

11 Hydrogeology and Ground Conditions

11.1 Introduction

11.1.1 This chapter summarises the assessment of hydrogeology and ground conditions associated with the proposed Recycling, Recovery and Renewable Energy (3Rs) Facility at Langhurstwood Road, Horsham, West Sussex.

Scope of Study

11.1.2 This chapter of the ES assesses the effects that may arise due to the current ground conditions, geology, hydrogeology and land contamination and as a result of the construction and operation of the 3Rs Facility. The chapter describes the assessment methodology; the baseline conditions currently existing at the site and surroundings; and the likely significant environmental effects, taking into account the mitigation measures adopted to prevent, reduce or offset any significant adverse effects.

11.2 Legislation and Policy Context

11.2.1 This section summarises relevant legislation and policies that are directly relevant to hydrogeology and ground conditions.

Legislation

11.2.2 In general terms the legislation advocates the use of a risk assessment approach to assessing contamination and remedial requirements. Relevant legislation includes:

- Part 2A of the Environmental Protection Act (1990);
- The Environment Act (1995);
- The Water Resources Act 1991 (as amended);
- Contaminated Land (England) Regulations (2006);
- The Groundwater (England and Wales) Regulations 2009;
- The Environmental Damage (Prevention and Remediation) Regulations (2015);
- Environmental Permitting (England and Wales) Regulations (2016, as amended); and
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

11.2.3 The Building Act 1984 and the Building Regulations are the two key legislative drivers when considering structural and design aspects of a development in terms of geotechnical properties of the ground and the presence of ground gas.

National Policy and Guidance

National Planning Policy Framework (2012)

11.2.4 The National Planning Policy Framework (NPPF) (DCLG, 2012) sets out the Government's planning policies for England and how these are expected to be applied. With respect to pollution and contamination, paragraph 109 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by:

- *'preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and*
- *remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.'*

11.2.5 Paragraph 111 states that planning policies and decisions should encourage the effective use of land by re-using land that has been previously developed (brownfield land), provided that it is not of high environmental value.

11.2.6 Paragraph 120 states that:

'To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.'

11.2.7 Paragraph 121 states that:

'Planning policies and decisions should also ensure that:

- *the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;*
- *after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and*
- *adequate site investigation information, prepared by a competent person, is presented.'*

National Planning Practice Guidance

11.2.8 The contaminated land regime under Part 2A of the Environmental Protection Act 1990 provides a risk-based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or the environment.

11.2.9 National Planning Practice Guidance has been produced to accompany the NPPF (DCLG, 2014) and includes guidance on how land affected by contamination is dealt with through the planning regime.

Development Plan Policy

West Sussex Waste Local Plan (2014)

11.2.10 The West Sussex Waste Local Plan (West Sussex County Council and South Downs National Park Authority, 2014) reinforces the County's aspiration to become a zero waste to landfill authority and provides guidance on land use planning policy for waste. It provides the basis for making consistent land use planning decisions about planning applications for waste management facilities, making the document important in consideration for the proposed facility.

11.2.11 The Plan includes an assessment of the former brickworks site (referred to as Brookhurst Wood within the document) as a potential waste processing site. Policy W10 outlines a series of conditions that are required

to be fulfilled to allow development. The following condition is considered to be relevant to the consideration of hydrogeology and ground conditions:

- Assessment of impacts on the water environment and possible mitigation required.

11.2.12 The West Sussex Waste Local Plan identifies a number of policies that are relevant to the consideration of hydrogeology and ground conditions.

11.2.13 Policy W16: Air, Soil and Water states that:

"Proposals for waste development will be permitted provided that:

(a) there are no unacceptable impacts on the intrinsic quality of, and where appropriate the quantity of, air, soil, and water resources (including ground, surface, transitional, and coastal waters);

(b) there are no unacceptable impacts on the management and protection of such resources, including any adverse impacts on Air Quality Management Areas and Source Protection Zones;

(c) the quality of rivers and other watercourses is protected and, where possible, enhanced (including within built-up areas); and

(d) they are not located in areas subject to land instability, unless problems can be satisfactorily resolved."

Horsham District Planning Framework (2015)

11.2.14 The Horsham District Planning Framework (Horsham District Council, 2015) is described as the overarching planning document for Horsham district, which has been produced to be used alongside national guidance such as the NPPF. The framework sets out the development visions of Horsham Council until 2031, however the vast majority of the document relates to residential or town centre redevelopment and prosperity without a specific development environmental focus.

11.2.15 Policy 24 (Environmental Protection) of the Horsham District Planning Framework is relevant to consideration of hydrogeology and ground conditions and states that:

"The high quality of the district's environment will be protected through the planning process and the provision of local guidance documents. Taking into account any relevant Planning Guidance Documents, developments will be expected to minimise exposure to and the emission of pollutants including noise, odour, air and light pollution and ensure that they:

1. Address land contamination by promoting the appropriate re-use of sites and requiring the delivery of appropriate remediation;

2. Are appropriate to their location, taking account of ground conditions and land instability;

3. Maintain or improve the environmental quality of any watercourses, groundwater and drinking water supplies, and prevents contaminated run-off to surface water sewers;

4. Minimise the air pollution and greenhouse gas emissions in order to protect human health and the environment;

5. Contribute to the implementation of local Air Quality Action Plans and do not conflict with its objectives;

6. Maintain or reduce the number of people exposed to poor air quality including odour. Consideration should be given to development that will result in new public exposure, particularly where vulnerable people (e.g. the elderly, care homes or schools) would be exposed to the areas of poor air quality; and

7. Ensure that the cumulative impact of all relevant committed developments is appropriately assessed."

11.3 Assessment Methodology

11.3.1 Determination of the baseline conditions at the site has been established through a review of the available assessments previously undertaken for the site, presented in the form of a Ground Conditions Desk Study (Appendix 11.1). The assessments considered within the desk study were:

- Risk Management Ltd (2015) Site Investigation, undertaken in February 2015, an intrusive investigation at the site comprising boreholes, trial pits and the production of a human health risk assessment using a commercial end use scenario;
- SLR Consulting (2014) Desk Study, undertaken in September 2014, which included a site reconnaissance visit and the production of a Preliminary Land Quality Risk Assessment (PLORA) on completion;
- SLR (undated) Environmental Statement Technical Chapter 13: Land Quality. The environmental statement also included a reconnaissance visit and the production of a Preliminary Land Quality Risk Assessment (PLORA) upon completion;
- Scott Wilson Ltd (2009) Desk Study, undertaken in December 2009, included a site reconnaissance visit and the production of a Conceptual Site Model and Preliminary Risk Assessment for the proposed development of an industrial building within the site boundary; and
- Capita Symonds (2005), Ground Investigation, which included the advancement of an unconfirmed volume of investigative positions (boreholes and trial pits) and the collection of 18 soil samples.

11.3.2 Further details of these assessments and reports are summarised within the desk study (Appendix 11.1).

11.3.3 In addition to a review of the above documents, the desk study was based on the following:

- A review of historic maps and GroundSure data for the site;
- A review of geology, hydrogeology and groundwater vulnerability maps and designated groundwater source protection zones (SPZs);
- A review of statutory designations such as Sites of Special Scientific Interest (SSSI);
- A site walkover to identify potentially contaminating land uses, and any evidence of contamination;
- A review of Environment Agency records relating to the permitted activities at the site; and
- The development of a Conceptual Site Model (CSM) and Preliminary Risk Assessment (PRA).

11.3.4 The study area in a number of the historical reports varies from that currently under consideration within this ES. For clarity, the current site boundary is detailed on Figure 1.2 of this ES.

Relevant Guidance

11.3.5 The assessment methodology has been informed by guidance contained within the following documents:

- BS10175:2011 + A1:2013 Code of Practice for Investigation of Potentially Contaminated Sites (BSI, 2013);
- BS1377:1990 Methods of Test for Soils for Civil Engineering Purposes (BSI, 1990);
- BS5930:2015 Code of Practice for Site Investigations (BSI, 2015);

- Model Procedures for the Management of Contaminated Land, Contaminated Land Report 11, Environment Agency (Environment Agency and Defra, 2004);
- The Generic Assessment Criteria for Human Health Risk Assessment (LOM/CIEH, 2015);
- Assessing Risks Posed by Hazardous Ground Gases to Buildings, CIRIA Report C665 (CIRIA, 2007);
- Contaminated Land Exposure Assessment (CLEA) guidance; and
- Surface Water Environmental Quality Standards (EQS) and UK Drinking Water Standards.

Consultation

- 11.3.6 In carrying out the hydrogeological and ground conditions assessment consultation has included:
- Request for a scoping opinion; and
 - Informal scoping comprising initial consultation with the Adam Dracott, the Principal Environmental Health Officer at Horsham District Council in June 2016.
- 11.3.7 Through this consultation, the desk based approach to establishing the baseline conditions at the site was agreed. The issues raised through the consultation outlined above that are relevant to hydrogeology and ground conditions are summarised in Table 11.1 below.
- 11.3.8 A full copy of the Scoping Opinion is contained in Appendix 4.2 and details of the informal scoping relevant to this chapter are contained in Appendix 11.2.

Table 11.1: Consultation Responses Relevant to Hydrogeology and Ground Conditions

Date/Source	Consultee and Issues Raised	How/ Where Addressed
October 2015/ Scoping Opinion	Horsham District Council – No issues raised by consultee. Approach formally agreed.	Assessment undertaken in accordance with agreed approach

Assessment Criteria and Assignment of Significance

- 11.3.9 Following establishing the baseline conditions, the likely significant effects of the facility due to hydrogeology and ground conditions were considered based on:
- Evaluation of the potential impacts of the facility and the effect these could have on the baseline conditions;
 - Evaluation of the significance of these effects through consideration of the sensitivity of receptors, and determination of the magnitude of the impacts (adverse and beneficial);
 - Identification of measures to mitigate against any potential adverse impacts resulting from the facility; and
 - Identification of significance of the effects, taking into account the mitigation measures that form part of the project.
- 11.3.10 The sensitivity or value (High, Medium or Low) of existing features and attributes (known as receptors) has been described using the criteria and examples with respect to land contamination as outlined in Table 11.2.

Table 11.2: Criteria for Determining the Importance or Sensitivity of Receptors

Sensitivity	Criteria	Example of Attribute
High (England/UK/International)	Highly sensitive receptor or attribute of significant value	Principal Aquifer within source protection zone for potable use. High value surface water course. Residential properties.
Medium (County/Regional)	Moderately sensitive receptor or attribute of moderate value	Secondary Aquifer with resource value or contribution to surface water flow. Water course with low value. Landscape use and construction workers
Low (Local/District)	Low sensitivity receptor or attribute of low value	Unproductive Strata Industrial use.

11.3.11 The magnitude (High, Medium or Low) of the predicted impact has been described using the criteria and examples with respect to land contamination in Table 11.3.

Table 11.3: Definitions of Magnitude

Magnitude	Criteria	Example
High	Results in loss of attribute and likely to cause exceedances of statutory objectives and/or breaches of legislation	Contamination of a potable source of water abstraction, or gross and widespread contamination of the site requiring significant remediation.
Medium	Results in effect on integrity of attribute or loss of part of attribute, possibly with or without exceedances of statutory objectives or with or without breaches of legislation	Reduction in land value due to contamination. Contaminant pollutant linkages in specific areas identified requiring remediation
Low	Results in minor effect	Slight impact upon a water feature not resulting in a breach of a water quality standard

11.3.12 The identification of significant effects has taken into account the sensitivity of the receptor and the predicted magnitude of impact, as shown in Table 11.4, and uses the terms beneficial (for an advantageous or positive effect on an environmental resource and receptor) or adverse (for a detrimental or negative effect on an environmental resource or receptor).

Table 11.4: Assessment Matrix

Sensitivity / Value of Receptor	Magnitude of Impact		
	High	Medium	Low
High	Major	Major/ Moderate	Moderate
Medium	Major/ Moderate	Moderate	Moderate/ Minor
Low	Moderate	Moderate/ Minor	Minor

11.3.13 For the purposes of this assessment, effects of moderate or greater significance are considered to be significant in terms of the EIA Regulations.

11.4 Limitations of the Assessment

- 11.4.1 The assessment is based on the available reports. Whilst only partial information is available in relation to some of the previous assessments, it is considered that the previous investigations, together with the desk study research undertaken for this assessment, ensures that the available information is sufficiently robust to support the assessment.

11.5 Baseline Conditions

- 11.5.4 The baseline conditions at the site have been assessed using information collated in the desk study provided at Appendix 11.1. The main findings of the desk study are summarised below:

- An area of Made Ground (worked ground (undivided)) is shown in the north east corner of the site.
- Superficial Drift Geology - Superficial deposits are not recorded beneath the site. Although an area of Alluvium is shown to the west and Arun Terrace Deposits are shown to the south.
- Solid Geology - The solid geology beneath the whole site is recorded as the Weald Clay Formation. Beneath the Weald Clay is the Tunbridge Wells Sand.
- The Weald Clay beneath the site is classified as an unproductive stratum (proven to a depth of 5 m), with the underlying Tunbridge Wells formation classified as a Secondary A Aquifer. Groundwater is estimated to be at a depth of approximately 10 m below ground level (m bgl).
- Radon Gas - The site is classified as being in a Radon Affected Area, as between 1 and 3% of properties are above the Action Level, but no radon protective measures are considered necessary.
- Mining, and Ground Stability Hazards - The whole of the site is indicated as Historic Surface Ground Workings associated with the brickworks between 1914 and 1956. Abstraction within the site is not recorded on the available records or indicated by the available ground investigation reports.
- No historical underground workings are recorded on or close to the site. Non-coal mining related activities (Iron Ore) are indicated as being highly unlikely on site.
- The GroundSure report states that there are low to negligible ground stability hazards from shrinking / swelling clay, landslides, soluble rocks, collapsible rocks and running sands. There is moderate potential for compressible ground.
- Hydrology, Surface Water and River Network - Two small ponds associated with the former brickworks are located immediately off-site to the north. An additional pond is located to the east of the site, directly south of the Biffa-operated MBT plant. The nearest river is indicated as a tertiary river to the west of the site. Boldings Brook is also located to the west of the site.
- Surface Water Abstractions - There is one surface water abstraction within 1 km of the site. This is located 39 m south for general use relating to secondary category (medium loss).
- As a result of previous activities at the site there is considered to be potential for the presence of contamination, although the previous investigation works suggest that any contamination is likely to be localised.
- The preliminary conceptual site model developed within the desk study to inform the preliminary risk assessment assessed the potential risks posed from the identified potential contamination sources to controlled waters, human health and the risk from ground gas. The conceptual site model concluded that there was a low or negligible risk to human health and controlled waters from soil contamination and ground gases.

Future Baseline Conditions

- 11.5.5 It is not anticipated that the baseline conditions identified would be likely to change significantly during the lifetime of the project. It is not considered likely that future climate change would affect the hydrogeology or ground conditions at the site.

11.6 Incorporated Enhancement and Mitigation

- 11.6.1 As set out in Chapter 2 of this ES, construction would be undertaken in accordance with a Construction Environmental Management Plan (CEMP). This would include the following measures in relation to ground conditions and hydrogeology.

Exposure of Construction Workers

Chemical Contamination of Soil and Groundwater

- Appropriate use of standard Personal Protective Equipment (PPE);
- Appropriate segregation of 'dirty' and 'clean' working areas and the establishment of appropriate washing facilities for construction workers;
- Appropriate briefing of site staff; and
- Implementation of personal hygiene protocols.

Ground Gases

- Recognition of confined space, and use of safe entry procedures;
- Appropriate use of standard PPE; and
- Appropriate training and briefing of site staff.

Asbestos

- Asbestos strip from buildings prior to site clearance and demolition;
- Airborne asbestos monitoring and personal asbestos monitoring;
- Appropriate use of PPE, to include but not restricted to masks (P3 rated), coveralls, boot covers and gloves;
- Appropriate segregation of the asbestos affected area (considered a 'dirty' area) from the remainder of the site and the implementation of appropriate decontamination measures;
- Appropriate training and briefing of site staff; and
- Implementation of personal hygiene protocols.

- 11.6.2 Additionally, airborne particles would be controlled through dust suppression measures such as damping. Removal of asbestos or asbestos contaminated materials would be undertaken by suitably experienced specialist contractors.

Mobilisation of Existing Contamination

Contaminated Dusts and Airborne Asbestos

- Damping down of exposed formations and stockpiles during dry conditions;
- Covering of contaminated stockpiles arising during remediation;

- Appropriate location of stockpile away from sensitive receptors;
- Restriction of works which are likely to generate dusts during windy conditions;
- Wheel washing of vehicles leaving site; and
- Creation of temporary haul roads away from sensitive receptors.

Contaminated Soils and Groundwaters

- Controlled excavation of known localised contaminated soils prior to bulk excavation works;
- The control of waters entering any excavation;
- The periodic inspection of excavations to identify significant water build up and the implementation of measures to prevent water flow from excavations;
- Periodic inspection of excavations to identify residual contamination if required, and allow its removal prior to deepening of excavations;
- Stockpiling of contaminated materials away from water courses/drains; and
- Covering of stockpiles to prevent leaching of contaminants.

11.6.3 It is considered that the potential for impact to controlled waters can be mitigated through the completion of a piling risk assessment in advance of construction. The piling risk assessment should identify the most appropriate piling method to minimise the generation of vertical contaminant migration pathways.

Creation of New Areas of Contamination

11.6.4 It is considered that the potential for accidental spillage of site process materials can be mitigated through appropriate storage and handling of materials in designated areas, with appropriate infrastructure and drainage systems in place. Any chemical and material storage on the site would be undertaken in accordance with the Environment Agency guidance in order to avoid pollution.

11.6.5 The following measures would be adopted:

- Regular servicing and inspection of vehicles used on-site;
- The restriction of refuelling of vehicles to bunded areas underlain by hard standing, or other impermeable materials; and
- Deployment of spill kits to immediately control any spills that do occur.

11.7 Assessment of Construction Effects

11.7.1 An assessment of the likely significance of effects has been undertaken based on the identified baseline conditions. The assessment considers the impact of the construction of the facility on the sensitive receptors on the site and off-site receptors.

11.7.2 Construction works have the potential to generate the following potential impacts relevant to this assessment:

- Exposure of construction workers to contamination;
- Mobilisation of any existing contaminants into ground, groundwater, surface water and off-site;
- Creation of new areas of contamination e.g. through spillage; and
- Alteration of groundwater flow regime.

Exposure of Construction Workers

Soil and Groundwater Contamination

- 11.7.3 During construction and demolition works, workers at the site may be exposed to contaminants in soils and groundwater (where present) through ingestion, dermal contact or inhalation of volatile or dust particles.
- 11.7.4 As is always the case in the development of brownfield sites there is potential for areas of previously unidentified contamination to be present. Therefore, there are potential health risks to construction workers if mitigation measures are not in place. Exposure to the identified and any previously unidentified areas of contamination that may be present will be short-term exposure rather than long-term. With the proposed mitigation measures in place, the magnitude of the impact is considered to be low and the sensitivity of the receptor medium. Therefore, with appropriate mitigation, the likely significance of effect is considered to be minor adverse, short term and local.

Ground Gases

- 11.7.5 During construction of the proposed development, workers may be exposed to ground gases that may accumulate in confined spaces and, in exceptional circumstances, lead to a risk of explosion (methane) or asphyxiation (carbon dioxide). The magnitude of the impact is considered to be low with suitable mitigation in place and the sensitivity of the receptor medium. Therefore, with mitigation, the likely significance of effect is considered to be minor adverse, short term and local.

Asbestos

- 11.7.6 During demolition works there is the potential that workers may be exposed to asbestos fibres unless mitigation and controls are put in place. Asbestos containing materials have been observed in building fabric of the existing buildings.
- 11.7.7 Where airborne fibres are generated during demolition these may be inhaled or ingested by workers unless controls are in place. The magnitude of the impact is considered to be low and the sensitivity of the receptor medium. Therefore, with mitigation, the likely significance of effect is considered to be minor adverse, short term and local.

Mobilisation of Existing Contamination

- 11.7.8 Construction activities at the site may lead to the generation of dust that could be inhaled or ingested by construction workers and people in adjacent areas, if the dust were to migrate off the site. Due to the low levels and localised nature of chemical contaminants identified during the ground investigations undertaken on the site, dust generated from ground disturbance during construction is unlikely to be contaminated. The exception to this relates to the existing structures which were recorded to contain asbestos. The magnitude of the impact with suitable mitigation in place is considered to be low and the sensitivity of the receptor high. Therefore, the likely significance of the effect is considered minor adverse, short term and local.
- 11.7.9 Construction activities can result in the mobilisation of contaminants within the soil and the creation of a pathway for contaminants to migrate to underlying groundwater. The Weald Clay underlying the site is classified as an unproductive stratum and is of a low permeability and is present to depths of greater than 5 m. This stratum is underlain by the Tunbridge Wells formation that is classified as a Secondary A Aquifer and is considered a relatively sensitive receptor. Therefore, where the construction works fully penetrate the Weald Clay this may lead to generation of a vertical pathway. It should, however, be noted that such a thickness of clay is likely to retard migration of contaminants and will be naturally annealing limiting the potential for migration. Additionally, ground investigation has identified that ground contamination at the site is limited in extent and severity. The magnitude of the impact is considered to be low and the sensitivity of the receptor medium. Therefore, the likely significance of this effect is considered minor adverse, short term and local with mitigation.

Creation of New Areas of Contamination

11.7.10 During construction works there is the potential for accidental spillage that may contaminate soils, surface waters or groundwater at the site. The Weald Clay underlying the site is classified as an unproductive stratum and the surface water features surrounding the site are unnamed small scale streams. The main source of potential spillages is considered to be from construction plant (relating to refuelling, maintenance, breakdowns etc.) and the storage of potentially hazardous construction materials on the site. The magnitude of change for the soils, surface waters, and groundwater due to accidental spillage of contaminated materials would be dependent on the nature, frequency and size of the spillage. Given the nature of the development it is considered that there is the potential for large volumes of potentially hazardous material (ready mix concrete etc.) to be stored on the site for short periods, and therefore there is the potential for a significant contamination event if appropriate measures are not in place. The magnitude of the impact is considered to be high and the sensitivity of the receptor low. Therefore, the likely significance of this effect is considered minor adverse, short term and local with mitigation.

Alteration of Groundwater Flow Regime

11.7.11 During construction at the site it is unlikely that the groundwater regime would be altered in such a way as to affect groundwater flows and surrounding surface water features. The investigation has identified that the only shallow ground water is perched water pockets in the made ground above the Weald Clay. A consistent groundwater table is estimated to be present at a depth of approximately 10 m bgl. Construction works to this depth are limited and unlikely to alter the groundwater regime beneath the site. The magnitude of the impact is considered to be low and the sensitivity of the receptor low. Therefore, the likely significance of this effect is considered minor adverse, short term and local with mitigation.

11.8 Assessment of Operational Effects

11.8.1 Potential likely during operation are outlined below:

- Exposure of worker and site visitors to any contamination;
- Impact to controlled waters from contamination; and
- Alteration of groundwater flow regime.

Exposure of Workers and Site Visitors to Contamination

11.8.2 There is a potential for end users to be exposed to contamination that may be present at the site through incidental soil ingestion, dermal contact, inhalation of volatiles and dust particles or landfill gas. The proposed development comprises a commercial development that would lead to capping of the majority of the site with hardstanding. Additionally, the structures at the site would be highly ventilated, consistent with the proposed waste management processes. This would limit exposure to any residual contamination. The current investigation information indicates that contamination at the site is localised and of limited severity. There is, however, the potential for unidentified contamination to be present. The magnitude of the impact is considered to be low and the sensitivity of the receptor medium. Therefore, the likely significance of effect is considered to be minor adverse, long term and local.

Impact to Controlled Waters from Contamination

11.8.1 Completion of the proposed development is unlikely to increase the potential for persistent pathways to be introduced that may allow contamination to effect controlled water receptors. The Weald Clay underlying the site would create a natural barrier to vertical migration of contaminants to the underlying Tunbridge Wells formation which is classified as a Secondary A Aquifer and is therefore considered a sensitive receptor. Where this layer is fully penetrated by structures, such as piles and the proposed bunker, this would create a pathway for contamination. Such a pathway is, however, likely to be limited as a result of the Weald Clay

which would act to retard migration of contamination and is likely to be naturally annealing around structures. Additionally, ground investigation has identified that ground contamination at the site is limited in extent and severity. The magnitude of the impact is considered to be low and the sensitivity of the receptor medium. Therefore, the likely significance of effect is considered to be of minor adverse, long term and local.

Alteration of Groundwater Flow Regime

- 11.8.2 The presence of substantial below ground structures following redevelopment has the potential to alter groundwater flow. The potential significance of this effect would relate to the conditions pre-construction and the groundwater flows beneath the site. As previously stated, the Weald Clay formation beneath the site is classified as an unproductive stratum and, therefore, groundwater flows through this unit would be negligible. A consistent groundwater table is, however, estimated to be present at a depth of approximately 10 m bgl within the Tunbridge Wells formation. Where permanent structures extend into this formation to a depth greater than 10 m bgl they have the potential to impact groundwater flows. Significant structures are not proposed beyond this depth. Whilst parts of the bunker structural slab would extend beyond the finished floor level, significant structures would not extend significantly below the water table. The magnitude of the impact is considered to be low and the sensitivity of the receptor low. Therefore, the likely significance of this effect is considered minor adverse, long term and local.

11.9 Assessment of Decommissioning Effects

- 11.9.1 Where complete removal of structures is undertaken as part of decommissioning it is considered that the decommissioning effects at the plant would be broadly similar to the construction effects with regards to plant, equipment, materials and personnel required to return the site to a vacant, clear condition. In the event that the hardstanding remains in place post decommissioning, the significance of the effects would be less than reported for construction.
- 11.9.2 In this respect, similar mitigation measures should be adopted to prevent pollution. It should be possible to exclude asbestos mitigation measures from any future decommissioning plans, as it is anticipated that asbestos containing materials would not be utilised in the construction of the facility.

11.10 Assessment of Cumulative Effects

- 11.10.1 As set out above, it is anticipated that the proposed development would have only low level and localised effects that would not affect other sites. As other schemes come forward for development, the land involved in those developments and any potential contamination within those sites will need to undergo assessment to evaluate the risks and the significance of effects posed by those developments. Following that assessment, any identified requirement for remediation should be completed prior to the start of, or as a justified part of, the construction phase. Accepting that other proposed developments in the area around the site are adequately assessed, remediated and mitigated, they should themselves result in no significant adverse effects, and it is therefore not anticipated that there would be measurable cumulative effects.

11.11 Inter-relationships

- 11.11.1 There is potential for contamination to be identified during construction and the need for it to be managed and removed from site to a licensed waste management facility. In the unlikely event that this requirement arises additional vehicle movements would be required. It is anticipated that volumes of material would be limited and therefore any increase in vehicle movement would be negligible above those required for the general construction activities.
- 11.11.2 Effects on surface water receptors are considered in Chapter 10 of this ES.

11.12 Further Mitigation Measures

11.12.1 As set out above, the CEMP would include a range of good practice measures to control the potential for contamination and for effects on workers and receptors in the surrounding area. No further mitigation is considered necessary.

11.13 Monitoring and Management Strategies

11.13.1 Implementation of specific monitoring or management strategies is not considered necessary.

11.14 Residual Effects

11.14.1 Table 11.9 summarises the significance of effects for the construction and the operational phase for the project taking into account the mitigation measures incorporated into the facility.

Table 11.9: Summary of Likely Environmental Effects During Construction and Operation of 3Rs Facility

Parameter (e.g. Receptor No 1)	Sensitivity of receptor	Likely impact	Duration	Magnitude of impact	Significance of effect	Mitigation	Magnitude of Residual Impact	Significance of Residual Effect	Significant
Demolition and Construction									
Exposure of construction workers to any existing contamination present within soils and groundwater	Medium	Human health impacts through construction workers being exposed to contaminated materials.	Short	High	Moderate adverse, short term and local	Adherence of standard construction protocols for potentially contaminated sites, appropriate use of PPE, segregation of 'dirty' and 'clean' working areas and the establishment of decontamination facilities, appropriate briefing of site staff, Implementation of personal hygiene protocols.	Low	Minor, short term and local.	Not significant
Exposure of Construction Worker: Ground gases	Medium	Inhalation of ground gasses, causing nausea or asphyxiation. Risk of explosion.	Short	High	Major adverse, short term and local.	Use of PPE Identify and risk assess confined spaces and use confined space entry procedures with trained staff.	Low	Minor, short term and local.	Not significant
Exposure of Construction Worker: Asbestos	Medium	Inhalation of asbestos fibres	Short	High	Major adverse, short term and local	Soft asbestos strip from buildings and removal of asbestos contaminated soil prior to demolition, appropriate use of PPE, appropriate segregation of the asbestos effected area (considered a 'dirty' area) from the remainder of the site, appropriate briefing of site staff and implementation of personal hygiene protocols	Low	Minor, short term and local.	Not significant

Parameter (e.g. Receptor No 1)	Sensitivity of receptor	Likely impact	Duration	Magnitude of impact	Significance of effect	Mitigation	Magnitude of Residual Impact	Significance of Residual Effect	Significant
Mobilisation of any existing contaminants through the generation of dust and inhalation by humans.	High	Inhalation of dusts.	Short	High	Major adverse, short term and local.	Damping down, covering of contaminated stockpiles, wheel washing of vehicles leaving site, creation of temporary haul roads.	Low	Minor, adverse short term and local.	Not significant
Mobilisation of any existing contaminants into ground and groundwater.	Medium	Contamination of controlled waters.	Short	Low	Minor / moderate adverse, short term and local.	inspection of excavations and removal of contaminated groundwater.	Low	Minor, adverse short term and local.	Not significant
Creation of new areas of contamination e.g. through spillage	Low	Contamination of soils and controlled waters.	Short	High	Moderate adverse, short term and local	Regular servicing and inspection of vehicles used onsite, restriction of refuelling of vehicles to bunded areas, and deployment of spill kits.	Low	Minor, adverse short term and local.	Not significant
Alteration of groundwater flow regime beneath the site.	Low	Alteration of groundwater flows beneath the site.	Short	Low	Minor adverse, short term and local	N/A	N/A	N/A	Not significant
Operational Phase									
Exposure of future users to any existing contamination present within soils and groundwater	Medium	Human health impacts through site occupation being exposed to contaminated materials.	Long term	Low	Minor adverse, long term and local	N/A	Low	Minor adverse, long term and local	Not significant

Parameter (e.g. Receptor No 1)	Sensitivity of receptor	Likely impact	Duration	Magnitude of impact	Significance of effect	Mitigation	Magnitude of Residual Impact	Significance of Residual Effect	Significant
Impact on controlled waters	Medium	There is not anticipated to be a sensitive controlled waters body.	Long	Low	Minor/moderate, long term and local	Piling risk assessment	Low	Minor, long term and local.	Not significant
Alteration of groundwater flow regime beneath the site.	Low	Groundwater beneath the site is not deemed at risk.	Long	Low	Minor adverse, long term and local	N/A	Low	Minor adverse, long term and local	Not significant

11.15 Conclusions

- 11.15.1 With appropriate mitigation, the impacts associated with redevelopment and operation of the site relating to hydrogeology and ground conditions is assessed as low and the significance of effect as no greater than minor adverse. It is considered that the proposed facility would not generate an unacceptable effect.

11.16 References

Published Documents

- BSI (2013) BS10175:2011 + A1:2013 Code of Practice for Investigation of Potentially Contaminated sites.
- BSI (1990) BS1377:1990 Methods of Test for Soils for Civil Engineering Purposes.
- BSI (2015) BS5930:2015 Code of Practice for Site Investigations.
- Capita Symonds (2005) Ground Investigation.
- CIRIA (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings, CIRIA Report C665.
- DCLG (2012) National Planning Policy Framework; Department for Energy and Climate Change. London. HMSO. March 2012.
- DCLG (2014) National Planning Practice Guidance.
- Environment Agency and Defra (2004) Model Procedures for the Management of Contaminated Land, Contaminated Land Report 11.
- Groundsure (2013a) EnviroInsight Report, Report Ref. EMS-228947_303751, 28st November 2013.
- Groundsure (2013b) GeoInsight, Report Ref. EMS-228947_303750, 28st November 2013.
- Horsham District Council (2015) Horsham District Planning Framework (excluding South Downs National Park).
- LQM/CIEH (2015) The LQM/CIEH S4ULs for Human Health Risk Assessment.
- Risk Management Ltd (2015) Risk management Ltd. - site Investigation on behalf of Britaniacrest recycling Ltd.
- Scott Wilson (2009) Scott Wilson. - Former Wealdenn Brickworks, Langhurstwood Road, Horsham, West Sussex, Phase 1 Desk Study.
- SLR Consulting (2014) Site Hb, The Wealden Brickworks, Preliminary Land Quality Risk Assessment. SLR Ref: 416-01258-00002.
- SLR Consulting (undated) Environmental Statement Technical Chapter, based on 2014 desk top study.
- West Sussex County Council and South Downs National Park Authority (2014) West Sussex Waste Local Plan. April 2014.

Web Resources

- British Geological Survey Geology of Britain Viewer
<http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html?src=topNav>
- Contaminated Land Exposure Assessment (CLEA)
<https://www.gov.uk/government/publications/contaminated-land-exposure-assessment-clea-tool>
- Environment Agency, What's in your backyard? www.environment-agency.gov.uk/maps