POWERFUEL

Portland energy recovery facility

Environmental statement

8

Ground conditions and water quality

8 Ground conditions and water quality

Introduction

8.1 Arup was appointed to undertake the assessments of the potential for effects on ground conditions and water quality. Effects on flood risk were scoped out of the EIA and are addressed in the stand alone flood risk assessment submitted in support of the application. The findings of the assessments are summarised in this chapter and the full reports are included as technical appendices I1 (ground conditions) and I2 (water quality). The data sources and references used in the assessments are shown in table 8.1.

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Maritime and Coastguard Agency, 2018, Control and management of ballast water
Planning Inspectorate, 2017, The Water Framework Directive
Powerfuel Portland Ltd, 2019, Powerfuel Research Document Portland Port Ground Conditions
RPS, 2009, Port of Portland Phase 2 Site Investigation Report
RPS, 2009, Port of Portland, Castletown, Isle of Portland, Initial Asbestos Screening Assessment Report
Zetica, 2020, Portland Port UXO Desk Study & Risk Assessment
Table 8.1: References and data sources

Legislation and policy

Legislation

8.2 Environmental risks are assessed in accordance with the Contaminated Land (England) Regulations 2006 (as amended), which consolidated previous regulations that addressed contaminated land, including Part IIA of the Environmental Protection Act 1990 (as introduced by the Environment Act 1995). Part IIA defines contaminated land as:

> *"land which appears to the local authority in whose area it is situated to be in such a condition that, by reasons of substances in, on or under the land that significant harm is being caused, or there is a significant possibility of such harm being caused, or significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused."*

8.3 The Water Framework Directive (2000/60/EC) was published in December 2000 and transposed into English law in December 2003 through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, which were subsequently updated in 2015 and 2017. The intention of the directive is to provide a more holistic approach to protection of the water environment by addressing a wide range of aspects, including physico-chemical, chemical, hydromorphological and ecological.

8.4 The Groundwater Directive (2006/118/EC) established a framework to prevent the input of hazardous substances and manage the input of non-hazardous pollutants into groundwater. It was transposed into English law by the Groundwater (England and Wales) Regulations 2009, which were subsequently revoked by the Environmental Permitting (England and Wales) (Amendment) Regulations 2010 and onwards. The latter require an environmental permit or registered exemption to be obtained from the Environment Agency to discharge anything other than clean, uncontaminated water into inland freshwaters, groundwater, estuaries and coastal waters.

8.5 The Environmental Quality Standards Directive (2008/105/EC, as amended by 2013/39/EU) sets out standards for certain priority and priority hazardous substances considered to be of concern, with the aim of reducing or phasing out their presence in the water environment. The directive was transposed into English law by the Water Environment (WFD) (England and Wales) (Amendment) Regulations 2015.

Policy

8.6 Paragraph 170 of the National Planning Policy Framework (NPPF; 2019) notes that planning decisions should prevent new development from contributing to unacceptable levels of soil or water pollution. Paragraph 178 states, in relation to contamination, that planning policies and decisions should ensure that:

> *"A site is suitable for its proposed use, taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation, including land remediation (as well as potential impacts on the natural environment arising from that remediation)."*

8.7 The Environment Agency's online Land Contamination: Risk Management guidance provides the technical framework for structured decision-making about land contamination. It advocates a phased approach to risk assessment.

8.8 Policy 16 of the adopted Bournemouth, Christchurch, Poole and Dorset Waste Plan (2019) states that proposals for waste management facilities will be permitted where all of the following criteria are met:

- It can be demonstrated that the quality and quantity of water resources (including ground, surface, transitional and coastal waters) would not be adversely impacted and / or would be adequately mitigated
- Ground conditions are shown to be suitable
- Site soils would be adequately protected, re-used and / or improved as required
- There would not be a loss of best and most versatile agricultural land unless the environmental, social and / or economic benefits of the proposal outweigh this loss and it can be demonstrated that the proposals have avoided the highest grades of land wherever possible

8.9 Policy ENV9 of the adopted West Dorset, Weymouth & Portland Local Plan 2015 states that development will not be permitted that would result in an unacceptable risk of pollution to groundwater, surface waterbodies and tidal waters. Planning permission for development on or adjoining land that is suspected to be contaminated will not be granted unless it can be demonstrated that there is no unacceptable risk to future occupiers of the development, neighbouring uses and the environment from the contamination.

Methodology

Ground conditions

Background

8.10 Within the current regulatory framework, the assessment of contaminated land uses a risk-based approach. Under the risk assessment procedure, for harm to the non-aquatic environment or pollution of controlled waters to occur, there must be a 'pollutant linkage'. A pollutant linkage is based on the characterisation of the following, all of which must be present for a pollutant linkage to occur:

- Source (a substance that is a potential contaminant)
- Pathways for the contaminant to move from source to receptor
- Receptor (such as human beings, ecology, controlled waters physical systems and built structures), which could be affected by the contaminant

Baseline

8.11 In order to establish the existing baseline condition of the site and its surrounds, a desktop study was undertaken, including a review of the reports produced by RPS in 2009 to support the application for the energy plant. No intrusive investigations were carried out, but the findings of previous investigations carried out by RPS on the site have been reviewed. A full list of the references and data sources used in the baseline study is set out in table 8.1.

Impact assessment

8.12 The information from the desk study was reviewed in the context of the proposed development to create a conceptual site model and evaluate the potential effects associated with the proposed development.

8.13 The significance of the potential effects was assessed by considering the sensitivity of receptors and the magnitude of the potential impacts. Sensitivities were assigned to typical land quality receptors and resources of relevance to the site, in accordance with figure 8.1. These criteria were developed using industry guidance, combined with professional experience. Where possible, impact magnitude was assessed using site-specific data; where these were not available, impacts were assessed qualitatively. The criteria used in the assessment of impact magnitude are set out in figure 8.2.

8.14 Effect significance was then assessed by combining the impact magnitude and receptor sensitivity to determine the degree of effect using the matrix shown in figure 8.3. As discussed in chapter 3, effects that are moderate or above are considered to be significant in EIA terms.

Uncertainties and limitations

8.15 A site walkover could not be undertaken because of the current COVID-19 restrictions; however, detailed descriptions and photographs were provided by the project team.

8.16 The previous site investigations undertaken by RPS in 2009 were widely spaced, with limited coverage beneath the footprints of former buildings. The exploratory hole spacing is not compliant with BS 10175:2011 *Investigation of potentially contaminated sites*, and further site investigations will be required in due course.

Water quality

Baseline

8.17 Baseline conditions were identified through a desk study. Consultation was undertaken with the Environment Agency and Dorset Council and relevant data and published materials relating to the local and wider water environment were reviewed. This review included establishing the existing quality of local coastal waterbodies and groundwater. The study area was selected based on a source-pathway-receptor approach. For direct effects on coastal waters, the study area included the geographical extent of the full scope of works and all surface water features within 500 m of the proposed development. Indirect effects on coastal waters were considered up to 1 km away where features have hydrological connectivity with the proposed development.

8.18 A full list of the references and data sources used in the baseline study is set out in table 8.1. No difficulties were encountered in obtaining the necessary information.

Impact assessment

8.19 There are no standard significance criteria for assessing effects on water quality. The assessment was therefore based on guidance provided by the Design Manual for Roads and Bridges (DMRB) LA 113 *Road drainage and the water environment.* Although this guidance is primarily aimed at road projects, it is recognised as a robust approach and can be applied to other types of development. The methodology follows a four-step approach:

- Step 1: identification of water features within the study area and an assessment of the importance / value / sensitivity of each of these receptors, using the criteria shown in figure 8.4
- Step 2: identification of potential impacts on the water features identified in step 1, from construction and / or operation. Under the Water Framework Directive, an impact is defined as causing a deterioration in the status of a waterbody, or preventing a waterbody from reaching 'good' status in the future
- Step 3: assessment of the potential magnitude of any construction or operation impacts on the receptor, using the criteria in figure 8.5
- Step 4: assessment of the overall significance of any effects to receptors, using the significance matrix provided in figure 8.6. As discussed in chapter 3, effects that are moderate or above are considered to be significant in EIA terms

Baseline

Ground conditions

8.20 The British Geological Survey 1:50,000 scale mapping shows that the bedrock beneath the site is the Kimmeridge Clay Formation, which comprises a succession of thinly laminated mudstones and clays. It is overlain by superficial deposits, including Landslide Deposits of an unknown / unclassified rock type in the south west corner and Tidal Flat Deposits comprising silt and sand along the shoreline in the east and in the north east corner. Groundsure mapping indicates the presence of made ground in the north and centre of the site. While not recorded on the maps, made ground associated with the historical development of the site is expected to be present across the entire site area.

8.21 The previous site investigations undertaken by RPS recorded made ground deposits across the whole site at depths between 5.1 and 8 metres below ground level (mbgl). This comprised a mix of firm, locally firm to stiff, clays, gravelly clays, silty sands, sands and gravels. Occasional bricks and concrete were encountered in soils beneath the north east of the site. However, anthropogenic materials were generally limited in the made ground and it may be that this largely comprises reworked natural materials used to form the original port development in the 1800s.

8.22 Superficial deposits were only recorded by RPS in the north east corner of the site. These comprised grey and brown sands and gravels at depths of between 5 and 12 mbgl, and were considered likely to be Tidal Flat Deposits. A weathered zone of Kimmeridge Clay was identified in two boreholes in the north of the site at depths of between 5.1 and 9 mbgl. The Kimmeridge Clay was proven to a maximum depth of 21 mbgl and largely comprised mudstones, with occasional bands of stiff clay.

8.23 Details of the site's hydrogeology are set out in the water environment section of this chapter.

Site history

8.24 The site history was established by a review of historic Ordnance Survey maps dating back to 1864, which are provided in technical appendix I1. The wider Portland Harbour was constructed between 1837 and 1890 to provide a harbour and coaling station for the steam navy. In 1864, several railway lines ran across the site, servicing a number of buildings in the north and west and a gas works immediately to the south of the site. The gas works had been removed by 1901 and a slaughter house had been constructed in the south of the site. The buildings in the north and west were occupied by the Royal Naval Hospital and there was a boat house in the east. An area of shingle beach in the north east of the site had been infilled and formed part of the portside. A timber yard had been constructed in the north east of the site by 1903.

8.25 The railway lines had been removed by 1927 and the slaughter house and hospital had also been removed. Two new buildings had been constructed on site by 1938. By 1963, the site was occupied by several large buildings and labelled as a dockyard. During the use of the port as HM Naval Base Portland, from 1923 to 1995/96, the buildings on site were used as a weapons research establishment and mechanical repair facilities for military vehicles. The buildings on the site were progressively demolished from 1999 to create cargo storage space, with material stockpiled on the site until 2018. The last vacated buildings in the north of the site, used by UMC, Portland Shellfish and Permavent, were demolished in 2014 and 2017.

8.26 Potentially contaminative historic uses in the vicinity of the site include the gasworks, a coal depot 100 m to the north, railway lines, an electricity substation to the north, and port-related activities.

8.27 In summary, there have been over 150 years of port and industrial uses at the site. Made ground was placed across the site to create a development platform, in several phases. No specific potential sources of contamination, such as fuel tanks, have been identified on the site, but spills and contaminant releases could have occurred across the site. Demolition of the 20th century buildings could have resulted in asbestos in fill materials.

Unexploded ordnance

8.28 An unexploded ordnance (UXO) desk study and risk assessment has been undertaken by Zetica and the full report is provided in technical appendix I1. This identified a high localised bombing density in the vicinity of the site during WWII and estimated that the average bomb penetration depths on the site would range from 2.5 m to 6.0 m, depending on the weight of the bomb. The report concluded that the site has a moderate risk of unexploded bombs being present.

Past intrusive investigations

8.29 Initial information on ground contamination at the site is available from the site investigations undertaken in 2009 by RPS. These recorded evidence of hydrocarbon contamination in three locations in the north east of the site, in the form of a hydrocarbon odour, dark brown staining within soils and oil droplets in groundwater. The RPS risk assessment compared the results of the soil chemical analysis to human health generic risk assessment criteria (GAC) for a commercial / industrial land use.

8.30 The only exceedance of the GAC recorded was for benzo(a)pyrene in one sample of made ground from the north east of the site. Asbestos testing was not undertaken on the soil samples, but an asbestos screening assessment was carried out on the stockpiles of demolition rubble present on the site at the time of the investigation. This did not identify any asbestos fibres or asbestos-containing materials within the rubble.

8.31 Ground gas monitoring indicated a limited potential risk from ground gas, due to low ground gas concentrations (methane and carbon dioxide) and limited gas flow.

Summary of potential sources of contamination

8.32 The main potential source of contamination within the site is the made ground associated with the port development, which contains a range of materials and potential contaminants. In addition, historical uses of the site and the surrounding area may also be potential sources of contamination. There is the potential for the following contaminants to be present:

- Asbestos
- Extremes of pH
- Heavy metals
- Petroleum hydrocarbons
- Polycyclic aromatic hydrocarbons
- Volatile and semi-volatile organic compounds
- Ground gases (methane and carbon dioxide)

Water quality

Surface water

8.33 The site lies on the coast, with Portland Harbour to the north and Balaclava Bay to the east. The two waterbodies are divided by the inner breakwater. Lyme Bay East coastal waterbody is on the western coast of Portland. Portland Harbour is a 10.2 km^2 waterbody designated as 'shellfish waters'. This designation places specific restrictions on levels of microbial pollution in the water. Portland Harbour Castle Cove and Portland Harbour Sandsfoot Castle bathing waters are 3.8 km from the site, at the north of the harbour.

8.34 Balaclava Bay lies within the wider Dorset / Hampshire coastal waterbody, which is an area of 513.1 km^2 stretching from Portland in the west to the Isle of Wight in the east. The Dorset / Hampshire waterbody includes the following marine protected areas:

- Studland to Portland Special Area of Conservation (SAC), 3 km to the south and 6.5 km to the east of the site, designated for reefs
- Purbeck Coast Marine Conservation Zone (MCZ), 6.5 km to the east of the site

8.35 To the west of Portland Harbour is the Fleet Lagoon waterbody, which is bordered by the shingle beaches of Chesil Beach. This is a 4.9 km^2 waterbody connected to Portland Harbour through a narrow channel, which at its closest point is approximately 2.5 km to the north west of the site. Designations associated with this waterbody include:

- Chesil and the Fleet SAC, the area of which includes this waterbody, Chesil Beach and the adjacent coastline to the south
- Chesil Beach and the Fleet Special Protection Area (SPA)
- The Fleet Shellfish Waters (2014)

8.36 Lyme Bay East coastal waterbody is a 118.2 km^2 waterbody to the west of Portland, approximately 8 km along the coastline from the proposed development. The closest designations to the site in this area are:

- South of Portland MCZ, 8.3 km to the south of the site, to the south of Portland Bill
- Chesil and The Fleet SAC and Chesil Beach and Stennis Ledges MCZ, approximately 1.8 km over land and 12 km along the coastline from the site

8.37 All four waterbodies are Water Framework Directive waterbodies for which the Environment Agency has responsibility. The Agency uses over 30 measures to classify the quality of waterbodies under the directive. The status of waterbodies against these measures is classified by the Agency as high, good, moderate, poor or bad. 'High' represents 'largely undisturbed conditions', while the other classes show increasing deviation from undisturbed conditions. The Dorset / Hampshire, Portland Bay and Fleet Lagoon waterbodies had an overall classification of moderate in 2016, with a target status of good by 2021. Lyme Bay had a good overall classification in 2016.

8.38 There are no surface watercourses on or in close proximity to the site. The nearest is the River Wey, approximately 5 km to the north. An isolated pond and a spring-fed pond lie 150 m to the south of the site and another spring-fed pond lies 300 m to the south west. These are discrete, localised features that do not connect to other watercourses. With no pathway for the proposed development to affect these features, they are not considered further within the assessment.

8.39 There are no drinking water protected areas or safeguard zones in the vicinity of the site.

Hydrogeology

8.40 Groundwater mapping shows that the Kimmeridge Clay bedrock beneath the site is classified as unproductive strata, which are layers with low permeability that have negligible significance for water supply or river base flow. The superficial deposits (Tidal Flat Deposits) are classified as secondary undifferentiated aquifers, meaning that these are both minor and non-aquifers in different locations due to the variable characteristics of the rock type.

Groundwater

8.41 Monitoring undertaken as part of RPS's intrusive investigations recorded groundwater at depths of between 7.18 and 7.88 mbgl in the Kimmeridge Clay and at a depth of approximately 7.7 mbgl in the superficial deposits in the north east of the site. Localised perched groundwater was also recorded in the made ground at depths of between 2.57 and 3.4 mbgl.

8.42 The groundwater beneath the site forms a natural gradient towards the coast and discharges into the sea. Testing indicated the presence of saline and brackish water beneath the site, suggesting the presence of a saline / freshwater interface.

8.43 RPS compared the groundwater chemical analysis to published water quality standards. The results indicated that there were occasional elevated concentrations of arsenic, chromium, copper and nickel compared to the environmental quality standard for saltwater. Concentrations of total petroleum hydrocarbons and polycyclic aromatic hydrocarbons were elevated when compared to UK drinking water standards.

8.44 The site is not within an Environment Agency groundwater source protection zone or groundwater drinking water safeguard zone. There are no groundwater abstractions within 1 km of the site.

Sensitive receptors

8.45 The following sensitive receptors have been identified with regard to the guidance in figure 8.4:

- Portland Harbour – very high sensitivity
- Balaclava Bay – very high sensitivity
- Fleet Lagoon – very high sensitivity
- Lyme Bay East – very high sensitivity
- Groundwater in Kimmeridge Clay bedrock – low sensitivity

Future baseline

8.46 In the absence of the proposed development, the site would continue in its current use. It is therefore unlikely that there would be any change in contamination conditions. The existing water environment could be subject to change as a result of climate change.

Effects during construction

Ground conditions

8.47 In order for potential contaminants to pose a risk to receptors, there has to be a viable pathway for the contaminant to reach the receptor. Construction workers have the potential to come into direct contact with soil and groundwater during site works and construction activities, and also to be subject to accidental soil and groundwater ingestion and inhalation of dust, vapours and gases. The latter could also affect adjacent site users if dust, vapours or gases are blown from the site. There is also the potential for UXO beneath the site to explode as a result of below ground construction activities, such as excavations and piling.

8.48 There is the potential for rainfall infiltration, leaching and contaminant migration in open areas of the site to affect the water environment. Contaminated groundwater could also flow laterally into the sea. Deep foundations will be required to support the proposed development as a result of the presence of made ground on site and the RDF bunker will also need to be excavated. There is the potential for contamination within the made ground to be mobilised via newly created pathways into groundwater. Given the excavation requirements, dewatering may need to be undertaken. This has the potential to mobilise contamination into water in the excavations, causing contamination of water that is pumped out, groundwater and the coastal water that is in hydrological continuity with the groundwater.

8.49 A conceptual site model has been developed for the construction phase, informed by the desk study, to illustrate potential sources, pathways and receptors at the site (table 8.2).

Source	Pathway		Receptor
Contaminated made ground	Inhalation of soil, fibres and soil dust Inhalation of vapours and odour	✓	Construction workers Users of adjacent sites
	Ingestion of soil and dust	✓	Construction workers
	Dermal contact with soil	✓	Construction workers
	Leaching of exposed soils	✓	Groundwater
	Vertical migration during piling	✓	Groundwater
Contaminated groundwater	Inhalation of vapours	X	Groundwater not considered as a potential vapour source
	Dermal contact with groundwater	✓	Construction workers
	Ingestion of groundwater	✓	Construction workers
	Lateral migration of groundwater	✓	Sea Groundwater in Tidal Flat Deposits
Ground gases	Inhalation of gases in confined spaces	✓	Construction workers Users of adjacent sites
	Accumulation of gases to explosive concentrations in confined spaces	✓	Construction workers Users of adjacent sites
UXO	Explosion during excavation or piling activities	✓	Construction workers Users of adjacent sites

Table 8.2: Construction phase conceptual site model

8.50 A plausible pollutant linkage has been identified in table 8.2 relating to construction workers and adjacent site users as a result of the excavation of potentially contaminated materials, which may generate contaminated dust and vapour, or result in exposure to contamination via dermal contact and ingestion. However, the concentrations of contaminants in soil and groundwater were typically below those that might pose a risk to construction workers. In the absence of mitigation, the impact magnitude is large and the receptor sensitivity is low, with reference to figures 8.1 and 8.2. Therefore, the unmitigated effect will be moderate and significant.

8.51 Ground gases may pose a risk to construction workers and adjacent site users in enclosed or confined spaces. It is possible that disturbance of the ground during construction, and activities such as compaction, may result in a temporary worsening of ground gas risks compared to the baseline. On the basis of the current assessed low risk, a small impact is predicted on construction workers and a negligible impact is predicted on users of adjacent sites. The receptors are of low sensitivity with reference to figure 8.1 and the effects will therefore be negligible and not significant.

8.52 UXO may pose an explosion risk to construction workers and adjacent site users if encountered during excavation works or piling activities during construction. On the basis of the current assessments, the impact magnitude is assessed as being medium and the receptors are of high sensitivity, leading to a substantial, significant adverse effect in the absence of mitigation.

8.53 A potential pollutant linkage was identified as a result of the exposure of contaminated soils when existing hardstanding is removed, which could lead to a temporary increase in rainwater infiltration and consequently an increase in the leaching of contaminants into groundwater. This could also allow direct runoff of contaminants into groundwater where it is encountered during deep excavations. The sensitivity of the groundwater is considered to be low because it is not used for water supply and has elevated salinity. In the absence of mitigation, a medium impact is predicted, leading to a slight effect that will not be significant.

8.54 During piling activities, a potential pollutant linkage has been identified where piling could drive contaminants down into the groundwater from the overlying made ground. The sensitivity of the groundwater body is low and the magnitude of impact in the absence of mitigation would be medium, leading to a slight adverse effect that would not be significant.

8.55 Any additional contamination that leaches into the groundwater during construction has the potential to migrate laterally into the sea, where it could impact on the water quality. The receptor sensitivity is high. In the absence of mitigation, a small impact is predicted, leading to a moderate, significant adverse effect.

Water environment

Coastal water quality

8.56 During the construction phase, there is the potential for the pollution of coastal waters from sediment runoff, spillages from vehicles / plant and concrete wash-waters, or discharges resulting from construction activities. As a result of the presence of made ground on site, there is also the potential for contaminated runoff from stockpiled material. Temporary increases in traffic flow and deposits on access roads from construction vehicles and machinery also have the potential to affect coastal water quality. In the absence of mitigation, there will be a large impact on coastal water quality, leading to a very substantial, significant adverse effect.

Groundwater quality

8.57 Sources of potential pollutants to groundwater quality during construction include accidental spills (e.g. fuel from vehicles / plant), silt-laden waters from excavation activities, and water contaminated during specific activities such as concrete pouring / washing. The installation of foundations and excavations for bunker construction will provide potential pathways for pollution to reach groundwater. Direct infiltration at the pollutant source is also a potential pathway. In the absence of mitigation, a medium magnitude of change is predicted. Combined with the low sensitivity of the groundwater resource, this will lead to a slight adverse effect that will not be significant.

Effects post-construction

Ground conditions

8.58 The proposed development will largely cover the site with hardstanding and buildings, except for small areas of soft landscaping. This means that there is very limited potential for future site users to come into contact with soils and groundwater post-construction. There is the potential for ground gases to build up in confined spaces within the proposed buildings post-construction. The post-construction conceptual site model is shown in table 8.3.

Source	Pathway		Receptor
Contaminated made ground	Inhalation of soil and soil dust Inhalation of vapours	X	Future users. Pathway removed during construction as a result of the scheme design
	Ingestion of soil and soil-derived dust	X	
	Dermal contact with soil and soil dust	X	
	Leaching of exposed soils	X	Groundwater. Pathway removed / reduced during construction as a result of the scheme design.
Contaminated groundwater	Inhalation of vapours	X	Future users. No pathway – groundwater will not be exposed at the surface in future development. Groundwater not considered as a potential vapour source
	Dermal contact with groundwater	X	
	Ingestion of groundwater	X	
	Lateral migration of groundwater	X	Sea, groundwater in Tidal Flat Deposits. Source of any contamination will be depleted as a result of construction and scheme design
Ground gases	Inhalation of gases in confined spaces	✓	Future site users. Pathway controlled by measures in scheme design
	Accumulation of gases to explosive concentrations in confined spaces	✓	

Table 8.3: Post-construction conceptual site model

8.59 The conceptual site model in table 8.3 shows that many of the potential pollutant linkages will be broken as a result of the implementation of measures inherent in the proposed development's design. The build-up of ground gases poses a potential risk to future site users. No significant ground gases have been identified at the site to date, but further assessment of ground gas risks will be undertaken following additional site investigations. In the absence of mitigation, a small impact is predicted on a receptor of low sensitivity, leading to a negligible adverse effect that will not be significant.

Water environment

8.60 As the site will be largely covered in hardstanding post-construction, and no infiltration drainage is proposed, there is no potential for significant effects on groundwater quality. This section therefore focuses on the potential effects on coastal water quality.

8.61 Post-construction, there is the potential for coastal water quality to be affected by leaks and spills from plant, vehicles and equipment used across the site, spillage of fuels, oil or waste materials on the local road network from HGV traffic accessing the site, additional ship movements related to the delivery of RDF to the site or the removal of bottom ash, and contaminated runoff from the site.

8.62 As discussed in chapter 2, an environmental management system will be put in place during the operation of the proposed ERF. This will include the following measures to safeguard water quality:

- A number of spill procedures will be produced for each potential spillage event identified, including spillages of raw material inputs to the plant, ready-use consumables, and waste material outputs
- Suitable and sufficient equipment will be maintained on site, such as spill kits, in order to deal with the predicted scale of possible spillages of materials
- Staff will receive training in the use of the spill kits and will regularly practise as part of the normal operation of the facility
- Engineering controls will be employed where these would reduce the potential for spillage (or minimise the impact of spillage), such as bunded areas for fuel storage above ground
- Ship deliveries associated with the proposed development will be compliant with relevant standards and protocols, including the Maritime and Coastguard Agency's and the International Maritime Organisation's guidance

8.63 The risk of spillages from vehicles will be managed by operational measures such as speed limits and road markings, and implementing procedures for delivery and movement of materials. All vehicles carrying RDF and other materials into or out of the facility will be covered or sheeted, minimising the potential for litter to escape.

8.64 As discussed in chapter 2, under the worst-case scenario of all deliveries and removal of ash being undertaken by road, the proposed development is forecast to generate up to 80 HGV movements per day (40 each way). While this is not a significant traffic volume, and therefore will not result in a significant change in road-related pollutants, there is a residual risk of a spillage of contaminating material such as fuels or oils. However, this is not predicted to be significant.

8.65 The delivery of RDF to the plant by ship will increase ship movements in the area, potentially affecting coastal waters through the increased risk of leaks and spills from shipping in the vicinity of the site. However, as discussed in chapter 2, the port has sufficient capacity to accommodate the additional movements and the increase in numbers will be negligible in the context of the existing shipping traffic at the port. As set out above, deliveries by ship will be compliant with relevant standards and protocols.

8.66 Subject to agreement with Wessex Water, as set out in chapter 2, all process effluent and foul water generated on site will be discharged to the sewer system. All surface water runoff from buildings, roads and hardstanding will be passed through an oil bypass separator prior to discharge. In addition, sustainable drainage systems in the form of a swale have been incorporated within the landscaping areas, which will also provide water treatment capabilities.

8.67 The incorporation of the above measures within the proposed development means that no change is predicted to coastal water quality post-construction and the effect will be neutral and not significant.

Mitigation and monitoring

Ground conditions

Construction

8.68 Further ground investigation works will be undertaken ahead of construction to provide additional information on ground contamination conditions at the site, which will be used to refine the risk assessment and, if necessary, produce a remediation strategy that will be implemented during construction. These works will include trial pits and boreholes, soil and water sampling for laboratory testing, groundwater and gas monitoring.

8.69 To protect sensitive receptors during construction, measures will be put in place through a framework construction environmental management plan (CEMP), as set out in technical appendix C. These will include the following:

- Systematic excavation of made ground in areas of the site subject to historic development, to remove obstructions such as old foundations and known contamination sources
- Dust suppression measures and use of appropriate site controls, abatement measures and monitoring
- Observation of excavated materials by appropriately trained and qualified staff to identify suspected asbestos and implementation of measures to manage suspect material
- Appropriate health and safety briefings for contractors on the types of contaminants known to exist on site and the possibility of unexpected contamination
- Implementation of procedures for use in the event that unexpected contamination is encountered
- Provision of personal protective equipment for contractors, appropriate for the contamination expected
- Sequencing of earthworks to minimise the amount of soil exposed at any one time
- During piling activities, an appropriate piling method will be selected that will reduce the risk of cross-contamination from made ground into the underlying groundwater

8.70 Material will be replaced to achieve the required development levels and in accordance with an agreed geotechnical and chemical specification. As part of any future remediation implementation plan, materials re-use criteria will be developed to protect human health and controlled waters. These will be agreed with Dorset Council and the Environment Agency. Only soils that have been validated as meeting the required re-use criteria will be used in the earthworks.

8.71 With the above measures in place, the magnitude of impacts during construction from contamination will be reduced to negligible and no significant effects are predicted.

8.72 All excavations will be supervised by an explosive ordnance clearance engineer, who will assess any suspect items encountered. An intrusive magnetometer survey will be undertaken at each proposed pile location to clear pile positions of UXO. This will reduce the risk posed by UXO to slight and not significant.

Post-construction

8.73 As discussed above, further ground investigations and risk assessment will be undertaken to characterise the ground gas risk prior to development. If required, a scheme of ground gas protection will be incorporated into any remediation implementation plan and the new buildings will incorporate measures to prevent ingress of gases into confined spaces where necessary. The design will follow UK good practice (BS 8485:2015 *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*). This will reduce the magnitude of impact associated with ground gases to negligible.

Water quality

8.74 As discussed above, a framework CEMP has been prepared that will be agreed with the Environment Agency and Dorset Council. This will ensure that industry standard practice working methods and mitigation measures set out in the Environment Agency's guidance for pollution prevention are implemented, including measures outlined in the following documents:

- CIRIA, 2002, SP156: *Control of water pollution from construction sites – guide to good practice*
- CIRIA, 2001, C532: *Control of water pollution from construction sites – guidance for consultants and contractors*
- CIRIA, 2010, C692: *Environmental good practice on-site*
- CIRIA, 2016, C750: *Groundwater control: design and practice (second edition)*

8.75 Measures set out in the framework CEMP to prevent impacts on coastal water and groundwater quality include the following:

- Appropriate consents for the storage and use of controlled substances will need to be obtained, for example under the Oil Storage Regulations and the Environmental Permitting Regulations
- Temporary drainage facilities will be put in place to control discharge of water from the site, ensuring the suitable treatment of surface water discharges from the site during the construction phase
- Water and sediment will be managed across the site and provisions put in place to minimise the likelihood of runoff, for example the use of sedimats or check-dams to offer filtration

- Earthworks will be sequenced to minimise the amount of soil exposed at any one time. This will reduce the exposure of soils during removal of the existing hardstanding and reduce the potential for leaching and infiltration into groundwater
- Spill kits will be kept on-site, appropriate to the types of material being stored. Emergency spillage response procedures will be developed and incorporated into the CEMP
- Surface water discharges to controlled waters will require Environment Agency consent
- Containment of spillage to capture or treat wastewaters will be provided where necessary
- The management of earthworks and stockpiles will be detailed to prevent releases of runoff, and appropriate measures will be put in place for dealing with any unexpected contamination encountered. This will include appropriate bunding and drainage measures and positioning to limit any impact of surface runoff in the event of extreme rainfall
- A requirement for a suitable construction traffic management plan will be included to minimise the risk of accidents and related spillages
- A commitment will be made to regular inspection throughout the construction programme and following completion, as agreed with Dorset Council

8.76 With the above measures in place, the magnitude of impacts on coastal water and groundwater quality will be reduced to negligible and there will be no significant effects.

Residual effects

Ground conditions

8.77 With the above measures in place, no significant residual effects are predicted as a result of contamination.

Water quality

8.78 With the above measures in place, no significant residual effects are predicted on coastal water or groundwater quality.

Cumulative effects

Ground conditions

8.79 The other developments in the vicinity of the site will be required to adhere to the same environmental standards as those discussed above and will therefore also need to implement appropriate mitigation measures to accord with regulatory requirements. Given this, and the fact that no significant effects are predicted as a result of the proposed development, there is no potential for significant cumulative effects as a result of contamination.

Water quality

8.80 It is likely that the other developments in the vicinity of the site will be required to implement similar good practice measures to protect the water environment during construction as those set out above for the proposed development. All the other schemes will also be required to put drainage systems in place to manage runoff and control water quality post-construction. Given this, and the fact that no significant effects are predicted as a result of the proposed development, there is no potential for significant cumulative effects on water quality.

Sensitivity of receptor – Ground conditions

High	Medium	Low	Negligible

Typical description of the receptor

High:
- **Human health:**
  Residential, schools and playing fields
- **Controlled waters:**
  Catchment or surface water bodies of high quality and/or principal aquifers with high to minor vulnerability. Likely to be groundwater protection zone SPZ1 (inner or outer source protection zone) with short travel times to sources or sensitive watercourses

Medium:
- **Human health:**
  Retail and business parks (public and work places), allotments and market gardens
- **Controlled waters:**
  Catchment or surface water bodies of moderate quality, and/or secondary A aquifers with moderate to low vulnerability. Likely to be SPZ2 and 3 for potable water supplies

Low:
- **Human health:**
  Public open space, commercial developments, construction workers with acute exposure
- **Controlled waters:**
  Surface water bodies of low quality. Secondary B and undifferentiated aquifers with low vulnerability. Likely to be SPZ3 (total catchment source protection zone). Unproductive strata with no apparent abstraction use, including aquifers affected by saline intrusion
- **Property:**
  Infrastructure susceptible to potential gas accumulation, attack by aggressive contaminants or permeation

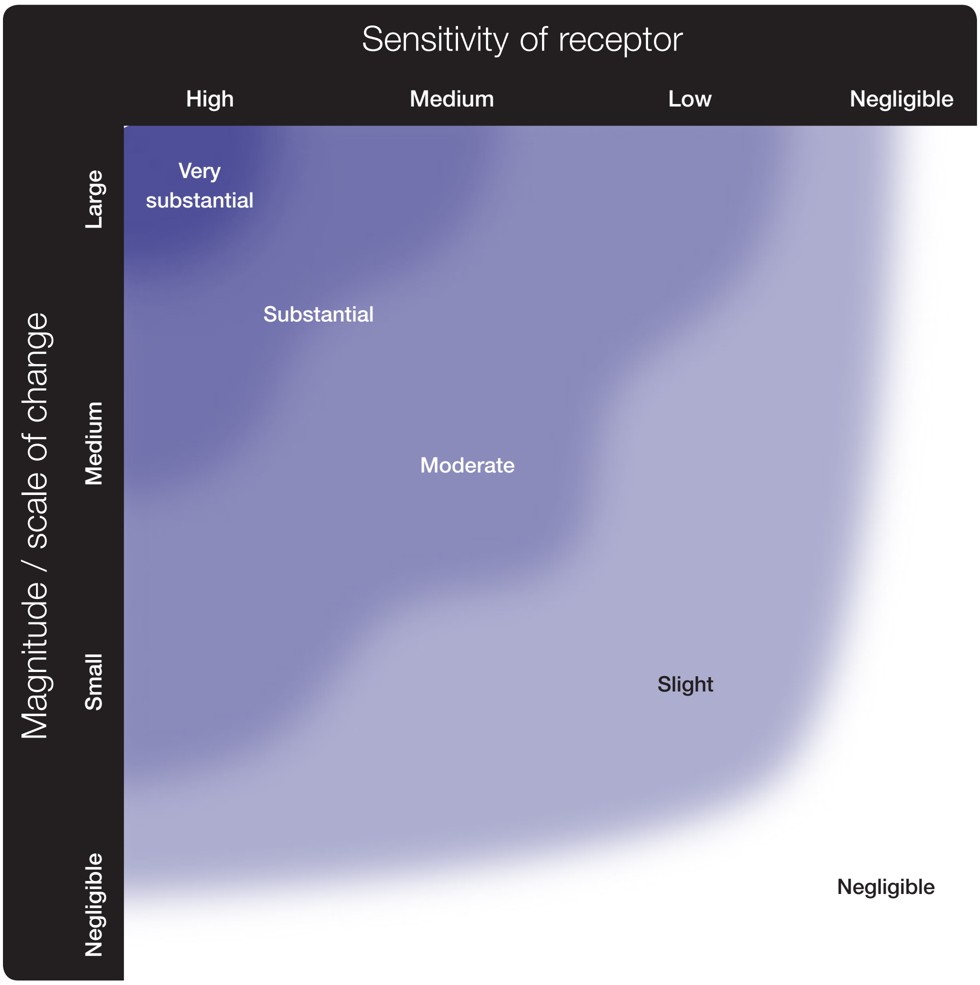
Negligible:
- **Human health:**
  Industrial development
- **Controlled waters:**
  Secondary B aquifer, undifferentiated aquifers, surface water bodies of poor quality

Figure 8.1 Receptor sensitivity (ground conditions)

Impact magnitude – Ground conditions

	Large	Medium	Small	Negligible
Definition – Typical description of the receptor	Severe or substantial alteration to a key receptor such that the post-development character/ composition/attributes will be fundamentally changed	Loss or alteration to one or more key receptors of the baseline conditions such that the post-development character/ composition/attributes of the baseline will be materially changed	A small shift away from baseline conditions. Change arising from the loss/alteration will be discernible/ detectable, but not material. The underlying character/composition/ attributes of the baseline condition will be similar to the pre-development circumstances/ situation	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation
Example of impact on receptors	**Human health:** Introduction/removal of contamination resulting in acute change in risk to health based on the potential effects on the critical human health receptor **Controlled waters:** Introduction/removal of pollution to a principal aquifer within a SPZ (inner and outer) or potable supply characterised by a breach of drinking water standards (DWS)	**Human health:** Introduction of contamination resulting in chronic damage to health **Controlled waters:** Pollution of a principal aquifer outside a SPZ characterised by a breach of DWS	**Human health:** Introduction of contamination resulting in minimal short-term effects to health **Controlled waters:** Low levels of pollution to a principal aquifer outside a SPZ, or pollution of a secondary A/B aquifer	**Human health:** No appreciable impact on health **Controlled waters:** No appreciable impact on pollution or water quality

Determination of significance matrix – Ground conditions



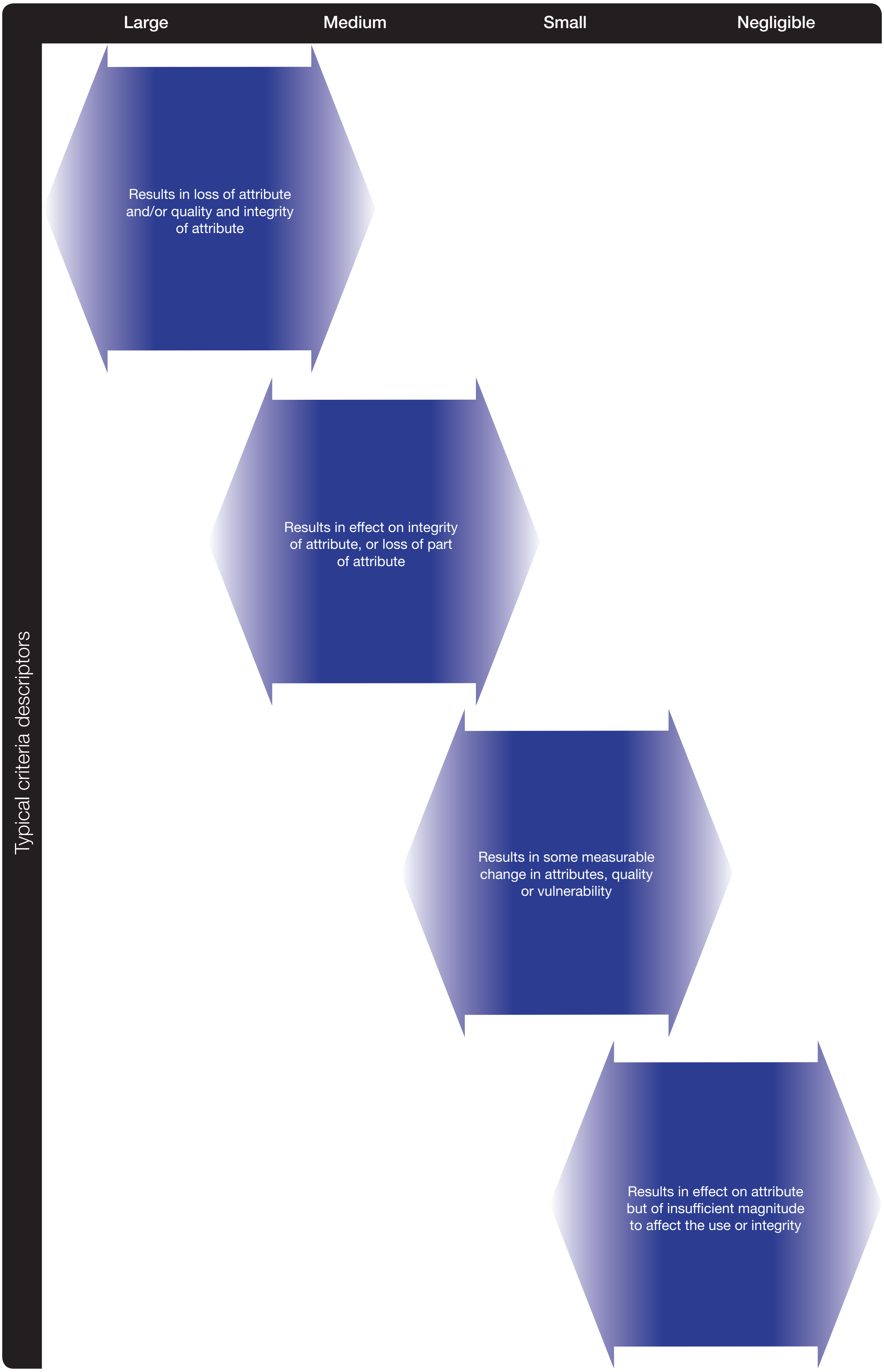
Significance

If the degree of effect is moderate or above, then the effect is considered to be significant.

Receptor sensitivity (water quality)

	Very high	High	Medium	Low
Quality/substitutability	Attribute has a high quality and rarity on regional or national scale	Attribute has a high quality and rarity on local scale	Attribute has a medium quality and rarity on a local scale	Attribute has a low quality and rarity on local scale
Typical examples	Surface water: Watercourse having a WFD classification shown in a RBMP and Q95 ≥ 1.0 m3/s. Site protected/designated under EC or UK legislation (special area of conservation, special protection area, SSSI, Ramsar site, salmonid water)/species protected by EC legislation ecology and nature conservation Groundwater: Principal aquifer providing a regionally important resource and/or supporting a site protected under EC and UK legislation ecology and nature conservation. Groundwater locally supports GWDTE SPZ1	Surface water: Watercourse having a WFD classification shown in a RBMP and Q95 <1.0 m3/s. Species protected under EC or UK legislation ecology and nature conservation Groundwater: Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a GWDTE SPZ2	Surface water: Watercourses not having a WFD classification shown in a RBMP and Q95 >0.001 m3/s Groundwater: Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3	Surface water: Watercourses not having a WFD classification shown in a RBMP and Q95 ≤ 0.001 m3/s Groundwater: Unproductive strata

Impact magnitude (water quality)



Degree of effect matrix (water quality)

Receptor value	Impact magnitude: No change	Negligable	Small	Medium	Large
Negligable	Neutral	Neutral	Neutral / slight	Neutral / slight	Slight
Low	Neutral	Neutral / slight	Neutral / slight	Slight	Slight / moderate
Medium	Neutral	Neutral / slight	Slight	Moderate	Moderate / substantial
High	Neutral	Slight	Slight / moderate	Moderate / substantial	Substantial / very substantial
Very high	Neutral	Slight	Moderate / substantial	Substantial / very substantial	Very substantial