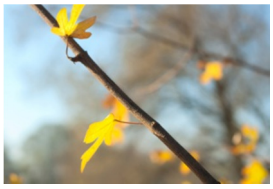
H FRASER CONSULTING
CONTAMINATED LAND AND HYDROGEOLOGY

Whitemoss Landfill Response to Environmental Permit Application

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1. INTRODUCTION

Action to Reduce and Recycle our Waste (ARROW) has instructed H Fraser Consulting Ltd (HFCL) to prepare a response to the Environmental permit application made by Whitemoss Landfill Ltd to extend landfilling operations at Whitemoss Landfill.

Whitemoss Landfill have an existing permit for their current activities and have applied for a variation of that permit to include an extension of the landfill area.

1.1 Objective

The objective of this report is to provide a hydrogeological review of the Environmental Permit Application and supporting documentation, and to provide an opinion as to whether the proposed operations present an unacceptable risk to the environment, and whether it is appropriate to grant an Environmental Permit.

1.2 Scope of works

The following works have been undertaken:

- Review of Environmental Permit and associated documentation
- Assessment and Reporting

2 BACKGROUND

Waste management activities have been ongoing at Whitemoss Landfill since the 1970s, with co-disposal of biodegradable and inert waste; landfilling of special waste has been licensed here since the 1990s, and a hazardous landfill permit was granted in 2004. The site has permission to operate until 2018, with restoration until 2019.

2.1 Development Consent Order

Whitemoss Landfill Company Ltd (WLL) (formerly J. Routledge & Sons) has applied for a Development Consent Order (DCO) to extend landfill operations to include the following:

- The construction of new landfill void for the disposal of the same range of hazardous wastes as at the current landfill site at an input rate of up to 150,000 tonnes per annum (tpa) supported by the existing site infrastructure.
- The continuation of filling with hazardous waste at the current landfill.
- As part of the creation of the western landfill void, the extraction and stockpiling of clay, mudstones, coal, and general fill materials.
- Continuation of operations at an interceptor waste treatment facility until 2035, including a hazardous waste input of 20,000 tpa.
- The restoration of the site to a mixture of species rich grassland/meadow, scrub pockets and broadleaf woodland with peripheral marshland/moss habitats including ponds, scrapes and ditches using soils available at the site.
- Completion of landfilling operations by the end of 2035 and completion of restoration by the end of 2036.
- The retention of the environmental management infrastructure including the leachate treatment plant and the gas flare until necessary.

The Development Consent Order hearings are now complete, and the Planning Inspectorate (PINS) is in the process of determining the application.

2.2 Hydrogeological Study

In June 2014, ARROW commissioned HFCL to undertake a study of the hydrogeology at Whitemoss Landfill, Skelmersdale, Lancashire (HFCL, 2014). This study was submitted to the DCO hearing, and is presented here as Appendix A. The report presented the technical background, including the hydrogeological conceptual model for the site, along with a description of current and proposed operations. The report then undertook a technical assessment of key features of the proposals, including: baseline characterisation; dewatering the shallow aquifer system; dewatering the Coal Measures; water features survey; review of HRA and predictions for groundwater quality; post operational impacts; requisite monitoring and surveillance; and basal heave. The report concluded that:

> *'the proposals present a significant risk to the water environment, and that key aspects of the Environmental Statement concerning baseline characterisation, contaminant transport modelling and proposals for monitoring and surveillance are not adequate to ensure that these risks can be controlled or mitigated. In addition, proposals for treatment and management of groundwater discharge may be entirely inadequate, creating a potential for flooding and pollution, and it is not certain that hydraulic containment can be achieved in this complex hydrogeological setting. It is recommended that the planning application be refused.'*

This current report (30047R2) draws on information presented in the Hydrogeological Study (HFCL, 2014), and the reader is referred to that document (Appendix A) for a full

understanding of the technical issues discussed in this report. It is recommended that Appendix A is read prior to reading this report.

2.3 Permitted wastes

The operations at Whitemoss Landfill are subject to an Environmental Permit (ref DP3639LM), attached as Appendix B. It is noted that a wide range of waste types is currently permitted to be disposed of at Whitemoss Landfill, including wastes of highly variable density and chemical composition.

The European Waste Catalogue comprises 20 categories of waste, and the Whitemoss Permit includes wastes from each of these 20 categories. Many of the permitted waste entries include a description such as ' organic solvents containing dangerous substances, or sludge containing dangerous substances, therefore covering a very wide range of potential chemical pollutants. Chemicals and substances that are specifically named in the permit include cyanide, mercury, heavy metals, arsenic, transition metals, asbestos, barium sulphate, dangerous silicones, nickel-cadmium (batteries) lead, tar and tar products, PCBs, pesticides, organic solvents, inorganic plant protection products, wood preserving agents and other biocides, halogenated filter cakes, organic solvents, isocyanates, calcium arsenate, phosphoric acid, and wood preservatives.

The permitted waste types are highly variable in terms of physical composition, including sludges, soils, glass, dusts, slag, ash, filter cakes, dross and skimmings, activated carbon, cables, batteries, oil filters, brake pads, packaging, waxes and fats, adhesives and sealants, sawdust, shavings, wood, particle board and veneer, electrical and electronic equipment, fluorescent tubes, plastic, metal, insulation materials, gypsum, grease and oil, paint inks, adhesives and resins, absorbents, filter materials, wiping cloths and protective clothing.

2.4 Environmental Permit Application and additional information

The Environmental Permit Application is dated May 2014. The Environment Agency found that the application was not duly made, and requested additional information. MJCA's document

> '*Schedule 1 to the email to T Hemsley of the Environment Agency dated 17 July 2014 Response to the letter reference EPR/DP3639LM/V005/ TH1 dated 27 June 2014',*

referred to throughout this report as 'MJCA's Additional Information', responds to the request for the additional information requested by the Environment Agency.

3 ASSESSMENT

This assessment examines each of the documents submitted with the Environmental Permit application in turn, including changes and amendments made by MJCA's Additional Information.

3.1 Permit application forms

In Section C2 3a, the applicant is asked whether they or any other relevant person has been convicted of any relevant offence. The application documents note that J Routledge and Sons Ltd, the former operators of the landfill, were prosecuted for odour related offences in 2006, yet it is not stated whether there was a conviction as a result of that prosecution. The Environmental Permit was transferred to Whitemoss Landfill Ltd in 2008; the current managing director and Competent Person at Whitemoss Landfill is Rob Routledge who was also a director of J Routledge and Sons Ltd.

3.2 Management system (Appendix C of the EPA)

The information provided with the Environmental Permit Application is insufficient to judge the effectiveness of the management systems at the site.

The current proposals implicitly rely on waste having a minimum density, in order to control basal heave, and also rely on the waste being of a nature that will not generate landfill gas, as no landfill gas control measures are proposed for the Western Extension. These crucial factors are not explicitly stated in the application. Waste Acceptance protocols are therefore critical to the environmental performance and safety of the site, and cannot be evaluated on the basis of the information provided.

3.3 Competence

Section 3a of The Environment Agency's guidance form EPC: 'Application for an environmental permit – Part C2 general – varying a bespoke permit' under the heading 'relevant offences' states that

> *'If you are applying to add a waste operation or installation you should provide a post-conviction plan. This is your opportunity to explain what steps you have taken to ensure you will not offend again. We will consider the severity of the offences along with your post-conviction plan before deciding whether to proceed with your application or refuse it.'*

It is understood that the 2006 prosecution was undertaken after enforcement notices were served and insufficient action taken to remedy the issue. This points to a lack of willingness on the part of the operator to engage with the regulator to solve the problem identified. It is reasonable to have concerns regarding the applicant's ability or willingness to respond appropriately to a similar issue in the future.

3.4 Environmental Setting and Installation Design (ESID) (appendix E of the EPA)

Several issues are identified in the ESID report, as detailed below.

3.4.1 Mineral barrier

Table ESID 3 states that the mineral barrier will comprise:

> *'A minimum 1 m thickness of compacted clay with a maximum hydraulic conductivity of 1 x 10^{-9} m/s. Liner to be constructed from site derived glacial till.'*

Wardell Armstrong's report on the suitability of the indigenous clay (Wardell Armstrong, 1997) states that:

'A further criterion is that the clay achieves a permeability of less than or equal to 1 x 10^{-9} metres per second after compaction and we are satisfied that this can sensibly be achieved between the moisture range of 11% to 17%'.

There is no indication in the report that the clay is required to be suitable to meet a lower permeability criterion.

Section 3.2 of Annex 1 of the landfill directive requires that

The landfill base and sides shall consist of a mineral layer which satisfies permeability and thickness requirements with a combined effect in terms of protection of soil, groundwater and surface water at least equivalent to the one resulting from the following requirements:

- *Landfill for hazardous waste K≤ 1,0 x 10^{-9} m/s; thickness ≥ 5m*

A liner of 1m thickness and permeability of 1 x 10^{-9} m/s does not comply with the Landfill Directive. There is no indication in the available reports that the site-won clay has been tested to demonstrate that a lower permeability than 1 x 10^{-9} m/s can be achieved, nor is there any indication that there is sufficient site won material available to provide a 5 m mineral layer across the entire base of the landfill.

MJCA in their 'Additional Information' state that the modelling work undertaken in the HRA demonstrates that the proposed liner provides sufficient protection to groundwater, however the long term post closure scenario with leachate rebound has not been modelled, and the long term performance of the liner system has therefore not been assessed.

3.4.2 Landfill gas infrastructure

Section 2.4.1 of the ESID states that:

'The waste acceptance procedures will minimise the risk that waste types which have the potential to generate significant quantities of landfill gas will be accepted at the site. As described in the LFGRA, no landfill gas management infrastructure is needed or proposed for the western landfill area'

As noted in Section 2.3 of this report, the current (and proposed) List of permitted wastes (Schedule 3 of the EP) includes materials likely to generate significant quantities of landfill gas, such as sawdust, shavings, wood, particle board and veneer, wiping cloths and protective clothing. In addition, there is the potential for other waste types such as contaminated soils, oils and greases, and solvents to undergo biodegradation in the landfill environment and generate both landfill gas and more exotic trace gases. It is considered highly inappropriate to retain the scheduled list of permitted wastes under the proposals; either the list of wastes should be reduced to contain no materials or substances likely to produce gas under landfill conditions, or gas management infrastructure should be included with the proposals.

The proposals as they stand provide insufficient environmental protection with regards to landfill gas generation.

3.4.3 Basal heave

Section 2.45 of the ESID states that:

'When the level of the waste is sufficient to counter the upward pressure exerted by groundwater, confined in the Coal Measures, groundwater control will cease and groundwater will be allowed to rise to rest levels.'

The Hydrogeological Study (HFCL, 2014) examined the issue of basal heave, and concluded that there is a risk of basal heave if waste density is not sufficient, or if winter groundwater

levels (or, in the long term, rising groundwater levels) are higher than anticipated. Section 3.6 of this report discusses basal heave further.

3.4.4 Surface water management

The Hydrogeological Study (HFCL, 2014) made predictions of the volume of groundwater underdrainage required to dewater the Coal Measures, and concluded that there is a risk that the surface water management system has insufficient capacity to deal with groundwater underdrainage volumes. Section 4.1.1 of the Surface Water Management Plan (ESID Appendix B) states that

'*the groundwater pumping will only be completed during normal weather conditions and will cease during heavy or extreme storm events.'*

Because the groundwater level monitoring data are monthly, it is not known how rapidly groundwater levels in the Coal Measures respond to rainfall events at the site. Turning off groundwater control at times of high and extreme rainfall could result in rapid changes in groundwater levels which may have severe implications for the stability of the basal liners, particularly when the waste thickness is small.

If the surface water system does not have sufficient capacity to deal with groundwater drainage, there is a risk of uncontrolled discharge to controlled waters, or of inundation of the site. MJCA's Additional Information (p13) provides a response to the Environment Agency's request for justification of the groundwater inflow estimates. Their response is not robust. It is not clear that the groundwater discharge has ever been measured, rather estimates are made based on continuous pumping at an assumed pumping rate. These estimates could be significantly different than true pumping rates. MJCA's own calculations of groundwater inflow (Appendix HRA5) ranged up to 2088 m^3/d, more than four times the rate assumed in the Environmental Permit Application. Modelling of surface water and groundwater inflows and outflows to the water management system is required to demonstrate sufficient capacity in the system.

3.4.5 Permit surrender

Section 2.58 of the ESID states that

> *'Permit surrender will be acceptable when the concentration of contaminants in the leachate are such that without active management there is no significant risk to groundwater quality from the migration of leachate'*

Recovery of leachate levels into waste that is largely dry due to the presence of a cap and lining system will give rise to development of a leachate chemistry that has not been adequately assessed – see Section 3.5 for further discussion.

3.4.6 Groundwater quality data

Appendix L of the ESID presents surface water and groundwater quality monitoring data. Appendix C of this report presents the monitoring data and graphs of ammoniacal nitrogen, chloride, arsenic and sulphate concentrations at all of the groundwater monitoring points.

The data indicate that for chloride and ammoniacal nitrogen, a clear upward trend is evident in the data for some locations. The trend is clearest in BH36 and the underdrainage effluent (UDE), but may also be present in data from BH26, BH28, BH34 and BH40. These boreholes are all located around the central area of the current landfill (BH40 and BH36 on the eastern boundary and BH28 and BH26 on the western boundary). The spatial grouping of the boreholes indicates that there is a local effect causing the trend in concentrations.

The data for arsenic and sulphate do not show the same trend, indicating that the observed trend for ammoniacal nitrogen and chloride is not a result of local changes in the

background quality of the Coal Measures groundwater, for example due to changes in recharge and dilution.

To clearly illustrate the trend, Figure 3.1 shows ammoniacal nitrogen concentrations in groundwater through time, at BH36, BH29 and the underdrainage effluent (UDE). Figure 3.2 shows the same information for Chloride. It is evident that the concentration of ammoniacal nitrogen and chloride are increasing in BH36 and the UDE, compared with a steady concentration at BH29.

It is noted that BH36 recorded high gas concentrations in 2006, potentially indicative of a breach of landfill containment (EA email 26 September 2006, Appendix D).

These data have significant implications regarding the integrity of the existing containment system. The observed trends may be due to a breach in landfill liner and migration of leachate to the affected boreholes. The maximum measured concentration of ammoniacal nitrogen at BH36 is 9.1 mg/l, which compares with an EQS of 1 mg/l[1], a drinking water standard of 0.5 mg/l[2] and a current trigger level of 0.005 mg/l (n.b. the current permit sets a trigger level of 5 ug/l for ammoniacal nitrogen; Whitemoss Landfill monitoring data state the trigger level to be '5' with no units specified, however all other ammoniacal data are presented in mg/l The minimum reporting level (MRL) for ammoniacal nitrogen is 0.05 mg/l. There is therefore a discrepancy between the trigger level as permitted, the MRL and the trigger level used in environmental monitoring and reporting).

The data also raise serious questions regarding the assessment of the environmental performance of the facility to date, as these trends should have been apparent in 2012, and could certainly have been identified by 2013.

The relevance to the Permit Application is that significant doubts are raised as to the effectiveness of the hydraulic containment methods proposed for this setting, and the ability of the operator to detect any adverse impacts of the facility on the environment.

It is noted that the current permit allows underdrainage effluent to be discharged to a watercourse (W1) at a rate of 235 m^3/d with a limit of 2.5 mg/l of ammoniacal nitrogen. The last three consecutive measurements of ammoniacal nitrogen in the UDE were 3 mg/l, in excess of the discharge limit. It is understood that UDE is used for dust suppression, which is considered likely to pollute the Shirdley Hill aquifer.

MJCA report the UDE pumping rate as 450 m^3/d. The volume limit on discharge to surface water is 235 m^3/d. There is therefore a daily surplus of UDE of 215 m^3/d. It is noted that excess UDE might be put through the leachate treatment plant and disposed to sewer, but the limit on discharge (of leachate) to sewer is 50 m^3/d. There is therefore at least 165 m^3/d of UDE that cannot be discharged to surface water or sewer under the current permit conditions. It is suggested that the use of this water for dust suppression may in fact constitute a waste disposal activity.

The quality of the UDE raises concerns about future plans to discharge UDE to surface water; if discharge limits are exceeded, treatment or an alternative disposal route will be required, neither of which are included for in the current proposals.

[1] Surface Waters (Fishlife) (Classification) Regulations 1997
[2] Water Supply (Water Quality) Regulations 2000

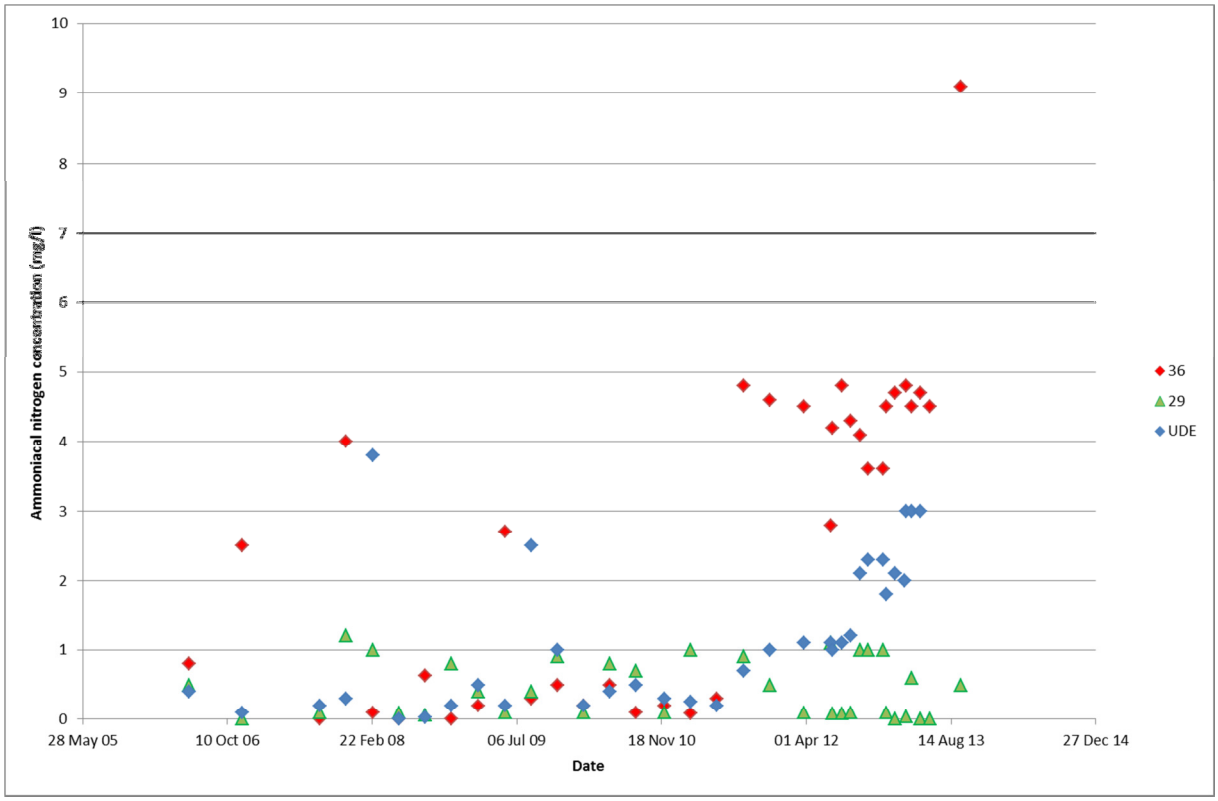

Figure 3.1 Concentrations of ammoniacal nitrogen in groundwater

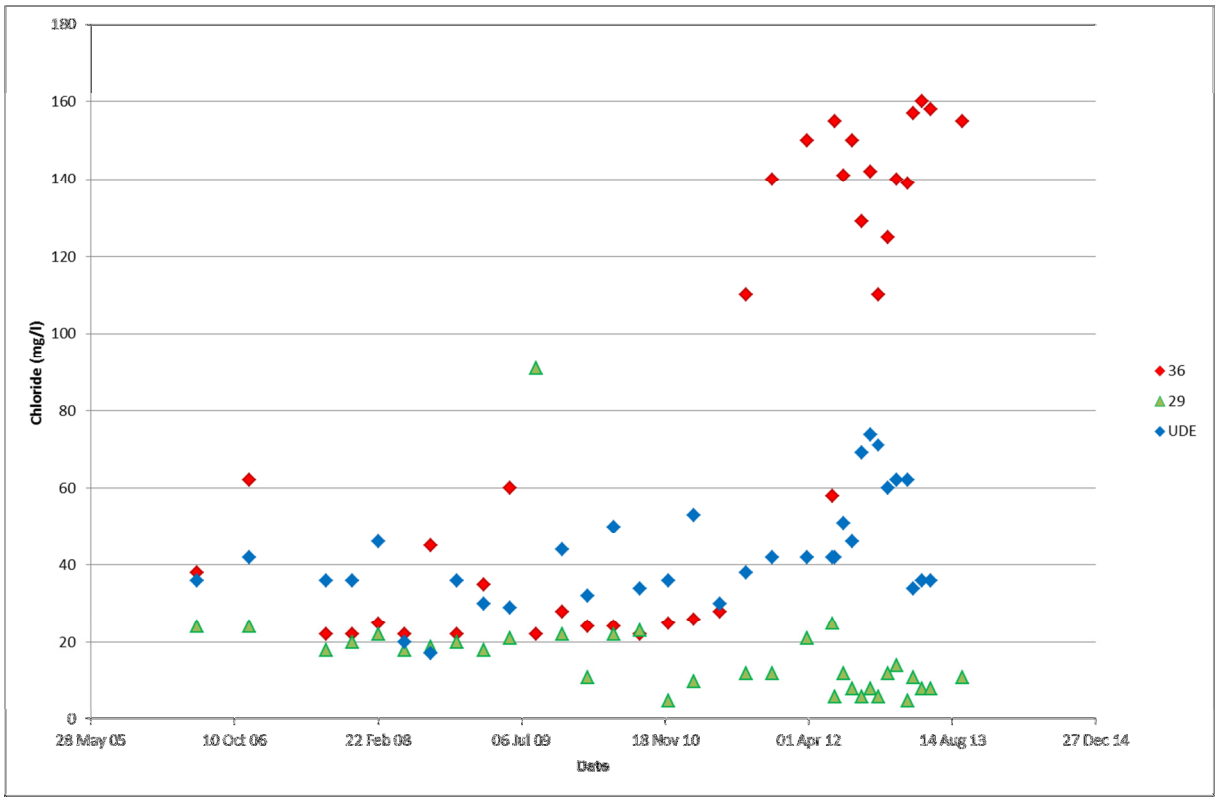

Figure 3.2 Concentrations of chloride in groundwater

3.5 Hydrogeological Risk Assessment (HRA) (appendix F of the EPA)

The Hydrogeological Study (HFCL, 2014) raised a number of issues with the HRA, which are summarised below (the reader is referred to Appendix A for a fuller discussion):

- Late post operational risks arising from leachate rebound have not been assessed
- The suite of chemicals included in the risk assessment was highly restricted. This has been addressed through additional modelling reported in the HRA addendum.
- The suite of chemicals proposed for monitoring was highly restricted. This has been partly improved with the addendum report, however given the wide range of wastes permitted, it is considered appropriate to include an annual monitoring event to include for a wide range of VOCs, SVOCs, pesticides, and herbicides. Any parameters detected should be included in ongoing monitoring for a year or until they are not detected in three consecutive monitoring events, whichever is greater. There remains concern that a very limited number hydrocarbons associated with fuel are routinely monitored, particularly as an interceptor waste treatment facility operates on site and the solid waste output from the process is landfilled at the site.
- Proposals for monitoring of surface waters include derivation of control levels and compliance targets based on future water quality, which is not considered protective of controlled waters as future water quality may be heavily influenced by groundwater discharge quality.
- Monitoring proposals do not include for monitoring of the volume of discharge from the groundwater drainage system.

The Hydrogeological Study also highlighted a problem with the derivation of Environmental Assessment Levels based on groundwater quality data. As discussed in Section 3.4.6 of this report, groundwater quality appears to have been impacted by landfill operations. For example, the average of concentrations of ammoniacal nitrogen measured in groundwater in 2006 was 0.85 mg/l; compared with 5.47 mg/l in 2013. Derivation of EALs based on the full data set may overestimate background concentrations in the Coal Measures aquifer.

Table HRA13 (second revision) proposes that no borehole will have compliance limits or control levels applied during the period of groundwater control. Given the lack of certainty in the conceptual model and the likely changes to the groundwater regime with pumping from new landfill cells, and the treatment of the mine shafts, this is considered wholly inappropriate.

3.6 Stability Risk Assessment (SRA) (appendix G of the EPA)

Basal Heave was quantitatively assessed in Wardell Armstrong's 2003 Stability Risk Assessment report, appended to MJCA's 2014 SRA report.

The quantitative assessment assumed a waste density of 1500 kg/m^3, and concluded that basal heave was not likely to be an issue. Calculations presented in the Hydrogeological Study (HFCL, 2014) demonstrate that at lower waste densities and higher groundwater elevations, there could be a significant risk of basal heave and rupture of the landfill liner. There are insufficient operational controls in the proposal to guarantee sufficient waste density, for example, it is not proposed to monitor waste density or to prohibit placement of insufficiently dense waste. The List of Permitted Wastes in Schedule 3 of the Environmental Permit allows for wastes that would not be sufficiently dense to control basal heave.

As discussed in Section 3.4.3 , if groundwater control is interrupted at times of high rainfall, rising groundwater levels could cause basal heave particularly when waste thickness is small.

3.7 Nuisance Risk Assessment (NRA) (appendix I of EPA)

The nuisance risk assessment does not consider risks arising from subsidence, due to dewatering of the superficial peat deposits (see Section 5.3 of the Hydrogeological Study (HFCL, 2014). Whitemoss Road South is clearly affected by subsidence.

3.8 Development Consent Order (DCO) and Environmental Statement (ES)

The reader is referred to the Hydrogeological Study (HFCL, 2014) for a full discussion of technical issues identified in the DCO and ES. A summary of issues not yet discussed in this report is provided below:

- The impact of dewatering both the peat and the Coal Measures aquifer have not been quantified; receptors to the South of the site are not adequately considered. A geological section which demonstrates the plausible link between groundwater at the site and a groundwater discharge zone to the south was submitted to the DCO hearing, and is presented in Appendix E.
- It is proposed to commence the landfill extension prior to treating the mine shafts at the site, with a 25 m buffer zone to be left around the mine shafts. The risks associated with this approach are considered unacceptably high due to the fractured nature of the Coal Measures, which is likely to be exacerbated near the mine shafts. A driving head of c .14 m will exist between the mine shaft and the base of the landfill excavation and if there is good fracture connectivity in the rock, this will result in an unplanned and potentially significant inflow to the landfill excavation.
- Issues concerning basal heave and groundwater control in the Coal Measures are affected by the depth of the landfill, yet there will be a requirement to win Coal where it is discovered. Cell 3 of the current operation went deeper than planned due to this requirement (pers. comm. R Routledge). It is not clear, therefore, whether the operator will have control over the final depth of the landfill.

3.9 Financial Provision

Financial provision is via a trust fund (Section 3c, application form) Section 3c asks the applicant to 'provide a plan of your estimated expenditure on each phase of the landfill or mining waste facility'. The applicant refers the reader to Appendix L, which fails to supply this information. Without an assessment of the long-term risks to the environment during leachate rebound, it is not possible to know whether the long term financial provision for the landfill is sufficient.

3.10 Closure Plan

The information provided regarding the closure plan is insufficient to judge the adequacy of the long term plans for the site. Outline proposals for long term aftercare and monitoring should be included to demonstrate that there is a robust basis for the financial provisions made.

4 CONCLUSIONS

The following conclusions are drawn with regard to the Environmental Permit Application:

1. Groundwater quality data show strong evidence that the hydraulic containment system at the current landfill may have been breached, raising questions about the effectiveness of the hydraulic containment methods proposed for this setting, and the ability of the operator to detect any adverse impacts of the facility on the environment.
2. The quality of the groundwater drainage effluent exceeds discharge limits for ammoniacal nitrogen, raising significant concerns regarding current and future management of this effluent.
3. Environmental assessment levels are calculated on the basis of background groundwater quality, without taking into consideration the impact that the existing facility has had on groundwater quality.
4. The hydrogeological setting presents a risk of basal heave, which may cause liner rupture and breach of the hydraulic containment system. There's an implicit assumption in the proposals that waste density will be 1500 m^3/d, but there are no operational controls to guarantee that waste will be sufficiently dense. The list of permitted wastes includes materials that would not be sufficiently dense to prevent basal heave.
5. The list of permitted wastes includes materials that will degrade to create landfill gas. Waste acceptance procedures have not been provided to demonstrate that there will be operational controls to prevent degradable materials being landfilled. The current proposals provide insufficient environmental protection with respect to generation of landfill gas.
6. Given the wide range of permitted wastes, leachate and groundwater monitoring should include an annual assessment for a wide range of hazardous and non-hazardous pollutants in both leachate and groundwater. The current monitoring proposals are not sufficiently protective of controlled waters.
7. Proposals to derive surface water control levels based on future water quality are not protective of controlled waters, as this future water quality is likely to be heavily influenced by discharge of groundwater drainage effluent.
8. The impacts of dewatering the Peat and the potential for subsidence have not been considered.
9. The assumptions concerning future groundwater discharge volumes are not sufficiently robust, raising significant doubts regarding the capacity of the facility to manage surface water and groundwater discharge at times of high rainfall, and resulting in a risk of uncontrolled releases to controlled waters or inundation of the site.
10. The use of groundwater discharge for dust suppression is not considered protective of groundwater quality in the Shirdley Hill aquifer and Peat. The current practice of using groundwater drainage effluent for dust suppression may in fact constitute a waste disposal activity. The volume of groundwater pumped from the underdrainage system should be monitored, in addition to the volume discharged to controlled waters.
11. The risks associated with groundwater inflow from the mineshafts are not considered to have been adequately addressed. The shafts should be treated prior to the landfill extension proceeding.
12. The assumption that leachate will rebound and leachate quality will not deteriorate as the waste mass becomes saturated is wholly unsupported and not protective of the

environment. Without assessment of the long term performance of the landfill, assumptions regarding financial provision are also unsupported.

13. The proposals for a 1 m thick liner are not consistent with the requirements of the Landfill Directive; the lack of assessment of the long term performance of the liner means that there has not been a sufficiently robust demonstration that the proposals are protective of groundwater.

14. Post closure monitoring and management proposals are insufficient

15. The 2006 prosecution raises concerns regarding the suitability of the operator to identify and mitigate environmental impacts in timely and environmentally responsible manner.

It is concluded that there is a significant risk of impacts to controlled waters arising from the current proposals, and the information provided by the applicant does not demonstrate that proposed control measures are appropriate for mitigating the risks and their potential impacts, nor does it provide a reasonable basis to determine the permit conditions. Under these circumstances, and in accordance with Environmental permitting guidance (Defra, 2013) it is not considered appropriate to vary the Environmental Permit as requested by the application.

5 REFERENCES

Defra (2013) Environmental Permitting Guidance Core guidance For the Environmental Permitting (England and Wales) Regulations 2010. Last revised: March 2013.

Wardell Armstrong, 1997. Report on the suitability of the indigenous clay source for the use in lining works at Whitemoss Road South Landfill Site, Skelmersdale including procedures for compaction and post-placement quality control testing.

APPENDIX A

Site plans and elevations