Bexhill to Hastings Link Road

Chapter 8 Geology and Soils

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8 Geology and Soils

8.1 Introduction

8.1.1 This chapter discusses geology and soils issues relating to the Scheme. It provides an overview of the baseline geological, hydrogeological and soil conditions for the area, including the potential for soil and groundwater contamination to be present and related soil waste. It also details predicted impacts that the Scheme may have and appropriate mitigation measures. Further discussion of Water Quality and Drainage impacts are considered in Chapter 9.

Study Area

8.1.2 For the purposes of geology and soils, the study area covers the proposed Scheme footprint and associated construction areas. An area of 250m either side of the route alignment and construction sites has been assessed with regard to mobile contaminants.

8.1.3 For clarity, in some sections of this chapter the study area is considered in two parts – The Bexhill Connection (Ch 0 - Ch 1500) and the Rural Section including Queensway Junction (Ch 1500 – Ch 5500). The Bexhill Connection encompasses most of the dismantled railway and urban Bexhill, and the Rural Section including Queensway Junction is located on predominantly agricultural land, characterised by fields and farms.

8.2 Method of Assessment

8.2.1 The environmental assessments of the geological and soil conditions relating to the Scheme have been carried out in accordance with the requirements of the Design Manual for Roads and Bridges (DMRB) Volume 4, Section 1, Part 7 and DMRB Volume 11, Section 3, Part 11, which includes:

- Identification of the baseline conditions, to record any potential sources of contamination through desktop surveys, site reconnaissance and preliminary ground investigation;
- Prediction of the changes to the baseline conditions as a result of the proposed Scheme;
- Identification of the mitigation measures required;
- Assessment of the residual construction impacts on soils and geology in the context of the proposed mitigation;
- Assessment of the residual operational impacts on soils and geology in the context of the proposed mitigation; and,
- Conclude the key findings.

8.2.2 There are no prescribed methodologies for determining significance of impacts to soils and geology. There are many individual factors influencing

significance for any identified impact. To determine significance, conservative, site specific quantitative risk assessment is routinely used to determine the risk a predicted impact may have on the environment.

8.2.3 Risk is commonly modelled probabilistically or by adopting 'worse case' assumptions whereas impact is determined by comparing impacts to standards (Environmental Quality Standards (EQS), Drinking Water Standards (DWS), etc.).

8.2.4 Qualitative assessments have been undertaken to determine significance criteria in relation to soils and geology. A detailed intrusive site investigation will be undertaken post planning permission which will be a combined geo-environmental assessment. A preliminary geotechnical investigation was undertaken in Spring 2006.

8.2.5 Qualitative assessments of significance have therefore been undertaken following guidance published by the Institute of Environmental Management and Assessment 'Guidelines for Environmental Impact Assessment, 2004.' This guidance lists the following headings for the determination of significance of an impact:

- Comparison with regulations and standards;
- Reference to criteria such as species, protected sites, landscapes, etc;
- Consultation with consultees and decision makers;
- Compliance with policy objectives;
- Comparison with experience on similar projects elsewhere; and,
- Experience and professional judgement of the specialist assessor.

8.2.6 This approach is appropriate to predict the potential impacts which will arise from the Scheme and has been the methodology successfully used to assess the impacts relating to soils, geology and land contamination on a number of similar infrastructure and transportation schemes.

Sources of Information

8.2.7 The following sources of information have been reviewed to obtain information regarding soils and geology for the Scheme:

- British Geological Survey Hastings and Dungeness Sheet 320/321 Solid and Drift Geology Map 1:50,000 Series, 1980.
- Geology of the country around Hastings and Dungeness, Memoir for the 1:50000 geological sheets 320 and 321, Lake, R.D. and Shephard-Thorn, E.R (Eds.), British Geological Survey, 1987.
- Hydrogeological Map of England and Wales, Institute of Geological Sciences, 1:625000 scale, 1977.
- *Policy and Practice for the Protection of Groundwater*, the Environment Agency, 1998

- Groundwater Vulnerability 1:100,000 Map Series Sheets 46 and 47. National Rivers Authority
- *The physical properties of major aquifers in England and Wales*, Environment Agency R&D 8
- Owen Williams Phase 1 Environmental Risk Assessment
- Owen Williams Preliminary Geotechnical Report. Report No. 262701/02/July2006. Issue 1
- A Landmark Envirocheck report: Report reference 15981701-7-2, 7th December 2005
- Consultation with Environmental Health Officers at Rother District Council, Hastings Borough Council and the Environment Agency.

8.2.8 The data supplied was analysed with respect to the identification of any known or likely contaminative sources, particularly associated with historical activities or processes.

Legislative Framework and Guidance

8.2.9 The assessments of the presence of contaminants within the ground and the potential impact of these contaminants have been undertaken in compliance with current legislation. The key legislation, standards and policy guidance covering soil contamination and geology which has a bearing on this Scheme, includes:

- Environmental Protection Act 1990 Part IIa;
- Contaminated Land Regulations 2000 (SI 2000/227);
- Environmental Protection (Duty of Care) Regulations 1991;
- Waste Management Licensing Regulations 1994;
- EC Landfill Directive 1999;
- Water Resources Act 1991(WRA 1991);
- Groundwater Regulations 1998 (GR 1998);
- Planning Policy Statement (PPS) 23: Planning and Pollution Control;
- Planning Policy Guideline (PPG) 14: Development on Unstable Land;
- Planning Policy Statement (PPS) 25: Development and Flood Risk;
- Pollution Prevention Guidelines, the Environment Agency;
- Environment Agency technical advise to third parties on Pollution of Controlled Waters for Part IIA of the Environment Protection Act 1990;
- Contaminated Land Report 11: Model Procedures for the Management of Contaminated Land;
- Rother District Local Plan (July 2006);
- Hastings Local Plan (Adopted April 2004);
- East Sussex and Hove and Brighton Minerals Plan; and
- East Sussex and Hove and Brighton Waste Local Plan.

Significance Criteria

8.2.10 There are no significance criteria for geology and soils listed in DMRB and WebTAG; therefore the criteria developed below and presented in Table 8.1 have been devised based on that type of assessment.

Table 8.1 Significance Criteria

Significance Criteria	Example
Large Adverse	A contaminated land source is detected which significantly exceeds national or international guidelines and is mobilised by the construction works causing a permanent effect on land quality, rendering it unusable for the existing or proposed use; or causing a permanent detrimental effect on water quality, rendering it unusable for the existing or proposed use; or leading to permanent human health detriment to construction workers or the public.
Moderate Adverse	A contaminated land source is detected which is elevated in comparison to national or international guidelines and is mobilised by the construction works causing a temporary effect on land quality; water quality or human health. Reactivation of existing slips surfaces could cause slope collapse. Acceptability of the geotechnical support materials may be less than anticipated causing slip or collapse.
Slight Adverse	A contaminated land source is detected which is the equivalent to national or international guidelines and is mobilised by the construction works causing a localised temporary impacts to land quality or water quality. A contaminated land source is detected and is mobilised by the construction works leading to a requirement for additional protection measures for construction workers or the public. Ground treatment by lime or cement stabilisation makes the soil alkaline and affects the water environment.
Neutral	No significant temporary or permanent effects on geology or soils. No significant temporary or permanent effects on land quality. No significant temporary or permanent effects on water quality. No significant temporary or permanent effects on human health.

Significance Criteria	Example
Slight Beneficial	A contaminated land source is detected and appropriate design modifications are made to encapsulate it within the scheme preventing further impacts to human health or the environment. Greater knowledge of the rock strata gained through creation of cuttings. Geotechnical treatment on existing unstable slopes.
Moderate Beneficial	A contaminated land source is detected and removed during the works, benefiting land quality, water quality or human health. Prevention of road pollution incidences directly into a Site of Special Scientific Interest (SSSI).
Large Beneficial	A significant contaminated land source is detected but is not mobilised by the construction works and is wholly or partially removed or treated during the works, benefiting the land quality, water quality or human health.

8.2.11 The significance of the predicted and residual impacts are based on the combined assessment of the scale (i.e. distance, area, volume, concentration, etc.) and duration of the effect creating the impact (i.e. short term, medium term, long term). Hence, a localised, short term impacting event is assigned a lower significance than a large scale or long term event. Additionally, greater significance is assigned to pollution or damage to the environment that is non reversible.

8.2.12 A small volume of contaminant spilt by a construction vehicle has the potential to cause contamination of surface water and groundwater but the relating pollution incident would be of lesser significance compared with a significantly larger volume of contaminant being spilt from a storage container. The latter resulting groundwater pollution impact would be greater in magnitude and would last longer within the environment once the pollution event itself has ceased and consequently would be of greater significance.

8.3 Existing Conditions

8.3.1 Baseline conditions have been determined using the data sources and surveys as mentioned previously.

Geology

8.3.2 The following descriptions represent the sequence of strata beneath the study area and are based on the published geological map, an extract of which is presented as Figure 8.1, and on the Owen Williams Preliminary Geotechnical Report (OW PGR).

Made Ground

8.3.3 No made ground is shown on the published geological maps however ground investigation indicates made ground to be present in the area of the Bexhill Connection and dismantled railway, and in discrete areas generally near existing structures along the rest of the proposed Scheme. The made ground described in the OW PGR is variable often comprising clays, sands and gravels with flints, chalk, ash, steel, glass, plastic, metal and wood.

Quaternary Deposits

8.3.4 River alluvium is present in areas near the Combe Haven and its tributaries, and other small streams along the Scheme. The OW PGR describes the alluvial material as generally comprising interbedded very soft to firm silts and clays, and loose sands, the majority of which are indicated to have some organic content.

8.3.5 The Hastings and Dungeness geological memoir (BGS, 1987) also notes boreholes at the landfill site to the south of the Preferred Route Option (G.R. 7773 1965), have proved up to 17m depth of alluvium with peat layers. At the former railway viaduct to the south of Ch 4200 (G.R. 763 103) up to 12m of clay and peat were recorded in the foundations.

Cretaceous Tunbridge Wells Sand

8.3.6 Tunbridge Wells Sand is indicated by the published geological map and the OW PGR to outcrop in the south-west area of the Proposed Route Option. The deposits encountered during the OW PGR investigation are generally described as stiff to very stiff fissured clayey silts and very dense fine sands. The geological memoir describes the formation as comprising siltstones with subordinate sandstones and mudstones, locally thin lignite beds may be present.

Cretaceous Wadhurst Clay

8.3.7 Wadhurst Clay is shown in the OW PGR to outcrop between approximately Ch 1890 to 1970, and Ch 4900 to Ch 5040. The deposits are generally described as firm to very stiff sandy gravelly clay, underlain by weathered very weak friable mudstone. Silty fine sand and sandstone (Sand in Wadhurst Clay) was also encountered approximately between Ch 4980 to Ch 5050.

8.3.8 Shear surfaces were encountered at depths up to 1.80m below ground level (bgl) in the Wadhurst Clay and erosion surfaces, rootlets or seatearth lithologies may also be present.

Cretaceous Ashdown Beds

8.3.9 The oldest formation indicated by the geological map is the Ashdown Beds which underlie much of the route corridor and is also present beneath

the Quaternary deposits in the centre of the route. Weathered Ashdown Beds were typically encountered during the OW PGR investigation as interbedded firm to very stiff clays and silts with some dense sands and gravels. Below the weathered parts, the Ashdown Beds generally comprise weak to moderately weak, occasionally strong, thinly laminated to very thickly bedded mudstone with some interbedded medium grained sandstone.

8.3.10 Details presented in the published geological memoir for sheets 320/321 describe the Ashdown Beds as comprising sandstones, siltstones and mudstones with some subordinate beds of lignite. The total thickness of this formation is between 180m and 215m. The junction with the Wadhurst clay is typically, although not invariably, marked by the presence of the Top Ashdown Sandstone, a massive sandstone up to 10m thick. The overlying Top Ashdown Pebble Bed is normally taken as the basal bed of the Wadhurst Clay.

Structural Setting

8.3.11 The 1:50000 British Geological Survey (BGS) Sheet 320/321 indicates that the site is situated on the southern limb of the Wealden Anticlinorium, a roughly WNW-ESE trending domed structure incorporating the rocks of Cretaceous age beneath the site. Faulting is associated with the folding, and the major faults in the region including the Old Town, Sidley and Wilting Faults. The majority of the proposed route is within a block roughly made by these faults.

8.3.12 The Old Town Fault crosses the proposed route at approximately Ch 475, where the route mirrors the A269 London Road. The fault runs roughly WNW-ESE, downthrowing to the south, allowing the Tunbridge Wells Sand to outcrop.

8.3.13 The Sidley Fault runs SSW to NNE from the Old Town Fault, almost tracing the proposed route along the dismantled railway.

8.3.14 The Wilting Fault traverses approximately east-west in the far north east of the proposed route. Downthrow is to the south, leading to the juxtaposition of Wadhurst Clay and Ashdown beds.

8.3.15 Several other minor faults may be inferred from the BGS Sheet to cross the path of the proposed route. A more detailed study of the geology, hydrology and hydrogeology is now presented, splitting the Scheme into two parts as mentioned in the introduction to the study area.

Bexhill Connection (Ch 0 – Ch 1500)

8.3.16 This part of the Scheme is within the urban extent of Bexhill. The southern end requires some property take. The section at present comprises residential and industrial land with derelict and operational buildings, rough land and the dismantled railway.

8.3.17 From approximately Ch 1100 the Scheme is almost wholly contained within the route of the dismantled railway. The railway fell into disuse around 1964 (Sussex Industrial Archaeology Society, 2004). This part of the Scheme is located in cuttings generally increasing in height from the southern part of the section to the northern part, from no cutting to a cutting of approximately 12m at the Glovers Farm Overbridge.

8.3.18 The Scheme would be on a small embankment at the southern end (Ch 0 ~ Ch 300) before being in cutting for the rest of the section. Most of the cuttings currently exist as part of the dismantled railway, however require modification in places.

Geology of the Bexhill Connection

8.3.19 From Ch 0 to Ch 800 (south of Ninfield Road Overbridge) the Scheme is underlain by Cretaceous Tunbridge Wells Sand Formation. Alluvial deposits were encountered overlying the Tunbridge Wells Sand between Ch 250 to Ch 685.

8.3.20 The Scheme crosses the Old Town Fault at around Ch 475. The Old Town Fault runs roughly WNW-ESE, downthrowing to the south.

8.3.21 At approximately Ch 800 the Scheme crosses the NNE-SSW trending Sidley Fault, which downthrows to the west. The location of this fault is uncertain on the BGS map.

8.3.22 Between the Sidley Fault and Ch 1500 the Scheme is underlain by Ashdown Beds.

Hydrology and Hydrogeology of the Bexhill Connection

8.3.23 Egerton Stream flows in a southerly direction from around Ch 690 and in places is sited in a 3m deep cut. The stream appears to be underground, possibly within a culvert, from Ch 0 to Ch 150. It is just off the line of the Scheme at Ch 150. The Scheme crosses the stream between Ch 200 and Ch 300 so the stream runs on the eastern side until approximately Ch 610. The stream then crosses the Scheme to where it leaves the study area around Ch 690.

8.3.24 This section of the Scheme is not located in the Environment Agency Indicative Flood Plain (EA IFP). Groundwater beneath this part of the Scheme is predicted to be within 5m of the ground surface, possibly deepening to the north of the section.

8.3.25 This section is designated as a minor aquifer (variable permeability) of high leaching potential (Soil Class U). The site is not located within a Groundwater Source Protection Zone.

8.3.26 Although the site is not considered to be significantly contaminated, the historical presence of a railway, current industrial and other general usage

cannot preclude the presence of contaminated materials at the site. Further information relating to the hydrology and hydrogeology of the Bexhill connection can be found in Chapter 9: Water Quality and Drainage.

The Rural Section including Queensway Junction (Ch 1500 – Ch 5500)

8.3.27 This section of the Scheme traverses the hills and valleys around the Combe Haven. Land use is mainly agricultural. The Scheme would consist of several cuttings through the hills and embankments over the valleys. The Scheme crosses four main tributaries to the Combe Haven and in places several other drainage channels.

8.3.28 Little variation in land use is shown on the historical Ordnance Survey maps. The Scheme crosses the disused railway at Ch 4200. It also crosses existing Crowhurst Road at Ch 5150 and the existing London to Hastings Railway at Ch 5300. A gas valve compound is present just to the south of the Scheme around Ch 5120.

Geology of the Rural Section

8.3.29 This part of the Scheme is largely underlain by Ashdown Beds.

8.3.30 In some sections (approximately Ch 1890 to Ch 1950 and Ch 4670 to Ch 5040) Wadhurst Clay is thought to underlay the Scheme. Sand in Wadhurst Clay underlies the Scheme from approximately Ch 4900 to Ch 5050.

8.3.31 Where the Scheme crosses streams and valleys river alluvium would be encountered.

Hydrology and Hydrogeology of the Rural Section

8.3.32 Four surface watercourses and several drains are present along this section of the Scheme. Groundwater beneath the site is generally close to surface in the valley sections (<2m) and deeper beneath the hills.

8.3.33 The majority of this section of the Scheme is upon a minor aquifer (variable permeability) of intermediate or low leaching potential (Soil Class 1). A small section to the north of the Scheme is upon a non-aquifer.

8.3.34 No licensed abstractions are noted within the Envirocheck report within 250m of the Scheme. In addition the Local Authority has stated that there are no private abstractions within 250m of the Scheme alignment. Further information relating to the hydrology and hydrogeology of the Rural Section can be found in Chapter 9: Water Quality and Drainage.

Designated Geology and Geomorphological Sites

8.3.35 Regionally Important Geological and Geomorphological Sites (RIGS), designated by locally developed criteria, are currently the most important places for geology and geomorphology outside statutorily protected land such as SSSIs. The designation of RIGS is one way of recognising and protecting important earth science and landscape features for future generations to enjoy.

8.3.36 RIGS are those which, whilst not benefiting from national statutory protection, are nevertheless regionally or locally representative sites where consideration of their importance becomes integral to the planning process according to the Earth Science Conservation Strategy (ESCS).

8.3.37 RIGS are equivalent to local Wildlife Sites and other non-statutory wildlife designations. They can be listed in local authorities' development plans and shown on ‘alert maps’.

8.3.38 No RIGS are present along the Scheme, the nearest being Galley Hill and Little Galley Hill approximately 2km southeast of the part of the Scheme. These would not be affected by the Scheme.

Mineralogical Facilities

8.3.39 There are no recorded coal mining hazards within 250m of the study area. Several low risk shallow mining hazards are identified within the Envirocheck report. Those of note include one approximately 30m west of Ch 1150 and one approximately 20m east of Ch 0 the Scheme. These hazards relate to possible historical chalk mining in the area and so the presence and exact location of these features is often unknown and undocumented.

8.3.40 A Low and Very Low hazard potential for Running Sand Ground Instability and Shrinking or Swelling of Clay Ground is identified in the Envirocheck report. The area is not shown to be Radon affected, with less than 1% of the housing above the action level.

Potential for Soil and Groundwater Contamination

Industrial Land Use

8.3.41 The Envirocheck report contains numerous contemporary trade entries, the majority of which occur in the Bexhill Connection part of the Scheme. These include ones relating to vehicle sales and garages, waste disposal, builders merchants, joinery manufacture, washing machine servicing, cleaning services, blind making, antiques restoration, printing, upholstery cleaning, furniture manufacturing, gas supplying, tile manufacture, and petrol filling stations.

8.3.42 Three contemporary trade entries are located near the northern end of the Scheme which relate to cladding, plastics extrusion and sheet metal

work. These industrial land uses have been identified as possible sources of contamination that may affect the Scheme. A map showing the key potential contamination sources is presented in Figure 8.2.

8.3.43 Although the site is not considered likely to be significantly contaminated, agricultural usage cannot preclude the presence of contaminated materials at the site. A summary of the water quality classifications for the Scheme area is provided in Chapter 8: Water Quality and Drainage.

Walkover Survey

8.3.44 In addition to the review of the published data, a walkover survey was conducted in order to establish if there were any other areas of potential contamination. This is detailed in the Owen Williams Phase 1 Environmental Risk Assessment and summarized in Table 8.2. A further walkover conducted by Mott MacDonald in June 2006 did not encounter any obvious further potential sources of contamination.

Table 8.2 Summary of Walkover survey[1]

Location	Possible Contaminants
Corporation Yard (Ch 150 – Ch 300)	Asphalt, tar, mineral oils, metals, asbestos, unknown oils.
Egerton Stream (Ch 300 – Ch 690)	Unknown oils, metals, fly tipped waste.
McNicholas Yard (Ch 690 – Ch 825)	Asphalt, tar, mineral oils, metals, fly tipped waste.
Hav-a-Skip Yard (Ch 825 – Ch 950)	Fly tipped and other waste, asphalt, tar, mineral oils, metals.
1066 Motorcycle Training (Ch 975 – Ch 1125)	Fly tipped waste, asphalt, tar, mineral oils, metals.
Dismantled railway (Ch 300 – 1500)	Metals, sulphates, asbestos, hydrocarbons, PCBs. Severe fly tipping has also occurred along several stretches of the dismantled railway.
Agricultural Land (Ch 1500 – Ch5100).	Occasional locations of fly tipping, possible red algae, buried carcasses, asbestos, fertilisers and pesticides.
Gas Valve Compound (Ch 5120)	Asbestos.
Existing Railway (Ch 5290 – Ch 5310)	Metals, sulphates, asbestos, hydrocarbons, PCBs.

Notes:

[1]The detailed nature and extent of contamination at the locations identified in the above table is yet to be confirmed. The contaminants listed are typical of those found with the associated land use. Detailed site investigations will be conducted post planning consent.

Waste

8.3.45 Three local authority recorded landfill sites are identified within the study area: Glover's Farm (Ch 1650), Hillcroft Farm (Ch3500) and Upper Wilting Farm (Ch 5500). Glovers Farm was reportedly used in the late 1800s for the tipping of farm waste, ash and glass bottles. According to the Envirocheck report the license lapsed in January 1979. According to a report provided by the local authority Hillcroft Farm has been used for various unlicensed waste disposal activities since the1960s. According to the Envirocheck report Upper Wilting Farm was license to accept inert waste but the licence lapsed in January 1979.

8.3.46 Two operational licensed Waste Management and Transfer Stations are identified: Sidley Waste Transfer depot located at approximately Ch 750 operated by East Sussex County Council (ESCC) classed as a household, commercial and industrial transfer station. A metal recycling facility located approximately 250m south of Ch 0 and operated by F. Davis & Co.

8.3.47 There is a registered waste treatment and disposal site identified at Adams Farm at Ch 4000 which dealt with scrap metal and lead-acid batteries. The licence lapsed in 1978.

8.3.48 Fourteen Environment Agency (EA) discharge consents have been issued within 250m of the site. Of these 6 are known to have been revoked. Consents of note include: Three storm sewage overflow consents, issued for discharge to freshwater streams or rivers, 20m west of Ch 300, 20m west of Ch 500 and 10m west of Ch10. Six surface water discharge consents, issued for discharge to freshwater streams or rivers, 10m east of Ch 1150, 20m west of Ch 200, 50m west of Ch 180, 80m west of Ch 0, 75m west of Ch 300 and 250m southwest of Ch 0. Discharge consents for the wider area are detailed in Section 8.3 of the Water Quality and Drainage Chapter.

8.3.49 Two category 3 minor pollution incidents occurring within 250m of the site were identified in the Envirocheck report as follows:

- A release of petrol into a drain occurred in 1997 from a residential property 15m west of Ch170; and,
- A release of chemicals into a surface water drain occurred in 1994 from an industrial property 233m southwest of Ch 0.

Hazardous Substances

8.3.50 No hazardous substances, Control of Major Accident Hazardous Sites (COMAH), explosive sites or planning consents or enforcements relating to hazardous substances were recorded within 250m of the study area.

Site Investigation

8.3.51 The OW PGR was undertaken taken during Spring 2006 and data incorporated in the sections above. Further intrusive investigation is planned

for post planning permission in which testing for contaminants shall be an integral part.

Key Receptors

8.3.52 Key Receptors from contamination comprise construction workers, neighbouring residents, the surrounding land, surface waters and groundwater, the soil structure itself and related ecology, as well as the Scheme. This includes the Combe Haven SSSI, agricultural land and livestock.

8.3.53 The principal potential effect of the construction would be the need to remove or treat contaminated materials which pose unacceptable risks to receptors. Disturbance of contaminated materials may activate or enhance existing pathways to known receptors. Construction workers would also be potentially at risk from contamination through contact with harmful materials.

8.4 Mitigation Strategy

8.4.1 The site can be considered in two sections for clarity. The Bexhill Connection (Ch 0 to Ch 1500) and the Rural Section including Queensway Junction (Ch 1500 – Ch 5500).

8.4.2 In the baseline assessment, which at present consists of a Phase 1 Environmental Risk Assessment, Desk Study assessments, walkover surveys and Preliminary Geotechnical Report, potential contaminant sources have been identified. However to date chemical analysis has not been undertaken to allow site characterisation or the nature and significance of any contaminants that may be present. This will be undertaken as part of the geo-environmental site investigations which are planned post planning permission.

8.4.3 The Bexhill Connection is within the urban extent of Bexhill. As such several possible sources of contamination have been identified and a degree of soil contamination should be expected in this part of the Scheme.

8.4.4 The Rural Section is agricultural and due to the rural nature of this part of the Scheme, very little soil contamination is predicted in this area. However certain chainages are identified as having possible contaminants.

8.4.5 No contaminant concentrations have been determined to date. The contaminated land mitigation strategy will be developed in line with current best practise as detailed in CLR 11-Model Procedures for the Management of Contaminated Land. A summary of the main stages is provided as Appendix 8-A.

8.4.6 The current baseline assessment has identified several potentially significant contaminant sources within the Bexhill Connection part of the Scheme, and few potentially significant contaminant sources within the Rural Section section.

8.4.7 A worst case scenario may arise where the risk assessment undertaken indicates that some form of remedial works are necessary. In cases such as these the remediation strategy employed would endeavour to utilise innovative and sustainable techniques to treat identified contaminated material where it is cost effective and practicable to do so. These techniques may include a range of biological, chemical and physical treatments such as biopiles, air sparging or soil washing employed either prior to or during construction.

8.4.8 It should be noted, however, that in the event of remediation works being necessary, site specific factors, such as the quantity of contaminated material identified and the nature of the contaminants, may mean that the use of such remediation techniques is not practicable, and that a more traditional disposal at landfill is required. It is possible that some areas may also require vertical or horizontal barriers or containment systems or complete removal of identified sources (i.e. leaking oil tanks).

8.4.9 Mitigation measures relating to surface and groundwater quality are discussed in further detail in Chapter 9: Water Quality and Drainage.

8.4.10 Cuttings, embankments, side slopes and drainage measures would be designed into the Scheme to avoid risk of instability to adjacent land outside the construction site. Techniques employed would include soil nailing, drainage blankets and reinforced earth. Where cuttings, embankments, side slopes and drainage are currently in place, assessment of their current performance and performance under the new conditions shall be undertaken.

8.4.11 An earthworks strategy detailing the removal, handling, storage and placement of soils is presented in Chapter 3B: Construction Strategy. The earthworks strategy will be further developed following award of contract to construct the Scheme. The earthworks strategy will form part of the Construction Environmental Management Plan (CEMP).

8.4.12 Areas of fly tipping would be further characterised to assess the presence of potential contaminant sources. Once the waste has been characterised it would be cleared and disposed of off-site to a suitable licensed waste management facility.

8.4.13 Ground stabilisation techniques may be utilised on the Scheme. These may include the use of lime, which could have an adverse impact on some species of plants and animals and change the relative abundance of others. Mitigation measures to manage and eliminate each of the risks identified are presented in Table 8.3 and Table 8.4.

Table 8.3 Lime and Cement Stabilisation Mitigation During Construction

Risk	Action
1. Dust generated during mixing causing contamination.	Follow DMRB (4.1.6) guidelines and general good construction practice, use of appropriate plant and care in workmanship.
2. Contamination of aquifer by leachate from treated materials resulting in breach of Groundwater Regulations and contamination of surface waters. 3. Alkaline leachate increasing the alkalinity of the soil and groundwater environment. 4. Leachate causing changes to the groundwater chemistry within Drinking Water Regulations. but significantly altering the taste of the water used in private supply.	Leaching tests and field trials to fully characterise the site materials and their behaviour; selection of appropriate testing. Testing to analyse leachate chemistry both before and after placement of the treated materials. Pre earth works drainage construction to be completed prior to stabilisation operations. Rapid earthwork construction. Protection of earthworks from excessive ingress of water during construction, i.e. normal procedure of compaction of layer with cross-fall at end of each day. Treatment of collected leachate prior to controlled discharge and monitoring.

Table 8.4 Lime and Cement Stabilisation Mitigation Long Term

Risk	Action
5. Contamination of aquifer by leachate from treated materials resulting in breach of Groundwater Regulations.	Leaching tests and field trials to fully characterise the site materials and their behaviour, selection of appropriate testing. Testing to analyse leachate chemistry both before and after placement of the treated materials. Encapsulation of fill material beneath road pavement and appropriate thickness of more cohesive landscape fill on the embankment shoulders to reduce leachate volume. Treatment of collected leachate prior to controlled discharge and monitoring.
6. Alkaline leachate increasing the alkalinity of the soil and groundwater environment, impacting on local ecology.	As 5. above. Include groundwater monitoring as part of ecological and soil chemistry monitoring.
7. Blocking of drainage by precipitation of Calcium Carbonate from leachate.	Monitoring and maintenance of drainage layers and collection vessels.

8.5 Construction Impacts

8.5.1 The predicted impacts and an assessment of their significance are presented in Table 8.5, Table 8.6, Table 8.7 and Table 8.8.

8.5.2 The following tables summarize the predicted construction impacts. The tables are divided into construction impacts relating to the geology in the Bexhill connection and the Rural Section and construction impacts resulting from land contamination in the Bexhill connection and the Rural Section. The events have been determined from the proposed design of the Scheme and the predicted impacts from consideration and experience.

Table 8.5 Construction Impacts on Geology, their significance and mitigation measures – Bexhill Connection

Event	Predicted Impact	Mitigation Measures	Residual Impact
1. Demolition of buildings and modifications to current road network (e.g. Ch 0 – Ch 300)	Demolition and excavation may create surplus spoil, likely to be variable in composition possibly with elevated levels of residual contamination. This may require special consideration for re-use or disposal at a suitable licensed landfill.	Excavated spoil deemed unsuitable for reuse on site by testing, should be removed to a suitable licensed landfill and the necessary measures should be implemented to ensure compliance with the Environmental Protection Act (1990) and waste legislation.	Neutral
2. Excavation necessary for road construction.	Excavation may create surplus spoil, likely to be variable in composition possibly with elevated levels of residual contamination. This may require special consideration for re-use or disposal at a suitable licensed landfill.	Excavated spoil deemed unsuitable for reuse on site by testing, should be removed to a suitable licensed landfill and the necessary measures should be implemented to ensure compliance with the Environmental Protection Act (1990) and waste legislation.	Neutral
3. Excavation of existing cuttings	Widening of base of existing railway bed to accommodate Scheme necessitating excavation and steepening of existing cut slopes. May initiate short term slope failures. This may impact on construction and property along the corridor.	Geotechnical assessment of cutting stability and correct design of new slopes as a result of Ground Investigation to ensure stability is maintained. Short term slope support measures could be implemented.	Neutral
	Will provide exposures again through an area of complex geological structure. Opportunities for geologists to re-map and review geological strata and location and form of various faults.	Contractor to provide access to BGS geologist and other relevant research bodies to allow undertaking of remapping during construction.	Slight beneficial
4. Dust resulting from excavation of fine soils and silts.	Dust into atmosphere decreasing visibility on roads and reducing air quality.	When dust is anticipated wetting of the strata should be undertaken to keep dust down. Suitable precautions should be taken to avoid entry of silted water to watercourses. Further discussion of air quality mitigation measures is provided in Chapter 10: Air Quality.	Neutral
5. Use of lime and cement for ground stabilisation	Alteration of the chemistry of the water environment causing impacts to water quality or aquatic environment.	As detailed in Table 7.3 and Table 7.4.	Neutral

Table 8.6 Construction Impacts on Geology, their significance and mitigation – The Rural Section including Queensway Junction

Event	Predicted Impact	Mitigation Measures	Residual Impact
6. Cuttings in hillsides	Will provide new exposures through an area of complex geological structure. Opportunities for geologists to map and review geology.	Contractor to provide access to BGS geologist and other relevant research bodies to allow undertaking of remapping during construction.	Slight Beneficial
	May lead to instability and short term failure of cuttings during construction. May damage property and surrounding land leading to loss of crop or sensitive habitats. May also delay construction of the Scheme.	Geotechnical assessment of cutting stability and correct design of new slopes as a result of Ground Investigation to ensure stability is maintained. Short term slope support measures could be implemented.	Neutral
	Excavation may create surplus spoil.	This spoil is likely to be relatively uncontaminated and would be used elsewhere in the Scheme.	Slight beneficial
7. Demolition of buildings and modifications to current road network	Demolition and excavation may create surplus spoil, likely to be variable in composition possibly with elevated levels of residual contamination. This may require special consideration for re-use or disposal at a suitable licensed landfill.	Excavated spoil deemed unsuitable for reuse on site by testing, should be removed to a suitable licensed landfill and the necessary measures should be implemented to ensure compliance with the Environmental Protection Act (1990) and subordinate legislation.	Neutral
8. Dust resulting from excavation of fine soils and silts.	Dust into atmosphere decreasing visibility on roads and reducing air quality.	When dust is anticipated wetting of the strata should be undertaken to keep dust down. Suitable precautions should be taken to avoid entry of silted water to watercourses. Further discussion of air quality mitigation measures is provided in Chapter 10: Air Quality.	Neutral
9. Use of lime and cement for ground stabilisation	Alteration of the chemistry of the water environment causing impacts to water quality or aquatic environment.	As detailed in Table 7.3 and Table 7.4.	Neutral

Table 8.7 Construction Impacts on relating to Land Contamination, their significance and mitigation – The Bexhill Connection

Event	Predicted Impact	Mitigation Measures	Residual impact
10. Construction workers and site visitors exposed to soil and groundwater contamination particularly around the dismantled railway.	Site personnel may experience detrimental health impacts due to exposure.	Site investigations completed prior to the construction of the link road will identify the nature and extent of contamination and ensure that appropriate health and safety and personal protection measures are provided.	Neutral
11. Residents in close proximity to the Scheme may be exposed to soil and groundwater contamination	Residents may experience detrimental health impacts due to exposure to contaminants.	Site investigations completed prior to the construction of the link road will identify the nature and extent of contaminants along the route. The Environmental Management Plan will ensure that appropriate techniques are employed during construction to minimise exposure.	Neutral
12. Residual contamination is mobilised by ground works and nearby water resources are impacted.	Detrimental impact to groundwater or surface water resources in the vicinity of the Scheme.	Site investigations completed prior to the construction of the link road will identify the nature and extent of contamination along the route. If contaminants are present which are considered to pose unacceptable impacts to water resources, remedial treatment should be undertaken prior to construction works.	Neutral
13. Sources of contamination are identified and removed during the construction works.	Improvement in land quality in respect to contamination in relation to the proposed Scheme.	Land quality improvement works undertaken as part of the construction. Appropriate treatment and removal works for contaminated materials.	Slight beneficial

Table 8.8 Construction Impacts on relating to Land Contamination, their significance and mitigation – The Rural Section including Queensway Junction

Event	Predicted Impact	Mitigation Measures	Residual impact
14. Construction workers and site visitors exposed to soil and groundwater contamination	Site personnel may experience detrimental health impacts due to exposure.	Site investigations completed prior to the construction of the link road will identify the nature and extent of contamination and ensure that appropriate health and safety and personal protection measures are provided. An emergency procedure will be developed where unknown contaminants are encountered.	Neutral
15. Residual contamination is mobilised by ground works and nearby water resources are impacted.	Detrimental impact to groundwater or surface water resources in the vicinity of the Scheme.	Site investigations completed prior to the construction of the link road will identify the nature and extent of contamination along the route. If contaminants are present which are considered to pose unacceptable impacts to water resources, remedial treatment should be undertaken prior to construction works.	Neutral
16. Sources of contamination are identified and removed during the construction works.	Improvement in land quality in respect to contamination in relation to the proposed Scheme.	Land quality improvement works undertaken as part of the construction. Appropriate treatment and removal works for contaminated materials.	Slight beneficial

8.6 Operational Impacts

8.6.1 The predicted operational impacts and an assessment of their significance are presented in Table 8.9 and Table 8.10.

8.6.2 The following tables have been constructed to summarize predicted operational impacts. The tables are divided into operational impacts relating to the geology in the Bexhill connection and the Rural Section.

8.6.3 Routine surface water run off pollutants are covered in Chapter 9: Water Quality and Drainage.

8.6.4 There are no operational impacts predicted for land contamination.

Table 8.9 Predicted Operational Impacts on Geology, their significance and mitigation measures – Bexhill Connection

Event	Predicted Impact	Mitigation Measures	Residual impact
15. Long term slope failure	Possible damage to surrounding property. Disruption to road which may need clearing and repair resulting in closure.	Appropriate slope design and engineering possibly incorporating drainage, vegetation etc.	Neutral

Table 8.10 Operational Impacts on Geology, their significance and mitigation – The Rural Section including Queensway Junction

Event	Predicted Impact	Mitigation Measures	Residual impact
16. Long term slope failure	Possible damage to surrounding property. Disruption to road which may need clearing and repair resulting in closure.	Appropriate slope design and engineering possibly incorporating drainage, vegetation etc.	Neutral

8.7 Conclusions

8.7.1 The Scheme is to be constructed in both urban and rural areas. Several possible contaminant sources have been identified in the urban area and few in the rural parts of the Scheme. Future ground investigation will seek to determine whether these potential sources of contamination have impacted on soil and water quality.

8.7.2 Any contaminants that may cause significant impact to the Scheme or that may be mobilised during the construction phase and affect identified receptors have been initially assessed using a Phase 1 site specific risk assessment. Further intrusive investigation and laboratory testing would be undertaken to establish the scale and significance of identified possible contaminants. Then an appropriate course of action including remedial works if necessary would be undertaken. If this route is followed then innovative and environmentally sustainable remedial methods would be considered prior to off-site disposal. Where cost effective and practicable, material would be treated and re-used on site. Provided suitable mitigation measures are carried out during construction as required the overall impact of contamination on the Scheme during the construction and operational phases will be neutral.

8.7.3 The Scheme may include lime/cement stabilising of some soils to enhance their geotechnical suitability. Detailed ground investigation and good construction practice would ensure that the risk of contamination to groundwater and local ecology will be mitigated and the overall impact to be neutral.

8.7.4 Provided the relevant mitigation measures are implemented it is considered unlikely that the construction and operation of the Scheme would adversely affect the geology of the surrounding area. The cuttings necessary for the Scheme would expose the geology and provide an increase in knowledge of the area.

8.7.5 Hydrology and hydrogeology impacts are discussed further in Chapter 9: Water Quality and Drainage.

8.7.6 The overall impact of the Scheme in terms of geology, soils and land contamination is considered to be neutral, provided the mitigation measures are incorporated and best practise is followed within the detailed design stage and during the construction phase.