8. Land Quality

Introduction and Methodology

8.1 The principal aim of this chapter is to identify past land uses or events which might lead to unacceptable risks to health or to the environment (including controlled waters) and enable planning for further investigation and mitigation of those risks, if any are identified. The impact on land quality due to the proposed development is also considered.

8.2 Chapter 6: Geology, Soils and Agriculture should be referenced accordingly for detailed assessment on land quality due to the proposed development.

8.3 The information gathered in this assessment has been presented in keeping with the Model Procedures for the Management of Land Contamination, Contaminated Land Report (CLR) 11 produced by DEFRA in conjunction with the Environment Agency (EA).

8.4 Within this chapter the following two types of risk assessment have been undertaken:

- Preliminary Risk Assessment (PRA); and
- Generic Quantitative Risk Assessment (GQRA).

8.5 The PRA stage of CLR11 is development of an initial Conceptual Site Model (CSM) and evaluation of whether or not there are potentially unacceptable risks. This facilitates planning for further investigation and mitigation of the risks identified, if any.

8.6 Risk assessment presents a structural gathering of information to form a judgement about the risks associated with a given route of exposure. For a risk to arise there must be a possible pollutant linkage from a source to a pathway and receptor, though the likelihood and magnitude of a risk will depend on the site specific combination of those factors.

8.7 PRA identifies potential sources by research, whereas the presence of a source is only confirmed when a potentially hazardous substance is identified in the ground.

8.8 Consultation has taken place with the Geological Survey of Northern Ireland (GSNI), Northern Ireland Environment Agency (NIEA) Land and Resource Management (LRM) Section, and Antrim, Belfast and Newtownabbey Council's Environmental Health Department to determine whether they have knowledge of, or concerns relating to, the land quality in the area of the proposed development. Site visits have also been undertaken to aid evaluation of the site and record prominent features not shown on published maps, such as new housing or industry.

8.9 This chapter includes research into the historical uses of the application site and a review of published information on features such as geology, soil and land use.

8.10 A GQRA has also been undertaken. The aim of the GQRA is to:

- Target potential contamination sources that have been identified in the PRA;

- Sample and analyse environmental media that may indicate potential contamination;
- Revise the CSM based on findings of analysis.

Regulatory Framework and Assessment Process

8.11 Within Northern Ireland there is legislation which prescribes protection measures for environmental media (land, water and air) that are regulated at the regional level by statutory bodies such as the NIEA and also at the local level by local Councils. In this case two local council areas are involved with both Antrim Borough Council and Newtownabbey Borough Council administrative areas straddling the application site area.

8.12 Part 3 of the Waste and Contaminated Land Order 1997 contains the main legal provisions for the introduction of a contaminated land regime in Northern Ireland. The Part 3 regime aims to deal with the legacy of historically contaminated land through the "polluter pays" principle. This ensures that, where possible, those who pollute the land will pay for its remediation so that it is "suitable for use". It should be noted that Part 3 of the order has yet to be commenced,

8.13 There are many benefits associated with the implementation of a contaminated land regime. The Part 3 regime:

- Acts in the interests of environmental and health protection;
- Encourages land regeneration and contributes to planning targets in the Regional Development Strategy and Belfast Metropolitan Area Plan; and
- Contributes to the principal objectives of the Water Framework Directive.

Conceptual Site Model

8.14 A conceptual model is used to summarise the potential pollutant sources, the possible hazards and the processes that affect the transport of contaminants from the potential sources through the various migration pathways to potential receptors.

8.15 A pollutant source is generally identified as a potential cause of a hazard or statutory nuisance. A pathway is a migration route by which the hazard or nuisance may impact a potential receptor. A pollutant linkage is defined as the relationship between a potential hazard or nuisance source (e.g. waste or dust), a pathway (e.g. permeable ground) and a receptor (e.g. humans or groundwater). Without the presence of a link between a hazard or nuisance source, a viable pathway and a receptor, a pollutant linkage does not exist and therefore there cannot be a risk to a receptor. However, it cannot be assumed that no risk will ever exist as changes in land use or activities can influence either a source, pathway or receptor.

Risk Assessment

8.16 Where potential contamination sources are, or were present, that have or had a potential to cause ground contamination, it is necessary to carry out a health and environmental risk assessment. Environmental risk assessment is a tool to assist evaluation of the significance of

possible chemical contamination with regard to its potential impact on human health and the environment in general.

8.17 Environmental risk assessment is normally based on the pollutant linkage concept whereby a pollutant linkage comprises a pollutant source, a valid migration pathway and a likely receptor. If a pollutant linkage is demonstrated then there is a potential risk to a receptor, which may or may not require remedial measures. The DEFRA and EA publication CLR 11 Model Procedures for the Management of Contaminated Land, outlines three tiers of risk assessment: preliminary risk assessment, generic quantitative risk assessment and detailed quantitative risk assessment.

8.18 The first of these is qualitative, based on desk and site reconnaissance information whereas the generic quantitative risk assessment utilises generic assessment criteria to enable a screening assessment of a site, in particular to determine whether there are actual or potentially unacceptable risks.

8.19 The approach adopted as part of this assessment is to describe the Conceptual Model for the application site and carry out an Environmental Risk Assessment to evaluate the potential source-pathway-receptor pollutant linkages and risks to human health and controlled waters.

8.20 The risk assessment is informed by professional judgement based on available information and data and effectively constitutes a preliminary risk assessment as described in CLR 11. The assessment then informs the prediction of environmental effects arising from the proposed development.

Explanation of Baseline Conditions

Application Site Details

8.21 The operational component (MBT, EFW, RDF Storage, IBA, and Visitor Centre) of the application site extends to approximately 13.37 hectares. The wider application site area is 52.3 hectares (including road upgrade, site access, site operational area and construction compound areas). The overall quarry site currently owned by Tarmac has a site area of 62 hectares.

8.22 The proposed development site has been used as a basalt quarry since the early 1980s. The quarry currently has full planning consent for mineral extraction and associated activities. The quarry site currently operates to ISO14001 standards, audited by BSI, with a company EMS in place and strong operational records held.

8.23 Located to the east of the quarry within the application site is an Asphalt Plant and associated fuel and bitumen tanks. Three bitumen tanks are located in this area, each with a 10,000 gallon capacity. There were localised signs of bitumen spillage during site visits and inspections. The fuel tanks included a gas oil tank (capacity 50,000 litres) and a plastic fuel tank (circa 2000 litres). These fuel tanks were bunded and no spillages were observed.

8.24 The area of the asphalt plant is flat and pools of standing water were observed. Dust and sand stores are located adjacent to the asphalt plant and these are used in the asphalt process. The area of the asphalt plant is shown in Figure 8.1.

Fig 8.1 Asphalt Plant

8.25 North of the Asphalt plant area is an area of made ground (sourced from quarry) which was previously used for construction waste recycling activities. No signs of contamination were evident during site inspections within this area.

8.26 North of the EfW location (within the quarry) are maintenance buildings, bunded fuel tanks, water tank and an electricity sub-station. Petrol oil is stored in three metal tanks (only two bunded) each with a capacity of 50,000 litres. No signs of spillages were noted during site inspections.

8.27 Further north of the maintenance area an abandoned building exists with suspected asbestos containing roof material. No spillages or signs of contamination were identified within these areas. No underground storage tanks are located on the site.

8.28 The operational component of the application is located within the southern section of the quarry. This section of the site is known as the Upper Yard and is divided by two broad benches that are cut into the rock with platform elevations of 244 mOD and 260 mOD. A typical view of the upper platform is displayed in Figure 8.2.

Fig 8.2 Upper Platform

8.29 A layer of fine gravel and fine sand/silt overlays the rock. This layer was observed as being very thin in the region of 25-50mm. Exposed rock was also observed throughout the application site.

8.30 During the site visit a number of pools of standing water were observed (see Figure 8.3) on the surface of the application site indicating a relatively impervious surface, though that may in part be due to infilling of fractures within the bedrock by quarry rock dust. It was confirmed with the quarry operators that the source of this water is rainfall and not an artesian source.

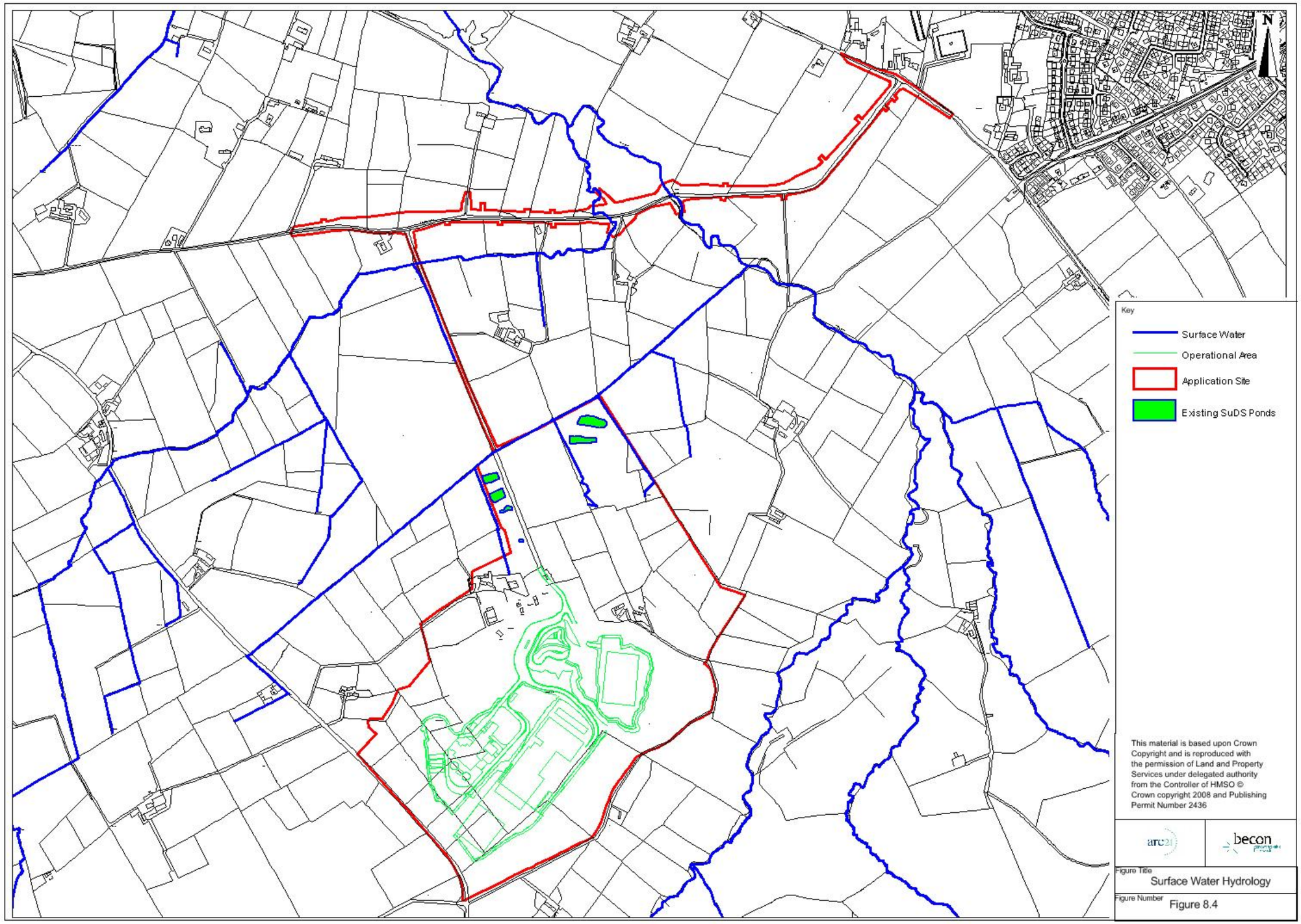
Fig 8.3 Pool of standing water

8.31 Due to the relatively impervious surfaces within the quarry area, surface water run-off mainly drains from the site via overland flow.

8.32 Small open drainage channels have formed in various parts of the site which carry flows towards the north-eastern corner of the quarry site and run alongside the site access road before attenuation and settlement in existing ponds prior to discharging into a tributary of the Flush River. The first four ponds are located on the western side of the site access road and these ponds provide settlement prior to being piped under the access road and into a final settlement/balancing pond which also provides tertiary treatment in the form of reeds. The flow from the final balancing pond enters a 3 stage Petrol Interceptor prior to discharge to a field drain which connects to the Flush River.

8.33 The Boghill Road component of the application site is approximately 1.4 km in length from Hydepark Road to a point west of the existing quarry access road. No visible signs of pollution were observed along this stretch of road or the adjacent areas during site inspection.

8.34 Drainage from Boghill Road currently flows into a number of natural drainage ditches, which in turn drain into Flush River. Figure 8.4 shows details of surface water features in relation to the application site.


N
Key
Surface Water
Operational Area
Application Site
Existing SuDS Ponds
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Surface Water Hydrology
Figure Number
Figure 8.4

8.35 Flush River flows into Hydepark Dam and eventually enters the designated Ballymartin Water approximately 1.8 km downstream of the Dam. Ballymartin Water is one of the main tributaries of Six Mile Water which enters Lough Neagh adjacent to the Lough Shore Park in Antrim. Six Mile Water is one of six major rivers that flow into Lough Neagh. Detailed information on the hydrological regime is provided in Chapter 7: The Water Environment and should be referenced accordingly.

Surrounding Area

8.36 The operational component of the application site is bounded by agricultural land to the west and south. The remaining components of the quarry site are located to the north and east. The entire quarry is essentially surrounded by agricultural land, with some scattered dwellings and a number of roads.

8.37 A property is indicated on background mapping to the north-west of the site but this house has been demolished. Anecdotal evidence suggests that fly-tipping of domestic material takes place on Flush Road. At present, agricultural activities are dominant in the surrounding area to the proposed development site with fields in active use for improved and semi-improved pasture.

8.38 Figure 8.5 displays the application site, surrounding area and various features of interest taken into account during this assessment.

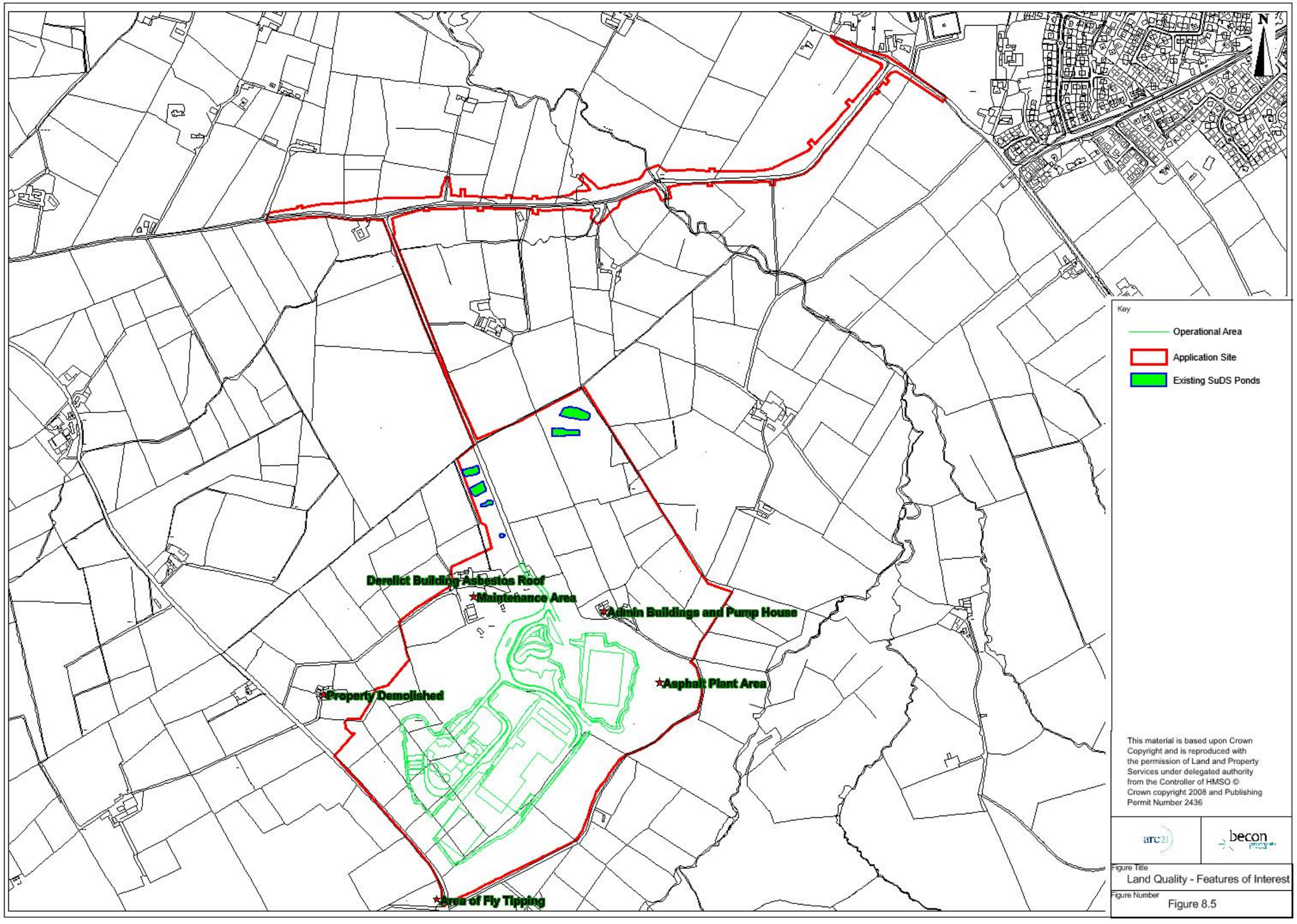
N
Key
Operational Area
Application Site
Existing SuDS Ponds
Derelict Building Asbestos Roof
Maintenance Area
Admin Buildings and Pump House
Asphalt Plant Area
Property Demolished
Area of Fly Tipping
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Figure Title
Land Quality - Features of Interest
Figure Number
Figure 8.5

Historical Uses of the Site and Adjacent Areas

8.40 Table 8.1 provides information from Ordnance Survey Northern Ireland (OSNI) historic maps database dating back to the 6 inch series of maps from 1820-1851.

Table 8.1 - OSNI Historic Maps Data

Time Period	Map Ref	Features on Application Site	Features in Study Area
1820-1851	OS 6 Inch Country Edition 1. 1829 – 1835	Fields including Marshy Areas	Road identified to west, scattered dwellings and quarry to south
1851-1883	OS 6 Inch Country Edition 2. 1831 – 1904	Fields including Marshy Areas	Road identified to west and scattered dwellings
1883-1920	OS 10 25 Inch Country Edition 2. 1894-1957	Marsh Areas	Road identified to west and scattered dwellings
1883-1920	OS 6 6 inch Country Edition 3. 1857-1932	Marsh Areas	Road identified to west and scattered dwellings
1883-1920	OS 8 Large Scale Town Plans	Fields	Road identified to west and scattered dwellings
1920-1951	OS10 25 Inch Country Edition 3 1901-1957	Marsh Areas	Road identified to west and scattered dwellings
1920-1951	OS10 25 Inch Country Edition 4 1895-1956	Marsh Areas	Road identified to west and scattered dwellings
1920-1951	OS6 6 inch Country Edition 4. 1907-1957	Marsh Areas	Road identified to west and scattered dwellings
1920-1951	OS6 6 inch Country Edition 5. 1907-1964	Marsh Areas	Road identified to west and scattered dwellings
1920-1951	OS6 6 inch Country Edition 6. 1907-1963	Marsh Areas	Road identified to west and scattered dwellings
1951 - Latest	OS11 25 inch Irish Grid Edition 1. 1901-1979	Marsh Areas	Road identified to west and scattered dwellings

8.41 There are a number of known heritage sites recorded within the vicinity of the application site on the NIEA Sites and Monuments database. The closest sites are listed in Table 8.2. Chapter 11: Cultural Heritage provides further assessment and should be referenced accordingly.

Table 8.2 - Heritage Sites

NIEA Reference	Type of Feature	Description
Ant 056:102	Sites and Monuments	Booley Huts (Excavated)
Ant 056:069	Sites and Monuments	Circular Cropmark (Aerial Photo identification)
Ant 056:073	Sites and Monuments	Settlement Complex
07300.000.00	Industrial Heritage	Bridge
07301.003.00	Industrial Heritage	Mill Pond

Land Quality Database

8.42 Information in relation to the application site has been obtained from NIEA Land and Resource Management Land Use Database. That database was developed in 1997 and contains details on approximately 12,000 sites within NI. The information received from NIEA is presented in Table 8.3 and provides details of current and previous industrial uses within the vicinity of the application site.

Table 8.3 - Land Use Database sites in close proximity to the application site

Site Number	Borough	Distance /Direction from Application Site	Address	Description	History	1930 Land Use	1904 Land Use	1856 Land Use	1834 Land use
BT129/055	Belfast	1150m south	Ballyutoag TD	Mineral Workings	1966 Quarry	Quarry	Agriculture	Agriculture	Agriculture
AM129/014	Antrim	729m south	Flush Road	Mineral Workings	1966 Quarry	Quarry	Quarry	Quarry	Quarry
LN113/001	Lisburn	626m south	Ballyutoag TD	Mineral Workings	1996 Quarry	Quarry	Agriculture	Agriculture	Agriculture
BT129/053	Belfast	628m south	Flush Road	Mineral Workings	1966 Quarry	Quarry	Quarry	Quarry	Quarry
LN113/002	Lisburn	Application Site	Ballyutoag TD	Mineral Workings	1996 Quarry	Agriculture	Agriculture	Agriculture	Agriculture
AM129/013	Antrim	293m south west	Flush Road	Reclaimed Land	1966 Agriculture	Agriculture	Agriculture	Agriculture	Gravel Pit
NY113/004	Newtownabbey	912m North	Grange of Mallusk TD	Reclaimed Land	1963 Quarry (Disused)	Quarry	Quarry	Quarry	Quarry

Published Geology and Hydrogeology

8.43 Data on site geology and hydrogeology is provided in Chapter 6: Geology, Soils and Agriculture and should be referenced accordingly.

8.44 One groundwater abstraction has been identified (from the NIEA abstractions database) in the vicinity of the application site:

- AIL/2008/0162 Hightown Quarry – Ballyutoag.

8.45 This is an abstraction that is used by Tarmac at the existing quarry for operational purposes. This supply will cease once mains water has been connected to the site. Please refer to Chapter 7 for further detail on this issue.

8.46 Specific information relating to the hydrogeology of the application site was collected during August and September 2012. Groundwater dips were taken at a number of boreholes located on the quarry site and the results are presented in Table 8.4. The locations of the boreholes are located on Figure 8.6.

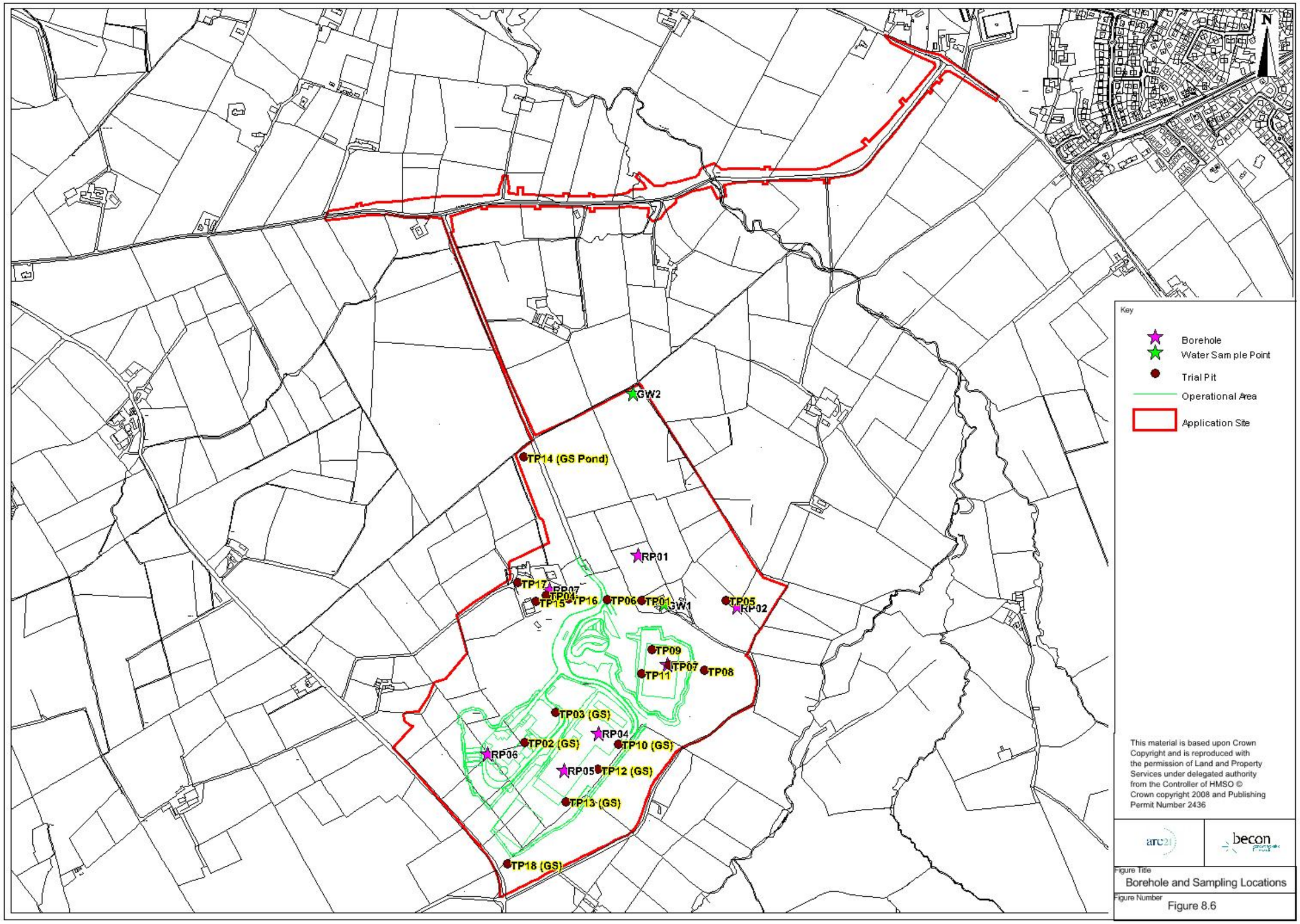
Table 8.4 Groundwater Depths at Hightown Quarry

Date of Sample	**06/09/12**	**13/09/12**	**18/09/12**	**27/09/12**	**08/01/13**	**15/01/13**	**15/05/13**
	Depth m OD						
RP01	219.04	218.42	221.18	218.46	219.32	219.4	218.32
RP02	233.3	233.16	233.02	233.46	232.88	232.77	232.64
RP03	229.78	229.77	229.57	229.72	-*	230.95	230.94
RP04	257.52	257.66	257.49	257.97	257.42	257.35	257.37
RP05	255.89	255.67	255.57	256.23	256.1	256	255.49
RP06	243.68	243.54	243.44	243.66	243.46	247.25	243.29
RP07	226.78	226.57	226.48	226.94	226.69	226.59	226.44

8.47 The groundwater levels taken at the individual boreholes are indicative of a groundwater flow in a northerly direction.

Borehole Records

8.48 A geotechnical site investigation has been undertaken specifically for this project and the findings are presented in Table 6.1, Chapter 6. Locations of individual borehole positions are displayed on Figure 8.6. Borehole Logs for the recent site investigation are located in Appendix 6.1.


N
Key
Borehole
Water Sam ple Point
Trial Pit
Operational Area
Application Site
GW2
TP14 (GS Pond)
RP01
TP17
RP07
TP04
TP15
TP16
TP06
TP01
GW1
TP05
RP02
TP09
TP07
TP08
TP11
TP03 (GS)
RP04
TP02 (GS)
TP10 (GS)
RP06
RP05
TP12 (GS)
TP13 (GS)
TP18 (GS)
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Borehole and Sampling Locations
Figure Number
Figure 8.6

Predicted Environmental Effects and their Significance (Construction and Operational) and Proposed Mitigation Measures

Conceptual Site Model

8.49 Based on the available information a Conceptual Site Model (CSM) has been devised for the application site. For each of the pollutant linkages identified within the CSM (i.e. a potential migration pathway from pollutant source to a possible receptor) a PRA has been made of the potential consequence of a hazard receptor link.

8.50 Based on the information gained by this assessment it is apparent that the identified land uses will have included activities with a potential to cause ground contamination. The areas of potential concern are summarised in Table 8.5. It is also possible that the land quality at the application site could have been affected by activities in the adjacent area.

Table 8.5 - Land Quality Concerns within the Site and in the Surrounding Area

Description	Reason(s) for Concern	Potential Pollutants
Application Site		
Quarrying Operations	Intermittent or localised spillages by mobile plant e.g. lorries and semi-mobile plant e.g. crushers in quarrying operations.	Petroleum Hydrocarbons
Made Ground	Accidental Spillages. Gas in main areas of made ground.	Petroleum Hydrocarbons. Methane (CH_4), Carbon Dioxide (CO_2), Carbon Monoxide (CO) and Hydrogen Sulphide (H_2S)
Asphalt Plant Area - Bitumen Tanks (10,000 Gallons) and Fuel Tanks (Gas oil tank 50,000 litres and 2,000 litres)	Spillages, leaks	Bitumen, Petroleum Hydrocarbons
Boghill Road	Accidental Spillages	Petroleum Hydrocarbons
Maintenance area – Oil Tanks (3 Petrol Oil tanks each with 50,000 litre capacities)	Potential spillages	Petroleum Hydrocarbons
Maintenance Area – Electricity Substation	Leakages	PCB’s and hydrocarbons
Maintenance Area – Derelict Building	Potential asbestos cement roofing sheets.	Asbestos

Description	Reason(s) for Concern	Potential Pollutants
Surrounding Area		
Agricultural Land Surrounding the Application Site	Leaching of Pollutants.	Nitrate, phosphate, ammonia, metals, sulphur, chlorine, pesticides and herbicides.
Rubble from demolished building	Unknown make up of building and contents.	Asbestos, metals, petroleum hydrocarbons
Fly Tipping on Flush Road	Unknown Waste materials	Metals, petroleum hydrocarbons, semi-volatile organic compounds including polyaromatic hydrocarbons
Heating Oil tanks at domestic properties	Potential Spillages	Petroleum Hydrocarbons
Surface water and foul drainage from domestic properties, septic tanks	Potential for leakage of sewage.	Bacteria

8.51 Contamination sources can generally be placed into two categories, point or dispersed sources. Point sources can be described as having a localised nature such as a liquid storage area, spill or leakage situation. A dispersed source relates to a wider source such as extensive made ground or the application of fertilizers or pesticides.

8.52 Relatively small areas of made ground exist within the quarry site, mainly around the existing maintenance area and the area previously used for construction waste recycling activities. It should be noted that both these areas were constructed using material from the quarry and both areas will only be used throughout the construction phase of the development.

8.53 In respect of the proposed development on the site comprising a mix of new buildings, access routes and landscaping, the following conceptual site model has been formulated:

Source

8.54 The possible sources of contamination which are potentially relevant include:

- Contaminated soil / overburden;
- Ground Borne Gases; and
- Contaminated Groundwater.

Receptors

8.55 These have potential to impact the following receptors:

- Site construction workers;
- Site users;
- Occupiers of adjacent properties;
- Groundwater;
- Surface water;
- Vegetation and fauna;
- Soils;
- Neighbouring Properties.

Pathways

8.56 This could occur via the following possible pathways:

- Inhalation or ingestion of soil containing hazardous substances;
- Inhalation of vapours from volatile hazardous substances;
- Downward migration of liquid or leachable products by infiltration of surface water to groundwater;
- Groundwater migration to a surface water feature or abstraction point;
- Surface water runoff to on-site lagoons and onward discharge;
- Wind dispersal of dust or odour;
- Uptake from soil by plants; and
- Overland flow to surface water bodies.

Risk Assessment

8.57 Risk can be defined as a combination of the likelihood of occurrence of a defined hazard and the magnitude of the consequences of the occurrence. A risk assessment evaluates the potential source-pathway-receptor linkages based on the available information.

8.58 For each of the possible pollutant linkages identified within the CSM, i.e. a potential migration pathway from pollutant source to a possible receptor, a judgement has been made regarding the potential consequence of a hazard receptor link, the likelihood of a hazard receptor linkage and the potential significance (risk) of a hazard occurring.

8.59 The relative terms described in Table 8.6 have been used to provide an overall classification for the risk assessment.

Table 8.6 - Risk Assessment

Class	Description
Intolerable Risk	A risk with severe or significant consequences has been identified as happening or more than likely. Urgent action is required to investigate (if not already undertaken) and understand the risk. Remedial action more than likely to be required.
Substantial Risk	A risk has been identified which either has a high likelihood of moderate consequences or a lower likelihood of severe consequences. The issue should be investigated further (if not already undertaken) in order to understand the risk better. Remedial action likely to be required.
Moderate Risk	A risk has been identified but there are unlikely to be more than moderate consequences. The issue should be investigated further (if not already undertaken) but extensive remedial action is unlikely to be required.
Tolerable Risk	A risk has been identified but the likelihood of more than transient consequences is very low. No further investigation is likely and remedial action if necessary would be minor.
Nil Risk	No risk has been identified. No action required.

8.60 Based on the available information Table 8.7 summarises the CSM for each potential source-pathway-receptor linkage along with an evaluation of the potential risk identifying the requirement (if any) for more detailed assessment or mitigation of the risk.

Table 8.7 - Conceptual Site Model, Preliminary Assessment and Mitigation of Risk

Potential Source and Reason for Concern	Potential Pathway(s) to Receptor	Potential Receptor	Preliminary Risk Assessment and Mitigation of Relevant Source-Pathway-Linkage	Is further investigation required?
Application Site				
Quarrying /Site Operations – Intermittent or localised spillages by cars, lorries and mobile plan and semi mobile plant e.g crushers in quarry. Potential pollutants from such spillages could include Petroleum Hydrocarbons.	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	road users, site construction workers, site users, site visitors, occupiers of adjacent properties	Tolerable to Moderate Risk – assessed in terms of potential spillages from mobile plant and blasting operations.	Yes Investigation is required to identify any soil / overburden contaminants. DOE Industry profiles
	Fissure in rock.	Groundwater, surface water	Tolerable - Moderate Risk – assessed in terms of potential spillages from mobile plant and blasting operations.	Yes – Investigation is required to identify any groundwater contaminants.
Made Ground. Potential contaminants within made ground due to relatively recent spillages during site operations.	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	construction workers	Tolerable to Moderate Risk – Although made ground comprises clean stone from the quarry the areas have been used for permanent and semi permanent fuel storage. No spillages evident during site visits but potential does exist for ground borne gases potentially due to historic spillages.	Yes Investigation is required to identify any contaminants within the made ground.

Potential Source and Reason for Concern	Potential Pathway(s) to Receptor	Potential Receptor	Preliminary Risk Assessment and Mitigation of Relevant Source-Pathway-Linkage	Is further investigation required?
Potential pollutants from such spillages could include petroleum hydrocarbons.				
Gas in main areas of made ground. Potential for ground gas to be present due to the degradation of historic spillages.	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	construction workers	Tolerable - Moderate Risk – Although made ground comprises clean stone from the quarry the areas have been used for permanent and semi permanent fuel storage. No spillages evident during site visits but potential does exist for ground borne gases potentially due to historic spillages.	Yes – gas monitoring recommended.
Asphalt Plant Area – Bitumen and Fuel Tanks Spillages. Potential pollutants from such spillages could include Petroleum Hydrocarbons and bitumen.	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	Road users, site construction workers, site users, site visitors, occupiers of adjacent properties	Tolerable to Moderate Risk assessed due to Signs of bitumen spillage and potential for fuel spillages from tanks.	Yes Investigation is required to identify any soil / overburden contaminants. DOE Industry Profile for Ceramics, Cement and Asphalt Manufacturing was consulted and potential contaminant have been included within the analytical suites.
	Fissure in Rock.	Groundwater	Moderate Risk assessed in terms of potential historic fuel spillages due to the presence of large fuel tanks.	Yes – Investigation is required to identify any groundwater contaminants. DOE Industry Profile for Ceramics, Cement and Asphalt

Potential Source and Reason for Concern	Potential Pathway(s) to Receptor	Potential Receptor	Preliminary Risk Assessment and Mitigation of Relevant Source-Pathway-Linkage	Is further investigation required?
				Manufacturing was consulted and potential contaminant have been included within the analytical suites.
Boghill Road – fuel spillages. Potential pollutants could include petroleum hydrocarbons.	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	road users, site construction workers, site users, site visitors, occupiers of adjacent properties	Nil to tolerable Risk. No signs of spillages or vegetation degradation during numerous visits. Road surface made up of bitumous hard surfacing creating a barrier for spillages which would be directed to drainage system. Risk to site construction workers are considered low given the short periods of exposure. Also all works will be carried out in accordance with CDM Regulations, identifying potential health and safety risks throughout the construction process. No soil will be transferred off site. Any controlled waste will be disposed of appropriately.	No further investigation or mitigation is recommended
	Run-off	Surface water	Nil to Tolerable Risk – No signs of spillages during numerous visits. Natural drainage ditches in place to assist in retention of run-off from road. Any potential contaminants are likely to have been washed away.	No further investigation or mitigation is recommended
Maintenance Area – Fuel Tanks,	Contact with, inhalation or	Road users, site construction	Moderate Risk assessed in terms of potential historic spillages due to the presence of large	Yes Investigation is required to identify any soil / overburden contaminants. DOE

Potential Source and Reason for Concern	Potential Pathway(s) to Receptor	Potential Receptor	Preliminary Risk Assessment and Mitigation of Relevant Source-Pathway-Linkage	Is further investigation required?
Electricity Substation. Potential pollutants could include PCB's and Hydrocarbons.	ingestion of soil particles. Wind dispersal of soil particles.	workers, site users, site visitors, occupiers of adjacent properties	fuel tanks and Electricity Substation.	Industrial profiles for Electrical and Electronic Equipment Manufacturing was consulted and potential contaminant have been included within the analytical suites.
	Fissure in Rock.	Groundwater	Moderate Risk assessed in terms of potential historic spillages due to the presence of large fuel tanks and Electricity Substation.	Yes - Investigation is required to identify any groundwater contaminants. DOE Industrial profile for Electrical and Electronic Equipment Manufacturing was consulted and potential contaminant have been included within the analytical suites.
Maintainance Area – Derelict Building. Potential asbestos cement roofing sheets have been used in the buildings construction.	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	Road users, site construction workers, site users, ste visitors, occupiers of adjacent properties	Tolerable to Moderate risk – assessed in terms of asbestos with degradation of potential asbestos cement roofing.	Yes Investigation is required to identify any soil / overburden contaminants.
Agricultural Land. Potential pollutants	Contact with, inhalation or	Road users, site construction	Nil to Tolerable Risk – site or recorded evidence has not indicated this to be a	No further investigation or mitigation is recommended

Potential Source and Reason for Concern	Potential Pathway(s) to Receptor	Potential Receptor	Preliminary Risk Assessment and Mitigation of Relevant Source-Pathway-Linkage	Is further investigation required?
include nitrates, phosphorus, ammonia, metals, sulphur, chlorine, pesticides and herbicides.	ingestion of soil particles. Wind dispersal of soil particles. Overland flow.	workers, site users, site visitors, Occupiers of adjacent properties	problem. Quarry site is elevated relative to surrounding area.	
	Groundwater migration	Groundwater	Nil to Tolerable Risk – site or recorded evidence has not indicated this to be a problem. Quarry site is elevated relative to surrounding area.	No further investigation or mitigation is recommended
Surrounding Area				
Rubble from demolished building. As building make up unknown a potential exists for pollutants such as asbestos, metals,	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	Road users, site construction workers, site users, site visitors, occupiers of adjacent properties	Nil to Tolerable risk – No evidence of wind dispersion and due to the time elapsed since demolition dust particles have already dispersed. Quarry site is elevated relative to surrounding area.	No further investigation or mitigation is recommended

Potential Source and Reason for Concern	Potential Pathway(s) to Receptor	Potential Receptor	Preliminary Risk Assessment and Mitigation of Relevant Source-Pathway-Linkage	Is further investigation required?
petroleum hydrocarbons.	Fissure in Rock.	Groundwater	Nil to Tolerable risk – No fuel spillages were observed and this area is outside the application site. Quarry site is elevated relative to surrounding area.	No further investigation or mitigation is recommended
Fly Tipping on Flush Road	Physical Risk	Road users, site construction workers, site users, site visitors, occupiers of adjacent properties	Nil to Tolerable risk – no obvious evidence of ground contamination but represents a physical hazard however is outside application site	No further investigation or mitigation is recommended
Heating Oil tanks at domestic properties	Wind dispersal of soil particles.	Road users, site construction workers, site users, site visitors, occupiers of adjacent properties	Nil to Tolerable risk – No fuel spillages were observed and this area is outside the application site. Quarry site is elevated relative to surrounding area.	No further investigation or mitigation is recommended
	Groundwater	Groundwater	Nil to Tolerable risk – No fuel spillages were observed and this area is outside the	No further investigation or mitigation is recommended

Potential Source and Reason for Concern	Potential Pathway(s) to Receptor	Potential Receptor	Preliminary Risk Assessment and Mitigation of Relevant Source-Pathway-Linkage	Is further investigation required?
	migration		application site. Quarry site is elevated relative to surrounding area.	
	Migration through soil	Flora and Fauna	Nil to Tolerable Risk – no obvious evidence of impact to vegetation or fauna. Quarry site is elevated relative to surrounding area.	No further investigation or mitigation is recommended
Surface water and foul drainage from domestic properties, septic tanks	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	Road users, site construction workers, site users, site visitors, occupiers of adjacent properties	Nil to Tolerable Risk – as no evidence of plant degradation or of a water pollution incident was discovered during site visits. No further investigation or mitigation is recommended. Outside the application site. Quarry site is elevated relative to surrounding area.	No further investigation or mitigation is recommended
	Surface water infiltration.	Groundwater	Nil to Tolerable Risk – site or recorded evidence has not indicated this to be a problem. Quarry site is elevated relative to surrounding area.	No further investigation or mitigation is recommended
	Migration through soil	Flora and Fauna	Nil to Tolerable Risk – no obvious evidence of impact to vegetation or fauna. Quarry site is elevated relative to surrounding area.	No further investigation or mitigation is recommended

Preliminary Risk Assessment Findings

8.61 The PRA has appraised the potential contamination sources, pathways and receptors for the application site, with that appraisal presented within Table 8.7.

8.62 From the PRA it is considered that the principal sources of contamination that may be present are due to historic activities on the quarry site and particularly the presence of fuel and other holding tanks within the site.

8.63 Further investigative sampling and testing was considered necessary in order to fully qualify the potential risk to human health and environmental receptors. Soil / overburden, water and gas sampling was recommended.

Intrusive Ground Investigation and Contamination Assessment (Phase 2)

8.64 A targeted sampling strategy was utilised for the sampling. 18 locations were identified for soil / overburden sampling and seven on site borewells have been utilised for groundwater and gas monitoring. Surface water samples have also been taken from the balancing ponds along with samples from existing licensed groundwater supply. Locations of boreholes and sampling points are located on Figure 8.6. The sampling strategy utilised for this project is detailed in Appendix 8.1.

8.65 The spatial distribution of the boreholes installed during the site investigation and sampling locations was based upon guidance contained in the following:

- *British Standard (BS)10175:2011 – Investigation of Potentially Contaminated Sites – Code of Practice; and*
- *DEFRA: CLR4 – Sampling Strategies for Contaminated Land.*

Environmental Monitoring Techniques

8.66 Soil Samples were taken via trial pits and grab samples across the site on 7th January 2013. Trial pits were dug using a track machine. Soil samples were analysed for the a number of determinands (identified utilising DOE Industry Profiles) including some of those within the following groupings:

- Asbestos;
- Inorganics;
- Total Petroleum Hydrocarbons;
- Polyaromatic Hydrocarbon;
- PCB's;
- Semi Volatile Organic Compounds; and

- Volatile Organic Compounds.

8.67 Groundwater and gas samples taken from the seven existing borewells. These wells were constructed using 50mm HDPE slotted pipes and gas bungs were installed to facilitate the monitoring of groundwater and any potential ground borne gas.

8.68 Purging of at least three well volumes took place to ensure a representative sample of groundwater was taken from the wells. A dip meter was also used at each borehole to determine the depth of the groundwater. Gas samples were obtained using a calibrated GA2000 portable infrared gas meter.

8.69 Water samples were analysed for a number of determinants (identified from DoE Industry profiles) including some of those within the following groupings:

- Inorganics;
- Total Petroleum Hydrocarbons;
- Polyaromatic Hydrocarbon;
- Semi Volatile Organic Compounds; and
- Volatile Organic Compounds.

8.70 Two additional water samples were also taken from within the application site. One sample was taken from a tap which is supplied by groundwater and is used for operational requirements at the quarry. Another sample was taken from the final settlement/balancing pond.

Generic Quantitative Risk Assessment (GQRA)

8.71 The laboratory and on-site sample results obtained as result of recommendations within the PRA have been utilised to carry out a GQRA.

Sources of Contaminants

Soil / Overburden Contamination

8.72 Generic assessment criteria are scientifically based criteria used during initial assessment of human health risks which may arise from long-term and on-site exposure to chemical contamination in soil. Generic assessment criteria which have been utilised by this study include the UK Soil Guideline Values (SGVs), the Atkins' Soil Screening Values (SSVs), the LQM / CIEH Generic Assessment Criteria, and the CL:AIRE soil GAC.

8.73 The Atkins'SSVs have been derived in line with the Environment Agency 2009 guidance (SR2, SR3, SR4, SR7) using the CLEA v1.04 and CLEA v1.06 software. For a sandy loam soil there are two sets of SSVs: one at 6% soil organic matter (SOM); and there is also a set of SSVs at 1% SOM for a sand soil.

8.74 The Land Quality Management / Chartered Institute of Environmental Health (LQM / CIEH) Generic Assessment Criteria (GAC) 2nd edition has been updated to reflect the significant changes in human health risk assessment technical guidance and policy since the release of the first edition. The 2nd edition presents GAC for an extended range of substances and GAC have been derived for a range of generic land uses and soil organic matter contents.

8.75 The CL:AIRE soil GAC is published jointly by the following organisations; CL:AIRE, the Environmental Industries Commission (EIC) [www.eic-uk.co.uk] and the Association of Geotechnical and Geoenvironmental Specialists (AGS). The GAC's have been derived for a number of SOM contents.

8.76 If a GAC is exceeded, it is recommended that:

- the pollutant linkage(s) associated with the relevant contaminant are re-affirmed; and
- the significance of the linkage(s) is considered further.

8.77 If representative soil concentrations are above a GAC, it is generally recommended that Detailed Quantitative Risk Assessment (DQRA) is undertaken as a next step. A decision on the need for either further risk assessment or the consideration of remedial options should take into account the magnitude by which the soil concentration exceeds the SGV.

8.78 Where representative soil concentrations of contaminants on a site are at or below the GAC (and the generic land use scenario used to derive the GAC is sufficiently representative of, or conservative for, the site under evaluation), it can be assumed that it is very unlikely that a significant possibility of significant harm exists (Defra, 2008b)

8.79 A copy of the soil sample analysis is attached as Appendix 8.2. The Soil Organic Matter (SOM) content of these samples is between 0.344 and 3.64%. In order to carry out a generic assessment of the analysis results, published guideline values have been utilised, i.e. UK Soil Guideline Values (SGV), Atrisk Soil, Land Quality Management Ltd / Chartered Institute of Environmental Health (LQM/CIEH) and CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment. Guideline Values, which have been derived on the basis of a particular land-use, i.e. residential, allotments and commercial/industrial. The standard land-uses take into account human behaviour and the professional judgment of policy-makers to provide a conceptual model suitable for a range of generic site conditions and land-uses. Due to the nature of the proposed operations on this site, a commercial end use has been adopted. From the analysis of the labaoratory results contained in Appendix 8.2 the soil samples were recorded below the relevant GAC. It would therefore be considered very unlikely that concentrations of contaminant in soils at the site would have the potential to cause significant harm.

Groundwater / Surface Water Contamination

8.80 A copy of the water monitoring analysis is attached as Appendix 8.3. Nine water samples were obtained (on 15th January 2013), six from the monitoring wells, one from the existing

groundwater abstraction (tap), one surface water sample from the final settlement pond and one was a sample blank (RP09). RP03 was inaccessible due to a kink in the standpipe.

8.81 The results were initially screened against Atrisk' Water Screening Values (WSV) for commercial land uses. Atrisk' WSVs were derived for use in assessing chronic human health exposure to from the inhalation of vapours due to commonly encountered contaminants in shallow groundwater or perched water. All water samples obtained are lower than the WSV available.

8.82 The chemical results were also compared against a number of standards/sources including:

- Freshwater Environmental Quality Standards (EQS);
- Drinking Water Standards (UK and WHO);
- WHO Petroleum Products in Drinking Water 2005;
- Private Water Supply Regulations (NI) 2009; and
- Freshwater Fisheries Directive (FFD) standards.

8.83 All water samples obtained (for which the concentration was above the laboratory limit of detection) were screened against the above standards/sources. A copy of water sample analysis undertaken is located in Appendix 8.3. All individual determinants are within the recommended quality screening values with the exception of RP04 which exhibited raised levels of Polycyclic Aromatic Hydrocarbons (PAH's) when screened against the Private Water Supply Regulations (NI) 2009 standards. The interpretation of these results is discussed later in this chapter.

Ground Borne Gases

8.84 Ground borne gas is produced as a result of the decomposition of organic materials. In addition to methane (CH_4) and carbon dioxide (CO_2), numerous trace gases may be present in ground gas depending on the material that is decomposing. Trace constituents principally may include carbon monoxide (CO) and hydrogen sulphide (H_2S).

8.85 Ground borne gas can be a hazard due to toxic and explosive properties. In certain quantities these gases can also cause breathing difficulties and asphyxiation.

8.86 Four rounds of groundborne gas monitoring were undertaken in May 2013. A copy of the raw gas monitoring results obtained at each of the boreholes is contained within Appendix 8.4 and a summary is displayed in Table 8.8.

Table 8.8 Gas Monitoring Results

ID	DATE	CH_4 (%)	CO_2 (%)
RP01	08/05/2013	0	0
RP02	08/05/2013	0.1	0
RP03	08/05/2013	0.1	0
RP04	08/05/2013	0.1	0
RP05	08/05/2013	0	0
RP06	08/05/2013	0	0
RP07	08/05/2013	0	0
RP01	15/05/2013	0	0.2
RP02	15/05/2013	0	0.2
RP03	15/05/2013	0	0
RP04	15/05/2013	0.1	0
RP05	15/05/2013	0.1	0.1
RP06	15/05/2013	0	0.1
RP07	15/05/2013	0	0.9
RP01	21/05/2013	0	0.2
RP02	21/05/2013	0	0.3
RP03	21/05/2013	0	0
RP04	21/05/2013	0.1	0
RP05	21/05/2013	0.1	0.1
RP06	21/05/2013	0.1	0.1
RP07	21/05/2013	0	0.6
RP01	30/05/2013	0.1	0.2
RP02	30/05/2013	0	0.2
RP03	30/05/2013	0	0
RP04	30/05/2013	0	0

ID	DATE	CH_4 (%)	CO_2 (%)
RP05	30/05/2013	0	0
RP06	30/05/2013	0	0
RP07	30/05/2013	0	0.8

8.87 Slightly elevated concentrations of CO_2 and CH_4 were observed over the monitoring period. The monitoring results indicate that the gas regime of the site is classified as Characteristic Situation 1 in accordance with CIRIA C665. Gas protection methods are therefore not deemed necessary. Characteristic Situation 1 includes CO_2 levels less than or equal to 5% and CH4 levels less than or equal to 1%. The risk classification is very low and the measured levels are typical for made ground or natural ground.

Pathways

8.88 Pathways associated with impacts to human health through dermal contact, ingestion and dust inhalation will be minimal on the developed site.

8.89 As stated previously the majority of the site's operational area that will be impacted during the construction phase is mainly rock with a shallow overburden. The proposed development will also provide coverage through the building footprints and hardstanding/car-parking, which will significantly reduce the already extremely low risk from direct contact, ingestion and inhalation to human health.

8.90 The potential for volatilisation to indoor air is considered to be extremely low due to the fact that operational buildings will be located on rock and no significant volatile contaminants were identified during the assessment.

8.91 A potential pathway exists for vertical and horizontal migration in groundwater within fissures and fractures in the basalt rock. But with the exception of RP04 (Elevated Hydrocarbons), none of the groundwater samples indicated and exceedences against the GAC utilised. However the duplicate sample at RP04 indicated no exceedences of hydrocarbons. As stated previously it is considered that the elevated levels of hydrocarbons observed are most likely due to borehole construction.

8.92 The proposed development will also provide coverage through the building footprints and hardstanding/car-parking, which will significantly reduce the already extremely low risk. Petrol interceptors will also be located on site as part of the drainage design, hence for the unlikely occurrence of groundwater seepage into the site drainage, that would flow via the site drainage interceptors prior to discharge from the site.

Receptors

8.93 The potential for exposure via ingestion or soil or dust, dermal contact and inhalation of soil or dust or vapours to long term end users is deemed to be negligible as a result of the redevelopment with buildings and hardstanding covering the operational area.

8.94 Construction workers involved in site clearance, excavation, earthmoving and material handling operations may be exposed to contamination by direct dermal contact and inhalation or ingestion of soil and dust particles and vapours. These risks can be minimised by the implementation of stringent site management practices, the wearing of appropriate Personal Protective Equipment (PPE), the adoption of good hygiene and dampening down of construction activities to prevent airborne dust.

8.95 The proposed buildings and external hardstanding areas will occupy a large proportion of the development site. Any landscaped areas will be low maintenance raised beds comprised of clean topsoil to provide a suitable growing environment. The overall risk to landscape planting is therefore considered to be low.

8.96 As the permanent buildings and operational area will be located on rock, building foundations and services will be safe from eroding agents that may occur in certain soils. The chemical analysis of the sulphate in water samples was low overall and the results indicated that the groundwater of the site will be non-aggressive.

Revised Conceptual Model

8.97 A review of the CSM created during the PRA has been undertaken with the aid of a GQRA and the findings are as follows:

Source

8.98 The Possible hazards which are potentially relevant include:

- Contaminated soil / overburden;
- Ground Borne Gases;
- Contaminated Groundwater.

Receptors

8.99 These have the potential to impact upon the following receptors:

- Site construction workers;
- Site users;
- Vegetation and fauna;
- Building foundations and underground services;
- Surface Water.

Pathways

8.100 This could occur via the following possible pathways:

- Contact with, inhalation or ingestion of soil particles.
- Wind dispersal of soil particles;
- Inhalation of vapours from volatile hazardous substances;
- Lateral and vertical groundwater migration.

Updated Risk Assessment

8.101 Based on the available information Table 8.9 summarises the CSM for each potential source-pathway-receptor linkage along with an evaluation of the potential risk identifying the requirement (if any) for more detailed assessment or mitigation of the risk.

Table 8.9 – Revised Conceptual Site Model, Risk Assessment and Mitigation of Risk

Potential Source and Reason for Concern	Potential Pathway(s) to Receptor	Potential Receptor	GQRA and Mitigation of Relevant Source-Pathway-Linkage	Is further investigation required?
Application Site				
Quarrying /Site Operations – Intermittent or localised spillages by cars, lorries and mobile plan and semi mobile plant e.g crushers in quarry. Potential pollutants from such spillages could include Petroleum Hydrocarbons.	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	road users, site construction workers, site users, site visitors, occupiers of adjacent properties	Nil to Tolerable Risk – assessed in terms of soil analysis results all being within relevant GAC for a commercial operation.	No
	Fissure in rock.	Groundwater, surface water	Nil to Tolerable Risk – assessed in terms of water analysis results. Only sample taken at RP04 displayed slight elevations of certain hydrocarbons. This has been attributed to borehole construction.	No
Made Ground. Potential contaminants within made ground due to relatively recent spillages during site operations.	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	construction workers	Nil to Tolerable Risk – assessed in terms of soil analysis results all being within relevant GAC for a commercial operation.	No

Potential Source and Reason for Concern	Potential Pathway(s) to Receptor	Potential Receptor	GQRA and Mitigation of Relevant Source-Pathway-Linkage	Is further investigation required?
Potential pollutants from such spillages could include petroleum hydrocarbons.				
Gas in main areas of made ground. Potential for ground gas to be present due to the degradation of historic spillages.	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	construction workers	Nil – tolerable Risk – Assessed in terms of gas monitoring results from borewells located throughout site including areas of made ground	No
Asphalt Plant Area – Bitumen and Fuel Tanks Spillages. Potential pollutants from such spillages could include Petroleum Hydrocarbons and bitumen.	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	Road users, site construction workers, site users, site visitors, occupiers of adjacent properties	Nil to Tolerable Risk – assessed in terms of soil analysis results all being within relevant GAC for a commercial operation.	No
	Fissure in Rock.	Groundwater	Nil to Tolerable Risk – assessed in terms of water analysis results in vicinity all being within relevant GAC for a commercial operation.	No

Potential Source and Reason for Concern	Potential Pathway(s) to Receptor	Potential Receptor	GQRA and Mitigation of Relevant Source-Pathway-Linkage	Is further investigation required?
Maintenance Area – Fuel Tanks, Electricity Substation. Potential pollutants could include PCB's and Hydrocarbons.	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	Road users, site construction workers, site users, site visitors, occupiers of adjacent properties	Nil to Tolerable Risk – assessed in terms of soil analysis results all being within relevant GAC for a commercial operation.	No
	Fissure in Rock.	Groundwater	Nil to Tolerable Risk – assessed in terms of water analysis results in vicinity all being within relevant GAC for a commercial operation.	No
Maintainance Area – Derelict Building. Potential asbestos cement roofing sheets have been used in the buildings construction.	Contact with, inhalation or ingestion of soil particles. Wind dispersal of soil particles.	Road users, site construction workers, site users, site visitors, occupiers of adjacent properties	Nil to Tolerable Risk – assessed in terms of soil analysis results all being within relevant GAC for a commercial operation. Note that if asbestos roofing is to be removed it will be done so in a safe and appropriate manner in accordance with Health and Safety Executive Guidance (a14).	No

Description of Residual Effects and their Significance taking Mitigation into Account

8.102 No significant pollutant linkages have been identified from the risk assessments undertaken. The following section provides a summary of the findings of this land quality assessment and summarises the mitigation measures to be incorporated as part of the proposed development.

Soil / Overburden

8.103 The application site does not display any signs of pollution from samples analysed and the associated risk of disturbing contaminated solid material is considered low. To minimise any potential risks, project safety information will be developed by the Principal Contractor in accordance with the CDM Regulations (2007), identifying potential health and safety risks throughout the construction process and the mitigating measures which shall be adopted. Following this all site personnel will be given an induction briefing by the Site Agent responsible for Health and Safety. This should stress the potential health and safety on site risks and the importance of adhering to strict hygiene and site management practices and wearing of PPE equipment, including boots, overalls, gloves and if necessary dust masks. Washing and messing facilities should also be established on site. If necessary, dust suppression measures should also be adopted.

8.104 Health and Safety/Site Management Practices to minimise the risks during construction will include;

- Documented risks and appointed CDM co-ordinator;
- Approved methods and sequencing of operations;
- Induction of staff;
- Strict hygiene and site management practices;
- Wearing of PPE equipment, including boots, overalls, gloves and if appropriate, dust masks;
- Washing and messing facilities provided on site; and
- Dust suppression measures, if required.

Water

8.105 A copy of water sample analysis undertaken is located in Appendix 8.3. All individual determinants are within the recommended quality screening values with the exception of RP04 which exhibited raised levels of Polycyclic Aromatic Hydrocarbons (PAH's).

8.106 The Private Water Supply Regulations (NI) 2009 standards for PAH use the sum of 4 specified PAH's as the quality standard. When applying this methodology to samples taken at RP04, elevated levels of PAH's were observed. However the use of these standards is considered extremely conservative as groundwater is not used for drinking water in this area.

Soil/overburden samples which were taken in the area of the boreholes located in the upper terrace of the quarry did not display any contamination by hydrocarbons. Also there is no record of fuel tanks or fixed plant use in the area.

8.107 Due to the location of RP04 it is likely that the source of the elevated PAH's was caused by oil ingress during the actual well construction. This opinion is based on the fact that there are no fixed items of plant or fuel tanks located within this upper terrace of the quarry and soil/overburden samples in the vicinity did not display any elevated levels of PAH's. Also, the other wells which are located down gradient of RP04 did not display any elevated PAH's.

8.108 The potential impact risk of the proposed construction or on-site operational activities on groundwater is considered insignificant.

8.109 Construction and operational activities would not lead to any adverse groundwater issues due to appropriate mitigation measures.

Ground Gas

8.110 No specific recommendations are made in respect of ground borne gas either during the construction or operational phases of the development as no specific mitigation measures are deemed necessary.

General Issues

8.111 The principal contractor has developed a Site Waste Management Plan (SWMP) which incorporates details of off-site disposal procedures for any waste materials that may be encountered.

8.112 The above ground oil storage tanks and bunds are to be removed by Tarmac prior to construction commencement. The Asphalt Plant and its associated storage tanks will also be decommissioned prior to construction. Any bitumen spillages will also be removed and disposed of appropriately.

8.113 Existing structures to be retained temporarily on site include:

- Substation / switchroom – this will be retained during the construction phase to provide power to the site offices and compound area;
- Water borehole / pumphouse – this will be retained to provide a water supply during the construction phase;
- Weighbridge complex / wheelwash – this will be utilised during the construction phase for site access control and vehicle washing where required. This will be decommissioned and removed on completion of construction works; and
- Store Rooms / Workshop – to be retained and utilised during the construction phase for contractor maintenance works.

8.114 These structures will be decommissioned at the end of the construction phase. All other minor structures and temporary accommodation will be removed by Tarmac prior to site possession.

8.115 No other intrusive investigations are recommended as the other potential risks are classified as “Nil to Tolerable”. However the potential for contamination has been incorporated into the Environmental Management Plan (EMP) for the development construction works.

8.116 The EMP stipulates the actions required should evidence of potential ground contamination be encountered during the site clearance and construction works, including obtaining further professional advice, sampling and analysis of the ground, waste characterisation and disposal, or other localised remedial action. The EMP is contained within the Construction Management Plan (CMP). A copy of the CMP is located within Appendix 3.1.

8.117 This GQRA has demonstrated that land contamination is unlikely to be present on site which will have a material impact on human health or on the environment either during construction or when the proposed development is operational.