

Appendix G

Contaminated Land

Adwick washlands habitat creation – planning application supporting information

A group of eight small disused breeze block buildings on concrete floors is located in the southwest corner of the project area and is the sole built structure. This is a Heavy Anti-Aircraft site dating back to the Second World War. The site is a Scheduled Monument (Station H17, see Appendix 4). The buildings are grouped in a circle of approximately 20 m diameter within a discontinuous earth bund. One of the buildings extends below ground level and appears to be flooded. The buildings lie upslope of the floodplain (still within the washland), but the schedule includes the entrance track, which crosses a short section of floodplain to join Lowfield Lane.

Scheduled Monuments have national protection and therefore development proposals on or near designated sites would require detailed consultation and agreement with English Heritage. This designated archaeological feature should not be affected by any of the scheme works. There would be no works within 25 m of the structure, although the potential for raising the water levels on the floodplain near the monument may require consultation.

Table 7. Summary of services

Water	Yorkshire Water plc	There are no mains running through West Moor Closes.
Sewage	Yorkshire Water plc	There are no sewage mains within the vicinity of West Moor Closes.
Electricity	Yorkshire Electricity	The owners of both pylon and pole mounted systems on and around the site. UK Coal liaised with Yorkshire Electricity to divert the pole-mounted line that runs in a northwest to southeast direction over West Moor Closes. The line would be permanently diverted along the eastern site boundary, which was intended to confer positive benefits upon restoration through the removal of perch posts for predatory birds.
Telecommunications		There are no telephone lines within the vicinity of the site.
Gas mains		There are no gas mains within the West Moor Closes area.

6.8 Contaminated land and potential pollution

Disturbance of surface mining backfill or areas of landfill, by altering hydrologic pathways or ground moving, have the potential to contaminate ground and surface waters. The Groundwater Vulnerability map of the area (National Rivers Authority, 1995) shows the site to lie entirely on a Minor Aquifer of Variable Permeability overlain by soils of H1 Category (High) vulnerability. A Minor Aquifer itself does not have high permeability but is important for local water supplies and the maintenance of river flows.

Three potential areas within the project area have been identified:

Embankments of River Dearne and West Moor Dike. These have been shown to be largely constructed, or capped, with colliery spoil. The river embankment will not be disturbed.

Landfill. On-site landfill sites are restricted to a single location given as the northwest corner of the site (SE 464 032). This landfill and the surrounding area will not be disturbed.

Extensive area of surface mining backfill. Large areas in the central part of the site have previously been opencast for coal and subsequently backfilled with colliery spoil. This is composed of fragments of Coal Measures rocks and coal. The UK Coal Report indicates the extent of this material to be approximately 550 m x 270 m, as shown in Figure 6, with a thickness of between 3.2 m and 24.7 m. Assuming a mean thickness of approximately 11 m, it may be estimated that around 16 million m³ of spoil has been placed across the central part of the site.

Colliery spoil is an inherently contaminated material. This material is likely to contain contaminative levels of heavy metals and organics, including iron, lead, mercury, arsenic, polyaromatic hydrocarbons and phenols. Iron staining recorded in the archive logs and noted in the soak dike suggests that the ground will contain high levels of iron, and that some iron has been mobilised within the drainage system.

The issues associated with scheme design are:

1. **Deep cut-and-fill excavation.** The hazard associated with excavation is the exposure of materials containing readily leachable contaminants.
2. **Ditch excavation.** The hazard associated with excavation is the exposure of materials containing readily leachable contaminants.
3. **Shunting polluted waters.** The potential also exists for shunting polluted water from the backfilled surface mine and towards the River Dearne via the bed of sands and gravels in the floodplain. This could be effected by the addition of dike waters into the surface substrates as part of the scheme.
4. **Spoil disposal.** The proposed scheme design does not require off-site disposal of colliery spoil.

With reference to the Babbie et al report (2004), and the careful attention paid to chemical and geotechnical testing of the colliery spoil within a hazard management framework, the Environment Agency made the following internal comments (Memorandum from Jerome Barton to Amanda Best, 6th December 2004):

“The site has been subject to flooding for a number of years, and is likely to be subject to variable groundwater levels due to its proximity to the river Dearne. We are not aware of any environmental impact on the Dearne as it passes the site, or to groundwater due to contamination problems at the site. As the river is likely to be exerting seasonal fluctuations on groundwater levels, a flushing action is likely to be already occurring in the shallow soils.”

The approach taken in the scheme design requires the following interventions:

- shallow excavation (<1 m) to cut and fill areas of land to create wet grassland
- excavation of new sections of ditch (<2 m)

At this depth, the soil survey (section 4.3.2.1) indicates that the excavation will be contained with the surficial loams and silty clay of the backfill capping. The hazard associated with penetrating the capping would be significant both in terms of accessing more permeable materials, and thus losing transmitted water, and in exposing leachable contaminants.

ELP sampled the upper soil horizons of the backfill, to assess the chemical composition of this material, and for the presence of readily leachable contaminants (see section 6.8.1).

Spoil has already been used in embankment construction (for both West Moor Dike and the river). It is anticipated that the spoil from shallow excavations would be suitable to construct earth bunding within the project area.

6.8.1 ELP testing of superficial substrates

When dealing with potentially contaminated sites, the key question that must be answered is 'does the soil concentration of contaminant X pose a risk to human health or the environment?' The Soil Guideline Values (SGVs) are used to answer this question. SGVs represent 'intervention values', which if exceeded indicate potentially unacceptable risks to site users. Exceedance of SGVs may also indicate that further investigation and/or remedial action may be required to protect human health. SGVs can be used in support of the application of the statutory regimes addressing land contamination, especially Part IIA of the Environmental Protection Act 1990 (the contaminated land regime) and development control under the Town and Country Planning Acts. CLAN 2/05 published by Defra (2005) provides advice on the use of Soil Guideline Values in the determination of land as contaminated land under Part IIA.

Soil Guideline Values have been derived using the Contaminated Land Exposure Assessment (CLEA) model for three land uses:

- residential (with and without vegetable growing)
- allotments; and
- commercial / industrial.

The location of sampling points for chemical analysis of the made ground is shown in Figure 12. The samples were taken at a depth of c.1 metre below the upper surface of the dark grey silty clay subsoil. Each sample was tested by the National Laboratory Service for a standard suite of 76 determinands used to assess potential industrially contaminated soils for waste licensing, as prescribed by the Environment Agency. Tests were also conducted for the leachability of 19 key contaminants. A full list of analytes is given in Appendix 5. The complete report of result are included on the CD.

It is noted that eight-eight of the ninety-five tests produced results within the parameters set by the regulations for all samples.

Standard test reports were produced for each sample of tests where results fell above the levels set in current regulations. Summary results, showing soil sample descriptions, including determinands where the results of one or more samples fell above levels set in current regulations, are shown in Table 8. Table 9 records which samples fell outside particular regulations.

Table 9 shows that all samples fall outside the SGVs for nickel, which obviates spoil use for residential and allotment use. Coal fragments appear to be present throughout the restored area, in some cases above the threshold for hazardous waste. However, it is also noted that coal appears within samples 1, 2 and 10, taken from outside the area indicating the extent of the former surface mine, and it is therefore confirmed that the spoil has been spread over the surroundings during regrading (see also section 4.2.3).

Particular samples, or groups of samples, suggest there is variability of results in different parts of the restored area:

Acidity. This varies between samples from moderately acid (samples 3 and (and 5)) to slightly alkaline. Acid readings were recorded from all samples from the southwest part of the backfilled area.

Polyaromatic hydrocarbons (PAHs). PAHs are cancer-causing chemicals from soot and petroleum-based products. These are also known to occur naturally within the Coal Measures in some regions, particularly in the catchment of the River Don. Values exceed the SGV for inert waste landfill in samples 2, 3 and 9, which are all located on the northwest side of the backfilled area. (Table 8 records all PAH tests as 0.00 mg/kg; the full results provided on the CD give recorded levels of PAH compounds.)

Total dissolved solids. Samples 5, 6 (and 7) registered much higher values than the other samples. It is noted that these samples were located on the downslope side of the backfilled area.

Sulphate. This determinand was measured as leachable dry weight. In common with samples 5, 6 (and 7), the highest values were recorded from the downslope side of the backfilled area.

It is apparent that the downslope side of the backfilled area has high levels of Total Dissolved Solids (TDS) and leachable sulphate. This suggests that rainwater percolating through these substrates is effecting the translocation of dissolved solids, including sulphate-producing colloids. It may be that the silty clay layer is acting as an aquitard, directing percolation downslope.

It is noted that any production of sulphate within the root zone is likely to make residual agricultural phosphates, and phosphates introduced by the water management system, available to plants. It is assumed that seasonal flooding of the low-lying lands north of Lowfield Lane currently produces this effect.

However, it is considered that the burial of the lower part of the backfilled area by surficial loams from upslope, and the raising of the watertable in this area, are both likely to reduce the potential impact of TDS and sulphate production on the wet grassland.

6.9 Current ecological interest

As reviewed in section 2.3, the presence of water voles in banks of West Moor Dike and associated watercourses represents the only existing and known ecological interest within the project area.

An appropriate environmental assessment and repeat presence/absence survey (described in Strachan and Moorhouse 2006) will be required during the season prior to works, and mitigation measures will need to be incorporated within the adopted scheme design.

Reprofiling and other works associated with West Moor Dike and other watercourses would require specific undertakings related to the protection of water vole habitat. There may be the need to mitigate for the loss of water vole habitat. This would require further investigation, but the creation of a vertical earth bank on the new wetlands would be a likely requirement to maintain habitat for this species. Water level rise throughout the site may decrease the attractiveness of some of the existing dikes to water voles. Loss of feeding habitat coupled with loss of suitable burrowing habitat may occur if the water level in all dikes within the site was high throughout the year.

It is noted that an increase in the length of dikes, and an improvement to dike connectivity provides opportunities for further water vole colonisation.

Table 8. Soil sample descriptions, including determinands where the results of one or more samples fell above levels set in current regulations

Sample No.	Sample description	Nickel Dry weight	Loss on ignition	pH: solid sample	Polyaromatic Hydrocarbons Total dry weight	Total Organic Carbon Dry weight	Total Dissolved Solids	Sulphate LDW as SO4
		mg/kg	%	pH units	mg/kg	%	mg/kg	mg/kg
1	The sample appeared to be a mottled grey/orange/brown clay with coal dust present.	71.200	6.47	7.370	0.00	1.900	494.00	136.
2	The sample appeared to be a medium brown sandy clay with coal pieces present.	80.800	8.39	7.250	0.00	1.600	583.00	191.
3	The sample appeared to be a mottled grey and brown clay with sand and stones present.	60.800	7.36	4.430	0.00	1.300	832.00	618.
4	The sample appeared to be a very wet mottled black and brown clay with coal lumps present.	57.000	15.10	5.110	0.00	4.500	458.00	426.
5	The sample appeared to be a dark brown/grey clay with orange inclusions, coal and dust present.	63.000	7.96	6.040	0.00	1.500	10600.00	7150.
6	The sample appeared to be a grey/brown sandy clay with coal present.	82.500	4.85	6.760	0.00	1.600	12200.00	8850.
7	The sample appeared to be a dark grey/brown clay with coal pieces present.	80.200	7.14	7.810	0.00	1.800	2310.00	1600.

8	The sample appeared to be a brown and orange sandy clay with a small amount of coal present.	107.000	10.60	7.570	0.00	1.100	442.00	152.
9	The sample appeared to be a medium brown clay with coal lumps/fragments present.	81.800	7.03	7.810	0.00	1.300	911.00	144.
10	The sample appeared to be a grey/brown clay with coal present.	74.200	10.40	7.210	0.00	2.100	791.00	465.

Table 9. Soil samples with results falling outside particular regulations

Sample	1	2	3	4	5	6	7	8	9	10
The sample did breach Soil Guideline Values (SGV) from the Contaminated Land Environmental Assessment model (CLEA) for the following parameters that were determined:										
Nickel (dry weight) for soils with residential use with plant uptake and for allotments.	x	x	x	x	x	x	x	x	x	x
The sample breached Waste Acceptance Criteria thresholds from the Environment Agency Guidance on Sampling and Testing of Wastes to Meet Landfill Acceptance Procedures: Version 1: April 2005 for the following parameters that were determined:										
HAZARDOUS WASTE LANDFILL criteria:										
Loss on ignition				x				x		x
STABLE NON-REACTIVE HAZARDOUS WASTE in NON-HAZARDOUS LANDFILL criteria:										
pH			x	x						
INERT WASTE LANDFILL criteria:										
Polyaromatic Hydrocarbons (dry weight)		x	x						x	
Total Organic Carbon (dry weight)				x						
Total Dissolved Solids (leachable)					x	x	x			
Sulphate (leachable)					x	x	x			

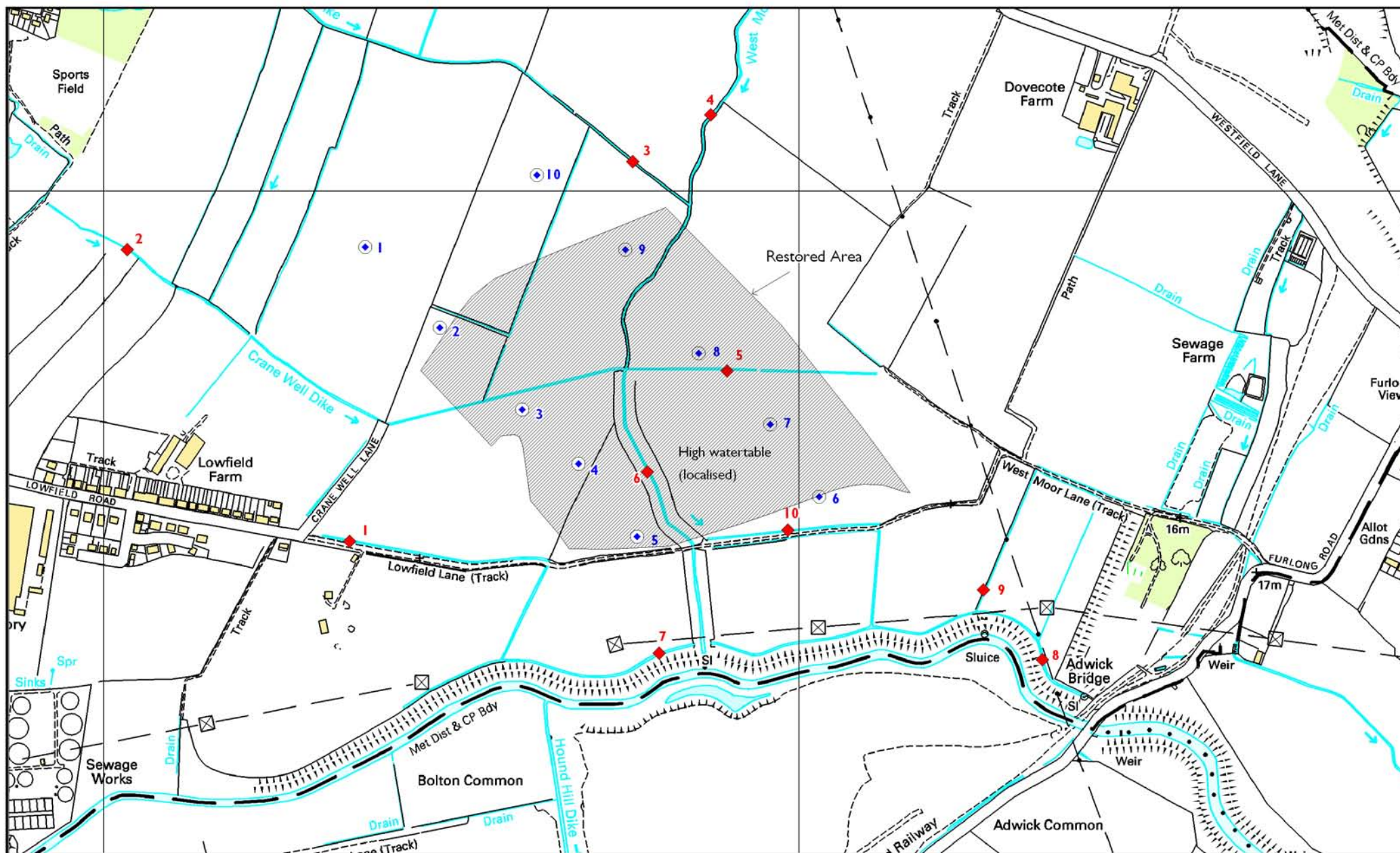


Figure 12. Soil and water test sampling points

Key: ♦ Water quality test sampling points ■ Restored area
 ● Soil contamination test sampling points

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