6.0 Geology, Soils and Groundwater

6.1 Inroduction

1. This draft Chapter presents the potential environmental impacts of the proposed development upon the geology, soils and groundwater beneath the site. It also presents an assessment of existing impacts from contaminated soils on human health and the environment and those arising from disturbance from the construction of the proposed development and its operation.

2. The Assessment being prepared as part of the ES is considering the impacts of the Proposed Development as a whole, including the 'main site' of the SRFI itself, and the other components of the Proposed Development including development of the Bypass Corridor and other highways mitigation works (including at Junction 15, 15a, and on the A508 corridor route).

3. Some supplementary investigation and assessment work is still being processed and will be incorporated into the final ES chapter ahead of submission. The work undertaken to date provides a detailed characterisation of the geological ground model to form the baseline for the assessment of potential risks both during construction and operation of the proposed scheme. In doing this, assessments of the potential impacts resulting from soil, soil gas and groundwater contamination have been assessed along with minerals potential, ground stability and earthworks. The likely impacts are assessed within this chapter and the detailed supporting information is provided within the reports which form the appendices to this chapter.

4. This Chapter describes:

- The strategic planning context;
- The assessment methodology and significance criteria adopted in undertaking the assessment;
- An overview of the baseline conditions on much of the Proposed Development site, and initial assessments of likely impacts;
- An assessment of the potential significant impacts and proposed mitigation for the construction phase; and

- The potential significant impacts and proposed mitigation for the operation phase.

5. This Chapter also describes an assessment of any potential cumulative impacts with other relevant development proposals relating to geology, soils and groundwater with particular reference to contaminated land and mineral extraction.

6. The work to date has been informed in part by work completed as part of a planning application on a large part of the main site in 2014. The investigations and assessments have been undertaken in line with current practice to robustly confirm the existing ground model for the site.

6.2 Planning Policy Context

This section discusses the national, regional and local policies that exist and apply to the application proposal.

6.2.1 National Policy - Contaminated Land & Land Stability

1. The Proposed Development is a Nationally Significant Infrastructure Project (NSIP) and as such the key source of national policy is the **National Policy Statement for National Networks** (NPSNN) (Ref. 6 – 24). The NPSNN includes guidance regarding the key issues to be considered and assessed when bringing forward NSIP proposals on the national networks, including SRFI. Section 5 of the NPSNN identifies '*Land instability*' as one of the generic impacts to be considered, with cross-reference to the planning policy guidance set out in the NPPF (see below). Other parts of the same Section refer to issues relating to water quality, and to dust, which can also have some relevance to the issues of focus in this chapter.

2. The NPSNN also includes brief references to mineral resources, primarily in the 'land use' part of Section 5. It states that applicants should "*safeguard any mineral resources on the proposed site as far as possible*" (paragraph 5.169), and that the Secretary of State should ensure "*appropriate mitigation measures*" are put forward (paragraph 5.182).

3. In addition to the NPSNN, the **National Planning Policy Framework** (NPPF) (Ref. 6-1) recommends that planning decisions should aim to ensure that:

- *'New development is appropriate for the location with respect to pollution and instability';*

- *'The effects of pollution on health, the natural environment, general amenity and potential sensitivity of the area or proposed development to adverse effects of pollution should be taken account of';*
- *'Where a site is affected by contamination or land instability that responsibility for securing safe development rests with the developer';*
- *'The site is suitable for its new use taking account of ground conditions and land instability and proposals for mitigation including land remediation'; and*
- *'That following remediation land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990'.*

4. The National Planning Policy Framework (NPPF) and the National Planning Policy Guidance (NPPG) (Ref.6-23) replaced numerous earlier documents including

- Planning Policy Statement 23: Planning and Pollution Control, 2004;
- Planning Policy Guidance 14: Development On Unstable Ground, 1990; and
- Minerals Policy Statement 1: Planning and Minerals, 2006.

5. However the principal guidelines for identifying environmental impacts and mitigating these impacts defined within these now superseded documents are still relevant to assist in the appraisal of proposed developments and have been adopted within the NPPG with respect to these three aspects.

6. Planning Policy Statement 23 (PPS 23) superseded by the current NPPG addresses the prevention of water pollution and provides guidance on the location of and the appropriateness of certain 'polluting' developments so as to prevent pollution and ensure that the environment and human health were protected

7. Planning Policy Guidance 14 (PPG 14) superseded by the NPPG addresses the need to mitigate the risks of instability on land from underground natural or manmade features including solution features and mining and the existence of existing instability or the nature of the proposed development causing activation of slope instability.

Minerals Policy Statement 1 (MPS 1) superseded by the NPPG addresses the need to identify potential mineral resources that required safeguarding for future exploitation and to ensure that planned development takes account of this avoiding non mineral development over such

resources without due consideration to the potential to allow these resources to be removed in advance or after development has been completed.

6.2.2 National Legislation - Contaminated Land & Land Stability

1. The management of potentially contaminated or contaminated land is regulated under **Part IIA of the Environmental Protection Act (EPA) 1990** (Ref.6-2) updated within Part IIA Statutory Guidance April 2012 and by the use of the **Contaminated Land Regulations (England) 2006** (Ref.6-3) amended 2012.
2. This is underpinned by the risk-based 'suitable for use' approach, which the Government considers as the most appropriate to deal with historic contamination. The purpose of the contaminated land regime is to investigate and, if necessary, remediate land to ensure that it is suitable for its current use. The management of contaminated land within the planning regime is achieved by assessing risks posed by contamination in relation to the proposed use of the site, and ensuring that it is suitable for use before planning permission is granted. Under both regimes, it is the existence of potentially unacceptable risk due to contamination, rather than the presence of contamination alone that is the 'driver' for remedial action.
3. Under Part IIA of the EPA, sites are identified as "contaminated land" if they are: (a) causing significant harm, or if there is a significant possibility of such harm, or (b) if the site is causing, or could cause, pollution of controlled waters. The Contaminated Land Regulations provide for the circumstances in which contaminated land requires to be designated as a "special site" and provides for a remediation regime in that regard. The Water Environment commonly known as the "**Water Framework Directive** (WFD)", (Ref.6-4) provides for a single system of water management at the river basin or catchment level.
4. Once a site is determined to be "contaminated land" then remediation may be required to render significant pollutant linkages (i.e. the source-pathway-receptor relationships that are associated with significant harm and/or pollution of controlled waters) insignificant, subject to a test of reasonableness.

5. Part 4 of **Groundwater Protection: Policy and Practice (GP3)** (Ref.6-9) summarises the legislation relevant to the management and protection of groundwater and sets out the Environment Agencies associated and complementary policies. This sets out the land contamination policy and legal framework regarding the contamination and the protection of groundwater.
6. In a Source Protection Zone (SPZ) 1, the EA will object to proposals for new developments such as waste treatment facilities. In all other areas, the EA applies a risk-based approach to management of non-landfill waste operations as detailed within (Ref.6-7 & 6-8) that present a risk to groundwater. Where necessary, activities are controlled via permits (Ref.6-5).

6.2.3 Local & Regional Policy- Contaminated Land & Land Stability

1 In addition to the national policies and guidance detailed above, baseline conditions have also been assessed with reference to the local South Northamptonshire Council requirements in order to put any potential impacts in a localised context.

2 In particular the South Northamptonshire Council Local Plan Saved Polices (Ref.6-16 and South Northamptonshire Council Settlements and Development Management Policies Local Plan (Ref.6-17) has been consulted. No particular local plan policies were identified specific to this chapter.

3 South Northamptonshire Council Contaminated Land Strategy 2009 (Ref.6-19) was consulted and a review of the information contained within this and the scoping opinion raised the potential for naturally occurring elevated arsenic concentrations within soils and Radon Gas related to the presence of Northampton Sand Ironstones. However these geological formations are present across the site and this has been confirmed within the various desk based studies in consideration of the available geological mapping and intrusive investigations undertaken and detailed within the appendices to this chapter.

6.2.4 Local & Regional Policy – Minerals (Sand & Gravel resources)

1 The British Geological Survey Mineral Safeguarding in England Good Practice and Guidance (Ref.6-10) has been consulted along with the British Geological Survey Mineral Resource

Information for Development Plans Northamptonshire: Resources and Constraints (Ref.6-11). The general guidance and NPPF guidance for mineral planning suggests that the Mineral Planning Authority's should plan to have permitted and allocated sites (land bank) with sufficient capacity to provide a steady supply of sand and gravel aggregates for at least the next seven years, the yearly amounts required being determined by the last ten years requirements. Work carried out by the BGS reported in this document specific to Northamptonshire suggests that the BGS had "***revealed quite extensive concealed glacial sand and gravel resources, approximately doubling the known extent of resources within this area"***.

2 Northamptonshire County Council Minerals and Waste Local Plan Submission Document: Local Aggregates Assessment 2013 (Ref. 6-14) has been consulted and this demonstrates a significant decline in the sales of Sand and Gravels between 2002 and 2011 with needs dropping from 0.9M tonnes in 2002 to 0.23M tonnes in 2011. This report also confirms that all but one of the seven surrounding Mineral Planning Authorities have land bank supplies of sand and gravel in excess of 7 years indicating that there is not a great regional shortfall in supply availability. The report indicates that Northamptonshire County Council has sufficient "permitted and allocated" sites available to provide sufficient sand and gravel supply for the next 20 years, 13 years more than the national guidance suggests is required. The report notes that the quality of the resource can limit extraction opportunities. Whilst it is reported that there had been a diversification from river terrace resources to greater emphasis on exploitation of glacial sands and gravels, it has been reported that the mineral extraction industry has to date (at the time of reporting) not put forward any applications to exploit glacial sands and gravel resources. It is reported that this is likely to be a result of the more variable and less economic nature of the deposits. The report later confirms that higher yields per hectare are likely to be achieved outside of the county suggesting that this fact makes it less economically feasible to exploit such resources within the County.

3 The Northamptonshire Minerals and Waste Development Framework; Core Strategy DPD 2010 (Ref.6-12), Locations for Minerals Development DPD 2011 (Ref.6-13), Minerals and Waste Local Plan (Ref.6-15), online Minerals & waste Development Framework Plans and

Development Framework and South Northamptonshire Council consultation document (Ref.6-18) have been consulted. The online plans have identified that the main development site sits partially across a large Minerals Safeguarding Area but does **not** sit within a permitted or allocated development site.

4 The plans also show that a site MA2 is allocated between Milton Malsor (west) and Collingtree (east) immediately north of the proposed site. Details provided within the plans indicate that the allocated site MA2 is 15Ha and is anticipated to yield a quantity of 1.2M tonnes of sand and gravel. It is noted that access for removal of the product cannot be through the two villages and that road access is not viable at this time. Exploitation of the mineral at this site is wholly dependent upon provision of new infrastructure including a new road bridge over the Railway to join the Towcester road.

5 It is stated within the Local Plan ***"The Local Plan identifies sufficient sites for both sand and gravel and crushed rock to meet the plans total provision".***

6 With respect to sand and gravel resources the plan also notes that ***"The allocations therefore provide 2.1M tonnes beyond that which is required to be identified".***

7 Policy 1; providing for an adequate supply of aggregates states;

- *"Provision will be made over the plan period 2011 to 2031 for the extraction of 10million tonnes of sand and gravel (annual average of 0.5M tonnes)*
- *The maintenance of a land bank of at least 7 years for sand and gravel will be sought."*

8 Policy 32: Mineral Safeguarding Areas (MSA) states that "*Development of a significant nature within Mineral Safeguarding Areas will have to demonstrate that the sterilisation of proven mineral resources of economic importance will not occur as a result of the development, and that the development would not pose a serious hindrance to future extraction in the vicinity. If this cannot be demonstrated, prior extraction will be sought where practicable".*

9 This policy goes on to state that;

"*Development of a non-mineral related nature within a Mineral Safeguarding Area which is in compatible with the safeguarding of minerals should not proceed unless;*

- *It can clearly be demonstrated that the mineral concerned is no longer of value*

- *Or that substantial economically viable deposits of a similar quality exist elsewhere in the county*
- *Or the mineral can be extracted where practicable prior to the development taking place*
- *Or the incompatible development is of a temporary nature and can be restored to a condition that does not inhibit extraction*
- *The development of a minor nature*
- *There is an overriding need for the development."*

Significant development is defined to be redevelopment of commercial or industrial sites over 1Ha or more.

10 Consultation of the BGS geological mapping and available BGS borehole records detailed within the Preliminary Sources Study report included within Appendix 6.4 suggests that the Milton Malsor allocated site MA2 discussed above is not covered by a mantle of cohesive Oadby Member (Glacial Till) unlike the application site which is shown to be covered by a significant mantle of cohesive Oadby Member (Glacial Till). For ease of reference map extracts and logs are also included within Appendix 6.9.

11 As referred to in Section 6.2, the NPSNN includes brief references to minerals as they relate to NSIP applications. The NPSNN requires applications to safeguard mineral resources as far as possible, and to put forward appropriate mitigation measures.

6.3 Assessment Methodology and Significance Criteria

6.3.1 Overview

1. The Environment Agency provides guidance on the conduct of an Environmental Impact Assessment with regard to **contamination issues** (Scoping Guidelines on the Environmental Impact Assessment of Projects 2002), and there is a considerable body of guidance that has been prepared in order to assist both local authorities and practitioners in assessing the degree to which land is contaminated and deciding whether such land is contaminated within the meaning of the Part IIA of the Environmental Protection Act 1990.

2. Further guidance on the risk assessment process is given in EA documentation on the basis of the Contaminated Land Exposure Assessment (CLEA) model which is intended to be used as the common basis for contamination assessments in the UK. Guidance on the risk assessment process is given in the Contaminated Land Report 11 prepared by DEFRA.

3. With regard to pollution of **controlled waters**, the EA has prepared guidance on methods of assessment. These are contained in their Research and Development Publication No 20 'Methodology for the Derivation of Remedial Targets for Soils and Groundwater to protect Groundwater and in GP3 parts 1 to 4 (Ref 6-9)

4. There is no standard procedure for assessing the impact of the effect of **potential unstable ground** on a development project and the wider area. A 'weight of evidence' approach is used to determine whether unstable ground is likely to be a hazard and hence whether any mitigation or special construction measures may be needed. The data that needs to be assessed under a 'weight of evidence' methodology includes:

   - Geological mapping and memoirs for the area;
   - Inspections of the site and surrounding area;
   - Information from ground investigations;
   - Information from the local authority.

5. There is little guidance on addressing the issues of Mineral Safeguarding and its assessment within an EIA context. However through Desk studies and ground investigation it has been possible to identify the baseline conditions and the extent of areas of potential sand and gravel resources beneath parts of the site and their potential quality and suitability for future exploitation. Discussion as to the potential impact of the proposed development upon such resources and any likely mitigation necessary will be agreed and provided as part of the application. However, based on the detailed discussions held with the Minerals and Waste Planning Authority in 2015 and 2016, it was shown and agreed that the mineral resource on-site is not accessible, and not likely to be commercially viable. In this regard it is different to the

mineral resource to the north in the same Mineral Safeguarding Area. Correspondence appended to this Chapter (RSK letter to NCC dated 20/4/15) addresses the approach to relevant local plan policies on this matter and email correspondence between RSK and NCC (dated 13/9/15 and 15/12/16) confirm the agreement reached with the County Council on this issue. Copies of the relevant correspondence are included within Appendix 6.9.

6.3.2 Contamination Risk Assessment Methodology

1. An assessment of the potential impacts of the proposed development on ground conditions at the site has considered the following stages of the development:

- **Pre-development:** an assessment of existing environmental impacts from the existing site on human health and the environment; i.e. the existing "baseline conditions";
- **During construction**: the potential short term significant environmental impacts of the construction of the proposed development on human health and the environment; i.e. geology, soils and groundwater beneath the site, and;
- **During operation**: the potential long term significant environmental impacts arising from the construction of the proposed development and its post construction operation.

2. Underpinning all sets of guidance on contamination issues is a hazard-pathway-receptor methodology which is used to identify significant pollutant linkages (SPLs). The following definitions apply:

- Hazard: source of contamination;
- Receptor: the entity which is vulnerable to harm from the hazard; and
- Pathway: the means by which the hazardous contamination can come into contact with the receptor.

3. In order for there to be a "pollutant linkage" all three; "hazard", "receptor" and "pathway", must be present. Without all three, there is considered to be no significant pollutant linkage.

4. Without a significant pollutant linkage the contamination may be a hazard but does not constitute a risk to human health or the environment.

5. Therefore, in assessing the potential for contamination to cause a significant effect, the extent and nature of the potential source or sources of contamination must be assessed, pathways identified, and sensitive receptors or resources identified and appraised, to determine their value and sensitivity to contamination related impacts.

6.3.3 Sources of Contamination

1. The following methods have been used to assess the magnitude of the sources of land contamination at the site:

- Consideration of previous land use: this includes the study of historic site maps and anecdotal information, covering both the site itself and the surrounding area; and
- Review of ground investigation data gathered on-site, including chemical contamination data.

2. The magnitude of sources of land contamination can be described qualitatively according to the categories shown in Table 6.1.

Table 6.1: Scale for Magnitude of Extent and Potential Sources of Land Contamination

Magnitude	Definition	Previous Land Uses
Very Low	No detectable contamination from site investigation work on the site.	Greenfield site.
Low	Detectable but minor soil contamination less than threshold and unlikely to affect most sensitive receptors. Site investigation data detecting no significant contamination.	Previous or on-going activities with low potential to cause contamination (e.g. residential, retail or offices etc.).
Medium	Detectable localised soil contamination above threshold limits, identified during ground investigation.	Previous or on-going activities with some potential to cause moderate contamination (e.g. railways, collieries, scrap yards etc.).
High	Site investigation data indicating widespread and/or severe localised contamination.	Previous or on-going activity on or near to the Site with high potential to cause land contamination (e.g. gasworks, chemical works, landfill etc.).

6.3.4 Receptor Identification

1. The presence of and sensitivity of receptors at risk from potential land contamination can be assessed by consideration of the following:

- Surrounding land uses, based on mapping and site visits and existing planning designations;
- Proposed end-use, based on the nature of the proposed development;
- Type of construction operations that will be necessary as part of the proposed development;
- Surrounding sites of nature conservation importance; and
- Geology, hydrogeology and hydrology of the site and its surrounding area.

2. The sensitivity of potential receptors can be described qualitatively according to the categories shown in Table 6.2.

Table 6.2: Receptor Sensitivity

Sensitivity	Definition	Future Site Users	Surrounding Land Uses	Construction Workers	Ecological Sites	Built Environment
Very Low	Environment is insensitive to impact, no discernible changes e.g. soils are not in use, the land has an industrial / commercial land use and / or mainly covered by hard standing.	**Industrial land covered by hard standing**	Heavily industrialised areas	**No disturbance to ground**	No sites of potential ecological value nearby	**Minor industrial development without subsurface services**
Low	Environment responds in a minimal way such that only minor changes are detectable e.g. landscaped areas.	**Commercial landscaping or open space areas**	Light industrial areas, commercial landscaping or open space areas	**Minimal disturbance of ground**	No sites of significant ecological value close by	**Infrastructure (roads, bridges, railways)**
Medium	Environment clearly responds to effect(s) in quantifiable manner e.g. low grade agricultural land, recreational ground.	**Residential without plant uptake**	Residential without plan uptake	**Limited earthworks**	Locally designated ecological sites	**Buildings, including services and foundations**
High	Environment responds to major change(s) e.g. agricultural land use for good production, allotments.	**Residential with plant uptake, and allotments**	Residential with plant uptake, and allotments	**Extensive earthworks, and demolition of buildings**	Nationally or internationally designated ecological sites	**As above but of high historic value or other sensitivity**

6.3.5 Significance Criteria

1. If a hazard has been identified and potential sensitive receptors are present, then the potential impacts can be determined by considering the pathways whereby the hazard may impact upon the receptors. Table 6.3 indicates the most feasible potential impacts that may generally occur in relation to proposed development sites for different classes of receptor. During the assessment it has been assumed that there is (or will be during or after construction) a pathway present between the hazard and the receptor, unless there is a clear indication that this will not be the case.

Table 6.3: Potential Impacts of Land Contamination on Sensitive/Important Receptors

Receptor	Potential Impact
Future Site Users (residents/workers/visitors)	Direct or indirect ingestion of contaminated soil, inhalation, dermal contact (operational) Concentration of flammable or asphyxiating in-ground gases in enclosed spaces (operational) Inhalation of harmful in-ground vapours indoors and outdoors (operational)
Surrounding Land Uses	Inhalation or deposition of wind-borne dust (construction stage) Migration of contamination in sub-surface strata (including ground gases) (operational and/or construction stage)
Construction Workers	Direct or indirect ingestion of contaminated soil and groundwater, inhalation, dermal contact (construction stage) Concentration of flammable or asphyxiating gases in confined spaces (construction stage) Inhalation of asbestos during building demolition (construction stage)
Ecological Receptors	Phytotoxic impacts on plan species (operational) Toxic impacts on fauna (operational) Indirect impacts via contamination of water resources (operational and/or construction stage)
Built Environment	Chemical attack of buried concrete structures (operational) Permeation of water supply pipelines (operational) Concentration of explosive gases above LEL (operational)

2. The strength of pathway between a source and receptor is a function of the distance between the two and the ease or otherwise of the migration pathway. For example, on sites underlain by impermeable clays, the migration pathway via groundwater would be weak even over short distances, whereas within sands or gravels, the migration pathway would be strong for receptors in close proximity to a source and weak for receptors at some distance from the source.
3. For construction workers on contaminated sites, the pathway is invariably strong because they are likely to be in close proximity to the soils, particularly during ground works.
4. For industrial and commercial developments, where much of the ground may be covered in hard surfacing, the migration pathways for soil or water contamination are generally moderate or weak.

6.3.6 Magnitude of Impact

1. A combination of the source and receptor rankings will provide an indication of the level of contamination on the site and nature and severity of possible effects. It should be noted that both rankings may vary in the different scenarios being considered (i.e. baseline, construction and operation).
2. For sites where there is no (or very limited) site investigation data, this stage consists of comparing the magnitude of the hazard and the sensitivity of the receptor for each potential impact, using the qualitative descriptions outlined in Tables 6.1 and 6.2 above.
3. Where site investigation data are available, the assessment of the magnitude of impact can be assisted by an assessment of the testing results that exceed relevant contaminant screening levels for each particular type of impact. Appropriate screening levels are selected based on the nature of the hazard-pathway-receptor linkage and with reference to current published guidelines.

6.3.7 Significance of Effects

1. The likely significance of effects (before any mitigation) can then be assessed on the basis of the matrix as shown in Table 6.4 in conjunction with professional judgement of the site specific factors that may be of relevance.

Table 6.4: Classification of Effects

Sensitivity of Receptor	**Magnitude of Impact**			
	High	Medium	Low	Very Low
High	Major	Major / Moderate	Moderate	Moderate /Minor
Medium	Major / Moderate	Moderate	Moderate / Minor	Minor
Low	Moderate	Moderate / Minor	Minor	Negligible
Very Low	Moderate / Minor	Minor	Negligible	Negligible

2. Major and moderate effects are considered to be significant. Minor and negligible effects are considered insignificant. Where a Moderate/Minor effect has been identified then judgement will be used to determine whether the effect is significant or not.

6.3.8 Risk Assessment

1. The severity of the potential significance (determined using the above matrix), and consideration of likelihood of an event occurring, can then be incorporated into the final risk based assessment. Likelihood would take into account both the presence and distribution of a particular hazard within the site as well as the integrity (strength) of the pathway between the hazard and receptor.

Table 6.5: Likelihood Matrix

Magnitude of Impact	**Strength of Pathway**		
	Strong	Moderate	Weak
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Unlikely
Very Low	Unlikely	Unlikely	Unlikely

Table 6.5 demonstrates the perceived likelihood of an event occurring and Table 6.6 provides details of the level of risk based on the combination of the likelihood of an event occurring and significance of effects. Table 6.6 interprets the risk assessment.

Table 6.6: Risk Assessment

Likelihood	**Significance of Effect**			
	Major	Moderate	Minor	Negligible
High	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
Medium	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
Low	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

2. Impacts on ground conditions as a result of the proposed development are assessed in terms of changes to the baseline conditions during the site preparation and construction phases, and post development during the operational phases. Impacts of the site preparation and construction phase on baseline ground conditions will be reflected as changes to any potentially complete pollutant linkages. Similarly, the residual impacts of the proposed development are identified by reviewing the baseline data in the light of the post-development context and identifying net changes.

3. The assessment approach has been undertaken with an understanding of:

- Previous land uses;
- Existing physical baseline conditions;
- Underlying geology and soils;
- Sensitivity of surrounding receptors; and
- Potential to mitigate impacts resulting from the proposed development.

4. The sensitivity of receptors at risk from potential contamination or earthworks has been assessed with an understanding of the following:

- Surrounding land use;

- Type of construction methods, which will be necessary to achieve the final design layout;
- Surrounding sites of nature conservation or built heritage importance; and
- Underlying geology and soils.

The results of external consultations undertaken as part of the information gathering for the determination of the baseline conditions have been included within the Desk Study report attached within Appendix 6.4 to 6.6.

6.4 Baseline Conditions

6.4.1 Introduction

1. This section provides summary of existing environmental impacts from the existing situation on human health and the environment; i.e. the existing "baseline conditions".

6.4.2 Supporting Information

1. The baseline ground model of soil and geological conditions at the sites have been assessed by means of a staged process as recommended by Local Authority and industry guidance:
   - **Preliminary Sources Study Report (PSSR):** desk study including site walkovers and the assessment of available geological plans, historical plans, published environmental data and available exploratory hole logs have been undertaken. In addition preliminary consultations have been undertaken with regulators including South Northamptonshire Council (Contaminated Land), Environment Agency, Highways England, Northamptonshire County Council Mineral Safeguarding Team, Northampton County Council Highways, Network Rail, Anglian Water and Natural England to confirm the expected ground model and geotechnical hazards and risks and contaminated land risks. Separate reports have been prepared for the proposed Main Development Site (SRFI), the Roade Bypass and the M1 Junction 15 junction amendments. The reports have sought to identify particular hazards. A copy of these reports is included within Appendix 6.4 to 6.6.

- **Factual Site Investigation Reports**: A Ground Investigation was previously undertaken on the development area for the earlier (2014) scheme previously proposed on part of the main site and was carried out to confirm the ground conditions. The Factual Ground Investigation report compiles the data obtained from the intrusive ground investigations carried out across the majority of the main development site to date including detailed engineers exploratory hole logs, insitu testing, gas and groundwater monitoring, soil and groundwater chemical and geotechnical testing results and as built plans showing the position of all boreholes. A copy of this report is included within Appendix 6.7.
- **Preliminary Ground Investigation Interpretative Reports:** Available Ground Investigation data has been used previously to provide a separate interpretative report for the earlier planning application area. The extent of this report covers most but not all of the main site development area now being proposed. This report draws together, builds upon and updates the data and risk assessments included within the PSSR using the site specific factual ground investigation data obtained. This seeks to confirm the ground model for the development area allowing geotechnical and geo-environmental risk assessments to be updated using the current up to date site specific data. A copy of this report is included within Appendix 6.8.

2. Investigations have been carried out generally in accordance with standard industry practice and guidance including but not limited to the following primary documents;

- *Site Investigation Steering Group Specification For Ground Investigation (2012).*
- *British Standards Institution BS5930:1999+A2:2010 'Code of practice for site investigations',*
- *British Standards Institution (2011), 'BS 10175:2011. Investigation of potentially contaminated sites: Code of practice'.*
- *British Standards Institution (BSI) (1990), 'BS 1377:1990. Methods of test for soils for civil engineering purposes'.*
- *BS EN 1997-2:2007. Eurocode 7 — Geotechnical design — Part 2: Ground investigation and testing.*
- *Environment Agency (2004a), Model Procedures for the Management of Contaminated Land. Contaminated Land Report Number 11 (CLR11), September (Bristol: Environment Agency).*

- *Environment Agency (2010a), 'GPLC1 – Guiding Principles of Land Contamination', 'GPLC2 – Frequency Asked Questions, Technical Information, Detailed Advice and References', and 'GPLC3 – Reporting Checklists', all March.*
- *Highways Agency HD22/08, 'Managing Geotechnical Risk',*
- *Wilson, S., Oliver, S., Mallet, H., Hutchings, H. and Card, G. (2007), CIRIA Report C665: Assessing risks posed by hazardous ground gases to buildings (London: CIRIA).*

3. The baseline conditions are confirmed in detail within the reports included within Appendix 6.4 to 6.8 of this chapter. Further supplementary ground investigations are in progress and will be supplied as Appendix 6.10 to 6.13 in the final chapter. The baseline conditions identified to date are summarised below;

6.4.3 Local Landscape Character, Topography, Geography and Geomorphology

Summary

1. The site sits within a formerly glaciated area signified by rolling hills created by the glacial erosion and subsequent deposition of glacial deposits.

Main Site

2. The main site generally slopes down from west to east, with the peak of the hill on which the site sits being located near to the centre of the western boundary of the site. The top of the hill forms a ridge which extends along the majority of the western boundary of the site. At its highest, the site elevation is approximately 102m AOD, located near to the centre of the western boundary, down to its lowest elevation of approximately 80m AOD along the sites eastern boundary, within a shallow valley associated with the unnamed brook flowing north east, along the sites south eastern boundary.

3. The M1 motorway is located in a shallow cutting along the eastern site boundary.

4. The geological sequence of the area is understood to be one of fossiliferrous mudstone and siltstone, laminated and bituminous in part, with thin siltstone or silty mudstone beds and rare fine-grained calcareous sandstone beds deposited within sea conditions and eroded by periods of glaciations and overlain by later deposition of Oadby Member and Glaciofluvial Deposits.

Bypass

5. The site sits within a formerly glaciated area. The land is gently undulating with a general slope to the south of the site. At its highest, the site elevation is approximately 122m AOD located where the proposed bypass branches off from the A508 Northampton Road, north of the town of Roade. The proposed bypass crosses over a railway line north-west of the town of Roade, which is located within a deep cutting. The route dips to less than 115m AOD just after it crosses Blisworth Road and the drainage ditch, before rising back to 120m AOD at its most westerly extent. At the time of the walkover the drainage ditch did not contain any water. The route the drops again towards the A508 Stratford Road, rejoining at an elevation of approximately 100m AOD, although the topography is undulating at this end of the site.

6. The proposed bypass is to meet a modified section of the A508 Stratford Road, at the point at which it crosses an historic, now dismantled, overgrown railway line which from mapping is suggested to be within cutting.

7. The geological sequence of the majority of the site is understood to comprise Oadby Member Glacial Till (Superficial) overlying solid deposits anticipated to be the Blisworth Limestone Formation, which is principally limestones with thin bands of fossiliferous mudstone and marls, underlain by the succession of marine and non-marine mudstones of the Blisworth Clay, Rutland Formation, Stamford Member, Northampton Sand Formation with the Whitby Mudstones at depth. Locally other deposits including Cornbrash limestones might be encountered at depth at the northern extent.

Highways Mitigation Measures

8. Assessment of any ground conditions implications on the land included in the package of Highways Mitigation measures will form part of the final ES chapter. Much of those works (outside of the bypass which is referred to above) are proposed within or adjoining the existing highway, and based on initial judgements and available desk-top information, no significant issues are anticipated.

6.4.4 History

MainSite

1. Available mapping shows that the site has and remained in agricultural use since the earliest maps from the 1880's with the villages of Collingtree beyond and to the north east, Milton Malsor beyond and to the North West.
2. During the Mid 1960's the M1 appears to have been constructed as it is shown now running north to south along the eastern boundary of the site with Junction 15 constructed as a grade separated junction arrangement upon embankment over the M1 immediately south east of the site with the A508 running along the southern boundary of the site. The majority of the changes following this period up to the present relate to minor changes to the highway infrastructure.
3. Full details of the history of the site and surrounding areas can be found within the PSSR report included in Appendix 6.4 & 6.6 of this chapter.

Bypass

4. Available mapping shows that the site has remained in agricultural use since the earliest maps from the 1880's with the village of Roade adjacent to the south east.
5. A mainline railway intersects the site route roughly north south in cutting predating the 1883 maps.
6. Full details of the history of the site and surrounding areas can be found within the PSSR report included in Appendix 6.5 of this chapter.

6.4.5 Geology and Soils

1. Full details of the geology, ground conditions and ground model are included within the supporting reports included within the Appendices 6.4 – 6.8 attached to this chapter. Further supplementary investigations and technical assessment work is ongoing to robustly validate the anticipated ground conditions model assumptions and environmental risks and impacts provided by the reports presented in Appendices 6.4 to 6.8. A short summary of the ground conditions defined is detailed below:

Main Site

6.4.5.1 Made Ground

2. No Made Ground has been identified across the site.
3. Limited localised areas of Made Ground are anticipated to be present associated with the farm tracks and farm buildings.
4. Full details of available supporting information can be found within the detailed reports included within Appendix 6.4 to 6.8 of this chapter.

6.4.5.2 Drift Geology

1. The majority of the development area is covered by a mantle of cohesive Glacial Till known as the **Oadby Member**. This is underlain at depth by granular **Glaciofluvial Deposits**, these are locally anticipated to be exposed close to surface where the Glacial Till is not thought to be present. This model has been confirmed by the Ground investigations undertaken although no significant granular Glaciofluvial deposits have been identified close to surface across the vast majority of exploratory holes undertaken to date with cohesive soils being predominant close to surface.
2. Full details of available supporting information can be found within the detailed reports included within Appendix 6.4 to 6.8 of this chapter.

6.4.5.3 Solid Geology:

1. The site is underlain by the Whitby Mudstone Formation which is weathered to clays and silts close to its upper boundary immediately beneath the overlying drift deposits but tends to a mudstone with subordinate siltstone and limestone bands with depth as the degree of weathering reduces.
2. Full details of available supporting information can be found within the detailed reports included within Appendix 6.4 to 6.8 of this chapter.

Bypass

6.4.5.4 Made Ground

1. Limited data is available at this stage but no significant areas or depths of Made Ground are anticipated to be present across the site, with the exception of perhaps a former low railways embankment which dissects the route at the southern end of the bypass.
2. Limited localised areas of Made Ground are anticipated to be present associated with the farm tracks and farm buildings in the vicinity of the proposed alignment.
3. Full details of available supporting information can be found within the detailed reports included within Appendix 6.5 of this chapter.

6.4.5.5 Drift Geology

1. Available BGS mapping of the area suggests that the majority of the site appears to be underlain by a mantle of Oadby Member (Diamicton Till / Glacial Till) which is anticipated to be primarily over consolidated sandy gravelly clay. It may also contain sandy gravel strings, lenses and pockets which may bare localised pockets of perched or confined groundwater.
2. Limited deposits of Glaciofluvial Deposits are also anticipated to be present at the southern end of the route and are likely to take the form of sands and gravels.
3. Full details of available supporting information can be found within the detailed reports included within Appendix 6.5 of this chapter.

6.4.5.6 Solid Geology:

1. Based on information available to date, almost the entirety of the Site is indicated to be underlain by the Blisworth Limestone Member likely to be weathered beneath the overlying superficial deposits to firm to stiff grey and brown clays tending to off-white or yellowish limestone with thin marl and mudstone bands. Calcareous shell and fossil fragments are common throughout these deposits. Beneath which the Blisworth Clay Formation is likely to be encountered.
2. In the extreme south of the site the Rutland Formation is also present, and is likely to be weathered to grey clays and silts.
3. Below this strata it is likely that the Stamford Member which is anticipated to comprise sandstone, and interbedded siltstone will be present overlying the Northampton Sand Formation all above the Whitby Mudstone Formation.

4. Full details of available supporting information can be found within the detailed reports included within Appendix 6.5 of this chapter.

6.4.6 Hydrology – Surface Waters

Main Site

1. One surface water feature is located on site; it is identified as a pond and is located within the gun club grounds at Rectory Farm in the western part of the site and does not fall within the development area.
2. An unnamed brook (classed as a tertiary river) flows east along the southern boundary of the site. Full details of the findings are available within the individual reports included within the Appendices to this chapter.

Bypass

3. An unnamed tertiary river / drain crosses the centre of the site, flowing south-east, and is classed as a secondary river when it crosses the site for a second time in the south-east corner, this time, flowing south.

6.4.7 Hydrogeology - Groundwater

1. The Proposed Development site is not located upon a source protection zone with respect groundwater.
2. The cohesive Glacial Till (Oadby Member) is classified as Unproductive Strata.
3. The Glaciofluvial Deposits are classified as a Secondary A Aquifer.
4. The Blisworth Limestone Member is a principal aquifer.
5. The cohesive Whitby Mudstone Formation at depth is classified as Unproductive Strata.
6. Perched groundwater water tables were identified to be present within the granular pockets throughout the mantle of the cohesive Glacial Till.
7. An apparently continuous groundwater table has been tentatively identified to be present within the deeper granular Glaciofluvial deposits at depths of around 80m AOD.

8. Smaller variable seepages of groundwater appear to have been identified within the subordinate permeable strata (siltstones) confined within the mudstones of the deeper Whitby Mudstone.
9. Full details of available supporting information can be found within the detailed reports included within Appendix 6.4 to 6.8 of this chapter.
10. Further technical assessment work including intrusive investigations will be undertaken to allow the ground conditions model assumptions and environmental risks and impacts to be robustly validated.

6.4.8 Contamination & Ground Gases

1. Review of South Northamptonshire Council Contaminated Land Strategy (Ref. 6-19) did not identify any naturally occurring contaminants that might be expected to be present in any of the areas associated with the proposed development. This was confirmed by the soil contamination and chemistry testing data obtained as part of the PSSR research.
2. Available ground investigation results on the main site confirmed the concentrations of potential contamination within the site soils. The soil concentrations have been compared to the proposed commercial end use Generic Assessment Criteria (GAC) to assess the risk to human health and the environment; and have not identified any contaminants of concern. Indeed many of the contaminants tested for were at or below detection limits as would be expected of natural soils.
3. Available ground investigation results on the main site confirm the concentrations of contamination within the groundwater beneath the site. The groundwater concentrations have been compared to suitable controlled water screening values and have not identified any contaminants of concern. Indeed many of the contaminants tested for were at or below detection limits as would be expected of groundwater's from natural soils.
4. Gas monitoring has been undertaken upon the main site and did not detect any significant soil gas concentrations of concern as would be expected of natural soils with no discernible potential sources of gas identified.
5. Full details of available supporting information can be found within the detailed reports included within Appendix 6.4 -6.8 of this chapter.

6. Further technical assessment work including intrusive investigations will be undertaken to allow the ground conditions model assumptions and environmental risks and impacts to be robustly validated.

6.4.9 Mining and mineral extraction

1. The Proposed Development is not located within an area affected by coal mining or mining instability. This is supported by the Coal Authority's online Gazetteer and interactive map viewer.
2. The main development site partially lies across a defined Minerals Safeguarding Area as defined by Northamptonshire County Council. This is understood to relate to the potential for sand and gravel resources to be present at the site.
3. The bypass does not overlie any mineral safeguarding areas.
4. The site is not allocated as a future site to provide resource to the county within the 20 year plan. Sufficient resources have been identified within the county and "permitted" or and "allocated" to provide the required future resource and land bank requirements within the county over the 20 year life of the plan (to 2031).
5. A site known as Milton Malsor MA2, located immediately north of the main site has been "allocated" as a potential mineral extraction site within the Northamptonshire County Council Minerals and Waste Development Framework and Local Plan. It is understood that this is for the extraction of up to 1.2M tonnes of sand and gravel across a 15Ha area. The Milton Malsor site is understood to be directly underlain by Glaciofluvial sand and gravels with no cohesive Glacial Till mantle present above.
6. The Existing information and studies referenced earlier suggest that there are significant sand and gravel resources available within Northamptonshire and the surrounding counties and Mineral Planning Authorities areas to cover the minimum future provision requirements of 7 years. Therefore there is no county or regional shortage of sand and gravel resources. The yields are reported to be greater in deposits within nearby counties, therefore it is considered less economic to undertake extraction of sand and gravel particularly from glacial sand and gravel sources within the Northamptonshire area.

7. The BGS report (Ref.6-11) had "revealed quite extensive concealed glacial sand and gravel resources, approximately doubling the known extent of resources within Northamptonshire". Therefore greater resource than originally mapped is likely to be available within Northamptonshire.

8. Full details of available supporting information can be found within the detailed reports included within Appendix 6.4 -6.8 of this chapter.

6.4.10 Landfill, Waste Disposal, Waste Treatment and Waste Transfer

1. There are three recorded licensed waste management facilities within 500m of the main development site, all related to Wooton Quarry and located 144m, 380m and 381m north east of the site. While the nearest results all relate to a co-disposal landfill site, more recent entries, positioned further from site although still at Wooton Quarry, indicate the landfill accepts or has accepted solid (inert, degradable, putrescible), domestic, difficult, bonded asbestos and toxic (non-special) waste. Given the distances involved it is not considered to represent a significant risk of contamination or gas that would detrimentally impact upon the site and this has been confirmed by the ground investigation carried out within the development area of the site.

2. There are two recorded licensed waste management facilities within 500m of the bypass site both located immediately east of the southern end of the proposed bypass, on the opposite side of the A508 Stratford Road. Both are noted to have accepted household, commercial and industrial waste.

3. Full details of available supporting information can be found within the detailed reports included within Appendix 6.4 -6.8 of this chapter.

6.4.11 Land Use and Pollution

1. With the exception of the farm buildings on and close to the main development site and bypass site the majority of the site has and remains in agricultural use and is not considered to represent any potential sources of pollution.

2. Ground Investigations undertaken on the main site have confirmed this to be the case with no significant sources of contamination, made ground or contaminant levels being identified within the soils or groundwater beneath the development area.
3. Some additional Ground Investigation at enabling works stage (post planning) maybe necessary in the areas of the farm buildings and along the route of the bypass. However, it is considered unlikely that significant contamination sources would be encountered and were contamination to be found it is likely that it would be very localised as the underlying geology is cohesive in nature and would inhibit movement vertically and horizontally.
4. There are no major or significant pollution incidents recorded upon the site.
5. Full details can be found within the detailed reports included within Appendix 6.4 -6.8 of this chapter.

6.4.12 Geological SSSI

1. It is understood that the bypass passes over a geological SSSI. The SSSI relates to geological exposures within the railway cutting which the Bypass route crosses. However the SSSI relates to the cutting faces created when the railway was constructed and is therefore by necessity for safety reasons inaccessible given this remains a live railway (Main Line). The Bypass will bridge the railway and therefore is not likely to impact upon the SSSI as the construction of the bridge abutments is anticipated to be set back from the cutting face or will only likely affect the upper shallower cut slope faces which are within the Glacial Till and not the geology of interest, this being the solid deposits below.

6.4.13 Potentially Sensitive Receptors

1. These include:
   - Current and Future End Users;
   - The Glaciofluvial strata beneath the site are designated as a Secondary Aquifer;
   - The Blisworth Limestone Member is a principal aquifer.
   - The local surface water stream on the southern boundary of the site; and
   - Neighbours and Public.

6.4.14 Summary of Site Status

1. The Proposed Development site is open farmland with no major or significant past or present sources of soil, groundwater or potential gas contamination identified.
2. No significant geotechnical hazards have been identified to underlie the site or represent risks to land stability in its current form, during construction or operation. Further analysis of the ground conditions at both the Main site and along the Bypass Corridor is being undertaken to confirm the anticipated ground conditions and to confirm these initial assessments
3. Limited thickness of sand and gravel are anticipated to be present beneath a thick mantle of cohesive Glacial Till. Given the depth below cohesive Glacial Till and the groundwater table present within the sand and gravel, the deposits varied and mixed nature it is not considered to be economically suitable for commercial extraction. This appears to be demonstrated by the fact that even the allocated site adjacent to the site where no overburden is anticipated to be present has not yet been exploited.
4. Sufficient future sand and gravel resource for the next 20 years have been identified and included within the Local Plan. The application site is not one of these sites and will not affect the potential future exploitation of sand and gravel at the allocated site MA2 immediately beyond the northern boundary.
5. Significant and sufficient allocated further sand and gravel resources are available in the county and region.

6.5 Impacts

1. This section provides an assessment of the potential significant environmental impacts of the proposed development on human health and the environment during both the construction and operational phases. It is based on the information available at this stage, but will be updated as further data and analysis is added to the evidence base which underpins the application.
2. The assessment is based on an assessment of the magnitude of contamination sources, geotechnical hazards and mineral sterilisation as obtained from desk study, existing ground

investigation and monitoring information included within Appendices 6.4 – 6.7, which form the base line conditions and an assessment of the source – pathway – receptor philosophy and identified pollutant linkages.

3. The receptors potentially at risk from land contamination that could be present are indicated below and their relative sensitivity is assessed using the criteria below to enable predicted impact to be determined. This approach is consistent with that required to assess anticipated impacts specific to these particular ground related issues.

Table 6.7: Potential Construction and Operational Phase Receptors

Receptor	Sensitivity	Comments
Construction / maintenance workers	High	Significant earthworks planned. Construction workers involved with in and below ground construction will have a high sensitivity. Construction workers involved in above ground works will be less sensitive.
Adjacent Commercial site users	Low	Includes workers at Grange Park, Travellers on the M1/A508 and other associated highways.
Adjacent Residential users	High	More sensitive receptors associated with the adjacent and nearby residential areas (Collingtree and Milton Malsor) including local schools.
Future site users	Very Low to Low	Includes employees, visitors i.e. commercial /industrial setting with minimal exposure opportunity to contamination sources.
Surface water	High	Stream along southern boundary. Pond.
Groundwater	High	The Glaciofluvial Sand and Gravel is a Secondary Aquifer. The Blisworth Limestone is a Principal Aquifer.

4. The available baseline data supported by the attached reports included within Appendices 6.4 -6.7 confirms the current state of the site. In order to assess the proposed development impacts it is important to understand the impacts that the existing site poses at present. Due

to the varying characteristics of the site and the impacts and risks are presented on table Matrix 6.1 included within Appendix 6.1.

5. It can be seen from studies undertaken to date that the geology, soils and groundwater beneath the development area present Low or Very Low existing impacts and risks to the environment, in particular to controlled waters (aquifer and rivers), site users and adjacent land users.

6.5.1 Construction Phase Impacts and Mitigation

1. The construction of the scheme with respect to land use, geology and soils are discussed within the separate sections below according to the anticipated order of construction. A risk matrix detailing the main construction risks related to soil, geology and groundwater is included in Appendix 6.2 as Matrix 6.2.

6.5.1.1 Works Contamination

1. Construction plant and activities have the potential to affect ground conditions through the introduction or mobilisation of contamination via accidental spillages/leaks on the site e.g. from oils, lubricants and fuel. However no existing sources of contamination are present and risks related to works will be managed by the adoption of a **Construction Environmental Management Plan (CEMP)**.

2. Therefore, provided the Works are adequately supervised and managed, in accordance with current best practice, the environmental impacts from construction plant and activities to geology and soils are considered to be **very low to negligible**.

6.5.1.2 Works Methods & Phasing

1. Following DCO approval, the detailed design of the construction work will be undertaken in accordance with current best practice guidance and legislation. This will be supplemented by the preparation and adoption of detailed site specific construction environmental monitoring and management plans supplementary too the CEMP, including:

- Measures and processes to manage air, noise, dust, light, and odour effects;

- Site waste management plan to include measures for both demolition and construction phases
- A Soil Management Plan, relating to movement and storage of topsoil's,
- Earthworks strategy and specification relating to the management and reuse of strata within earthworks cut and fill works.

These are discussed in further detail below:

2. The CEMP will set out the overarching systems and controls that will be adopted and developed during construction of the scheme to minimise any adverse environmental impacts. This will be included within all construction contracts and all contractors will be required to comply with these overarching principals. Contractors will be required to plan and undertake the works in a suitable manner including providing and monitoring of noise, dust and vibration and where appropriate controlled water quality as well as control of waste. Contractors will be required to prepare and agree action plans with regulators and establish agreed trigger levels. The action plans will define the monitoring requirements and will be agreed with regulators and reviewed throughout the works to confirm that no unacceptable emissions from site occur. Should an exceedance occur the action plan will define what remedial actions must be taken.

3. The CEMP will incorporate measures in accordance with the Site Waste Management Plan Regulations 2008 (Ref.6-6). This will promote the reduction, re-use and recycling of waste, and reduce the amount of waste going to landfill. On this site it is anticipated that a cut and fill earthworks balance will aim to be achieved to minimise off site disposal and importation of clean replacement materials. Investigations suggest that all natural site won soils shall be suitable for reuse within the earthworks cut to fill works necessary.

4. As the site is considered to be clean and no contaminated soils requiring remediation or special controls have been identified then at this stage it is **not** considered necessary or mandatory to prepare a Materials Management Plan in accordance with the CL: AIRE Code of Practice entitled "The Definition of Waste: Development Industry Code of Practice, Version 2, March 2011, as only "clean and natural" soils will be re-used on the site of origin. However, should recycled or reused materials from off-site sources be proposed to be

imported for use within the works then a Material Management Plan will need to be developed alternatively sources will need to meet a suitable environmental quality standard such as WRAP.

5. A Soil Management Plan will define care, storage, transport and reuse of topsoil's in a similar way to a Materials Management Plan to control the acceptability and suitability of materials reused.

6. An Earthworks Strategy and Specification will define the geotechnical classification and properties of insitu materials, how and where they may be reused, to control the acceptability and suitability of materials reused and ensure that the engineering properties are achieved to support the development.

7. Risk assessments will be undertaken to identify main health and safety and environmental risks and indicate suitable mitigation to be put in place to reduce risks to acceptable levels.

8. The works will be designed to achieve a cut to fill volume balance to minimise waste and to reduce off-site disposal and on site importation of aggregates. This will reduce lorry movements to a minimum and the subsequent environmental impacts.

9. Appropriate working times and plant will be utilised to minimise noise impact.

10. Careful positioning of plant, appropriate use of plant and appropriate methods of working including the use of dust suppression will be used, as appropriate, to minimise dust nuisance wherever possible and practical.

11. Temporary surface water control measures will be carefully designed and constructed to manage surface water runoff and avoid suspended solids and contamination reaching water courses or sewers or surface waters.

12. Works methods will be designed to minimise risks to personnel and shall utilise appropriate plant and equipment. Where risks remain appropriate training, supervision, personal protective equipment (PPE), welfare and hygiene measures will be put in place.

13. Site haul roads and construction movements will be limited, as far as reasonably possible and main temporary haul roads will be sensitively positioned within reason to minimise impacts to neighbours and the public.

14. Works methods and plant will be selected to reduce and minimise light, noise, dust and vibration which may have a minor impact upon Neighbouring Sites and the public.

15. Therefore, the environmental impacts from the earthworks works are considered likely to be **short term minor negative impacts.**

6.5.1.3 Earthworks

1. An earthworks cut and fill is necessary to allow the scheme to be constructed. This will be designed to achieve a cut and fill balance, thus minimising the need for off-site disposal and import of materials.

2. These works would be commenced by the removal of topsoil, this material being either temporarily stockpiled for reuse in landscape screening bunds, habitat creation areas around the built scheme or being placed directly on areas of the open space and farmland.

3. Excavation will be undertaken using large excavators which should be able to excavate through the strata.

4. All natural arisings from earthworks cutting should be suitable for reuse within general fill operations, provided they are suitably handled (see Report included within Appendix 6.8).

5. Where arising's are wet or optimum or prevailing weather conditions at the time of works make them unsuitable for reuse within structural fill they may be reused within non-structural landscaping areas or modified or stabilised using lime or cement to allow reuse within structural fill, thereby ensuring a cut fill balance is achieved and minimising the export of unsuitable arising's to landfill or import of replacement materials.

6. Potentially fugitive dust will be controlled by water dampeners as necessary, especially during the dry summer months during the earthworks or other construction processes.

7. Therefore the environmental impacts from earthworks are considered **short term minor negative impacts** primarily related to dust generation**.**

6.5.1.4 Sensitive Receptors

1. Works are not anticipated to interfere directly with the underlying secondary aquifers. However, limited downward percolation and infiltration of rainfall may occur during the earthworks reprofiling once compacted vegetated cover is removed and excavations and mass earthworks are exposed however the cohesive nature of the deposits will greatly reduce the risk. Where possible works will be phased to minimise exposed open areas as far

as is reasonable. Techniques and methods of construction will also be utilised to minimise this wherever possible with particular care taken to managing earthworks and temporary surface water drainage to avoid increased infiltration from surface water and migration of silts to surface water receptors. It is considered impossible to avoid this completely, however as no contamination has been identified this is not considered likely to have any impact upon the aquifer water quality.

6.5.2 Operation Phase Impacts and Mitigation

6.5.2.1 Design

1. The reuse of site won soils at the main site within the earthworks is anticipated to have a **no environmental impact** whilst facilitating development to proceed in the most sustainable manner possible.
2. The operation of the constructed proposed development will be contained by buildings and hard standings. No exposure pathway will be present which would allow waste discharges to land, surface water or groundwater as the proposed development design and operation will be controlled by environmental legislation and regulations which are protective of environmental receptors. Therefore, there will be a **no impact** to geology, soils and groundwater from the operation of the proposed development.
3. Any fuels, chemical substances and hazardous materials required to be stored at the sites during operation will be stored in accordance with contemporary guidance and pollution prevention control regulations. This will ensure that there is a **no impact**.
4. In ground concrete required for buildings and infrastructure will be designed in accordance with BRE SD1 to ensure that it will resist any contamination or naturally occurring aggressive ground conditions. This will ensure that there is a **no impact**.
5. There are not anticipated to be any long term impacts upon the geology as a result of the operation of the proposed development**.**
6. The development of the bypass results in the requirements for a bridge crossing the 4 line mainline railway which are in deep cutting (Roade Cutting). Roade Cutting is designated as a geological SSSI. Currently, the geological SSSI is not visible or safely accessible for examination as the feature comprises heavily overgrown and vegetated man made cutting

faces located along the mainline railway which is currently inaccessible being within the railway lands. The bridge design is being formulated to avoid interfering with the slope and as such it is concluded that there will be **no impact** upon the geological SSSI**.**

6.5.2.2 Stability, Mining, Minerals & Aggregates

1. Appropriately designed Earthworks embankment, cutting and foundation design will be undertaken using traditional construction methods to ensure that the reprofiled land across the Proposed Development area is stable and buildings, infrastructure and surrounding adjacent lands are suitably supported.
2. There are no identified natural or manmade geohazards beneath the development site which could result in significant or catastrophic failures.
3. Full details of available supporting information can be found within the detailed reports included within Appendix 6.4 -6.8 of this chapter.
4. Based upon the current understanding of the ground model **no impacts** will be experienced from instability.
5. The site does not lie within an area affected by shallow or deep mining. Therefore **no impacts** will be experienced with respect to instability resulting from below ground mining.
6. Reference to the various associated British Geological Survey, South Northamptonshire Council and Northamptonshire County Council documents related to mineral resource protection and safeguarding suggests the following;
    - The BGS studies have "***revealed quite extensive concealed glacial sand and gravel resources, approximately doubling the known extent of resources within this area"***.
    - There has been a steady and significant decline in the demand for sand and gravel resources within the Northamptonshire area over the past 10 years.
    - all but one of the seven surrounding Mineral Planning Authorities have a land bank of supplies of sand and gravel in excess of 7 years so there is not a regional shortfall in supply availability.

- Northamptonshire County Council has sufficient "permitted and allocated" sites available to provide sufficient sand and gravel supply for the next 20 years, 13 years more than the national guidance requires.
- The mineral extraction industry has to date not put forward any applications to exploit glacial sands and gravel resources within Northamptonshire due to the variable quality.
- Higher yields per hectare for sand and gravel exploitation are likely to be achieved outside of Northamptonshire, suggesting that it less economically feasible to exploit such resources within the Northamptonshire.
- The site does not lie within either a permitted or an allocated area.
- The site geology is not conducive to economic extraction due to the thick mantle of cohesive Glacial Till (circa 6m depth) overburden which overlies the localised areas of granular Glaciofluvial deposits beneath the northern parts of the site.
- The Glaciofluvial deposits encountered within the south of the site closer to current ground levels are very mixed and of poor quality being mixed with cohesive soils and therefore are not considered to be economically viable for extraction.
- The groundwater table present within the Glaciofluvial deposits beneath the application site would limit the depth of any exploitation to less than 3m thickness even if it were considered to be economically viable to extract.
- Unlike the proposed development site, the allocated site immediately north of the application site boundary at Milton Malsor (MA2) is not covered by an overburden of cohesive Glacial Till making it easier to exploit the sand and gravel – however, that site still has not been exploited to date.
- The development of the application site would not detrimentally affect or prevent the exploitation of the Milton Malsor (MA2) site.
- Prior extraction and removal of any resource before construction of the planned development (as per NCC policy) is not considered economically feasible, sustainable or environmentally suitable as the excavated materials would need to be replaced with a similar or better imported materials to support the proposed development which will be sensitive to differential settlements. In addition the traffic

movements to and from the site as a result of any such export and import of replacement materials would have a significant impact upon the already over capacity local highway network around the M1 Junction 15 area. The northern boundary highway could not be utilised as it would require lorry movements to transit through the villages of Collingtree or Milton Malsor which is understandably not desirable and is one of the major constraints to developing of the Milton Malsor MA2 site for sand and gravel abstraction.

- Whilst it is acknowledged that the proposed development may be seen to sterilise a volume of potential sand and gravel resource within the Northamptonshire County Council Mineral Safeguarding Area there is clearly no shortage of resource elsewhere within Northamptonshire or the region with planned and allocated resources available for the next twenty years in clearly more economically viable areas.

7. Therefore the sterilisation of a very limited volume of potential future aggregate resource, relative to the regionally available resources is considered to be a **minor negative environmental** impact.

8. This has been agreed with the Northamptonshire County Council Minerals Safe Guarding team and is highlighted within the correspondence included within Appendix 6.9.

6.5.2.3 Re-instatement (Open Space Areas)

1. Wherever possible the areas of the site designed to be retained as open space, landscape or habitat will be left untouched by main earthworks. This is considered to represent **no impact.**

2. Where works affect the area of open space and landscaping the recommendations of the Soil Code (The Code of Good Agricultural Practice for the Protection of Soils) will be adhered to in order to avoid causing long term change to the soils. Normal procedure is to strip topsoil with a bulldozer blade or excavator and to store it to one side of the working-width. This will ensure separation from any other materials and will protect it from further stress. The forces exerted by this action are comparable with those experienced during

cultivation so significant compaction to the topsoil is avoided. This approach is considered to represent **no impact.**

3. Soil resilience generally increases throughout the spring and summer months as the soil dries out, so that even vulnerable soils may be handled with minimal impact when dry. In this respect the works programme will wherever possible attempt to schedule any works during this period to improve opportunities for phasing of soil handling. This is considered to represent **no impact.**
4. Areas of planned open space and landscape areas affected by significant cut and fill earthworks will be restored and reinstated to the requirements of the ecologists and landscape designers with planting undertaken to their requirements. Similarly where possible, land form will also be to the requirements of landscape, visual requirements. This is considered to represent a **no impact.**
5. Careful attention to slopes angles and drainage conditions will facilitate the re-establishment of normal rooting patterns. This is considered to represent a **no impact.**
6. Should sub-soil compaction be suspected, re-excavation and aeration or other appropriate cultivation can be undertaken if required. This is considered to represent a **no impact.**

6.5.2.4 Sensitive Receptors

1. Works are not anticipated to interfere with or directly affect the underlying secondary aquifers water quality.
2. Works are not anticipated to interfere with or directly affect the adjacent stream. Therefore river quality is anticipated to be unaffected and it is considered to represent a **no impact.**
3. The development of the bypass results in the requirements for a bridge crossing the 4 line mainline railway which are in deep cutting (Roade Cutting). Roade Cutting is designated as a geological SSSI. Currently, the geological SSSI is not visible or safely accessible for examination as the feature comprises heavily overgrown and vegetated man made cutting faces located along the mainline railway which is currently inaccessible being within the railway lands. The bridge design is being formulated to avoid interfering with the slope and as such it is concluded that there will be **no impact** upon the geological SSSI**.**

6.5.2.5 Sustainability

1. The reprofiling works will be designed to achieve an earthworks cut to fill balance thus minimising the need for off-site disposal and import of materials. This reduces the need for waste disposal and loss of void space in off-site landfills, reduces the requirement for importation of valuable natural quarried soils and rock and has the added benefit of minimising off site lorry movements. Therefore this is considered to represent a sustainable approach to development.
2. Where materials are required to be imported, the developer will endeavour to utilise recycled inert clean aggregate and soils sourced locally. This might include the reuse of crushed concrete and brick in place of importing natural aggregate and rock resources. Therefore this is considered to represent a sustainable approach to development.

6.6 Assessment of Likely Residual Impacts

1. The project as described and the mitigation measures proposed are anticipated to result in negligible environmental impacts. This can be summarised by the following points:
2. The hard development does not sterilise any areas of land permitted or allocated for future provision of mineral or aggregate resource supply.
3. Earthworks cut and fill balance will negate the need for large amounts of lorry movements and removal of materials to landfill and importation of materials.
4. The reuse of clean natural soils will not cause any impact to surface waters or aquifers.
5. A project management team will oversee construction work and enforce appropriate environmental monitoring control measures. This will ensure that short term construction impacts to environmental receptors including the public and adjacent site users are managed and minimised or completely prevented.
6. The construction contractor will adhere to best construction practice.

6.7 Assessment of Cumulative Impacts

1. There are no known or identified cumulative impacts resulting from this proposed development with any surrounding committed projects with respect to soils, geology and contamination as there are not going to be any likely interfaces with respect to geology, soils and groundwater with any proposed adjacent developments such as Rail Central.

2. The proposed Milton Malsor MA2 allocated sand and gravel extraction site on the northern boundary of the application site will be unaffected by the proposed development.

3. Therefore there are not anticipated to be any potential future cumulative impacts resulting from the proposed development or any resulting later extraction of the Milton Malsor site beyond the northern boundary.

6.8 References

Ref. 6-1 *National Planning Policy Framework (March 2012).*

Ref. 6-2 *Environmental Protection Act, 1990/2004 (Part IIA).*

Ref. 6-3 *Contaminated Land Regulations (England) 2006 amended 2012*

Ref. 6-4 *The Water Environment (Water Frameworks Directive) (England & Wales) Regulations 2003.*

Ref. 6-5 *The Environmental Permitting Regulations (England & Wales)Regulations 2010.*

Ref. 6-6 *The Site Waste Management Plans Regulations 2008.*

Ref. 6-7 *Environment Agency: Guiding Principles of Land Contamination (2010)*

Ref. 6-8 *Environment Agency: Model Procedures For The Management of Land Contamination (2014)*

Ref. 6-9 *Environment Agency: Groundwater Protection: Policy & Practice (GP3) 2013.*

Ref. 6-10 *British Geological Survey: Mineral Safeguarding in England: good practice and advice (Minerals and Waste Programme Open Report OR/11/046) 2011.*

Ref. 6-11 *British Geological Survey: Mineral Resource Information for development Plans Northamptonshire: Resources and Constraints (technical Report WF/00/4 Mineral Resources Series)*

Ref. 6-12 *Northamptonshire County Council: Minerals and Waste Development Framework Core Strategy Development Plan Document adopted May 2010.*

Ref. 6-13 *Northamptonshire County Council: Minerals and Waste Development Framework; Locations for Minerals Development, Development Plan Document adopted March 2011.*

Ref. 6-14 *Northamptonshire County Council: Minerals and Waste Local Plan Update; Submission Document August 2016.*

Ref. 6-15 *Northamptonshire County Council: Minerals and Waste Local Plan adopted October 2014.*

Ref. 6-16 *South Northamptonshire Council: Local Development Scheme March 2016..*

Ref. 6-17 *South Northamptonshire Council: Settlements and Development Management Policies Local Plan October 2013.*

Ref.6-18 *South Northamptonshire Council; Planning Policy and regeneration strategy committee 13th March 2013: Consultation on the Northamptonshire minerals and waste development framework partial review; draft minerals and waste local plan.*

Ref. 6-19 *South Northamptonshire Council; Contaminated Land Strategy August 2009.*

Ref.6-20 *Northants Contaminated Land Group: Contaminated Land; A guide to developers and their advisors V3. November 2005.*

Ref. 6-21 *Environmental Protection Act, 1990 (Part IIA) – Statutory Guidance April 2012*

Ref. 6-22 *The Contaminated Land (England) (Amendment) Regulations 2012*

Ref.6-23 *National Planning Policy Guidance – Live Web resource introduced February 2014.*

Ref 6-24 *National Policy Statement for National Networks (NPSNN) December 2014.*