0.04	44.93	
6613	14:10:24	14.2201	0	70.40	0.522	3	13.4	0.04	44.98	
6628	14:10:54	14.2208	30	70.90	0.521	3	13.4	0.04	45.68	
6629	14:10:56	14.2201	0	70.93	0.522	3	13.4	0.04	45.73	
6644	14:11:26	14.2187	30	71.43	0.523	3	13.4	0.04	46.42	
6645	14:11:28	14.2173	0	71.47	0.524	3	13.4	0.04	46.47	
6660	14:11:58	14.2166	30	71.97	0.525	3	13.4	0.04	47.16	
6661	14:12:00	14.2166	0	72.00	0.525	3	13.4	0.04	47.20	
6676	14:12:30	14.2166	30	72.50	0.525	3	13.4	0.04	47.88	
6677	14:12:32	14.2173	0	72.53	0.524	3	13.4	0.04	47.92	
6692	14:13:02	14.2151	30	73.03	0.527	3	13.4	0.04	48.60	
6693	14:13:04	14.2158	0	73.07	0.526	3	13.4	0.04	48.64	
6708	14:13:34	14.2144	30	73.57	0.527	3	13.4	0.04	49.30	
6709	14:13:36	14.2144	0	73.60	0.527	3	13.4	0.04	49.35	
6724	14:14:06	14.2137	30	74.10	0.528	3	13.4	0.04	50.00	
6725	14:14:08	14.2137	0	74.13	0.528	3	13.4	0.04	50.05	
6740	14:14:38	14.2137	30	74.63	0.528	3	13.4	0.04	50.70	
6741	14:14:40	14.2123	0	74.67	0.529	3	13.4	0.04	50.74	
6756	14:15:10	14.213	30	75.17	0.529	3	13.4	0.04	51.38	
6757	14:15:12	14.2116	0	75.20	0.530	3	13.4	0.04	51.43	
6772	14:15:42	14.213	30	75.70	0.529	3	13.4	0.04	52.06	
6773	14:15:44	14.2109	0	75.73	0.531	3	13.4	0.04	52.11	
6788	14:16:14	14.2109	30	76.23	0.531	3	13.4	0.04	52.74	
6789	14:16:16	14.2101	0	76.27	0.531	3	13.4	0.04	52.78	
6804	14:16:46	14.2087	30	76.77	0.533	3	13.4	0.04	53.41	
6805	14:16:48	14.2094	0	76.80	0.532	3	13.4	0.04	53.45	
6820	14:17:18	14.208	30	77.30	0.534	3	13.4	0.04	54.08	
6821	14:17:20	14.2101	0	77.33	0.531	3	13.4	0.04	54.12	
6836	14:17:50	14.208	30	77.83	0.534	3	13.4	0.04	54.74	
6837	14:17:52	14.208	0	77.87	0.534	3	13.4	0.04	54.78	
6852	14:18:22	14.2087	30	78.37	0.533	3	13.4	0.04	55.39	
6853	14:18:24	14.2073	0	78.40	0.534	3	13.4	0.04	55.43	
6868	14:18:54	14.2059	30	78.90	0.536	3	13.4	0.04	56.05	
6869	14:18:56	14.2073	0	78.93	0.534	3	13.4	0.04	56.09	
6884	14:19:26	14.2066	30	79.43	0.535	3	13.4	0.04	56.69	
6885	14:19:28	14.2059	0	79.47	0.536	3	13.4	0.04	56.74	
6900	14:19:58	14.2066	30	79.97	0.535	3	13.4	0.04	57.34	
6901	14:20:00	14.2059	0	80.00	0.536	3	13.4	0.04	57.38	
6916	14:20:30	14.2059	30	80.50	0.536	3	13.4	0.04	57.98	
6917	14:20:32	14.2051	0	80.53	0.537	3	13.4	0.04	58.02	
6932	14:21:02	14.2051	30	81.03	0.537	3	13.4	0.04	58.62	
6933	14:21:04	14.2059	0	81.07	0.536	3	13.4	0.04	58.66	
6948	14:21:34	14.2044	30	81.57	0.537	3	13.4	0.04	59.25	
6949	14:21:36	14.2044	0	81.60	0.537	3	13.4	0.04	59.29	
6964	14:22:06	14.203	30	82.10	0.539	3	13.4	0.04	59.89	
6965	14:22:08	14.2037	0	82.13	0.538	3	13.4	0.04	59.93	
6980	14:22:38	14.2037	30	82.63	0.538	3	13.4	0.04	60.52	
6981	14:22:40	14.2044	0	82.67	0.537	3	13.4	0.04	60.55	
6996	14:23:10	14.2023	30	83.17	0.539	3	13.4	0.04	61.14	
6997	14:23:12	14.203	0	83.20	0.539	3	13.4	0.04	61.18	
7012	14:23:42	14.2023	30	83.70	0.539	3	13.4	0.04	61.77	
7013	14:23:44	14.2023	0	83.73	0.539	3	13.4	0.04	61.80	
7028	14:24:14	14.2023	30	84.23	0.539	3	13.4	0.04	62.39	
7029	14:24:16	14.2023	0	84.27	0.539	3	13.4	0.04	62.43	
7044	14:24:46	14.2016	30	84.77	0.540	3	13.4	0.04	63.01	
7045	14:24:48	14.2016	0	84.80	0.540	3	13.4	0.04	63.04	
7060	14:25:18	14.1994	30	85.30	0.542	3	13.4	0.04	63.62	

7061	14:25:20	14.2009	0	85.33	0.541	3	13.4	0.04	63.66
7076	14:25:50	14.1994	30	85.83	0.542	3	13.4	0.04	64.24
7077	14:25:52	14.1987	0	85.87	0.543	3	13.4	0.04	64.28
7092	14:26:22	14.1994	30	86.37	0.542	3	13.4	0.04	64.85
7093	14:26:24	14.1994	0	86.40	0.542	3	13.4	0.04	64.89
7108	14:26:54	14.1987	30	86.90	0.543	3	13.4	0.04	65.46
7109	14:26:56	14.1987	0	86.93	0.543	3	13.4	0.04	65.50
7124	14:27:26	14.198	30	87.43	0.544	3	13.4	0.04	66.07
7125	14:27:28	14.1973	0	87.47	0.544	3	13.4	0.04	66.11
7140	14:27:58	14.198	30	87.97	0.544	3	13.4	0.04	66.68
7141	14:28:00	14.198	0	88.00	0.544	3	13.4	0.04	66.71
7156	14:28:30	14.1966	30	88.50	0.545	3	13.4	0.04	67.28
7157	14:28:32	14.1959	0	88.53	0.546	3	13.4	0.04	67.32
7172	14:29:02	14.1987	30	89.03	0.543	4	10.8	0.05	67.88
7173	14:29:04	14.2009	0	89.07	0.541	4	10.8	0.05	425.25
7188	14:29:34	14.2051	30	89.57	0.537	4	10.8	0.05	220.40
7189	14:29:36	14.2059	0	89.60	0.536	4	10.8	0.05	217.36
7204	14:30:06	14.2094	30	90.10	0.532	4	10.8	0.05	188.56
7205	14:30:08	14.2101	0	90.13	0.531	4	10.8	0.05	187.29
7220	14:30:38	14.2109	30	90.63	0.531	4	10.8	0.05	172.86
7221	14:30:40	14.2123	0	90.67	0.529	4	10.8	0.05	172.12
7236	14:31:10	14.2137	30	91.17	0.528	4	10.8	0.05	163.01
7237	14:31:12	14.2137	0	91.20	0.528	4	10.8	0.05	162.51
7252	14:31:42	14.2158	30	91.70	0.526	4	10.8	0.05	156.11
7253	14:31:44	14.2151	0	91.73	0.527	4	10.8	0.05	155.75
7268	14:32:14	14.2158	30	92.23	0.526	4	10.8	0.05	150.96
7269	14:32:16	14.2158	0	92.27	0.526	4	10.8	0.05	150.69
7284	14:32:46	14.2187	30	92.77	0.523	4	10.8	0.05	146.96
7285	14:32:48	14.218	0	92.80	0.524	4	10.8	0.05	146.74
7300	14:33:18	14.2208	30	93.30	0.521	4	10.8	0.05	143.76
7301	14:33:20	14.2216	0	93.33	0.520	4	10.8	0.05	143.59
7316	14:33:50	14.2244	30	93.83	0.517	4	10.8	0.05	141.16
7317	14:33:52	14.2244	0	93.87	0.517	4	10.8	0.05	141.01
7332	14:34:22	14.2273	30	94.37	0.514	4	10.8	0.05	138.99
7333	14:34:24	14.2273	0	94.40	0.514	4	10.8	0.05	138.87
7348	14:34:54	14.2301	30	94.90	0.512	4	10.8	0.05	137.19
7349	14:34:56	14.2301	0	94.93	0.512	4	10.8	0.05	137.08
7364	14:35:26	14.2323	30	95.43	0.509	4	10.8	0.05	135.66
7365	14:35:28	14.2337	0	95.47	0.508	4	10.8	0.05	135.57
7380	14:35:58	14.2344	30	95.97	0.507	4	10.8	0.05	134.36
7381	14:36:00	14.2351	0	96.00	0.507	4	10.8	0.05	134.28
7396	14:36:30	14.2366	30	96.50	0.505	4	10.8	0.05	133.25
7397	14:36:32	14.2366	0	96.53	0.505	4	10.8	0.05	133.19
7412	14:37:02	14.2387	30	97.03	0.503	4	10.8	0.05	132.30
7413	14:37:04	14.2394	0	97.07	0.502	4	10.8	0.05	132.25
7428	14:37:34	14.2408	30	97.57	0.501	4	10.8	0.05	131.49
7429	14:37:36	14.2408	0	97.60	0.501	4	10.8	0.05	131.44
7444	14:38:06	14.2423	30	98.10	0.499	4	10.8	0.05	130.80
7445	14:38:08	14.2423	0	98.13	0.499	4	10.8	0.05	130.76
7460	14:38:38	14.2444	30	98.63	0.497	4	10.8	0.05	130.20
7461	14:38:40	14.2451	0	98.67	0.496	4	10.8	0.05	130.17
7476	14:39:10	14.2451	30	99.17	0.496	4	10.8	0.05	129.70
7477	14:39:12	14.2451	0	99.20	0.496	4	10.8	0.05	129.67
7492	14:39:42	14.2458	30	99.70	0.496	4	10.8	0.05	129.27
7493	14:39:44	14.2473	0	99.73	0.494	4	10.8	0.05	129.25
7508	14:40:14	14.248	30	100.23	0.494	4	10.8	0.05	128.91
7509	14:40:16	14.248	0	100.27	0.494	4	10.8	0.05	128.89
7524	14:40:46	14.2487	30	100.77	0.493	4	10.8	0.05	128.62
7525	14:40:48	14.2494	0	100.80	0.492	4	10.8	0.05	128.60
7540	14:41:18	14.2501	30	101.30	0.492	4	10.8	0.05	128.37
7541	14:41:20	14.2501	0	101.33	0.492	4	10.8	0.05	128.36
7556	14:41:50	14.2515	30	101.83	0.490	4	10.8	0.05	128.18
7557	14:41:52	14.2515	0	101.87	0.490	4	10.8	0.05	128.17
7572	14:42:22	14.2523	30	102.37	0.489	4	10.8	0.05	128.03
7573	14:42:24	14.2515	0	102.40	0.490	4	10.8	0.05	128.03
7588	14:42:54	14.253	30	102.90	0.489	4	10.8	0.05	127.93
7589	14:42:56	14.2523	0	102.93	0.489	4	10.8	0.05	127.92
7604	14:43:26	14.2544	30	103.43	0.487	4	10.8	0.05	127.86
7605	14:43:28	14.2544	0	103.47	0.487	4	10.8	0.05	127.85
7620	14:43:58	14.2551	30	103.97	0.486	4	10.8	0.05	127.82
7621	14:44:00	14.2551	0	104.00	0.486	4	10.8	0.05	127.82
7636	14:44:30	14.2551	30	104.50	0.486	4	10.8	0.05	127.81
7637	14:44:32	14.2558	0	104.53	0.486	4	10.8	0.04	127.81
7652	14:45:02	14.2565	30	105.03	0.485	4	10.8	0.04	127.83
7653	14:45:04	14.2558	0	105.07	0.486	4	10.8	0.04	127.84
7668	14:45:34	14.2565	30	105.57	0.485	4	10.8	0.04	127.88
7669	14:45:36	14.2565	0	105.60	0.485	4	10.8	0.04	127.89
7684	14:46:06	14.2565	30	106.10	0.485	4	10.8	0.04	127.95
7685	14:46:08	14.2565	0	106.13	0.485	4	10.8	0.04	127.96
7700	14:46:38	14.2565	30	106.63	0.485	4	10.8	0.04	128.05
7701	14:46:40	14.2573	0	106.67	0.484	4	10.8	0.04	128.05
7716	14:47:10	14.2565	30	107.17	0.485	4	10.8	0.04	128.16
7717	14:47:12	14.2573	0	107.20	0.484	4	10.8	0.04	128.17
7732	14:47:42	14.258	30	107.70	0.484	4	10.8	0.04	128.29
7733	14:47:44	14.258	0	107.73	0.484	4	10.8	0.04	128.30
7748	14:48:14	14.2594	30	108.23	0.482	4	10.8	0.04	128.44
7749	14:48:16	14.258	0	108.27	0.484	4	10.8	0.04	128.45
7764	14:48:46	14.2587	30	108.77	0.483	4	10.8	0.04	128.61
7765	14:48:48	14.2587	0	108.80	0.483	4	10.8	0.04	128.62
7780	14:49:18	14.2587	30	109.30	0.483	4	10.8	0.04	128.80
7781	14:49:20	14.2587	0	109.33	0.483	4	10.8	0.04	128.81
7796	14:49:50	14.2587	30	109.83	0.483	4	10.8	0.04	128.99
7797	14:49:52	14.2594	0	109.87	0.482	4	10.8	0.04	129.01
7812	14:50:22	14.2594	30	110.37	0.482	4	10.8	0.04	129.20
7813	14:50:24	14.2594	0	110.40	0.482	4	10.8	0.04	129.22
7828	14:50:54	14.2601	30	110.90	0.482	4	10.8	0.04	129.43
7829	14:50:56	14.2594	0	110.93	0.482	4	10.8	0.04	129.44
7844	14:51:26	14.2601	30	111.43	0.482	4	10.8	0.04	129.66
7845	14:51:28	14.2594	0	111.47	0.482	4	10.8	0.04	129.68
7860	14:51:58	14.2594	30	111.97	0.482	4	10.8	0.04	129.91
7861	14:52:00	14.2594	0	112.00	0.482	4	10.8	0.04	129.93
7876	14:52:30	14.2601	30	112.50	0.482	4	10.8	0.04	130.17
7877	14:52:32	14.2601	0	112.53	0.482	4	10.8	0.04	130.19
7892	14:53:02	14.2608	30	113.03	0.481	4	10.8	0.04	130.44
7893	14:53:04	14.2601	0	113.07	0.482	4	10.8	0.04	130.45
7908	14:53:34	14.2601	30	113.57	0.482	4	10.8	0.04	130.71
7909	14:53:36	14.2601	0	113.60	0.482	4	10.8	0.04	130.73
7924	14:54:06	14.2601	30	114.10	0.482	4	10.8	0.04	131.00
7925	14:54:08	14.2601	0	114.13	0.482	4	10.8	0.04	131.02

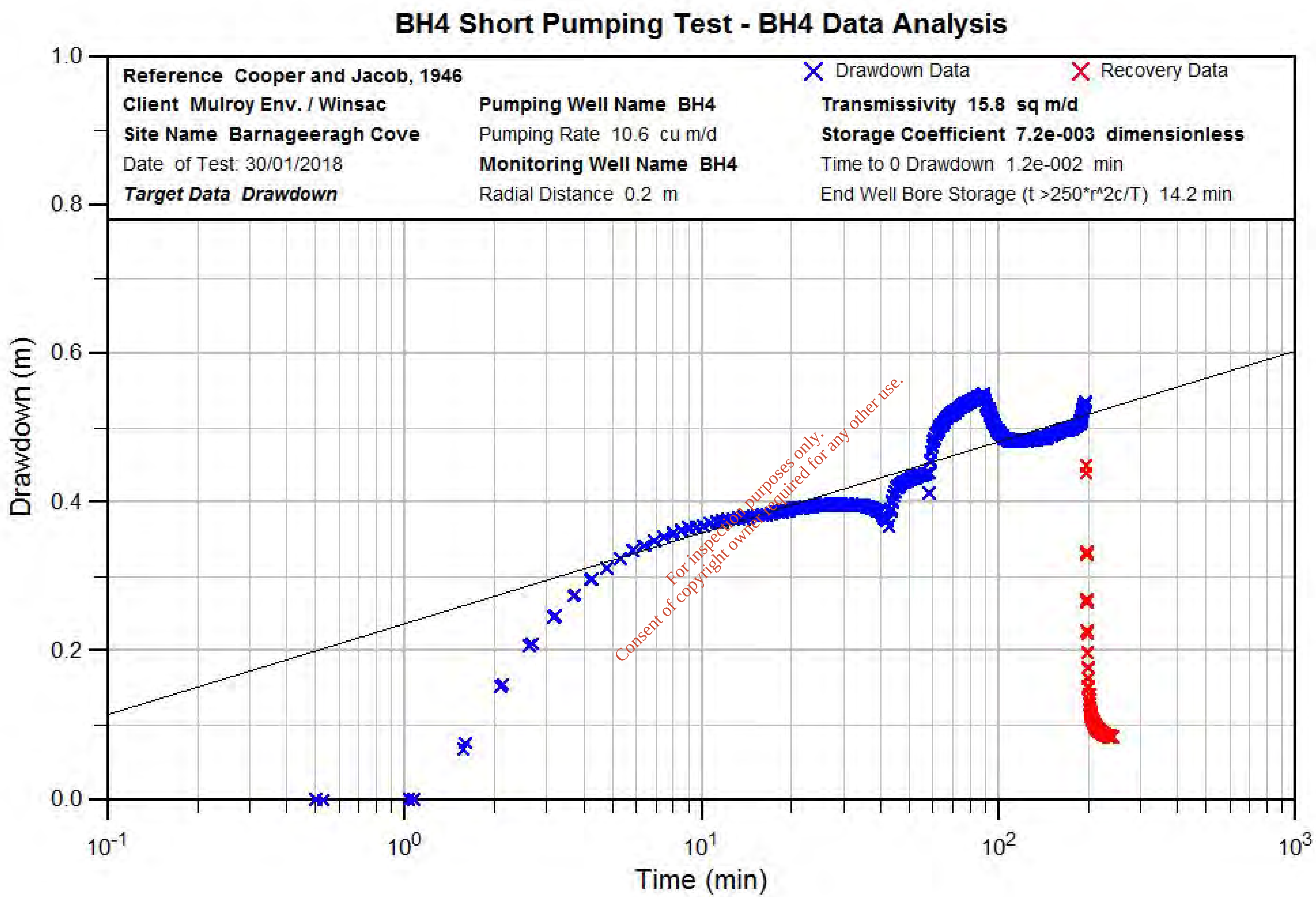
7940	14:54:38	14.2601	30	114.63	0.482	4	10.8	0.04	131.30
7941	14:54:40	14.2608	0	114.67	0.481	4	10.8	0.04	131.31
7956	14:55:10	14.2601	30	115.17	0.482	4	10.8	0.04	131.60
7957	14:55:12	14.2601	0	115.20	0.482	4	10.8	0.04	131.62
7972	14:55:42	14.2601	30	115.70	0.482	4	10.8	0.04	131.91
7973	14:55:44	14.2601	0	115.73	0.482	4	10.8	0.04	131.93
7988	14:56:14	14.2594	30	116.23	0.482	4	10.8	0.04	132.23
7989	14:56:16	14.2608	0	116.27	0.481	4	10.8	0.04	132.25
8004	14:56:46	14.2601	30	116.77	0.482	4	10.8	0.04	132.55
8005	14:56:48	14.2601	0	116.80	0.482	4	10.8	0.04	132.57
8020	14:57:18	14.2601	30	117.30	0.482	4	10.8	0.04	132.88
8021	14:57:20	14.2594	0	117.33	0.482	4	10.8	0.04	132.90
8036	14:57:50	14.2601	30	117.83	0.482	4	10.8	0.04	133.22
8037	14:57:52	14.2608	0	117.87	0.481	4	10.8	0.04	133.24
8052	14:58:22	14.2594	30	118.37	0.482	4	10.8	0.04	133.56
8053	14:58:24	14.2587	0	118.40	0.483	4	10.8	0.04	133.59
8068	14:58:54	14.2594	30	118.90	0.482	4	10.8	0.04	133.91
8069	14:58:56	14.2587	0	118.93	0.483	4	10.8	0.04	133.94
8084	14:59:26	14.2587	30	119.43	0.483	4	10.8	0.04	134.27
8085	14:59:28	14.2587	0	119.47	0.483	4	10.8	0.04	134.29
8100	14:59:58	14.2587	30	119.97	0.483	4	10.8	0.04	134.63
8101	15:00:00	14.258	0	120.00	0.484	4	10.8	0.04	134.65
8116	15:00:30	14.258	30	120.50	0.484	4	10.8	0.04	134.99
8117	15:00:32	14.2573	0	120.53	0.484	4	10.8	0.04	135.02
8132	15:01:02	14.2573	30	121.03	0.484	4	10.8	0.04	135.36
8133	15:01:04	14.2573	0	121.07	0.484	4	10.8	0.04	135.39
8148	15:01:34	14.258	30	121.57	0.484	4	10.8	0.04	135.74
8149	15:01:36	14.2573	0	121.60	0.484	4	10.8	0.04	135.76
8164	15:02:06	14.2573	30	122.10	0.484	4	10.8	0.04	136.12
8165	15:02:08	14.258	0	122.13	0.484	4	10.8	0.04	136.14
8180	15:02:38	14.258	30	122.63	0.484	4	10.8	0.04	136.50
8181	15:02:40	14.258	0	122.67	0.484	4	10.8	0.04	136.52
8196	15:03:10	14.2573	30	123.17	0.484	4	10.8	0.04	136.89
8197	15:03:12	14.2573	0	123.20	0.484	4	10.8	0.04	136.91
8212	15:03:42	14.2573	30	123.70	0.484	4	10.8	0.04	137.28
8213	15:03:44	14.258	0	123.73	0.484	4	10.8	0.04	137.30
8228	15:04:14	14.2587	30	124.23	0.483	4	10.8	0.04	137.67
8229	15:04:16	14.2587	0	124.27	0.483	4	10.8	0.04	137.70
8244	15:04:46	14.2594	30	124.77	0.482	4	10.8	0.04	138.07
8245	15:04:48	14.2587	0	124.80	0.483	4	10.8	0.04	138.09
8260	15:05:18	14.2587	30	125.30	0.483	4	10.8	0.04	138.47
8261	15:05:20	14.258	0	125.33	0.484	4	10.8	0.04	138.50
8276	15:05:50	14.2587	30	125.83	0.483	4	10.8	0.04	138.87
8277	15:05:52	14.258	0	125.87	0.484	4	10.8	0.04	138.90
8292	15:06:22	14.258	30	126.37	0.484	4	10.8	0.04	139.28
8293	15:06:24	14.2587	0	126.40	0.483	4	10.8	0.04	139.31
8308	15:06:54	14.258	30	126.90	0.484	4	10.8	0.04	139.69
8309	15:06:56	14.258	0	126.93	0.484	4	10.8	0.04	139.72
8324	15:07:26	14.258	30	127.43	0.484	4	10.8	0.04	140.11
8325	15:07:28	14.258	0	127.47	0.484	4	10.8	0.04	140.13
8340	15:07:58	14.2573	30	127.97	0.484	4	10.8	0.04	140.52
8341	15:08:00	14.258	0	128.00	0.484	4	10.8	0.04	140.55
8356	15:08:30	14.258	30	128.50	0.484	4	10.8	0.04	140.94
8357	15:08:32	14.2587	0	128.53	0.483	4	10.8	0.04	140.97
8372	15:09:02	14.2587	30	129.03	0.483	4	10.8	0.04	141.37
8373	15:09:04	14.2587	0	129.07	0.483	4	10.8	0.04	141.39
8388	15:09:34	14.258	30	129.57	0.484	4	10.8	0.04	141.79
8389	15:09:36	14.258	0	129.60	0.484	4	10.8	0.04	141.82
8404	15:10:06	14.258	30	130.10	0.484	4	10.8	0.04	142.22
8405	15:10:08	14.2587	0	130.13	0.483	4	10.8	0.04	142.24
8420	15:10:38	14.258	30	130.63	0.484	4	10.8	0.04	142.65
8421	15:10:40	14.2573	0	130.67	0.484	4	10.8	0.04	142.67
8436	15:11:10	14.2573	30	131.17	0.484	4	10.8	0.04	143.08
8437	15:11:12	14.258	0	131.20	0.484	4	10.8	0.04	143.11
8452	15:11:42	14.2573	30	131.70	0.484	4	10.8	0.04	143.51
8453	15:11:44	14.258	0	131.73	0.484	4	10.8	0.04	143.54
8468	15:12:14	14.2587	30	132.23	0.483	4	10.8	0.04	143.95
8469	15:12:16	14.2573	0	132.27	0.484	4	10.8	0.04	143.98
8484	15:12:46	14.2573	30	132.77	0.484	4	10.8	0.04	144.39
8485	15:12:48	14.2565	0	132.80	0.485	4	10.8	0.04	144.42
8500	15:13:18	14.2573	30	133.30	0.484	4	10.8	0.04	144.83
8501	15:13:20	14.2565	0	133.33	0.485	4	10.8	0.04	144.86
8516	15:13:50	14.2565	30	133.83	0.485	4	10.8	0.04	145.27
8517	15:13:52	14.2565	0	133.87	0.485	4	10.8	0.04	145.30
8532	15:14:22	14.2565	30	134.37	0.485	4	10.8	0.04	145.71
8533	15:14:24	14.2573	0	134.40	0.484	4	10.8	0.04	145.74
8548	15:14:54	14.2565	30	134.90	0.485	4	10.8	0.04	146.16
8549	15:14:56	14.2558	0	134.93	0.486	4	10.8	0.04	146.19
8564	15:15:26	14.2565	30	135.43	0.485	4	10.8	0.04	146.61
8565	15:15:28	14.2558	0	135.47	0.486	4	10.8	0.04	146.64
8580	15:15:58	14.2565	30	135.97	0.485	4	10.8	0.04	147.06
8581	15:16:00	14.2558	0	136.00	0.486	4	10.8	0.04	147.09
8596	15:16:30	14.2558	30	136.50	0.486	4	10.8	0.04	147.51
8597	15:16:32	14.2558	0	136.53	0.486	4	10.8	0.04	147.54
8612	15:17:02	14.2558	30	137.03	0.486	4	10.8	0.04	147.96
8613	15:17:04	14.2558	0	137.07	0.486	4	10.8	0.04	147.99
8628	15:17:34	14.2558	30	137.57	0.486	4	10.8	0.04	148.42
8629	15:17:36	14.2558	0	137.60	0.486	4	10.8	0.04	148.44
8644	15:18:06	14.2544	30	138.10	0.487	4	10.8	0.05	148.87
8645	15:18:08	14.2551	0	138.13	0.486	4	10.8	0.05	148.90
8660	15:18:38	14.2544	30	138.63	0.487	4	10.8	0.05	149.33
8661	15:18:40	14.2551	0	138.67	0.486	4	10.8	0.05	149.36
8676	15:19:10	14.2537	30	139.17	0.488	4	10.8	0.05	149.79
8677	15:19:12	14.2551	0	139.20	0.486	4	10.8	0.05	149.82
8692	15:19:42	14.2544	30	139.70	0.487	4	10.8	0.05	150.25
8693	15:19:44	14.2544	0	139.73	0.487	4	10.8	0.05	150.28
8708	15:20:14	14.2551	30	140.23	0.486	4	10.8	0.05	150.71
8709	15:20:16	14.2551	0	140.27	0.486	4	10.8	0.05	150.74
8724	15:20:46	14.2551	30	140.77	0.486	4	10.8	0.05	151.17
8725	15:20:48	14.2544	0	140.80	0.487	4	10.8	0.05	151.20
8740	15:21:18	14.2544	30	141.30	0.487	4	10.8	0.05	151.64
8741	15:21:20	14.2537	0	141.33	0.488	4	10.8	0.05	151.67
8756	15:21:50	14.2544	30	141.83	0.487	4	10.8	0.05	152.10
8757	15:21:52	14.2551	0	141.87	0.486	4	10.8	0.05	152.13
8772	15:22:22	14.2544	30	142.37	0.487	4	10.8	0.05	152.57
8773	15:22:24	14.2537	0	142.40	0.488	4	10.8	0.05	152.60
8788	15:22:54	14.2537	30	142.90	0.488	4	10.8	0.05	153.04
8789	15:22:56	14.2537	0	142.93	0.488	4	10.8	0.05	153.07
8804	15:23:26	14.2544	30	143.43	0.487	4	10.8	0.05	153.51

8805	15:23:28	14.2537	0	143.47	0.488	4	10.8	0.05	153.53
8820	15:23:58	14.2544	30	143.97	0.487	4	10.8	0.05	153.98
8821	15:24:00	14.2544	0	144.00	0.487	4	10.8	0.05	154.01
8836	15:24:30	14.2544	30	144.50	0.487	4	10.8	0.05	154.45
8837	15:24:32	14.2544	0	144.53	0.487	4	10.8	0.05	154.48
8852	15:25:02	14.2544	30	145.03	0.487	4	10.8	0.05	154.92
8853	15:25:04	14.2551	0	145.07	0.486	4	10.8	0.05	154.95
8868	15:25:34	14.2544	30	145.57	0.487	4	10.8	0.05	155.39
8869	15:25:36	14.2537	0	145.60	0.488	4	10.8	0.05	155.42
8884	15:26:06	14.2537	30	146.10	0.488	4	10.8	0.05	155.87
8885	15:26:08	14.2537	0	146.13	0.488	4	10.8	0.05	155.90
8900	15:26:38	14.2501	30	146.63	0.492	4	10.8	0.05	156.34
8901	15:26:40	14.2494	0	146.67	0.492	4	10.8	0.05	156.37
8916	15:27:10	14.2494	30	147.17	0.492	4	10.8	0.05	156.82
8917	15:27:12	14.2515	0	147.20	0.490	4	10.8	0.05	156.85
8932	15:27:42	14.2501	30	147.70	0.492	4	10.8	0.05	157.30
8933	15:27:44	14.2508	0	147.73	0.491	4	10.8	0.05	157.33
8948	15:28:14	14.2515	30	148.23	0.490	4	10.8	0.05	157.77
8949	15:28:16	14.2515	0	148.27	0.490	4	10.8	0.05	157.80
8964	15:28:46	14.2515	30	148.77	0.490	4	10.8	0.05	158.25
8965	15:28:48	14.2515	0	148.80	0.490	4	10.8	0.05	158.28
8980	15:29:18	14.2515	30	149.30	0.490	4	10.8	0.05	158.73
8981	15:29:20	14.2515	0	149.33	0.490	4	10.8	0.05	158.76
8996	15:29:50	14.2515	30	149.83	0.490	4	10.8	0.05	159.21
8997	15:29:52	14.2515	0	149.87	0.490	4	10.8	0.05	159.24
9012	15:30:22	14.2515	30	150.37	0.490	4	10.8	0.05	159.69
9013	15:30:24	14.2523	0	150.40	0.489	4	10.8	0.05	159.72
9028	15:30:54	14.2515	30	150.90	0.490	4	10.8	0.05	160.18
9029	15:30:56	14.2508	0	150.93	0.491	4	10.8	0.05	160.21
9044	15:31:26	14.2515	30	151.43	0.490	4	10.8	0.05	160.66
9045	15:31:28	14.2515	0	151.47	0.490	4	10.8	0.05	160.69
9060	15:31:58	14.2515	30	151.97	0.490	4	10.8	0.05	161.14
9061	15:32:00	14.2515	0	152.00	0.490	4	10.8	0.05	161.17
9076	15:32:30	14.2515	30	152.50	0.490	4	10.8	0.05	161.63
9077	15:32:32	14.2515	0	152.53	0.490	4	10.8	0.05	161.66
9092	15:33:02	14.2508	30	153.03	0.491	4	10.8	0.05	162.11
9093	15:33:04	14.2508	0	153.07	0.491	4	10.8	0.05	162.14
9108	15:33:34	14.2501	30	153.57	0.492	4	10.8	0.05	162.60
9109	15:33:36	14.2515	0	153.60	0.490	4	10.8	0.05	162.63
9124	15:34:06	14.2501	30	154.10	0.492	4	10.8	0.05	163.09
9125	15:34:08	14.2494	0	154.13	0.492	4	10.8	0.05	163.12
9140	15:34:38	14.2494	30	154.63	0.492	4	10.8	0.05	163.58
9141	15:34:40	14.2494	0	154.67	0.492	4	10.8	0.05	163.61
9156	15:35:10	14.2494	30	155.17	0.492	4	10.8	0.05	164.06
9157	15:35:12	14.2494	0	155.20	0.492	4	10.8	0.05	164.09
9172	15:35:42	14.2494	30	155.70	0.492	4	10.8	0.05	164.55
9173	15:35:44	14.2494	0	155.73	0.492	4	10.8	0.05	164.58
9188	15:36:14	14.2487	30	156.23	0.493	4	10.8	0.05	165.04
9189	15:36:16	14.2494	0	156.27	0.492	4	10.8	0.05	165.07
9204	15:36:46	14.248	30	156.77	0.494	4	10.8	0.05	165.53
9205	15:36:48	14.248	0	156.80	0.494	4	10.8	0.05	165.56
9220	15:37:18	14.2494	30	157.30	0.492	4	10.8	0.05	166.02
9221	15:37:20	14.2487	0	157.33	0.493	4	10.8	0.05	166.05
9236	15:37:50	14.2487	30	157.83	0.493	4	10.8	0.05	166.51
9237	15:37:52	14.2487	0	157.87	0.493	4	10.8	0.05	166.54
9252	15:38:22	14.2473	30	158.37	0.494	4	10.8	0.05	167.01
9253	15:38:24	14.2465	0	158.40	0.495	4	10.8	0.05	167.04
9268	15:38:54	14.2473	30	158.90	0.494	4	10.8	0.05	167.50
9269	15:38:56	14.2466	0	158.93	0.495	4	10.8	0.05	167.53
9284	15:39:26	14.2465	30	159.43	0.495	4	10.8	0.05	167.99
9285	15:39:28	14.2458	0	159.47	0.496	4	10.8	0.05	168.02
9300	15:39:58	14.2458	30	159.97	0.496	4	10.8	0.05	168.49
9301	15:40:00	14.2458	0	160.00	0.496	4	10.8	0.05	168.52
9316	15:40:30	14.2451	30	160.50	0.496	4	10.8	0.05	168.98
9317	15:40:32	14.2451	0	160.53	0.496	4	10.8	0.05	169.01
9332	15:41:02	14.2458	30	161.03	0.496	4	10.8	0.05	169.47
9333	15:41:04	14.2444	0	161.07	0.497	4	10.8	0.05	169.51
9348	15:41:34	14.2444	30	161.57	0.497	4	10.8	0.05	169.97
9349	15:41:36	14.2451	0	161.60	0.496	4	10.8	0.05	170.00
9364	15:42:06	14.2444	30	162.10	0.497	4	10.8	0.05	170.47
9365	15:42:08	14.2451	0	162.13	0.496	4	10.8	0.05	170.50
9380	15:42:38	14.2444	30	162.63	0.497	4	10.8	0.05	170.96
9381	15:42:40	14.2444	0	162.67	0.497	4	10.8	0.05	170.99
9396	15:43:10	14.2451	30	163.17	0.496	4	10.8	0.05	171.46
9397	15:43:12	14.2444	0	163.20	0.497	4	10.8	0.05	171.49
9412	15:43:42	14.2437	30	163.70	0.498	4	10.8	0.05	171.96
9413	15:43:44	14.2444	0	163.73	0.497	4	10.8	0.05	171.99
9428	15:44:14	14.2437	30	164.23	0.498	4	10.8	0.05	172.45
9429	15:44:16	14.2444	0	164.27	0.497	4	10.8	0.05	172.49
9444	15:44:46	14.2437	30	164.77	0.498	4	10.8	0.05	172.95
9445	15:44:48	14.2444	0	164.80	0.497	4	10.8	0.05	172.98
9460	15:45:18	14.2444	30	165.30	0.497	4	10.8	0.05	173.45
9461	15:45:20	14.2437	0	165.33	0.498	4	10.8	0.05	173.48
9476	15:45:50	14.2437	30	165.83	0.498	4	10.8	0.05	173.95
9477	15:45:52	14.2444	0	165.87	0.497	4	10.8	0.05	173.98
9492	15:46:22	14.2444	30	166.37	0.497	4	10.8	0.05	174.45
9493	15:46:24	14.2437	0	166.40	0.498	4	10.8	0.05	174.48
9508	15:46:54	14.2451	30	166.90	0.496	4	10.8	0.05	174.95
9509	15:46:56	14.2444	0	166.93	0.497	4	10.8	0.05	174.98
9524	15:47:26	14.2444	30	167.43	0.497	4	10.8	0.05	175.45
9525	15:47:28	14.2437	0	167.47	0.498	4	10.8	0.05	175.48
9540	15:47:58	14.2437	30	167.97	0.498	4	10.8	0.05	175.95
9541	15:48:00	14.2437	0	168.00	0.498	4	10.8	0.05	175.98
9556	15:48:30	14.2437	30	168.50	0.498	4	10.8	0.05	176.45
9557	15:48:32	14.2444	0	168.53	0.497	4	10.8	0.05	176.48
9572	15:49:02	14.2437	30	169.03	0.498	4	10.8	0.05	176.95
9573	15:49:04	14.2437	0	169.07	0.498	4	10.8	0.05	176.99
9588	15:49:34	14.2437	30	169.57	0.498	4	10.8	0.05	177.46
9589	15:49:36	14.2444	0	169.60	0.497	4	10.8	0.05	177.49
9604	15:50:06	14.2437	30	170.10	0.498	4	10.8	0.05	177.96
9605	15:50:08	14.2437	0	170.13	0.498	4	10.8	0.05	177.99
9620	15:50:38	14.2437	30	170.63	0.498	4	10.8	0.05	178.46
9621	15:50:40	14.2444	0	170.67	0.497	4	10.8	0.05	178.49
9636	15:51:10	14.2437	30	171.17	0.498	4	10.8	0.05	178.96
9637	15:51:12	14.243	0	171.20	0.499	4	10.8	0.05	179.00
9652	15:51:42	14.243	30	171.70	0.499	4	10.8	0.05	179.47
9653	15:51:44	14.2423	0	171.73	0.499	4	10.8	0.05	179.50
9668	15:52:14	14.2423	30	172.23	0.499	4	10.8	0.05	179.97
9669	15:52:16	14.2423	0	172.27	0.499	4	10.8	0.05	180.00

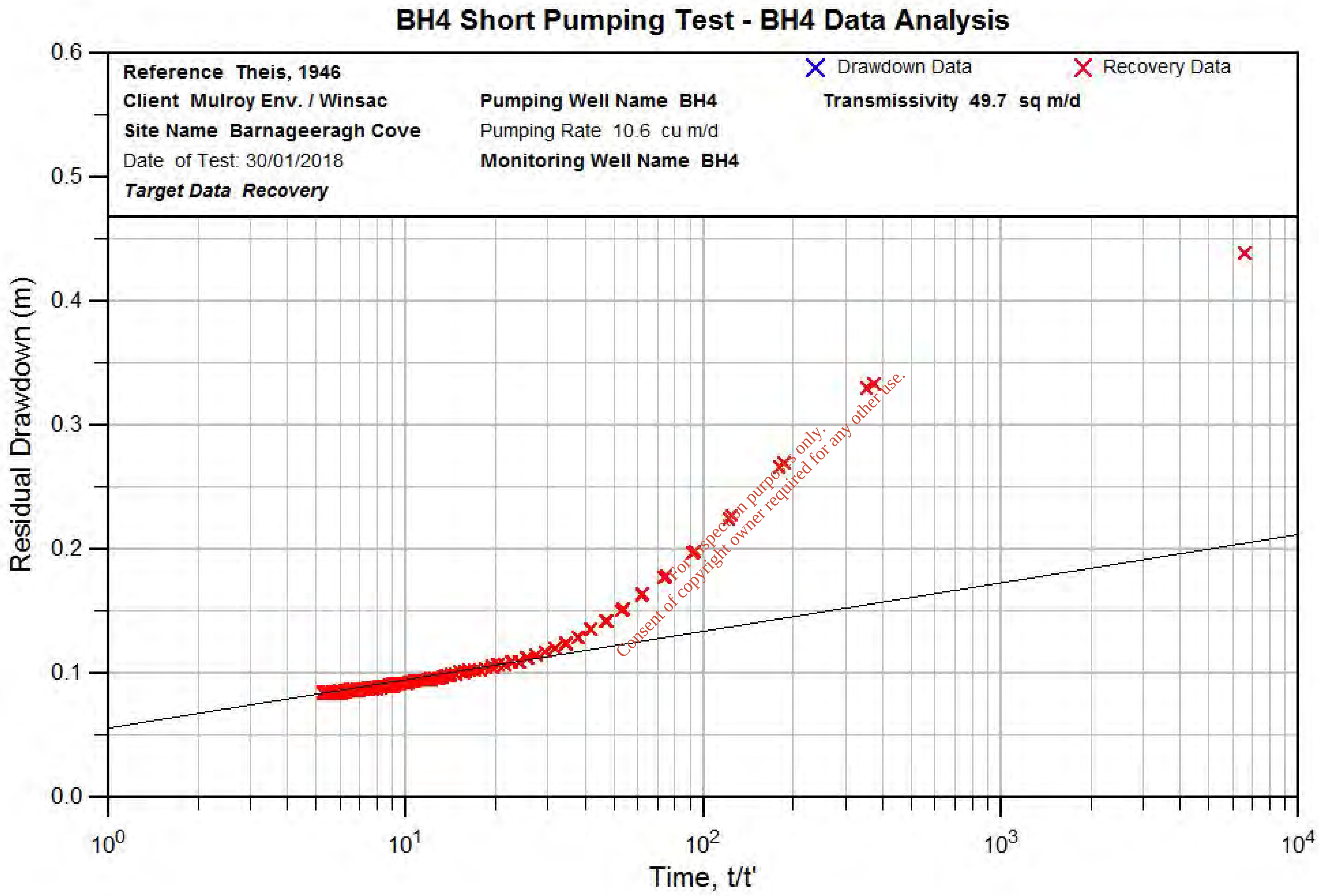
9684	15:52:46	14.2423	30	172.77	0.499	4	10.8	0.05	180.48
9685	15:52:48	14.2416	0	172.80	0.500	4	10.8	0.05	180.51
9700	15:53:18	14.2416	30	173.30	0.500	4	10.8	0.05	180.98
9701	15:53:20	14.2423	0	173.33	0.499	4	10.8	0.05	181.01
9716	15:53:50	14.2416	30	173.83	0.500	4	10.8	0.05	181.49
9717	15:53:52	14.2423	0	173.87	0.499	4	10.8	0.05	181.52
9732	15:54:22	14.2408	30	174.37	0.501	4	10.8	0.05	181.99
9733	15:54:24	14.2416	0	174.40	0.500	4	10.8	0.05	182.02
9748	15:54:54	14.2416	30	174.90	0.500	4	10.8	0.05	182.50
9749	15:54:56	14.2416	0	174.93	0.500	4	10.8	0.05	182.53
9764	15:55:26	14.2408	30	175.43	0.501	4	10.8	0.05	183.00
9765	15:55:28	14.2408	0	175.47	0.501	4	10.8	0.05	183.03
9780	15:55:58	14.2416	30	175.97	0.500	4	10.8	0.05	183.51
9781	15:56:00	14.2416	0	176.00	0.500	4	10.8	0.05	183.54
9796	15:56:30	14.2416	30	176.50	0.500	4	10.8	0.05	184.01
9797	15:56:32	14.2423	0	176.53	0.499	4	10.8	0.05	184.05
9812	15:57:02	14.2416	30	177.03	0.500	4	10.8	0.05	184.52
9813	15:57:04	14.2423	0	177.07	0.499	4	10.8	0.05	184.55
9828	15:57:34	14.2408	30	177.57	0.501	4	10.8	0.05	185.03
9829	15:57:36	14.2416	0	177.60	0.500	4	10.8	0.05	185.06
9844	15:58:06	14.2408	30	178.10	0.501	4	10.8	0.05	185.54
9845	15:58:08	14.2408	0	178.13	0.501	4	10.8	0.05	185.57
9860	15:58:38	14.2408	30	178.63	0.501	4	10.8	0.05	186.04
9861	15:58:40	14.2416	0	178.67	0.500	4	10.8	0.05	186.08
9876	15:59:10	14.2408	30	179.17	0.501	4	10.8	0.05	186.55
9877	15:59:12	14.2401	0	179.20	0.502	4	10.8	0.05	186.58
9892	15:59:42	14.2401	30	179.70	0.502	4	10.8	0.05	187.06
9893	15:59:44	14.2401	0	179.73	0.502	4	10.8	0.05	187.09
9908	16:00:14	14.2394	30	180.23	0.502	4	10.8	0.05	187.57
9909	16:00:16	14.2401	0	180.27	0.502	4	10.8	0.05	187.60
9924	16:00:46	14.2394	30	180.77	0.502	4	10.8	0.05	188.08
9925	16:00:48	14.2394	0	180.80	0.502	4	10.8	0.05	188.11
9940	16:01:18	14.2387	30	181.30	0.503	4	10.8	0.05	188.59
9941	16:01:20	14.2394	0	181.33	0.502	4	10.8	0.05	188.62
9956	16:01:50	14.2394	30	181.83	0.502	4	10.8	0.05	189.10
9957	16:01:52	14.2394	0	181.87	0.502	4	10.8	0.05	189.13
9972	16:02:22	14.2387	30	182.37	0.503	4	10.8	0.05	189.61
9973	16:02:24	14.2387	0	182.40	0.503	4	10.8	0.05	189.64
9988	16:02:54	14.238	30	182.90	0.504	4	10.8	0.05	190.11
9989	16:02:56	14.2394	0	182.93	0.502	4	10.8	0.05	190.15
10004	16:03:26	14.2373	30	183.43	0.504	4	10.8	0.05	190.63
10005	16:03:28	14.2373	0	183.47	0.504	4	10.8	0.05	190.66
10020	16:03:58	14.2373	30	183.97	0.504	4	10.8	0.05	191.14
10021	16:04:00	14.2373	0	184.00	0.504	4	10.8	0.05	191.17
10036	16:04:30	14.2366	30	184.50	0.505	4	10.8	0.05	191.65
10037	16:04:32	14.2373	0	184.53	0.504	4	10.8	0.05	191.68
10052	16:05:02	14.2366	30	185.03	0.505	4	10.8	0.05	192.16
10053	16:05:04	14.2366	0	185.07	0.505	4	10.8	0.05	192.19
10068	16:05:34	14.2366	30	185.57	0.505	4	10.8	0.05	192.67
10069	16:05:36	14.2366	0	185.60	0.505	4	10.8	0.05	192.70
10084	16:06:06	14.2366	30	186.10	0.505	4	10.8	0.05	193.18
10085	16:06:08	14.2366	0	186.13	0.505	4	10.8	0.05	193.21
10100	16:06:38	14.2358	30	186.63	0.506	4	10.8	0.05	193.69
10101	16:06:40	14.2366	0	186.67	0.505	4	10.8	0.05	193.72
10116	16:07:10	14.2358	30	187.17	0.506	4	10.8	0.05	194.20
10117	16:07:12	14.2366	0	187.20	0.505	4	10.8	0.05	194.23
10132	16:07:42	14.2351	30	187.70	0.507	4	10.8	0.05	194.71
10133	16:07:44	14.2366	0	187.73	0.505	4	10.8	0.05	194.75
10148	16:08:14	14.233	30	188.23	0.509	4	10.8	0.05	195.23
10149	16:08:16	14.2337	0	188.27	0.508	4	10.8	0.05	195.26
10164	16:08:46	14.233	30	188.77	0.509	4	10.8	0.05	195.74
10165	16:08:48	14.233	0	188.80	0.509	4	10.8	0.05	195.77
10180	16:09:18	14.2294	30	189.30	0.512	4	10.8	0.05	196.25
10181	16:09:20	14.2287	0	189.33	0.513	4	10.8	0.05	196.28
10196	16:09:50	14.2266	30	189.83	0.515	4	10.8	0.05	196.76
10197	16:09:52	14.2258	0	189.87	0.516	4	10.8	0.05	196.80
10212	16:10:22	14.223	30	190.37	0.519	4	10.8	0.05	197.28
10213	16:10:24	14.223	0	190.40	0.519	4	10.8	0.05	197.31
10228	16:10:54	14.2208	30	190.90	0.521	4	10.8	0.05	197.79
10229	16:10:56	14.2201	0	190.93	0.522	4	10.8	0.05	197.82
10244	16:11:26	14.218	30	191.43	0.524	4	10.8	0.05	198.30
10245	16:11:28	14.2187	0	191.47	0.523	4	10.8	0.05	198.34
10260	16:11:58	14.2166	30	191.97	0.525	4	10.8	0.05	198.82
10261	16:12:00	14.2166	0	192.00	0.525	4	10.8	0.05	198.85
10276	16:12:30	14.2151	30	192.50	0.527	4	10.8	0.05	199.33
10277	16:12:32	14.2151	0	192.53	0.527	4	10.8	0.05	199.36
10292	16:13:02	14.213	30	193.03	0.529	4	10.8	0.05	199.85
10293	16:13:04	14.213	0	193.07	0.529	4	10.8	0.05	199.88
10308	16:13:34	14.2123	30	193.57	0.529	4	10.8	0.05	200.36
10309	16:13:36	14.2123	0	193.60	0.529	4	10.8	0.05	200.39
10324	16:14:06	14.2109	30	194.10	0.531	4	10.8	0.05	200.87
10325	16:14:08	14.2101	0	194.13	0.531	4	10.8	0.05	200.91
10340	16:14:38	14.2087	30	194.63	0.533	4	10.8	0.05	201.39
10341	16:14:40	14.2101	0	194.67	0.531	4	10.8	0.05	201.42
10356	16:15:10	14.208	30	195.17	0.534	4	10.8	0.05	201.90
10357	16:15:12	14.2073	0	195.20	0.534	4	10.8	0.05	201.94
10372	16:15:42	14.2059	30	195.70	0.536	4	10.8	0.05	202.42
10373	16:15:44	14.2066	0	195.73	0.535	4	10.8	0.05	202.45
10388	16:16:14	14.2066	30	196.23	0.535	4	10.8	0.05	202.93
10389	16:16:16	14.2059	0	196.27	0.536	4	10.8	0.05	202.97
10404	16:16:46	14.2922	30	196.77	0.449	5			
10405	16:16:48	14.3022	0	196.80	0.439	5			
10420	16:17:18	14.4087	30	197.30	0.333	5			
10421	16:17:20	14.4115	0	197.33	0.330	5			
10436	16:17:50	14.4729	30	197.83	0.269	5			
10437	16:17:52	14.4758	0	197.87	0.266	5			
10452	16:18:22	14.5151	30	198.37	0.227	5			
10453	16:18:24	14.5172	0	198.40	0.224	5			
10468	16:18:54	14.5436	30	198.90	0.198	5			
10469	16:18:56	14.5451	0	198.93	0.197	5			
10484	16:19:26	14.5636	30	199.43	0.178	5			
10485	16:19:28	14.5644	0	199.47	0.177	5			
10500	16:19:58	14.5779	30	199.97	0.164	5			
10501	16:20:00	14.5786	0	200.00	0.163	5			
10516	16:20:30	14.5901	30	200.50	0.152	5			
10517	16:20:32	14.5915	0	200.53	0.150	5			
10532	16:21:02	14.5993	30	201.03	0.142	5			
10533	16:21:04	14.5993	0	201.07	0.142	5			
10548	16:21:34	14.6065	30	201.57	0.135	5			

10549	16:21:36	14.6065	0	201.60	0.135	5
10564	16:22:06	14.6122	30	202.10	0.129	5
10565	16:22:08	14.6129	0	202.13	0.129	5
10580	16:22:38	14.6179	30	202.63	0.124	5
10581	16:22:40	14.6186	0	202.67	0.123	5
10596	16:23:10	14.6215	30	203.17	0.120	5
10597	16:23:12	14.6215	0	203.20	0.120	5
10612	16:23:42	14.6243	30	203.70	0.117	5
10613	16:23:44	14.6243	0	203.73	0.117	5
10628	16:24:14	14.6265	30	204.23	0.115	5
10629	16:24:16	14.6272	0	204.27	0.114	5
10644	16:24:46	14.6293	30	204.77	0.112	5
10645	16:24:48	14.6293	0	204.80	0.112	5
10660	16:25:18	14.6322	30	205.30	0.109	5
10661	16:25:20	14.6322	0	205.33	0.109	5
10676	16:25:50	14.6322	30	205.83	0.109	5
10677	16:25:52	14.6329	0	205.87	0.109	5
10692	16:26:22	14.635	30	206.37	0.107	5
10693	16:26:24	14.6343	0	206.40	0.107	5
10708	16:26:54	14.635	30	206.90	0.107	5
10709	16:26:56	14.635	0	206.93	0.107	5
10724	16:27:26	14.6372	30	207.43	0.104	5
10725	16:27:28	14.6358	0	207.47	0.106	5
10740	16:27:58	14.6372	30	207.97	0.104	5
10741	16:28:00	14.6379	0	208.00	0.104	5
10756	16:28:30	14.6393	30	208.50	0.102	5
10757	16:28:32	14.6393	0	208.53	0.102	5
10772	16:29:02	14.6393	30	209.03	0.102	5
10773	16:29:04	14.6393	0	209.07	0.102	5
10788	16:29:34	14.6401	30	209.57	0.102	5
10789	16:29:36	14.6401	0	209.60	0.102	5
10804	16:30:06	14.6408	30	210.10	0.101	5
10805	16:30:08	14.6415	0	210.13	0.100	5
10820	16:30:38	14.6408	30	210.63	0.101	5
10821	16:30:40	14.6408	0	210.67	0.101	5
10836	16:31:10	14.6422	30	211.17	0.099	5
10837	16:31:12	14.6422	0	211.20	0.099	5
10852	16:31:42	14.6429	30	211.70	0.099	5
10853	16:31:44	14.6436	0	211.73	0.098	5
10868	16:32:14	14.6436	30	212.23	0.098	5
10869	16:32:16	14.6436	0	212.27	0.098	5
10884	16:32:46	14.6444	30	212.77	0.097	5
10885	16:32:48	14.6444	0	212.80	0.097	5
10900	16:33:18	14.6458	30	213.30	0.096	5
10901	16:33:20	14.6458	0	213.33	0.096	5
10916	16:33:50	14.6458	30	213.83	0.096	5
10917	16:33:52	14.6458	0	213.87	0.096	5
10932	16:34:22	14.6458	30	214.37	0.096	5
10933	16:34:24	14.6465	0	214.40	0.095	5
10948	16:34:54	14.6465	30	214.90	0.095	5
10949	16:34:56	14.6472	0	214.93	0.094	5
10964	16:35:26	14.6473	30	215.43	0.094	5
10965	16:35:28	14.6473	0	215.47	0.094	5
10980	16:35:58	14.6473	30	215.97	0.094	5
10981	16:36:00	14.6473	0	216.00	0.094	5
10996	16:36:30	14.648	30	216.50	0.094	5
10997	16:36:32	14.648	0	216.53	0.094	5
11012	16:37:02	14.648	30	217.03	0.094	5
11013	16:37:04	14.6487	0	217.07	0.093	5
11028	16:37:34	14.6487	30	217.57	0.093	5
11029	16:37:36	14.6487	0	217.60	0.093	5
11044	16:38:06	14.6487	30	218.10	0.093	5
11045	16:38:08	14.6494	0	218.13	0.092	5
11060	16:38:38	14.6501	30	218.63	0.091	5
11061	16:38:40	14.6494	0	218.67	0.092	5
11076	16:39:10	14.6494	30	219.17	0.092	5
11077	16:39:12	14.6494	0	219.20	0.092	5
11092	16:39:42	14.6508	30	219.70	0.091	5
11093	16:39:44	14.6508	0	219.73	0.091	5
11108	16:40:14	14.6508	30	220.23	0.091	5
11109	16:40:16	14.6501	0	220.27	0.091	5
11124	16:40:46	14.6508	30	220.77	0.091	5
11125	16:40:48	14.6516	0	220.80	0.090	5
11140	16:41:18	14.6508	30	221.30	0.091	5
11141	16:41:20	14.6523	0	221.33	0.089	5
11156	16:41:50	14.6515	30	221.83	0.090	5
11157	16:41:52	14.6523	0	221.87	0.089	5
11172	16:42:22	14.6523	30	222.37	0.089	5
11173	16:42:24	14.6523	0	222.40	0.089	5
11188	16:42:54	14.6523	30	222.90	0.089	5
11189	16:42:56	14.653	0	222.93	0.089	5
11204	16:43:26	14.653	30	223.43	0.089	5
11205	16:43:28	14.6523	0	223.47	0.089	5
11220	16:43:58	14.6537	30	223.97	0.088	5
11221	16:44:00	14.653	0	224.00	0.089	5
11236	16:44:30	14.653	30	224.50	0.089	5
11237	16:44:32	14.653	0	224.53	0.089	5
11252	16:45:02	14.6537	30	225.03	0.088	5
11253	16:45:04	14.6544	0	225.07	0.087	5
11268	16:45:34	14.6537	30	225.57	0.088	5
11269	16:45:36	14.6537	0	225.60	0.088	5
11284	16:46:06	14.6537	30	226.10	0.088	5
11285	16:46:08	14.6544	0	226.13	0.087	5
11300	16:46:38	14.6537	30	226.63	0.088	5
11301	16:46:40	14.6537	0	226.67	0.088	5
11316	16:47:10	14.6544	30	227.17	0.087	5
11317	16:47:12	14.6537	0	227.20	0.088	5
11332	16:47:42	14.6544	30	227.70	0.087	5
11333	16:47:44	14.6544	0	227.73	0.087	5
11348	16:48:14	14.6544	30	228.23	0.087	5
11349	16:48:16	14.6551	0	228.27	0.087	5
11364	16:48:46	14.6551	30	228.77	0.087	5
11365	16:48:48	14.6551	0	228.80	0.087	5
11380	16:49:18	14.6551	30	229.30	0.087	5
11381	16:49:20	14.6551	0	229.33	0.087	5
11396	16:49:50	14.6551	30	229.83	0.087	5
11397	16:49:52	14.6558	0	229.87	0.086	5
11412	16:50:22	14.6551	30	230.37	0.087	5
11413	16:50:24	14.6558	0	230.40	0.086	5

	11428	16:50:54	14.6558	30	230.90	0.086	5
	11429	16:50:56	14.6558	0	230.93	0.086	5
	11444	16:51:26	14.6551	30	231.43	0.087	5
	11445	16:51:28	14.6558	0	231.47	0.086	5
	11460	16:51:58	14.6551	30	231.97	0.087	5
	11461	16:52:00	14.6551	0	232.00	0.087	5
	11476	16:52:30	14.6551	30	232.50	0.087	5
	11477	16:52:32	14.6558	0	232.53	0.086	5
	11492	16:53:02	14.6558	30	233.03	0.086	5
	11493	16:53:04	14.6558	0	233.07	0.086	5
	11508	16:53:34	14.6558	30	233.57	0.086	5
	11509	16:53:36	14.6558	0	233.60	0.086	5
	11524	16:54:06	14.6558	30	234.10	0.086	5
	11525	16:54:08	14.6565	0	234.13	0.085	5
	11540	16:54:38	14.6565	30	234.63	0.085	5
	11541	16:54:40	14.6565	0	234.67	0.085	5
	11556	16:55:10	14.6565	30	235.17	0.085	5
	11557	16:55:12	14.6565	0	235.20	0.085	5
	11572	16:55:42	14.6565	30	235.70	0.085	5
	11573	16:55:44	14.6572	0	235.73	0.084	5
	11588	16:56:14	14.6558	30	236.23	0.086	5
	11589	16:56:16	14.6558	0	236.27	0.086	5
	11604	16:56:46	14.6565	30	236.77	0.085	5
	11605	16:56:48	14.6572	0	236.80	0.084	5
	11620	16:57:18	14.6565	30	237.30	0.085	5
	11621	16:57:20	14.6565	0	237.33	0.085	5
	11636	16:57:50	14.6565	30	237.83	0.085	5
	11637	16:57:52	14.6572	0	237.87	0.084	5
	11652	16:58:22	14.6572	30	238.37	0.084	5
	11653	16:58:24	14.6572	0	238.40	0.084	5
	11668	16:58:54	14.6572	30	238.90	0.084	5
	11669	16:58:56	14.6565	0	238.93	0.085	5
	11684	16:59:26	14.6572	30	239.43	0.084	5
	11685	16:59:28	14.6572	0	239.47	0.084	5
	11700	16:59:58	14.6572	30	239.97	0.084	5
	11701	17:00:00	14.6572	0	240.00	0.084	5
	11716	17:00:30	14.6565	30	240.50	0.085	5
	11717	17:00:32	14.6579	0	240.53	0.084	5
	11732	17:01:02	14.6579	30	241.03	0.084	5
	11733	17:01:04	14.6572	0	241.07	0.084	5
	11748	17:01:34	14.6572	30	241.57	0.084	5
	11749	17:01:36	14.6565	0	241.60	0.085	5
	11764	17:02:06	14.6572	30	242.10	0.084	5
	11765	17:02:08	14.6579	0	242.13	0.084	5
	11780	17:02:38	14.6572	30	242.63	0.084	5
x	11781	17:02:40	14.6565	0	242.67	0.085	5



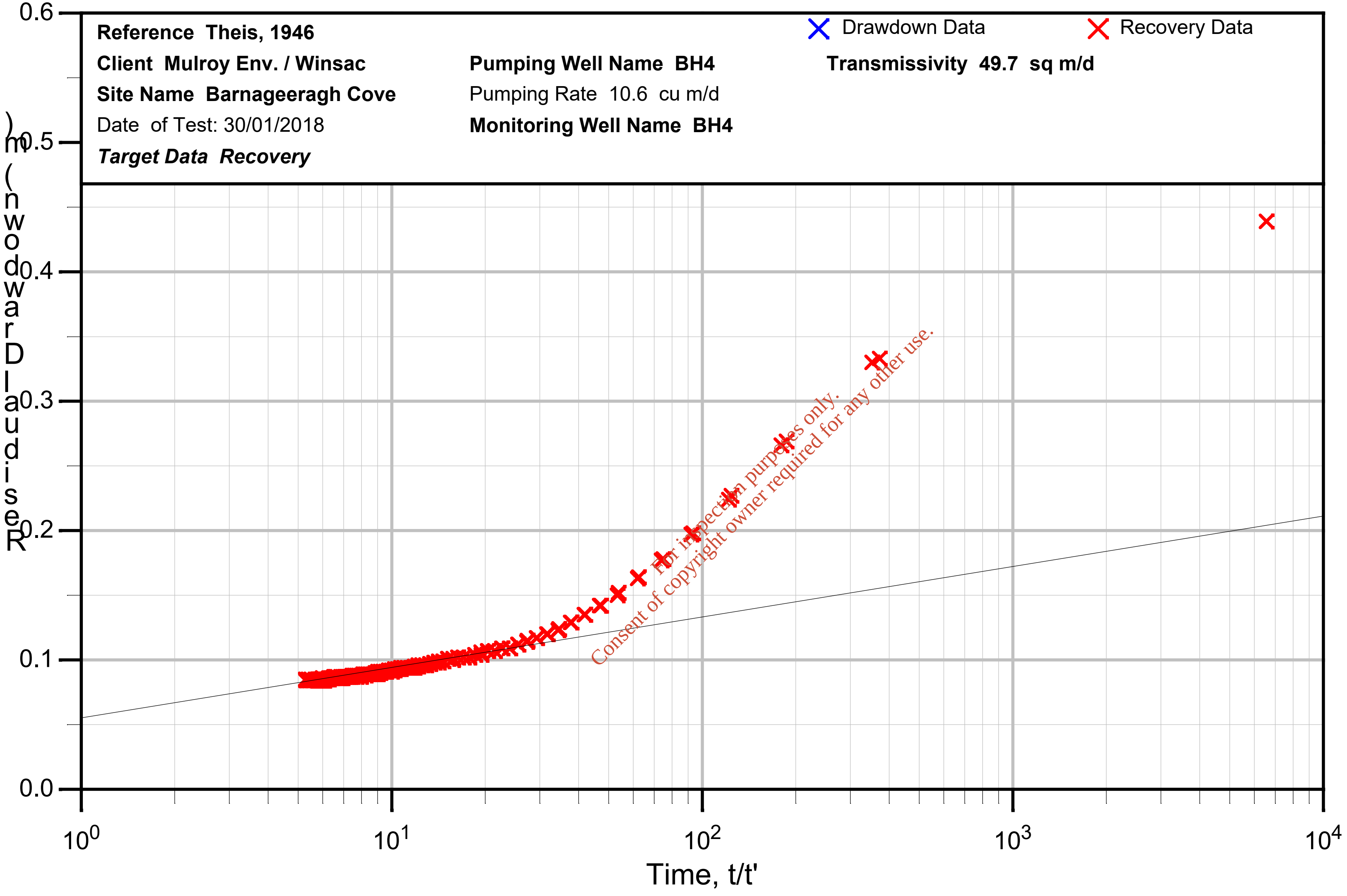
1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

BH4 Short Pumping Test - BH4 Data Analysis



1114 Barnageeragh Cove
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Hidrigeolaíocht Uí Chonaire Teoranta

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
1	0.25	0.002	×
2	0.5	0.002	×
3	0.75	0.001	×
4	1	0	×
5	1.25	-0.001	×
6	1.5	0.004	×
7	1.75	0.004	×
8	2	0	×
9	2.25	0	×
10	2.5	0.003	×
11	2.75	0.002	×
12	3	0.002	×
13	3.25	0.002	×
14	3.5	0.003	×
15	3.75	0.001	×
16	4	0.001	×
17	4.25	0.001	×
18	4.5	0.003	×
19	4.75	0.002	×
20	5	0.001	×
21	5.25	0	×
22	5.5	0.004	×
23	5.75	0.001	×
24	6	0.004	×
25	6.25	0.003	×
26	6.5	0.002	×
27	6.75	0.004	×
28	7	0.004	×
29	7.25	0.003	×
30	7.5	0.003	×
31	7.75	0.004	×
32	8	0.003	×
33	8.25	0.001	×
34	8.5	0.005	×
35	8.75	0.003	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
36	9	0	×
37	9.25	0.004	×
38	9.5	0	×
39	9.75	0.004	×
40	10	0	×
41	10.25	0.003	×
42	10.5	0.004	×
43	10.75	0.004	×
44	11	0.004	×
45	11.25	0.004	×
46	11.5	0.008	×
47	11.75	0.01	×
48	12	0.005	×
49	12.25	0.006	×
50	12.5	0.006	×
51	12.75	0.006	×
52	13	0.008	×
53	13.25	0.008	×
54	13.5	0.005	×
55	13.75	0.006	×
56	14	0.008	×
57	14.25	0.006	×
58	14.5	0.007	×
59	14.75	0.005	×
60	15	0.006	×
61	15.25	0.005	×
62	15.5	0.006	×
63	15.75	0.006	×
64	16	0.004	×
65	16.25	0.006	×
66	16.5	0.004	×
67	16.75	-0.001	×
68	17	0.004	×
69	17.25	0.004	×
70	17.5	0.004	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
71	17.75	0.004	×
72	18	0.006	×
73	18.25	0.005	×
74	18.5	0.006	×
75	18.75	0.004	×
76	19	0.006	×
77	19.25	0.007	×
78	19.5	0.004	×
79	19.75	0.005	×
80	20	0.006	×
81	20.25	0.008	×
82	20.5	0.004	×
83	20.75	-0.001	×
84	21	0.007	×
85	21.25	0.005	×
86	21.5	0.007	×
87	21.75	0.005	×
88	22	0.01	×
89	22.25	0.007	×
90	22.5	0.007	×
91	22.75	0.005	×
92	23	0.004	×
93	23.25	0.004	×
94	23.5	0.006	×
95	23.75	0.009	×
96	24	0.008	×
97	24.25	0.009	×
98	24.5	0.005	×
99	24.75	0.004	×
100	25	0.007	×
101	25.25	0.009	×
102	25.5	0.01	×
103	25.75	0.01	×
104	26	0.009	×
105	26.25	0.01	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
106	26.5	0.006	×
107	26.75	0.005	×
108	27	0.005	×
109	27.25	0.009	×
110	27.5	0.011	×
111	27.75	0.008	×
112	28	0.008	×
113	28.25	0.008	×
114	28.5	0.009	×
115	28.75	0.009	×
116	29	0.008	×
117	29.25	0.01	×
118	29.5	0.012	×
119	29.75	0.008	×
120	30	0.008	×
121	30.25	0.009	×
122	30.5	0.01	×
123	30.75	0.009	×
124	31	0.007	×
125	31.25	0.01	×
126	31.5	0.008	×
127	31.75	0.007	×
128	32	0.005	×
129	32.25	0.01	×
130	32.5	0.011	×
131	32.75	0.008	×
132	33	0.011	×
133	33.25	0.011	×
134	33.5	0.012	×
135	33.75	0.011	×
136	34	0.01	×
137	34.25	0.011	×
138	34.5	0.009	×
139	34.75	0.011	×
140	35	0.011	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
141	35.25	0.012	×
142	35.5	0.012	×
143	35.75	0.04	×
144	36	0.015	×
145	36.25	0.015	×
146	36.5	0.012	×
147	36.75	0.013	×
148	37	0.014	×
149	37.25	0.013	×
150	37.5	0.014	×
151	37.75	0.013	×
152	38	0.012	×
153	38.25	0.015	×
154	38.5	0.012	×
155	38.75	0.011	×
156	39	0.014	×
157	39.25	0.011	×
158	39.5	0.015	×
159	39.75	0.013	×
160	40	0.011	×
161	40.25	0.012	×
162	40.5	0.012	×
163	40.75	0.013	×
164	41	0.015	×
165	41.25	0.014	×
166	41.5	0.011	×
167	41.75	0.013	×
168	42	0.014	×
169	42.25	0.011	×
170	42.5	0.014	×
171	42.75	0.012	×
172	43	0.013	×
173	43.25	0.013	×
174	43.5	0.013	×
175	43.75	0.015	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
176	44	0.012	×
177	44.25	0.012	×
178	44.5	0.01	×
179	44.75	0.016	×
180	45	0.013	×
181	45.25	0.013	×
182	45.5	0.012	×
183	45.75	0.013	×
184	46	0.015	×
185	46.25	0.012	×
186	46.5	0.014	×
187	46.75	0.014	×
188	47	0.015	×
189	47.25	0.013	×
190	47.5	0.014	×
191	47.75	0.012	×
192	48	0.014	×
193	48.25	0.014	×
194	48.5	0.012	×
195	48.75	0.011	×
196	49	0.014	×
197	49.25	0.015	×
198	49.5	0.016	×
199	49.75	0.015	×
200	50	0.015	×
201	50.25	0.015	×
202	50.5	0.014	×
203	50.75	0.016	×
204	51	0.016	×
205	51.25	0.016	×
206	51.5	0.012	×
207	51.75	0.017	×
208	52	0.017	×
209	52.25	0.018	×
210	52.5	0.016	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
211	52.75	0.016	×
212	53	0.017	×
213	53.25	0.018	×
214	53.5	0.014	×
215	53.75	0.016	×
216	54	0.018	×
217	54.25	0.014	×
218	54.5	0.019	×
219	54.75	0.019	×
220	55	0.018	×
221	55.25	0.017	×
222	55.5	0.014	×
223	55.75	0.015	×
224	56	0.017	×
225	56.25	0.014	×
226	56.5	0.018	×
227	56.75	0.017	×
228	57	0.018	×
229	57.25	0.017	×
230	57.5	0.018	×
231	57.75	0.019	×
232	58	0.017	×
233	58.25	0.019	×
234	58.5	0.017	×
235	58.75	0.018	×
236	59	0.02	×
237	59.25	0.019	×
238	59.5	0.019	×
239	59.75	0.018	×
240	60	0.018	×
241	60.25	0.017	×
242	60.5	0.019	×
243	60.75	0.017	×
244	61	0.019	×
245	61.25	0.02	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
246	61.5	0.019	×
247	61.75	0.018	×
248	62	0.022	×
249	62.25	0.019	×
250	62.5	0.019	×
251	62.75	0.021	×
252	63	0.017	×
253	63.25	0.019	×
254	63.5	0.019	×
255	63.75	0.019	×
256	64	0.02	×
257	64.25	0.018	×
258	64.5	0.021	×
259	64.75	0.021	×
260	65	0.021	×
261	65.25	0.018	×
262	65.5	0.02	×
263	65.75	0.021	×
264	66	0.02	×
265	66.25	0.019	×
266	66.5	0.022	×
267	66.75	0.023	×
268	67	0.025	×
269	67.25	0.023	×
270	67.5	0.023	×
271	67.75	0.024	×
272	68	0.022	×
273	68.25	0.021	×
274	68.5	0.023	×
275	68.75	0.021	×
276	69	0.024	×
277	69.25	0.022	×
278	69.5	0.022	×
279	69.75	0.024	×
280	70	0.023	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
281	70.25	0.025	×
282	70.5	0.023	×
283	70.75	0.022	×
284	71	0.025	×
285	71.25	0.024	×
286	71.5	0.024	×
287	71.75	0.024	×
288	72	0.023	×
289	72.25	0.021	×
290	72.5	0.018	×
291	72.75	0.025	×
292	73	0.026	×
293	73.25	0.025	×
294	73.5	0.026	×
295	73.75	0.027	×
296	74	0.025	×
297	74.25	0.026	×
298	74.5	0.026	×
299	74.75	0.025	×
300	75	0.026	×
301	75.25	0.026	×
302	75.5	0.026	×
303	75.75	0.027	×
304	76	0.026	×
305	76.25	0.027	×
306	76.5	0.021	×
307	76.75	0.019	×
308	77	0.021	×
309	77.25	0.027	×
310	77.5	0.024	×
311	77.75	0.026	×
312	78	0.028	×
313	78.25	0.028	×
314	78.5	0.026	×
315	78.75	0.028	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
316	79	0.026	×
317	79.25	0.029	×
318	79.5	0.029	×
319	79.75	0.027	×
320	80	0.026	×
321	80.25	0.029	×
322	80.5	0.031	×
323	80.75	0.03	×
324	81	0.029	×
325	81.25	0.028	×
326	81.5	0.028	×
327	81.75	0.029	×
328	82	0.029	×
329	82.25	0.029	×
330	82.5	0.028	×
331	82.75	0.028	×
332	83	0.029	×
333	83.25	0.03	×
334	83.5	0.029	×
335	83.75	0.03	×
336	84	0.028	×
337	84.25	0.027	×
338	84.5	0.028	×
339	84.75	0.033	×
340	85	0.028	×
341	85.25	0.029	×
342	85.5	0.027	×
343	85.75	0.031	×
344	86	0.032	×
345	86.25	0.031	×
346	86.5	0.03	×
347	86.75	0.029	×
348	87	0.027	×
349	87.25	0.031	×
350	87.5	0.03	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
351	87.75	0.031	×
352	88	0.03	×
353	88.25	0.034	×
354	88.5	0.032	×
355	88.75	0.03	×
356	89	0.031	×
357	89.25	0.032	×
358	89.5	0.031	×
359	89.75	0.03	×
360	90	0.032	×
361	90.25	0.034	×
362	90.5	0.029	×
363	90.75	0.026	×
364	91	0.028	×
365	91.25	0.034	×
366	91.5	0.034	×
367	91.75	0.034	×
368	92	0.032	×
369	92.25	0.031	×
370	92.5	0.032	×
371	92.75	0.032	×
372	93	0.032	×
373	93.25	0.032	×
374	93.5	0.031	×
375	93.75	0.035	×
376	94	0.032	×
377	94.25	0.033	×
378	94.5	0.035	×
379	94.75	0.033	×
380	95	0.033	×
381	95.25	0.033	×
382	95.5	0.034	×
383	95.75	0.032	×
384	96	0.036	×
385	96.25	0.036	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
386	96.5	0.036	×
387	96.75	0.035	×
388	97	0.034	×
389	97.25	0.034	×
390	97.5	0.033	×
391	97.75	0.035	×
392	98	0.038	×
393	98.25	0.037	×
394	98.5	0.034	×
395	98.75	0.038	×
396	99	0.037	×
397	99.25	0.032	×
398	99.5	0.037	×
399	99.75	0.035	×
400	100	0.037	×
401	100.25	0.035	×
402	100.5	0.035	×
403	100.75	0.035	×
404	101	0.038	×
405	101.25	0.036	×
406	101.5	0.036	×
407	101.75	0.037	×
408	102	0.037	×
409	102.25	0.037	×
410	102.5	0.038	×
411	102.75	0.035	×
412	103	0.038	×
413	103.25	0.038	×
414	103.5	0.038	×
415	103.75	0.037	×
416	104	0.039	×
417	104.25	0.038	×
418	104.5	0.038	×
419	104.75	0.037	×
420	105	0.037	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
421	105.25	0.031	×
422	105.5	0.037	×
423	105.75	0.037	×
424	106	0.035	×
425	106.25	0.039	×
426	106.5	0.036	×
427	106.75	0.036	×
428	107	0.039	×
429	107.25	0.037	×
430	107.5	0.035	×
431	107.75	0.038	×
432	108	0.037	×
433	108.25	0.037	×
434	108.5	0.039	×
435	108.75	0.037	×
436	109	0.039	×
437	109.25	0.038	×
438	109.5	0.039	×
439	109.75	0.04	×
440	110	0.037	×
441	110.25	0.039	×
442	110.5	0.039	×
443	110.75	0.04	×
444	111	0.032	×
445	111.25	0.039	×
446	111.5	0.042	×
447	111.75	0.041	×
448	112	0.039	×
449	112.25	0.04	×
450	112.5	0.039	×
451	112.75	0.041	×
452	113	0.039	×
453	113.25	0.037	×
454	113.5	0.038	×
455	113.75	0.041	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
456	114	0.039	×
457	114.25	0.04	×
458	114.5	0.038	×
459	114.75	0.04	×
460	115	0.038	×
461	115.25	0.04	×
462	115.5	0.041	×
463	115.75	0.04	×
464	116	0.039	×
465	116.25	0.041	×
466	116.5	0.039	×
467	116.75	0.038	×
468	117	0.041	×
469	117.25	0.042	×
470	117.5	0.037	×
471	117.75	0.041	×
472	118	0.042	×
473	118.25	0.041	×
474	118.5	0.04	×
475	118.75	0.041	×
476	119	0.042	×
477	119.25	0.042	×
478	119.5	0.039	×
479	119.75	0.042	×
480	120	0.043	×
481	120.25	0.041	×
482	120.5	0.039	×
483	120.75	0.042	×
484	121	0.044	×
485	121.25	0.043	×
486	121.5	0.043	×
487	121.75	0.041	×
488	122	0.043	×
489	122.25	0.042	×
490	122.5	0.044	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
491	122.75	0.041	×
492	123	0.043	×
493	123.25	0.044	×
494	123.5	0.042	×
495	123.75	0.042	×
496	124	0.043	×
497	124.25	0.042	×
498	124.5	0.04	×
499	124.75	0.042	×
500	125	0.041	×
501	125.25	0.042	×
502	125.5	0.043	×
503	125.75	0.045	×
504	126	0.043	×
505	126.25	0.045	×
506	126.5	0.043	×
507	126.75	0.041	×
508	127	0.042	×
509	127.25	0.044	×
510	127.5	0.042	×
511	127.75	0.045	×
512	128	0.044	×
513	128.25	0.044	×
514	128.5	0.044	×
515	128.75	0.046	×
516	129	0.044	×
517	129.25	0.042	×
518	129.5	0.046	×
519	129.75	0.044	×
520	130	0.044	×
521	130.25	0.045	×
522	130.5	0.046	×
523	130.75	0.047	×
524	131	0.046	×
525	131.25	0.045	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
526	131.5	0.045	×
527	131.75	0.046	×
528	132	0.045	×
529	132.25	0.044	×
530	132.5	0.045	×
531	132.75	0.046	×
532	133	0.043	×
533	133.25	0.045	×
534	133.5	0.045	×
535	133.75	0.043	×
536	134	0.049	×
537	134.25	0.047	×
538	134.5	0.049	×
539	134.75	0.045	×
540	135	0.045	×
541	135.25	0.043	×
542	135.5	0.042	×
543	135.75	0.046	×
544	136	0.047	×
545	136.25	0.045	×
546	136.5	0.045	×
547	136.75	0.045	×
548	137	0.045	×
549	137.25	0.045	×
550	137.5	0.045	×
551	137.75	0.047	×
552	138	0.048	×
553	138.25	0.046	×
554	138.5	0.045	×
555	138.75	0.049	×
556	139	0.047	×
557	139.25	0.047	×
558	139.5	0.049	×
559	139.75	0.046	×
560	140	0.047	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
561	140.25	0.048	×
562	140.5	0.049	×
563	140.75	0.048	×
564	141	0.048	×
565	141.25	0.05	×
566	141.5	0.05	×
567	141.75	0.05	×
568	142	0.046	×
569	142.25	0.049	×
570	142.5	0.047	×
571	142.75	0.048	×
572	143	0.05	×
573	143.25	0.047	×
574	143.5	0.048	×
575	143.75	0.049	×
576	144	0.049	×
577	144.25	0.05	×
578	144.5	0.051	×
579	144.75	0.048	×
580	145	0.05	×
581	145.25	0.048	×
582	145.5	0.046	×
583	145.75	0.051	×
584	146	0.048	×
585	146.25	0.05	×
586	146.5	0.047	×
587	146.75	0.051	×
588	147	0.053	×
589	147.25	0.049	×
590	147.5	0.049	×
591	147.75	0.054	×
592	148	0.051	×
593	148.25	0.051	×
594	148.5	0.052	×
595	148.75	0.05	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
596	149	0.052	×
597	149.25	0.05	×
598	149.5	0.053	×
599	149.75	0.049	×
600	150	0.052	×
601	150.25	0.052	×
602	150.5	0.05	×
603	150.75	0.051	×
604	151	0.048	×
605	151.25	0.049	×
606	151.5	0.054	×
607	151.75	0.049	×
608	152	0.051	×
609	152.25	0.052	×
610	152.5	0.053	×
611	152.75	0.052	×
612	153	0.053	×
613	153.25	0.051	×
614	153.5	0.051	×
615	153.75	0.052	×
616	154	0.05	×
617	154.25	0.052	×
618	154.5	0.052	×
619	154.75	0.046	×
620	155	0.05	×
621	155.25	0.053	×
622	155.5	0.051	×
623	155.75	0.054	×
624	156	0.053	×
625	156.25	0.056	×
626	156.5	0.053	×
627	156.75	0.056	×
628	157	0.053	×
629	157.25	0.054	×
630	157.5	0.051	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
631	157.75	0.052	×
632	158	0.051	×
633	158.25	0.052	×
634	158.5	0.054	×
635	158.75	0.053	×
636	159	0.055	×
637	159.25	0.054	×
638	159.5	0.053	×
639	159.75	0.054	×
640	160	0.053	×
641	160.25	0.055	×
642	160.5	0.053	×
643	160.75	0.052	×
644	161	0.053	×
645	161.25	0.052	×
646	161.5	0.053	×
647	161.75	0.051	×
648	162	0.052	×
649	162.25	0.055	×
650	162.5	0.051	×
651	162.75	0.052	×
652	163	0.053	×
653	163.25	0.054	×
654	163.5	0.052	×
655	163.75	0.057	×
656	164	0.054	×
657	164.25	0.054	×
658	164.5	0.052	×
659	164.75	0.055	×
660	165	0.054	×
661	165.25	0.055	×
662	165.5	0.057	×
663	165.75	0.056	×
664	166	0.056	×
665	166.25	0.057	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
666	166.5	0.055	×
667	166.75	0.056	×
668	167	0.055	×
669	167.25	0.056	×
670	167.5	0.055	×
671	167.75	0.057	×
672	168	0.055	×
673	168.25	0.054	×
674	168.5	0.056	×
675	168.75	0.056	×
676	169	0.054	×
677	169.25	0.056	×
678	169.5	0.057	×
679	169.75	0.057	×
680	170	0.057	×
681	170.25	0.056	×
682	170.5	0.057	×
683	170.75	0.054	×
684	171	0.059	×
685	171.25	0.057	×
686	171.5	0.058	×
687	171.75	0.056	×
688	172	0.058	×
689	172.25	0.059	×
690	172.5	0.057	×
691	172.75	0.059	×
692	173	0.058	×
693	173.25	0.057	×
694	173.5	0.059	×
695	173.75	0.058	×
696	174	0.059	×
697	174.25	0.059	×
698	174.5	0.058	×
699	174.75	0.059	×
700	175	0.059	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
701	175.25	0.057	×
702	175.5	0.06	×
703	175.75	0.059	×
704	176	0.058	×
705	176.25	0.06	×
706	176.5	0.059	×
707	176.75	0.058	×
708	177	0.06	×
709	177.25	0.059	×
710	177.5	0.059	×
711	177.75	0.057	×
712	178	0.058	×
713	178.25	0.061	×
714	178.5	0.058	×
715	178.75	0.062	×
716	179	0.06	×
717	179.25	0.061	×
718	179.5	0.058	×
719	179.75	0.059	×
720	180	0.059	×
721	180.25	0.058	×
722	180.5	0.049	×
723	180.75	0.06	×
724	181	0.06	×
725	181.25	0.057	×
726	181.5	0.061	×
727	181.75	0.061	×
728	182	0.059	×
729	182.25	0.062	×
730	182.5	0.061	×
731	182.75	0.061	×
732	183	0.058	×
733	183.25	0.061	×
734	183.5	0.059	×
735	183.75	0.062	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
736	184	0.06	×
737	184.25	0.061	×
738	184.5	0.06	×
739	184.75	0.062	×
740	185	0.062	×
741	185.25	0.059	×
742	185.5	0.062	×
743	185.75	0.059	×
744	186	0.06	×
745	186.25	0.06	×
746	186.5	0.061	×
747	186.75	0.062	×
748	187	0.061	×
749	187.25	0.064	×
750	187.5	0.062	×
751	187.75	0.065	×
752	188	0.063	×
753	188.25	0.062	×
754	188.5	0.059	×
755	188.75	0.061	×
756	189	0.063	×
757	189.25	0.06	×
758	189.5	0.061	×
759	189.75	0.061	×
760	190	0.062	×
761	190.25	0.062	×
762	190.5	0.064	×
763	190.75	0.06	×
764	191	0.064	×
765	191.25	0.064	×
766	191.5	0.063	×
767	191.75	0.063	×
768	192	0.061	×
769	192.25	0.065	×
770	192.5	0.061	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
771	192.75	0.064	×
772	193	0.062	×
773	193.25	0.062	×
774	193.5	0.063	×
775	193.75	0.062	×
776	194	0.065	×
777	194.25	0.063	×
778	194.5	0.064	×
779	194.75	0.063	×
780	195	0.065	×
781	195.25	0.063	×
782	195.5	0.064	×
783	195.75	0.063	×
784	196	0.065	×
785	196.25	0.064	×
786	196.5	0.064	×
787	196.75	0.066	×
788	197	0.062	×
789	197.25	0.067	×
790	197.5	0.066	×
791	197.75	0.065	×
792	198	0.064	×
793	198.25	0.065	×
794	198.5	0.065	×
795	198.75	0.065	×
796	199	0.064	×
797	199.25	0.064	×
798	199.5	0.064	×
799	199.75	0.066	×
800	200	0.065	×
801	200.25	0.067	×
802	200.5	0.065	×
803	200.75	0.066	×
804	201	0.069	×
805	201.25	0.066	×

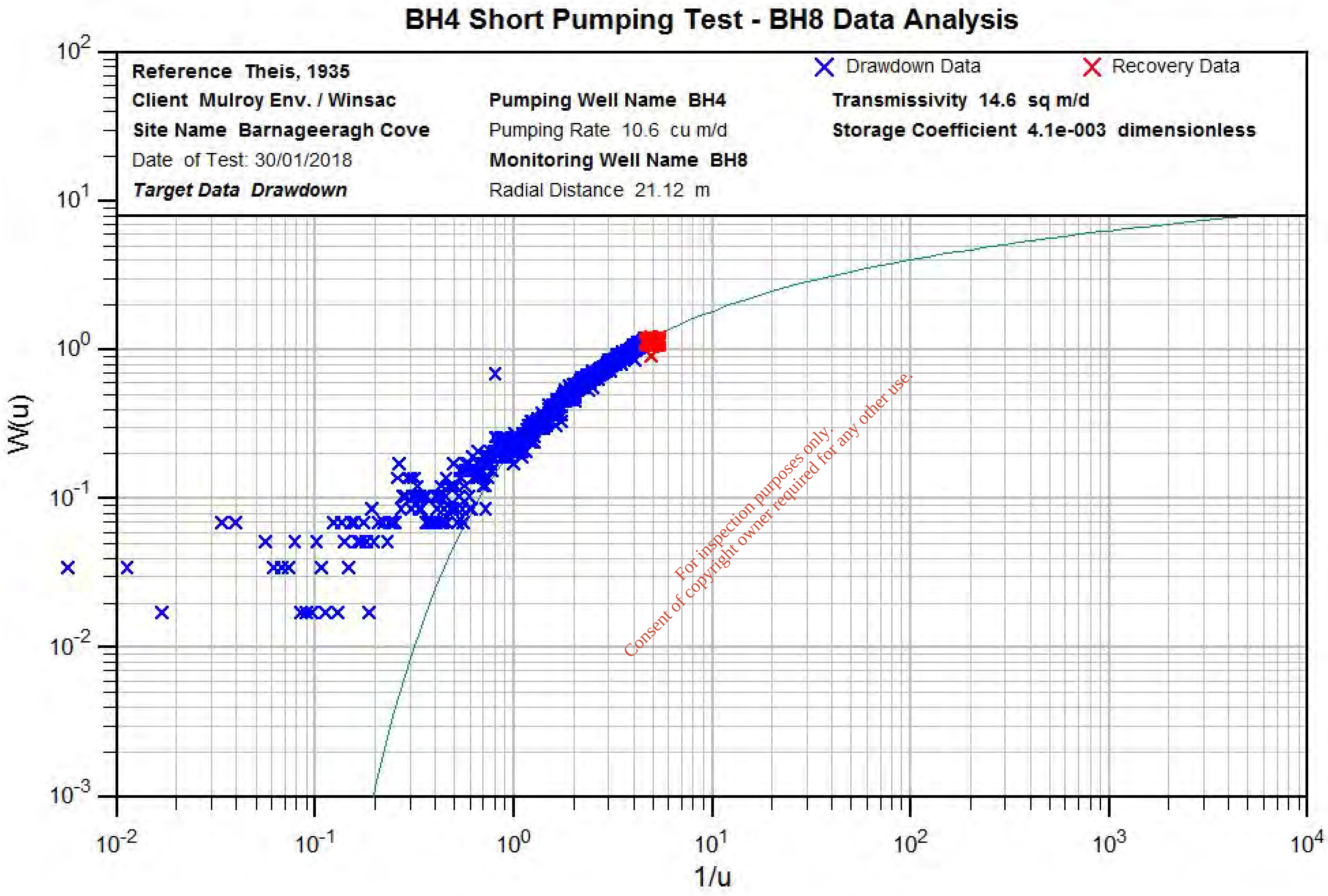
	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
806	201.5	0.064	×
807	201.75	0.066	×
808	202	0.066	×
809	202.25	0.062	×
810	202.5	0.067	×
811	202.75	0.067	×
812	203	0.068	×
813	203.25	0.069	×
814	203.5	0.067	×
815	203.75	0.068	×
816	204	0.065	×
817	204.25	0.068	×
818	204.5	0.066	×
819	204.75	0.066	×
820	205	0.068	×
821	205.25	0.067	×
822	205.5	0.066	×
823	205.75	0.068	×
824	206	0.066	×
825	206.25	0.067	×
826	206.5	0.068	×
827	206.75	0.067	×
828	207	0.066	×
829	207.25	0.067	×
830	207.5	0.069	×
831	207.75	0.069	×
832	208	0.067	×
833	208.25	0.066	×
834	208.5	0.067	×
835	208.75	0.064	×
836	209	0.068	×
837	209.25	0.062	×
838	209.5	0.065	×
839	209.75	0.066	×
840	210	0.066	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
841	210.25	0.065	✕
842	210.5	0.066	✕
843	210.75	0.068	✕
844	211	0.068	✕
845	211.25	0.066	✕
846	211.5	0.068	✕
847	211.75	0.067	✕
848	212	0.065	✕
849	212.25	0.067	✕
850	212.5	0.065	✕
851	212.75	0.064	✕
852	213	0.067	✕
853	213.25	0.065	✕
854	213.5	0.064	✕
855	213.75	0.067	✕
856	214	0.068	✕
857	214.25	0.066	✕
858	214.5	0.068	✕
859	214.75	0.067	✕
860	215	0.068	✕
861	215.25	0.067	✕
862	215.5	0.065	✕
863	215.75	0.069	✕
864	216	0.064	✕
865	216.25	0.066	✕
866	216.5	0.067	✕
867	216.75	0.068	✕
868	217	0.067	✕
869	217.25	0.066	✕
870	217.5	0.053	✕
871	217.75	0.069	✕
872	218	0.069	✕
873	218.25	0.069	✕
874	218.5	0.068	✕
875	218.75	0.068	✕

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
876	219	0.069	✕
877	219.25	0.068	✕
878	219.5	0.071	✕
879	219.75	0.068	✕
880	220	0.067	✕
881	220.25	0.069	✕
882	220.5	0.067	✕
883	220.75	0.065	✕
884	221	0.067	✕
885	221.25	0.068	✕
886	221.5	0.067	✕
887	221.75	0.068	✕
888	222	0.066	✕
889	222.25	0.069	✕
890	222.5	0.068	✕
891	222.75	0.068	✕
892	223	0.061	✕
893	223.25	0.068	✕
894	223.5	0.065	✕
895	223.75	0.068	✕
896	224	0.066	✕
897	224.25	0.066	✕
898	224.5	0.066	✕
899	224.75	0.068	✕
900	225	0.068	✕
901	225.25	0.068	✕
902	225.5	0.068	✕
903	225.75	0.067	✕
904	226	0.07	✕
905	226.25	0.068	✕
906	226.5	0.068	✕
907	226.75	0.068	✕
908	227	0.069	✕
909	227.25	0.07	✕
910	227.5	0.064	✕

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
911	227.75	0.069	×
912	228	0.069	×
913	228.25	0.066	×
914	228.5	0.065	×
915	228.75	0.064	×
916	229	0.065	×
917	229.25	0.067	×
918	229.5	0.068	×
919	229.75	0.065	×
920	230	0.064	×
921	230.25	0.065	×
922	230.5	0.062	×
923	230.75	0.066	×
924	231	0.067	×
925	231.25	0.065	×
926	231.5	0.067	×
927	231.75	0.068	×
928	232	0.069	×
929	232.25	0.068	×
930	232.5	0.068	×
931	232.75	0.066	×
932	233	0.069	×
933	233.25	0.066	×
934	233.5	0.068	×
935	233.75	0.068	×
936	234	0.068	×
937	234.25	0.069	×
938	234.5	0.066	×
939	234.75	0.067	×
940	235	0.066	×
941	235.25	0.064	×
942	235.5	0.067	×
943	235.75	0.066	×
944	236	0.066	×
945	236.25	0.067	×

	Time (min)	BH4 Abstraction, Drawdown in BH8 (m)	Symbol
946	236.5	0.065	✕
947	236.75	0.064	✕
948	237	0.066	✕
949	237.25	0.067	✕
950	237.5	0.063	✕
951	237.75	0.066	✕
952	238	0.062	✕
953	238.25	0.067	✕
954	238.5	0.067	✕
955	238.75	0.066	✕
956	239	0.068	✕
957	239.25	0.068	✕
958	239.5	0.066	✕
959	239.75	0.067	✕
960	240	0.069	✕
961	240.25	0.068	✕
962	240.5	0.071	✕
963	240.75	0.07	✕
964	241	0.069	✕
965	241.25	0.07	✕
966	241.5	0.069	✕
967	241.75	0.069	✕
968	242	0.068	✕
969	242.25	0.068	✕
970	242.5	0.064	✕



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	Time (min)	BH4 Abstraction, Drawdown in BH9 (m)	Symbol
1	1	-0.003	×
2	2	-0.002	×
3	3	-0.011	×
4	4	-0.009	×
5	5	-0.003	×
6	6	-0.009	×
7	7	0.001	×
8	8	-0.004	×
9	9	-0.003	×
10	10	-0.002	×
11	11	-0.005	×
12	12	-0.006	×
13	13	-0.003	×
14	14	-0.004	×
15	15	-0.003	×
16	16	-0.004	×
17	17	-0.004	×
18	18	-0.003	×
19	19	-0.003	×
20	20	-0.005	×
21	21	-0.004	×
22	22	-0.003	×
23	23	-0.004	×
24	24	-0.004	×
25	25	-0.005	×
26	26	-0.004	×
27	27	-0.003	×
28	28	-0.004	×
29	29	-0.004	×
30	30	-0.003	×
31	31	-0.003	×
32	32	-0.001	×
33	33	-0.003	×
34	34	-0.003	×
35	35	-0.002	×

	Time (min)	BH4 Abstraction, Drawdown in BH9 (m)	Symbol
36	36	-0.002	×
37	37	0	×
38	38	-0.001	×
39	39	-0.001	×
40	40	-0.001	×
41	41	0	×
42	42	0.002	×
43	43	0.001	×
44	44	0.001	×
45	45	0.001	×
46	46	0.003	×
47	47	0.001	×
48	48	-0.001	×
49	49	0	×
50	50	0.001	×
51	51	0.002	×
52	52	0.001	×
53	53	0.001	×
54	54	0.002	×
55	55	0	×
56	56	0.002	×
57	57	0.001	×
58	58	0.001	×
59	59	0.001	×
60	60	0.003	×
61	61	0.002	×
62	62	0.002	×
63	63	0.003	×
64	64	0.003	×
65	65	0.003	×
66	66	0.003	×
67	67	0.003	×
68	68	0.002	×
69	69	0.004	×
70	70	0.004	×

	Time (min)	BH4 Abstraction, Drawdown in BH9 (m)	Symbol
71	71	0.004	×
72	72	0.005	×
73	73	0.006	×
74	74	0.006	×
75	75	0.006	×
76	76	0.006	×
77	77	0.006	×
78	78	0.006	×
79	79	0.007	×
80	80	0.008	×
81	81	0.009	×
82	82	0.01	×
83	83	0.009	×
84	84	0.009	×
85	85	0.008	×
86	86	0.009	×
87	87	0.009	×
88	88	0.009	×
89	89	0.009	×
90	90	0.01	×
91	91	0.01	×
92	92	0.018	×
93	93	0.01	×
94	94	0.011	×
95	95	0.011	×
96	96	0.012	×
97	97	0.009	×
98	98	0.011	×
99	99	0.011	×
100	100	0.012	×
101	101	0.012	×
102	102	0.012	×
103	103	0.012	×
104	104	0.012	×
105	105	0.012	×

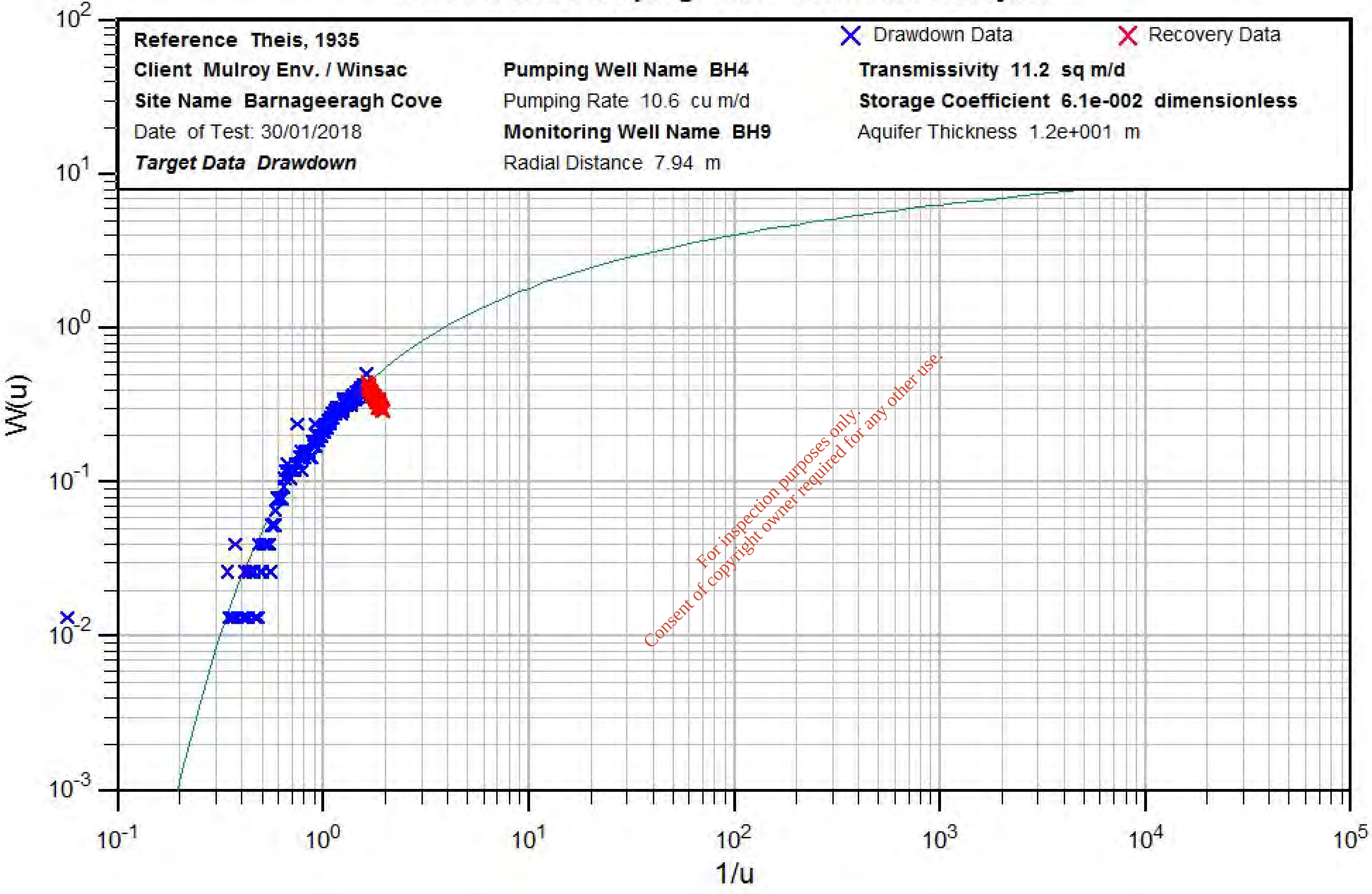
	Time (min)	BH4 Abstraction, Drawdown in BH9 (m)	Symbol
106	106	0.011	×
107	107	0.011	×
108	108	0.011	×
109	109	0.014	×
110	110	0.014	×
111	111	0.013	×
112	112	0.018	×
113	113	0.013	×
114	114	0.014	×
115	115	0.015	×
116	116	0.015	×
117	117	0.014	×
118	118	0.015	×
119	119	0.015	×
120	120	0.015	×
121	121	0.015	×
122	122	0.016	×
123	123	0.017	×
124	124	0.016	×
125	125	0.017	×
126	126	0.018	×
127	127	0.018	×
128	128	0.018	×
129	129	0.017	×
130	130	0.019	×
131	131	0.019	×
132	132	0.018	×
133	133	0.019	×
134	134	0.02	×
135	135	0.02	×
136	136	0.021	×
137	137	0.02	×
138	138	0.02	×
139	139	0.021	×
140	140	0.022	×

	Time (min)	BH4 Abstraction, Drawdown in BH9 (m)	Symbol
141	141	0.021	×
142	142	0.023	×
143	143	0.022	×
144	144	0.022	×
145	145	0.022	×
146	146	0.022	×
147	147	0.023	×
148	148	0.023	×
149	149	0.023	×
150	150	0.023	×
151	151	0.021	×
152	152	0.022	×
153	153	0.023	×
154	154	0.026	×
155	155	0.025	×
156	156	0.024	×
157	157	0.025	×
158	158	0.025	×
159	159	0.024	×
160	160	0.026	×
161	161	0.024	×
162	162	0.026	×
163	163	0.026	×
164	164	0.025	×
165	165	0.025	×
166	166	0.026	×
167	167	0.024	×
168	168	0.025	×
169	169	0.026	×
170	170	0.027	×
171	171	0.026	×
172	172	0.027	×
173	173	0.027	×
174	174	0.028	×
175	175	0.027	×

	Time (min)	BH4 Abstraction, Drawdown in BH9 (m)	Symbol
176	176	0.027	×
177	177	0.027	×
178	178	0.027	×
179	179	0.029	×
180	180	0.027	×
181	181	0.029	×
182	182	0.029	×
183	183	0.029	×
184	184	0.03	×
185	185	0.03	×
186	186	0.03	×
187	187	0.031	×
188	188	0.03	×
189	189	0.03	×
190	190	0.031	×
191	191	0.031	×
192	192	0.031	×
193	193	0.031	×
194	194	0.032	×
195	195	0.031	×
196	196	0.032	×
197	197	0.032	×
198	198	0.032	×
199	199	0.026	×
200	200	0.038	×
201	201	0.034	×
202	202	0.033	×
203	203	0.03	×
204	204	0.032	×
205	205	0.032	×
206	206	0.031	×
207	207	0.031	×
208	208	0.029	×
209	209	0.029	×
210	210	0.03	×

	Time (min)	BH4 Abstraction, Drawdown in BH9 (m)	Symbol
211	211	0.029	✕
212	212	0.029	✕
213	213	0.027	✕
214	214	0.027	✕
215	215	0.027	✕
216	216	0.027	✕
217	217	0.027	✕
218	218	0.028	✕
219	219	0.027	✕
220	220	0.026	✕
221	221	0.025	✕
222	222	0.026	✕
223	223	0.026	✕
224	224	0.025	✕
225	225	0.023	✕
226	226	0.025	✕
227	227	0.025	✕
228	228	0.025	✕
229	229	0.026	✕
230	230	0.025	✕
231	231	0.024	✕
232	232	0.025	✕
233	233	0.023	✕
234	234	0.024	✕
235	235	0.024	✕
236	236	0.023	✕
237	237	0.023	✕
238	238	0.022	✕
239	239	0.022	✕
240	240	0.022	✕
241	241	0.022	✕

BH4 Short Pumping Test - BH9 Data Analysis



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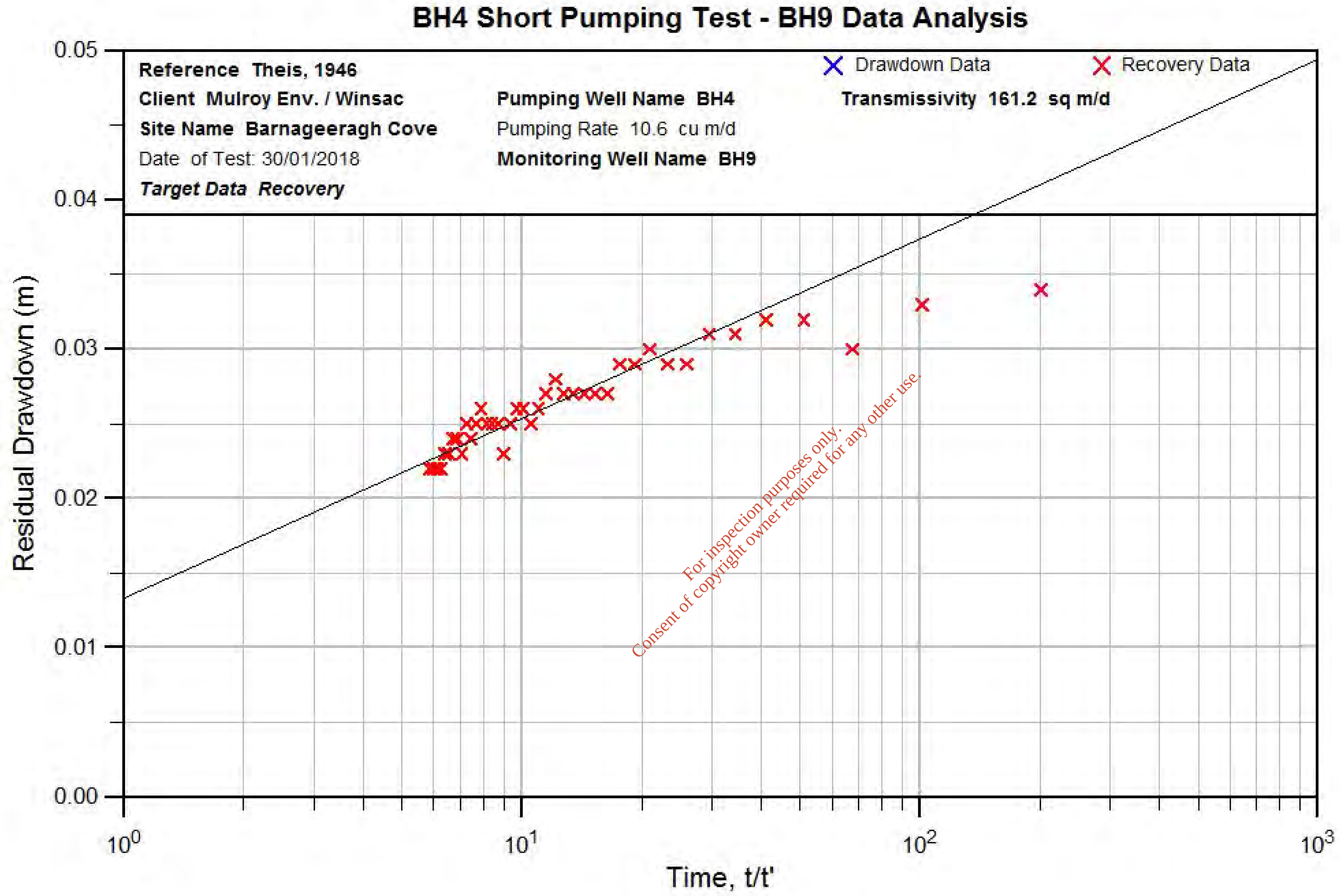
HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



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	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
1	0.25	0.001	×
2	0.5	0	×
3	0.75	0.001	×
4	1	0.001	×
5	1.25	-0.001	×
6	1.5	0.002	×
7	1.75	0.001	×
8	2	0.003	×
9	2.25	0.003	×
10	2.5	0.005	×
11	2.75	0.006	×
12	3	0.005	×
13	3.25	0.006	×
14	3.5	0.007	×
15	3.75	0.008	×
16	4	0.011	×
17	4.25	0.009	×
18	4.5	0.011	×
19	4.75	0.014	×
20	5	0.015	×
21	5.25	0.016	×
22	5.5	0.016	×
23	5.75	0.015	×
24	6	0.018	×
25	6.25	0.02	×
26	6.5	0.019	×
27	6.75	0.021	×
28	7	0.021	×
29	7.25	0.022	×
30	7.5	0.024	×
31	7.75	0.025	×
32	8	0.024	×
33	8.25	0.023	×
34	8.5	0.025	×
35	8.75	0.023	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
36	9	0.026	×
37	9.25	0.025	×
38	9.5	0.024	×
39	9.75	0.028	×
40	10	0.027	×
41	10.25	0.029	×
42	10.5	0.029	×
43	10.75	0.028	×
44	11	0.029	×
45	11.25	0.03	×
46	11.5	0.029	×
47	11.75	0.03	×
48	12	0.032	×
49	12.25	0.031	×
50	12.5	0.029	×
51	12.75	0.031	×
52	13	0.031	×
53	13.25	0.031	×
54	13.5	0.033	×
55	13.75	0.033	×
56	14	0.035	×
57	14.25	0.036	×
58	14.5	0.032	×
59	14.75	0.035	×
60	15	0.032	×
61	15.25	0.036	×
62	15.5	0.035	×
63	15.75	0.035	×
64	16	0.036	×
65	16.25	0.036	×
66	16.5	0.033	×
67	16.75	0.035	×
68	17	0.036	×
69	17.25	0.036	×
70	17.5	0.036	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
71	17.75	0.036	×
72	18	0.037	×
73	18.25	0.035	×
74	18.5	0.039	×
75	18.75	0.037	×
76	19	0.039	×
77	19.25	0.037	×
78	19.5	0.039	×
79	19.75	0.038	×
80	20	0.039	×
81	20.25	0.038	×
82	20.5	0.04	×
83	20.75	0.038	×
84	21	0.038	×
85	21.25	0.04	×
86	21.5	0.039	×
87	21.75	0.038	×
88	22	0.04	×
89	22.25	0.038	×
90	22.5	0.041	×
91	22.75	0.039	×
92	23	0.042	×
93	23.25	0.04	×
94	23.5	0.041	×
95	23.75	0.041	×
96	24	0.04	×
97	24.25	0.041	×
98	24.5	0.043	×
99	24.75	0.042	×
100	25	0.043	×
101	25.25	0.041	×
102	25.5	0.043	×
103	25.75	0.044	×
104	26	0.041	×
105	26.25	0.042	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
106	26.5	0.042	×
107	26.75	0.042	×
108	27	0.042	×
109	27.25	0.042	×
110	27.5	0.043	×
111	27.75	0.044	×
112	28	0.043	×
113	28.25	0.044	×
114	28.5	0.043	×
115	28.75	0.045	×
116	29	0.046	×
117	29.25	0.045	×
118	29.5	0.044	×
119	29.75	0.046	×
120	30	0.045	×
121	30.25	0.044	×
122	30.5	0.045	×
123	30.75	0.044	×
124	31	0.048	×
125	31.25	0.044	×
126	31.5	0.045	×
127	31.75	0.045	×
128	32	0.049	×
129	32.25	0.046	×
130	32.5	0.048	×
131	32.75	0.047	×
132	33	0.045	×
133	33.25	0.046	×
134	33.5	0.046	×
135	33.75	0.048	×
136	34	0.048	×
137	34.25	0.048	×
138	34.5	0.046	×
139	34.75	0.047	×
140	35	0.049	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
141	35.25	0.046	×
142	35.5	0.048	×
143	35.75	0.049	×
144	36	0.049	×
145	36.25	0.049	×
146	36.5	0.05	×
147	36.75	0.049	×
148	37	0.048	×
149	37.25	0.048	×
150	37.5	0.05	×
151	37.75	0.049	×
152	38	0.05	×
153	38.25	0.049	×
154	38.5	0.05	×
155	38.75	0.048	×
156	39	0.05	×
157	39.25	0.047	×
158	39.5	0.052	×
159	39.75	0.052	×
160	40	0.05	×
161	40.25	0.05	×
162	40.5	0.049	×
163	40.75	0.051	×
164	41	0.051	×
165	41.25	0.051	×
166	41.5	0.052	×
167	41.75	0.05	×
168	42	0.049	×
169	42.25	0.049	×
170	42.5	0.053	×
171	42.75	0.051	×
172	43	0.049	×
173	43.25	0.05	×
174	43.5	0.052	×
175	43.75	0.05	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
176	44	0.053	×
177	44.25	0.051	×
178	44.5	0.049	×
179	44.75	0.05	×
180	45	0.05	×
181	45.25	0.052	×
182	45.5	0.053	×
183	45.75	0.053	×
184	46	0.053	×
185	46.25	0.052	×
186	46.5	0.056	×
187	46.75	0.05	×
188	47	0.051	×
189	47.25	0.051	×
190	47.5	0.048	×
191	47.75	0.053	×
192	48	0.053	×
193	48.25	0.051	×
194	48.5	0.054	×
195	48.75	0.052	×
196	49	0.052	×
197	49.25	0.05	×
198	49.5	0.051	×
199	49.75	0.054	×
200	50	0.053	×
201	50.25	0.054	×
202	50.5	0.053	×
203	50.75	0.052	×
204	51	0.053	×
205	51.25	0.053	×
206	51.5	0.055	×
207	51.75	0.052	×
208	52	0.053	×
209	52.25	0.051	×
210	52.5	0.053	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
211	52.75	0.055	×
212	53	0.053	×
213	53.25	0.053	×
214	53.5	0.053	×
215	53.75	0.055	×
216	54	0.053	×
217	54.25	0.052	×
218	54.5	0.054	×
219	54.75	0.056	×
220	55	0.052	×
221	55.25	0.055	×
222	55.5	0.055	×
223	55.75	0.054	×
224	56	0.059	×
225	56.25	0.056	×
226	56.5	0.057	×
227	56.75	0.056	×
228	57	0.059	×
229	57.25	0.055	×
230	57.5	0.057	×
231	57.75	0.055	×
232	58	0.055	×
233	58.25	0.054	×
234	58.5	0.054	×
235	58.75	0.055	×
236	59	0.058	×
237	59.25	0.057	×
238	59.5	0.057	×
239	59.75	0.055	×
240	60	0.056	×
241	60.25	0.057	×
242	60.5	0.059	×
243	60.75	0.056	×
244	61	0.057	×
245	61.25	0.057	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
246	61.5	0.06	×
247	61.75	0.058	×
248	62	0.059	×
249	62.25	0.06	×
250	62.5	0.062	×
251	62.75	0.059	×
252	63	0.06	×
253	63.25	0.059	×
254	63.5	0.06	×
255	63.75	0.059	×
256	64	0.059	×
257	64.25	0.06	×
258	64.5	0.061	×
259	64.75	0.061	×
260	65	0.061	×
261	65.25	0.06	×
262	65.5	0.062	×
263	65.75	0.064	×
264	66	0.062	×
265	66.25	0.063	×
266	66.5	0.064	×
267	66.75	0.063	×
268	67	0.062	×
269	67.25	0.064	×
270	67.5	0.065	×
271	67.75	0.064	×
272	68	0.065	×
273	68.25	0.064	×
274	68.5	0.064	×
275	68.75	0.064	×
276	69	0.062	×
277	69.25	0.067	×
278	69.5	0.065	×
279	69.75	0.063	×
280	70	0.064	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
281	70.25	0.065	×
282	70.5	0.063	×
283	70.75	0.064	×
284	71	0.065	×
285	71.25	0.063	×
286	71.5	0.064	×
287	71.75	0.06	×
288	72	0.067	×
289	72.25	0.065	×
290	72.5	0.064	×
291	72.75	0.063	×
292	73	0.066	×
293	73.25	0.066	×
294	73.5	0.064	×
295	73.75	0.066	×
296	74	0.067	×
297	74.25	0.064	×
298	74.5	0.068	×
299	74.75	0.066	×
300	75	0.066	×
301	75.25	0.065	×
302	75.5	0.068	×
303	75.75	0.067	×
304	76	0.066	×
305	76.25	0.067	×
306	76.5	0.066	×
307	76.75	0.067	×
308	77	0.069	×
309	77.25	0.065	×
310	77.5	0.068	×
311	77.75	0.068	×
312	78	0.067	×
313	78.25	0.07	×
314	78.5	0.067	×
315	78.75	0.07	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
316	79	0.069	×
317	79.25	0.069	×
318	79.5	0.072	×
319	79.75	0.069	×
320	80	0.071	×
321	80.25	0.069	×
322	80.5	0.071	×
323	80.75	0.067	×
324	81	0.069	×
325	81.25	0.069	×
326	81.5	0.068	×
327	81.75	0.068	×
328	82	0.068	×
329	82.25	0.07	×
330	82.5	0.071	×
331	82.75	0.071	×
332	83	0.07	×
333	83.25	0.07	×
334	83.5	0.07	×
335	83.75	0.07	×
336	84	0.07	×
337	84.25	0.072	×
338	84.5	0.067	×
339	84.75	0.069	×
340	85	0.07	×
341	85.25	0.071	×
342	85.5	0.071	×
343	85.75	0.072	×
344	86	0.071	×
345	86.25	0.073	×
346	86.5	0.074	×
347	86.75	0.071	×
348	87	0.072	×
349	87.25	0.071	×
350	87.5	0.071	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
351	87.75	0.074	×
352	88	0.072	×
353	88.25	0.072	×
354	88.5	0.072	×
355	88.75	0.071	×
356	89	0.071	×
357	89.25	0.073	×
358	89.5	0.071	×
359	89.75	0.072	×
360	90	0.073	×
361	90.25	0.073	×
362	90.5	0.074	×
363	90.75	0.074	×
364	91	0.074	×
365	91.25	0.072	×
366	91.5	0.072	×
367	91.75	0.072	×
368	92	0.073	×
369	92.25	0.073	×
370	92.5	0.073	×
371	92.75	0.071	×
372	93	0.074	×
373	93.25	0.074	×
374	93.5	0.072	×
375	93.75	0.073	×
376	94	0.073	×
377	94.25	0.074	×
378	94.5	0.074	×
379	94.75	0.077	×
380	95	0.075	×
381	95.25	0.072	×
382	95.5	0.074	×
383	95.75	0.076	×
384	96	0.073	×
385	96.25	0.075	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
386	96.5	0.074	×
387	96.75	0.075	×
388	97	0.073	×
389	97.25	0.075	×
390	97.5	0.072	×
391	97.75	0.074	×
392	98	0.078	×
393	98.25	0.072	×
394	98.5	0.076	×
395	98.75	0.074	×
396	99	0.073	×
397	99.25	0.075	×
398	99.5	0.075	×
399	99.75	0.073	×
400	100	0.074	×
401	100.25	0.074	×
402	100.5	0.077	×
403	100.75	0.074	×
404	101	0.072	×
405	101.25	0.076	×
406	101.5	0.075	×
407	101.75	0.073	×
408	102	0.073	×
409	102.25	0.075	×
410	102.5	0.077	×
411	102.75	0.074	×
412	103	0.075	×
413	103.25	0.075	×
414	103.5	0.075	×
415	103.75	0.079	×
416	104	0.073	×
417	104.25	0.075	×
418	104.5	0.073	×
419	104.75	0.077	×
420	105	0.076	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
421	105.25	0.072	×
422	105.5	0.074	×
423	105.75	0.074	×
424	106	0.077	×
425	106.25	0.073	×
426	106.5	0.075	×
427	106.75	0.072	×
428	107	0.077	×
429	107.25	0.077	×
430	107.5	0.077	×
431	107.75	0.075	×
432	108	0.074	×
433	108.25	0.076	×
434	108.5	0.076	×
435	108.75	0.074	×
436	109	0.074	×
437	109.25	0.075	×
438	109.5	0.077	×
439	109.75	0.077	×
440	110	0.075	×
441	110.25	0.077	×
442	110.5	0.075	×
443	110.75	0.075	×
444	111	0.076	×
445	111.25	0.075	×
446	111.5	0.074	×
447	111.75	0.079	×
448	112	0.078	×
449	112.25	0.078	×
450	112.5	0.079	×
451	112.75	0.077	×
452	113	0.081	×
453	113.25	0.077	×
454	113.5	0.081	×
455	113.75	0.075	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
456	114	0.08	×
457	114.25	0.08	×
458	114.5	0.078	×
459	114.75	0.078	×
460	115	0.073	×
461	115.25	0.077	×
462	115.5	0.077	×
463	115.75	0.079	×
464	116	0.079	×
465	116.25	0.078	×
466	116.5	0.079	×
467	116.75	0.08	×
468	117	0.079	×
469	117.25	0.077	×
470	117.5	0.079	×
471	117.75	0.079	×
472	118	0.079	×
473	118.25	0.081	×
474	118.5	0.079	×
475	118.75	0.081	×
476	119	0.079	×
477	119.25	0.079	×
478	119.5	0.08	×
479	119.75	0.08	×
480	120	0.08	×
481	120.25	0.082	×
482	120.5	0.076	×
483	120.75	0.081	×
484	121	0.081	×
485	121.25	0.081	×
486	121.5	0.077	×
487	121.75	0.08	×
488	122	0.081	×
489	122.25	0.082	×
490	122.5	0.08	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
491	122.75	0.082	×
492	123	0.081	×
493	123.25	0.079	×
494	123.5	0.079	×
495	123.75	0.083	×
496	124	0.082	×
497	124.25	0.079	×
498	124.5	0.081	×
499	124.75	0.078	×
500	125	0.08	×
501	125.25	0.079	×
502	125.5	0.08	×
503	125.75	0.081	×
504	126	0.082	×
505	126.25	0.081	×
506	126.5	0.08	×
507	126.75	0.081	×
508	127	0.078	×
509	127.25	0.078	×
510	127.5	0.081	×
511	127.75	0.083	×
512	128	0.082	×
513	128.25	0.082	×
514	128.5	0.083	×
515	128.75	0.085	×
516	129	0.083	×
517	129.25	0.082	×
518	129.5	0.082	×
519	129.75	0.083	×
520	130	0.08	×
521	130.25	0.085	×
522	130.5	0.082	×
523	130.75	0.083	×
524	131	0.083	×
525	131.25	0.081	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
526	131.5	0.084	×
527	131.75	0.083	×
528	132	0.083	×
529	132.25	0.084	×
530	132.5	0.083	×
531	132.75	0.082	×
532	133	0.084	×
533	133.25	0.084	×
534	133.5	0.083	×
535	133.75	0.084	×
536	134	0.085	×
537	134.25	0.084	×
538	134.5	0.087	×
539	134.75	0.086	×
540	135	0.083	×
541	135.25	0.083	×
542	135.5	0.085	×
543	135.75	0.084	×
544	136	0.085	×
545	136.25	0.082	×
546	136.5	0.083	×
547	136.75	0.086	×
548	137	0.083	×
549	137.25	0.086	×
550	137.5	0.083	×
551	137.75	0.084	×
552	138	0.082	×
553	138.25	0.084	×
554	138.5	0.084	×
555	138.75	0.085	×
556	139	0.087	×
557	139.25	0.088	×
558	139.5	0.085	×
559	139.75	0.083	×
560	140	0.085	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
561	140.25	0.086	×
562	140.5	0.083	×
563	140.75	0.087	×
564	141	0.084	×
565	141.25	0.084	×
566	141.5	0.084	×
567	141.75	0.087	×
568	142	0.084	×
569	142.25	0.087	×
570	142.5	0.085	×
571	142.75	0.085	×
572	143	0.088	×
573	143.25	0.088	×
574	143.5	0.085	×
575	143.75	0.088	×
576	144	0.084	×
577	144.25	0.088	×
578	144.5	0.087	×
579	144.75	0.088	×
580	145	0.088	×
581	145.25	0.089	×
582	145.5	0.088	×
583	145.75	0.086	×
584	146	0.089	×
585	146.25	0.088	×
586	146.5	0.09	×
587	146.75	0.089	×
588	147	0.087	×
589	147.25	0.089	×
590	147.5	0.087	×
591	147.75	0.087	×
592	148	0.09	×
593	148.25	0.086	×
594	148.5	0.088	×
595	148.75	0.089	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
596	149	0.09	×
597	149.25	0.092	×
598	149.5	0.091	×
599	149.75	0.092	×
600	150	0.089	×
601	150.25	0.091	×
602	150.5	0.088	×
603	150.75	0.091	×
604	151	0.092	×
605	151.25	0.094	×
606	151.5	0.09	×
607	151.75	0.09	×
608	152	0.088	×
609	152.25	0.092	×
610	152.5	0.091	×
611	152.75	0.09	×
612	153	0.088	×
613	153.25	0.09	×
614	153.5	0.091	×
615	153.75	0.088	×
616	154	0.088	×
617	154.25	0.094	×
618	154.5	0.09	×
619	154.75	0.091	×
620	155	0.09	×
621	155.25	0.092	×
622	155.5	0.092	×
623	155.75	0.09	×
624	156	0.089	×
625	156.25	0.089	×
626	156.5	0.091	×
627	156.75	0.092	×
628	157	0.092	×
629	157.25	0.093	×
630	157.5	0.091	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
631	157.75	0.093	×
632	158	0.095	×
633	158.25	0.091	×
634	158.5	0.095	×
635	158.75	0.093	×
636	159	0.095	×
637	159.25	0.089	×
638	159.5	0.093	×
639	159.75	0.09	×
640	160	0.093	×
641	160.25	0.093	×
642	160.5	0.093	×
643	160.75	0.091	×
644	161	0.095	×
645	161.25	0.093	×
646	161.5	0.095	×
647	161.75	0.093	×
648	162	0.091	×
649	162.25	0.09	×
650	162.5	0.092	×
651	162.75	0.092	×
652	163	0.092	×
653	163.25	0.092	×
654	163.5	0.091	×
655	163.75	0.094	×
656	164	0.093	×
657	164.25	0.093	×
658	164.5	0.092	×
659	164.75	0.095	×
660	165	0.094	×
661	165.25	0.094	×
662	165.5	0.094	×
663	165.75	0.093	×
664	166	0.094	×
665	166.25	0.089	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
666	166.5	0.093	×
667	166.75	0.094	×
668	167	0.096	×
669	167.25	0.094	×
670	167.5	0.097	×
671	167.75	0.092	×
672	168	0.095	×
673	168.25	0.094	×
674	168.5	0.098	×
675	168.75	0.093	×
676	169	0.097	×
677	169.25	0.093	×
678	169.5	0.096	×
679	169.75	0.094	×
680	170	0.096	×
681	170.25	0.097	×
682	170.5	0.098	×
683	170.75	0.094	×
684	171	0.093	×
685	171.25	0.093	×
686	171.5	0.097	×
687	171.75	0.093	×
688	172	0.096	×
689	172.25	0.097	×
690	172.5	0.096	×
691	172.75	0.096	×
692	173	0.092	×
693	173.25	0.098	×
694	173.5	0.098	×
695	173.75	0.098	×
696	174	0.099	×
697	174.25	0.095	×
698	174.5	0.097	×
699	174.75	0.098	×
700	175	0.096	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
701	175.25	0.1	×
702	175.5	0.092	×
703	175.75	0.099	×
704	176	0.097	×
705	176.25	0.094	×
706	176.5	0.096	×
707	176.75	0.098	×
708	177	0.097	×
709	177.25	0.095	×
710	177.5	0.098	×
711	177.75	0.099	×
712	178	0.098	×
713	178.25	0.094	×
714	178.5	0.097	×
715	178.75	0.095	×
716	179	0.095	×
717	179.25	0.097	×
718	179.5	0.099	×
719	179.75	0.096	×
720	180	0.1	×
721	180.25	0.097	×
722	180.5	0.095	×
723	180.75	0.095	×
724	181	0.099	×
725	181.25	0.1	×
726	181.5	0.1	×
727	181.75	0.094	×
728	182	0.1	×
729	182.25	0.1	×
730	182.5	0.098	×
731	182.75	0.097	×
732	183	0.099	×
733	183.25	0.099	×
734	183.5	0.1	×
735	183.75	0.097	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
736	184	0.1	×
737	184.25	0.1	×
738	184.5	0.099	×
739	184.75	0.102	×
740	185	0.099	×
741	185.25	0.101	×
742	185.5	0.098	×
743	185.75	0.102	×
744	186	0.098	×
745	186.25	0.097	×
746	186.5	0.099	×
747	186.75	0.096	×
748	187	0.099	×
749	187.25	0.1	×
750	187.5	0.1	×
751	187.75	0.099	×
752	188	0.1	×
753	188.25	0.101	×
754	188.5	0.1	×
755	188.75	0.101	×
756	189	0.096	×
757	189.25	0.099	×
758	189.5	0.101	×
759	189.75	0.102	×
760	190	0.1	×
761	190.25	0.102	×
762	190.5	0.098	×
763	190.75	0.102	×
764	191	0.103	×
765	191.25	0.102	×
766	191.5	0.099	×
767	191.75	0.102	×
768	192	0.099	×
769	192.25	0.101	×
770	192.5	0.101	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
771	192.75	0.104	×
772	193	0.101	×
773	193.25	0.101	×
774	193.5	0.102	×
775	193.75	0.104	×
776	194	0.1	×
777	194.25	0.101	×
778	194.5	0.101	×
779	194.75	0.104	×
780	195	0.102	×
781	195.25	0.102	×
782	195.5	0.103	×
783	195.75	0.103	×
784	196	0.102	×
785	196.25	0.101	×
786	196.5	0.104	×
787	196.75	0.102	×
788	197	0.106	×
789	197.25	0.106	×
790	197.5	0.102	×
791	197.75	0.099	×
792	198	0.101	×
793	198.25	0.096	×
794	198.5	0.096	×
795	198.75	0.095	×
796	199	0.094	×
797	199.25	0.092	×
798	199.5	0.093	×
799	199.75	0.091	×
800	200	0.087	×
801	200.25	0.088	×
802	200.5	0.087	×
803	200.75	0.088	×
804	201	0.086	×
805	201.25	0.089	×

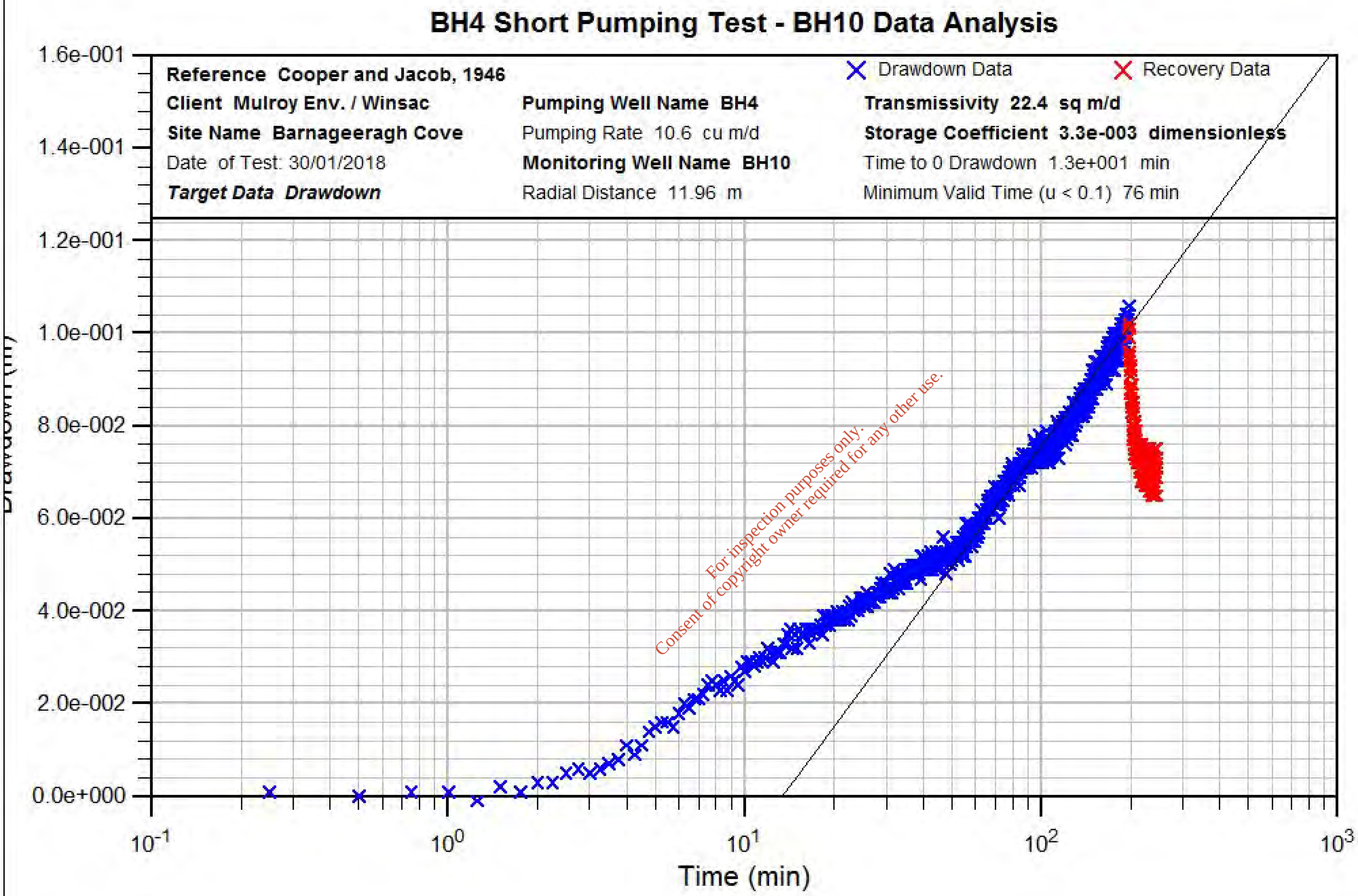
	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
806	201.5	0.085	✕
807	201.75	0.083	✕
808	202	0.085	✕
809	202.25	0.084	✕
810	202.5	0.089	✕
811	202.75	0.082	✕
812	203	0.078	✕
813	203.25	0.08	✕
814	203.5	0.085	✕
815	203.75	0.08	✕
816	204	0.08	✕
817	204.25	0.079	✕
818	204.5	0.084	✕
819	204.75	0.077	✕
820	205	0.077	✕
821	205.25	0.077	✕
822	205.5	0.08	✕
823	205.75	0.078	✕
824	206	0.076	✕
825	206.25	0.074	✕
826	206.5	0.077	✕
827	206.75	0.075	✕
828	207	0.075	✕
829	207.25	0.079	✕
830	207.5	0.081	✕
831	207.75	0.073	✕
832	208	0.077	✕
833	208.25	0.077	✕
834	208.5	0.079	✕
835	208.75	0.074	✕
836	209	0.075	✕
837	209.25	0.073	✕
838	209.5	0.074	✕
839	209.75	0.073	✕
840	210	0.072	✕

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
841	210.25	0.076	✕
842	210.5	0.072	✕
843	210.75	0.073	✕
844	211	0.074	✕
845	211.25	0.075	✕
846	211.5	0.074	✕
847	211.75	0.073	✕
848	212	0.075	✕
849	212.25	0.073	✕
850	212.5	0.074	✕
851	212.75	0.073	✕
852	213	0.073	✕
853	213.25	0.072	✕
854	213.5	0.076	✕
855	213.75	0.075	✕
856	214	0.07	✕
857	214.25	0.071	✕
858	214.5	0.075	✕
859	214.75	0.07	✕
860	215	0.074	✕
861	215.25	0.072	✕
862	215.5	0.071	✕
863	215.75	0.072	✕
864	216	0.075	✕
865	216.25	0.07	✕
866	216.5	0.072	✕
867	216.75	0.073	✕
868	217	0.075	✕
869	217.25	0.07	✕
870	217.5	0.076	✕
871	217.75	0.07	✕
872	218	0.068	✕
873	218.25	0.07	✕
874	218.5	0.073	✕
875	218.75	0.075	✕

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
876	219	0.075	✕
877	219.25	0.072	✕
878	219.5	0.069	✕
879	219.75	0.075	✕
880	220	0.071	✕
881	220.25	0.069	✕
882	220.5	0.071	✕
883	220.75	0.072	✕
884	221	0.072	✕
885	221.25	0.071	✕
886	221.5	0.069	✕
887	221.75	0.071	✕
888	222	0.069	✕
889	222.25	0.07	✕
890	222.5	0.068	✕
891	222.75	0.071	✕
892	223	0.07	✕
893	223.25	0.074	✕
894	223.5	0.075	✕
895	223.75	0.067	✕
896	224	0.071	✕
897	224.25	0.067	✕
898	224.5	0.07	✕
899	224.75	0.069	✕
900	225	0.071	✕
901	225.25	0.069	✕
902	225.5	0.072	✕
903	225.75	0.074	✕
904	226	0.072	✕
905	226.25	0.068	✕
906	226.5	0.075	✕
907	226.75	0.07	✕
908	227	0.069	✕
909	227.25	0.072	✕
910	227.5	0.071	✕

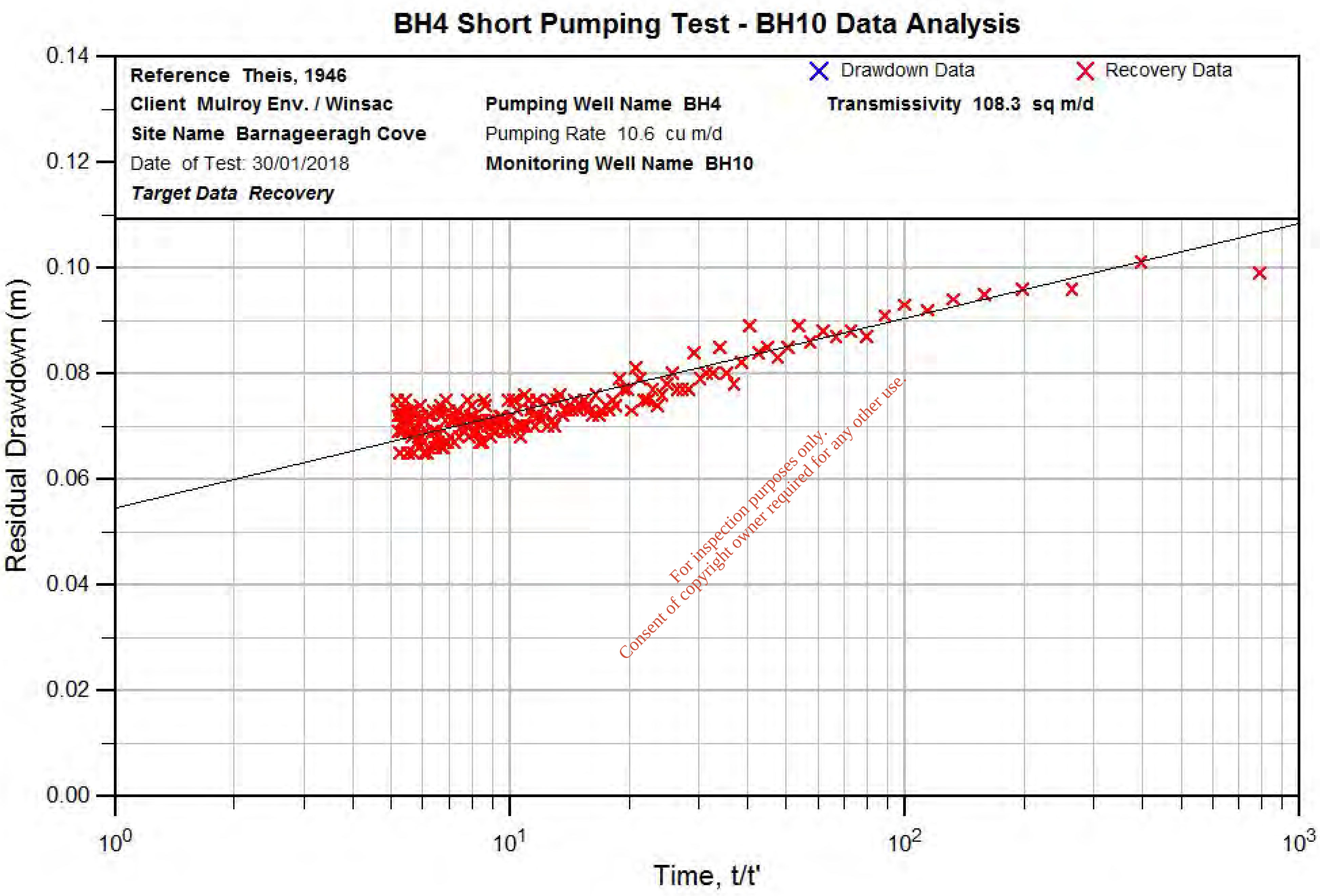
	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
911	227.75	0.07	×
912	228	0.071	×
913	228.25	0.068	×
914	228.5	0.073	×
915	228.75	0.073	×
916	229	0.072	×
917	229.25	0.067	×
918	229.5	0.071	×
919	229.75	0.071	×
920	230	0.071	×
921	230.25	0.068	×
922	230.5	0.073	×
923	230.75	0.067	×
924	231	0.075	×
925	231.25	0.071	×
926	231.5	0.067	×
927	231.75	0.066	×
928	232	0.066	×
929	232.25	0.072	×
930	232.5	0.074	×
931	232.75	0.073	×
932	233	0.067	×
933	233.25	0.068	×
934	233.5	0.069	×
935	233.75	0.066	×
936	234	0.069	×
937	234.25	0.073	×
938	234.5	0.069	×
939	234.75	0.072	×
940	235	0.072	×
941	235.25	0.066	×
942	235.5	0.072	×
943	235.75	0.065	×
944	236	0.069	×
945	236.25	0.069	×

	Time (min)	BH4 Abstraction, Drawdown in BH10 (m)	Symbol
946	236.5	0.071	✕
947	236.75	0.065	✕
948	237	0.067	✕
949	237.25	0.072	✕
950	237.5	0.068	✕
951	237.75	0.074	✕
952	238	0.066	✕
953	238.25	0.068	✕
954	238.5	0.067	✕
955	238.75	0.069	✕
956	239	0.072	✕
957	239.25	0.07	✕
958	239.5	0.073	✕
959	239.75	0.065	✕
960	240	0.068	✕
961	240.25	0.073	✕
962	240.5	0.069	✕
963	240.75	0.069	✕
964	241	0.072	✕
965	241.25	0.065	✕
966	241.5	0.073	✕
967	241.75	0.072	✕
968	242	0.071	✕
969	242.25	0.075	✕
970	242.5	0.07	✕
971	242.75	0.07	✕
972	243	0.069	✕
973	243.25	0.071	✕
974	243.5	0.072	✕
975	243.75	0.065	✕
976	244	0.073	✕
977	244.25	0.072	✕
978	244.5	0.069	✕
979	244.75	0.075	✕



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



1114 Barnageeragh Cove
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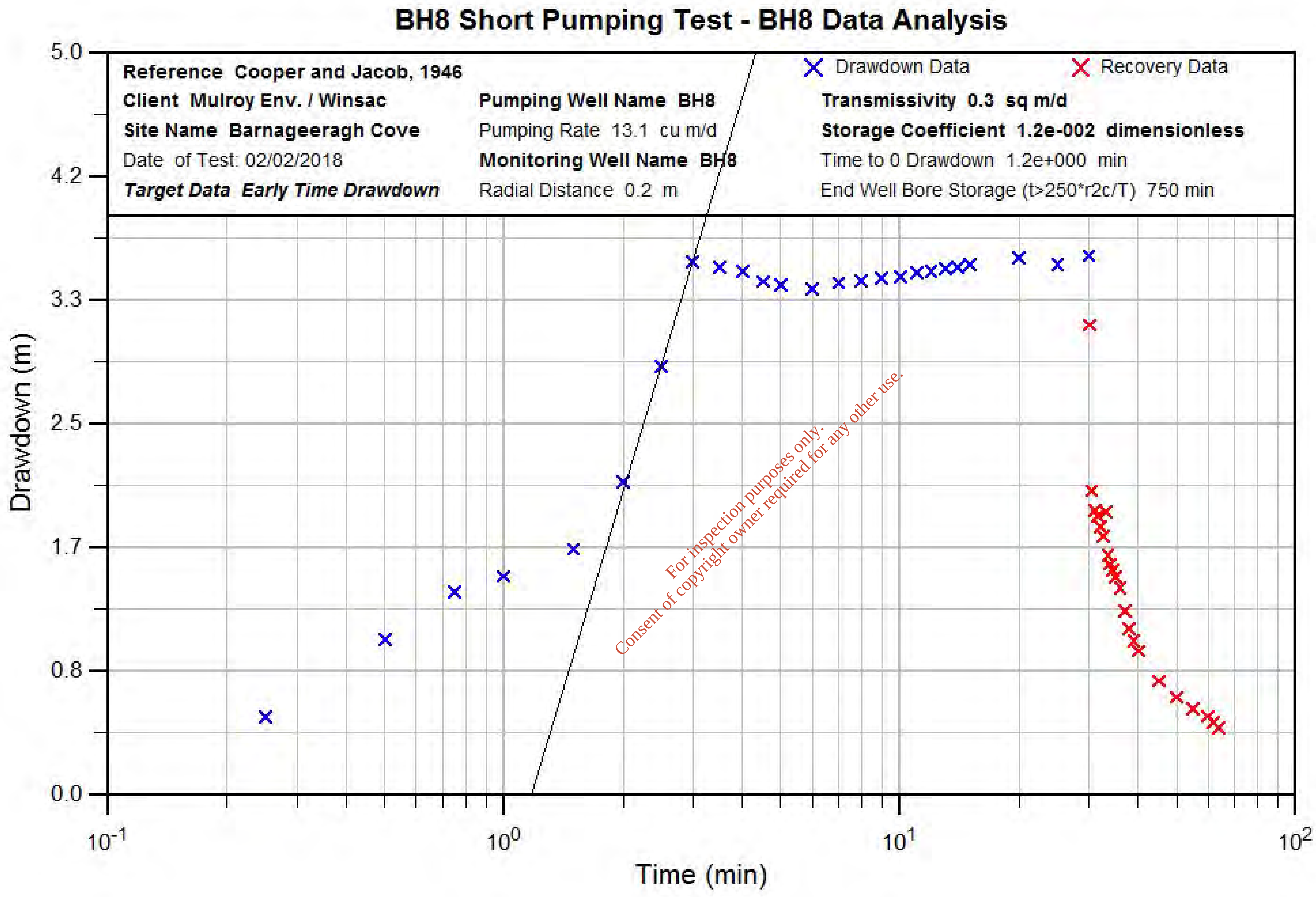
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

	Time (min)	BH8 Abstraction, Drawdown in BH8 (m)	Symbol
1	0.25	0.523	×
2	0.5	1.042	×
3	0.75	1.368	×
4	1	1.47	×
5	1.5	1.656	×
6	2	2.107	×
7	2.5	2.884	×
8	3	3.594	×
9	3.5	3.554	×
10	4	3.526	×
11	4.5	3.459	×
12	5	3.436	×
13	6	3.41	×
14	7	3.45	×
15	8	3.46	×
16	9	3.48	×
17	10	3.493	×
18	11	3.518	×
19	12	3.527	×
20	13	3.549	×
21	14	3.556	×
22	15	3.575	×
23	20	3.622	×
24	25	3.572	×
25	30	3.633	×
26	30.12	3.165	×
27	30.5	2.047	×
28	31	1.914	×
29	31.5	1.883	×
30	32	1.809	×
31	32.5	1.741	×
32	33.08	1.905	×
33	33.5	1.612	×
34	34	1.554	×
35	34.5	1.511	×

	Time (min)	BH8 Abstraction, Drawdown in BH8 (m)	Symbol
36	35	1.467	✕
37	36	1.393	✕
38	37	1.238	✕
39	38	1.118	✕
40	39	1.037	✕
41	40	0.968	✕
42	45	0.765	✕
43	50	0.658	✕
44	55	0.575	✕
45	60	0.529	✕
46	62	0.484	✕
47	64	0.451	✕



1114 Barnageeragh Cove
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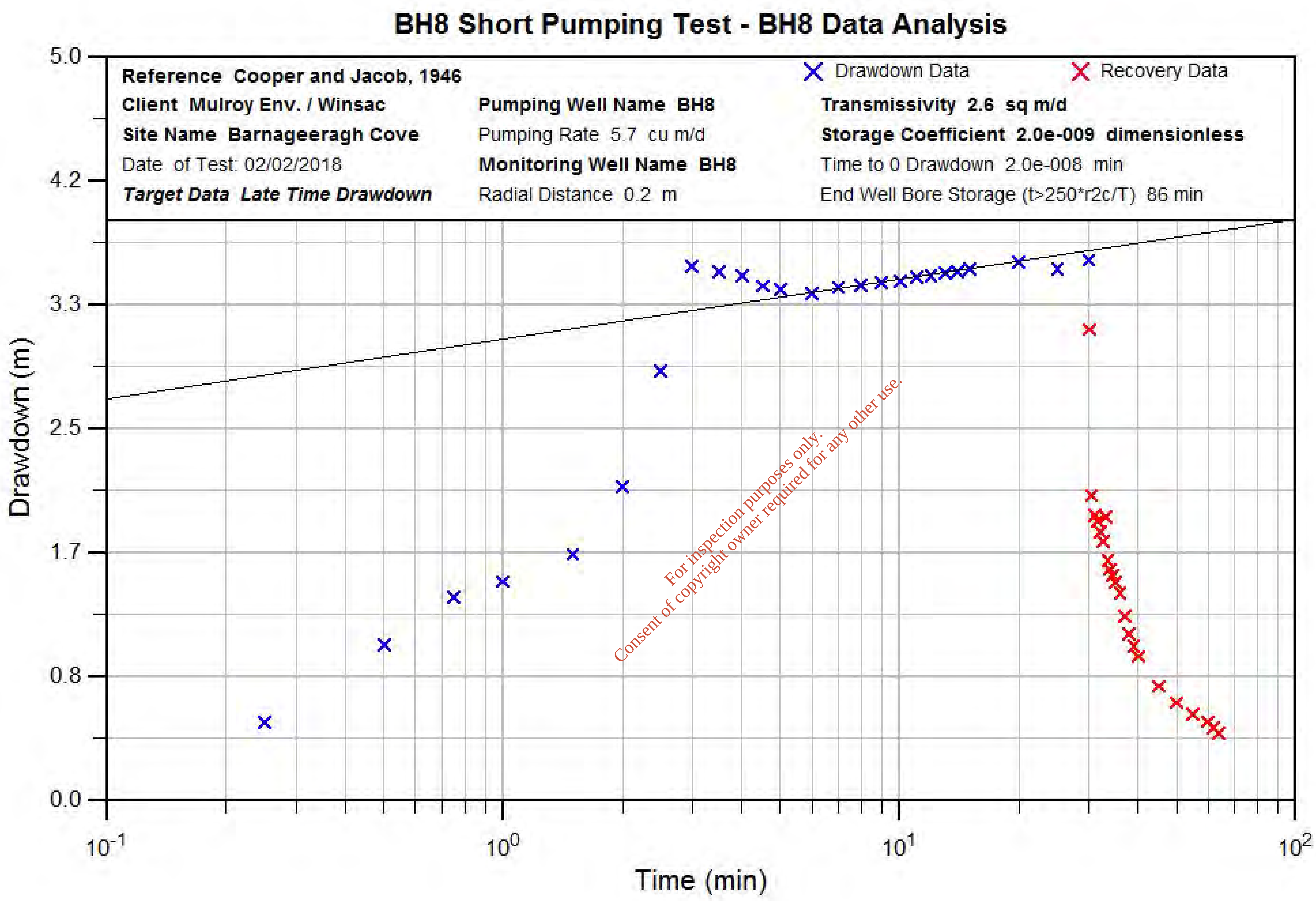
HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



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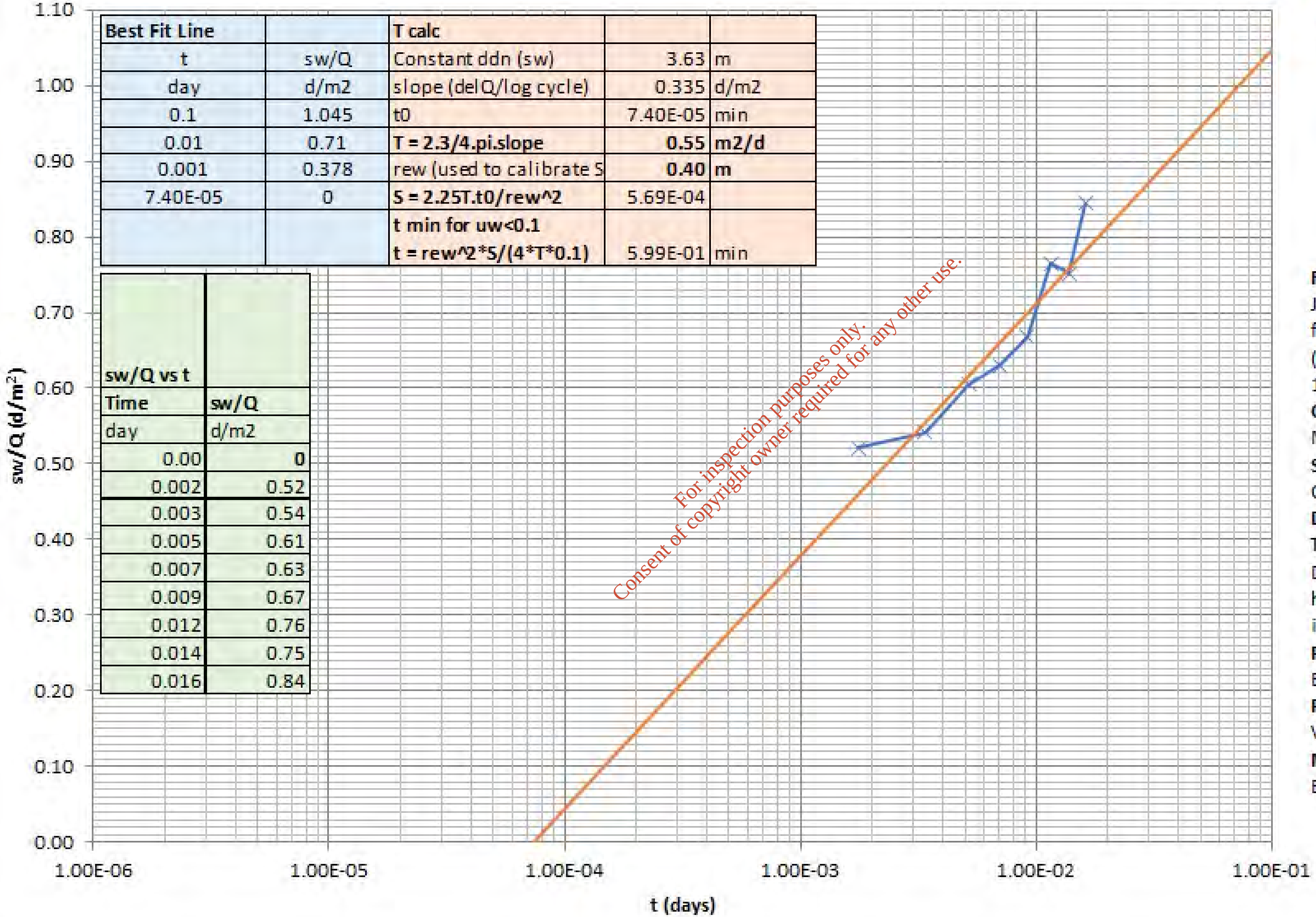
HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

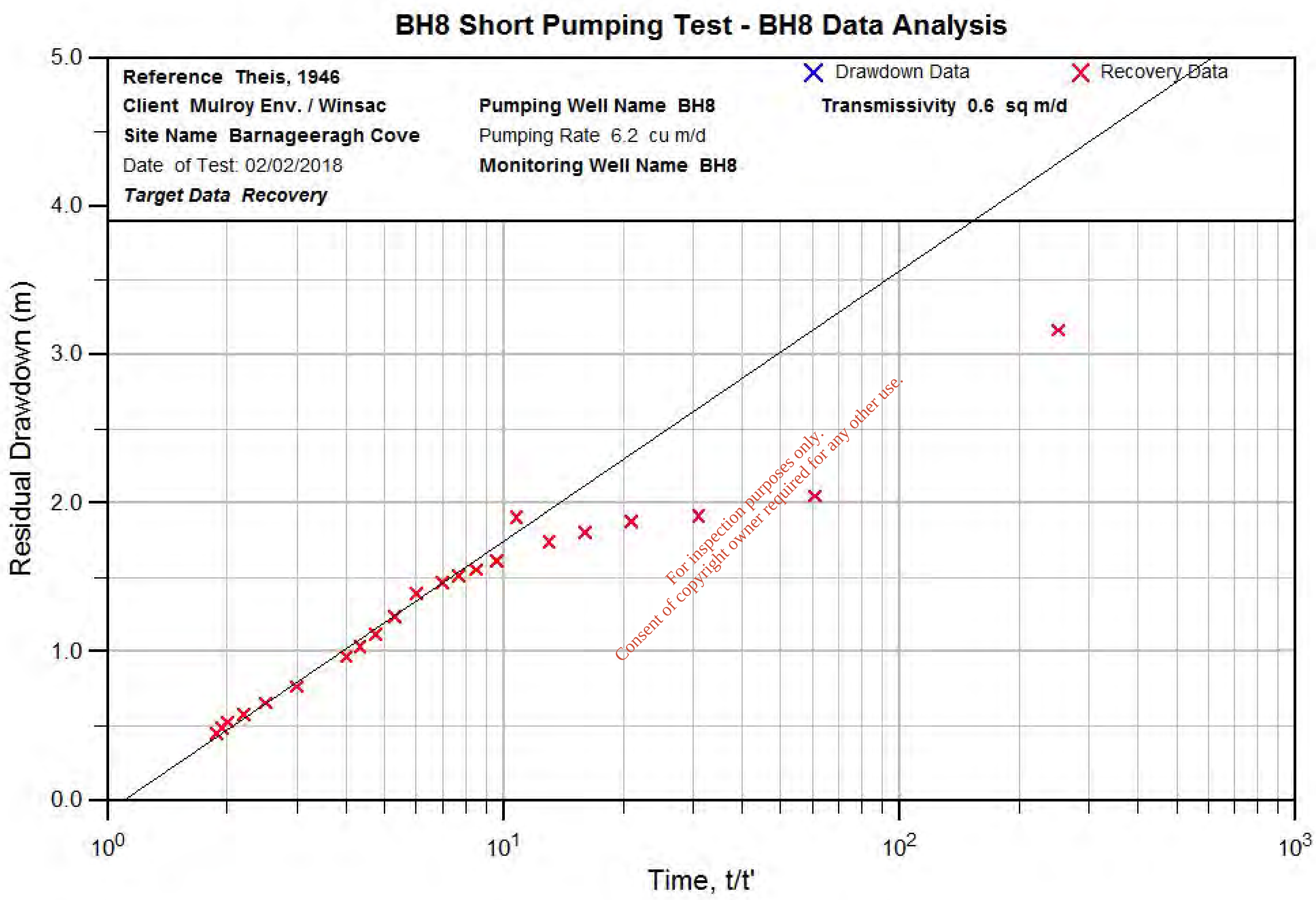
BH8 - Jacob-Lohman Analysis (sw/Q vs t) (sw constant) on BH8 Data



Best Fit Line		T calc		
t	sw/Q	Constant ddn (sw)	3.63	m
day	d/m2	slope (delQ/log cycle)	0.335	d/m2
0.1	1.045	t0	7.40E-05	min
0.01	0.71	**T = 2.3/4.pi.slope**	**0.55**	**m2/d**
0.001	0.378	rew (used to calibrate S	**0.40**	**m**
7.40E-05	0	**S = 2.25T.t0/rew^2**	5.69E-04	
		t min for uw<0.1 **t = rew^2*S/(4*T*0.1)**	5.99E-01	min

sw/Q vs t	
Time	**sw/Q**
day	d/m2
0.00	0
0.002	0.52
0.003	0.54
0.005	0.61
0.007	0.63
0.009	0.67
0.012	0.76
0.014	0.75
0.016	0.84

Reference: Jacob-Lohman, free-flowing confined (Kruseman & de Ridder, 1990)
Client: Mulroy Env. / Winsac
Site Name: Barnageeragh Cove
Date of Test: 02/02/2018
Target Data: Declining Discharge after head constant at pump intake
Pumping Well Name: BH8
Pumping Rate: Variable
Monitoring Well Name: BH8

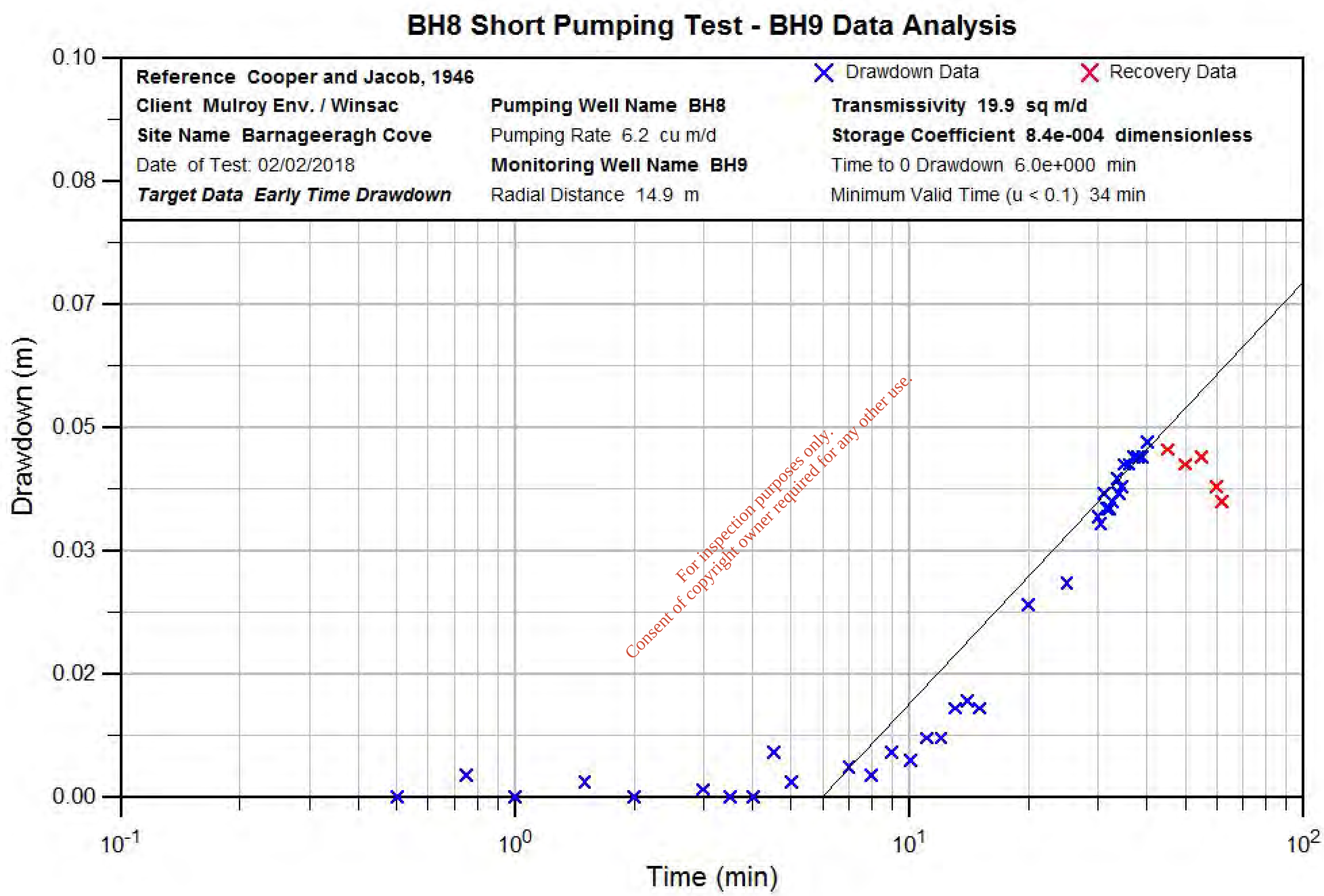


1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

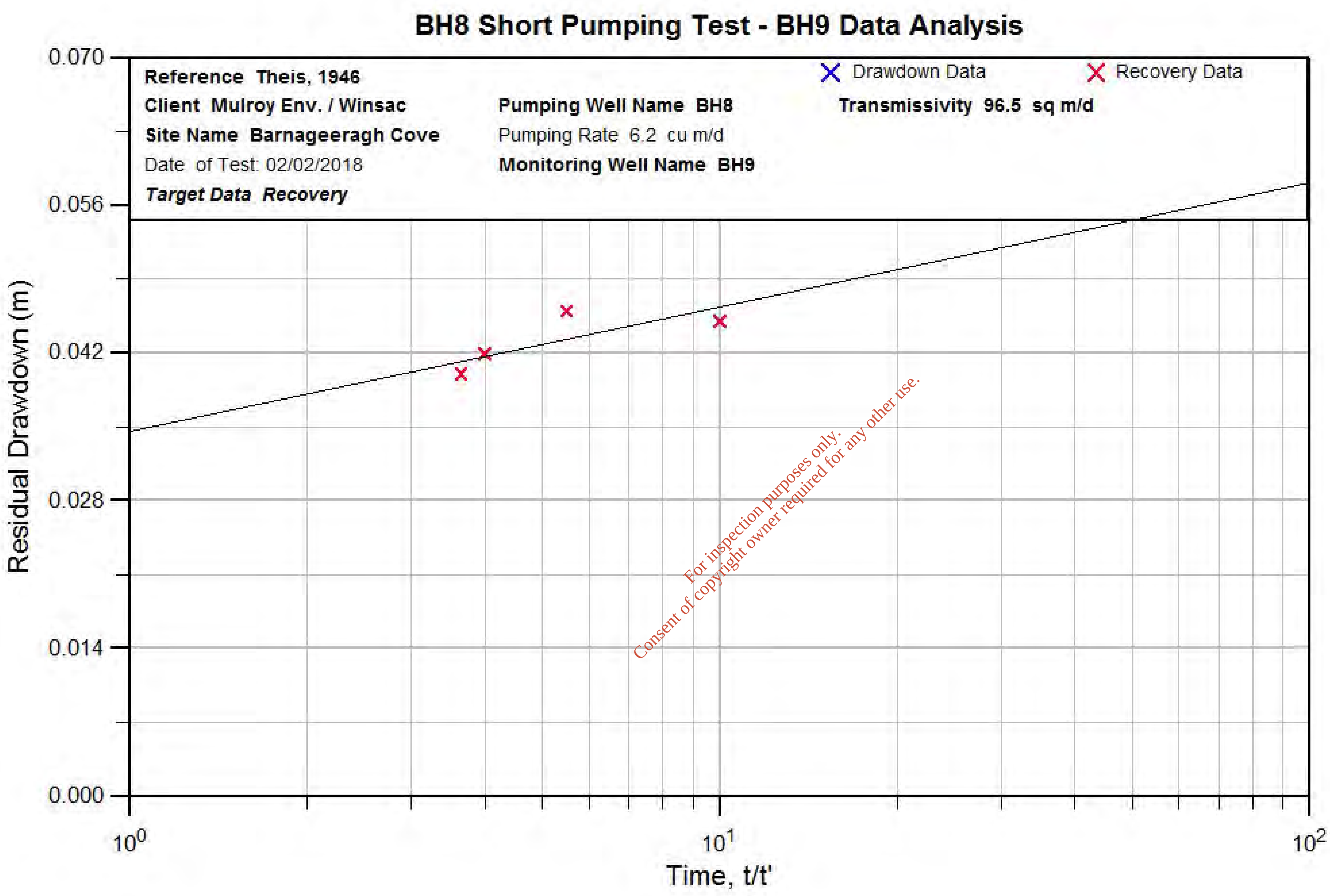
SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

	Time (min)	BH8 Abstraction, Drawdown in BH9 (m)	Symbol
1	0.5	0	×
2	0.75	0.003	×
3	1	0	×
4	1.5	0.002	×
5	2	0	×
6	0	0	×
7	3	0.001	×
8	3.5	0	×
9	4	0	×
10	4.5	0.006	×
11	5	0.002	×
12	7	0.004	×
13	8	0.003	×
14	9	0.006	×
15	10	0.005	×
16	11	0.008	×
17	12	0.008	×
18	13	0.012	×
19	14	0.013	×
20	15	0.012	×
21	20	0.026	×
22	25	0.029	×
23	30	0.038	×
24	30.5	0.037	×
25	31	0.041	×
26	31.5	0.039	×
27	32	0.039	×
28	32.5	0.04	×
29	33.5	0.043	×
30	34	0.041	×
31	34.5	0.042	×
32	35	0.045	×
33	36	0.045	×
34	37	0.046	×
35	38	0.046	×

	Time (min)	BH8 Abstraction, Drawdown in BH9 (m)	Symbol
36	39	0.046	×
37	40	0.048	×
38	45	0.047	×
39	50	0.045	×
40	55	0.046	×
41	60	0.042	×
42	62	0.04	×



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

	Time (min)	BH9 Abstraction, Drawdown in BH8 (m)	Symbol
1	5.5	0	×
2	5.75	0.001	×
3	6	0.001	×
4	6.25	0.001	×
5	6.5	0.005	×
6	6.75	0.004	×
7	7	0.003	×
8	7.25	0.004	×
9	7.5	0.005	×
10	7.75	0.005	×
11	8	0.008	×
12	8.25	0.003	×
13	8.5	0.005	×
14	8.75	0.005	×
15	9	0.006	×
16	9.25	0.007	×
17	9.5	0.008	×
18	9.75	0.009	×
19	10	0.007	×
20	10.25	0.008	×
21	10.5	0.008	×
22	10.75	0.008	×
23	11	0.006	×
24	11.25	0.007	×
25	11.5	0.008	×
26	11.75	0.008	×
27	12	0.009	×
28	12.25	0.01	×
29	12.5	0.008	×
30	12.75	0.01	×
31	13	0.011	×
32	13.25	0.008	×
33	13.5	0.012	×
34	13.75	0.01	×
35	14	0.01	×

	Time (min)	BH9 Abstraction, Drawdown in BH8 (m)	Symbol
36	14.25	0.012	×
37	14.5	0.011	×
38	14.75	0.011	×
39	15	0.012	×
40	15.25	0.016	×
41	15.5	0.014	×
42	15.75	0.015	×
43	16	0.012	×
44	16.25	0.013	×
45	16.5	0.014	×
46	16.75	0.014	×
47	17	0.013	×
48	17.25	0.015	×
49	17.5	0.016	×
50	17.75	0.016	×
51	18	0.015	×
52	18.25	0.017	×
53	18.5	0.018	×
54	18.75	0.018	×
55	19	0.02	×
56	19.25	0.02	×
57	19.5	0.018	×
58	19.75	0.015	×
59	20	0.019	×
60	20.25	0.019	×
61	20.5	0.021	×
62	20.75	0.02	×
63	21	0.019	×
64	21.25	0.018	×
65	21.5	0.021	×
66	21.75	0.019	×
67	22	0.021	×
68	22.25	0.024	×
69	22.5	0.021	×
70	22.75	0.023	×

	Time (min)	BH9 Abstraction, Drawdown in BH8 (m)	Symbol
71	23	0.023	×
72	23.25	0.023	×
73	23.5	0.024	×
74	23.75	0.024	×
75	24	0.022	×
76	24.25	0.023	×
77	24.5	0.025	×
78	24.75	0.028	×
79	25	0.022	×
80	25.25	0.024	×
81	25.5	0.024	×
82	25.75	0.027	×
83	26	0.027	×
84	26.25	0.026	×
85	26.5	0.026	×
86	26.75	0.027	×
87	27	0.027	×
88	27.25	0.028	×
89	27.5	0.026	×
90	27.75	0.028	×
91	28	0.03	×
92	28.25	0.029	×
93	28.5	0.027	×
94	28.75	0.03	×
95	29	0.026	×
96	29.25	0.03	×
97	29.5	0.03	×
98	29.75	0.03	×
99	30	0.03	×
100	30.25	0.03	×
101	30.5	0.029	×
102	30.75	0.032	×
103	31	0.031	×
104	31.25	0.033	×
105	31.5	0.033	×

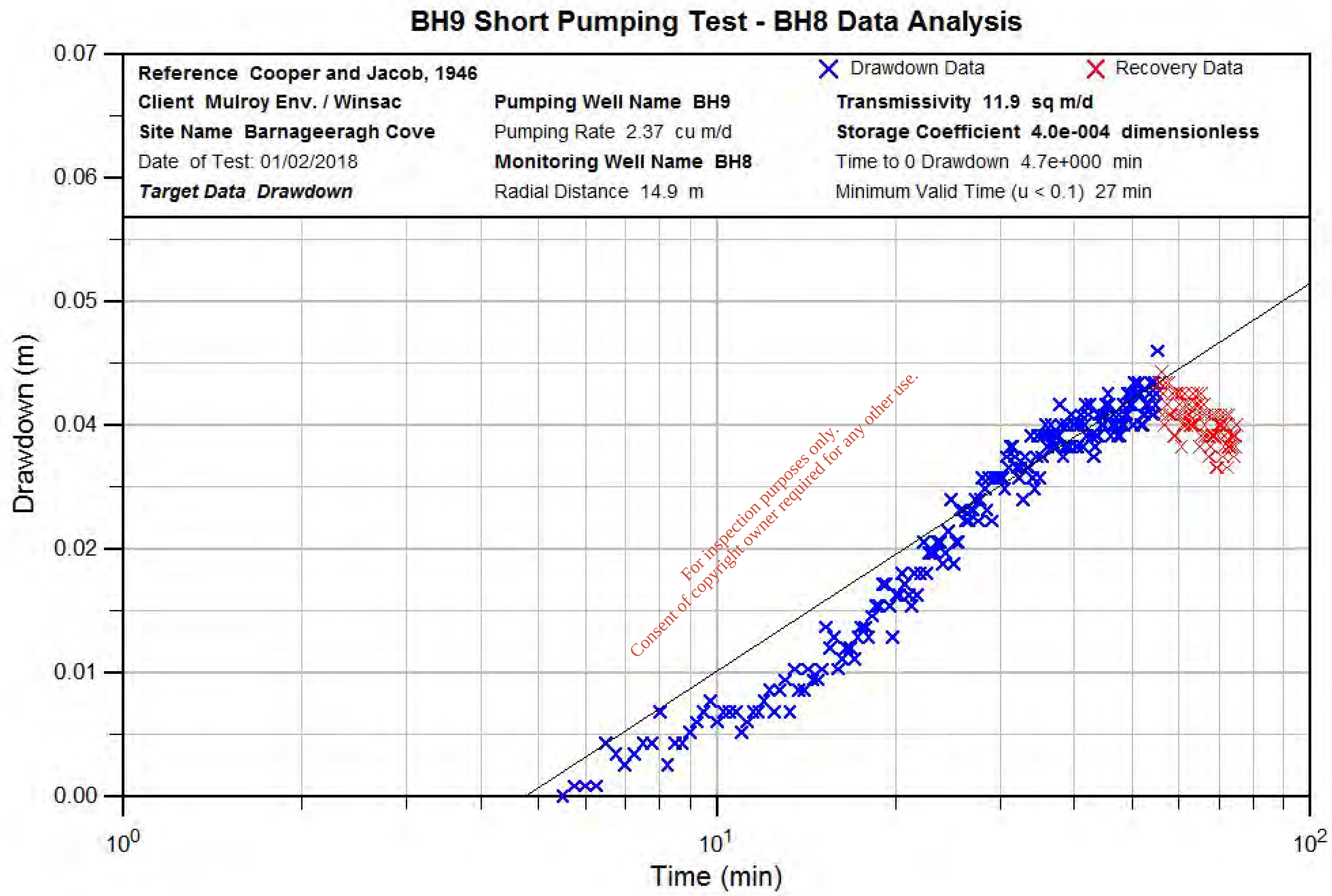
	Time (min)	BH9 Abstraction, Drawdown in BH8 (m)	Symbol
106	31.75	0.032	×
107	32	0.031	×
108	32.25	0.03	×
109	32.5	0.031	×
110	32.75	0.028	×
111	33	0.032	×
112	33.25	0.031	×
113	33.5	0.031	×
114	33.75	0.034	×
115	34	0.03	×
116	34.25	0.029	×
117	34.5	0.032	×
118	34.75	0.034	×
119	35	0.03	×
120	35.25	0.032	×
121	35.5	0.034	×
122	35.75	0.035	×
123	36	0.033	×
124	36.25	0.034	×
125	36.5	0.035	×
126	36.75	0.033	×
127	37	0.034	×
128	37.25	0.033	×
129	37.5	0.034	×
130	37.75	0.037	×
131	38	0.035	×
132	38.25	0.032	×
133	38.5	0.033	×
134	38.75	0.035	×
135	39	0.033	×
136	39.25	0.033	×
137	39.5	0.036	×
138	39.75	0.035	×
139	40	0.035	×
140	40.25	0.033	×

	Time (min)	BH9 Abstraction, Drawdown in BH8 (m)	Symbol
141	40.5	0.033	×
142	40.75	0.035	×
143	41	0.036	×
144	41.25	0.033	×
145	41.5	0.035	×
146	41.75	0.037	×
147	42	0.034	×
148	42.25	0.036	×
149	42.5	0.037	×
150	42.75	0.034	×
151	43	0.032	×
152	43.25	0.033	×
153	43.5	0.034	×
154	43.75	0.034	×
155	44	0.036	×
156	44.25	0.036	×
157	44.5	0.035	×
158	44.75	0.035	×
159	45	0.036	×
160	45.25	0.037	×
161	45.5	0.038	×
162	45.75	0.037	×
163	46	0.034	×
164	46.25	0.035	×
165	46.5	0.036	×
166	46.75	0.035	×
167	47	0.035	×
168	47.25	0.034	×
169	47.5	0.036	×
170	47.75	0.034	×
171	48	0.035	×
172	48.25	0.037	×
173	48.5	0.035	×
174	48.75	0.036	×
175	49	0.036	×

	Time (min)	BH9 Abstraction, Drawdown in BH8 (m)	Symbol
176	49.25	0.038	×
177	49.5	0.037	×
178	49.75	0.038	×
179	50	0.037	×
180	50.25	0.035	×
181	50.5	0.039	×
182	50.75	0.038	×
183	51	0.038	×
184	51.25	0.039	×
185	51.5	0.038	×
186	51.75	0.035	×
187	52	0.035	×
188	52.25	0.036	×
189	52.5	0.036	×
190	52.75	0.037	×
191	53	0.037	×
192	53.25	0.037	×
193	53.5	0.038	×
194	53.75	0.039	×
195	54	0.036	×
196	54.25	0.036	×
197	54.5	0.039	×
198	54.75	0.037	×
199	55	0.038	×
200	55.25	0.042	×
201	55.5	0.039	×
202	55.75	0.039	×
203	56	0.04	×
204	56.25	0.036	×
205	56.5	0.038	×
206	56.75	0.035	×
207	57	0.039	×
208	57.25	0.037	×
209	57.5	0.036	×
210	57.75	0.039	×

	Time (min)	BH9 Abstraction, Drawdown in BH8 (m)	Symbol
211	58	0.036	×
212	58.25	0.036	×
213	58.5	0.038	×
214	58.75	0.034	×
215	59	0.034	×
216	59.25	0.038	×
217	59.5	0.038	×
218	59.75	0.036	×
219	60	0.037	×
220	60.25	0.038	×
221	60.5	0.033	×
222	60.75	0.036	×
223	61	0.035	×
224	61.25	0.038	×
225	61.5	0.037	×
226	61.75	0.035	×
227	62	0.036	×
228	62.25	0.037	×
229	62.5	0.036	×
230	62.75	0.035	×
231	63	0.035	×
232	63.25	0.038	×
233	63.5	0.035	×
234	63.75	0.035	×
235	64	0.037	×
236	64.25	0.036	×
237	64.5	0.038	×
238	64.75	0.037	×
239	65	0.033	×
240	65.25	0.034	×
241	65.5	0.038	×
242	65.75	0.036	×
243	66	0.037	×
244	66.25	0.035	×
245	66.5	0.034	×

	Time (min)	BH9 Abstraction, Drawdown in BH8 (m)	Symbol
246	66.75	0.036	×
247	67	0.034	×
248	67.25	0.032	×
249	67.5	0.032	×
250	67.75	0.033	×
251	68	0.036	×
252	68.25	0.034	×
253	68.5	0.034	×
254	68.75	0.034	×
255	69	0.036	×
256	69.25	0.031	×
257	69.5	0.031	×
258	69.75	0.034	×
259	70	0.035	×
260	70.25	0.035	×
261	70.5	0.036	×
262	70.75	0.035	×
263	71	0.032	×
264	71.25	0.033	×
265	71.5	0.034	×
266	71.75	0.036	×
267	72	0.035	×
268	72.25	0.031	×
269	72.5	0.033	×
270	72.75	0.036	×
271	73	0.033	×
272	73.25	0.034	×
273	73.5	0.034	×
274	73.75	0.033	×
275	74	0.032	×
276	74.25	0.034	×
277	74.5	0.034	×
278	74.75	0.033	×
279	75	0.035	×



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

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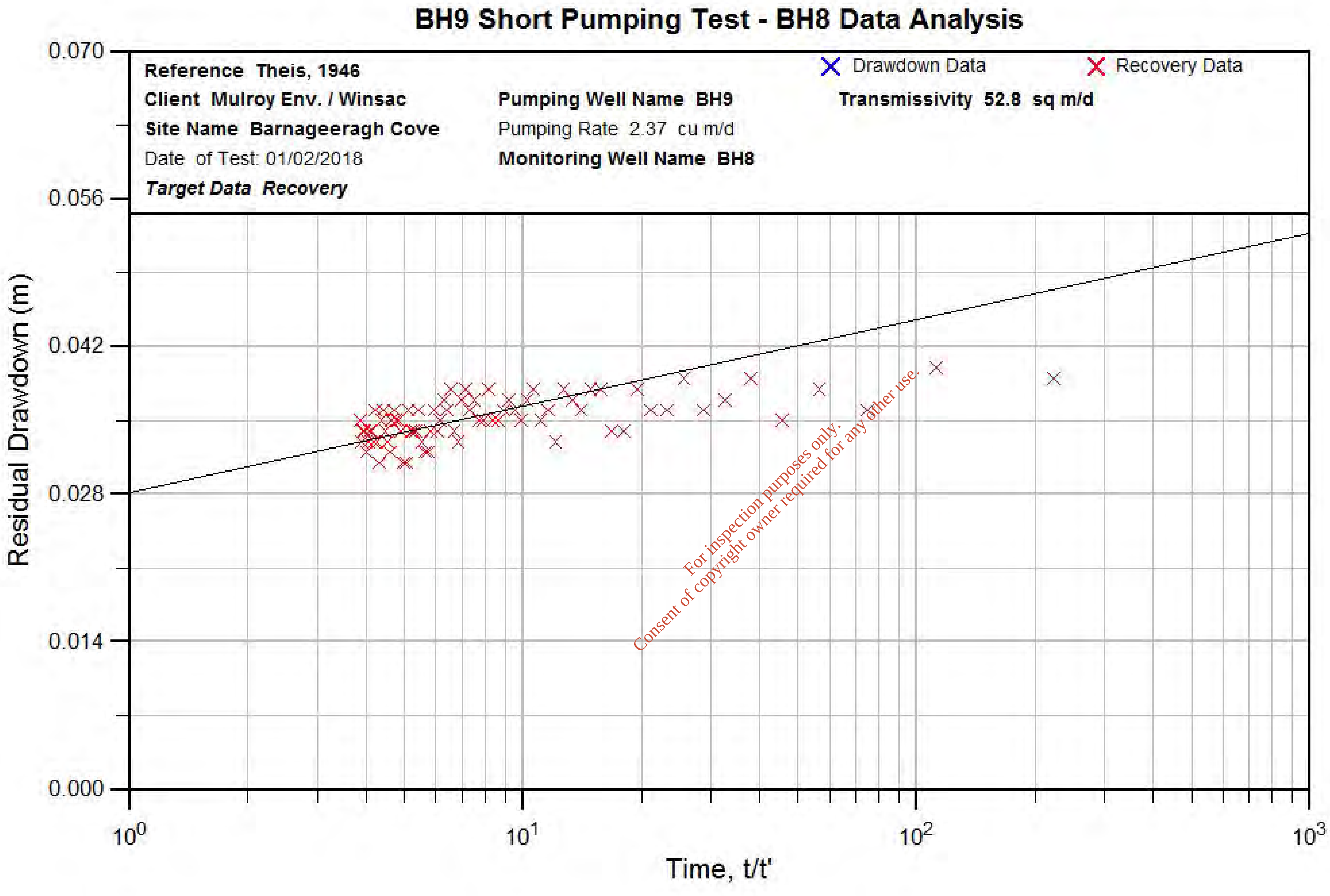


1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

	Time (min)	BH9 Abstraction, Drawdown in BH9 (m)	Symbol
1	0.25	0.718	×
2	0.5	0.724	×
3	0.75	0.705	×
4	1	0.721	×
5	1.25	0.785	×
6	1.5	0.874	×
7	1.75	0.939	×
8	2	1.02	×
9	2.25	1.125	×
10	2.5	1.288	×
11	2.75	1.461	×
12	3	1.733	×
13	3.25	2.606	×
14	3.5	3.552	×
15	3.75	4.274	×
16	4	3.734	×
17	4.25	3.502	×
18	4.5	3.277	×
19	4.75	3.065	×
20	5	2.893	×
21	5.25	2.719	×
22	5.5	2.549	×
23	5.75	2.415	×
24	6	2.258	×
25	6.25	2.123	×
26	6.5	1.994	×
27	6.75	1.883	×
28	7	1.761	×
29	7.25	1.979	×
30	7.5	3.015	×
31	7.75	4.443	×
32	8	4.011	×
33	8.25	3.754	×
34	8.5	3.581	×
35	8.75	3.403	×

	Time (min)	BH9 Abstraction, Drawdown in BH9 (m)	Symbol
36	9	3.252	×
37	9.25	3.082	×
38	9.5	2.92	×
39	9.75	2.813	×
40	10	2.702	×
41	10.25	2.541	×
42	10.5	2.42	×
43	10.75	2.309	×
44	11	2.165	×
45	11.25	2.064	×
46	11.5	1.964	×
47	11.75	1.871	×
48	12	1.787	×
49	12.25	1.692	×
50	12.5	1.614	×
51	12.75	1.583	×
52	13	1.559	×
53	13.25	1.533	×
54	13.5	1.522	×
55	13.75	1.516	×
56	14	1.5	×
57	14.25	1.977	×
58	14.5	2.951	×
59	14.75	4.195	×
60	15	4.092	×
61	15.25	3.779	×
62	15.5	3.665	×
63	15.75	3.459	×
64	16	3.332	×
65	16.25	3.226	×
66	16.5	3.073	×
67	16.75	2.933	×
68	17	2.803	×
69	17.25	2.716	×
70	17.5	2.562	×

	Time (min)	BH9 Abstraction, Drawdown in BH9 (m)	Symbol
71	17.75	2.476	×
72	18	2.374	×
73	18.25	2.26	×
74	18.5	2.142	×
75	18.75	2.054	×
76	19	1.969	×
77	19.25	1.867	×
78	19.5	1.788	×
79	19.75	1.691	×
80	20	1.664	×
81	20.25	1.619	×
82	20.5	1.568	×
83	20.75	1.578	×
84	21	1.539	×
85	21.25	1.515	×
86	21.5	1.485	×
87	21.75	1.498	×
88	22	1.479	×
89	22.25	1.467	×
90	22.5	1.435	×
91	22.75	1.532	×
92	23	2.152	×
93	23.25	3.147	×
94	23.5	4.523	×
95	23.75	4.012	×
96	24	3.789	×
97	24.25	3.64	×
98	24.5	3.489	×
99	24.75	3.355	×
100	25	3.22	×
101	25.25	3.092	×
102	25.5	2.96	×
103	25.75	2.839	×
104	26	2.74	×
105	26.25	2.195	×

	Time (min)	BH9 Abstraction, Drawdown in BH9 (m)	Symbol
106	26.5	1.681	×
107	26.75	1.624	×
108	27	1.586	×
109	27.25	1.561	×
110	27.5	1.545	×
111	27.75	1.527	×
112	28	1.515	×
113	28.25	1.503	×
114	28.5	1.489	×
115	28.75	1.478	×
116	29	1.473	×
117	29.25	1.459	×
118	29.5	1.447	×
119	29.75	1.439	×
120	30	1.427	×
121	30.25	1.422	×
122	30.5	1.411	×
123	30.75	1.399	×
124	31	1.387	×
125	31.25	1.377	×
126	31.5	1.365	×
127	31.75	1.353	×
128	32	1.344	×
129	32.25	1.33	×
130	32.5	1.32	×
131	32.75	1.309	×
132	33	1.297	×
133	33.25	1.287	×
134	33.5	1.274	×
135	33.75	1.264	×
136	34	1.254	×
137	34.25	1.241	×
138	34.5	1.233	×
139	34.75	1.221	×
140	35	1.21	×

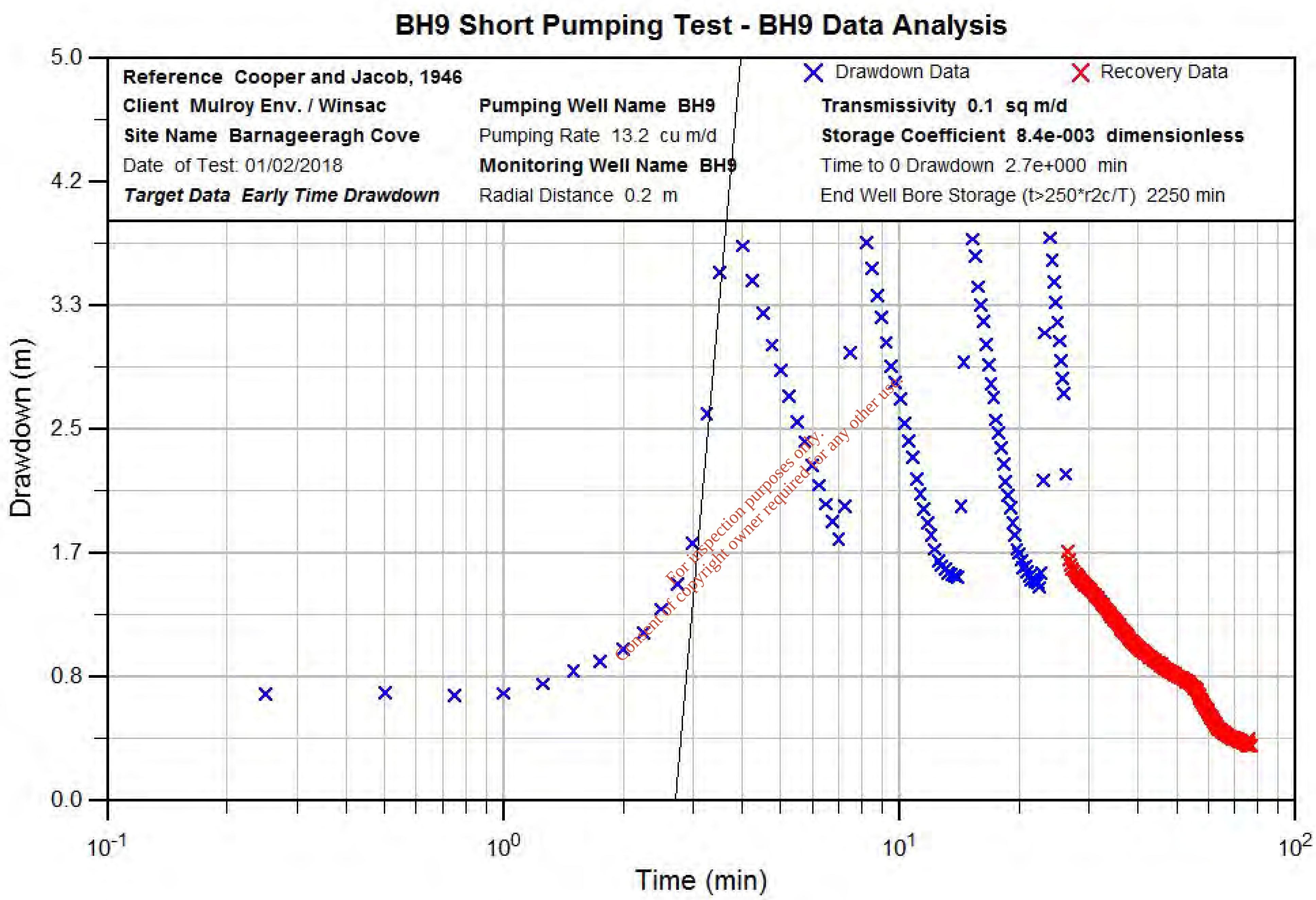
	Time (min)	BH9 Abstraction, Drawdown in BH9 (m)	Symbol
141	35.25	1.2	✕
142	35.5	1.188	✕
143	35.75	1.183	✕
144	36	1.17	✕
145	36.25	1.157	✕
146	36.5	1.148	✕
147	36.75	1.139	✕
148	37	1.128	✕
149	37.25	1.117	✕
150	37.5	1.11	✕
151	37.75	1.101	✕
152	38	1.089	✕
153	38.25	1.078	✕
154	38.5	1.073	✕
155	38.75	1.064	✕
156	39	1.057	✕
157	39.25	1.052	✕
158	39.5	1.046	✕
159	39.75	1.037	✕
160	40	1.027	✕
161	40.25	1.024	✕
162	40.5	1.016	✕
163	40.75	1.008	✕
164	41	1.005	✕
165	41.25	0.999	✕
166	41.5	0.993	✕
167	41.75	0.988	✕
168	42	0.985	✕
169	42.25	0.976	✕
170	42.5	0.971	✕
171	42.75	0.965	✕
172	43	0.963	✕
173	43.25	0.958	✕
174	43.5	0.951	✕
175	43.75	0.948	✕

	Time (min)	BH9 Abstraction, Drawdown in BH9 (m)	Symbol
176	44	0.944	✕
177	44.25	0.94	✕
178	44.5	0.931	✕
179	44.75	0.926	✕
180	45	0.922	✕
181	45.25	0.926	✕
182	45.5	0.911	✕
183	45.75	0.912	✕
184	46	0.916	✕
185	46.25	0.9	✕
186	46.5	0.89	✕
187	46.75	0.891	✕
188	47	0.886	✕
189	47.25	0.882	✕
190	47.5	0.88	✕
191	47.75	0.873	✕
192	48	0.875	✕
193	48.25	0.867	✕
194	48.5	0.864	✕
195	48.75	0.86	✕
196	49	0.856	✕
197	49.25	0.851	✕
198	49.5	0.852	✕
199	49.75	0.844	✕
200	50	0.841	✕
201	50.25	0.841	✕
202	50.5	0.838	✕
203	50.75	0.83	✕
204	51	0.829	✕
205	51.25	0.826	✕
206	51.5	0.825	✕
207	51.75	0.819	✕
208	52	0.814	✕
209	52.25	0.813	✕
210	52.5	0.812	✕

	Time (min)	BH9 Abstraction, Drawdown in BH9 (m)	Symbol
211	52.75	0.807	✕
212	53	0.799	✕
213	53.25	0.802	✕
214	53.5	0.799	✕
215	53.75	0.796	✕
216	54	0.785	✕
217	54.25	0.782	✕
218	54.5	0.776	✕
219	54.75	0.773	✕
220	55	0.766	✕
221	55.25	0.767	✕
222	55.5	0.755	✕
223	55.75	0.754	✕
224	56	0.75	✕
225	56.25	0.74	✕
226	56.5	0.73	✕
227	56.75	0.714	✕
228	57	0.708	✕
229	57.25	0.684	✕
230	57.5	0.681	✕
231	57.75	0.669	✕
232	58	0.662	✕
233	58.25	0.642	✕
234	58.5	0.641	✕
235	58.75	0.637	✕
236	59	0.623	✕
237	59.25	0.617	✕
238	59.5	0.62	✕
239	59.75	0.606	✕
240	60	0.596	✕
241	60.25	0.599	✕
242	60.5	0.579	✕
243	60.75	0.569	✕
244	61	0.562	✕
245	61.25	0.565	✕

	Time (min)	BH9 Abstraction, Drawdown in BH9 (m)	Symbol
246	61.5	0.549	✕
247	61.75	0.547	✕
248	62	0.53	✕
249	62.25	0.526	✕
250	62.5	0.523	✕
251	62.75	0.513	✕
252	63	0.505	✕
253	63.25	0.494	✕
254	63.5	0.483	✕
255	63.75	0.482	✕
256	64	0.477	✕
257	64.25	0.476	✕
258	64.5	0.477	✕
259	64.75	0.469	✕
260	65	0.471	✕
261	65.25	0.464	✕
262	65.5	0.46	✕
263	65.75	0.457	✕
264	66	0.453	✕
265	66.25	0.452	✕
266	66.5	0.447	✕
267	66.75	0.446	✕
268	67	0.439	✕
269	67.25	0.441	✕
270	67.5	0.434	✕
271	67.75	0.435	✕
272	68	0.433	✕
273	68.25	0.431	✕
274	68.5	0.428	✕
275	68.75	0.423	✕
276	69	0.416	✕
277	69.25	0.422	✕
278	69.5	0.42	✕
279	69.75	0.419	✕
280	70	0.412	✕

	Time (min)	BH9 Abstraction, Drawdown in BH9 (m)	Symbol
281	70.25	0.415	×
282	70.5	0.411	×
283	70.75	0.409	×
284	71	0.405	×
285	71.25	0.402	×
286	71.5	0.405	×
287	71.75	0.4	×
288	72	0.398	×
289	72.25	0.397	×
290	72.5	0.396	×
291	72.75	0.404	×
292	73	0.396	×
293	73.25	0.391	×
294	73.5	0.39	×
295	73.75	0.388	×
296	74	0.39	×
297	74.25	0.384	×
298	74.5	0.377	×
299	74.75	0.381	×
300	75	0.38	×
301	75.25	0.378	×
302	75.5	0.367	×
303	75.75	0.418	×
304	76	0.384	×
305	76.25	0.367	×
306	76.5	0.366	×
307	76.75	0.366	×
308	77	0.365	×



1114 Barnageeragh Cove
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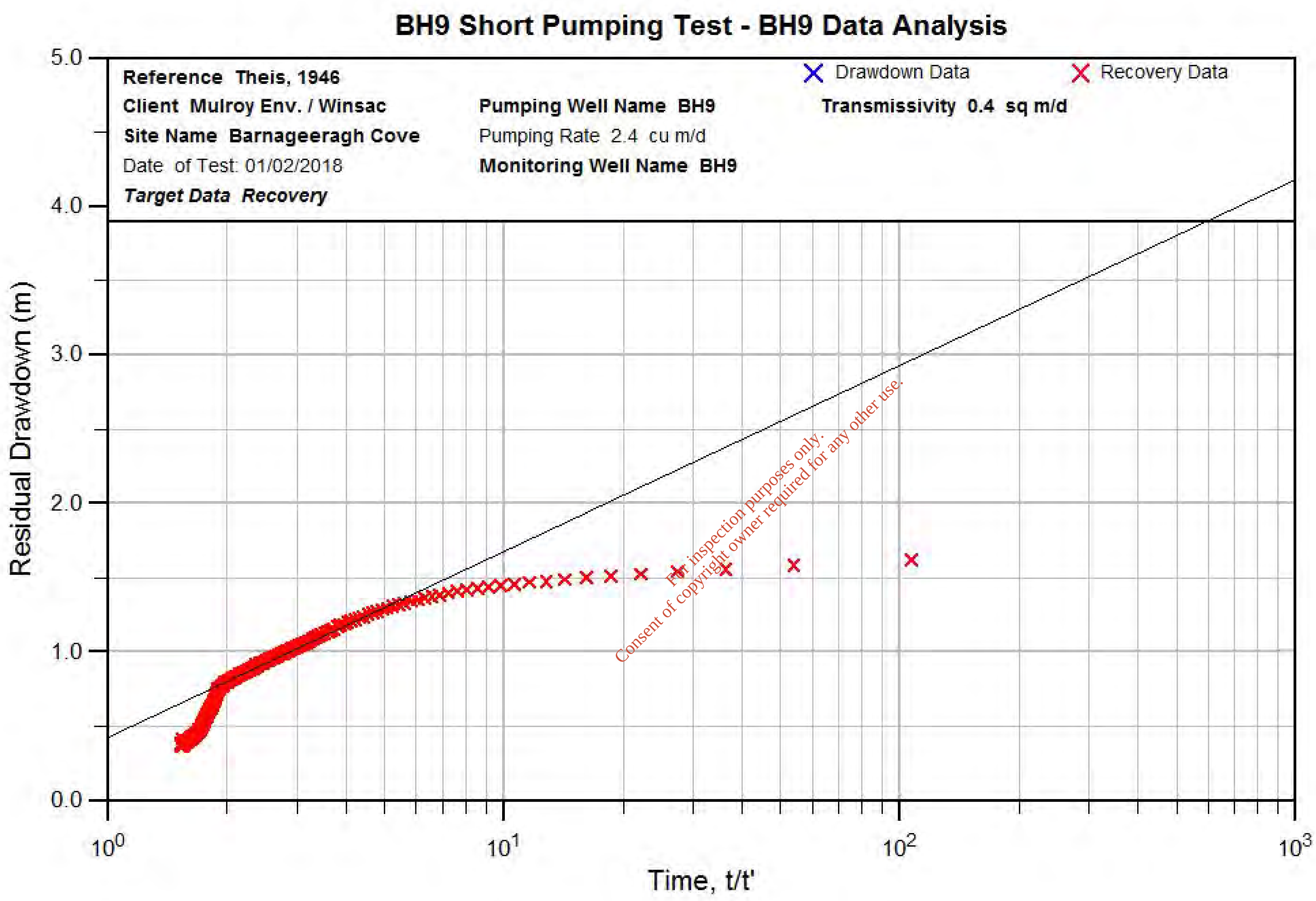

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	Time (min)	BH10 Abstraction, Drawdown in BH9 (m)	Symbol
1	0.25	0.005	×
2	0.5	0.003	×
3	0.75	0	×
4	1	0.003	×
5	1.25	-0.002	×
6	1.5	0.001	×
7	1.75	0.002	×
8	2	0.001	×
9	2.25	-0.001	×
10	2.5	0.002	×
11	2.75	0.002	×
12	3	0.002	×
13	3.25	0.001	×
14	3.5	0.003	×
15	3.75	0	×
16	4	0.002	×
17	4.25	0.002	×
18	4.5	0.002	×
19	4.75	0.006	×
20	5	0	×
21	5.25	0.004	×
22	5.5	0.005	×
23	5.75	0.002	×
24	6	0.007	×
25	6.25	0.006	×
26	6.5	0.004	×
27	6.75	0.008	×
28	7	0.004	×
29	7.25	0.004	×
30	7.5	0.005	×
31	7.75	0.008	×
32	8	0.005	×
33	8.25	0.006	×
34	8.5	0.007	×
35	8.75	0.005	×

	Time (min)	BH10 Abstraction, Drawdown in BH9 (m)	Symbol
36	9	0.01	×
37	9.25	0.008	×
38	9.5	0.004	×
39	9.75	0.008	×
40	10	0.008	×
41	10.25	0.006	×
42	10.5	0.009	×
43	10.75	0.011	×
44	11	0.011	×
45	11.25	0.009	×
46	11.5	0.012	×
47	11.75	0.011	×
48	12	0.012	×
49	12.25	0.014	×
50	12.5	0.009	×
51	12.75	0.01	×
52	13	0.011	×
53	13.25	0.01	×
54	13.5	0.012	×
55	13.75	0.014	×
56	14	0.009	×
57	14.25	0.011	×
58	14.5	0.014	×
59	14.75	0.012	×
60	15	0.014	×
61	15.25	0.011	×
62	15.5	0.014	×
63	15.75	0.017	×
64	16	0.012	×
65	16.25	0.013	×
66	16.5	0.013	×
67	16.75	0.013	×
68	17	0.011	×
69	17.25	0.013	×
70	17.5	0.011	×

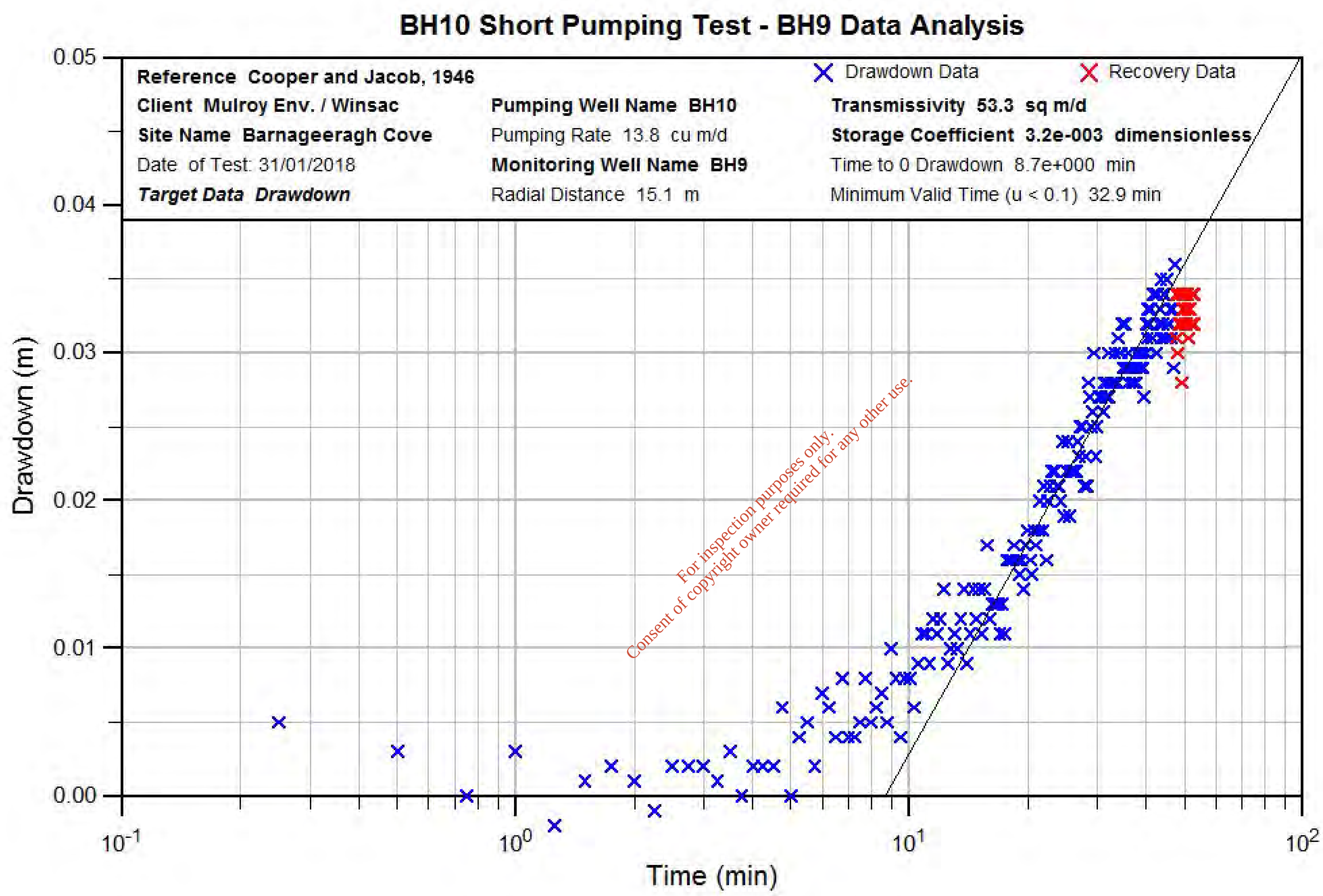
	Time (min)	BH10 Abstraction, Drawdown in BH9 (m)	Symbol
71	17.75	0.016	×
72	18	0.016	×
73	18.25	0.016	×
74	18.5	0.017	×
75	18.75	0.016	×
76	19	0.015	×
77	19.25	0.016	×
78	19.5	0.014	×
79	19.75	0.017	×
80	20	0.018	×
81	20.25	0.016	×
82	20.5	0.015	×
83	20.75	0.018	×
84	21	0.017	×
85	21.25	0.018	×
86	21.5	0.02	×
87	21.75	0.018	×
88	22	0.021	×
89	22.25	0.016	×
90	22.5	0.02	×
91	22.75	0.021	×
92	23	0.022	×
93	23.25	0.022	×
94	23.5	0.022	×
95	23.75	0.021	×
96	24	0.021	×
97	24.25	0.02	×
98	24.5	0.024	×
99	24.75	0.019	×
100	25	0.022	×
101	25.25	0.024	×
102	25.5	0.019	×
103	25.75	0.022	×
104	26	0.022	×
105	26.25	0.022	×

	Time (min)	BH10 Abstraction, Drawdown in BH9 (m)	Symbol
106	26.5	0.022	×
107	26.75	0.024	×
108	27	0.023	×
109	27.25	0.025	×
110	27.5	0.025	×
111	27.75	0.021	×
112	28	0.023	×
113	28.25	0.021	×
114	28.5	0.028	×
115	28.75	0.027	×
116	29	0.025	×
117	29.25	0.026	×
118	29.5	0.03	×
119	29.75	0.023	×
120	30	0.025	×
121	30.25	0.027	×
122	30.5	0.027	×
123	30.75	0.027	×
124	31	0.026	×
125	31.25	0.028	×
126	31.5	0.027	×
127	31.75	0.028	×
128	32	0.03	×
129	32.25	0.027	×
130	32.5	0.028	×
131	32.75	0.028	×
132	33	0.028	×
133	33.25	0.03	×
134	33.5	0.028	×
135	33.75	0.028	×
136	34	0.031	×
137	34.25	0.03	×
138	34.5	0.03	×
139	34.75	0.032	×
140	35	0.029	×

	Time (min)	BH10 Abstraction, Drawdown in BH9 (m)	Symbol
141	35.25	0.032	×
142	35.5	0.029	×
143	35.75	0.029	×
144	36	0.03	×
145	36.25	0.028	×
146	36.5	0.029	×
147	36.75	0.029	×
148	37	0.028	×
149	37.25	0.028	×
150	37.5	0.028	×
151	37.75	0.029	×
152	38	0.03	×
153	38.25	0.03	×
154	38.5	0.029	×
155	38.75	0.03	×
156	39	0.03	×
157	39.25	0.029	×
158	39.5	0.027	×
159	39.75	0.03	×
160	40	0.032	×
161	40.25	0.031	×
162	40.5	0.033	×
163	40.75	0.032	×
164	41	0.033	×
165	41.25	0.031	×
166	41.5	0.031	×
167	41.75	0.034	×
168	42	0.034	×
169	42.25	0.03	×
170	42.5	0.03	×
171	42.75	0.034	×
172	43	0.032	×
173	43.25	0.033	×
174	43.5	0.035	×
175	43.75	0.031	×

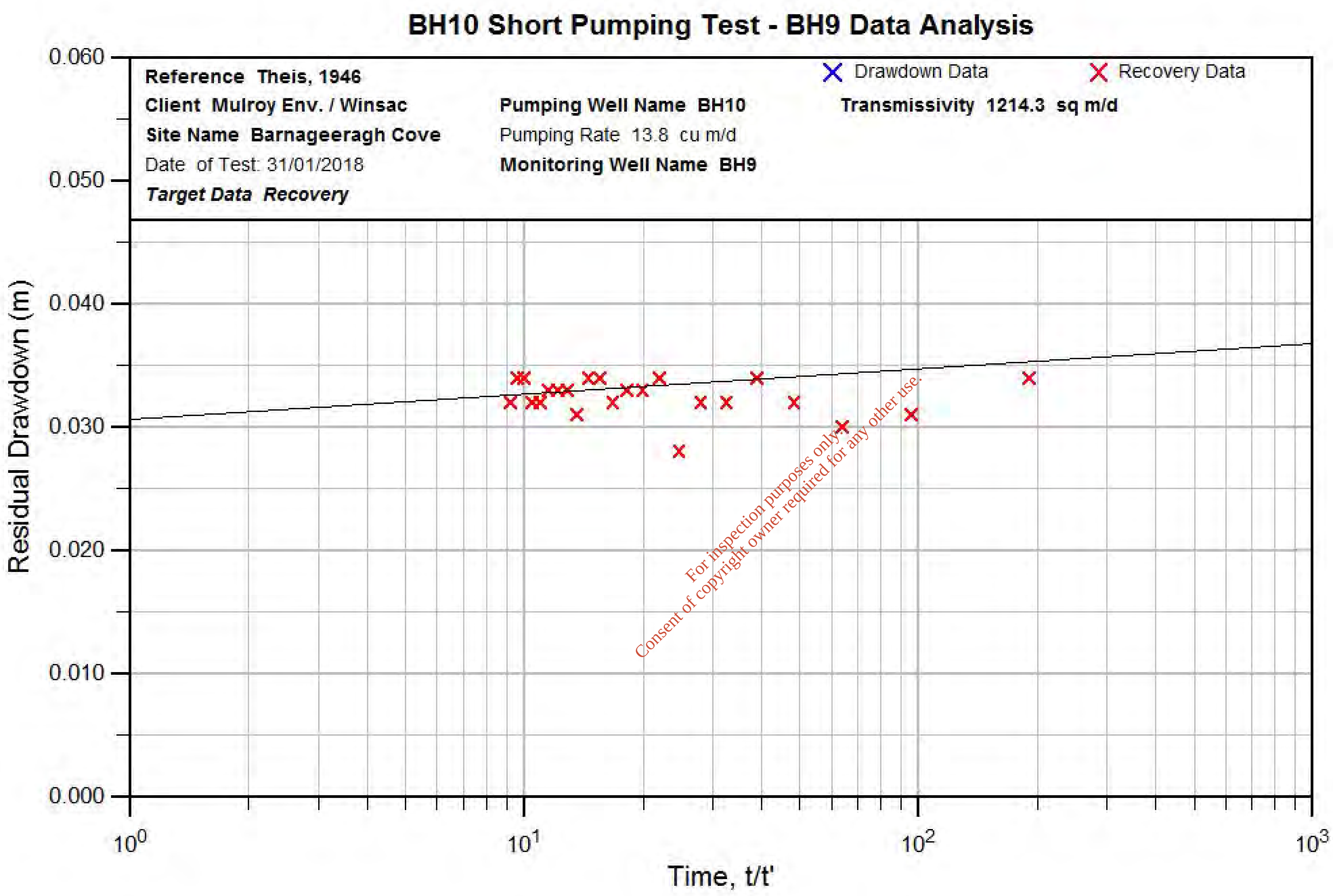
	Time (min)	BH10 Abstraction, Drawdown in BH9 (m)	Symbol
176	44	0.032	×
177	44.25	0.034	×
178	44.5	0.034	×
179	44.75	0.031	×
180	45	0.031	×
181	45.25	0.035	×
182	45.5	0.032	×
183	45.75	0.032	×
184	46	0.033	×
185	46.25	0.031	×
186	46.5	0.033	×
187	46.75	0.033	×
188	47	0.029	×
189	47.25	0.036	×
190	47.5	0.034	×
191	47.75	0.031	×
192	48	0.03	×
193	48.25	0.032	×
194	48.5	0.034	×
195	48.75	0.032	×
196	49	0.032	×
197	49.25	0.028	×
198	49.5	0.034	×
199	49.75	0.033	×
200	50	0.033	×
201	50.25	0.032	×
202	50.5	0.034	×
203	50.75	0.034	×
204	51	0.031	×
205	51.25	0.033	×
206	51.5	0.033	×
207	51.75	0.033	×
208	52	0.032	×
209	52.25	0.032	×
210	52.5	0.034	×

	Time (min)	BH10 Abstraction, Drawdown in BH9 (m)	Symbol
211	52.75	0.034	✕
212	53	0.032	✕

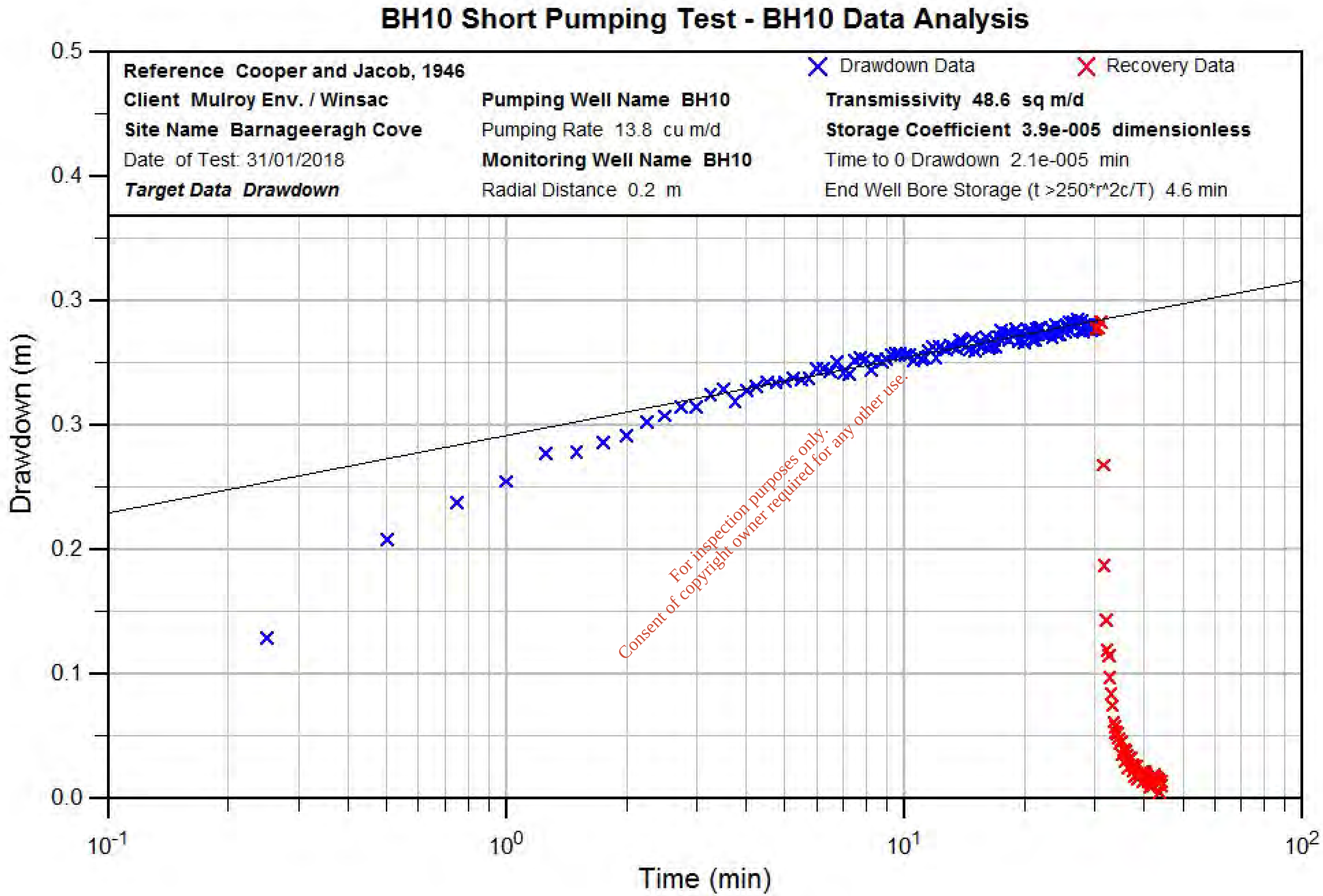


1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

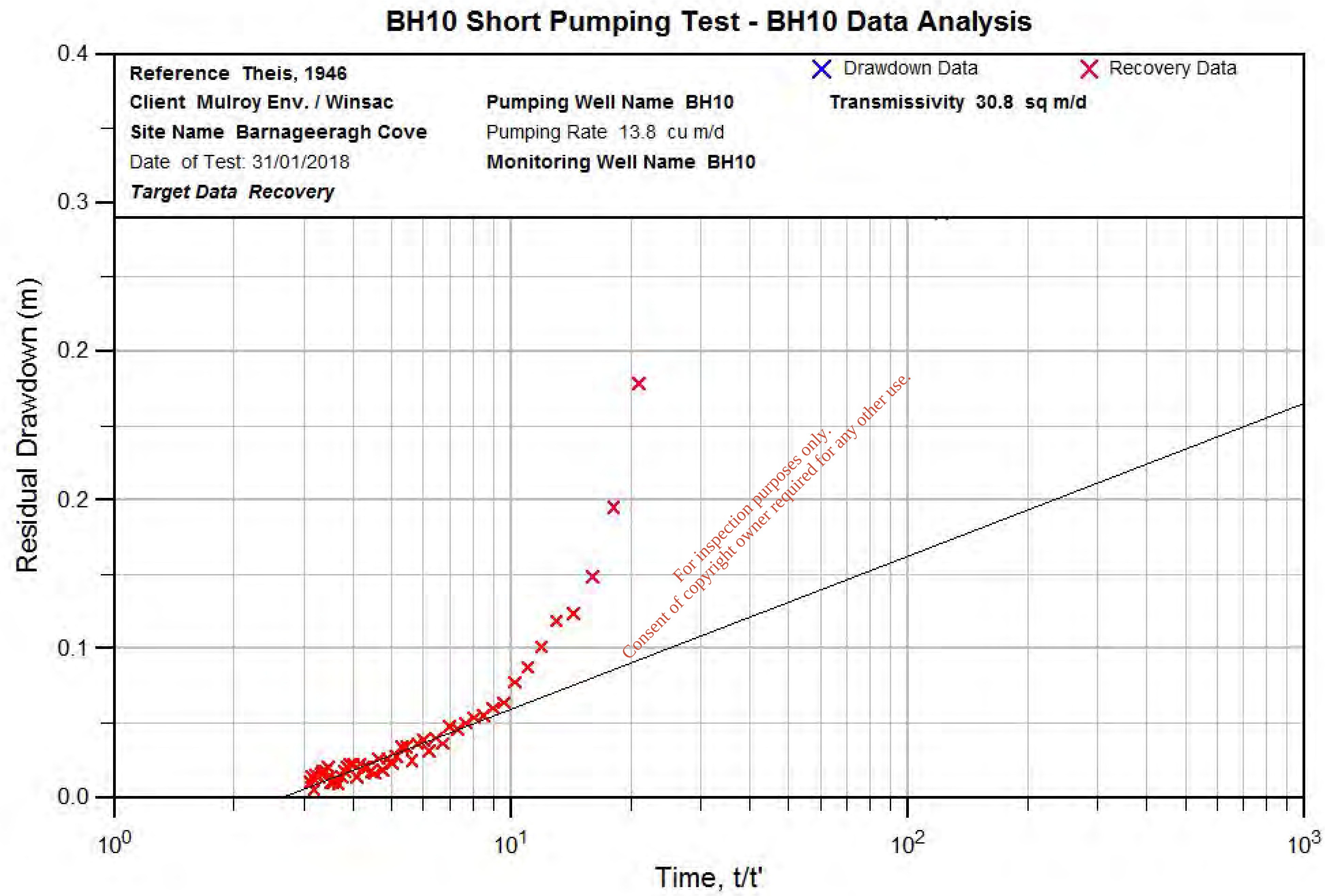


1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



1114 Barnageeragh Cove
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Hidrigeolaíocht Uí Chonaire Teoranta

HCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

	Time (min)	BH10 Abstraction, Drawdown in BH10 (m)	Symbol
1	0.25	0.107	×
2	0.5	0.173	×
3	0.75	0.198	×
4	1	0.212	×
5	1.25	0.231	×
6	1.5	0.232	×
7	1.75	0.238	×
8	2	0.243	×
9	2.25	0.252	×
10	2.5	0.256	×
11	2.75	0.262	×
12	3	0.262	×
13	3.25	0.27	×
14	3.5	0.274	×
15	3.75	0.266	×
16	4	0.273	×
17	4.25	0.276	×
18	4.5	0.279	×
19	4.75	0.278	×
20	5	0.279	×
21	5.25	0.282	×
22	5.5	0.28	×
23	5.75	0.281	×
24	6	0.288	×
25	6.25	0.288	×
26	6.5	0.286	×
27	6.75	0.292	×
28	7	0.285	×
29	7.25	0.284	×
30	7.5	0.293	×
31	7.75	0.295	×
32	8	0.294	×
33	8.25	0.287	×
34	8.5	0.294	×
35	8.75	0.292	×

	Time (min)	BH10 Abstraction, Drawdown in BH10 (m)	Symbol
36	9	0.294	×
37	9.25	0.297	×
38	9.5	0.298	×
39	9.75	0.298	×
40	10	0.297	×
41	10.25	0.297	×
42	10.5	0.293	×
43	10.75	0.296	×
44	11	0.294	×
45	11.25	0.295	×
46	11.5	0.3	×
47	11.75	0.302	×
48	12	0.295	×
49	12.25	0.302	×
50	12.5	0.301	×
51	12.75	0.3	×
52	13	0.303	×
53	13.25	0.302	×
54	13.5	0.301	×
55	13.75	0.307	×
56	14	0.306	×
57	14.25	0.303	×
58	14.5	0.3	×
59	14.75	0.308	×
60	15	0.299	×
61	15.25	0.304	×
62	15.5	0.306	×
63	15.75	0.303	×
64	16	0.309	×
65	16.25	0.301	×
66	16.5	0.302	×
67	16.75	0.307	×
68	17	0.302	×
69	17.25	0.309	×
70	17.5	0.313	×

	Time (min)	BH10 Abstraction, Drawdown in BH10 (m)	Symbol
71	17.75	0.309	×
72	18	0.312	×
73	18.25	0.307	×
74	18.5	0.312	×
75	18.75	0.31	×
76	19	0.314	×
77	19.25	0.306	×
78	19.5	0.312	×
79	19.75	0.308	×
80	20	0.305	×
81	20.25	0.31	×
82	20.5	0.313	×
83	20.75	0.313	×
84	21	0.307	×
85	21.25	0.307	×
86	21.5	0.314	×
87	21.75	0.315	×
88	22	0.315	×
89	22.25	0.31	×
90	22.5	0.31	×
91	22.75	0.31	×
92	23	0.31	×
93	23.25	0.315	×
94	23.5	0.309	×
95	23.75	0.312	×
96	24	0.317	×
97	24.25	0.31	×
98	24.5	0.31	×
99	24.75	0.314	×
100	25	0.313	×
101	25.25	0.312	×
102	25.5	0.317	×
103	25.75	0.314	×
104	26	0.319	×
105	26.25	0.318	×

	Time (min)	BH10 Abstraction, Drawdown in BH10 (m)	Symbol
106	26.5	0.319	×
107	26.75	0.316	×
108	27	0.318	×
109	27.25	0.321	×
110	27.5	0.313	×
111	27.75	0.32	×
112	28	0.312	×
113	28.25	0.316	×
114	28.5	0.316	×
115	28.75	0.317	×
116	29	0.314	×
117	29.25	0.318	×
118	29.5	0.313	×
119	29.75	0.314	×
120	30	0.317	×
121	30.25	0.314	×
122	30.5	0.315	×
123	30.75	0.315	×
124	31	0.319	×
125	31.25	0.319	×
126	31.5	0.223	×
127	31.75	0.156	×
128	32	0.119	×
129	32.25	0.099	×
130	32.5	0.095	×
131	32.75	0.081	×
132	33	0.07	×
133	33.25	0.062	×
134	33.5	0.051	×
135	33.75	0.048	×
136	34	0.044	×
137	34.25	0.043	×
138	34.5	0.04	×
139	34.75	0.037	×
140	35	0.038	×

	Time (min)	BH10 Abstraction, Drawdown in BH10 (m)	Symbol
141	35.25	0.029	✕
142	35.5	0.032	✕
143	35.75	0.025	✕
144	36	0.031	✕
145	36.25	0.029	✕
146	36.5	0.02	✕
147	36.75	0.027	✕
148	37	0.027	✕
149	37.25	0.022	✕
150	37.5	0.018	✕
151	37.75	0.021	✕
152	38	0.015	✕
153	38.25	0.021	✕
154	38.5	0.013	✕
155	38.75	0.014	✕
156	39	0.016	✕
157	39.25	0.016	✕
158	39.5	0.018	✕
159	39.75	0.011	✕
160	40	0.018	✕
161	40.25	0.018	✕
162	40.5	0.016	✕
163	40.75	0.014	✕
164	41	0.011	✕
165	41.25	0.007	✕
166	41.5	0.01	✕
167	41.75	0.008	✕
168	42	0.008	✕
169	42.25	0.016	✕
170	42.5	0.014	✕
171	42.75	0.014	✕
172	43	0.013	✕
173	43.25	0.011	✕
174	43.5	0.012	✕
175	43.75	0.004	✕

	Time (min)	BH10 Abstraction, Drawdown in BH10 (m)	Symbol
176	44	0.011	✕
177	44.25	0.008	✕

	Time (min)	BH11 Abstraction, Drawdown in BH10 (m)	Symbol
1	0.25	0.001	×
2	0.5	0.001	×
3	0.75	-0.001	×
4	1	-0.001	×
5	1.25	-0.001	×
6	1.5	0	×
7	1.75	0	×
8	2	0.001	×
9	2.25	-0.003	×
10	2.5	0.001	×
11	2.75	0	×
12	3	-0.001	×
13	3.25	0.002	×
14	3.5	0	×
15	3.75	0.002	×
16	4	-0.001	×
17	4.25	0.001	×
18	4.5	0	×
19	4.75	0.001	×
20	5	0.001	×
21	5.25	0.002	×
22	5.5	0	×
23	5.75	0.001	×
24	6	0	×
25	6.25	-0.001	×
26	6.5	0.001	×
27	6.75	0.002	×
28	7	-0.001	×
29	7.25	0	×
30	7.5	0.001	×
31	7.75	0.002	×
32	8	0.001	×
33	8.25	0.001	×
34	8.5	0.002	×
35	8.75	0.001	×

	Time (min)	BH11 Abstraction, Drawdown in BH10 (m)	Symbol
36	9	0.002	×
37	9.25	0	×
38	9.5	0.002	×
39	9.75	0.004	×
40	10	0.003	×
41	10.25	0.002	×
42	10.5	-0.002	×
43	10.75	0.001	×
44	11	0	×
45	11.25	0	×
46	11.5	0.001	×
47	11.75	0.001	×
48	12	0.003	×
49	12.25	0	×
50	12.5	-0.001	×
51	12.75	0.002	×
52	13	0	×
53	13.25	0.001	×
54	13.5	-0.001	×
55	13.75	0.003	×
56	14	0.002	×
57	14.25	0.002	×
58	14.5	0	×
59	14.75	0	×
60	15	-0.002	×
61	15.25	-0.001	×
62	15.5	0	×
63	15.75	0	×
64	16	-0.003	×
65	16.25	-0.002	×
66	16.5	-0.001	×
67	16.75	0.003	×
68	17	-0.001	×
69	17.25	-0.001	×
70	17.5	0	×

	Time (min)	BH11 Abstraction, Drawdown in BH10 (m)	Symbol
71	17.75	0	×
72	18	0	×
73	18.25	0.002	×
74	18.5	0	×
75	18.75	0.002	×
76	19	0.002	×
77	19.25	0	×
78	19.5	0	×
79	19.75	-0.003	×
80	20	0	×
81	20.25	-0.002	×
82	20.5	0.001	×
83	20.75	0.001	×
84	21	0	×
85	21.25	0.002	×
86	21.5	0	×
87	21.75	0	×
88	22	-0.003	×
89	22.25	0.001	×
90	22.5	0.001	×
91	22.75	0.001	×
92	23	-0.001	×
93	23.25	-0.001	×
94	23.5	0.001	×
95	23.75	0.002	×
96	24	0	×
97	24.25	0.001	×
98	24.5	-0.002	×
99	24.75	0.001	×
100	25	-0.001	×
101	25.25	0.003	×
102	25.5	-0.001	×
103	25.75	0	×
104	26	0.001	×
105	26.25	0.002	×

	Time (min)	BH11 Abstraction, Drawdown in BH10 (m)	Symbol
106	26.5	0.001	×
107	26.75	0	×
108	27	0	×
109	27.25	-0.002	×
110	27.5	-0.002	×
111	27.75	-0.001	×
112	28	-0.001	×
113	28.25	0	×
114	28.5	0	×
115	28.75	-0.004	×
116	29	-0.001	×
117	29.25	-0.001	×
118	29.5	-0.002	×
119	29.75	-0.002	×
120	30	-0.001	×
121	30.25	-0.002	×
122	30.5	-0.004	×
123	30.75	-0.003	×
124	31	-0.002	×
125	31.25	-0.002	×
126	31.5	-0.003	×
127	31.75	-0.002	×
128	32	-0.004	×
129	32.25	-0.006	×
130	32.5	-0.003	×
131	32.75	-0.002	×
132	33	-0.004	×
133	33.25	-0.001	×
134	33.5	-0.003	×
135	33.75	-0.003	×
136	34	8.88178e-015	×
137	34.25	8.88178e-015	×
138	34.5	-0.002	×
139	34.75	-0.001	×
140	35	-0.005	×

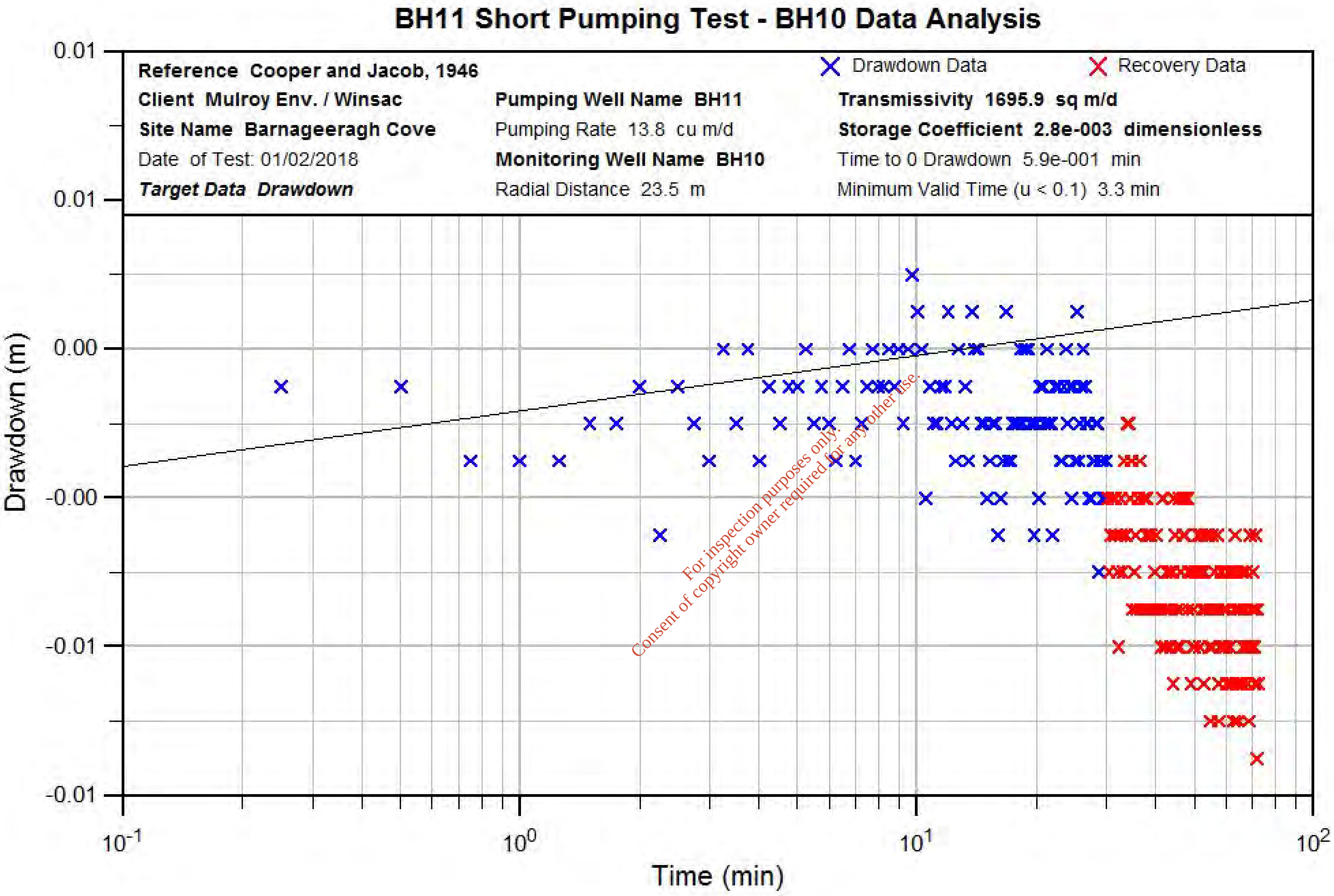
	Time (min)	BH11 Abstraction, Drawdown in BH10 (m)	Symbol
141	35.25	-0.004	✕
142	35.5	-0.003	✕
143	35.75	-0.005	✕
144	36	-0.002	✕
145	36.25	-0.002	✕
146	36.5	-0.001	✕
147	36.75	-0.005	✕
148	37	-0.005	✕
149	37.25	-0.002	✕
150	37.5	-0.005	✕
151	37.75	-0.003	✕
152	38	-0.002	✕
153	38.25	-0.003	✕
154	38.5	-0.005	✕
155	38.75	-0.003	✕
156	39	-0.003	✕
157	39.25	-0.005	✕
158	39.5	-0.005	✕
159	39.75	-0.004	✕
160	40	-0.003	✕
161	40.25	-0.005	✕
162	40.5	-0.005	✕
163	40.75	-0.005	✕
164	41	-0.005	✕
165	41.25	-0.006	✕
166	41.5	-0.002	✕
167	41.75	-0.002	✕
168	42	-0.005	✕
169	42.25	-0.006	✕
170	42.5	-0.004	✕
171	42.75	-0.005	✕
172	43	-0.005	✕
173	43.25	-0.004	✕
174	43.5	-0.006	✕
175	43.75	-0.005	✕

	Time (min)	BH11 Abstraction, Drawdown in BH10 (m)	Symbol
176	44	-0.004	✕
177	44.25	-0.007	✕
178	44.5	-0.002	✕
179	44.75	-0.003	✕
180	45	-0.005	✕
181	45.25	-0.006	✕
182	45.5	-0.006	✕
183	45.75	-0.002	✕
184	46	-0.006	✕
185	46.25	-0.004	✕
186	46.5	-0.005	✕
187	46.75	-0.002	✕
188	47	-0.003	✕
189	47.25	-0.003	✕
190	47.5	-0.002	✕
191	47.75	-0.002	✕
192	48	-0.002	✕
193	48.25	-0.005	✕
194	48.5	-0.004	✕
195	48.75	-0.004	✕
196	49	-0.007	✕
197	49.25	-0.004	✕
198	49.5	-0.006	✕
199	49.75	-0.005	✕
200	50	-0.006	✕
201	50.25	-0.004	✕
202	50.5	-0.004	✕
203	50.75	-0.004	✕
204	51	-0.004	✕
205	51.25	-0.003	✕
206	51.5	-0.006	✕
207	51.75	-0.004	✕
208	52	-0.003	✕
209	52.25	-0.005	✕
210	52.5	-0.004	✕

	Time (min)	BH11 Abstraction, Drawdown in BH10 (m)	Symbol
211	52.75	-0.004	×
212	53	-0.007	×
213	53.25	-0.003	×
214	53.5	-0.003	×
215	53.75	-0.005	×
216	54	-0.003	×
217	54.25	-0.003	×
218	54.5	-0.006	×
219	54.75	-0.005	×
220	55	-0.008	×
221	55.25	-0.003	×
222	55.5	-0.006	×
223	55.75	-0.005	×
224	56	-0.004	×
225	56.25	-0.004	×
226	56.5	-0.005	×
227	56.75	-0.005	×
228	57	-0.005	×
229	57.25	-0.003	×
230	57.5	-0.008	×
231	57.75	-0.007	×
232	58	-0.006	×
233	58.25	-0.004	×
234	58.5	-0.006	×
235	58.75	-0.004	×
236	59	-0.005	×
237	59.25	-0.006	×
238	59.5	-0.005	×
239	59.75	-0.006	×
240	60	-0.006	×
241	60.25	-0.007	×
242	60.5	-0.005	×
243	60.75	-0.004	×
244	61	-0.004	×
245	61.25	-0.007	×

	Time (min)	BH11 Abstraction, Drawdown in BH10 (m)	Symbol
246	61.5	-0.006	✕
247	61.75	-0.007	✕
248	62	-0.004	✕
249	62.25	-0.007	✕
250	62.5	-0.004	✕
251	62.75	-0.004	✕
252	63	-0.008	✕
253	63.25	-0.005	✕
254	63.5	-0.003	✕
255	63.75	-0.004	✕
256	64	-0.005	✕
257	64.25	-0.007	✕
258	64.5	-0.008	✕
259	64.75	-0.005	✕
260	65	-0.007	✕
261	65.25	-0.007	✕
262	65.5	-0.005	✕
263	65.75	-0.004	✕
264	66	-0.004	✕
265	66.25	-0.007	✕
266	66.5	-0.006	✕
267	66.75	-0.006	✕
268	67	-0.005	✕
269	67.25	-0.006	✕
270	67.5	-0.006	✕
271	67.75	-0.004	✕
272	68	-0.007	✕
273	68.25	-0.006	✕
274	68.5	-0.008	✕
275	68.75	-0.006	✕
276	69	-0.003	✕
277	69.25	-0.006	✕
278	69.5	-0.005	✕
279	69.75	-0.006	✕
280	70	-0.004	✕

	Time (min)	BH11 Abstraction, Drawdown in BH10 (m)	Symbol
281	70.25	-0.006	×
282	70.5	-0.005	×
283	70.75	-0.006	×
284	71	-0.007	×
285	71.25	-0.003	×
286	71.5	-0.005	×
287	71.75	-0.009	×
288	72	-0.005	×
289	72.25	-0.007	×



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

	Time (min)	BH11 Abstraction, Drawdown in BH11 (m)	Symbol
1	0.5	0.066	×
2	0.75	0.066	×
3	1	0.066	×
4	1.25	0.068	×
5	1.5	0.067	×
6	1.75	0.065	×
7	2	0.064	×
8	2.25	0.066	×
9	2.5	0.068	×
10	2.75	0.068	×
11	3	0.065	×
12	3.25	0.068	×
13	3.5	0.065	×
14	3.75	0.067	×
15	4	0.067	×
16	4.25	0.064	×
17	4.5	0.069	×
18	4.75	0.067	×
19	5	0.068	×
20	5.25	0.065	×
21	5.5	0.064	×
22	5.75	0.066	×
23	6	0.065	×
24	6.25	0.066	×
25	6.5	0.068	×
26	6.75	0.066	×
27	7	0.067	×
28	7.25	0.065	×
29	7.5	0.066	×
30	7.75	0.065	×
31	8	0.064	×
32	8.25	0.065	×
33	8.5	0.068	×
34	8.75	0.066	×
35	9	0.067	×

	Time (min)	BH11 Abstraction, Drawdown in BH11 (m)	Symbol
36	9.25	0.064	×
37	9.5	0.066	×
38	9.75	0.065	×
39	10	0.065	×
40	10.25	0.064	×
41	10.5	0.064	×
42	10.75	0.064	×
43	11	0.066	×
44	11.25	0.064	×
45	11.5	0.065	×
46	11.75	0.065	×
47	12	0.067	×
48	12.25	0.063	×
49	12.5	0.062	×
50	12.75	0.062	×
51	13	0.064	×
52	13.25	0.061	×
53	13.5	0.064	×
54	13.75	0.064	×
55	14	0.06	×
56	14.25	0.063	×
57	14.5	0.062	×
58	14.75	0.064	×
59	15	0.064	×
60	15.25	0.061	×
61	15.5	0.064	×
62	15.75	0.066	×
63	16	0.066	×
64	16.25	0.061	×
65	16.5	0.063	×
66	16.75	0.064	×
67	17	0.061	×
68	17.25	0.065	×
69	17.5	0.062	×
70	17.75	0.064	×

	Time (min)	BH11 Abstraction, Drawdown in BH11 (m)	Symbol
71	18	0.062	×
72	18.25	0.065	×
73	18.5	0.064	×
74	18.75	0.061	×
75	19	0.06	×
76	19.25	0.064	×
77	19.5	0.063	×
78	19.75	0.065	×
79	20	0.062	×
80	20.25	0.063	×
81	20.5	0.061	×
82	20.75	0.062	×
83	21	0.062	×
84	21.25	0.065	×
85	21.5	0.06	×
86	21.75	0.062	×
87	22	0.061	×
88	22.25	0.061	×
89	22.5	0.059	×
90	22.75	0.062	×
91	23	0.062	×
92	23.25	0.063	×
93	23.5	0.062	×
94	23.75	0.059	×
95	24	0.063	×
96	24.25	0.059	×
97	24.5	0.062	×
98	24.75	0.061	×
99	25	0.059	×
100	25.25	0.062	×
101	25.5	0.06	×
102	25.75	0.062	×
103	26	0.061	×
104	26.25	0.062	×
105	26.5	0.062	×

	Time (min)	BH11 Abstraction, Drawdown in BH11 (m)	Symbol
106	26.75	0.06	×
107	27	0.064	×
108	27.25	0.058	×
109	27.5	0.062	×
110	27.75	0.059	×
111	28	0.063	×
112	28.25	0.061	×
113	28.5	0.063	×
114	28.75	0.06	×
115	29	0.061	×
116	29.25	0.059	×
117	29.5	0.06	×
118	29.75	0.059	×
119	30	0.06	×
120	30.25	0	×
121	30.5	-0.019	×
122	30.75	0.006	×
123	31	0.007	×
124	31.25	0.006	×
125	31.5	0.008	×
126	31.75	0.006	×
127	32	0.005	×
128	32.25	0.004	×
129	32.5	0.005	×
130	32.75	0.003	×
131	33	0.005	×
132	33.25	0.004	×
133	33.5	0.006	×
134	33.75	0.003	×
135	34	0.005	×
136	34.25	0.004	×
137	34.5	0.005	×
138	34.75	0.004	×
139	35	0.004	×
140	35.25	0.003	×

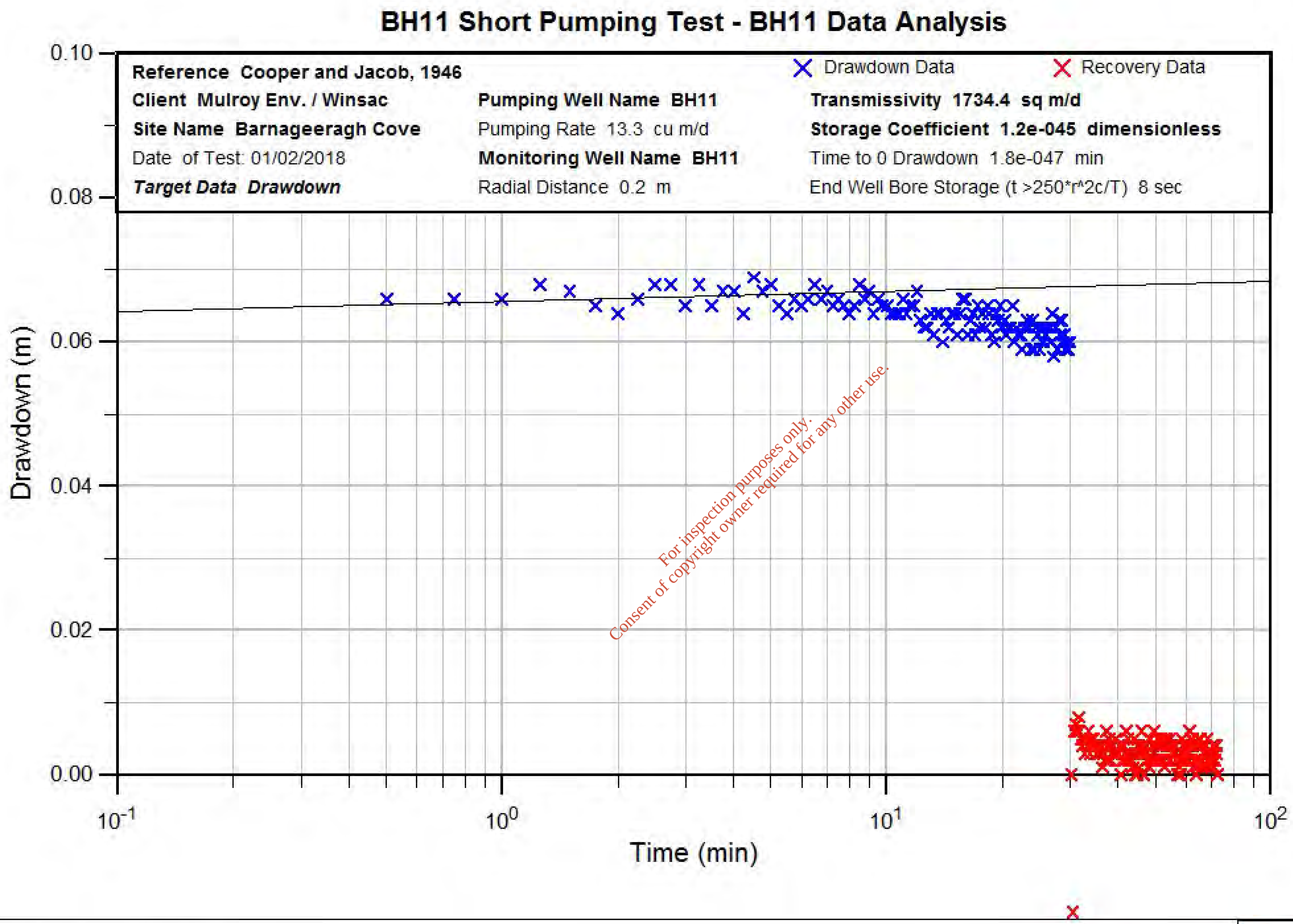
	Time (min)	BH11 Abstraction, Drawdown in BH11 (m)	Symbol
141	35.5	0.003	✕
142	35.75	0.003	✕
143	36	0.004	✕
144	36.25	0.004	✕
145	36.5	0.001	✕
146	36.75	0.003	✕
147	37	0.002	✕
148	37.25	0.006	✕
149	37.5	0.004	✕
150	37.75	0.002	✕
151	38	0.005	✕
152	38.25	0.002	✕
153	38.5	0.003	✕
154	38.75	0.004	✕
155	39	0.004	✕
156	39.25	0.003	✕
157	39.5	0.005	✕
158	39.75	0.003	✕
159	40	0.003	✕
160	40.25	0.004	✕
161	40.5	0.004	✕
162	40.75	0	✕
163	41	0.002	✕
164	41.25	0.004	✕
165	41.5	0.002	✕
166	41.75	0.003	✕
167	42	0.006	✕
168	42.25	0.003	✕
169	42.5	0.005	✕
170	42.75	0.002	✕
171	43	0.002	✕
172	43.25	0.003	✕
173	43.5	0.002	✕
174	43.75	0.001	✕
175	44	0.005	✕

	Time (min)	BH11 Abstraction, Drawdown in BH11 (m)	Symbol
176	44.25	0.003	✕
177	44.5	-8.88178e-016	✕
178	44.75	-8.88178e-016	✕
179	45	0.001	✕
180	45.25	0.004	✕
181	45.5	0.003	✕
182	45.75	0.003	✕
183	46	0.006	✕
184	46.25	0.004	✕
185	46.5	0.004	✕
186	46.75	0	✕
187	47	0.003	✕
188	47.25	0.004	✕
189	47.5	0.003	✕
190	47.75	0.002	✕
191	48	0.001	✕
192	48.25	0.005	✕
193	48.5	0.005	✕
194	48.75	0.002	✕
195	49	0.004	✕
196	49.25	0.004	✕
197	49.5	0.006	✕
198	49.75	0.003	✕
199	50	0.002	✕
200	50.25	0.002	✕
201	50.5	0.004	✕
202	50.75	0.005	✕
203	51	0.002	✕
204	51.25	0.005	✕
205	51.5	0.005	✕
206	51.75	0.005	✕
207	52	0.004	✕
208	52.25	0.002	✕
209	52.5	0.002	✕
210	52.75	0.001	✕

	Time (min)	BH11 Abstraction, Drawdown in BH11 (m)	Symbol
211	53	0.005	✕
212	53.25	0.005	✕
213	53.5	0.004	✕
214	53.75	0.004	✕
215	54	0.004	✕
216	54.25	0.002	✕
217	54.5	0.002	✕
218	54.75	0.005	✕
219	55	0.004	✕
220	55.25	0.003	✕
221	55.5	0.003	✕
222	55.75	0.004	✕
223	56	0.003	✕
224	56.25	0.003	✕
225	56.5	0.004	✕
226	56.75	0.002	✕
227	57	0.002	✕
228	57.25	-2.66454e-015	✕
229	57.5	0.002	✕
230	57.75	0.001	✕
231	58	-3.55271e-015	✕
232	58.25	0.003	✕
233	58.5	0.005	✕
234	58.75	0.002	✕
235	59	0.004	✕
236	59.25	0.002	✕
237	59.5	0.003	✕
238	59.75	0.003	✕
239	60	0.003	✕
240	60.25	0.004	✕
241	60.5	0.004	✕
242	60.75	0.003	✕
243	61	0.002	✕
244	61.25	0.006	✕
245	61.5	0.004	✕

	Time (min)	BH11 Abstraction, Drawdown in BH11 (m)	Symbol
246	61.75	0.005	×
247	62	0.004	×
248	62.25	0.004	×
249	62.5	0.005	×
250	62.75	0.001	×
251	63	0.001	×
252	63.25	0.002	×
253	63.5	0.002	×
254	63.75	0.004	×
255	64	-1.77636e-015	×
256	64.25	0.001	×
257	64.5	0.002	×
258	64.75	0.005	×
259	65	0.005	×
260	65.25	0.002	×
261	65.5	0.005	×
262	65.75	0.004	×
263	66	0.002	×
264	66.25	0.004	×
265	66.5	0.001	×
266	66.75	0.003	×
267	67	0.003	×
268	67.25	0.003	×
269	67.5	0.001	×
270	67.75	0.004	×
271	68	0.001	×
272	68.25	0.005	×
273	68.5	0.002	×
274	68.75	0.002	×
275	69	0.002	×
276	69.25	0.003	×
277	69.5	0.001	×
278	69.75	0.002	×
279	70	0.003	×
280	70.25	0.003	×

	Time (min)	BH11 Abstraction, Drawdown in BH11 (m)	Symbol
281	70.5	0.004	✕
282	70.75	0.001	✕
283	71	0.002	✕
284	71.25	0.004	✕
285	71.5	0.002	✕
286	71.75	0.004	✕
287	72	0.003	✕
288	72.25	0	✕



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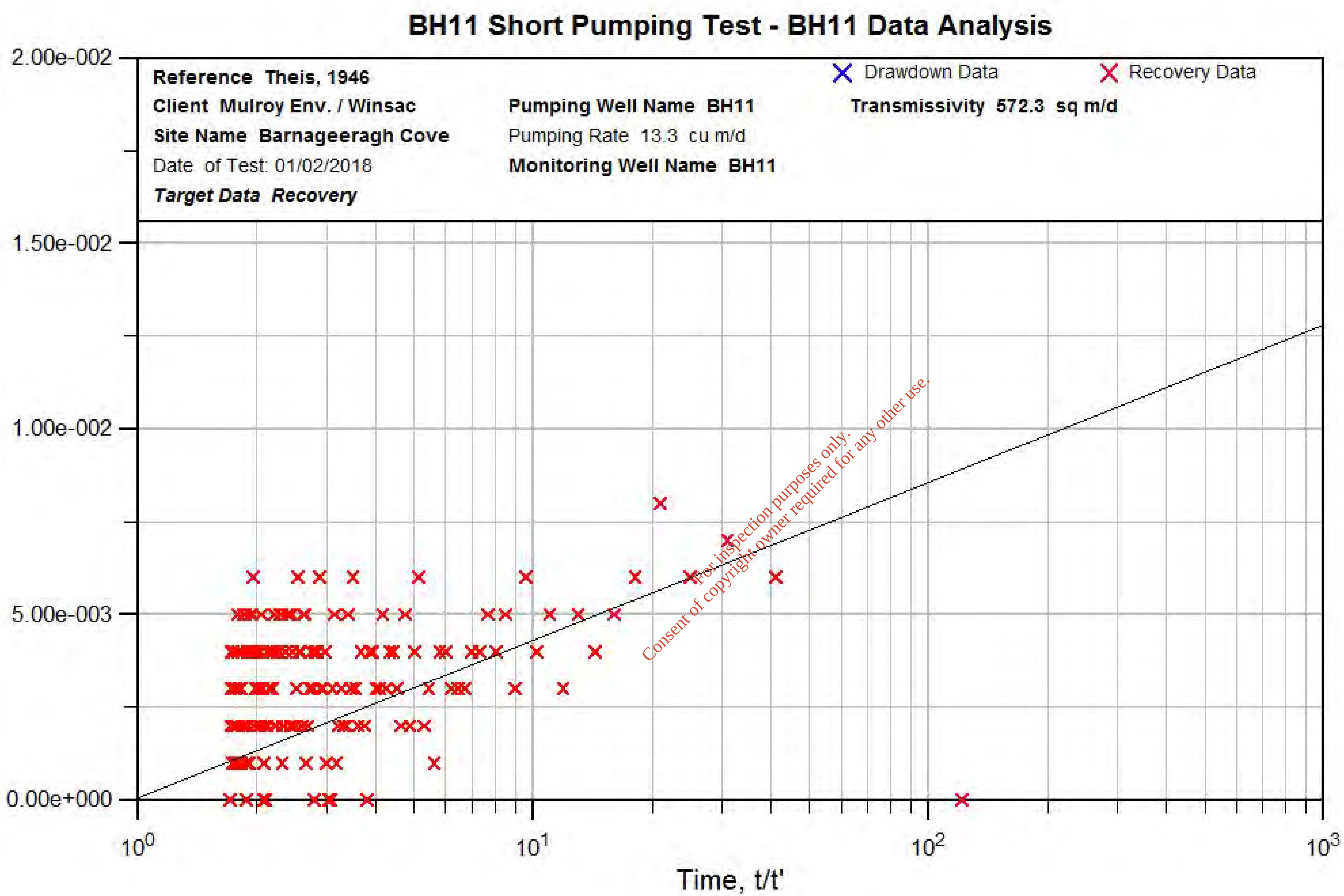
SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

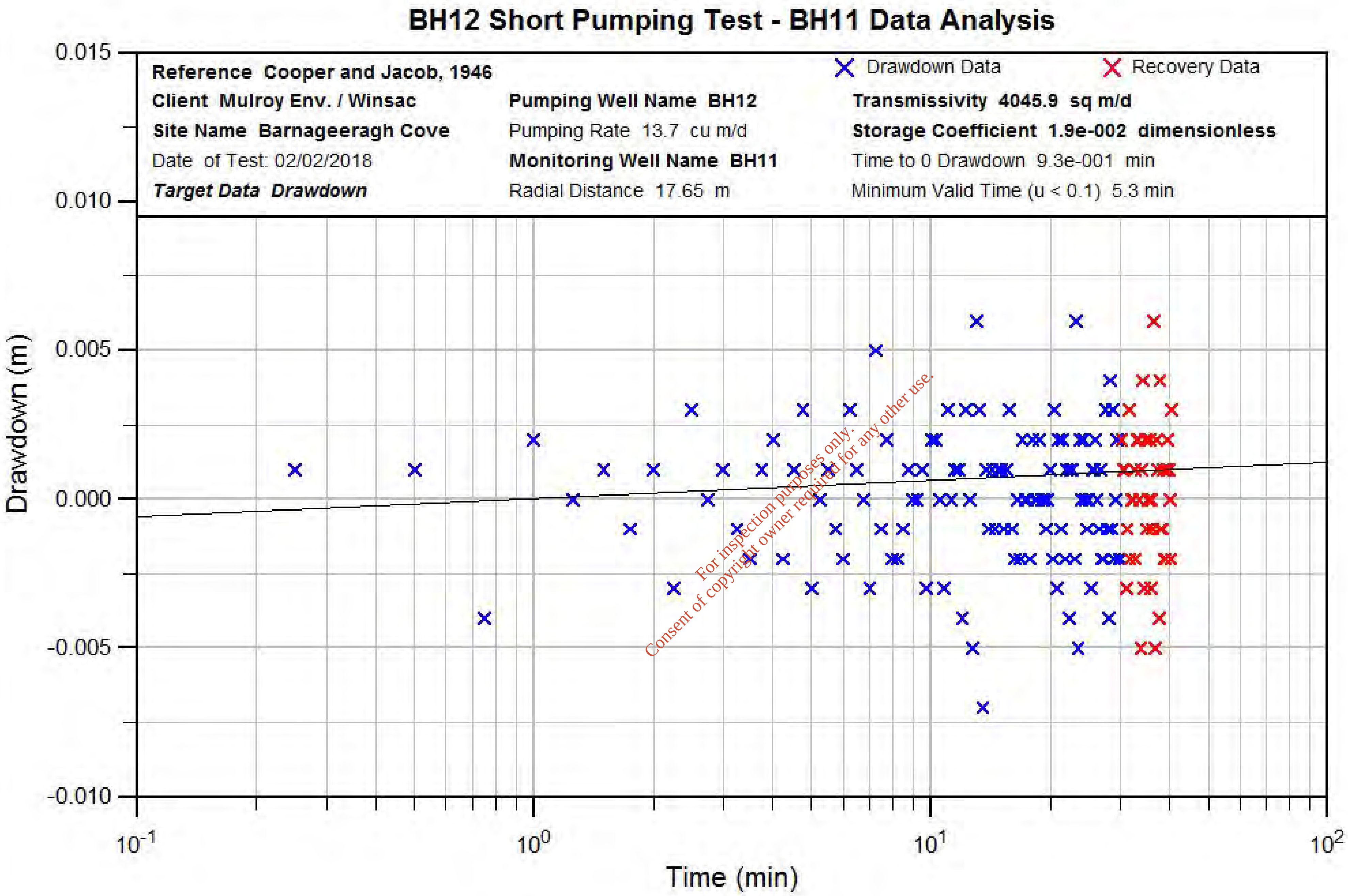
	Time (min)	BH12 Abstraction, Drawdown in BH11 (m)	Symbol
1	0.25	0.001	×
2	0.5	0.001	×
3	0.75	-0.004	×
4	1	0.002	×
5	1.25	0	×
6	1.5	0.001	×
7	1.75	-0.001	×
8	2	0.001	×
9	2.25	-0.003	×
10	2.5	0.003	×
11	2.75	0	×
12	3	0.001	×
13	3.25	-0.001	×
14	3.5	-0.002	×
15	3.75	0.001	×
16	4	0.002	×
17	4.25	-0.002	×
18	4.5	0.001	×
19	4.75	0.003	×
20	5	-0.003	×
21	5.25	0	×
22	5.5	0.001	×
23	5.75	-0.001	×
24	6	-0.002	×
25	6.25	0.003	×
26	6.5	0.001	×
27	6.75	0	×
28	7	-0.003	×
29	7.25	0.005	×
30	7.5	-0.001	×
31	7.75	0.002	×
32	8	-0.002	×
33	8.25	-0.002	×
34	8.5	-0.001	×
35	8.75	0.001	×

	Time (min)	BH12 Abstraction, Drawdown in BH11 (m)	Symbol
36	9	0	×
37	9.25	0	×
38	9.5	0.001	×
39	9.75	-0.003	×
40	10	0.002	×
41	10.25	0.002	×
42	10.5	0	×
43	10.75	-0.003	×
44	11	0.003	×
45	11.25	0	×
46	11.5	0.001	×
47	11.75	0.001	×
48	12	-0.004	×
49	12.25	0.003	×
50	12.5	0	×
51	12.75	-0.005	×
52	13	0.006	×
53	13.25	0.003	×
54	13.5	-0.007	×
55	13.75	0.001	×
56	14	-0.001	×
57	14.25	0.001	×
58	14.5	-0.001	×
59	14.75	0.001	×
60	15	0.001	×
61	15.25	-0.001	×
62	15.5	0.001	×
63	15.75	0.003	×
64	16	-0.001	×
65	16.25	-0.002	×
66	16.5	0	×
67	16.75	-0.002	×
68	17	0.002	×
69	17.25	0	×
70	17.5	0	×

	Time (min)	BH12 Abstraction, Drawdown in BH11 (m)	Symbol
71	17.75	-0.002	×
72	18	0.002	×
73	18.25	0	×
74	18.5	0	×
75	18.75	0.002	×
76	19	0	×
77	19.25	0	×
78	19.5	-0.001	×
79	19.75	0	×
80	20	0.001	×
81	20.25	-0.002	×
82	20.5	0.003	×
83	20.75	-0.003	×
84	21	0.002	×
85	21.25	-0.001	×
86	21.5	0.002	×
87	21.75	-0.002	×
88	22	0.001	×
89	22.25	-0.004	×
90	22.5	0.001	×
91	22.75	0.001	×
92	23	-0.002	×
93	23.25	0.006	×
94	23.5	-0.005	×
95	23.75	0.002	×
96	24	0	×
97	24.25	0.002	×
98	24.5	0	×
99	24.75	-0.001	×
100	25	0	×
101	25.25	-0.003	×
102	25.5	0.001	×
103	25.75	0.001	×
104	26	0.002	×
105	26.25	0	×

	Time (min)	BH12 Abstraction, Drawdown in BH11 (m)	Symbol
106	26.5	-0.001	×
107	26.75	0.001	×
108	27	-0.002	×
109	27.25	-0.002	×
110	27.5	0.003	×
111	27.75	-0.001	×
112	28	-0.004	×
113	28.25	0.004	×
114	28.5	-0.001	×
115	28.75	0.003	×
116	29	-0.002	×
117	29.25	0	×
118	29.5	0.002	×
119	29.75	-0.002	×
120	30	-0.002	×
121	30.25	0.002	×
122	30.5	0.001	×
123	30.75	0.001	×
124	31	-0.003	×
125	31.25	-0.001	×
126	31.5	0.003	×
127	31.75	-0.002	×
128	32	0	×
129	32.25	0	×
130	32.5	0.001	×
131	32.75	-0.002	×
132	33	0.002	×
133	33.25	0.002	×
134	33.5	0	×
135	33.75	-0.005	×
136	34	0.001	×
137	34.25	0.004	×
138	34.5	-0.003	×
139	34.75	0.002	×
140	35	-0.001	×

	Time (min)	BH12 Abstraction, Drawdown in BH11 (m)	Symbol
141	35.25	0	✕
142	35.5	0.002	✕
143	35.75	-0.003	✕
144	36	0	✕
145	36.25	-0.001	✕
146	36.5	0.006	✕
147	36.75	-0.005	✕
148	37	0.002	✕
149	37.25	0.001	✕
150	37.5	-0.004	✕
151	37.75	0.004	✕
152	38	-0.001	✕
153	38.25	-0.001	✕
154	38.5	0.001	✕
155	38.75	-0.002	✕
156	39	-0.002	✕
157	39.25	0.001	✕
158	39.5	0.002	✕
159	39.75	0.001	✕
160	40	0	✕
161	40.25	-0.002	✕
162	40.5	0.003	✕
163	40.75	-0.017	✕



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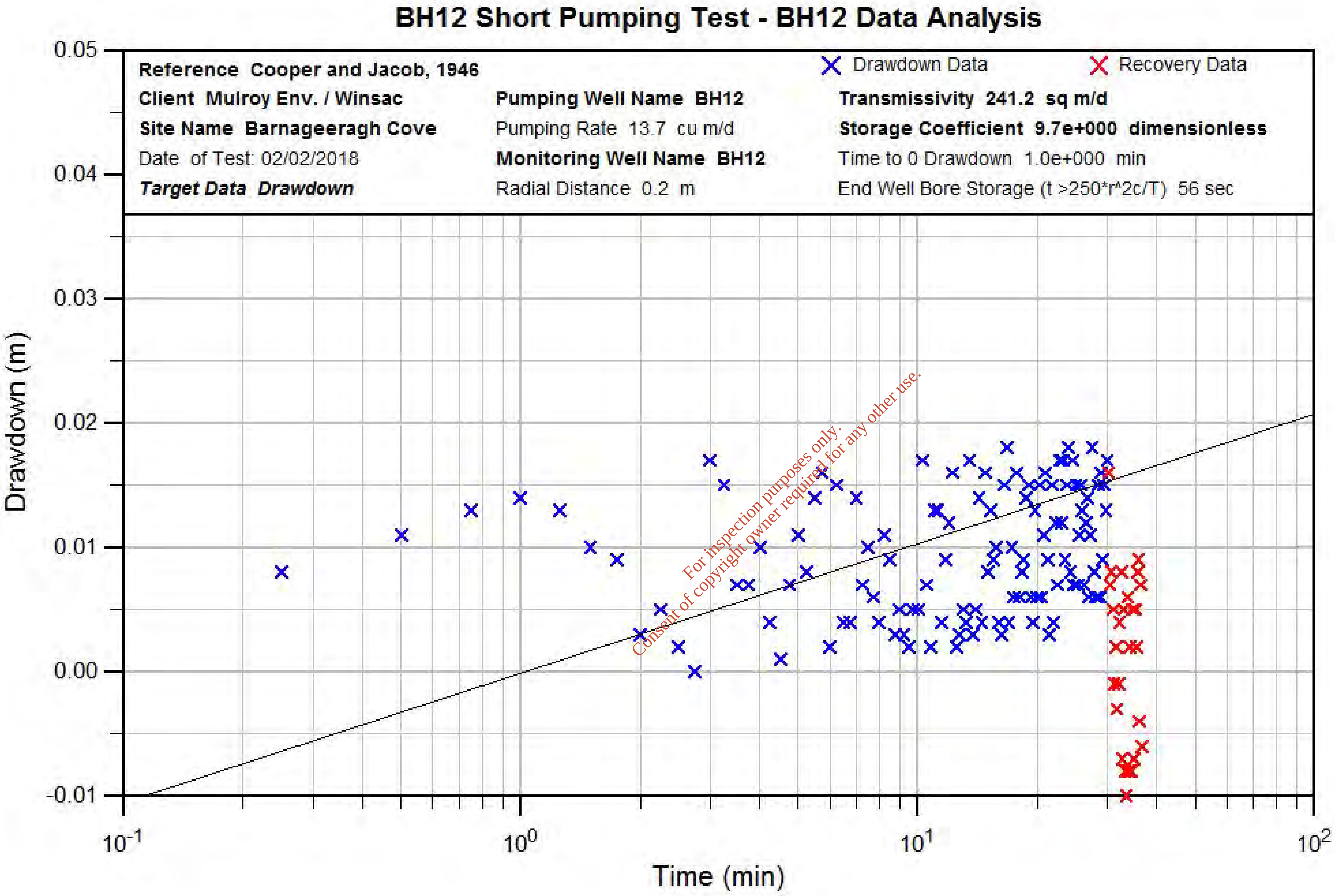
	Time (min)	BH12 Abstraction, Drawdown in BH12 (m)	Symbol
1	0.25	0.008	×
2	0.5	0.011	×
3	0.75	0.013	×
4	1	0.014	×
5	1.25	0.013	×
6	1.5	0.01	×
7	1.75	0.009	×
8	2	0.003	×
9	2.25	0.005	×
10	2.5	0.002	×
11	2.75	0	×
12	3	0.017	×
13	3.25	0.015	×
14	3.5	0.007	×
15	3.75	0.007	×
16	4	0.01	×
17	4.25	0.004	×
18	4.5	0.001	×
19	4.75	0.007	×
20	5	0.011	×
21	5.25	0.008	×
22	5.5	0.014	×
23	5.75	0.016	×
24	6	0.002	×
25	6.25	0.015	×
26	6.5	0.004	×
27	6.75	0.004	×
28	7	0.014	×
29	7.25	0.007	×
30	7.5	0.01	×
31	7.75	0.006	×
32	8	0.004	×
33	8.25	0.011	×
34	8.5	0.009	×
35	8.75	0.003	×

	Time (min)	BH12 Abstraction, Drawdown in BH12 (m)	Symbol
36	9	0.005	×
37	9.25	0.003	×
38	9.5	0.002	×
39	9.75	0.005	×
40	10	0.005	×
41	10.25	0.017	×
42	10.5	0.007	×
43	10.75	0.002	×
44	11	0.013	×
45	11.25	0.013	×
46	11.5	0.004	×
47	11.75	0.009	×
48	12	0.012	×
49	12.25	0.016	×
50	12.5	0.002	×
51	12.75	0.003	×
52	13	0.005	×
53	13.25	0.004	×
54	13.5	0.017	×
55	13.75	0.003	×
56	14	0.005	×
57	14.25	0.014	×
58	14.5	0.004	×
59	14.75	0.016	×
60	15	0.008	×
61	15.25	0.013	×
62	15.5	0.009	×
63	15.75	0.01	×
64	16	0.004	×
65	16.25	0.003	×
66	16.5	0.015	×
67	16.75	0.018	×
68	17	0.004	×
69	17.25	0.01	×
70	17.5	0.006	×

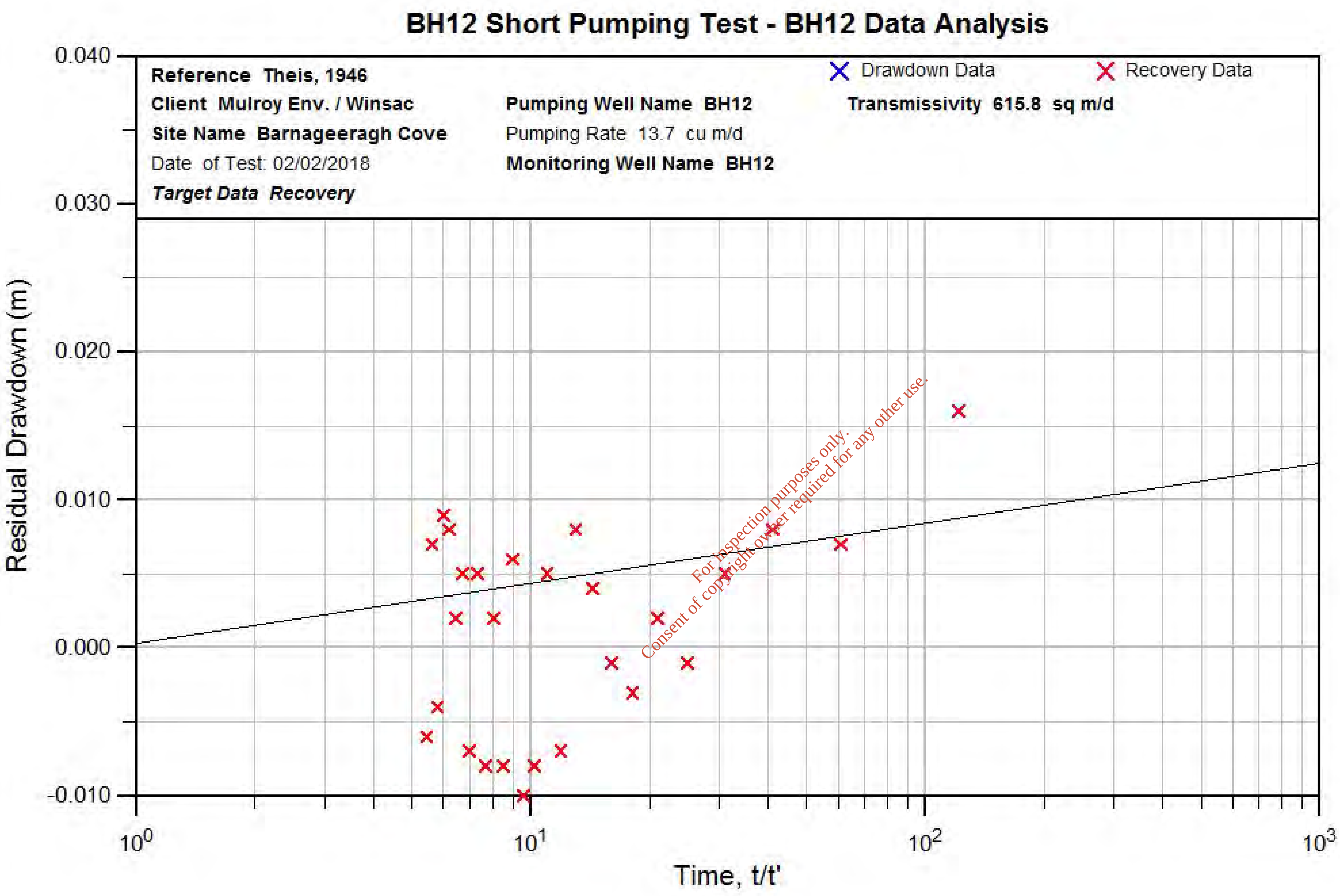
	Time (min)	BH12 Abstraction, Drawdown in BH12 (m)	Symbol
71	17.75	0.016	✕
72	18	0.006	✕
73	18.25	0.008	✕
74	18.5	0.009	✕
75	18.75	0.014	✕
76	19	0.015	✕
77	19.25	0.006	✕
78	19.5	0.004	✕
79	19.75	0.013	✕
80	20	0.006	✕
81	20.25	0.015	✕
82	20.5	0.006	✕
83	20.75	0.011	✕
84	21	0.016	✕
85	21.25	0.009	✕
86	21.5	0.003	✕
87	21.75	0.015	✕
88	22	0.004	✕
89	22.25	0.012	✕
90	22.5	0.007	✕
91	22.75	0.017	✕
92	23	0.012	✕
93	23.25	0.017	✕
94	23.5	0.009	✕
95	23.75	0.015	✕
96	24	0.018	✕
97	24.25	0.008	✕
98	24.5	0.017	✕
99	24.75	0.007	✕
100	25	0.015	✕
101	25.25	0.007	✕
102	25.5	0.011	✕
103	25.75	0.015	✕
104	26	0.013	✕
105	26.25	0.007	✕

	Time (min)	BH12 Abstraction, Drawdown in BH12 (m)	Symbol
106	26.5	0.012	× (blue)
107	26.75	0.014	× (blue)
108	27	0.006	× (blue)
109	27.25	0.011	× (blue)
110	27.5	0.018	× (blue)
111	27.75	0.008	× (blue)
112	28	0.006	× (blue)
113	28.25	0.006	× (blue)
114	28.5	0.015	× (blue)
115	28.75	0.006	× (blue)
116	29	0.016	× (blue)
117	29.25	0.009	× (blue)
118	29.5	0.015	× (blue)
119	29.75	0.013	× (blue)
120	30	0.017	× (blue)
121	30.25	0.016	× (red)
122	30.5	0.007	× (red)
123	30.75	0.008	× (red)
124	31	0.005	× (red)
125	31.25	-0.001	× (red)
126	31.5	0.002	× (red)
127	31.75	-0.003	× (red)
128	32	-0.001	× (red)
129	32.25	0.004	× (red)
130	32.5	0.008	× (red)
131	32.75	-0.007	× (red)
132	33	0.005	× (red)
133	33.25	-0.008	× (red)
134	33.5	-0.01	× (red)
135	33.75	0.006	× (red)
136	34	-0.008	× (red)
137	34.25	0.002	× (red)
138	34.5	-0.008	× (red)
139	34.75	0.005	× (red)
140	35	-0.007	× (red)

	Time (min)	BH12 Abstraction, Drawdown in BH12 (m)	Symbol
141	35.25	0.005	✕
142	35.5	0.002	✕
143	35.75	0.008	✕
144	36	0.009	✕
145	36.25	-0.004	✕
146	36.5	0.007	✕
147	36.75	-0.006	✕



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta



1114 Barnageeragh Cove
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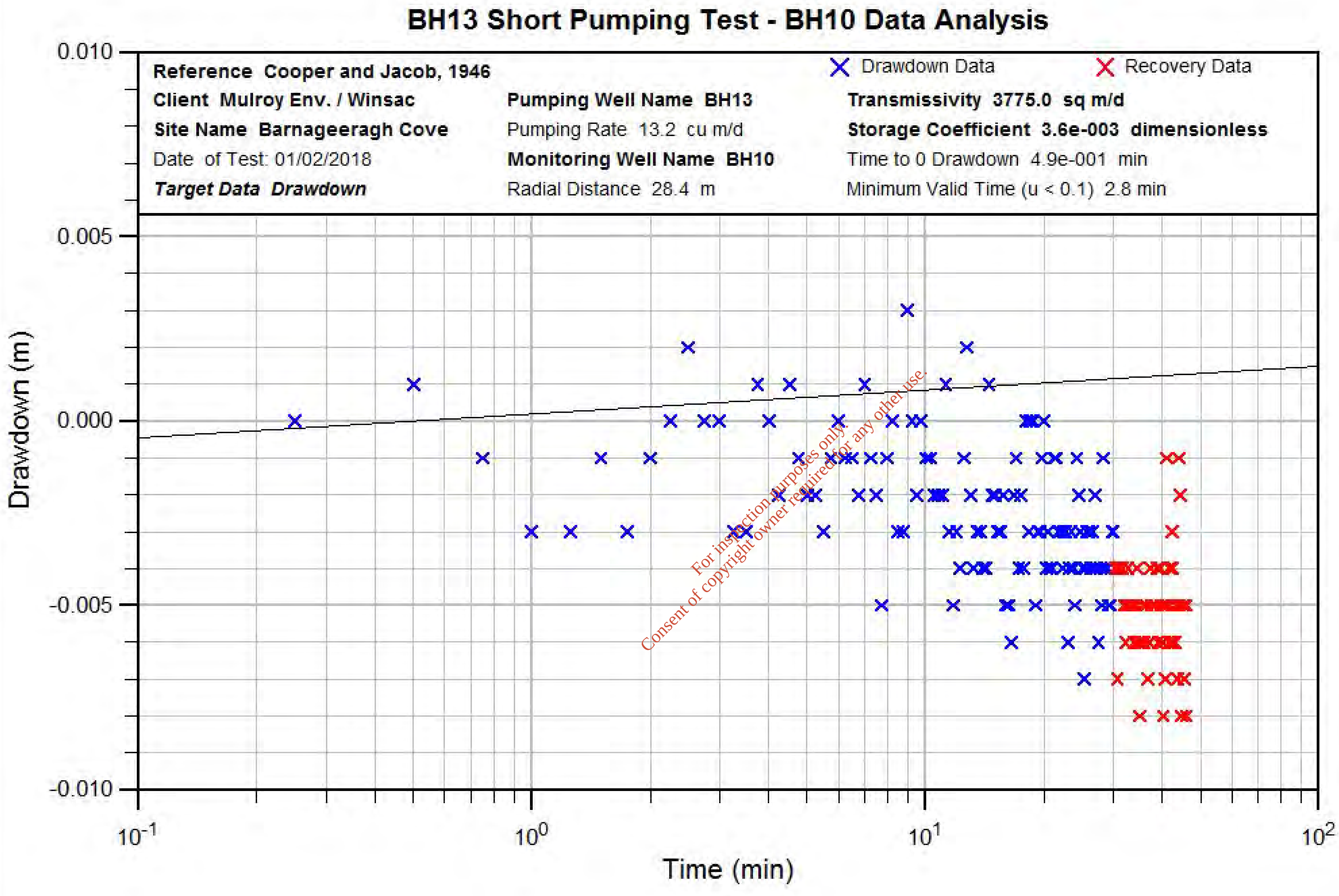
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



1114 Barnageeragh Cove
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Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

	Time (min)	BH13 Abstraction, Drawdown in BH13 (m)	Symbol
1	0.25	0.234	×
2	0.5	0.498	×
3	0.75	0.665	×
4	1	0.798	×
5	1.25	0.864	×
6	1.5	0.867	×
7	1.75	0.836	×
8	2	0.793	×
9	2.25	0.759	×
10	2.5	0.734	×
11	2.75	0.703	×
12	3	0.686	×
13	3.25	0.679	×
14	3.5	0.66	×
15	3.75	0.651	×
16	4	0.639	×
17	4.25	0.645	×
18	4.5	0.631	×
19	4.75	0.621	×
20	5	0.63	×
21	5.25	0.626	×
22	5.5	0.633	×
23	5.75	0.638	×
24	6	0.643	×
25	6.25	0.645	×
26	6.5	0.65	×
27	6.75	0.655	×
28	7	0.662	×
29	7.25	0.667	×
30	7.5	0.663	×
31	7.75	0.668	×
32	8	0.673	×
33	8.25	0.677	×
34	8.5	0.684	×
35	8.75	0.686	×

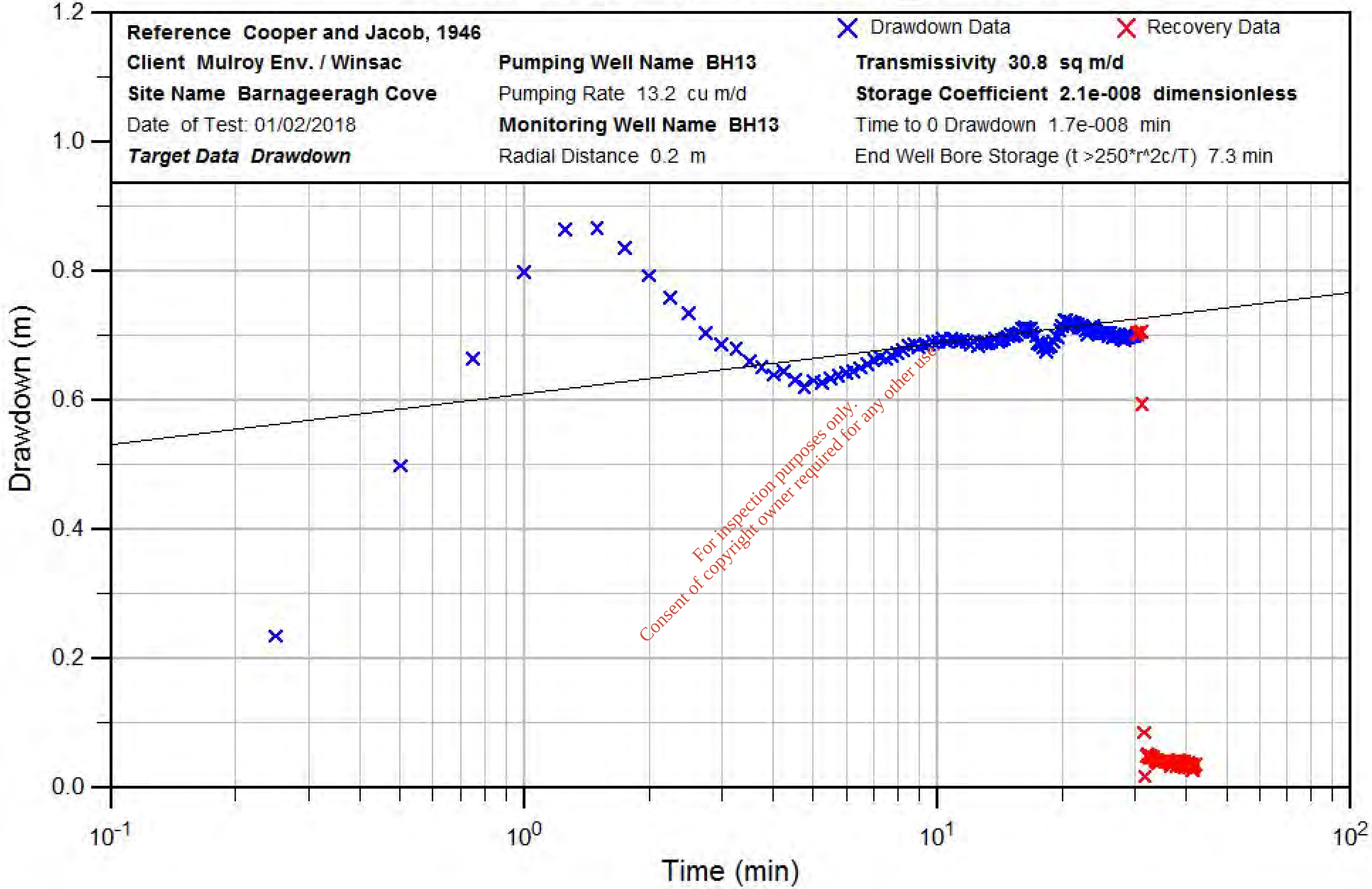
	Time (min)	BH13 Abstraction, Drawdown in BH13 (m)	Symbol
36	9	0.682	✕
37	9.25	0.685	✕
38	9.5	0.685	✕
39	9.75	0.691	✕
40	10	0.691	✕
41	10.25	0.696	✕
42	10.5	0.691	✕
43	10.75	0.694	✕
44	11	0.693	✕
45	11.25	0.69	✕
46	11.5	0.692	✕
47	11.75	0.691	✕
48	12	0.687	✕
49	12.25	0.69	✕
50	12.5	0.684	✕
51	12.75	0.688	✕
52	13	0.689	✕
53	13.25	0.689	✕
54	13.5	0.691	✕
55	13.75	0.694	✕
56	14	0.691	✕
57	14.25	0.693	✕
58	14.5	0.694	✕
59	14.75	0.698	✕
60	15	0.702	✕
61	15.25	0.699	✕
62	15.5	0.702	✕
63	15.75	0.705	✕
64	16	0.711	✕
65	16.25	0.713	✕
66	16.5	0.711	✕
67	16.75	0.71	✕
68	17	0.705	✕
69	17.25	0.7	✕
70	17.5	0.688	✕

	Time (min)	BH13 Abstraction, Drawdown in BH13 (m)	Symbol
71	17.75	0.686	×
72	18	0.681	×
73	18.25	0.674	×
74	18.5	0.682	×
75	18.75	0.684	×
76	19	0.691	×
77	19.25	0.7	×
78	19.5	0.697	×
79	19.75	0.708	×
80	20	0.714	×
81	20.25	0.723	×
82	20.5	0.723	×
83	20.75	0.719	×
84	21	0.721	×
85	21.25	0.719	×
86	21.5	0.719	×
87	21.75	0.717	×
88	22	0.713	×
89	22.25	0.713	×
90	22.5	0.712	×
91	22.75	0.707	×
92	23	0.702	×
93	23.25	0.71	×
94	23.5	0.712	×
95	23.75	0.715	×
96	24	0.711	×
97	24.25	0.706	×
98	24.5	0.703	×
99	24.75	0.703	×
100	25	0.704	×
101	25.25	0.705	×
102	25.5	0.703	×
103	25.75	0.704	×
104	26	0.7	×
105	26.25	0.705	×

	Time (min)	BH13 Abstraction, Drawdown in BH13 (m)	Symbol
106	26.5	0.697	×
107	26.75	0.701	×
108	27	0.699	×
109	27.25	0.699	×
110	27.5	0.699	×
111	27.75	0.696	×
112	28	0.696	×
113	28.25	0.693	×
114	28.5	0.697	×
115	28.75	0.698	×
116	29	0.697	×
117	29.25	0.701	×
118	29.5	0.698	×
119	29.75	0.698	×
120	30	0.699	×
121	30.25	0.703	×
122	30.5	0.701	×
123	30.75	0.705	×
124	31	0.706	×
125	31.25	0.594	×
126	31.5	0.085	×
127	31.75	0.017	×
128	32	0.049	×
129	32.25	0.05	×
130	32.5	0.047	×
131	32.75	0.048	×
132	33	0.047	×
133	33.25	0.047	×
134	33.5	0.042	×
135	33.75	0.043	×
136	34	0.04	×
137	34.25	0.038	×
138	34.5	0.041	×
139	34.75	0.041	×
140	35	0.041	×

	Time (min)	BH13 Abstraction, Drawdown in BH13 (m)	Symbol
141	35.25	0.041	✕
142	35.5	0.04	✕
143	35.75	0.04	✕
144	36	0.041	✕
145	36.25	0.042	✕
146	36.5	0.038	✕
147	36.75	0.033	✕
148	37	0.038	✕
149	37.25	0.039	✕
150	37.5	0.041	✕
151	37.75	0.033	✕
152	38	0.032	✕
153	38.25	0.042	✕
154	38.5	0.041	✕
155	38.75	0.033	✕
156	39	0.04	✕
157	39.25	0.041	✕
158	39.5	0.04	✕
159	39.75	0.031	✕
160	40	0.035	✕
161	40.25	0.032	✕
162	40.5	0.039	✕
163	40.75	0.03	✕
164	41	0.035	✕
165	41.25	0.027	✕
166	41.5	0.028	✕
167	41.75	0.033	✕
168	42	0.035	✕

BH13 Short Pumping Test - BH13 Data Analysis



1114 Barnageeragh Cove
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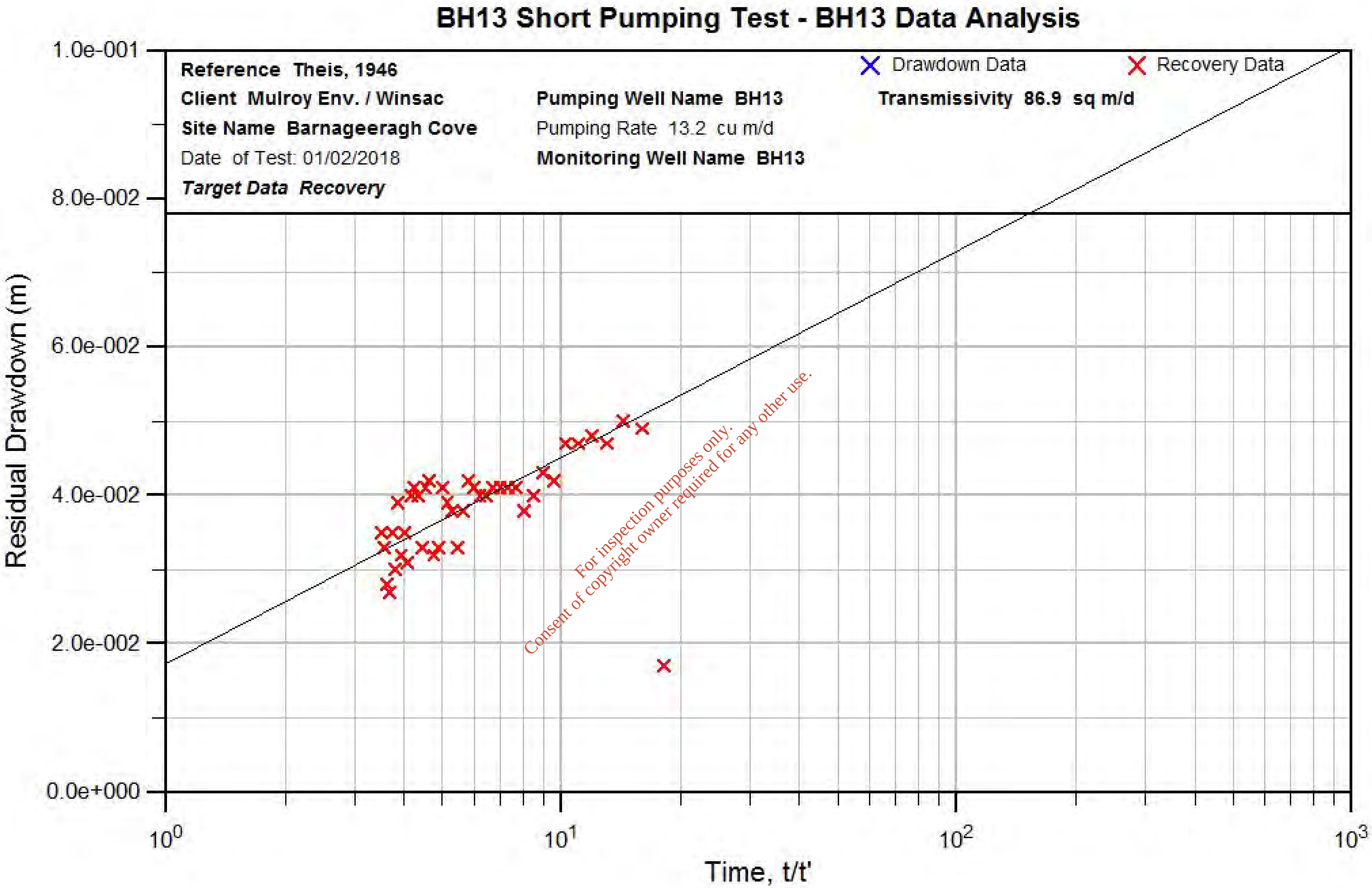
HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



1114 Barnageeragh Cove
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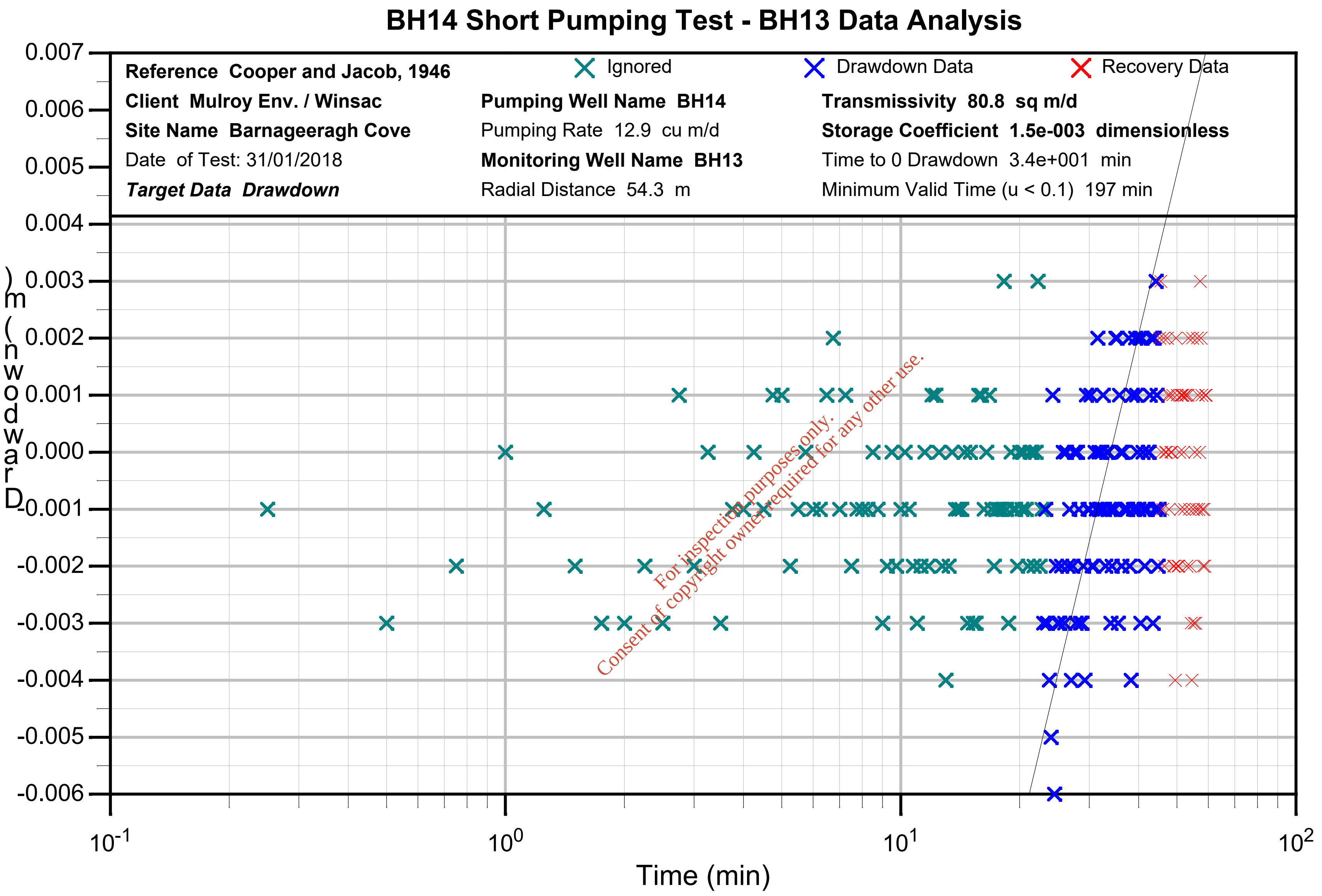
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT
SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



1114 Barnageeragh Cove
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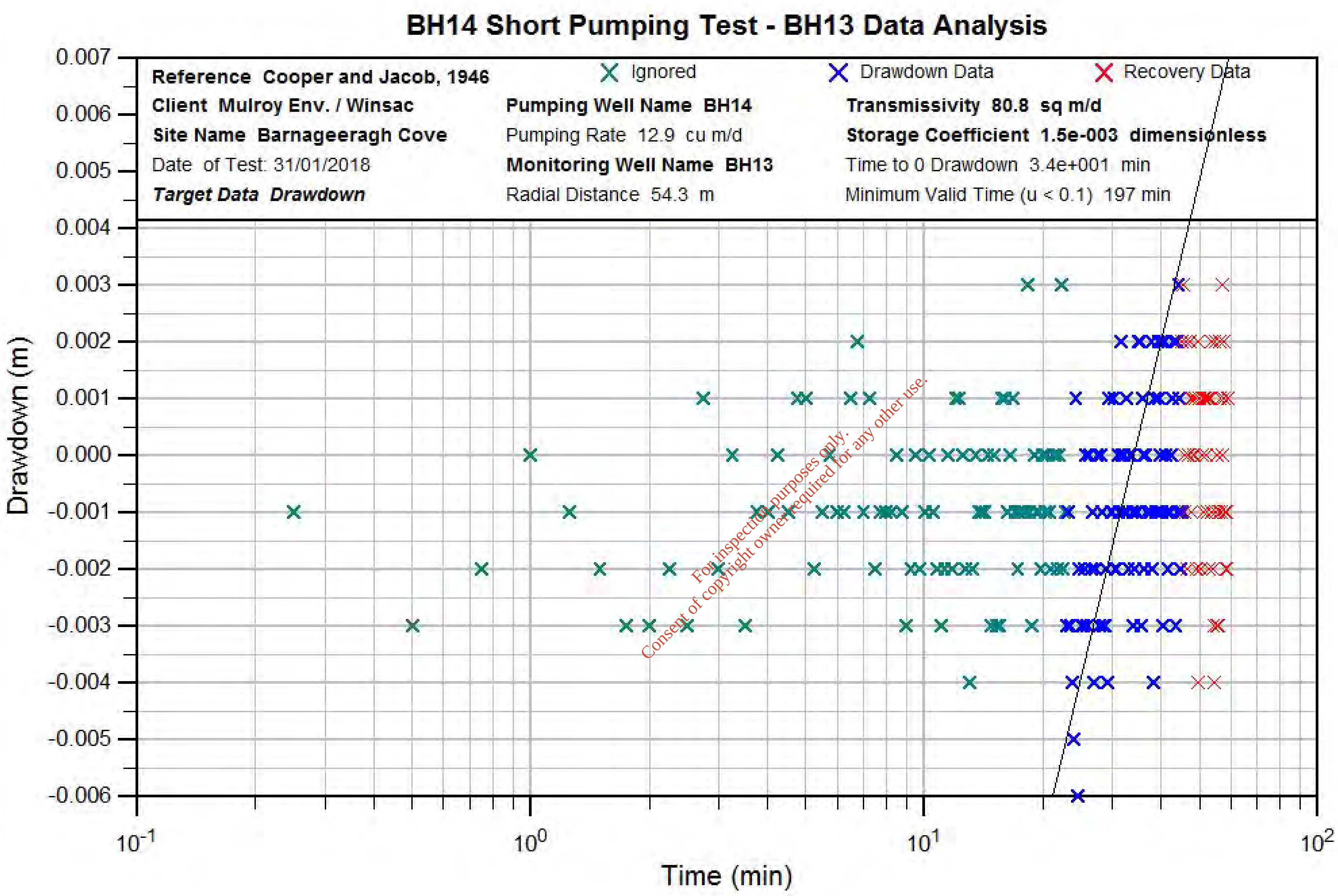

1114 Barnageeragh Cove
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	Time (min)	BH14 Abstraction, Drawdown in BH14 (m)	Symbol
1	0.25	0.229	×
2	0.5	0.294	×
3	0.75	0.342	×
4	1	0.396	×
5	1.25	0.452	×
6	1.5	0.508	×
7	1.75	0.57	×
8	2	0.633	×
9	2.25	0.69	×
10	2.5	0.735	×
11	2.75	0.792	×
12	3	0.837	×
13	3.25	0.879	×
14	3.5	0.925	×
15	3.75	0.976	×
16	4	1.025	×
17	4.25	1.088	×
18	4.5	1.139	×
19	4.75	1.2	×
20	5	1.256	×
21	5.25	1.296	×
22	5.5	1.337	×
23	5.75	1.368	×
24	6	1.407	×
25	6.25	1.442	×
26	6.5	1.476	×
27	6.75	1.512	×
28	7	1.547	×
29	7.25	1.583	×
30	7.5	1.613	×
31	7.75	1.647	×
32	8	1.684	×
33	8.25	1.708	×
34	8.5	1.746	×
35	8.75	1.78	×

	Time (min)	BH14 Abstraction, Drawdown in BH14 (m)	Symbol
36	9	1.807	×
37	9.25	1.832	×
38	9.5	1.86	×
39	9.75	1.891	×
40	10	1.916	×
41	10.25	1.943	×
42	10.5	1.962	×
43	10.75	1.989	×
44	11	2.012	×
45	11.25	2.041	×
46	11.5	2.073	×
47	11.75	2.09	×
48	12	2.109	×
49	12.25	2.136	×
50	12.5	2.156	×
51	12.75	2.176	×
52	13	2.19	×
53	13.25	2.213	×
54	13.5	2.233	×
55	13.75	2.256	×
56	14	2.269	×
57	14.25	2.303	×
58	14.5	2.329	×
59	14.75	2.345	×
60	15	2.351	×
61	15.25	2.356	×
62	15.5	2.375	×
63	15.75	2.403	×
64	16	2.411	×
65	16.25	2.425	×
66	16.5	2.447	×
67	16.75	2.474	×
68	17	2.481	×
69	17.25	2.497	×
70	17.5	2.511	×

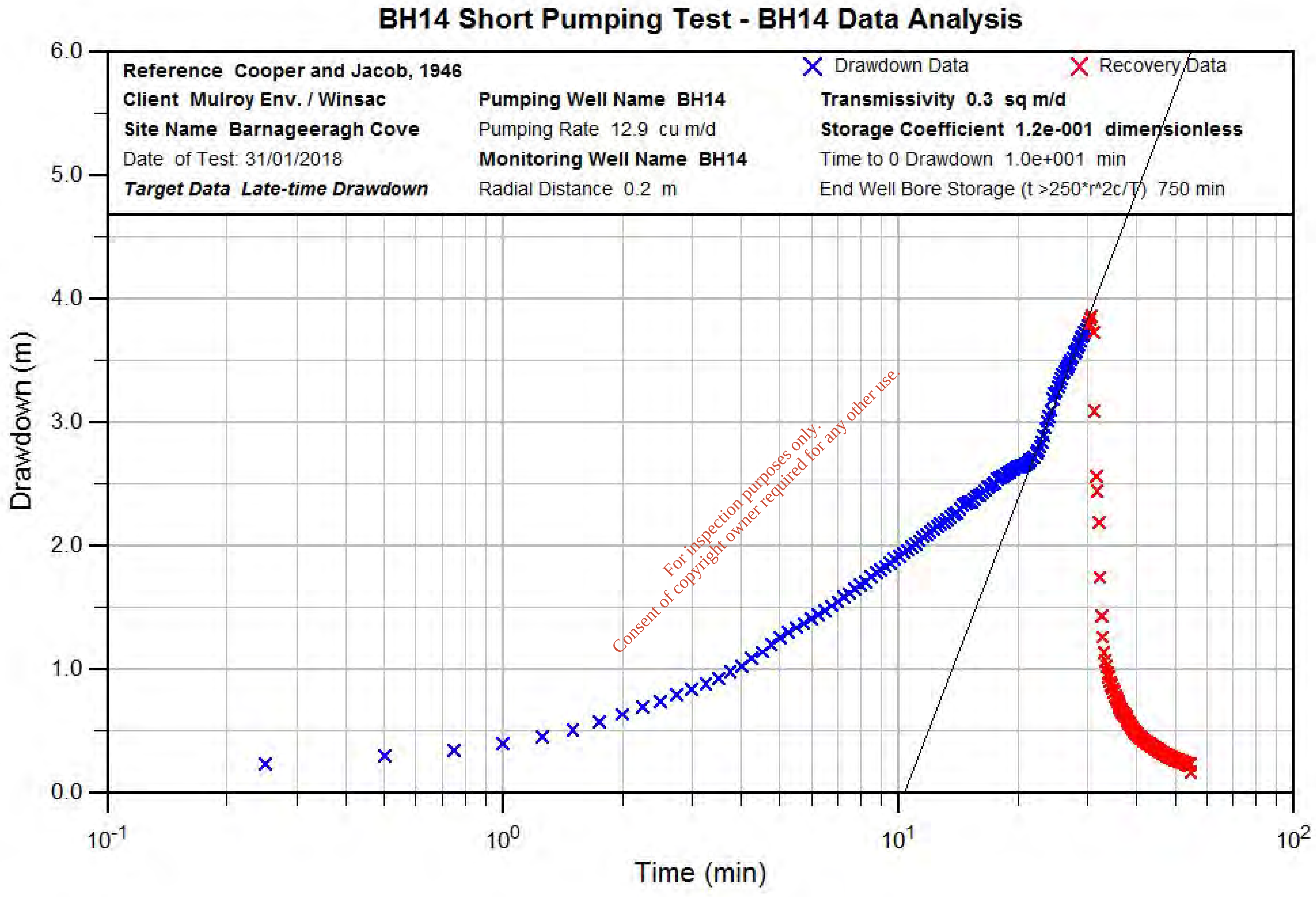
	Time (min)	BH14 Abstraction, Drawdown in BH14 (m)	Symbol
71	17.75	2.537	×
72	18	2.553	×
73	18.25	2.559	×
74	18.5	2.567	×
75	18.75	2.581	×
76	19	2.597	×
77	19.25	2.611	×
78	19.5	2.618	×
79	19.75	2.634	×
80	20	2.642	×
81	20.25	2.639	×
82	20.5	2.646	×
83	20.75	2.651	×
84	21	2.661	×
85	21.25	2.672	×
86	21.5	2.695	×
87	21.75	2.711	×
88	22	2.717	×
89	22.25	2.748	×
90	22.5	2.772	×
91	22.75	2.805	×
92	23	2.837	×
93	23.25	2.895	×
94	23.5	2.952	×
95	23.75	3.007	×
96	24	3.048	×
97	24.25	3.097	×
98	24.5	3.191	×
99	24.75	3.234	×
100	25	3.25	×
101	25.25	3.291	×
102	25.5	3.319	×
103	25.75	3.357	×
104	26	3.392	×
105	26.25	3.411	×

	Time (min)	BH14 Abstraction, Drawdown in BH14 (m)	Symbol
106	26.5	3.433	×
107	26.75	3.455	×
108	27	3.48	×
109	27.25	3.503	×
110	27.5	3.525	×
111	27.75	3.564	×
112	28	3.576	×
113	28.25	3.602	×
114	28.5	3.63	×
115	28.75	3.655	×
116	29	3.688	×
117	29.25	3.699	×
118	29.5	3.731	×
119	29.75	3.752	×
120	30	3.779	×
121	30.25	3.807	×
122	30.5	3.834	×
123	30.75	3.859	×
124	31	3.724	×
125	31.25	3.088	×
126	31.5	2.558	×
127	31.75	2.438	×
128	32	2.189	×
129	32.25	1.742	×
130	32.5	1.431	×
131	32.75	1.259	×
132	33	1.137	×
133	33.25	1.07	×
134	33.5	1.021	×
135	33.75	0.973	×
136	34	0.934	×
137	34.25	0.899	×
138	34.5	0.872	×
139	34.75	0.843	×
140	35	0.813	×

	Time (min)	BH14 Abstraction, Drawdown in BH14 (m)	Symbol
141	35.25	0.784	✕
142	35.5	0.761	✕
143	35.75	0.734	✕
144	36	0.713	✕
145	36.25	0.691	✕
146	36.5	0.67	✕
147	36.75	0.652	✕
148	37	0.643	✕
149	37.25	0.626	✕
150	37.5	0.615	✕
151	37.75	0.595	✕
152	38	0.579	✕
153	38.25	0.561	✕
154	38.5	0.546	✕
155	38.75	0.53	✕
156	39	0.518	✕
157	39.25	0.505	✕
158	39.5	0.497	✕
159	39.75	0.487	✕
160	40	0.476	✕
161	40.25	0.469	✕
162	40.5	0.459	✕
163	40.75	0.449	✕
164	41	0.445	✕
165	41.25	0.435	✕
166	41.5	0.43	✕
167	41.75	0.422	✕
168	42	0.414	✕
169	42.25	0.41	✕
170	42.5	0.402	✕
171	42.75	0.397	✕
172	43	0.394	✕
173	43.25	0.389	✕
174	43.5	0.381	✕
175	43.75	0.376	✕

	Time (min)	BH14 Abstraction, Drawdown in BH14 (m)	Symbol
176	44	0.371	✕
177	44.25	0.366	✕
178	44.5	0.36	✕
179	44.75	0.357	✕
180	45	0.35	✕
181	45.25	0.347	✕
182	45.5	0.342	✕
183	45.75	0.335	✕
184	46	0.329	✕
185	46.25	0.327	✕
186	46.5	0.321	✕
187	46.75	0.32	✕
188	47	0.315	✕
189	47.25	0.309	✕
190	47.5	0.307	✕
191	47.75	0.3	✕
192	48	0.298	✕
193	48.25	0.291	✕
194	48.5	0.288	✕
195	48.75	0.286	✕
196	49	0.283	✕
197	49.25	0.278	✕
198	49.5	0.278	✕
199	49.75	0.273	✕
200	50	0.269	✕
201	50.25	0.263	✕
202	50.5	0.268	✕
203	50.75	0.264	✕
204	51	0.259	✕
205	51.25	0.257	✕
206	51.5	0.255	✕
207	51.75	0.252	✕
208	52	0.25	✕
209	52.25	0.244	✕
210	52.5	0.245	✕

	Time (min)	BH14 Abstraction, Drawdown in BH14 (m)	Symbol
211	52.75	0.243	✕
212	53	0.239	✕
213	53.25	0.235	✕
214	53.5	0.231	✕
215	53.75	0.229	✕
216	54	0.224	✕
217	54.25	0.218	✕
218	54.5	0.234	✕
219	54.75	0.164	✕



1114 Barnageeragh Cove
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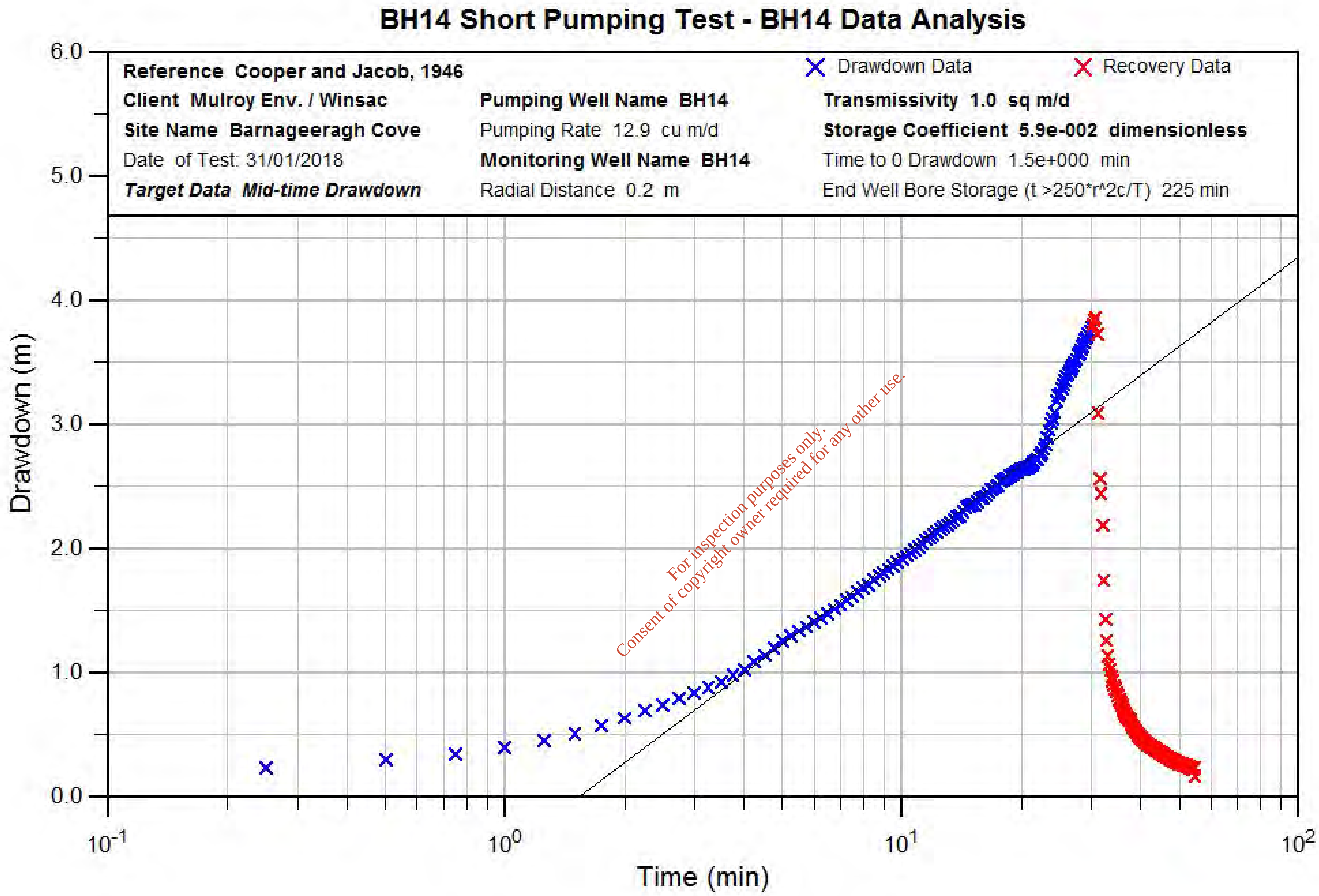
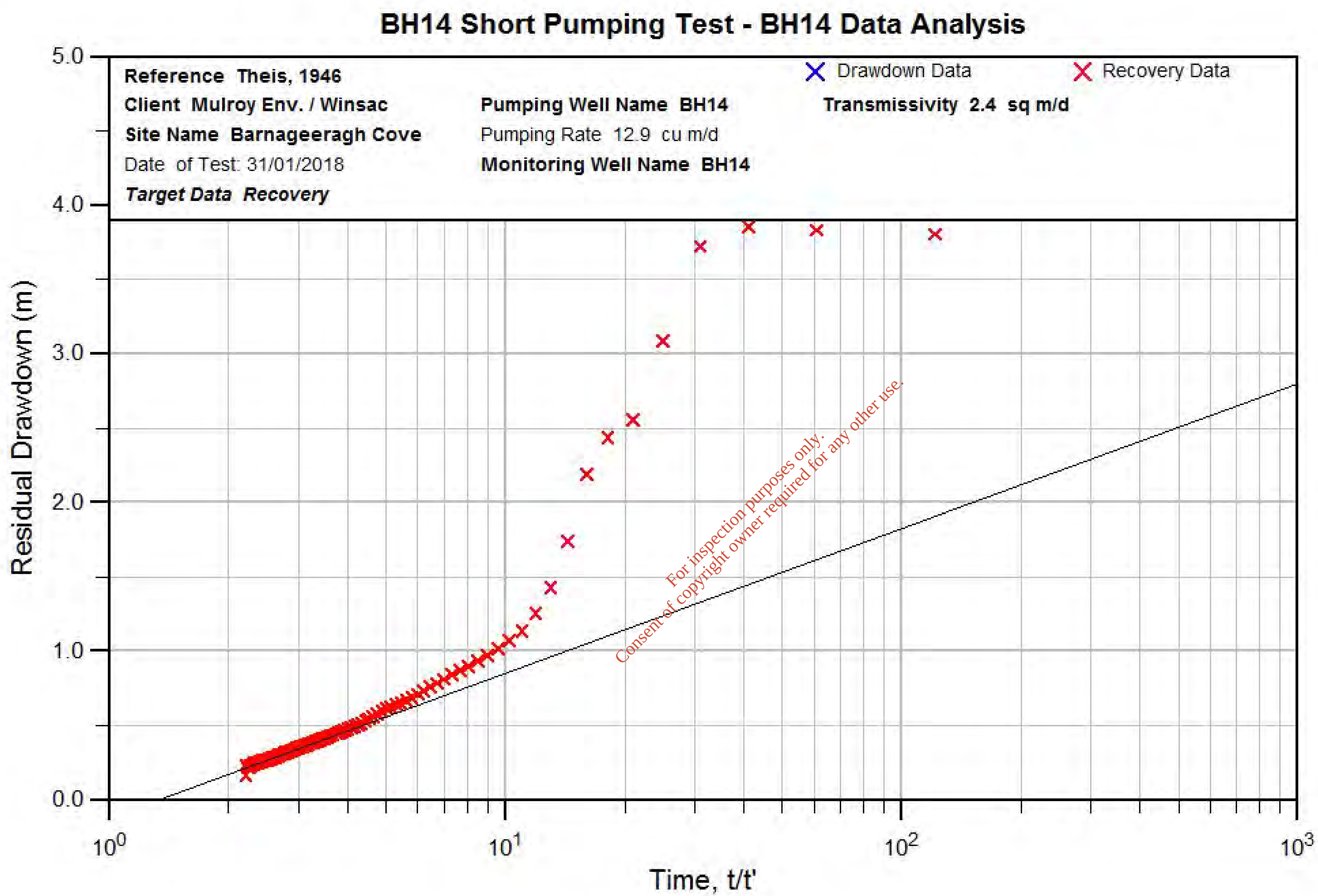
HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA



1114 Barnageeragh Cove
Winsac/Mulroy Environmental
Hidrigeolaíocht Uí Chonaire Teoranta

HUCT SEIRBHÍSÍ HIDRIGEOLAÍOCHTA

APPENDIX 3

- CONSIM Model Print Out

Project Details

Title: Barnageeragh Cove Landfill
Project Number: 1114
Prepared By: Peter Conroy
Date: 2019-01-21 10:28:48
Client Name: Mulroy Environmental / Winsac
Comments:

Consim version 2.05

Simulation Level

Level 3

Simulation Parameters

Iterations 201
Timeslices:0, 1, 5, 10, 25, 50, 100, 150, 200, 500, 1000

Water Quality Standard

User Defined

Source
Type 1 Waste - Soil Cover
Dry Bulk Density [g/cm³] SINGLE(1.4)
Moisture Content [%] UNIFORM(8,25)
Particle Density [g/cm³] SINGLE(2.6)
Thickness [m] TRIANGULAR(1.84,3.97,6.4)
Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)
Contaminated Land
Declining Source Term

Overall Unsaturated Zone Thickness [m] TRIANGULAR(3.3,5.69,7.12)

Infiltration
Infiltration [mm/year] SINGLE(239)

Source Inventory:
Ammonium (NH4+)
Measured as Total Concentration in Soil — Concentration [mg/kg] LOGTRIANGULAR(528,810,1092)
Inorganic
Partition Coefficient [ml/g] UNIFORM(2,4)
Maximum Solubility [mg/l] SINGLE(899000)

Arsenic
Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(24,61)
Inorganic
Partition Coefficient [ml/g] TRIANGULAR(29,31,117)
Maximum Solubility [mg/l] SINGLE(441000)

Benzo 3, 4 pyrene
Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.12,0.781)
Organic
koc [ml/g] UNIFORM(3760,1.3e+006) — Calculate kd
Henry's Law Constant SINGLE(1.93e-005) — Maximum Solubility [mg/l] SINGLE(0.0016)

Chloride
Measured as Total Concentration in Soil — Concentration [mg/kg] TRIANGULAR(37,61,84)
Inorganic
Partition Coefficient [ml/g] SINGLE(0)
Maximum Solubility [mg/l] SINGLE(36000)

Lead
Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(157,1700)
Inorganic
Partition Coefficient [ml/g] TRIANGULAR(27,270,27000)
Maximum Solubility [mg/l] SINGLE(690)

Mercury

Measured as Total Concentration in Soil | Concentration [mg/kg] UNIFORM(0.12,0.8)

Inorganic

Partition Coefficient [ml/g] SINGLE(450)

Maximum Solubility [mg/l] SINGLE(690)

Naphthalene

Measured as Total Concentration in Soil | Concentration [mg/kg] UNIFORM(0.044,0.43)

Organic

koc [ml/g] UNIFORM(112,9333) | Calculate kd

Henry's Law Constant SINGLE(0.0186) | Maximum Solubility [mg/l] SINGLE(31)

Phenol

Measured as Total Concentration in Soil | Concentration [mg/kg] SINGLE(0.05)

Organic

koc [ml/g] SINGLE(29) | Calculate kd

Henry's Law Constant UNIFORM(1.89e-005,2.44e-005) | Maximum Solubility [mg/l] UNIFORM(82000,93000)

Unsaturated Pathway: Unsaturated Pathway 1

Active

Porous Medium

Thickness [m] TRIANGULAR(3.3,5.69,7.12)

Dry Bulk Density [g/cm³] UNIFORM(1.36,2.19)

Vertical Dispersivity [m] TRIANGULAR(0.33,0.57,0.71)

Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)

Water Filled Porosity [fraction] UNIFORM(0.24,0.38)

Unsaturated Conductivity [m/s] LOGTRIANGULAR(7.5e-010,1.93e-009,6.82e-008)

Unsaturated Pathway Contaminants

Ammonium (NH4+)

Partition Coefficient [ml/g] UNIFORM(2,4)

Simulate Degradation in Dissolved and sorbed phases

Halflife [years] TRIANGULAR(0.036,1,6)

Arsenic

Partition Coefficient [ml/g] TRIANGULAR(29,31,117)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Benzo 3, 4 pyrene

koc [ml/g] UNIFORM(3760,1.3e+006) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.63,0.85)

Chloride

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Lead

Partition Coefficient [ml/g] TRIANGULAR(27,270,27000)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Mercury

Partition Coefficient [ml/g] SINGLE(450)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Naphthalene

koc [ml/g] UNIFORM(112,9333) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.27,0.82)

Phenol

koc [ml/g] SINGLE(29) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.027,0.27)

Source

Type 1 Waste - Capped

Dry Bulk Density [g/cm³] SINGLE(1.4)

Moisture Content [%] UNIFORM(8,25)

Particle Density [g/cm³] SINGLE(2.6)

Thickness [m] TRIANGULAR(2.01,5.22,9.18)

Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)

Contaminated Land

Declining Source Term

Overall Unsaturated Zone Thickness [m] TRIANGULAR(0.65,4.64,7.64)

Infiltration

Infiltration [mm/year] SINGLE(31.5)

Source Inventory:

Ammonium (NH4+)

Measured as Total Concentration in Soil — Concentration [mg/kg] LOGTRIANGULAR(528,810,1092)

Inorganic

Partition Coefficient [ml/g] UNIFORM(2,4)

Maximum Solubility [mg/l] SINGLE(899000)

Arsenic

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(24,61)

Inorganic

Partition Coefficient [ml/g] TRIANGULAR(29,31,117)

Maximum Solubility [mg/l] SINGLE(441000)

Benzo 3, 4 pyrene

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.12,0.781)

Organic

koc [ml/g] UNIFORM(3760,1.3e+006) — Calculate kd

Henry's Law Constant SINGLE(1.93e-005) — Maximum Solubility [mg/l] SINGLE(0.0016)

Chloride

Measured as Total Concentration in Soil — Concentration [mg/kg] TRIANGULAR(37,61,84)

Inorganic

Partition Coefficient [ml/g] SINGLE(0)

Maximum Solubility [mg/l] SINGLE(36000)

Lead

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(157,1700)

Inorganic

Partition Coefficient [ml/g] TRIANGULAR(27,270,27000)

Maximum Solubility [mg/l] SINGLE(690)

Mercury

Measured as Total Concentration in Soil

Concentration [mg/kg] UNIFORM(0.12,0.8)

Inorganic

Partition Coefficient [ml/g] SINGLE(450)

Maximum Solubility [mg/l] SINGLE(690)

Naphthalene

Measured as Total Concentration in Soil

Concentration [mg/kg] UNIFORM(0.044,0.43)

Organic

koc [ml/g] UNIFORM(112,9333)

Calculate kd

Henry's Law Constant SINGLE(0.0186)

Maximum Solubility [mg/l] SINGLE(31)

Phenol

Measured as Total Concentration in Soil

Concentration [mg/kg] SINGLE(0.05)

Organic

koc [ml/g] SINGLE(29)

Calculate kd

Henry's Law Constant UNIFORM(1.89e-005,2.44e-005)

Maximum Solubility [mg/l] UNIFORM(82000,93000)

Unsaturated Pathway: Unsaturated Pathway 1

Active

Porous Medium

Thickness [m] TRIANGULAR(0.65,4.64,7.64)

Dry Bulk Density [g/cm³] UNIFORM(1.36,2.19)

Vertical Dispersivity [m] TRIANGULAR(0.065,0.46,0.76)

Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)

Water Filled Porosity [fraction] UNIFORM(0.24,0.38)

Unsaturated Conductivity [m/s] LOGTRIANGULAR(7.5e-010,1.93e-009,6.82e-008)

Unsaturated Pathway Contaminants

Ammonium (NH4+)

Partition Coefficient [ml/g] UNIFORM(2,4)

Simulate Degradation in Dissolved and sorbed phases

Halflife [years] TRIANGULAR(0.036,1,6)

Arsenic

Partition Coefficient [ml/g] TRIANGULAR(29,31,117)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Benzo 3, 4 pyrene

koc [ml/g] UNIFORM(3760,1.3e+006) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.63,0.85)

Chloride

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Lead

Partition Coefficient [ml/g] TRIANGULAR(27,270,27000)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Mercury

Partition Coefficient [ml/g] SINGLE(450)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Naphthalene

koc [ml/g] UNIFORM(112,9333) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.27,0.82)

Phenol

koc [ml/g] SINGLE(29) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.027,0.27)

Project: Barnageeragh Cove Landfill

Project Number: 1114

Source

Type 2 Waste - BioWin1_AboveGWL

Dry Bulk Density [g/cm³] SINGLE(1.4)

Moisture Content [%] UNIFORM(8.9,21)

Particle Density [g/cm³] SINGLE(2.6)

Thickness [m] TRIANGULAR(3.97,4.09,4.21)

Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)

Contaminated Land

Declining Source Term

Overall Unsaturated Zone Thickness [m] SINGLE(1e-030)

Infiltration

Infiltration [mm/year] SINGLE(119.5)

Source Inventory:

1,1-Dichloroethene (1,1-DCE)

Measured as Total Concentration in Soil — Concentration [mg/kg] SINGLE(0.011)

Organic

koc [ml/g] SINGLE(49) — Calculate kd

Henry's Law Constant SINGLE(0.173) — Maximum Solubility [mg/l] SINGLE(6410)

Ammonium (NH4+)

Measured as Total Concentration in Soil — Concentration [mg/kg] TRIANGULAR(1543,3331,7586)

Inorganic

Partition Coefficient [ml/g] UNIFORM(2,4)

Maximum Solubility [mg/l] SINGLE(899000)

Arsenic

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(15,57)

Inorganic

Partition Coefficient [ml/g] TRIANGULAR(29,31,117)

Maximum Solubility [mg/l] SINGLE(441000)

Benzo 3, 4 pyrene

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.046,4.1)

Organic

koc [ml/g] UNIFORM(3760,1.3e+006) — Calculate kd

Henry's Law Constant SINGLE(1.93e-005) — Maximum Solubility [mg/l] SINGLE(0.0016)

Chloride

Measured as Total Concentration in Soil — Concentration [mg/kg] TRIANGULAR(13,193,521)

Inorganic

Partition Coefficient [ml/g] SINGLE(0)

Maximum Solubility [mg/l] SINGLE(36000)

Lead

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.12,0.76)

Inorganic

Partition Coefficient [ml/g] SINGLE(450)

Maximum Solubility [mg/l] SINGLE(690)

Mercury

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.12,0.76)

Inorganic

Partition Coefficient [ml/g] SINGLE(450)

Maximum Solubility [mg/l] SINGLE(690)

Naphthalene

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.05,0.32)

Organic

koc [ml/g] UNIFORM(112,9333) — Calculate kd

Henry's Law Constant SINGLE(0.0186) — Maximum Solubility [mg/l] SINGLE(31)

Phenol

Measured as Total Concentration in Soil — Concentration [mg/kg] SINGLE(0.12)

Organic

koc [ml/g] SINGLE(29) — Calculate kd

Henry's Law Constant UNIFORM(1.89e-005,2.44e-005) — Maximum Solubility [mg/l] UNIFORM(82000,93000)

n-Decane

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(2.9,8.9)

Organic

koc [ml/g] SINGLE(1500) — Calculate kd

Henry's Law Constant SINGLE(218) — Maximum Solubility [mg/l] SINGLE(0.052)

n-Hexadecane

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(63,980)

Organic

koc [ml/g] SINGLE(53000) — Calculate kd

Henry's Law Constant SINGLE(888) — Maximum Solubility [mg/l] SINGLE(2.1e-005)

Unsaturated Pathway: Unsaturated Pathway 1

Active

Porous Medium

Thickness [m] SINGLE(1e-030)

Dry Bulk Density [g/cm³] UNIFORM(1.36,2.19)

Vertical Dispersivity [m] SINGLE(1e-030)

Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)

Water Filled Porosity [fraction] UNIFORM(0.24,0.38)

Unsaturated Conductivity [m/s] LOGTRIANGULAR(7.5e-010,1.93e-009,6.28e-008)

Unsaturated Pathway Contaminants

1,1-Dichloroethene (1,1-DCE)

koc [ml/g] SINGLE(49) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(1.3)

Ammonium (NH4+)

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(1e+030)

Arsenic

Partition Coefficient [ml/g] TRIANGULAR(29,31,117)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Benzo 3, 4 pyrene

koc [ml/g] UNIFORM(3760,1.3e+006) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.63,0.85)

Chloride

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Lead

Partition Coefficient [ml/g] TRIANGULAR(27,270,27000)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Mercury

Partition Coefficient [ml/g] SINGLE(450)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Naphthalene
koc [ml/g] UNIFORM(112,9333) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.27,0.82)

Phenol
koc [ml/g] SINGLE(29) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.027,0.27)

n-Decane
koc [ml/g] SINGLE(1500) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.1)

n-Hexadecane
koc [ml/g] SINGLE(53000) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.21)

Source

Type 2 Waste - BioWin1_BelowGWL
Dry Bulk Density [g/cm³] SINGLE(1.4)
Moisture Content [%] UNIFORM(8.9,21)
Particle Density [g/cm³] SINGLE(2.6)
Thickness [m] TRIANGULAR(2.56,4.24,4.82)
Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)
Contaminated Land
Declining Source Term

Overall Unsaturated Zone Thickness [m] SINGLE(1e-030)

Infiltration

Infiltration [mm/year] TRIANGULAR(0.01,3,7.1)

Source Inventory:

1,1-Dichloroethene (1,1-DCE)
Measured as Total Concentration in Soil
Concentration [mg/kg] SINGLE(0.011)
Organic
koc [ml/g] SINGLE(49)
Calculate kd
Henry's Law Constant SINGLE(0.173)
Maximum Solubility [mg/l] SINGLE(6410)

Ammonium (NH4+)
Measured as Total Concentration in Soil
Concentration [mg/kg] TRIANGULAR(1543,3331,7586)
Inorganic
Partition Coefficient [ml/g] UNIFORM(2,4)
Maximum Solubility [mg/l] SINGLE(899000)

Arsenic
Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(15,57)
Inorganic
Partition Coefficient [ml/g] TRIANGULAR(29,31,117)
Maximum Solubility [mg/l] SINGLE(441000)

Benzo 3, 4 pyrene
Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(0.046,4.1)
Organic
koc [ml/g] UNIFORM(3760,1.3e+006)
Calculate kd
Henry's Law Constant SINGLE(1.93e-005)
Maximum Solubility [mg/l] SINGLE(0.0016)

Chloride
Measured as Total Concentration in Soil
Concentration [mg/kg] TRIANGULAR(13,193,521)
Inorganic
Partition Coefficient [ml/g] SINGLE(0)
Maximum Solubility [mg/l] SINGLE(36000)

Lead

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.12,0.76)

Inorganic

Partition Coefficient [ml/g] SINGLE(450)

Maximum Solubility [mg/l] SINGLE(690)

Mercury

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.12,0.76)

Inorganic

Partition Coefficient [ml/g] SINGLE(450)

Maximum Solubility [mg/l] SINGLE(690)

Naphthalene

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.05,0.32)

Organic

koc [ml/g] UNIFORM(112,9333) — Calculate kd

Henry's Law Constant SINGLE(0.0186) — Maximum Solubility [mg/l] SINGLE(31)

Phenol

Measured as Total Concentration in Soil — Concentration [mg/kg] SINGLE(0.12)

Organic

koc [ml/g] SINGLE(29) — Calculate kd

Henry's Law Constant UNIFORM(1.89e-005,2.44e-005) — Maximum Solubility [mg/l] UNIFORM(82000,93000)

n-Decane

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(2.9,8.9)

Organic

koc [ml/g] SINGLE(1500) — Calculate kd

Henry's Law Constant SINGLE(218) — Maximum Solubility [mg/l] SINGLE(0.052)

n-Hexadecane

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(63,980)

Organic

koc [ml/g] SINGLE(53000) — Calculate kd

Henry's Law Constant SINGLE(888) — Maximum Solubility [mg/l] SINGLE(2.1e-005)

Unsaturated Pathway: Unsaturated Pathway 1

Active

Porous Medium

Thickness [m] SINGLE(1e-030)

Dry Bulk Density [g/cm³] UNIFORM(1.36,2.19)

Vertical Dispersivity [m] SINGLE(1e-030)

Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)

Water Filled Porosity [fraction] UNIFORM(0.24,0.38)

Unsaturated Conductivity [m/s] LOGTRIANGULAR(7.5e-010,1.93e-009,6.28e-008)

Unsaturated Pathway Contaminants

1,1-Dichloroethene (1,1-DCE)

koc [ml/g] SINGLE(49) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(1.3)

Ammonium (NH4+)

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(1e+030)

Arsenic

Partition Coefficient [ml/g] TRIANGULAR(29,31,117)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Benzo 3, 4 pyrene

koc [ml/g] UNIFORM(3760,1.3e+006) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.63,0.85)

Chloride

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Lead

Partition Coefficient [ml/g] TRIANGULAR(27,270,27000)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Mercury

Partition Coefficient [ml/g] SINGLE(450)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Naphthalene
koc [ml/g] UNIFORM(112,9333) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.27,0.82)

Phenol
koc [ml/g] SINGLE(29) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.027,0.27)

n-Decane
koc [ml/g] SINGLE(1500) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.1)

n-Hexadecane
koc [ml/g] SINGLE(53000) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.21)

Source

Type 2 Waste_Cap_BelowGWLFtPrnt_BelowGWL
Dry Bulk Density [g/cm³] SINGLE(1.4)
Moisture Content [%] UNIFORM(8.9,21)
Particle Density [g/cm³] SINGLE(2.6)
Thickness [m] TRIANGULAR(0.01,2.68,6.35)
Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)
Contaminated Land
Declining Source Term

Overall Unsaturated Zone Thickness [m] SINGLE(1e-030)

Infiltration

Infiltration [mm/year] TRIANGULAR(0.01,3,7.1)

Source Inventory:

1,1-Dichloroethene (1,1-DCE)
Measured as Total Concentration in Soil — Concentration [mg/kg] SINGLE(0.011)
Organic
koc [ml/g] SINGLE(49) — Calculate kd
Henry's Law Constant SINGLE(0.173) — Maximum Solubility [mg/l] SINGLE(6410)

Ammonium (NH4+)
Measured as Total Concentration in Soil — Concentration [mg/kg] TRIANGULAR(1543,3331,7586)
Inorganic
Partition Coefficient [ml/g] UNIFORM(2,4)
Maximum Solubility [mg/l] SINGLE(899000)

Arsenic
Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(15,57)
Inorganic
Partition Coefficient [ml/g] TRIANGULAR(29,31,117)
Maximum Solubility [mg/l] SINGLE(441000)

Benzo 3, 4 pyrene
Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.046,4.1)
Organic
koc [ml/g] UNIFORM(3760,1.3e+006) — Calculate kd
Henry's Law Constant SINGLE(1.93e-005) — Maximum Solubility [mg/l] SINGLE(0.0016)

Chloride
Measured as Total Concentration in Soil — Concentration [mg/kg] TRIANGULAR(13,193,521)
Inorganic
Partition Coefficient [ml/g] SINGLE(0)
Maximum Solubility [mg/l] SINGLE(36000)

Lead

Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(0.12,0.76)
Inorganic
Partition Coefficient [ml/g] SINGLE(450)
Maximum Solubility [mg/l] SINGLE(690)

Mercury

Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(0.12,0.76)
Inorganic
Partition Coefficient [ml/g] SINGLE(450)
Maximum Solubility [mg/l] SINGLE(690)

Naphthalene

Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(0.05,0.32)
Organic
koc [ml/g] UNIFORM(112,9333)
Calculate kd
Henry's Law Constant SINGLE(0.0186)
Maximum Solubility [mg/l] SINGLE(31)

Phenol

Measured as Total Concentration in Soil
Concentration [mg/kg] SINGLE(0.12)
Organic
koc [ml/g] SINGLE(29)
Calculate kd
Henry's Law Constant UNIFORM(1.89e-005,2.44e-005)
Maximum Solubility [mg/l] UNIFORM(82000,93000)

n-Decane

Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(2.9,8.9)
Organic
koc [ml/g] SINGLE(1500)
Calculate kd
Henry's Law Constant SINGLE(218)
Maximum Solubility [mg/l] SINGLE(0.052)

n-Hexadecane

Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(63,980)
Organic
koc [ml/g] SINGLE(53000)
Calculate kd
Henry's Law Constant SINGLE(888)
Maximum Solubility [mg/l] SINGLE(2.1e-005)

Unsaturated Pathway: Unsaturated Pathway 1

Active

Porous Medium

Thickness [m] SINGLE(1e-030)

Dry Bulk Density [g/cm³] UNIFORM(1.36,2.19)

Vertical Dispersivity [m] SINGLE(1e-030)

Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)

Water Filled Porosity [fraction] UNIFORM(0.24,0.38)

Unsaturated Conductivity [m/s] LOGTRIANGULAR(7.5e-010,1.93e-009,6.28e-008)

Unsaturated Pathway Contaminants

1,1-Dichloroethene (1,1-DCE)

koc [ml/g] SINGLE(49) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(1.3)

Ammonium (NH4+)

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(1e+030)

Arsenic

Partition Coefficient [ml/g] TRIANGULAR(29,31,117)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Benzo 3, 4 pyrene

koc [ml/g] UNIFORM(3760,1.3e+006) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.63,0.85)

Chloride

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Lead

Partition Coefficient [ml/g] TRIANGULAR(27,270,27000)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Mercury

Partition Coefficient [ml/g] SINGLE(450)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Naphthalene
koc [ml/g] UNIFORM(112,9333) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.27,0.82)

Phenol
koc [ml/g] SINGLE(29) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.027,0.27)

n-Decane
koc [ml/g] SINGLE(1500) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.1)

n-Hexadecane
koc [ml/g] SINGLE(53000) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.21)

Source
Type 2 Waste_Cap_BelowGWLFtPrnt_AboveGWL
Dry Bulk Density [g/cm³] SINGLE(1.4)
Moisture Content [%] UNIFORM(8.9,21)
Particle Density [g/cm³] SINGLE(2.6)
Thickness [m] TRIANGULAR(3.74,6.8,9.83)
Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)
Contaminated Land
Declining Source Term

Overall Unsaturated Zone Thickness [m] SINGLE(1e-030)

Infiltration
Infiltration [mm/year] SINGLE(31.5)

Source Inventory:

1,1-Dichloroethene (1,1-DCE)
Measured as Total Concentration in Soil — Concentration [mg/kg] SINGLE(0.011)
Organic
koc [ml/g] SINGLE(49) — Calculate kd
Henry's Law Constant SINGLE(0.173) — Maximum Solubility [mg/l] SINGLE(6410)

Ammonium (NH4+)
Measured as Total Concentration in Soil — Concentration [mg/kg] TRIANGULAR(1543,3331,7586)
Inorganic
Partition Coefficient [ml/g] UNIFORM(2,4)
Maximum Solubility [mg/l] SINGLE(899000)

Arsenic
Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(15,57)
Inorganic
Partition Coefficient [ml/g] TRIANGULAR(29,31,117)
Maximum Solubility [mg/l] SINGLE(441000)

Benzo 3, 4 pyrene
Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.046,4.1)
Organic
koc [ml/g] UNIFORM(3760,1.3e+006) — Calculate kd
Henry's Law Constant SINGLE(1.93e-005) — Maximum Solubility [mg/l] SINGLE(0.0016)

Chloride
Measured as Total Concentration in Soil — Concentration [mg/kg] TRIANGULAR(13,193,521)
Inorganic
Partition Coefficient [ml/g] SINGLE(0)
Maximum Solubility [mg/l] SINGLE(36000)

Lead

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.12,0.76)
Inorganic
Partition Coefficient [ml/g] SINGLE(450)
Maximum Solubility [mg/l] SINGLE(690)

Mercury

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.12,0.76)
Inorganic
Partition Coefficient [ml/g] SINGLE(450)
Maximum Solubility [mg/l] SINGLE(690)

Naphthalene

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.05,0.32)
Organic
koc [ml/g] UNIFORM(112,9333) — Calculate kd
Henry's Law Constant SINGLE(0.0186) — Maximum Solubility [mg/l] SINGLE(31)

Phenol

Measured as Total Concentration in Soil — Concentration [mg/kg] SINGLE(0.12)
Organic
koc [ml/g] SINGLE(29) — Calculate kd
Henry's Law Constant UNIFORM(1.89e-005,2.44e-005) — Maximum Solubility [mg/l] UNIFORM(82000,93000)

n-Decane

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(2.9,8.9)
Organic
koc [ml/g] SINGLE(1500) — Calculate kd
Henry's Law Constant SINGLE(218) — Maximum Solubility [mg/l] SINGLE(0.052)

n-Hexadecane

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(63,980)
Organic
koc [ml/g] SINGLE(53000) — Calculate kd
Henry's Law Constant SINGLE(888) — Maximum Solubility [mg/l] SINGLE(2.1e-005)

Unsaturated Pathway: Unsaturated Pathway 1

Active

Porous Medium

Thickness [m] SINGLE(1e-030)

Dry Bulk Density [g/cm³] UNIFORM(1.36,2.19)

Vertical Dispersivity [m] SINGLE(1e-030)

Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)

Water Filled Porosity [fraction] UNIFORM(0.24,0.38)

Unsaturated Conductivity [m/s] LOGTRIANGULAR(7.5e-010,1.93e-009,6.28e-008)

Unsaturated Pathway Contaminants

1,1-Dichloroethene (1,1-DCE)

koc [ml/g] SINGLE(49) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(1.3)

Ammonium (NH4+)

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(1e+030)

Arsenic

Partition Coefficient [ml/g] TRIANGULAR(29,31,117)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Benzo 3, 4 pyrene

koc [ml/g] UNIFORM(3760,1.3e+006) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.63,0.85)

Chloride

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Lead

Partition Coefficient [ml/g] TRIANGULAR(27,270,27000)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Mercury

Partition Coefficient [ml/g] SINGLE(450)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Naphthalene
koc [ml/g] UNIFORM(112,9333) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.27,0.82)

Phenol
koc [ml/g] SINGLE(29) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.027,0.27)

n-Decane
koc [ml/g] SINGLE(1500) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.1)

n-Hexadecane
koc [ml/g] SINGLE(53000) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.21)

Source

Type 2 Waste_Cap_AboveGWL_West
Dry Bulk Density [g/cm³] SINGLE(1.4)
Moisture Content [%] UNIFORM(8.9,21)
Particle Density [g/cm³] SINGLE(2.6)
Thickness [m] TRIANGULAR(2.11,7.1,9.88)
Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)
Contaminated Land
Declining Source Term

Overall Unsaturated Zone Thickness [m] TRIANGULAR(0.01,2.22,7.73)

Infiltration

Infiltration [mm/year] SINGLE(31.5)

Source Inventory:

1,1-Dichloroethene (1,1-DCE)
Measured as Total Concentration in Soil
Concentration [mg/kg] SINGLE(0.011)
Organic
koc [ml/g] SINGLE(49)
Calculate kd
Henry's Law Constant SINGLE(0.173)
Maximum Solubility [mg/l] SINGLE(6410)

Ammonium (NH4+)
Measured as Total Concentration in Soil
Concentration [mg/kg] TRIANGULAR(1543,3331,7586)
Inorganic
Partition Coefficient [ml/g] UNIFORM(2,4)
Maximum Solubility [mg/l] SINGLE(899000)

Arsenic
Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(15,57)
Inorganic
Partition Coefficient [ml/g] TRIANGULAR(29,31,117)
Maximum Solubility [mg/l] SINGLE(441000)

Benzo 3, 4 pyrene
Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(0.046,4.1)
Organic
koc [ml/g] UNIFORM(3760,1.3e+006)
Calculate kd
Henry's Law Constant SINGLE(1.93e-005)
Maximum Solubility [mg/l] SINGLE(0.0016)

Chloride
Measured as Total Concentration in Soil
Concentration [mg/kg] TRIANGULAR(13,193,521)
Inorganic
Partition Coefficient [ml/g] SINGLE(0)
Maximum Solubility [mg/l] SINGLE(36000)

Lead
Measured as Total Concentration in Soil | Concentration [mg/kg] UNIFORM(0.12,0.76)
Inorganic
Partition Coefficient [ml/g] SINGLE(450)
Maximum Solubility [mg/l] SINGLE(690)

Mercury
Measured as Total Concentration in Soil | Concentration [mg/kg] UNIFORM(0.12,0.76)
Inorganic
Partition Coefficient [ml/g] SINGLE(450)
Maximum Solubility [mg/l] SINGLE(690)

Naphthalene
Measured as Total Concentration in Soil | Concentration [mg/kg] UNIFORM(0.05,0.32)
Organic
koc [ml/g] UNIFORM(112,9333) | Calculate kd
Henry's Law Constant SINGLE(0.0186) | Maximum Solubility [mg/l] SINGLE(31)

Phenol
Measured as Total Concentration in Soil | Concentration [mg/kg] SINGLE(0.12)
Organic
koc [ml/g] SINGLE(29) | Calculate kd
Henry's Law Constant UNIFORM(1.89e-005,2.44e-005) | Maximum Solubility [mg/l] UNIFORM(82000,93000)

n-Decane
Measured as Total Concentration in Soil | Concentration [mg/kg] UNIFORM(2.9,8.9)
Organic
koc [ml/g] SINGLE(1500) | Calculate kd
Henry's Law Constant SINGLE(218) | Maximum Solubility [mg/l] SINGLE(0.052)

n-Hexadecane
Measured as Total Concentration in Soil | Concentration [mg/kg] UNIFORM(63,980)
Organic
koc [ml/g] SINGLE(53000) | Calculate kd
Henry's Law Constant SINGLE(888) | Maximum Solubility [mg/l] SINGLE(2.1e-005)

Unsaturated Pathway: Unsaturated Pathway 1

Active

Porous Medium

Thickness [m] TRIANGULAR(0.01,2.22,7.73)

Dry Bulk Density [g/cm³] UNIFORM(1.36,2.19)

Vertical Dispersivity [m] TRIANGULAR(0.001,0.22,0.77)

Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)

Water Filled Porosity [fraction] UNIFORM(0.24,0.38)

Unsaturated Conductivity [m/s] LOGTRIANGULAR(7.5e-010,1.93e-009,6.28e-008)

Unsaturated Pathway Contaminants

1,1-Dichloroethene (1,1-DCE)

koc [ml/g] SINGLE(49) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(1.3)

Ammonium (NH4+)

Partition Coefficient [ml/g] UNIFORM(2,4)

Simulate Degradation in Dissolved and sorbed phases

Halflife [years] TRIANGULAR(0.036,1,6)

Arsenic

Partition Coefficient [ml/g] TRIANGULAR(29,31,117)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Benzo 3, 4 pyrene

koc [ml/g] UNIFORM(3760,1.3e+006) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.63,0.85)

Chloride

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Lead

Partition Coefficient [ml/g] TRIANGULAR(27,270,27000)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Mercury

Partition Coefficient [ml/g] SINGLE(450)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Naphthalene
koc [ml/g] UNIFORM(112,9333) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.27,0.82)

Phenol
koc [ml/g] SINGLE(29) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.027,0.27)

n-Decane
koc [ml/g] SINGLE(1500) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.1)

n-Hexadecane
koc [ml/g] SINGLE(53000) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.21)

Source

Type 2 Waste_Cap_AboveGWL_Mid
Dry Bulk Density [g/cm³] SINGLE(1.4)
Moisture Content [%] UNIFORM(8.9,21)
Particle Density [g/cm³] SINGLE(2.6)
Thickness [m] TRIANGULAR(4.68,6.51,8.92)
Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)
Contaminated Land
Declining Source Term

Overall Unsaturated Zone Thickness [m] TRIANGULAR(0.01,1.06,2.45)

Infiltration

Infiltration [mm/year] SINGLE(31.5)

Source Inventory:

1,1-Dichloroethene (1,1-DCE)
Measured as Total Concentration in Soil
Concentration [mg/kg] SINGLE(0.011)
Organic
koc [ml/g] SINGLE(49)
Calculate kd
Henry's Law Constant SINGLE(0.173)
Maximum Solubility [mg/l] SINGLE(6410)

Ammonium (NH4+)
Measured as Total Concentration in Soil
Concentration [mg/kg] TRIANGULAR(1543,3331,7586)
Inorganic
Partition Coefficient [ml/g] UNIFORM(2,4)
Maximum Solubility [mg/l] SINGLE(899000)

Arsenic
Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(15,57)
Inorganic
Partition Coefficient [ml/g] TRIANGULAR(29,31,117)
Maximum Solubility [mg/l] SINGLE(441000)

Benzo 3, 4 pyrene
Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(0.046,4.1)
Organic
koc [ml/g] UNIFORM(3760,1.3e+006)
Calculate kd
Henry's Law Constant SINGLE(1.93e-005)
Maximum Solubility [mg/l] SINGLE(0.0016)

Chloride
Measured as Total Concentration in Soil
Concentration [mg/kg] TRIANGULAR(13,193,521)
Inorganic
Partition Coefficient [ml/g] SINGLE(0)
Maximum Solubility [mg/l] SINGLE(36000)

Lead

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.12,0.76)

Inorganic

Partition Coefficient [ml/g] SINGLE(450)

Maximum Solubility [mg/l] SINGLE(690)

Mercury

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.12,0.76)

Inorganic

Partition Coefficient [ml/g] SINGLE(450)

Maximum Solubility [mg/l] SINGLE(690)

Naphthalene

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.05,0.32)

Organic

koc [ml/g] UNIFORM(112,9333) — Calculate kd

Henry's Law Constant SINGLE(0.0186) — Maximum Solubility [mg/l] SINGLE(31)

Phenol

Measured as Total Concentration in Soil — Concentration [mg/kg] SINGLE(0.12)

Organic

koc [ml/g] SINGLE(29) — Calculate kd

Henry's Law Constant UNIFORM(1.89e-005,2.44e-005) — Maximum Solubility [mg/l] UNIFORM(82000,93000)

n-Decane

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(2.9,8.9)

Organic

koc [ml/g] SINGLE(1500) — Calculate kd

Henry's Law Constant SINGLE(218) — Maximum Solubility [mg/l] SINGLE(0.052)

n-Hexadecane

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(63,980)

Organic

koc [ml/g] SINGLE(53000) — Calculate kd

Henry's Law Constant SINGLE(888) — Maximum Solubility [mg/l] SINGLE(2.1e-005)

Unsaturated Pathway: Unsaturated Pathway 1

Active

Porous Medium

Thickness [m] TRIANGULAR(0.01,1.06,2.45)

Dry Bulk Density [g/cm³] UNIFORM(1.36,2.19)

Vertical Dispersivity [m] TRIANGULAR(0.001,0.11,0.25)

Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)

Water Filled Porosity [fraction] UNIFORM(0.24,0.38)

Unsaturated Conductivity [m/s] LOGTRIANGULAR(7.5e-010,1.93e-009,6.28e-008)

Unsaturated Pathway Contaminants

1,1-Dichloroethene (1,1-DCE)

koc [ml/g] SINGLE(49) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(1.3)

Ammonium (NH4+)

Partition Coefficient [ml/g] UNIFORM(2,4)

Simulate Degradation in Dissolved and sorbed phases

Halflife [years] TRIANGULAR(0.036,1,6)

Arsenic

Partition Coefficient [ml/g] TRIANGULAR(29,31,117)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Benzo 3, 4 pyrene

koc [ml/g] UNIFORM(3760,1.3e+006) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.63,0.85)

Chloride

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Lead

Partition Coefficient [ml/g] TRIANGULAR(27,270,27000)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Mercury

Partition Coefficient [ml/g] SINGLE(450)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Naphthalene
koc [ml/g] UNIFORM(112,9333) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.27,0.82)

Phenol
koc [ml/g] SINGLE(29) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.027,0.27)

n-Decane
koc [ml/g] SINGLE(1500) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.1)

n-Hexadecane
koc [ml/g] SINGLE(53000) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.21)

Source
Type 2 Waste_Cap_AboveGWL_East
Dry Bulk Density [g/cm³] SINGLE(1.4)
Moisture Content [%] UNIFORM(8.9,21)
Particle Density [g/cm³] SINGLE(2.6)
Thickness [m] TRIANGULAR(0.03,2.75,7.16)
Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)
Contaminated Land
Declining Source Term

Overall Unsaturated Zone Thickness [m] TRIANGULAR(0.01,1.55,2.57)

Infiltration
Infiltration [mm/year] SINGLE(31.5)

Source Inventory:

1,1-Dichloroethene (1,1-DCE)
Measured as Total Concentration in Soil
Concentration [mg/kg] SINGLE(0.011)
Organic
koc [ml/g] SINGLE(49)
Calculate kd
Henry's Law Constant SINGLE(0.173)
Maximum Solubility [mg/l] SINGLE(6410)

Ammonium (NH4+)
Measured as Total Concentration in Soil
Concentration [mg/kg] TRIANGULAR(1543,3331,7586)
Inorganic
Partition Coefficient [ml/g] UNIFORM(2,4)
Maximum Solubility [mg/l] SINGLE(899000)

Arsenic
Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(15,57)
Inorganic
Partition Coefficient [ml/g] TRIANGULAR(29,31,117)
Maximum Solubility [mg/l] SINGLE(441000)

Benzo 3, 4 pyrene
Measured as Total Concentration in Soil
Concentration [mg/kg] UNIFORM(0.046,4.1)
Organic
koc [ml/g] UNIFORM(3760,1.3e+006)
Calculate kd
Henry's Law Constant SINGLE(1.93e-005)
Maximum Solubility [mg/l] SINGLE(0.0016)

Chloride
Measured as Total Concentration in Soil
Concentration [mg/kg] TRIANGULAR(13,193,521)
Inorganic
Partition Coefficient [ml/g] SINGLE(0)
Maximum Solubility [mg/l] SINGLE(36000)

Lead

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.12,0.76)
Inorganic
Partition Coefficient [ml/g] SINGLE(450)
Maximum Solubility [mg/l] SINGLE(690)

Mercury

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.12,0.76)
Inorganic
Partition Coefficient [ml/g] SINGLE(450)
Maximum Solubility [mg/l] SINGLE(690)

Naphthalene

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(0.05,0.32)
Organic
koc [ml/g] UNIFORM(112,9333) — Calculate kd
Henry's Law Constant SINGLE(0.0186) — Maximum Solubility [mg/l] SINGLE(31)

Phenol

Measured as Total Concentration in Soil — Concentration [mg/kg] SINGLE(0.12)
Organic
koc [ml/g] SINGLE(29) — Calculate kd
Henry's Law Constant UNIFORM(1.89e-005,2.44e-005) — Maximum Solubility [mg/l] UNIFORM(82000,93000)

n-Decane

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(2.9,8.9)
Organic
koc [ml/g] SINGLE(1500) — Calculate kd
Henry's Law Constant SINGLE(218) — Maximum Solubility [mg/l] SINGLE(0.052)

n-Hexadecane

Measured as Total Concentration in Soil — Concentration [mg/kg] UNIFORM(63,980)
Organic
koc [ml/g] SINGLE(53000) — Calculate kd
Henry's Law Constant SINGLE(888) — Maximum Solubility [mg/l] SINGLE(2.1e-005)

Unsaturated Pathway: Unsaturated Pathway 1

Active

Porous Medium

Thickness [m] TRIANGULAR(0.01,1.55,2.57)

Dry Bulk Density [g/cm³] UNIFORM(1.36,2.19)

Vertical Dispersivity [m] TRIANGULAR(0.001,0.16,0.26)

Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)

Water Filled Porosity [fraction] UNIFORM(0.24,0.38)

Unsaturated Conductivity [m/s] LOGTRIANGULAR(7.5e-010,1.93e-009,6.28e-008)

Unsaturated Pathway Contaminants

1,1-Dichloroethene (1,1-DCE)

koc [ml/g] SINGLE(49) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(1.3)

Ammonium (NH4+)

Partition Coefficient [ml/g] UNIFORM(2,4)

Simulate Degradation in Dissolved and sorbed phases

Halflife [years] TRIANGULAR(0.036,1,6)

Arsenic

Partition Coefficient [ml/g] TRIANGULAR(29,31,117)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Benzo 3, 4 pyrene

koc [ml/g] UNIFORM(3760,1.3e+006) Calculate kd

Simulate Degradation in Dissolved Phase only

Halflife [years] UNIFORM(0.63,0.85)

Chloride

Partition Coefficient [ml/g] SINGLE(0)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Lead

Partition Coefficient [ml/g] TRIANGULAR(27,270,27000)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Mercury

Partition Coefficient [ml/g] SINGLE(450)

Simulate Degradation in Dissolved Phase only

Halflife [years] SINGLE(9.9e+011)

Naphthalene
koc [ml/g] UNIFORM(112,9333) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.27,0.82)

Phenol
koc [ml/g] SINGLE(29) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.027,0.27)

n-Decane
koc [ml/g] SINGLE(1500) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.1)

n-Hexadecane
koc [ml/g] SINGLE(53000) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.21)

Aquifer Pathway

Thickness [m] TRIANGULAR(2,5.1,7.5)
Dry Bulk Density [g/cm³] UNIFORM(1.36,2.68)
Fraction of Organic Carbon [%] UNIFORM(0.34,2.7)
Mixing Zone Thickness [m] TRIANGULAR(2,5.1,7.5)
Hydraulic Conductivity [m/s] LOGTRIANGULAR(2.9e-007,1.7e-005,0.00099)
Effective Porosity [fraction] UNIFORM(0.05,0.41)
Hydraulic Gradient SINGLE(0.0036)
Groundwater Flow Direction (degrees), 90.00
Longitudinal Dispersivity [m] UNIFORM(0.5,9.2)
Lateral Dispersivity [m] UNIFORM(0.15,2.76)

Contaminant Inventory

1,1-Dichloroethene (1,1-DCE)
koc [ml/g] SINGLE(49) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(1.3)

Ammonium (NH4+)
Partition Coefficient [ml/g] UNIFORM(2,4)
Simulate Degradation in Dissolved and sorbed phases
Halflife [years] TRIANGULAR(0.036,1,6)

Arsenic
Partition Coefficient [ml/g] TRIANGULAR(29,31,117)
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(9.9e+011)

Benzo 3, 4 pyrene
koc [ml/g] UNIFORM(3760,1.3e+006) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.63,0.85)

Chloride
Partition Coefficient [ml/g] SINGLE(0)
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(9.9e+011)

Lead
Partition Coefficient [ml/g] TRIANGULAR(27,270,27000)
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(9e+011)

Mercury
Partition Coefficient [ml/g] SINGLE(450)
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(9.9e+011)

Naphthalene
koc [ml/g] UNIFORM(112,9333) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.27,0.82)

Phenol
koc [ml/g] SINGLE(29) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] UNIFORM(0.027,0.27)

n-Decane
koc [ml/g] SINGLE(1500) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.1)

n-Hexadecane
koc [ml/g] SINGLE(53000) Calculate kd
Simulate Degradation in Dissolved Phase only
Halflife [years] SINGLE(0.21)

Receptor

Receptor01	X 323278.000000	Y 260766.000000
Receptor02	X 323301.000000	Y 260816.000000
Receptor05	X 323259.735092	Y 260825.083310
Type 1 Waste - Soil Cover Recepto	X 323176.631943	Y 260845.624201
Type 1 Waste - Capped Receptor	X 323182.231747	Y 260840.237526
Type 2 Waste - BioWin1_AboveGW	X 323236.713787	Y 260833.819153
Type 2 Waste - BioWin1_BelowGW	X 323236.588012	Y 260833.968878
Type 2 Waste_Cap_BelowGWLFtF	X 323271.129873 Receptor	Y 260808.877264
Type 2 Waste_Cap_BelowGWLFtF	X 323271.112018 Receptor	Y 260808.761493
Type 2 Waste_Cap_AboveGWL_W	X 323189.150366	Y 260852.220234
Type 2 Waste_Cap_AboveGWL_M	X 323208.961168	Y 260828.469162
Type 2 Waste_Cap_AboveGWL_E	X 323276.602470	Y 260800.340012

Input Correlations

No Correlations

APPENDIX 4

- CONSIM Model Results Print Out

(note: the results printout is >300 pages long and is available in pdf format on request)