

# Condition 24

## Condition 24 Groundwater Monitoring Scheme

No excavation shall commence until a scheme of ground water monitoring for the site has been submitted to and approved in writing by the Waste Planning Authority. The scheme shall identify the locations for the installation of boreholes to monitor groundwater and the frequency of monitoring. The scheme shall be implemented in accordance with the details approved prior to the commencement of excavations on the site.

*Reason: To minimise the risk of pollution to ground and surface water and to comply with MLP policies MLP S1, S10 and DM1, WLP policies W4A, W4B, W8A and W10E and BLP policies RLP 36, RLP 62, RLP 71 and RLP 72.*

## Environmental Impact Assessments

The IWMF Environmental Impact Assessment (Chapter 6) noted that the saturated thickness of the sands and gravels varied from approximately 1 m to 3.5 m. It was concluded that this variability is related to hollows in the surface of the London Clay; with the greatest saturated aquifer thickness corresponding to the hollows. Blackwater Aggregates' ongoing quarrying operations across Site R and Site A2 have confirmed that perched groundwater is encountered within the hollows (or natural low points) that result from natural variations in the interface between the sand and gravel and London Clay, so this conclusion is still supported.

Monthly groundwater level data has been provided Essex County Council's Minerals Planning Authority for the period January 2008 to August 2015 as part of the Site A2 quarrying operations. The locations of the groundwater monitoring points are shown on Drawing 213033-SOD-24 (This is supported by Drawings 6-4 and 13 which accompanied Blackwater Aggregates' recent Site A2 and Sites A3 and A4 Environmental Impact Assessments). A plot of groundwater levels over time is presented in Appendix A. A summary of the groundwater level information for that period is presented in Table 1.

**Table 1: Summary of Groundwater Level Data (January 2008 to July 2015)**

Borehole	Groundwater Level			
	Minimum	Mean	Maximum	Range
PZ01 ^	33.88	34.38	34.93	1.05
PZ02	33.44	33.72	34.07	0.63
PZ04*	34.50	34.70	34.80	0.30
PZ07	33.54	34.02	34.89	1.35
PZ09A	32.86	33.23	33.96	1.1
PZ11	31.82	32.21	34.42	2.6
PZ16A	35.00	35.40	35.97	0.97
PZ18	37.21	37.69	38.59	1.38
PZ19	38.65	39.28	39.75	1.10
PZ20+	38.22	38.83	39.20	0.98
PZ21	31.77	33.12	34.54	2.77

<sup>^</sup> Not monitored in summer months due to bees.

\* Location stopped being monitoring in early 2009.

+ Dry since December 2012.

The monitoring data presented in Table 1 shows that groundwater elevations in the Kesgrave Formation sand and gravel are highest in the south west and lowest in the north east, suggesting groundwater flow in this deposit is likely to be towards the north east and the River Blackwater.

Groundwater elevations do not appear to vary much over the monitoring period and do not show any clear seasonal variation. Groundwater elevations do tend to be slightly higher towards the end of the winter and spring months, but this is not always the case. This limited seasonality may be due to restricted recharge through the overlying, low hydraulic conductivity, Lowestoft Formation.

From all available information (and experience from quarrying operations in and around the IWMF site), the Kesgrave Formation sand and gravel deposits beneath the Site contain minor amounts of water, with the pattern of groundwater flow in and around the Site being influenced to some degree by the River Blackwater, and also by the topography of the surface of the underlying London Clay. Hollows in the underlying London Clay surface typically contain groundwater. The cohesive and relative impermeable nature of the Lowestoft Formation overburden typically restricts the recharge to the Kesgrave Formation.

## 2014 Ground Investigation & Piezometer Installations

Twenty exploratory holes were carried out between 21 July 2014 and 22 August 2014 by CC Ground Investigation Limited in accordance with BS5930, Amendment 2 (2010). The location of the boreholes are indicated on Drawing 213033-150.

Piezometers were installed within BH 10, BH 11 and BH 19 with a response zone within the sand and gravel. Each installation comprises a 50mm ID HDPE slotted tube set in a filter response zone of Limestone free gravel. The installation was sealed above and below with a bentonite seal and accessed via a valve assembly. The piezometers are protected at the surface by a lockable galvanised steel borehole helmet set in concrete. Installation details are presented on the borehole logs within Appendix B.

On installation BH 10, BH 11 and BH 19 were dry (confirmed by quarrying operations within Site A2). As a contained low point within the operational quarry, this area of Site A2 has been used as a drainage lagoon and soak away for water pumped from the operational areas of the quarry. Groundwater monitoring of BH 10 and BH 11 have recorded water levels coincidental to water levels within the lagoon, BH 19 remains dry.

## Groundwater Monitoring Schedule - Proposals

The groundwater levels in the Sands and Gravels will continue to be monitored monthly throughout the extraction and construction phases of the IWMF. It is proposed that the existing groundwater monitoring wells within Bradwell Quarry (Pz01, Pz02, Pz07, Pz09a, Pz11, Pz16a, Pz18, Pz19 and Pz21) and boreholes BH 10, BH 11 and BH 19 are monitored on a monthly basis during the construction of the IWMF.

## Section 106

Section 3.18 of the IWMF's Section 106 Agreement requires the following:

- 3.18 *Prior to Implementation to submit and have approved by the County Council details of the "French Drain" referred to in Chapter 6 of the Developer's Environmental Statement dated August 2008 and details of a Ground Water Monitoring Scheme designed in accordance with the indicative details within such chapter to monitor groundwater levels on a regular basis from Implementation*

As previously noted, Blackwater Aggregates' ongoing quarrying operations across Site R and Site A2 have confirmed that perched groundwater is encountered within the hollows (or natural low points) that result from natural variations in the interface between the sand and gravel and London Clay. The groundwater monitoring

scheme outlined above is designed in accordance with the details presented within Chapter 6 of the original Groundwater Assessment and is intended to monitor the effects of the IWMF's construction.

Drawings 142064-DC-GA-C-108E Drainage Layout, 142064-DC-GA-C-109E Drainage Layout and 142064-DC-GA-C-111A Drainage Construction Details indicate details of the passive toe drains [or French Drains] that will be installed to the Soil Nailed and Earth Reinforced side slopes.

## Appendices

- A. Groundwater Monitoring January 2008 to July 2015
- B. Borehole Logs and Piezometer Installation details

## Drawings

213033-SOD-24 Proposed IWMF Groundwater Borehole Monitoring Points; Drawing 6-4; Drawing 13; Drawing 213033-150; 142064-DC-GA-C-108D Drainage Layout; 142064-DC-GA-C-109D Drainage Layout; and, 142064-DC-GA-C-111A Drainage Construction Details