



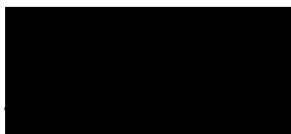
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Southbank
Great Wilson Street
Leeds
LS11 5AD**

**Geotechnical and Environmental
Assessment Report
Proposed ASDA Superstore
Littlehampton Road
Ferring, West Sussex
BN12 6PB**

**March 2011
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Report Details

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Executive Summary

Client	ASDA Stores Limited
Site Location	Country Fayre Garden Centre, Littlehampton Road, Ferring, West Sussex.
Proposed Redevelopment	It is understood that ASDA propose to construct a new superstore with associated car parking, ancillary structures and soft landscaping.
Site History	In the late 19 th and early 20 th Century the site comprised agricultural land with a railway track along the southern boundary of the site. Since the 1960's the site has been occupied by a garden centre/nursery in the north of the site with open land including ponds and ditches in the south of the site. Together with off site developments including light industry and residential properties, the site has remained largely unchanged since the 1970's.
Ground Investigation	The ground investigation was designed to enable a preliminary assessment of the environmental and geotechnical conditions beneath the site. The intrusive site investigation was undertaken between 1st and 16th February 2011 and comprised the drilling of five cable percussion boreholes to a maximum depth of 12.0m below ground level (bgl), one rotary drilled hole to a depth of 20.0m bgl, thirteen window samples to a maximum depth of 5.0m bgl, eleven mechanically excavated trial pits/trenches to a maximum depth of 2.6m bgl and a single hand excavated trial pit to a depth of 0.45m bgl. A subsequent combined groundwater sampling and gas monitoring visit was conducted between the 16th and 18th February 2011. Three further gas monitoring visits were conducted on 2nd March, 9th March and 17th March 2011. Based on information from the desk study on likely contaminants from the site's previous usage, a range of contaminants were to be tested for in both soil and groundwater including; speciated TPH, speciated PAH, VOC, SVOC, a range of metals and inorganic compounds, pesticides, pH and asbestos.
Ground Conditions	Ground conditions were generally consistent across the site as described below: Made Ground typically comprised gravelly clay or gravel with fragments of tile, glass and wood and was generally present to depths in the order of 0.3 to 0.6m. Locally however deeper areas of made ground were encountered. In the vicinity of borehole BH5 and WS 1 made ground and possible made ground were present to depths of 2.5m and 2m respectively. There is anecdotal evidence from the site owner that unwanted materials had been buried on site. Clay was encountered beneath the made ground. This varied in consistency from very soft to firm and was typically described as brown gravelly clay. In places the clay became more gravelly with depth. Some bands of gravel were encountered. Chalk was present beneath the clay, the interface between the two materials occurred at depths varying from 3m to 5.5m below ground level. The chalk recovered was typically described as a matrix dominant chalk (Grade Dm as defined by CIRIA Report C574 Engineering in Chalk). An improvement in chalk quality to clast dominant chalk (Grade Dc) was noted at approximately 12m depth. A further improvement in chalk quality was noted from 14.4m, below which the chalk was recovered as Grade Dc with layers of Grade B, as defined by CIRIA C574.
Groundwater	Groundwater was encountered across site at shallow depths within the exploratory holes. Based on data obtained during post fieldwork monitoring, it is considered that minimal perched water may be present in the shallow made ground, resting upon a confining layer of clay at approximately 3m bgl across the site. The groundwater across the site is thought to be dominantly influenced by the potentiometric surface within the underlying chalk aquifer, which indicates a

	flow direction towards the south/southeast across the site. In the deeper boreholes installed exclusively into the chalk strata, resting groundwater levels were recorded between a 5.345m AOD in BH6 and 4.659m AOD in BH1
Soil Impact	Soil samples were submitted to an accredited laboratory for specific analysis as detailed above. The results were compared to ARCADIS GAC protective of human health and set 2 (drinking water standards) water resource receptors. There were no exceedances of the GAC protective of human health with regards to commercial workers or neighbouring residents. Concentrations above the GAC protective of water resource receptors in shallow soils across the site with respect to several PAH compounds. Exceedences were noted in boreholes BH1, BH2, BH5, BH6, WS2, WS3, WS4, WS5, WS6, WS7, WS8 and WS9. Concentrations of hydrocarbon compounds (Aromatic fractions EC12-EC21) above the GAC protective of water resource receptors were noted in boreholes WS3, WS4, WS6 and WS7 in the shallow soils across the site. A single concentration above the GAC for benzene was detected in BH2. The majority of the exceedences were detected in shallow made ground. Minor detections of VOCs, SVOCs, metals, inorganics and PCBs have been reported for which no standard has been identified as suitable for deriving generic assessment criteria. Of these, the laboratory results have shown a number of compounds detected marginally above the MDL.
Groundwater Impact	Fourteen groundwater samples were submitted to an accredited laboratory for specific analysis as detailed above. The results were compared to ARCADIS GAC protective of human health and set 1 (EQS) water resource receptors. There were no concentrations of Contaminants of Concern (CoC in excess of the GAC protective of human health receptors associated with the site in the samples analysed. Single TPH fractions (including toluene, aliphatic C10-C12, aliphatic C12-C16, aliphatic C21-C35, aromatic EC7-EC8 and aromatic EC16-EC21) were reported at concentrations greater than the GAC for water resource receptors in three of the fourteen monitoring wells across the site. These boreholes (BH1, BH5 and WS1) are all located in the south of the site. A single PAH compound was reported in WS3 above the GAC for water resource receptors.
Ground Gas	Four monitoring visits have been carried out and have shown that several boreholes, particularly in areas of infilled ponds/ditches show high results of methane (26.4.1%), carbon dioxide (6.2%) and low levels of oxygen (14.0 %). The highest gas flow was recorded as 0.3l/hr.
Waste	Each of the three samples analysed for WAC were found to be suitable for disposal at an inert waste landfill, subject to discussion with the landfill operators. In order for any site won materials to be re-used, it is important that materials that moved around the site are not considered to be waste. In order to do this it is possible to either apply for an exemption from waste management licensing or to follow the new Code of Practice (CoP) on the definition of waste.

Conclusions and Recommendations	It has been shown a range of contaminants are present at low levels in both soil and groundwater across the site which has exceeded the GAC for water resource receptors. The concentrations of CoC detected in soils and groundwater were below the GAC protective of human health for neighbouring residents and commercial workers. These have therefore been removed from the conceptual model. Some of the CoC reported in the soil samples have leached into the groundwater beneath the site. Although no data has been obtained from off-site, there is the potential that low levels of CoC have migrated off the site. The culverted watercourse in the southeast of the site could provide a potential pollutant linkage between impacts associated with the shallow made ground on the site and the underlying aquifer. As such, surface waters remain as a receptor via a groundwater migration pathway. The ground gas concentrations are considered to present a risk to the proposed store building. Further ground gas monitoring may be required at the site to confirm the level of gas protection measures that are required for the proposed store development. It is possible that the Characteristic Situation for the site may be able to be reduced to Characteristic Situation 2 if the source of the highest gas concentrations are removed from site. The proposed store development should also consider radon protection measures.
Geotechnical	In situ SPTs were conducted in the chalk - from the top of the chalk to depths in the order of 13.5m the SPT N value ranged between 17 and 39. Three tests conducted in BH 5 below 13.5m depth gave N values > 50. A MEXE probe was used to estimate in-situ CBR values of the clay at a number of locations. These tests gave values in the range 1.5 to 2.8% The Plasticity Index of the samples were reported in the range 13 to 24%, representative of low to intermediate plasticity clays. Undrained triaxial shear strength testing was carried out on eight undisturbed clay samples. The determined shear strength values of the clays ranged between 15 and 91kN/m² which corresponds to very low to high strength clay. Laboratory CBR determinations on two clay samples indicated values of 0.6% and 2.4%. <u>Foundations</u> Given the presence of low strength and medium to highly compressible soils on site it will be necessary to utilise a piled foundation solution for this site. It is anticipated that CFA piles, end bearing within the chalk, will be the most cost effective solution. It is anticipated that piles in the order of 15m in length will be required, however, due to weathering processes the depth to competent chalk can vary considerably over short distances and therefore the depth of the pile should be calculated taking into account such local variations. <u>Floor Slab</u> Given the significant thickness of very soft to soft clay beneath the site, and the presence of locally deepened areas of made ground, it is considered that ground bearing floor slabs will not be suitable and a fully suspended floor slab will be required.

	Bulk ground gas data indicates that ground gas concentrations beneath the proposed store and flow rates place the site into Characteristic Situation 2 as defined by CIRIA C665. This is a result of the elevated methane concentrations reported in borehole WS3. A further period of ground gas monitoring has been recommended given the variability and magnitude of some of the gas monitoring data. Should this additional monitoring indicate continued high levels of methane in the ground then consideration should be given to removal of the gas source (organic silt within the former pond). The gas protection measures recommended for Characteristic Situation 2 in CIRIA 665 should be adopted, namely; Installation of a 2000 gauge gas membrane with all joints and penetrations sealed; Consideration of sub slab ventilation. Contrary to the information obtained in the desk study, examination of the BR211 document, "Radon: Guidance on protective measures for new buildings" (2007), the Site is not located in an area where basic radon protection measures are considered necessary. This should be verified further before building design is finalised. <u>Pavement Design</u> It is anticipated that the service yard will need to be supported on piled foundations due to the high imposed loads. Shallow ground stabilisation techniques may be employed to improve the CBR value of shallow soils within the customer car parking areas. It may be possible to improve the bearing capacity of the historic landfill using rolling dynamic compaction techniques or similar. Any ground improvement scheme for the external areas of the site should take account of potential differential settlement between the landfill and natural materials.
Buried Concrete	Laboratory soil sulphate and pH tests undertaken on a range of soil types and sample depths across the site indicate that for a brownfield site, a Design Sulphate Class DS-1 is appropriate for buried concrete at this site. Based upon the mobile water conditions and a lower bound pH of 6.5, an ACEC Class of AC-2z is recommended.
Recommendations	The following recommendations have been made: A further period of ground gas monitoring has been recommended given the variability and magnitude of some of the gas monitoring data. Should this additional monitoring indicate continued high levels of methane in the ground then consideration should be given to removal of the gas source (organic silt within the former pond).

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- I Generic Assessment Criteria For Soil and Groundwater (GAC)

List of Abbreviations that may be used in this report

ARCADIS	Arcadis UK Ltd
% v/v	Percentage by Volume
% w/w	Percentage by Weight
ACEC	Aggressive Chemical Environment for Concrete
ALARP	As Low As Reasonably Practical
AOD	Above Ordnance Datum
ASD	Arbitrary Site Datum
ASTM	American Society for Testing and Materials
ASTs	Above Ground Storage Tanks
BGS	British Geological Survey
BRE	Building Research Establishment
BS	British Standard
BTEX	Benzene, Toluene, Ethylbenzene, total Xylenes.
CAT	Cable Avoidance Tool
CBR	California Bearing Ratio
CIRIA	Construction Industry Research and Information Association
CLEA	Contaminated Land Exposure Assessment.
CLEA Metals Suite	Boron Water Soluble, Arsenic, Barium, Beryllium, Cadmium Chromium, Copper, Mercury, Nickel, Lead, Selenium, Vanadium, Zinc
CLR	Contaminated Land Report
CoC	Contaminants of Concern
CPU	Continued Petroleum Use
CSM	Conceptual Site Model
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
DQRA	Detailed Quantitative Risk Assessment
DRO	Diesel Range Organics (EC10-EC35)
DS	Design Sulphate
DWS	Drinking Water Standards
EA	Environment Agency
EC	Equivalent Carbon
EPH	Extractable Petroleum Hydrocarbons
EQS	Environmental Quality Standards
GAC	Generic Assessment Criteria
GC-FID	Gas Chromatography-Flame Ionisation Detector
GC-MS	Gas Chromatography Mass Spectrometry
GQRA	Generic Quantitative Risk Assessment
GSV	Gas Screening Value
HDPE	High Density Poly Ethylene
HH-GAC	Human Health Generic Assessment Criteria

HSG	Health and Safety Guides
ICP-OES	Inductively Coupled Plasma Mass Spectrometry -Occupational Exposure Standard
LNAPL	Light Non-Aqueous Phase Liquid
LOI	Loss On Ignition
m bgl	Metres Below Ground Level
MDL	Method Detection Limit
MTBE	Methyl Tertiary Butyl Ether
NGR	National Grid Reference
NRPB	National Radiological Protection Board
ODPM	Office of the Deputy Prime Minister
OS	Ordnance Survey
PAH	Polycyclic Aromatic Hydrocarbon
PAOC	Potential Area of Concern
PCB	Polychlorinated Biphenyl
PID	Photo-Ionisation Detector
ppmV	Parts Per Million Volume
PRO	Petrol Range Organics (EC5-EC10)
QA	Quality Assurance
QC	Quality Control
RTW	Remedial Target Worksheet
SGV	Soil Guideline Values
SNIFFER	Scotland and Northern Ireland Forum for Environmental Research
SOP	Standard Operating Procedure
SPT	Standard Penetration Test
SPZ	Source Protection Zone
SSAC	Site Specific Assessment Criteria
SSSI	Site of Special Scientific Interest
SVOC	Semi-Volatile Organic Compound
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons (EC5-EC35)
TPH CWG	Total Petroleum Hydrocarbons Criteria Working Group
TRRL	Transport and Road Research Laboratory
UKAS	United Kingdom Accreditation Service
US EPA 16	United States Environmental Protection Agency 16 (list of Speciated PAH)
UST	Underground Storage Tank
USTs	Underground Storage Tanks
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WAC	Waste Acceptance Criteria
WR-GAC	Water Resources Generic Assessment Criteria

1 INTRODUCTION

In February 2011, ARCADIS UK Limited (ARCADIS) was instructed by ASDA Stores Limited (ASDA), to carry out a geotechnical and environmental assessment survey at the site of the Country Fayre Garden Centre, Littlehampton Road, Ferring, West Sussex.

A site location plan is presented as Figure 1.

1.1 Background Information

The site is partially occupied with an existing garden centre and associated parking. The existing building comprises a single storey structure which was converted from greenhouses to a garden centre. The land to the south of the store comprises hardstanding and an area of rough grassland.

The land to the south of the site is occupied by a railway, to the north is Littlehampton Road, to the east is a house and greenhouses and to the west farmland. Drainage is present at the south eastern boundary of the site.

An existing site layout plan is presented as Figure 2.

The proposed development is understood to comprise a new ASDA store with associated access roads, vehicle parking, service yard and peripheral soft landscaping.

1.2 Previous Works

ARCADIS are not aware of any previous site investigation work being undertaken at the site.

1.3 Aims and Objectives

The objective of the works was to investigate, using a risk based approach, the below ground environmental and geotechnical condition of the site prior to the proposed construction by ASDA.

The principal aims of the works undertaken at the site were to:

- Aid in the identification of potential on- and off- site liabilities relating to the potential presence of Contaminants of Concern (CoCs); and
- Provide geotechnical parameters and recommendations relating to the construction design.

1.4 Scope of Work

The scope of work was prepared by ARCADIS and comprises the following:

- Preliminary Risk Assessment (PRA) - Desk study review of environmental data contained within Landmark Envirocheck® report ;
- Site Reconnaissance – Site walkover to identify potential areas of concern;
- Field Investigation – Intrusive works including health and safety planning, utility service tracing, borehole drilling, well installation, soil and groundwater sampling and laboratory analysis by accredited laboratories for environmental and geotechnical parameters and ground gas monitoring;
- Reporting - to include discussion of findings, Generic Quantitative Risk Assessment (GQRA), refinement of Conceptual Site Model (CSM) and assessment of likely requirement for further work; and

- Geotechnical Consideration – Assessment of findings with recommendations for the construction design.

The project has been carried out within the existing legislative framework. The legislative context and regulatory guidance for the project is outlined in Appendix A.

The scope of work was developed in accordance with the Environment Agency (EA) document Model Procedures for the Management of Land Contamination [Contaminated Land Report 11(CLR 11)]. An Overview of the Environmental Assessment Process is presented in Appendix B.

1.5 Reliability of Information / Limitations

A complete list of ARCADIS study limitations is presented in Section 12.

2 PRELIMINARY RISK ASSESSMENT – STAGE 1 – DESK STUDY

2.1 Description of Site and Facilities

An existing layout of the Site is summarised below:

Littlehampton Road, Ferring	
Site Description	The Site is irregular in shape and comprises six buildings with a car park to the north and an area of hardstanding to the south. Current site use is as a garden centre (Country Fayre). An electricity sub station is located on the eastern boundary.
Area of Site	Approximately 44,700m ² .
Site Elevation	The Site elevation is approximately 6m AOD.
National Grid Co-ordinates	508720, 103190 (approximate area centre).
Surrounding Land Use	
North:	A259 Littlehampton Road with commercial and light industrial units beyond.
East:	Commercial units with residential properties beyond
South:	A railway track with agricultural land beyond.
West:	Agricultural land.

2.2 Site History

The development history of the Site was established from a review of historical maps contained within the Sitecheck[®] and Waterman *EnviroRisk+* Report. In brief, the history of the Site is detailed below:

1876	
On-Site	The Site is open, agricultural land, with a small building in the north eastern corner.
Off-Site	A railway track is located along the southern boundary of the Site.
1897-1898	
On-Site	No significant change.
Off-Site	Hangleton Farm is marked approximately 100m to the north east.
1911	
On-Site	No significant change.
Off-Site	Hangleton Farm has been further developed; long, thin buildings with glazed roofs are orientated north – south, indicative of greenhouses. A windpump is marked approximately 170m north north east.
1932	
On-Site	No significant change.
Off-Site	The windpump is now marked as a tank.
1961-1972	
On-Site	Old Barn Nurseries is located in the northern part of the Site, comprising a rectangular building in the north west and an irregular shaped building in the north east; a tank is marked directly to the south of this building. A pond is located in the centre of the site towards the western boundary.
Off-Site	An engineering works is located approximately 105m to the north. There

	has been development of commercial and light industrial properties to the north and residential properties to the east.
1974	
On-Site	No significant change.
Off-Site	No significant change.
1983	
On-Site	Old Barn Nurseries has been further developed and is now labelled as a garden centre. The rectangular building in the north west corner has been replaced by two smaller buildings and two tanks. The tank to the east is no longer marked. Five large buildings have been developed in the centre of the Site.
Off-Site	No significant change.
1993	
On-Site	No significant change.
Off-Site	No significant change.
1994	
On-Site	No significant change.
Off-Site	No significant change.
Present Day	
On-Site	The pond has been infilled.
Off-Site	Further development in the surrounding commercial and light industrial properties. A joinery is located to the north of the site.

2.3 Intended Future Use of the Site

The Site is proposed to be redeveloped with a new ASDA store located in the southern central portion of the Site; this is to the south of the existing development. Car parking will be in the northern part of the Site, in the location of the existing Country Fayre store. There will be some areas of landscaping around the proposed Site periphery.

The proposed redevelopment plans are presented in Appendix C.

2.4 Environmental Setting

2.4.1 Published Geology

A review of the BGS, 1:50,000 scale, Geological Map (Solid and Drift) for the area, (Sheet 317/332, Chichester/Bognor 1996), indicates the Site to be underlain by the following geological sequence:

- A small area of Head deposits in the north west sector of the Site, comprising mainly impure clays, silts and sands; and
- Aeolian Deposits ("Brickearth"), comprising of mainly of silts with some gravels overlying;
- New Pit Chalk Formation.

2.4.2 Hydrogeology

BGS Hydrogeological map sheet 9 (Southampton) documents groundwater in the underlying Chalk aquifer (Cretaceous Upper Chalk) at a regional scale to the west of the site. The potentiometric contours within the Upper Chalk east of Portsmouth indicate a generally southerly flow direction towards the coastline with elevations between 0-10m above ordnance datum (AOD).

Although no hydrogeological map including the site's location was available to ARCADIS, it is anticipated that the identified groundwater flow regime east of Portsmouth will be broadly

similar to that in the vicinity of Littlehampton, and hence the site. Groundwater monitoring wells installed across the site during site investigation should verify the groundwater flow direction present beneath the site.

Groundwater Vulnerability

The EA website indicates that the drift deposits (Aeolian Deposits known as “Brickearth”) are classified as a Secondary A aquifer. These are drift deposits with *permeable layers capable of supporting water supplies on a local scale*. The EA website indicates that the solid geology (Chalk Formations) beneath the Site is classified as a principal aquifer¹.

Source Protection Zones

According to the EA website the Site is not located within a Source Protection Zone.

Groundwater Abstractions

According to the Sitecheck[®] Report there is one licensed groundwater abstraction point located approximately 230m to the northeast for agricultural use.

Discharge Consents

According to the Sitecheck[®] Report there is a discharge consent for the discharge of sewerage on the Site.

2.5 Hydrology

2.5.1 Surface Water Features

The nearest water feature is a pond which is located approximately 4m to the southeast. There is an unnamed stream, which is approximately 400m to the south. Ferring Rife is located approximately 400m to the east.

2.5.2 Surface Water Abstractions

According to the Sitecheck[®] Report there are no licensed surface water abstraction points within 250m of the Site.

2.5.3 Ecologically Sensitive Sites

Information presented on Natural England website details that there are no ecologically sensitive areas within 2km of the Site.

2.6 Coal Mining Report

The Coal Authority website details that from the information currently available to the Coal Authority, *a mining report is not required for this property*.

¹These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.).

2.7 Ground Gas

2.7.1 Radon

According to the BR211 document, "Radon: Guidance on protective measures for new buildings" (2007), the Site is located in an area where basic radon protection measures are considered necessary, as between 5 and 10% of the homes are above the action level.

2.7.2 Carbon Dioxide and Methane

The Sitecheck® Report details that there are no landfills within 250m of the Site.

2.8 Contemporary Trade Directories

The Sitecheck® Report documents 3 entries within 250m of the Site, primarily comprising commercial and light industrial premises.

2.9 Unexploded Ordnance

Inspection of the Zetica West Sussex regional low-resolution Unexploded Bomb (UXB) risk map indicates the site is not located in area considered to present a risk. The site lies between a moderate risk area surrounding Littlehampton to the west of the site, and a low risk area surrounding Worthing to the east of the site.

2.10 Summary of Previous Preliminary Desk Study

An *EnviroRisk* + Report produced by Waterman Energy, Environmental & Design Limited (Waterman) (11th November 2010) reviews current and historical Site uses and surrounding land uses. Waterman concludes that, due to the evidence of a historical tank, possible areas of infilled land and the underlying principal aquifer (New Pit Chalk Formation), the Site presents a *medium risk with respect to contaminative liabilities*.

2.11 Identification of Potential Source Areas and Contaminants of Concern

2.11.1 Potential Source Areas

Given the information obtained from the desk study, the following areas can be highlighted as potential areas of concern (PAOC):

Potential On-Site Primary/ Secondary Sources	- Historical impacts in subsurface soils relating to the former tank footprints in the northeast and northwest of the Site; and - Historical infilled pond in northwest area of site. - Impacts in the subsurface soils relating to the electricity substation in the northeast sector of the site. - Historical spillages of gardening products sold at the site (herbicides/pesticides, creosote etc.)
Potential Off-Site Sources	- Impacts from current and historical adjacent light industrial activities, including an engineering works/joinery. - Impacts in subsurface soils relating to the railway track.

2.11.2 Potential Contaminants of Concern

The following CoC may potentially be encountered at the site, based on the previous historical uses and with general reference to the relevant Industry Profile.

Historical Tanks	Oil/fuel hydrocarbons
Historical infilled pond	Infill material unknown.
Electrical substation	Oil/fuel hydrocarbons (transformer oil).
Historical and current adjacent light industrial activities (engineering works/joinery)	- Organochlorines; - Phenolics; - Metal carboxylates; - Pyrethroids; - Creosote; - Copper/chrome/arsenic preparations; - Organic solvents; and - Additives.
Railway track	- Hydrocarbons; diesel, lubrication oil, paraffin; - PCBs; - PAHs; - Solvents; - Ethylene glycol - Creosote; - Herbicides; - Ferrous residues; - Metal fines; - Asbestos; - Ash and fill; - Sulphates

3 PRELIMINARY RISK ASSESSMENT – STAGE 2 – SITE RECONNAISSANCE

A site reconnaissance was conducted on the 27th January 2011 with assistance from the site owner, Mr Wiggins. The purpose of the reconnaissance was to assess the site for PAOC which could represent potential sources of contamination and to identify factors that could affect the geotechnical conditions beneath the site.

The site comprises an existing retail building and associated car parking in the northern half of the site. The retail building is split into six joining sub-buildings that formed part of the former nursery at the site. A gentle fall of elevation is present across the site, with the highest elevations in the northern areas of the site.

The south of the site is accessed through a narrow roadway which runs along the eastern boundary of the site. An electricity substation/transformer was noted adjacent to the access gate and next to the roadway. The roadway leads south to a narrow open yard area on hardstanding which acts as a storage yard and deliveries area for the retail building. An Above Ground Storage Tank (AST) was located adjacent to the southern wall of the retail building.

The majority of the south of the site comprised rough ground with some evidence of materials storage and burning activities.

Surface drainage features were noted to be present along the north western boundary of the site, trending north south. These drains had been diverted to run approximately west-east across the edge of the concrete hardstanding in the southern deliveries yard and are assumed to be connected to a culverted watercourse along the southeastern boundary of the site.

Historical drainage ditches and ponds that were noted during the desk study were confirmed to have been filled in during recent works on site and should be targeted for investigation.

It was noted during discussions with the site owner, Mr Wiggins, and the structural engineer (Tony Macey of Kirksauders Ltd) that site materials including plastic chairs, historical tree rootballs, ceramic tiles and other site derived materials may have been buried in shallow pits across the southern section of the site.

4 PRELIMINARY RISK ASSESSMENT – STAGE 3 – OUTLINE CONCEPTUAL MODEL

An Outline Conceptual Site Model (CSM) of the site has been prepared and illustrates the potentially active pollutant linkages. A pollutant linkage exists only when a source, pathway and receptor are linked together.

- A **source** is a substance that has potential to cause harm or adversely affect controlled waters.
- A **receptor** is something that could be adversely affected by a contaminant such as human health, an ecological system, animals or crops, buildings or controlled waters.
- A **pathway** is a route or means by which a receptor can be exposed to, or affected by, a contaminant.

The outline CSM for the ASDA store development is presented as Figure 3 and is summarised below:

Potential On-Site Primary/Secondary Sources	• Historical impacts in subsurface soils relating to the former use of the land as a nursery/garden centre; and • Historical landfill – limited records of type of material disposed of, however, detailed to include plastic chairs, ceramic tiles and organic materials. • Historical landfill present a potential source of ground gas
Potential Off-Site Sources	• Impacts from current and historical adjacent activities; and • Railway land on the southern boundary of the site.
Potentially Active Pollutant Linkages	• Soil and groundwater vapours into indoor and outdoor air space followed by inhalation by on-site commercial workers; • Direct contact of soil by on-site commercial workers; • Inhalation of soil dust by on-site commercial workers; • Leaching of secondary soil sources to groundwater; • Off-Site migration of contamination via groundwater migration and / or preferential pathways such as drainage; • Direct contact of groundwater by neighbouring residents; • Vapours into indoor and outdoor air space followed by inhalation by neighbouring residents; and • Migration of bulk ground gas into buildings.
Potential Receptors	• Buildings and other structures; • Future commercial workers and site customers; • Off site residents; • Culverted surface waters; and • Principal Aquifer.

Direct contact with subsurface soil and/or groundwater during redevelopment works are not assessed as part of the CSM. It is considered that risks to workers will be managed as part of any redevelopment works at the site through the application of health and safety procedures, where required.

5 GEOTECHNICAL AND ENVIRONMENTAL FIELD INVESTIGATIONS

Field investigations were designed to enable a preliminary assessment of environmental and geotechnical conditions beneath the site. The site layout and exploratory hole location plan is presented as Figure 2.

5.1 Site Investigation Strategy

The intrusive site investigation was undertaken between 1st and 16th February 2011 and comprised the drilling of five cable percussion boreholes to a maximum depth of 12.0m below ground level (bgl), one rotary drilled hole to a depth of 20.0m bgl, thirteen window samples to a maximum depth of 5.0m bgl, eleven mechanically excavated trial pits/trenches to a maximum depth of 2.6m bgl and a single hand excavated trial pit to a depth of 0.45m bgl.

A subsequent combined groundwater sampling and gas monitoring visit was conducted between the 16th and 18th February 2011. Three further gas monitoring visits were conducted on 2nd March, 9th March and 17th March 2011.

Groundwater samples were taken using low-flow techniques and gas monitoring comprised the measurement of carbon dioxide, methane, carbon monoxide, hydrogen sulphide and oxygen levels and the inspection of wells for the presence of groundwater.

The standard site investigation methodology used is presented as Appendix D.

Exploratory hole logs, trial pit logs and details of the monitoring wells installed are presented as Appendix E.

5.2 Analytical Strategy

The justification behind the selection of the CoC for the site is presented in Section 2.12.

Selected soil samples were submitted to an accredited laboratory for analysis of the following:

- Total Petroleum Hydrocarbons - Criteria Working Group, which includes BTEX and MTBE compounds;
- Speciated Polycyclic Aromatic Hydrocarbons - US EPA 16 List;
- Volatile Organic Compounds (VOCs) + Tentatively Identified Compounds;
- Semi-Volatile Organic Compounds (SVOCs) + Tentatively Identified Compounds;
- Heavy Metals (CLEA Metals Suite) - (As, Ba, Cd, Cr, Cu, Hg, Ni, Pb, Se, Mo, V, Zn);
- Water soluble boron, Chloride, nitrate;
- Cyanide (Total and Free);
- Phenol;
- pH value, total sulphur, total sulphide and sulphate contents; and,
- Asbestos screen.

Full suite Waste Acceptance Criteria (WAC) testing was undertaken on three samples collected, two from the made ground and one from natural soil.

A total of fourteen groundwater samples were taken from wells installed in BH1-BH6 and WS1-8.

The water samples were submitted to an accredited laboratory for analysis of the following:

- Total Petroleum Hydrocarbons - Criteria Working Group, which includes BTEX and MTBE compounds;
- Speciated Polycyclic Aromatic Hydrocarbons - US EPA 16 List;

- Volatile Organic Compounds (VOC);
- Semi-Volatile Organic Compounds (SVOC);
- Heavy Metals (CLEA Metals Suite) - (As, Ba, Cd, Cr, Cu, Hg, Ni, Pb, Mo, V, Se, Zn);
- Total Cyanide;
- Pesticides;
- Phenols;
- Chloride, Ammoniacal Nitrogen, Nitrate, Nitrite; and
- pH value, hardness, total sulphur, total sulphide and soluble sulphate contents.

The results of the environmental analysis results are included as Appendix F.

A total of four rounds of ground gas monitoring conducted at roughly weekly intervals were scheduled; the visits were carried out during periods of falling barometric pressure. The borehole flows together with concentrations of carbon dioxide, carbon monoxide, methane, oxygen and hydrogen sulphide were recorded. Following the gas monitoring, the depth to water, depth to base of well and the presence of free phase product (if present) were recorded.

5.3 Quality Assurance and Quality Control

All samples were submitted by ARCADIS to an approved and United Kingdom Accredited Laboratory (UKAS) under a completed chain of custody. The laboratory carried out its own QA/QC programme to ensure that the quality of the analytical data conformed to the appropriate test method protocols.

5.4 Geotechnical Investigation

5.4.1 In-situ Testing

Standard Penetration Tests (SPTs) were carried out in granular and cohesive deposits to assess the relative density and consistency of the deposits respectively. SPTs were also performed in chalk as a guide to the chalk's quality. Hand penetrometer tests were undertaken on recovered samples to determine the shear strength of cohesive deposits encountered.

In-situ probing was also conducted at sixteen locations using a MEXE Probe to give an indication of California Bearing Ratio (CBR). Tests were conducted where possible just below the shallow made ground if encountered.

5.4.2 Laboratory Testing

The samples recovered from the boreholes were submitted to an accredited laboratory for the following analyses in general accordance with BS1377:1990:

- Determination of natural moisture content;
- Determination of Atterberg limits;
- Determination of California Bearing Ratio (CBR) value – laboratory determination;
- Determination of undrained shear strength by triaxial compression and laboratory shear vane;
- Determination of the one dimensional consolidation properties; and
- Determination of soil and groundwater pH and water soluble sulphate concentrations.

The results of the geotechnical testing are included in Appendix G.

6 GEOTECHNICAL AND ENVIRONMENTAL FIELD INVESTIGATION FINDINGS

6.1 Ground Conditions

A detailed description of the ground conditions beneath the site is included on the exploratory hole logs, which are presented in Appendix E.

Geology	Minimum depth to base of layer (m bgl)	Maximum depth to base of layer (m bgl)	Thickness range (m)	General Description
Made Ground	0.0	2.5	0.0-2.5	Concrete in the north and central areas of the site underlain by brown gravelly clay/ gravel including tile, wood, glass in the southern areas of the site. Made ground is generally deeper in the south of the site.
Clay	1.76	5.5	0.7-4.75	Very soft to firm, typically a brown gravelly clay. More gravelly with depth including thin horizons of flint gravels.
Chalk	Minimum extent of layer not proven	Maximum extent of layer not proven	n/a	Recovered as gravel sized fragments of Chalk with percussive techniques. Described as a matrix dominated chalk (CIRIA Grade Dm) down to approximately 12m bgl. Chalk quality increases with depth becoming a clast dominated chalk (CIRIA Grade Dc) at depths greater than between 12.0-14.4m bgl. Occasional thin flint gravels present.

6.2 Soil Quality

Minimal visual and olfactory evidence of contamination was noted. The results are detailed on the borehole logs presented in Appendix I.

6.2.1 Laboratory Analysis

The results of the environmental soil analysis results are included as Appendix F and are briefly described below:

TPH

Low concentrations of TPH were detected above the MDL from shallow made ground samples across the site. The majority of the detections were reported in the EC12-21 fractions.

PAH

PAH concentrations were reported above MDL in a number of shallow made ground samples across the site.

Metals and Inorganics

Concentrations of metals and inorganic compounds were reported above the method detection limit (MDL).

Asbestos

No Asbestos Containing Materials were detected in the samples screened.

PCBs

A single detection of PCB congener 101 was present in BH3 (0.1-0.3mbgl) at a concentration of 0.005mg/kg and detections of PCB congeners 101 (0.0043 mg/kg), 118 (0.005 mg/kg), 138 (0.005 mg/kg) and 153 (0.004 mg/kg) in WS6.

VOC and SVOC

Detections of benzene (0.025 mg/kg), toluene (0.017 mg/kg) and ethylbenzene (0.009 mg/kg) were found in BH2 (0.1-0.6mbgl). Carbon disulphide was measured at a concentration of 0.0135 mg/kg in Borehole 1.

Concentrations of SVOC were all recorded below MDL, with the exception of 0.12 mg/kg of bis(2-Ethylhexyl)phthalate in BH1.

No VOC or SVOC TICS were identified.

6.3 Groundwater

6.3.1 Groundwater Occurrence and Flow

Groundwater was encountered across site at shallow depths within the exploratory holes. Distinct water strikes were noted and are documented on the exploratory hole logs.

Based on data obtained during post fieldwork monitoring, it is considered that minimal perched water may be present in the shallow made ground, resting upon a confining layer of clay at approximately 3m bgl across the site. The groundwater across the site is thought to be dominantly influenced by the potentiometric surface within the underlying chalk aquifer, which indicates a flow direction towards the south/southeast across the site.

In the deeper boreholes (BH1-BH6) installed exclusively into the chalk strata, resting groundwater levels were recorded between a 5.345m AOD in BH6 and 4.659m AOD in BH1 on the 2nd March 2011.

Groundwater elevations are presented in Table 1.

6.4 Groundwater Quality

No visual or olfactory evidence of contamination was noted during the sampling of the monitoring wells.

6.4.1 Laboratory Analysis

The results of the environmental water analysis results are included as Appendix F and briefly discussed below.

TPH

TPH concentrations were only detected in groundwater analysed from boreholes BH1, BH5 and WS1. From these boreholes, total TPH concentrations ranged from a maximum of 133µg/l in BH5 to 50 µg/l in BH1. Low concentrations of hydrocarbons were detected across a number of different hydrocarbon fractions and included a single detection of a BTEX compound (Toluene) at a concentration of 18 µg/l in BH1.

PAH

A single detection of Benzo(a)pyrene was reported above the MDL in WS3 at a concentration of 0.0148 µg/l.

Metals and Inorganics

Metals and inorganics were primarily reported above MDL.

Pesticides

No pesticide compounds were detected above the MDL.

PCBs

No PCBs were detected above the MDL in any of the samples scheduled for analysis.

VOC and SVOC

No VOC or SVOC compounds were reported above the MDL in all samples scheduled for analysis.

6.5 Geotechnical Testing

Results of the *in-situ* geotechnical testing undertaken as part of the investigation are presented on the borehole logs presented in Appendix E.

The results of the geotechnical laboratory testing are presented in Appendix G.

6.6 Ground Gas Monitoring Results

A total of four ground gas monitoring visits were conducted as part of the post site investigation fieldwork, with maximum/minimum results detailed below.

- Maximum methane concentration of 26.4% v/v (WS3 on 9th March 2011),
- Maximum carbon dioxide concentration of 6.2% v/v (WS6 on 2nd March 2011),
- Minimum oxygen concentration of 14.0% v/v (WS6 on 2nd March 2011)
- Maximum carbon monoxide concentration of 19ppm (WS7 on 17th March 2011).
- The highest borehole flow rate was recorded at 0.3l/hr in WS105 on 27th October 2010.

The results of ground gas monitoring are included in Table 2.

7 GENERIC QUANTITATIVE RISK ASSESSMENT - STAGE 3 - ASSESSMENT

7.1 Selection and Derivation of Generic Assessment Criteria

Laboratory results have been compared with ARCADIS Generic Assessment Criteria (GAC) derived for commercial use with open spaces. The derivation of the GAC is presented as Appendix H.

Due to the proposed end-use of the site as a commercial retail development, and proximity of the site to neighbouring residents, the ARCADIS GAC derived for the protection of future commercial workers and neighbouring residents have been adopted for comparison to soil and groundwater data.

The nearest surface water feature to the site is the culverted drain located on the central/southeastern side of the site. Ground conditions encountered beneath the site are considered to be representative of a relatively thin (2-3m layer) of impermeable clays underlain by a Principal Chalk Aquifer.

Although the site is not located within a source protection zone and there are no potable groundwater abstractions within 1km of the site, the Set 2 GAC based on drinking water standards have been applied.

The ARCADIS GAC for protection of commercial workers and neighbouring residents, as well as water resource receptors, is presented in Appendix I.

7.2 Comparison of Soil Analysis Results to Generic Assessment Criteria

Human Health receptors

There were no exceedances of the GAC protective of human health with regards to commercial workers or neighbouring residents.

Water Resource receptors

Concentrations above the GAC protective of water resource receptors in shallow soils across the site with respect to several PAH compounds. Exceedences were noted in boreholes BH1, BH2, BH5, BH6, WS2, WS3, WS4, WS5, WS6, WS7, WS8 and WS9.

Concentrations of hydrocarbon compounds (Aromatic fractions EC12-EC21) above the GAC protective of water resource receptors were noted in boreholes WS3, WS4, WS6 and WS7 in the shallow soils across the site. A single concentration above the GAC for benzene was detected in BH2.

The majority of the exceedences were detected in shallow made ground.

7.3 Assessment of Soil Results without Respective GAC

Minor detections of VOCs, SVOCs, metals, inorganics and PCBs have been reported for which no standard has been identified as suitable for deriving generic assessment criteria. Of these, the laboratory results have shown a number of compounds detected marginally above the MDL.

GACs for metals and inorganic compounds, with respect to Set 2 Water Resources, are not derived as the only exposure pathway is via dust inhalation. It is recommended that any soft landscaping areas are correctly managed to ensure sufficient vegetation cover.

7.4 Asbestos

No Asbestos containing materials have been detected from the samples screened.

7.5 Comparison of Groundwater Analysis Results to Generic Assessment Criteria

Human Health receptors

There were no concentrations of Contaminants of Concern (CoC in excess of the GAC protective of human health receptors associated with the site in the samples analysed.

Water Resource receptors

Single TPH fractions (including toluene, aliphatic C10-C12, aliphatic C12-C16, aliphatic C21-C35, aromatic EC7-EC8 and aromatic EC16-EC21) were reported at concentrations greater than the GAC for water resource receptors in three of the fourteen monitoring wells across the site. These boreholes (BH1, BH5 and WS1) are all located in the south of the site.

A single PAH compound was reported in WS3 above the GAC for water resource receptors.

7.6 Refinement of Conceptual Site Model

Following the intrusive site investigation, Figure 4 presents a refined conceptual model to remove potential pollutant linkages that are no longer considered to be active. Discussion of the refined conceptual model is presented below.

Risk to Human Health

The concentrations of CoC detected in soils and groundwater were below the GAC protective of human health for neighbouring residents and commercial workers. These have therefore been removed from the conceptual model.

Risk to Controlled Waters

Some of the CoC reported in the soil samples have leached into the groundwater beneath the site. Although no data has been obtained from off-site, there is the potential that low levels of CoC have migrated off the site.

The culverted watercourse in the southeast of the site could provide a potential pollutant linkage between impacts associated with the shallow made ground on the site and the underlying aquifer. As such, surface waters remain as a receptor via a groundwater migration pathway.

Risk to Buildings

The ground gas concentrations are considered to present a risk to the proposed store building. Recommended gas protection measures to address this risk is discussed in Section 8.

8 GROUND GAS ASSESSMENT

8.1 Assessment Methodology

In order to understand the gassing regime at the site, a Characteristic Situation (as defined in CIRIA C665) is determined for the site. CIRIA C665 provides definitions for each Characteristic Situation based on Gas Screening Values (GSV) which are calculated as follows:

$$\text{Gas Screening Value (GSV)} = \text{Gas Concentration (\% v/v)} \times \text{Measured Borehole Flow Rate (l/hr)}$$

This method of assessment is aimed at assessing the risk to developments which are not low rise housing with gardens (assessed using a slightly different methodology).

The derivation of GSV used for this assessment, has been derived for each source area per monitoring event. The maximum carbon dioxide/methane concentration recorded in the boreholes is multiplied by the maximum flow rate recorded during the same monitoring event.

Gas emissions can vary depending upon a number of factors including changes in atmospheric pressure and groundwater levels as well as conditions such as waterlogged or frozen soils. It is therefore important that a number of gas monitoring events are undertaken in order to assess the gassing regime over a period of time, including at least one monitoring event carried out during falling atmospheric pressure representing a period of increased gas emissions.

8.2 Ground Gas Risk Assessment

The maximum GSV, based on the above methodology, was calculated from gas monitoring results with a maximum methane concentration of 26.4% v/v recorded from WS3, maximum carbon dioxide concentration of 6.2 % v/v recorded in WS6 and maximum flow of gas of 0.3 l/hr recorded in all boreholes.

Methane

$$\text{GSV} = 0.264 \times 0.3 \text{ l/hr} = \mathbf{0.0792 \text{ l/hr}}$$

Carbon Dioxide

$$\text{GSV} = 0.062 \times 0.3 \text{ l/hr} = \mathbf{0.0186 \text{ l/hr}}$$

The calculated GSVs place the site into Characteristic Situation 2 as defined by CIRIA C665.

8.3 Conclusions and Recommendations

The following section describes the key findings of the gas risk assessment with respect to the end users of the site, neighbouring properties and future construction workers. Potential gas control measures are also discussed.

8.3.1 Risk to Proposed Store Buildings

The proposed store is placed into Characteristic Situation 2 as defined by CIRIA C665.

ARACDIS therefore recommends the following:

- Installation of gas collection/venting system comprising a granular venting layer beneath the car parking surface to act as preferential migration pathway for gas accumulation to be vented.

Monitoring wells should be installed after installation of the venting trench/barrier in order to demonstrate that the potential gas migration has been reduced to an acceptable level. In addition, long term maintenance may be required to enable the venting trench to remain working effectively.

In addition, the following precautionary measures should be installed into the new store building:

- A minimum 2000 gauge membrane should be incorporated into the floor slab;
- For geotechnical reasons the floor slab is likely to be suspended and therefore, consideration could be given to the subfloor void being passively ventilated in accordance with the requirements of Building Research Establishment (BRE) document 414;
- All joints and penetrations of the membrane should be carefully sealed. Membrane joints should be sealed using a welding technique and not simply taped;
- It is recommended that the gas precautionary measures are installed by a specialist and integrity tested;
- There should be minimum penetration of the floor slab by services and minimum number of confined spaces such as cupboards above the floor slab; and
- All confined spaces should be ventilated.

8.3.2 Risk to Construction Workers

Oxygen concentrations below 19% can be hazardous to human health and in the range 6 to 10% can result in nausea and vomiting and may even be fatal below 6%. The table below details the physiological effects of depleted oxygen. Oxygen depleted conditions (<19%) have been reported in locations across the site. Oxygen levels less than 6% were recorded in several locations within the historic landfill and BH101.

Oxygen %	Physiological effects
19 – 21	Normal range of oxygen in atmospheric air
17	Faster, deeper breathing; slight impairment of judgement
16 – 10	Initial signs of anoxia leading to emotional upsets
10 – 6	Nausea, vomiting and unconsciousness, may lead to collapse
<6	Convulsion, gasping respiration, death

Low oxygen and/or elevated carbon dioxide/methane/carbon monoxide concentrations are only really of concern within confined spaces during excavation and remediation works. It would therefore be prudent to monitor all but shallow excavations for the presence of ground gases before entry, to ensure that there is no significant risk from reduced oxygen levels.

9 WASTE CLASSIFICATION

Each of the three samples analysed for WAC were found to be suitable for disposal at an inert waste landfill, subject to discussion with the landfill operators. The WAC analytical results are incorporated within the environmental laboratory testing results in Appendix I.

9.1 Re-use of material on-site

In order for any site won materials to be re-used, it is important that materials that moved around the site are not considered to be waste. In order to do this it is possible to either apply for an exemption from waste management licensing or to follow the new Code of Practice (CoP) on the definition of waste (CL:AIRE document 'The Definition of Waste: Development Industry Code Of Practice', September 2008).

The Code of Practice sets out a number of principles, which when followed can lead to waste achieving 'non waste status' such that excavated soil can be appropriately re-used. The following factors have to be demonstrated in order to reuse the materials:

- The materials are suitable for use (both chemically and geotechnically) without further processing;
- The use of the materials is certain; and
- Only the quantity required is used.

The consultancy work associated with this would require a detailed quantitative risk assessment to be carried out, together with a materials management plan and a signed declaration by a competent person.

10 ENVIRONMENTAL CONCLUSIONS AND RECOMMENDATIONS

10.1 Risk to Human Health

The concentrations of CoC detected in soils and groundwater were below the GAC protective of human health for neighbouring residents and commercial workers.

Appropriate care will need to be taken to protect workers and the general public during excavations as part of the redevelopment works. Advice can be sought from HS(G) 66 'Protection of Workers and the General Public during the Development of Contaminated Land'. Further assessment will be required if potentially asbestos containing material is encountered.

It would be considered that due to the nature of some of the materials encountered within the landfill made ground (metals wires, bricks etc), if not necessarily an environmental requirement, to emplace a cap of 'clean' material at the surface of any landscaped areas within the proposed development. The capping layers would act to break potential pollutant linkages from potential unidentified contaminant sources within made ground to users of the site.

10.2 Risk to Buildings from Ground Gas

High ground gas concentrations were encountered which will require protection measures to be installed. Full details of the ground gas assessment, together with recommended protection measures is presented in Section 8 of this report.

10.3 Risk to Controlled Waters

Reported concentrations were compared to ARCADIS GAC protective of water resources based on drinking water standards, which are based on environmental setting and conceptualisation of the site was considered appropriate.

Reported concentrations of hydrocarbons and PAH compounds have been encountered in soil and groundwater in a small number of exploratory holes in excess of the GAC protective of water resource receptors. Exceedances were primarily reported in soils obtained from within shallow made ground across the site.

Low concentrations of PCBs, VOCs and SVOCs in soil were reported marginally above the MDL. These detections may indicate historical sources of CoC which may have resulted in localised contamination hotspots which may need to be removed during the site redevelopment works (e.g. during decommissioning of the sub station on site). Further assessment should be carried out if any previously unidentified contamination is encountered during site redevelopment works.

No PCBs, Pesticides, VOCs or SVOCs were detected above the MDL in any groundwater samples.

The desk study information did reveal potential historical on-site sources of hydrocarbons, which may explain the low levels of TPH observed in soils and groundwater, although groundwater detections could also have been derived from an off-site source. It is anticipated that following further assessment the need for further action can be ruled out.

It is considered that the impacts reported in soil and groundwater above GAC protective of water resources are unlikely to present a significant risk to the underlying principal aquifer. It is noted, however, that given the uncertainty regarding the resource value of the principal aquifer, regulatory approval for this assumption should be sought with the Environment Agency.

10.4 Recommendations

In order to address the environmental aspects of the development, it is recommended that the following additional work is considered;

- Further ground gas monitoring may be required at the site to confirm the level of gas protection measures that are required for the proposed store development. It is possible that the Characteristic Situation for the site may be able to be reduced to Characteristic Situation 2 if the source of the highest gas concentrations are removed from site. The proposed store development should also consider radon protection measures.

Recommendations relating to the geotechnical aspects of the development are discussed in Section 11 of this report.

10.5 Health & Safety Considerations

To ensure direct exposure of construction workers involved in the site redevelopment to any impacted contaminated shallow soils is minimised, the guidance stated in HSG 66 "Protection of Workers and the General Public During Redevelopment of Contaminated Land" should be followed.

10.6 Disposal of Solid or Liquid Waste Arisings

All soil arisings that are not to be re-used on site should be removed from site by an appropriately registered waste carrier and disposed of in an appropriately licensed facility under the appropriate Duty of Care procedures.

In the event that shallow groundwater is encountered and identified as impacted, in accordance with the risk based screening criteria presented in Appendix I or from subsequent risk assessments, the groundwater should be removed from site by a registered waste carrier and transported to an appropriately licensed disposal facility, or treatment plant. Alternatively, the impacted groundwater could be treated on site using a mobile treatment unit. If the water is to be treated on site, agreement on discharge must be obtained from the local water company.

11 GEOTECHNICAL SITE ASSESSMENT

11.1 Proposed Development

It is understood that ASDA propose to construct a new store and external parking areas at the site. To this end the existing commercial units are to be demolished.

At the time of writing this report the proposed structural loads of the new store have not been finalised.

Details of proposed finished levels and cut and fill balance were unavailable for the proposed layout at the time of issue of this report.

Due to the early stages of the development process and as agreed upon commencement of this work, the geotechnical assessment has not been carried out fully in accordance with Eurocode 7. While this site investigation will form an integral part of the requirements of Eurocode 7 it may not be sufficient in isolation as further site investigation may be required by the designer. In addition, more information relating to the loading criteria of the building will need to be supplied to finalise the geotechnical design. This can be carried out later in the development programme if deemed necessary.

11.2 Geotechnical Ground Conditions

The investigation revealed the site to be underlain by the following strata:

Proposed Store Area

Made Ground:

This typically comprised gravelly clay or gravel with fragments of tile, glass and wood and was generally present to depths in the order of 0.3 to 0.6m. Locally however deeper areas of made ground were encountered. In the vicinity of borehole BH5 and WS 1 made ground and possible made ground were present to depths of 2.5m and 2m respectively. There is anecdotal evidence from the site owner that unwanted materials had been buried on site.

Clay:

Clay was encountered beneath the made ground. This varied in consistency from very soft to firm and was typically described as brown gravelly clay. In places the clay became more gravelly with depth. Some bands of gravel were encountered.

Chalk:

Chalk was present beneath the clay, the interface between the two materials occurred at depths varying from 3m to 5.5m below ground level. The chalk recovered was typically described as a matrix dominant chalk (Grade Dm as defined by CIRIA Report C574 Engineering in Chalk). Borehole BH5 was taken to greater depth (20m) and an improvement in chalk quality to clast dominant chalk (Grade Dc) was noted at approximately 12m depth. A further improvement in chalk quality was noted from 14.4m, below which the chalk was recovered as Grade Dc with layers of Grade B, as defined by CIRIA C574.

Proposed Car Park Areas

In the area of the proposed car park, the soil strata encountered was similar to that described for the store area.

Made Ground:

This was present to depths between 0.25m (WS 6) and 1.7m (WS 9). Concrete was present over a layer of gravel at the location of the existing store and car park. To the west of the existing store the made ground was deeper. The made ground typically comprised clay with wood or plastic, and ranged in depth from 0.32m (TP6) to 1.7m (WS9). At the location of WS3 and TP6 a material which comprised clay with decayed wood was present to depths of 1.8m and 1.76m respectively. It is probable that this material represents infill to a pond located in this general area, this feature was present on maps of the site area.

The top of the chalk was encountered at a minimum depth of 1.76m below ground in TP6. A number of exploratory holes did not encounter chalk at their completion depth (in the order of 3m), borehole BH6 did encounter chalk at 3.4m depth.

In-situ Testing

In situ SPTs were conducted in the chalk to assist in the interpretation of this material. From the top of the chalk to depths in the order of 13.5m the SPT N value ranged between 17 and 39. Three tests conducted in BH 5 below 13.5m depth gave N values > 50.

A MEXE probe was used to estimate in-situ CBR values of the clay at a number of locations. These tests gave values in the range 1.5 to 2.8%

The in-situ test results are presented on the appended borehole logs.

Geotechnical Laboratory Analysis

Atterberg limit testing was conducted on six samples of clay. The Plasticity Index of the samples were reported in the range 13 to 24%, representative of low to intermediate plasticity clays.

Undrained triaxial shear strength testing was carried out on eight undisturbed samples of the clays. The determined shear strength values of the clays ranged between 15 and 91kN/m² which corresponds to very low to high strength clay.

Two consolidation tests were carried out on samples of clay, these indicated that the clays were of medium to high compressibility.

Laboratory CBR determinations on two clay samples indicated values of 0.6% and 2.4%.

11.3 Foundations

Given the presence of low strength and medium to highly compressible soils on site it will be necessary to utilise a piled foundation solution for this site. It is anticipated that CFA piles, end bearing within the chalk, will be the most cost effective solution. It is anticipated that piles in the order of 15m in length will be required, however, due to weathering processes the depth to competent chalk can vary considerably over short distances and therefore the depth of the pile should be calculated taking into account such local variations.

Estimated pile carrying capacities have been calculated as outlined in CIRIA 574 *Engineering in Chalk Piled foundations*. An in-situ effective stress approach has been used to estimate shaft friction. For end bearing an SPT value of 25 has been assumed based on the testing undertaken by ARCADIS.

Pile Diameter (mm)	300mm CFA	450 mm CFA
Pile Length (m)	15m	15m
Pile capacity	240kN	425 kN

The estimated safe working load is indicative only and specialist piling contractors should be consulted with regard to the design and performance of their piled foundations. The safe working load has been calculated for a single isolated pile. The effect of group action has not been taken into consideration.

Consideration should be given to pile construction in the soft clays at this site. These are unlikely to provide much lateral support to the concrete before it sets.

It will be necessary to construct a piling mat to support the plant involved in construction of the foundations (see BRE Report 470 *Working platforms for Tracked Plant*)

The potential effects of any proposed site works on the adjacent railway should be considered. In settlement due to loading of the clays or dewatering of the ground should be determined

11.4 Floor Slab

Exact details of the proposed bearing pressures exerted by the floor slab were not known at the time of writing this report. However, given the significant thickness of very soft to soft clay beneath the site, and the presence of locally deepened areas of made ground, it is considered that ground bearing floor slabs will not be suitable and a fully suspended floor slab will be required.

Bulk ground gas data indicates that ground gas concentrations beneath the proposed store and flow rates place the site into Characteristic Situation 2 as defined by CIRIA C665. This is a result of the elevated methane concentrations reported in borehole WS3. It is considered that the elevated methane concentrations are related to the decomposition of the organic remains identified within the clay at this location, as detailed on the borehole log.

A further period of ground gas monitoring has been recommended given the variability and magnitude of some of the gas monitoring data. Should this additional monitoring indicate continued high levels of methane in the ground then consideration should be given to removal of the gas source (organic silt within the former pond). Alternatively the gas protection measures recommended for Characteristic Situation 2 in CIRIA 665 should be adopted, namely;

- Installation of a 2000 gauge gas membrane with all joints and penetrations sealed;
- Consideration of sub slab ventilation.

Contrary to the information obtained in the desk study, examination of the BR211 document, "Radon: Guidance on protective measures for new buildings" (2007), the Site is not located in an area where basic radon protection measures are considered necessary. This should be verified further before building design is finalised.

11.5 Pavement Design

The site is underlain by a significant thickness of compressible soils or made ground. Based upon the findings of the in-situ and laboratory testing it is recommended that for preliminary design purposes these materials should be considered to have a CBR of less than 2%.

It is anticipated that shallow ground stabilisation techniques may be employed to improve the CBR value of shallow soils and to create a suitable sub base for pavement construction. It may be necessary to include a geogrid reinforcement layer within the capping layers.

The use of cementitious or other binders to improve soils can be adversely affected by sulphate heave in certain soils. Specialist subcontractors should satisfy themselves that the levels of sulphate present in soil are not likely to result in heave.

The area in the vicinity of WS3 which probably represents a backfilled pond is likely to present a long term settlement problem. It is recommended that this material should be removed and replaced with a suitable engineered fill. Similar areas may be located elsewhere and a contingency should be allowed to deal with them.

It is recommended that once the site has been graded to the appropriate pavement formation level, it is inspected and, if necessary, in situ CBR testing be conducted on the sub-grade to confirm the appropriate pavement design (i.e. to determine the sub-base and capping thickness). In addition, the formation should be proof-rolled and any uncharacteristically soft/loose pockets encountered should be excavated and replaced with well compacted fill prior to pavement construction. Requirements for the design of road pavements are given in the Highways Agency, 'Design Manual for Roads and Bridges, Volume 7. Pavement Design and Maintenance: Foundations HD 25/94'.

11.6 Earthworks

It is anticipated that minimal earthworks will be carried out at this site, however, where future use comprises car parking, hardstanding, access roads and landscaping, materials excavated from site may be reused provided they comply with the acceptability criteria for earthworks as defined by the Highways Agency Manual of Contract for Highways Work, Volume 1: Specification for Highway Works (SHW), Series 600, Earthworks (available at www.standardsforhighways.co.uk/).

The materials should be compacted using an appropriate method compaction as defined in the SHW. It is anticipated that a number of soils may require stabilisation prior to re use due to the high natural moisture content and compressibility of a number of the clay materials encountered on site.

11.7 Excavations and Temporary Works

Shallow excavations in the made ground and soft clays are not likely to remain stable in the short term without support or without being battered back to a safe slope gradient. A detailed inspection of the side slopes should be made during excavation and a risk assessment carried out to fully assess the support measures required.

Soft clay is present at shallow depth. The construction platform for heavy equipment will need to be investigated to ensure that the soil has an adequate safe bearing capacity for piling equipment and cranes. The shallow soils are likely to deteriorate significantly due to the trafficking of construction plant or inclement weather. It is anticipated that the installation of a sacrificial capping layer or stabilisation of the shallow soils will be required to allow free access during the construction period.

It is anticipated that groundwater will be encountered at relatively shallow depth, results of monitoring indicate the presence of groundwater at depths between 0.3m and 1m in many parts of the site. It is likely that even relatively shallow excavations may require dewatering.

The potential for any instability in excavations and/or the potential effects of dewatering activities should be considered in relation to their potential to adversely affect the railway line adjacent to the southern site boundary.

11.8 Protection of Buried Concrete

Laboratory soil sulphate and pH tests undertaken on a range of soil types and sample depths across the site indicate that for a brownfield site, a Design Sulphate Class DS-1 is appropriate for buried concrete at this site.

Based upon the mobile water conditions and a lower bound pH of 6.5, an ACEC Class of AC-2z is recommended.

12 STUDY LIMITATIONS

IMPORTANT. This section should be read before reliance is placed on any of the information, opinions, advice, recommendations or conclusions contained in this report.

1. This report has been prepared by Arcadis (UK) Ltd (Arcadis), with all reasonable skill, care and diligence within the terms of the Appointment and with the resources and manpower agreed with Asda Stores Limited (the 'Client'). Arcadis does not accept responsibility for any matters outside the agreed scope.
2. This report has been prepared for the sole benefit of the Client unless agreed otherwise in writing.
3. Unless stated otherwise, no consultations with authorities or funders or other interested third parties have been carried out. Arcadis are unable to give categorical assurance that the findings will be accepted by these third parties as such bodies may have unpublished, more stringent objectives. Further work may be required by these parties.
4. All work carried out in preparing this report has used, and is based on, Arcadis' professional knowledge and understanding of current relevant legislation. Changes in legislation or regulatory guidance may cause the opinion or advice contained in this report to become inappropriate or incorrect. In giving opinions and advice pending changes in legislation, of which Arcadis is aware, have been considered. Following delivery of the report Arcadis have no obligation to advise the Client or any other party of such changes or their repercussions.
5. This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report.
6. Whilst this report and the opinions made are to the best of Arcadis' belief, Arcadis cannot guarantee the accuracy or completeness of any information provided by third parties.
7. This report has been prepared based on the information reasonably available during the project programme. All information relevant to the scope may not have received.
8. This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of changes in the condition of the site since the time of the investigation.
9. The content of this report represents the professional opinion of experienced environmental consultants. Arcadis does not provide specialist legal or other professional advice. The advice of other professionals may be required.
10. Where intrusive investigation techniques have been employed they have been designed to provide a reasonable level of assurance on the conditions. Given the discrete nature of sampling, no investigation technique is capable of identifying all conditions present in all areas. In some cases the investigation is further limited by site operations, underground obstructions and above ground structures. Unless otherwise stated, areas beyond the boundary of the site have not been investigated.
11. If below ground intrusive investigations have been conducted as part of the scope, service tracing for safe location of exploratory holes has been carried out. The location of underground services shown on any drawing in this report has been determined by visual observations and electromagnetic techniques. No guarantee can be given that all services have been identified. Additional services, structures or other below ground obstructions, not indicated on the drawing, may be present on site.
12. Unless otherwise stated the report provides no comment on the nature of building materials, operational integrity of the facility or on any regulatory compliance issues.
13. Unless otherwise stated, samples from the site (soil, groundwater, building fabric or other samples) have NOT been analysed or assessed for waste classification purpose.

TABLES

TABLE 1
Borehole and Groundwater Elevations

800120101_01 / March 2011

	Monitoring Well	Easting (m)	Northing (m)	Ground Level (mAOD)	16-18th February 2011		02/03/2011 *		09/03/2011		17/03/2011	
					GW Level (mbgl)	GW Level (mAOD)	GW Level (mbgl)	GW Level (mAOD)	GW Level (mbgl)	GW Level (mAOD)	GW Level (mbgl)	GW Level (mAOD)
Shallow Window Samples	WS1	508700	103116	5.979	0.9	5.079	0.962	5.017	1.113	4.866	1.249	4.730
	WS2	508783	103130	5.848	0.82	5.028	0.992	4.856	1.116	4.732	1.244	4.604
	WS3	508656	103170	5.528	0.5	5.028	0.534	4.994	0.627	4.901	0.736	4.792
	WS4	508709	103184	5.811	0.63	5.181	0.722	5.089	0.849	4.962	0.968	4.843
	WS5	508710	103226	6.049	0.47	5.579	0.773	5.276	0.912	5.137	1.054	4.995
	WS6	508756	103273	6.852	1.5	5.352	1.589	5.263	1.77	5.082	1.941	4.911
	WS7	508747	103304	7.273	2.19	5.083	1.92	5.353	2.109	5.164	2.27	5.003
	WS8	508669	103311	7.350	2	5.350	2.39	4.960	2.2	5.150	2.378	4.972
	WS9	508645	103261	6.287	n/a	-	n/a	-	n/a	-	n/a	-
	WS10	nr	nr	nr	n/a	-	n/a	-	n/a	-	n/a	-
	WS11	nr	nr	nr	n/a	-	n/a	-	n/a	-	n/a	-
	WS12	508770	103333	7.372	n/a	-	n/a	-	n/a	-	n/a	-
	WS14	508642	103140	5.542	n/a	-	n/a	-	n/a	-	n/a	-
Deep Boreholes	BH1	508765	103134	5.844	0.920	4.924	1.185	4.659	1.313	4.531	1.450	4.394
	BH2	508774	103060	5.604	0.750	4.854	0.769	4.835	1.018	4.586	1.172	4.432
	BH3	508669	103060	6.153	1.070	5.083	1.186	4.967	1.329	4.824	1.478	4.675
	BH4	508664	103141	5.313	0.480	4.833	0.328	4.985	0.428	4.885	0.568	4.745
	BH5	508722	103100	5.886	nr	-	1.183	4.703	1.292	4.594	1.486	4.400
	BH6	508688	103325	7.260	nr	-	1.915	5.345	2.102	5.158	2.255	5.005

* Groundwater levels used in report to interpret flow direction
mAOD metres Above Ordnance Datum
mbgl metres Below Ground Level
GW Groundwater
nr Not recorded
n/a Not applicable
Monitoring Well Vandalised

Table 2
Results of Ground Gas Monitoring

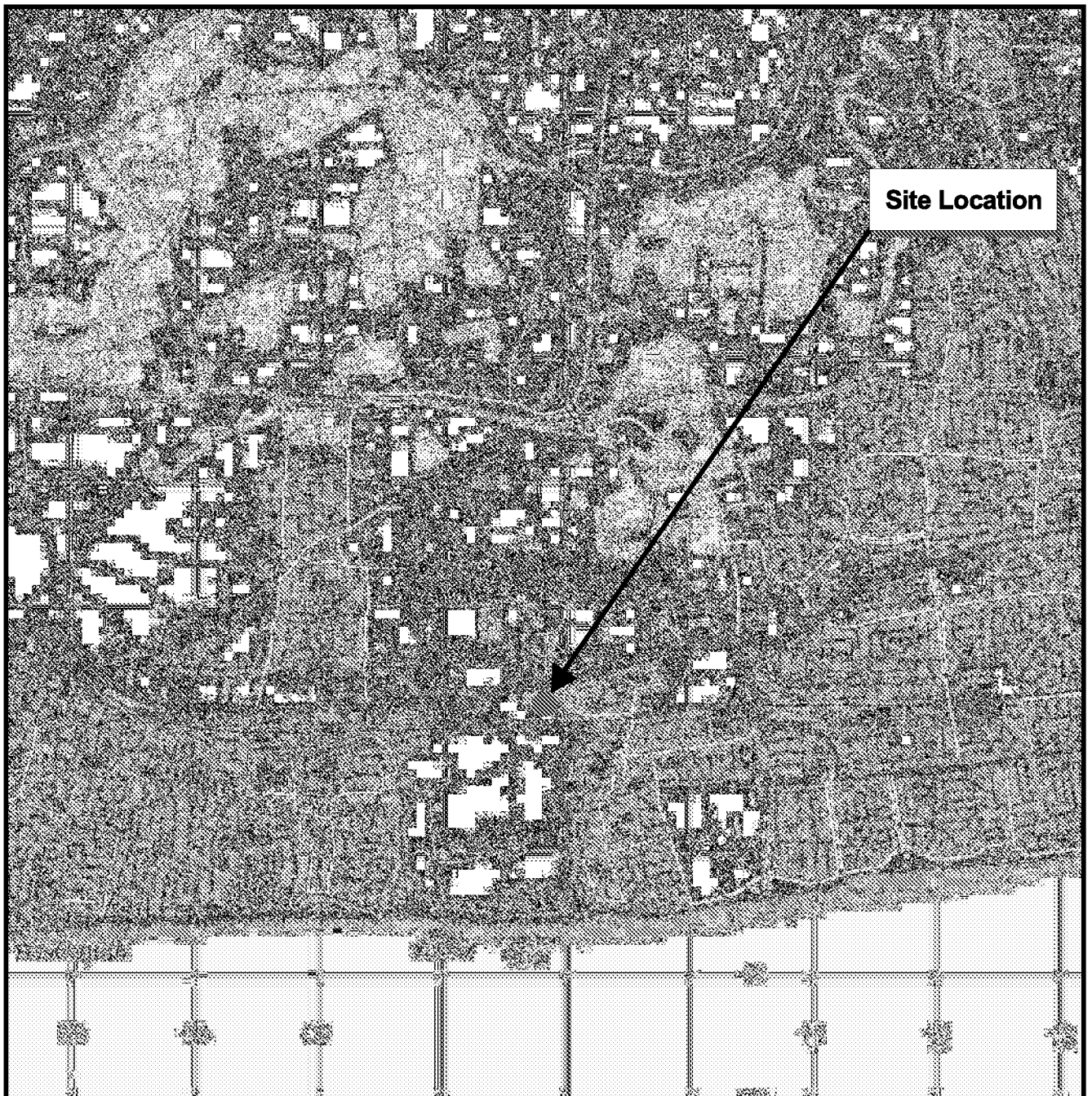
800120101_01 / March 2011

Borehole	Date	Depth to Water (m tgl)	Atmos. Pressure (mb)	Methane		Carbon Dioxide		Oxygen		Flow Rate (l/hr)	Gas Screening Values* (l/hr)		Remarks
				Peak (%v/v)	Steady (%v/v)	Peak (%v/v)	Steady (%v/v)	Minimum (%v/v)	Steady (%v/v)		Methane	Carbon Dioxide	
WS1	16th-18th February 2011	0.9	1009	<0.1	<0.1	0.1	0.0	20.5	20.6	0.0	<0.01	<0.01	
WS2		0.82	1008	<0.1	<0.1	0.6	0.2	18.1	20.6	-0.01	<0.01	<0.01	
WS3		0.5	1009	0.5	0.1	0.8	0.2	19.1	20.2	-0.2	<0.01	<0.01	Carbon Monoxide detected (max 6ppm)
WS4		0.63	1009	0.2	0.2	0.2	0.2	19.3	20.1	0.00	<0.01	<0.01	Carbon Monoxide detected (max 13ppm)
WS5		0.47	1018	0.0	0.0	0.1	0.0	20.8	20.8	0.0	<0.01	<0.01	
WS6		1.5	1017	0.0	0.0	0.0	0.0	20.9	20.9	0.0	<0.01	<0.01	
WS7		2.19	1018	0.5	0.5	1.1	0.4	18.1	19.2	-0.1	<0.01	<0.01	Carbon Monoxide detected (max 19ppm)
WS8		2	1017	0.0	0.0	1.3	0.4	19.2	20.3	-0.8	<0.01	<0.01	
BH1		0.920	Not recorded - Groundwater Sampling										
BH2		0.750											
BH3		1.070											
BH4		0.480											
BH5		nr											
BH6		nr											
Borehole	Date	Depth to Water (m tgl)	Atmos. Pressure (mb)	Methane		Carbon Dioxide		Oxygen		Flow Rate (l/hr)	Gas Screening Values* (l/hr)		Remarks
				Peak (%v/v)	Steady (%v/v)	Peak (%v/v)	Steady (%v/v)	Minimum (%v/v)	Steady (%v/v)		Methane	Carbon Dioxide	
WS1	2nd March 2011	0.962	1037	<0.1	<0.1	0.9	0.1	19.8	20.6	<0.1	<0.01	<0.01	Carbon Monoxide detected (max 2ppm)
WS2		0.992	1037	0.2	0.2	0.1	0.0	20.7	20.8	<0.1	<0.01	<0.01	Carbon Monoxide detected (max 1ppm)
WS3		0.534	1037	10.6	1.4	3.2	0.4	18.3	20.5	<0.1	<0.01	<0.01	
WS4		0.722	1036	0.1	0.1	0.4	0.1	20.1	20.8	0.1	<0.01	<0.01	Carbon Monoxide detected (max 3ppm)
WS5		0.773	1037	<0.1	<0.1	0.2	0.1	19.5	20.6	<0.1	<0.01	<0.01	Carbon Monoxide detected (max 1ppm)
WS6		1.589	1037	0.1	<0.1	6.2	4.7	14.0	15.0	0.1	<0.01	<0.01	Carbon Monoxide detected (max 4ppm)
WS7		1.92	1036	<0.1	<0.1	0.5	0.1	20.7	21.2	<0.1	<0.01	<0.01	
WS8		2.39	1037	<0.1	<0.1	2.0	0.3	19.0	21.3	<0.1	<0.01	<0.01	Carbon Monoxide detected (max 1ppm)
BH1		1.185	Not recorded.										
BH2		0.769											
BH3		1.186											
BH4		0.328											
BH5		1.183											
BH6		1.915											
Borehole	Date	Depth to Water (m tgl)	Atmos. Pressure (mb)	Methane		Carbon Dioxide		Oxygen		Flow Rate (l/hr)	Gas Screening Values* (l/hr)		Remarks
				Peak (%v/v)	Steady (%v/v)	Peak (%v/v)	Steady (%v/v)	Minimum (%v/v)	Steady (%v/v)		Methane	Carbon Dioxide	
WS1	9th March 2011	1.113	1020	0.2	0.2	1.9	1.6	20.0	19.6	0.1	<0.01	<0.01	
WS2		1.116	1019	0.1	0.1	0.5	0.1	20.8	20.8	0.1	<0.01	<0.01	
WS3		0.627	1020	26.4	4.0	5.3	1.0	16.0	19.5	0.1	<0.01	<0.01	
WS4		0.849	1020	0.2	0.2	1.0	1.0	20.5	20.4	<0.1	<0.01	<0.01	
WS5		0.912	1020	0.3	0.3	0.3	0.1	20.6	20.6	0.1	<0.01	<0.01	
WS6		1.77	1020	0.3	0.3	6.0	1.6	18.1	18.1	<0.1	<0.01	<0.01	
WS7		2.109	1019	0.1	0.1	0.8	0.1	21.0	21.0	<0.1	<0.01	<0.01	
WS8		2.2	1019	0.2	0.2	1.9	0.3	19.6	20.3	0.1	<0.01	<0.01	
BH1		1.313	1019	0.1	0.1	0.0	0.0	20.8	20.8	0.1	<0.01	<0.01	
BH2		1.018	1019	0.1	0.1	0.0	0.0	18.7	21.0	0.1	<0.01	<0.01	
BH3		1.329	1020	0.1	0.1	0.1	0.1	20.4	20.4	0.1	<0.01	<0.01	
BH4		0.428	1020	2.9	0.2	1.1	1.1	16.9	16.9	<0.1	<0.01	<0.01	
BH5		1.292	1020	0.2	0.2	0.5	0.4	20.7	20.8	0.3	<0.01	<0.01	
BH6		2.102	1019	0.2	0.2	0.3	0.2	20.8	20.7	<0.1	<0.01	<0.01	
Borehole	Date	Depth to Water (m tgl)	Atmos. Pressure (mb)	Methane		Carbon Dioxide		Oxygen		Flow Rate (l/hr)	Gas Screening Values* (l/hr)		Remarks
				Peak (%v/v)	Steady (%v/v)	Peak (%v/v)	Steady (%v/v)	Minimum (%v/v)	Steady (%v/v)		Methane	Carbon Dioxide	
WS1	17th March 2011	1.249	nr	<0.1	-	4.3	-	17.5	-	<0.1	<0.01	<0.01	
WS2		1.244	nr	<0.1	-	1.7	-	19.7	-	<0.1	<0.01	<0.01	
WS3		0.736	1018	12.7	-	4.0	-	18.3	-	<0.1	<0.01	<0.01	
WS4		0.968	1018	<0.1	-	1.0	-	20.2	-	<0.1	<0.01	<0.01	Carbon Monoxide detected (max 3ppm)
WS5		1.054	1018	<0.1	-	0.4	-	20.5	-	<0.1	<0.01	<0.01	Carbon Monoxide detected (max 1ppm)
WS6		1.941	nr	nr	-	nr	-	nr	-	nr	-	-	
WS7		2.270	1018	0.1	-	1.3	-	20.3	-	<0.1	<0.01	<0.01	
WS8		2.378	1018	<0.1	-	2.1	-	20.0	-	<0.1	<0.01	<0.01	Carbon Monoxide detected (max 1ppm)
BH1		1.450	nr	nr	-	nr	-	nr	-	nr	-	-	
BH2		1.172	nr	nr	-	nr	-	nr	-	nr	-	-	
BH3		1.478	nr	nr	-	nr	-	nr	-	nr	-	-	
BH4		0.568	1018	0.1	-	1.2	-	18.7	-	-7.4	<0.01	<0.01	Carbon Monoxide detected (max 9ppm)
BH5		1.486	nr	<0.1	-	3.1	-	18.4	-	<0.1	<0.01	<0.01	
BH6		2.255	1018	0.1	-	1.1	-	16.6	-	<0.1	<0.01	<0.01	Carbon Monoxide detected (max 11ppm)
Site Staff			Instrument			Notes							
Chris Ellison, Mike Ferguson, Anna Szpak			GA2000			* Gas Screening Values are calculated by multiplying the maximum borehole flow rate (l/hr) by the gas concentration (%) (CIRIA C665).							

Notes:

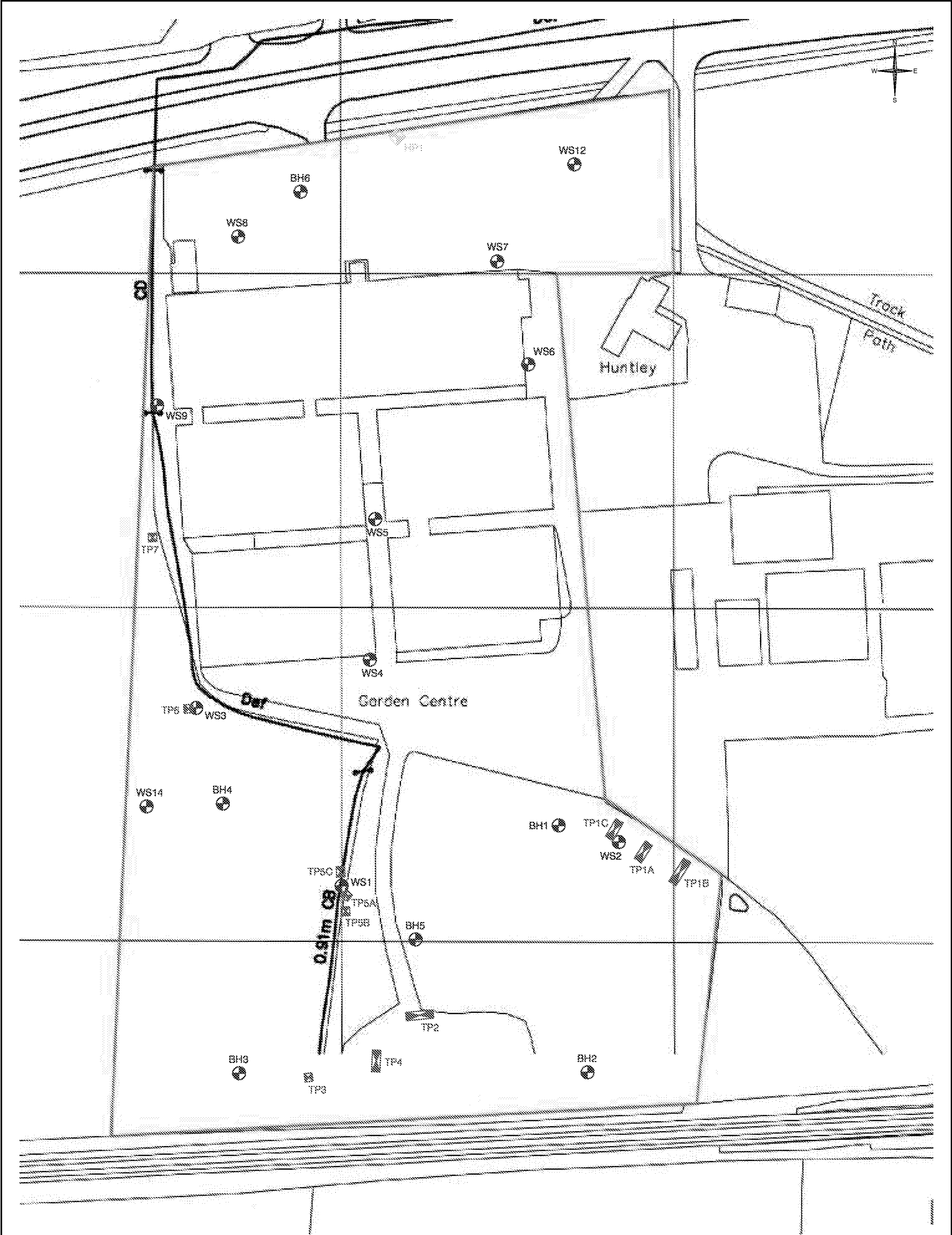
- Not measured.
- nr Not recorded

FIGURES



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LEGEND		NOTES	
 SITE LOCATION			
		TITLE : SITE LOCATION PLAN	
		SITE : WORTHING	
		CLIENT : ASDA STORES LTD	
		PROJECT : 80012/01	FIGURE 1
		DATE : 14/03/11	DRAWN BY : RJM
		DRG No : 800120109.apr / SLP	
		SCALE : 1 : 50,000	PRINT : A4
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								FIGURE 2			
		REV		DATE		COMMENT		CAD		 ARCADIS Infrastructure · Water · Environment · Buildings Tel +44 (0) 1638 674767 www.arcadis-uk.com	

Figure 3
Outline Conceptual Site Model - Commercial End-use

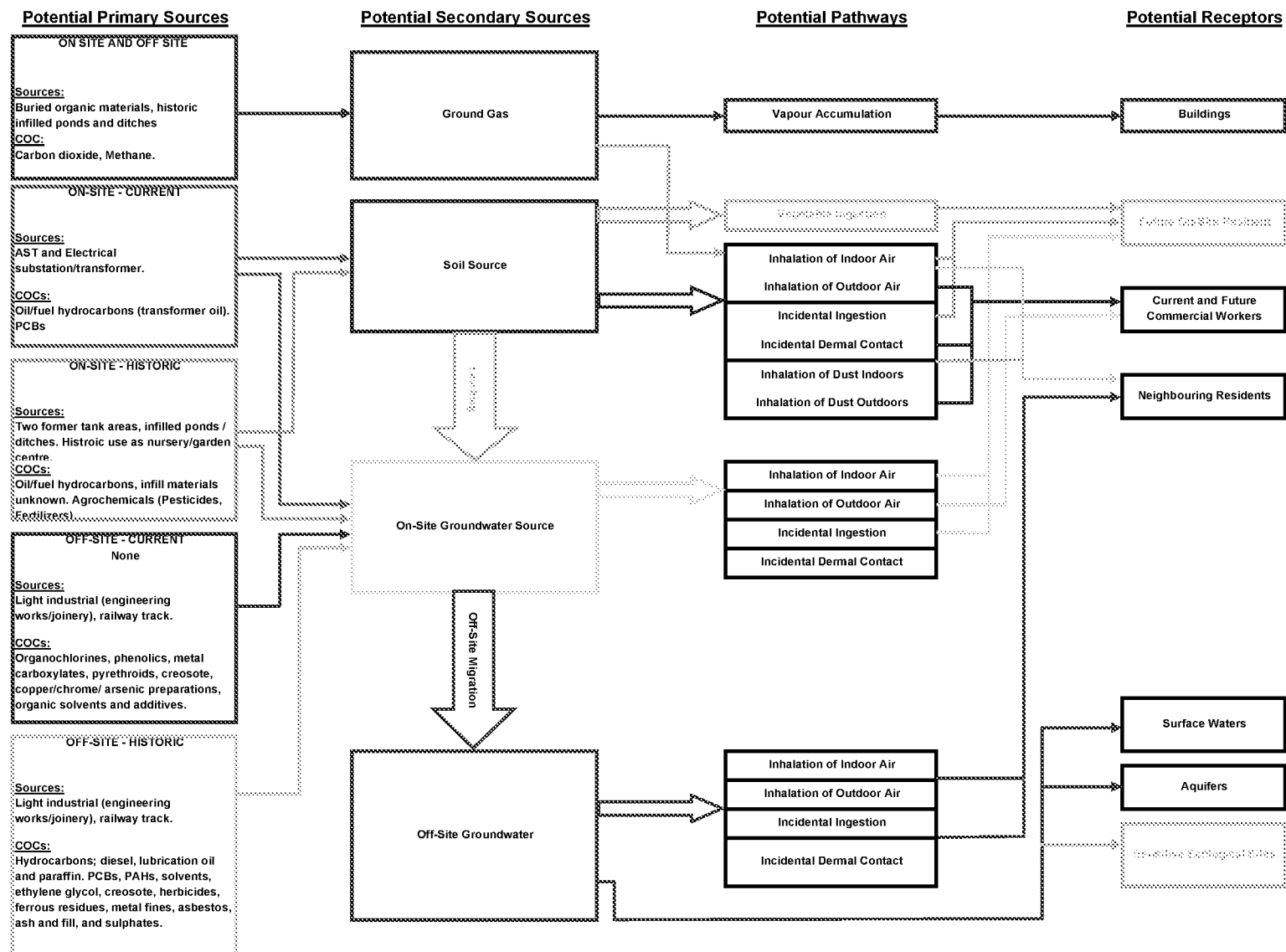
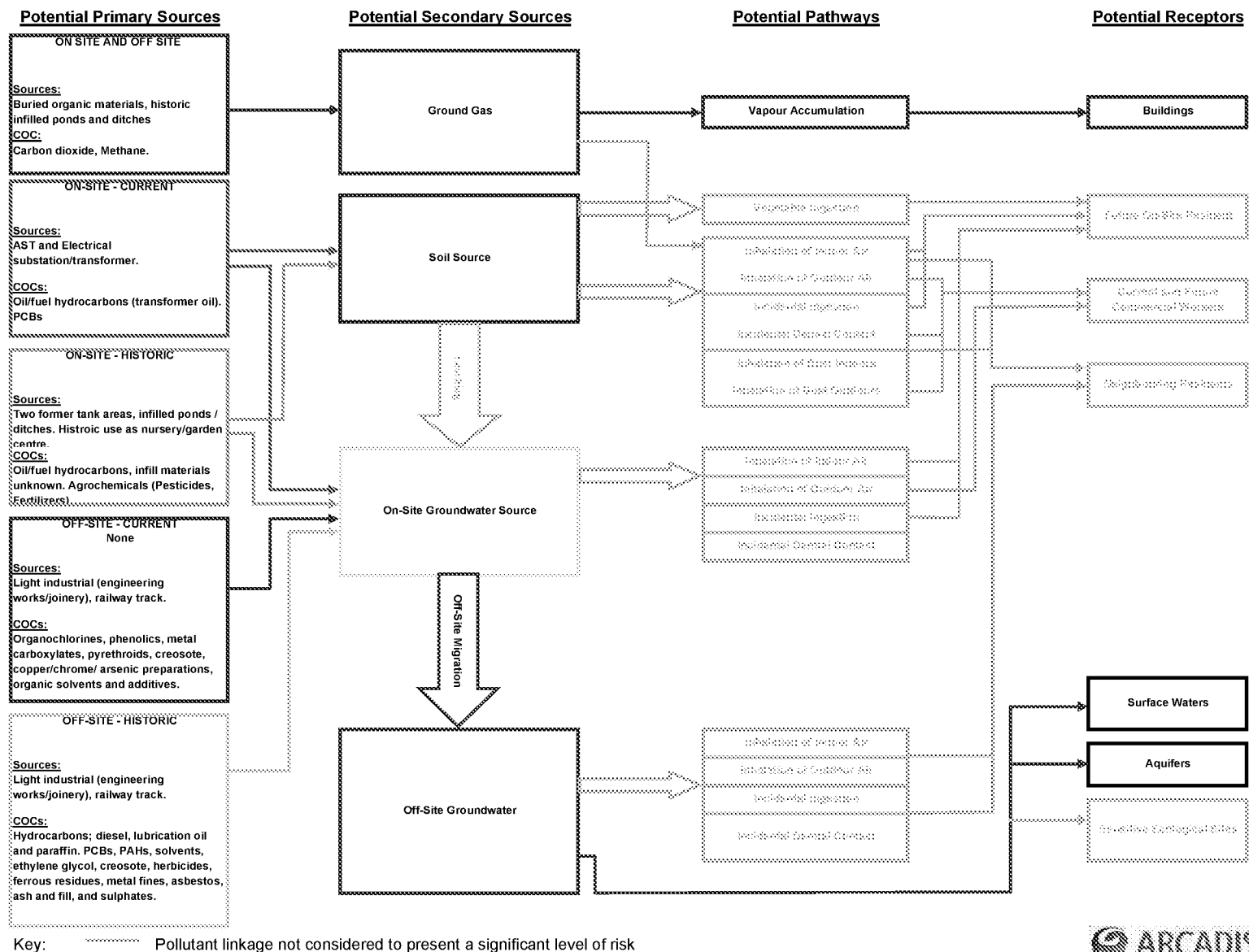


Figure 4
Refinement of Conceptual Site Model - Commercial End-use



APPENDICES

Appendix A
Legislative Context and Regulatory Guidance

APPENDIX A Regulatory and Legislative Context

Land contamination is generally dealt with by the following types of regulation:

- Acts of Parliament to investigate and remedy harm caused by land contamination;
- Conditions placed upon Planning Permissions for the redevelopment of land; and,
- Acts of Parliament and Regulations for the control of waste.

In England land contamination is identified and dealt with through Acts / Regulations including:

- The Contaminated Land Regulations (2006) (England) enabling Part 2A of the Environmental Protection Act (1990);
- The Town and Country Planning Act (1990);
- The Environmental Permitting (England and Wales) Regulations (2007);
- The Pollution Prevention and Control (England and Wales) Regulations (2000) (as amended);
- The Water Resources Act (1991);
- The Water Act (2003);
- The Environmental Damage (Prevention and Remediation) Regulations 2009; and,
- The Groundwater Regulations 1998.

Part 2A of the Environmental Protection Act 1990

Part 2A of the Environmental Protection Act 1990 (which was inserted by Section 57 of the Environment Act 1995) created a regime for the identification and remediation of contaminated land. Section 78A(2) of the Environmental Protection Act 1990 defines contaminated land for the purposes of Part 2A as:

‘any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that;

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) pollution of controlled waters is being, or is likely to be caused.¹²

Harm is defined under section 78A of the Environmental Protection Act as meaning ‘harm to the health of living organisms or other interference with the ecological systems of which they form part and, in the case of man, includes harm to his property’. Types of harm are related to specific receptors in order to determine whether they can be regarded as “significant”, as defined in Table A of Annex 3 of the DEFRA (2006)³ statutory guidance.

Part 2A sets the definition of contaminated land within the context of the ‘suitable for use’ approach. The legal definition of contaminated land is also discussed within Statutory Guidance released by DEFRA (2008)⁴.

The government has recognised the following objectives with regard to contaminated land for England (DEFRA, 2006):

- *to identify and remove unacceptable risks to human health and the environment from contaminated land,*
- *to reduce the pressure on green field land and to encourage the reuse of land that may have been subject to potentially contaminative uses, and*

¹² Definition to be amended to “significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused” under the Water Act 2003

³ Environmental Protection Act 1990: Part 2A. Contaminated Land. DEFRA Circular 01/2006

⁴ Guidance on the legal definition of contaminated land. DEFRA July 2008

- *to seek to ensure a proportionate, manageable and economically sustainable approach to the cost burdens faced by individuals, companies and society as a whole.'*

The 'suitable for use' approach underlies these objectives, and is based on the principles of risk assessment, including the concept of the 'pollutant linkage'.

In the event that there are unacceptable levels of risk posed by a site, a remediation notice can be served under the contaminated land regime introduced under Part 2A of the Environmental Protection Act 1990.

Regulation of Development on Land Affected by Contamination

Management of risks from contamination in development of land is also regulated in the England under the Town and Country Planning Act 1990. Land contamination is a material planning consideration within this planning regime. The Local Planning Authority may impose conditions on the development during planning that include preliminary risk assessment, site investigation, risk assessment and remediation. The Environment Agency may use its role as a statutory consultee to provide the Local Planning Authority with advice.

Assessment of risk is again based on the pollutant linkage concept. The aim of risk management in the development should be to render the land suitable for the proposed use and, therefore, to prevent consideration of the site under Part 2A.

ODPM Planning Policy Statement 23 (PPS23): Planning and Pollution Control and its Annex 2: Development on Land Affected by Contamination provides guidance on the relationship between development and the management of risks from land contamination caused by historical use. The Building Regulations 2000, made under the Building Act 1984, also require measures to be taken to protect new buildings and their occupants from the effects of contamination. Guidance on the requirements is provided in Approved Document C - Site preparation and resistance to contaminants and moisture, published by ODPM in 2004.

Voluntary Remediation Action

Voluntary remediation action on contamination resulting from historical activities can often anticipate future remediation requirements, such as through the Planning regime, and is encouraged (DEFRA, 2006), especially where the site is not being assessed under Part 2A.

Non-statutory regulatory technical guidance documents

The non-statutory regulatory technical guidance for England on the assessment of land contamination, primarily released as part of the Contaminated Land Exposure Assessment (CLEA) methodology (DEFRA and EA) has recently been updated. The following documents currently present guiding principles in investigating and assessing potentially contaminated land, which are generally adopted in considering sites within any of the legal frameworks discussed above, or when considering voluntary remediation action:

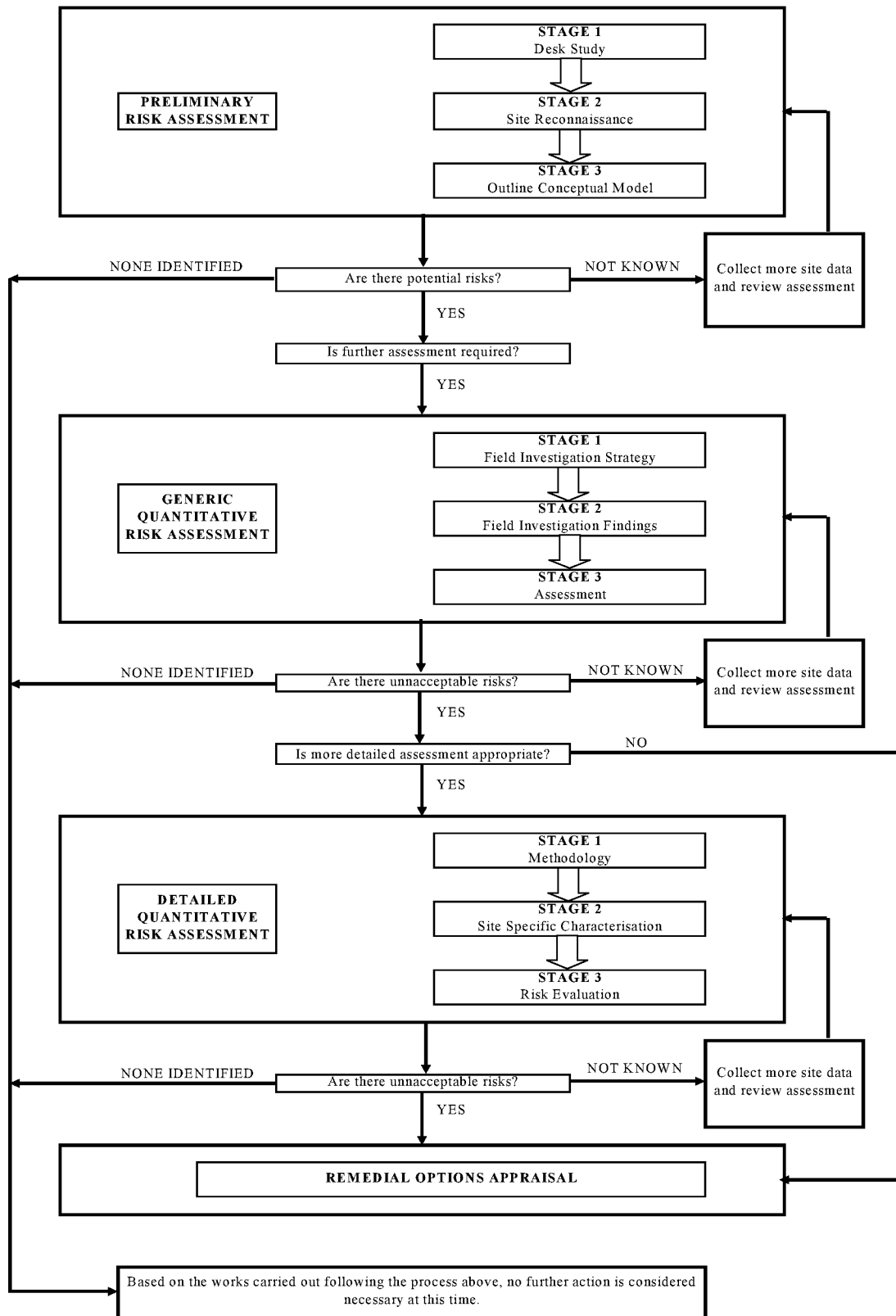
- *Investigation of potentially contaminated sites – Code of Practice* (British Standard 10175: 2001).
- *Contaminated Land Report CLR11 Model Procedures for the Management of Land Contamination.* (DEFRA and EA, 2004).
- *Human health toxicological assessment of contaminants in soil* Environment Agency Science Report SC050021/SR2 (EA, 2009)
- *Updated technical background to the CLEA model* Environment Agency Science Report SC050021/SR3 (EA, 2009)
- *Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values* Environment Agency Science Report SC050021/SR7 (EA, 2008)

- *An ecological risk assessment framework for contaminants in soil.* Environment Agency Science Report SC070009/SR1 and related reports S2a-e
- *Groundwater Protection: Policy and Practice*, Environment Agency GP3 Parts 1-4
- *Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination* (EA of England and Wales, 2006) developed in consultation with the Scottish Environment Protection Agency (SEPA) and the Northern Ireland Heritage and Environment Service.
- *Assessing risks posed by hazardous ground gases to buildings* Report C665 (CIRIA, 2007)
- *BS 8485:2007 Code of practice for the characterization and remediation from ground gas in affected developments*(British Standards Institution, 2007)
- *Risk Based Corrective Action (RBCA) Methodology* (ASTM designation E1739-95, E2081-00).
- DoE Industry Profiles

Appendix B
Overview of the Environmental Assessment Process

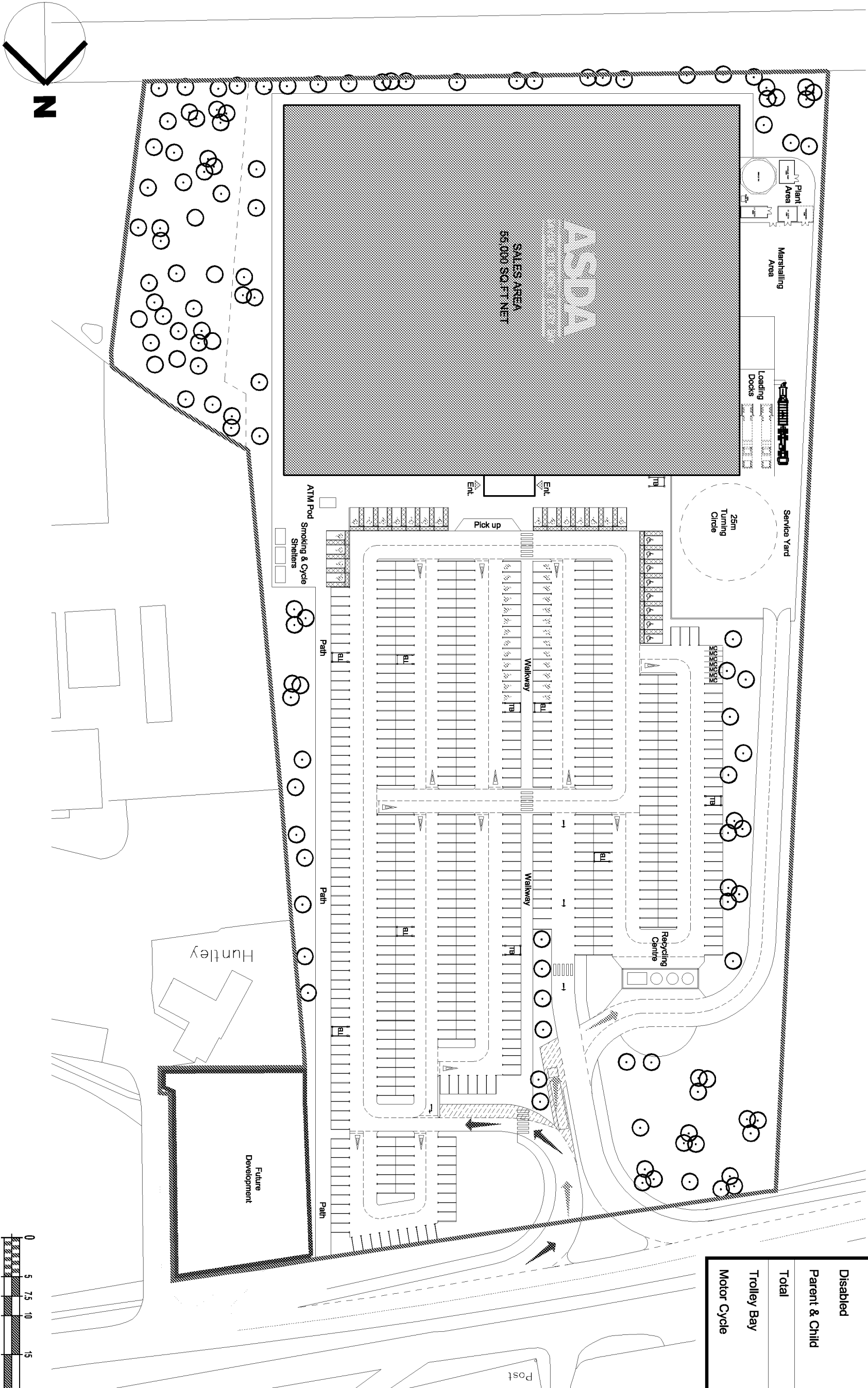
APPENDIX B

Overview of Model Procedures For Management of Land Contamination CLR 11



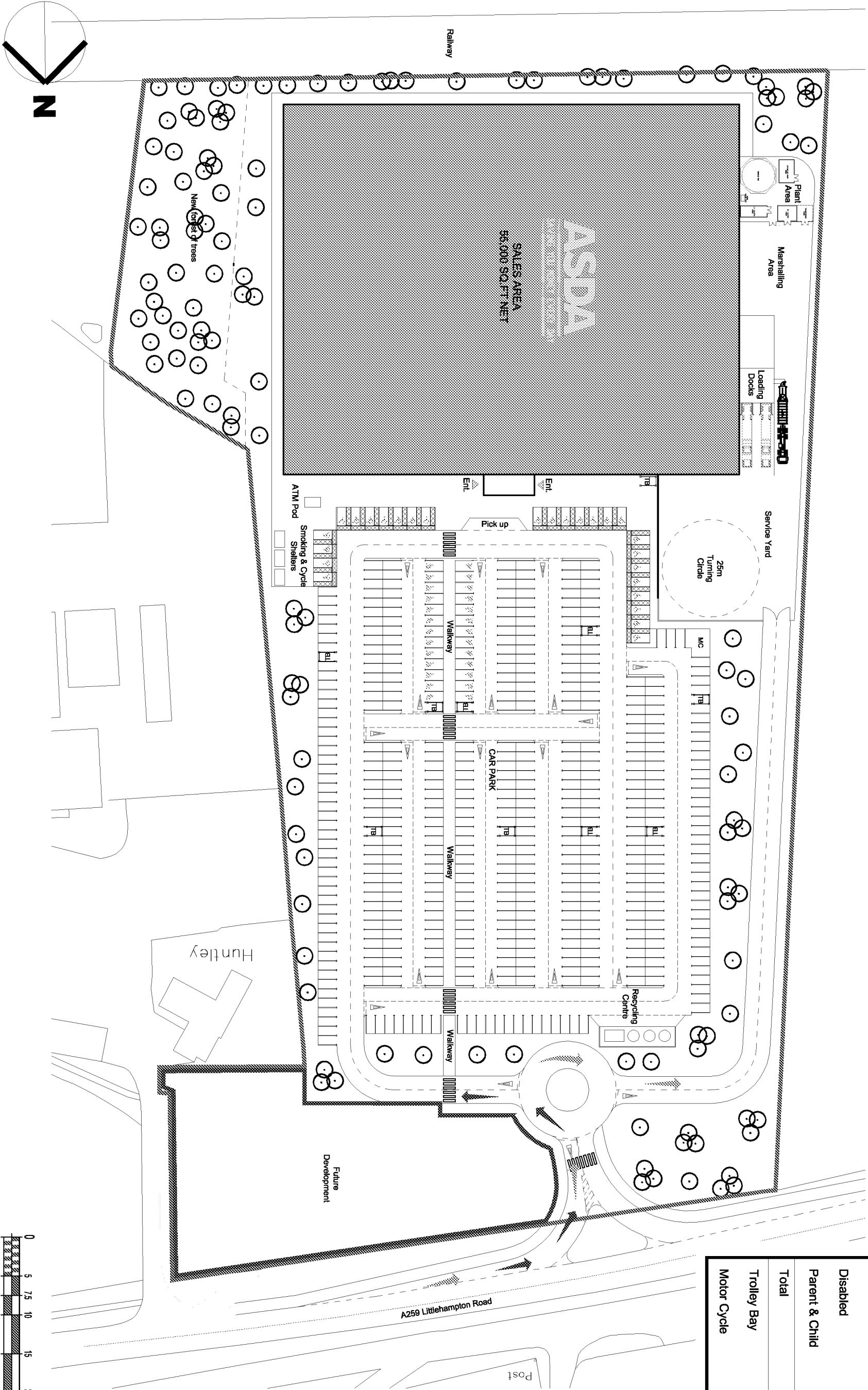
Appendix C Proposed Redevelopment Plans

Summary of Car Park Spaces :		
Standard	520	
Disabled	26	
Parent & Child	26	
Total	572	
Trolley Bay	9	
Motor Cycle	7	



Client			Title		
ASDA STORE LTD			ASDA WEST WORTHING		
Site Plan Option 2			Drawing No. 10.120.00_02		
Scale @ A2: 1:1000			Drawing No. 10.120.00_02		
Date: 03 Nov 2010			Drawing No. 10.120.00_02		
Drawn by: CK			Drawing No. 10.120.00_02		
Checked by: M.S			Drawing No. 10.120.00_02		
Revision:			Drawing No. 10.120.00_02		
-			Drawing No. 10.120.00_02		
HGP ARCHITECTS			Drawing No. 10.120.00_02		
FURZEHALL FARM, WICKHAM ROAD FAREHAM, HAMPSHIRE, PO16 7JH			Drawing No. 10.120.00_02		
T: 01329 203 225 F: 01329 237 004 E: EMAIL@HGP-ARCHITECTS.CO.UK W: WWW.HGP-ARCHITECTS.CO.UK			Drawing No. 10.120.00_02		
HGP Architects Ltd Copyright Reserved Drawn, dated, or del.			Drawing No. 10.120.00_02		
Revisions			Drawing No. 10.120.00_02		
New Date Description By PM			Drawing No. 10.120.00_02		
DISCUSSION			Drawing No. 10.120.00_02		

Summary of Car Park Spaces :	
Standard	475
Disabled	26
Parent & Child	26
Total	525
Trolley Bay	9
Motor Cycle	6



CLIENT		THE	
ASDA STORE LTD		ASDA WEST WORTHING	
Site Plan Option 1		HGP ARCHITECTS	
Scale @ A3: 1:1000		Drawn by: S.A.K	
Date: 11 Nov 2010		Checked by: M.S	
Drawing No: 10.120.00_01		Revised: -	
DISCUSSION		HGP ARCHITECTS	
FURZEHALL FARM, WICKHAM ROAD FAREHAM, HAMPSHIRE, PO16 7JH		1: 01329 203 225 F: 01329 237 004 W: WWW.HGP-ARCHITECTS.CO.UK	
HGP ARCHITECTS LTD Copyright Reserved Drawn on: 10.120.00_01		HGP ARCHITECTS LTD Copyright Reserved Drawn on: 10.120.00_01	

Appendix D
Site Investigation Methodology

APPENDIX D

Site Investigation Methodology

Borehole Drilling

The deeper boreholes were drilled using a combination of light cable percussion drilling (Shell and Auger rig) and rotary coring techniques using a Commachio Pioneer drilling rig. All field investigations were conducted in accordance with ARCADIS' Standard Operating Procedures and Method Statement for conducting site investigations.

Window Sample Drilling

The window sample boreholes were drilled using percussive sampling techniques using a Terrier drilling rig.

Trial Pit and Trial Trench Excavation

The trial pits were excavated using a backhoe excavator fitted with a narrow bucket. HP1 was excavated by hand. Excavated soils arising were placed beside the excavation in the order they were removed. The excavated soil was then replaced into the trial pit and compacted using the excavator bucket or hand rammer.

All field investigations were conducted in accordance with ARCADIS' Standard Operating Procedures and Method Statement for conducting site investigations.

Installation of Monitoring Wells

Permanent groundwater monitoring wells were installed in each borehole and window sample hole (except WS9-WS14) to allow for subsequent groundwater monitoring. The monitoring wells were constructed from 50mm-diameter threaded HDPE well screen with well sock and blank casing.

The well screening interval was designed to allow LNAPL and gas to enter the well. This is typically achieved by ensuring that the screened interval extends at least 200mm higher than the groundwater level.

A washed filter sand was used to fill the annulus between the monitoring well casing and the borehole wall. The filter sand extended 200mm above the uppermost screen slot. Bentonite granules were placed above the filter sand. A well cap and flush mounted security casing were installed flush with the ground surface.

Soil Sampling- Environmental

Ground conditions were logged generally in accordance with BS5930:1999, with a particular emphasis on any physical evidence of impact, such as soil staining, odour and the presence of separate phase liquids. The depths of any water strikes were also noted.

Disturbed soil samples were collected at approximately 0.5m intervals for field screening for volatile organic compounds. Field screening was carried out using a PID. This provides a qualitative method which results in a representation of the presence of volatile organic compounds in the soil. The numerical output cannot be directly compared to measured soil concentrations of CoC.

Soil samples were collected on the basis of field screening, obvious visible evidence of impact and, if neither was detected, immediately above the first detection of groundwater. PID readings are presented on the borehole logs in Appendix E.

Groundwater Sampling

Groundwater monitoring involved the inspection of all of the monitoring wells on site, existing and newly installed, for the presence of groundwater and free-phase product, measurement of depths to groundwater and thickness of free-phase product, if present, using a dip meter or interface probe, and collection of samples *via* low flow methodology.

The groundwater samples were taken after the monitoring wells had been developed and purged using dedicated Waterra pipe for each monitoring well. Well development was carried out during the site investigation and comprised the extraction of 10 times the saturated well volume. Well purging was carried out after monitoring well installation.

Low-flow sampling is a specific water delivery technique that is designed to produce a sample that most closely resembles the water quality in the aquifer adjacent to the screened zone of a well by reducing sample turbidity, which in turn reduces the variability in the sampling results. During low-flow sampling, purge water is passed through a flow cell and water quality parameters are measured using a multi-parameter meter. Dissolved Oxygen (DO), Oxidation-Reduction Potential (ORP), electrical conductivity and pH are measured at regular intervals until the DO and ORP readings stabilise to within 10% of the previous reading, or three saturated well volumes of groundwater has been removed from the well. A groundwater sample is subsequently collected.

Gas Monitoring

Gas monitoring involved the measurement of flow of gas into or out of the monitoring well followed by measurement of concentrations of carbon dioxide, methane and oxygen using an infra-red gas analyser. Both the peak and steady state gas concentrations were recorded. The pressure difference between the monitoring well and surrounding atmosphere was also recorded along with the atmospheric pressure. The groundwater level in each well was also measured.

Decontamination of Equipment

Decontamination of equipment was carried out at appropriate times throughout the site work in order to minimise the potential for cross-contamination of materials. Equipment decontamination measures were performed in the field between each sampling location and prior to equipment storage on completion of the work. All decontamination measures were undertaken in accordance with ARCADIS standard operating procedure SOP-013.

Drilling decontamination incorporated the cleaning of equipment using a brush to remove particulate matter and surface film while sampling equipment decontamination incorporated equipment rinsing and cleaning with potable tap water.

Waste

All waste soil arisings were placed in a skip provided by an appropriately registered waste carrier sourced through Skippy Nationwide. The waste carrier disposed of the waste soil arisings off site in accordance with the waste management duty of care.

APPENDIX D (Continued)

Site Investigation Methodology

Collection, Preservation and Transport of Samples

Soil- Environmental

Based upon the result of the field headspace screening soil samples were selected for chemical analysis. Samples to be analysed for organic compounds were collected and sealed in glass jars. In order to prevent the loss of volatile organic compounds, the air space was kept to a minimum by completely filling the jars as far as reasonably practicable.

Samples to be analysed for metals were collected in plastic containers.

Disposable gloves were worn and changed between each sample taken to prevent cross contamination.

The soil samples were stored in a cool box with ice packs and dispatched to the laboratory on the day of collection where possible. All sample details were recorded on the laboratory chain of custody documentation.

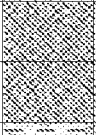
Groundwater

Groundwater samples were taken from all wells using dedicated disposable bailers and stored in amber glass jars. In order to prevent the loss of volatile organic compounds, samples were also collected in a glass vial. The sample containers were completely filled with water.

The water samples were stored in a cool box with ice packs and dispatched to the laboratory on the day of collection. All sample details were recorded on the laboratory chain of custody documentation.

Appendix E
Exploratory Hole Logs

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD):	Trial pit width (m): 0.30 Trial pit length (m): 0.30 Support Method: Pit Stability: Good	Scale 1:25
Client: ASDA Stores Ltd		Easting: 508717 Northing: 103341		Logged By: L. Barber
Project No: 80012.01	Date: 01/02/2011	Excavation Method: Hand Dug		Checked By:

STRATA RECORD			IN SITU TESTS / SAMPLES							Sheet 1 of 1
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	CBR Value	Water	
MADE GROUND: Grass over topsoil.		0.20								
MADE GROUND: Flint GRAVEL (Sub-base material).		0.40								
Soft to firm grey brown silty CLAY. End of Trial Pit at 0.45 m		0.45		D	0.50 0.50-1.15			1.75		
										1
										2
										3
										4

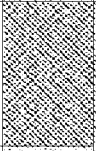
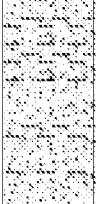
Key:

D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
J	Jar Sample		
	Water Strike		
	Standing Water Level		

Groundwater: No groundwater encountered.

Remarks: CBR estimated with MEXE probe.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD):	Trial pit width (m): 0.60 Trial pit length (m): 6.50 Support Method: Pit Stability: Good	Scale 1:25
Client: ASDA Stores Ltd		Easting: Northing:		Logged By: L. Barber
Project No: 80012.01	Date: 01/02/2011	Excavation Method: Backhoe Excavator		Checked By:

STRATA RECORD			IN SITU TESTS / SAMPLES							Sheet 1 of 1
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	CBR Value	Water	
MADE GROUND: Sandy GRAVEL. Sands and Gravels are fragments of brick, tile, glass, pottery and mixed lithologies. Numerous rootlets.		0.48			0.60-1.20			2.8		1
Firm to stiff greyish brown slightly gravelly sandy CLAY. Gravels are fine to medium subangular to subrounded flint and chalk fragments.		1.60								2
Soft becoming firm mottled grey orange brown gravelly sandy CLAY. Gravel is fine subrounded chalk fragments.		2.30								3
End of Trial Pit at 2.30 m										4

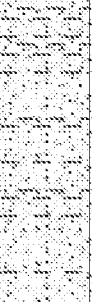
Key:

D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
J	Jar Sample		
	Water Strike		
	Standing Water Level		

Groundwater: Groundwater seepage at 1.65m depth.

Remarks: CBR estimated with MEXE probe. No collapse of trial pit.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD):	Trial pit width (m): 0.60 Trial pit length (m): 6.00 Support Method: Pit Stability: Good	Scale 1:25
Client: ASDA Stores Ltd		Easting: Northing:		Logged By: L. Barber
Project No: 80012.01	Date: 01/02/2011	Excavation Method: Backhoe Excavator		Checked By:

STRATA RECORD			IN SITU TESTS / SAMPLES							Sheet 1 of 1
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	CBR Value	Water	
MADE GROUND: Sandy GRAVEL. Sands and Gravels are fragments of brick, tile, glass, pottery and mixed lithologies. Numerous rootlets.		0.25								
(Possible MADE GROUND): Firm to stiff brown gravelly CLAY. Gravel is medium subrounded brick fragments.		0.45								
Firm to stiff grey brown gravelly CLAY. Gravel is fine to medium subrounded to angular of mixed lithologies.		1.50								1
Firm to stiff mottled grey brown/light brown very gravelly CLAY. Gravel is fine to coarse subrounded to angular chalk fragments.		2.60								2
End of Trial Pit at 2.60 m										3
										4

Key:

D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
J	Jar Sample		
	Water Strike		
	Standing Water Level		

Groundwater: Groundwater standing at 2.4m bgl after 10 minutes.

Remarks: Groundwater seepage at 1.9m. No collapse of trial pit.



Infrastructure Water Environment Services

2 Craven Court, Newmarket, Suffolk CB8 7FA

Trial Pit
Number
TP1C

Site: ASDA Worthing

Location:

Littlehampton Road, Worthing,
West Sussex, BN12 6PB

Ground Level (mASD):

Trial pit width (m): 0.60

Trial pit length (m): 6.00

Support Method:

Pit Stability: Good

Scale
1:25

Client:

ASDA Stores Ltd

Easting:

Northing:

Logged By:

L. Barber

Project No: 80012.01

Date: 01/02/2011

Excavation Method: Backhoe Excavator

Checked By:

STRATA RECORD

IN SITU TESTS / SAMPLES

Sheet 1 of 1

Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	CBR Value	Water
MADE GROUND: Grey clayey GRAVEL. Gravel is fragments of ceramic tiles. Numerous rootlets and rare plastic sheeting.		0.25							
Firm brown slightly gravelly CLAY. Gravel is fine to medium of mixed lithologies.		0.70-1.00						1.5	
Soft becoming firm light brown slightly gravelly CLAY. Gravel is fine to medium subrounded chalk gravels.		1.50							▽
End of Trial Pit at 1.70 m		1.70							

Key:

D Disturbed Sample

B Bulk Sample

J Jar Sample

▽ Water Strike

■ Standing Water Level

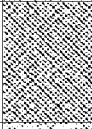
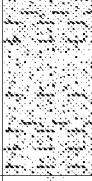
PPT Pocket Penetrometer Test

PID Photoionisation Detector

Groundwater: Groundwater seepage at 1.6m bgl.

Remarks: CBR estimated using MEXE probe. No collapse of trial pit.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD):	Trial pit width (m): 0.60 Trial pit length (m): 7.00 Support Method: Pit Stability: Good	Scale 1:25
Client: ASDA Stores Ltd		Easting: Northing:		Logged By: L. Barber
Project No: 80012.01	Date: 01/02/2011	Excavation Method: Backhoe Excavator		Checked By:

STRATA RECORD			IN SITU TESTS / SAMPLES							Sheet 1 of 1
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	CBR Value	Water	
MADE GROUND: Sandy GRAVEL. Sands and gravels are fragments of brick, tile, glass, mortar, concrete and wire.		0.40								
Firm orange brown slightly gravelly sandy CLAY. Gravel is fine to medium subrounded to subangular chalk and flint fragments.		1.00								1
End of Trial Pit at 1.00 m										2
										3
										4

Key:
D Disturbed Sample PPT Pocket Penetrometer Test
B Bulk Sample PID Photoionisation Detector
J Jar Sample
 Water Strike
 Standing Water Level

Groundwater: No groundwater encountered.

Remarks: No collapse of trial pit.



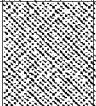
Checked By:

Excavation Method: Backhoe Excavator

Sheet 1 of 1

Key:		Groundwater: No groundwater encountered.
D Disturbed Sample	PPT Pocket Penetrometer Test	Remarks: CBR estimated with MEXE probe. No collapse of trial pit.
B Bulk Sample	PID Photoionisation Detector	
J Jar Sample		
 Water Strike		
 Standing Water Level		

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD):	Trial pit width (m): 0.60 Trial pit length (m): 6.00 Support Method: Pit Stability: Good	Scale 1:25
Client: ASDA Stores Ltd		Easting: Northing:		Logged By: L. Barber
Project No: 80012.01	Date: 01/02/2011	Excavation Method: Backhoe Excavator		Checked By:

STRATA RECORD			IN SITU TESTS / SAMPLES							Sheet 1 of 1
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	CBR Value	Water	
MADE GROUND: Sandy GRAVEL comprising brick and brick fragments. Rare rootlets, plastic and metal fragments.		0.35								
Soft becoming firm grey brown/brown mottled slightly gravelly CLAY. Gravel is fine to medium subangular to angular chalk and flint.		2.10								
End of Trial Pit at 2.10 m										

Key:
D Disturbed Sample PPT Pocket Penetrometer Test
B Bulk Sample PID Photoionisation Detector
J Jar Sample
 Water Strike
 Standing Water Level

Groundwater: Groundwater seepage at 2.0m bgl.

Remarks: No collapse of trial pit.



Infrastructure Water Environment Services

2 Craven Court, Newmarket, Suffolk CB8 7FA

Trial Pit
Number
TP5A

Site: ASDA Worthing

Location:

Littlehampton Road, Worthing,
West Sussex, BN12 6PB

Ground Level (mASD):

Trial pit width (m): 0.60

Trial pit length (m): 2.50

Support Method:

Pit Stability: Good

Scale
1:25

Client:

ASDA Stores Ltd

Easting:

Northing:

Logged By:

L. Barber

Project No: 80012.01

Date: 01/02/2011

Excavation Method: Backhoe Excavator

Checked By:

STRATA RECORD

IN SITU TESTS / SAMPLES

Sheet 1 of 1

Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	CBR Value	Water
MADE GROUND: Grey brown CLAY with numerous roots and brick fragments. Tree roots and tree stumps approximatley 100mm diameter. Slight organic odour.									
Firm grey brown/brown mottled CLAY with much sand and gravel sized, fine to medium subangular to angular chalk.		1.50							
End of Trial Pit at 1.70 m		1.70							

Key:

D Disturbed Sample

B Bulk Sample

J Jar Sample

Water Strike

Standing Water Level

PPT Pocket Penetrometer Test

PID Photoionisation Detector

Groundwater: Groundwater seepage at 1.6m bgl.

Remarks: No collapse of trial pit.



Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD):	Trial pit width (m): 0.60 Trial pit length (m):2.50 Support Method: Pit Stability: Good	Scale 1:25
Client: ASDA Stores Ltd		Easting:		Logged By: L. Barber
		Northing:		
Project No: 80012.01	Date: 01/02/2011	Excavation Method: Backhoe Excavator		Checked By:

Sheet 1 of 1

[illegible]

Groundwater: No groundwater encountered.

Remarks: No collapse of trial pit.



100

Checked By:

Excavation Method: Backhoe Excavator

Sheet 1 of 1

Key:		Groundwater: No groundwater encountered.
D Disturbed Sample	PPT Pocket Penetrometer Test	
B Bulk Sample	PID Photoionisation Detector	Remarks: No collapse of trial pit.
J Jar Sample		
 Water Strike		
 Standing Water Level		



Checked By:

Excavation Method: Backhoe Excavator

Sheet 1 of 1

Key:		Groundwater: Groundwater seepage at 1.76m bgl.
D Disturbed Sample	PPT Pocket Penetrometer Test	
B Bulk Sample	PID Photoionisation Detector	Remarks: CBR estimated with MEXE probe. No collapse of trial pit.
J Jar Sample		
 Water Strike		
 Standing Water Level		

Site: ASDA Worthing

Location:

Littlehampton Road, Worthing,
West Sussex, BN12 6PB

Ground Level (mASD):

Trial pit width (m): 0.60

Trial pit length (m): 2.50

Support Method:

Pit Stability: Good

Scale
1:25

Client:
ASDA Stores Ltd

Easting:

Northing:

Logged By:

L. Barber

Project No: 80012.01

Date: 01/02/2011

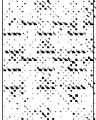
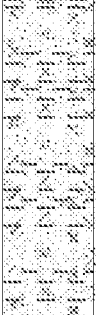
Excavation Method: Backhoe Excavator

Checked By:

STRATA RECORD

IN SITU TESTS / SAMPLES

Sheet 1 of 1

Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	CBR Value	Water
MADE GROUND: Stiff brown friable CLAY with rootlets and rare fine subangular gravels.		0.28		D	0.20				
(Possible MADE GROUND): Dark grey organic CLAY with many rootlets and some tree fragments.		0.32							
Soft to firm dark grey organic silty sandy CLAY with occasional brick and rootlets. Organic odour.		1.01		D	0.50-0.90			1.25	
Soft to firm brownish grey sandy silty CLAY with some fine to medium gravel sized subangular to angular chalk fragments. Occasional rootlets.		2.10		D	1.20				
End of Trial Pit at 2.10 m				D	2.10				

Key:

D Disturbed Sample PPT Pocket Penetrometer Test
B Bulk Sample PID Photoionisation Detector
J Jar Sample
 Water Strike
 Standing Water Level

Groundwater: Groundwater seepage at 1.1m depth.

Remarks: CBR estimated with MEXE probe. No collapse of trial pit.

Site: ASDA Worthing
Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB
Client: ASDA Stores Ltd

Ground Level (mASD): 5.84
Hole Diameter (mm): 200
Well Diameter (mm): 50
Filter Material: Gravel
Easting: 508765
Northing: 103134

Scale
1:65
Logged by:
C.Ellison

Project: 80012.01
Date: 09/02/2011

Method: Cable percussion

Checked by:

STRATA RECORD

IN SITU TESTS / SAMPLES

Sheet 1 of 1

Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Type 1/Angular gravel surface with rare vegetation (Rough Ground).		0.10	5.74	J	0.10-0.60					
MADE GROUND: Brown clayey sandy GRAVEL. Gravel is fine to coarse subangular fragments of brick, tiles, wood, plastic, glass, stone and flint and rare brick cobbles. Natural organic odour.		0.60	5.24	PPT D U	0.80-0.85 0.90-1.00 1.00-1.45		25			1
Soft light brown gravelly CLAY. Gravel is fine to coarse subangular chalk fragments. Gravels become more coarse with depth, including gravels/cobbles of flint.				PPT U D	1.50-1.55 1.60-2.05 2.05-2.10		117			2
Recovered as cream/white clayey CHALK gravels. Gravel is clasts of moderately strong chalk fragments within a clayey sand matrix (Clasts 30%, Matrix 70 % - Grade Dm).		3.00	2.84	D SPT	2.90-3.00 3.00-3.45			N=17 (3,3/4,4,4,5)		3
				J	3.50-3.60					4
				SPT	4.00-4.45			N=15 (3,3/3,3,4,5)		5
				SPT	5.00-5.45			N=26 (7,14/10,4,6,6)		6
				SPT	6.50-6.95 6.50-6.55			N=17 (3,4/5,4,4,4)		7
				SPT	8.00-8.45			N=23 (3,4/4,5,7,7)		8
				SPT	9.50-9.95			N=18 (2,3/4,4,5,5)		9
Recovered as white clayey CHALK gravels. Gravel is clasts of moderately strong chalk fragments within a clayey sand matrix (Clasts 30%, Matrix 70 % - Grade Dm).		10.00	-4.16	SPT	11.00-11.45			N=24 (2,2/2,4,8,10)		10
End of Borehole at 11.45 m		11.45	-5.61							11
										12

Key:
D Disturbed Sample PPT Pocket Penetrometer Test
B Bulk Sample PID Photoionisation Detector
U Undisturbed Sample SPT Standard Penetration Test (Uncorrected)
J Jar Sample
Water Strike
Standing Water Level

Remarks: Groundwater strike at 3.0m bgl during drilling on 09/02/2011.

Site:
ASDA Worthing

 Location:
Littlehampton Road, Worthing,
West Sussex, BN12 6PB

Ground Level (mASD): 5.60

Hole Diameter (mm): 200

 Scale
1:65

 Client:
ASDA Stores Ltd

Easting: 508774

Well Diameter (mm): 50

 Logged by:
C.Ellison

Northing: 103060

Filter Material: Gravel

Project: 80012.01

Date: 07/02/2011

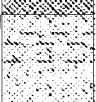
Method: Cable percussion

Checked by:

STRATA RECORD

IN SITU TESTS / SAMPLES

Sheet 1 of 1

Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Type 1/Angular gravel surface with rare vegetation (Rough Ground).		0.10	5.50	D J	0.10-0.20 0.10-0.60					
MADE GROUND: Dark brown very gravelly CLAY. Gravel is fine to coarse fragments of concrete, tiles, brick, glass and flint. Rare fragments of plastic piping / shotgun cartridge and organic material.		0.60	5.00	PPT U	0.80-0.85 1.00-1.45		50			1
Soft to firm light brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular flints.				J	1.50-2.00					
Firm light brown/cream sandy gravelly CLAY. Gravel is fine to coarse chalk and flint fragments.		2.00	3.60	PPT SPT	2.00-2.05 2.00-2.45		109	N=10 (1,2/2,2,2,4)		2
				SPT	3.00-3.45			N=18 (2,2/4,4,4,6)		3
Very coarse rounded flint GRAVELS.		3.50	2.10	J	3.50-3.55					
Recovered as cream/white fragments / cobbles of CHALK. Gravel is clasts of matrix dominated moderately strong chalk fragments (Clasts 20%, Matrix 80 % - Grade Dm).		3.80	1.80	SPT	4.00-4.45			N=26 (3,4/6,10,5,5)		4
				SPT	5.00-5.50			N=17 (2,3/3,3,5,6)		5
				J	5.50-5.55					6
				SPT	6.50-6.95			N=21 (7,5/5,5,5,6)		7
				SPT	8.00-8.45			N=19 (5,5/5,4,5,5)		8
				SPT	9.50-9.95			N=23 (3,4/5,5,5,8)		9
				SPT	11.00-11.45			N=39 (4,2/4,10,14,11)		10
End of Borehole at 11.45 m		11.45	-5.85							11
										12

Key:

D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
	Water Strike		
	Standing Water Level		

 Remarks: Groundwater strike at 2.5m bgl during drilling on 07/02/2011.
Water resting at 1.14m bgl on 08/02/2011.

Site:
ASDA Worthing

Location:
Littlehampton Road, Worthing,
West Sussex, BN12 6PB

Ground Level (mASD): 6.15

Hole Diameter (mm): 200

Scale
1:65

Client:
ASDA Stores Ltd

Easting: 508669

Well Diameter (mm): 50

Logged by:
E.Jarratt

Northing: 103060

Filter Material: Gravel

Project: 80012.01

Date: 02/02/2011

Method: Cable percussion

Checked by:

STRATA RECORD

IN SITU TESTS / SAMPLES

Sheet 1 of 1

Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Soft brown slightly gravelly CLAY. Frequent rootlets. Gravel is fine to medium subangular to subrounded fragments of flint, ceramic tile, chalk clasts, and rare glass.		0.30	5.85	D D PPT D D	0.10-0.30 0.30-0.50 0.40 0.50-0.95 1.00-1.20	<1 <1	72			
Soft brown slightly gravelly silty CLAY. Gravel is fine to medium subangular to rounded fragments of flint and chalk clasts.		1.50	4.65	PPT D U	1.60 1.60-1.80 2.00-2.45		24			
Soft light brown mottled orange/grey gravelly CLAY. Gravel is fine to coarse subangular to rounded flints. Mixed lithologies, and chalk clasts.		2.50	3.65							
Soft brown/orange very gravelly CLAY. Gravel is fine to coarse subangular to angular fragments of chalk clasts. Becoming more gravelly with depth.		3.00	3.15	D SPT D	2.80-3.00 3.00-3.45 3.00-4.00			N=22 (3,4/5,5,6,6)		
Poor recovery. Medium dense Light brown/beige slightly clayey GRAVEL. Gravel is medium to coarse fragments of chalk clasts with frequent chalk cobbles and flints. Becoming brownish white with depth.				SPT	4.00-4.45			N=22 (2,3/3,5,6,8)		
Brownish white recovered as gravels and cobbles of strong CHALK in white chalk matrix. Gravel is fine to coarse subangular to subrounded.		5.00	1.15	SPT	5.00-5.45			N=37 (5,5/8,9,10,10)		
				SPT	6.50-6.95			N=22 (2,3/4,5,5,8)		
				SPT	8.00-8.45					
				D	9.00-10.00					
				SPT	10.00-10.45			N=25 (5,5/5,5,8,7)		
End of Borehole at 10.45 m		10.45	-4.30							

Key:

D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
▽	Water Strike		
■	Standing Water Level		

Remarks: Groundwater strike at 3.0m bgl during drilling on 02/02/2011.
Water resting at 1.80m bgl on 03/02/2011.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD): 5.31	Hole Diameter (mm): 200	Scale 1:65
Client: ASDA Stores Ltd		Easting: 508664 Northing: 103141	Well Diameter (mm): 50 Filter Material: Gravel	Logged by: C.Ellison
Project: 80012.01	Date: 01/02/2011	Method: Cable percussion	Checked by:	

STRATA RECORD			IN SITU TESTS / SAMPLES						Sheet 1 of 1	
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
Soft brown gravelly CLAY with rootlets. Gravel is fine to medium subangular flint and chalk fragments. Possibly made ground.		0.40	4.91	D D PPT	0.30-0.80 0.50-0.60 0.50	<1	25			
Very soft light brownish grey slightly sandy slightly gravelly CLAY. Sand is coarse. Gravel is fine to coarse subangular to angular flint.		1.00	4.31	D U PPT	0.80-1.00 1.00-1.45 1.30		117			1
Firm light brownish grey very gravelly CLAY. Gravel is fine to coarse rounded to angular flints.				D PPT SPT	1.60-1.70 1.90 2.00-2.45		75	N=8 (1,1/2,1,2,3)		2
Soft light brown gravelly CLAY with chalk fragments. Becoming sandy with depth.		3.00	2.31	U	3.00-3.45					3
				SPT	4.00-4.45			N=14 (1,2/2,2,4,6)		4
Recovered as cobbles of strong very high density CHALK with black specs.		4.40	0.91	D	4.80-6.00					5
Recovered as fragments of moderately strong to strong cobbles and gravels of CHALK.		5.00	0.31	SPT	5.00-5.45			N=17 (2,2/3,3,5,6)		6
				SPT	6.50-6.95			N=34 (1,4/6,8,10,10)		7
				D SPT	8.00-9.00 8.00-8.45			N=36 (4,4/6,8,8,14)		8
				SPT	9.50-9.95			N=15 (1,2/3,3,4,5)		9
				SPT	11.50-11.95			N=29 (3,3/5,9,9,6)		10
End of Borehole at 11.95 m		12.00	-6.69							11
										12

Key:			
D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
▽	Water Strike		
▽	Standing Water Level		

Remarks: Groundwater strike encountered at 2.80m bgl during drilling on 01/02/2011. Water resting at 0.46m bgl on 02/02/2011.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD): 5.89	Hole Diameter (mm): 160	Scale 1:65
Client: ASDA Stores Ltd		Easting: 508722 Northing: 103100	Well Diameter (mm): 50 Filter Material: Gravel	Logged by: C.Ellison
Project: 80012.01	Date: 16/02/2011	Method: Rotary Percussive		Checked by:

STRATA RECORD		IN SITU TESTS / SAMPLES							Sheet 1 of 2	
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Type 1/Angular gravel surface with rare vegetation (Rough Ground).		0.15	5.74	J	0.15-0.50					
MADE GROUND: Dark brown black clayey sandy GRAVEL. Gravel is fragments of fine to coarse fragments of concrete, tiles, brick, plastic, glass and stone. Rare fragments of string and reworked alluvial clay. Dense organic (peaty) horizon at approximately 0.4m bgl.		0.50	5.39	PPT	0.70-0.75		150			1
(MADE GROUND): Firm to stiff brown slightly gravelly CLAY. Gravel is fine to medium subangular flint.		1.20	4.69	PPT	1.40-1.45		125			
MADE GROUND: Soft to firm light brown sandy gravelly CLAY. Sands and gravels are fragments of chalk and flint. Large (approximatley 30cm long) steel wire recovered in-situ at 2.2mbgl.		2.50	3.39	PPT	2.00-2.05		84			2
Soft to firm light brown sandy gravelly CLAY. Sands and gravels are fragments of chalk and flint.		3.50	2.39	J	3.60-4.00					3
Firm light grey green slightly gravelly CLAY. Gravel is fine chalk fragments.		4.00	1.89	PPT	4.00-4.05		50			4
Firm light brown very gravelly sandy CLAY. Sand and gravels are chalk fragments and coarse flint gravels and rare flint cobbles. Large flint cobble at 5.4m bgl.		5.50	0.39							5
Recovered as gravel/cobble sized fragments of moderately stong CHALK in a cream/light brown sandy clay matrix (CIRIA Grade Dm).										6
										7
										8
										9
Recovered as gravel/cobble sized fragments of medium dense, grey/white CHALK in a cream/light brown sandy clay chalk matrix (50% - CIRIA Grade Dm).		9.00	-3.11	SPT	9.25-9.70			N=22 (3,6/6,5,5,6)		10
										11
										12
Recovered as gravel/cobble sized fragments of medium-very high density off-white CHALK in a soft clalky clay matrix (30% - CIRIA Grade Dc). Core		12.00	-6.11							
Continued next sheet										

Key:			
D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
▽	Water Strike		
⊕	Standing Water Level		

Remarks: Groundwater strike encountered at approximately 2.00m bgl during drilling on 16/02/2011.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD): 5.89	Hole Diameter (mm): 160	Scale 1:65
Client: ASDA Stores Ltd		Easting: 508722 Northing: 103100	Well Diameter (mm): 50 Filter Material: Gravel	Logged by: C.Ellison
Project: 80012.01	Date: 16/02/2011	Method: Rotary Percussive	Checked by:	

STRATA RECORD			IN SITU TESTS / SAMPLES							Sheet 2 of 2	
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level	
recovery increased with depth. Solid core recovered between 14.4-14.6m bgl and 15.3-15.9m bgl and 18.0-19.5m bgl. Core is very high density off-white CHALK (CIRIA Grade Dc) with 60-200mm fractures (T3/T4) and no infill (Grade B).				SPT	13.50-13.93			50/280mm (6,10/14,12,15,9 for 55mm)		14	
				SPT	16.50-16.94			50/285mm (2,4/20,10,12,8 for 60mm)		15	
				SPT	19.50-19.67			69/245mm (4,14/20,35,14,0)		16	
End of Borehole at 19.95 m		19.95	-14.06							20	
										21	
										22	
										23	
										24	
										25	

Key:			
D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
	Water Strike		
	Standing Water Level		

Remarks: Groundwater strike encountered at approximately 2.00m bgl during drilling on 16/02/2011.

Site:
ASDA Worthing

 Location:
Littlehampton Road, Worthing,
West Sussex, BN12 6PB

 Client:
ASDA Stores Ltd

Easting: 508688

Northing: 103325

Hole Diameter (mm): 200

Well Diameter (mm): 50

Filter Material: Gravel

 Scale
1:65

 Logged by:
C.Ellison

Project: 80012.01

Date: 10/02/2011

Method: Cable percussion

Checked by:

STRATA RECORD

IN SITU TESTS / SAMPLES

Sheet 1 of 1

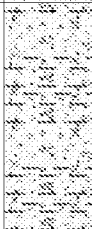
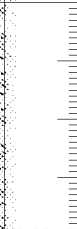
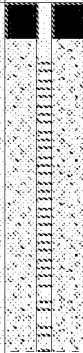
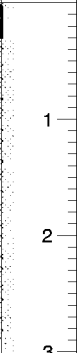
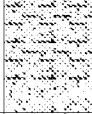
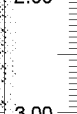
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: CONCRETE		0.12	7.14	J	0.20-0.25					
MADE GROUND: Flint GRAVEL (sub-base material).		0.20	7.06	B	0.20-0.50					
				U	0.50-0.95					
Soft becoming firm dark brown/cream gravelly CLAY. Gravel is fine to coarse subangular to subrounded flint and chalk fragments.				PPT	1.00-1.05		67			1
				D	1.00-1.10					
				J	1.90-2.00					2
				SPT	2.00-2.45			N=6 (1,1/1,1,2 ,2)		
				SPT	3.00-3.45			N=10 (2,2/2,2,2 ,4)		3
Flint GRAVEL		3.10	4.16							
		3.40	3.86							
Recovered as cream/white cobbles of moderately strong matrix dominated CHALK (Grade Dm).				SPT	4.00-4.45			N=60 (6,10/14,1 4,15,17)		4
				SPT	5.00-5.45			N=47 (6,7/7,10, 12,18)		5
				SPT	6.00-6.45			N=52 (7,10/11,1 2,14,15)		6
End of Borehole at 6.45 m		6.45	0.81							7
										8
										9
										10
										11
										12

Key:

D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
	Water Strike		
	Standing Water Level		

 Remarks: Groundwater strike encountered at 3.00m bgl during drilling on
10/02/2011.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD): 5.98	Hole Diameter (mm): 100	Scale 1:65
Client: ASDA Stores Ltd		Easting: 508700 Northing: 103116	Well Diameter (mm): 50 Filter Material: Gravel	Logged by: E.Jarratt
Project: 80012.01	Date: 07/02/2011	Method: Percussive		Checked by:

STRATA RECORD			IN SITU TESTS / SAMPLES						Sheet 1 of 1	
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
Soft to firm brown gravelly silty CLAY. Gravel is fine to coarse subangular to subrounded fragments of flint and chalk clasts. Frequent rootlets and frequent black organic staining.			3.98	PPT	0.20		130			
				D	0.30-0.60		54			
				D	0.80-1.00		52			
				PPT	0.90					
Soft light brown to orange sandy very gravelly CLAY. Gravel is fine to medium fragments of chalk clasts.			2.98	PPT	1.50		42			
				D	1.60-1.80					
End of Borehole at 3.00 m			2.98	PPT	1.90					
				D	2.50-2.70					

Key:			
D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
	Water Strike		
	Standing Water Level		

Remarks: No groundwater strike during drilling on 07/02/2011.

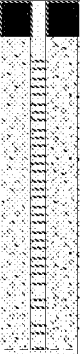
Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD): 5.85	Hole Diameter (mm): 100	Scale 1:65
Client: ASDA Stores Ltd		Easting: 508783 Northing: 103130	Well Diameter (mm): 50 Filter Material: Gravel	Logged by: E.Jarratt
Project: 80012.01	Date: 07/02/2011	Method: Percussive	Checked by:	

STRATA RECORD			IN SITU TESTS / SAMPLES						Sheet 1 of 1	
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Loose grey slightly sandy GRAVEL. Gravel is fine to coarse subangular to subrounded fragments of hardcore and red brick. Frequent rootlets.		0.30	5.55	D	0.30-0.80					
MADE GROUND: Brown slightly sandy very clayey GRAVEL. Gravel is fine to coarse subangular to subrounded fragments of red brick, ceramic tile, and mixed lithologies. Occasional brick cobbles and occasional decayed wood fragments.		0.80	5.05	PPT	0.90		172			1
		1.20	4.65	PPT	1.50		64			2
Firm brown mottled orange slightly gravelly CLAY. Gravel is fine subangular to subrounded chalk clasts. Occasional fragments of decayed wood.				PPT	1.90		107			
				PPT	2.20		140			
Soft to firm brown/white/orange gravelly very sandy CLAY. Gravel is fine to medium fragments of flint and chalk clasts.				D	2.50-2.70					
				PPT	2.80		59			
End of Borehole at 3.00 m		3.00	2.85							3
										4
										5
										6
										7
										8
										9
										10
										11
										12

Key:			
D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
	Water Strike		
	Standing Water Level		

Remarks: No groundwater strike during drilling 07/02/2011.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD): 5.53	Hole Diameter (mm): 100	Scale 1:65
Client: ASDA Stores Ltd		Easting: 508656 Northing: 103170	Well Diameter (mm): 50 Filter Material: Gravel	Logged by: E.Jarratt
Project: 80012.01	Date: 08/02/2011	Method: Percussive		Checked by:

STRATA RECORD			IN SITU TESTS / SAMPLES						Sheet 1 of 1	
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
Soft dark brown silty CLAY surfaced with vegetation. Frequent fragments of decayed wood. Occasional pockets of light brown silt.		0.70	4.83	PPT D PPT D D PPT U D PPT D PPT D	0.00-0.10 0.10-0.30 0.40 0.50-0.70 0.80 1.00-1.20 1.00-1.30 1.20 1.50		94 70 14 174 160			
Soft to firm light brown very silty CLAY. Becoming dark brown with depth. Occasional medium subrounded mixed lithology gravels. Occasional rootlets and decayed wood fragments. Rare pockets of light brown silt. Wet at 0.9m bgl.		1.60	3.93							1
Black decayed wood.		1.80	3.73							
		2.00	3.53							2
Firm white/grey/brown very gravelly CLAY. Gravel is fine to coarse subangular to subrounded chalk clasts and angular flint fragments.										
White/off white clast dominated CHALK (70% clasts, 30% matrix). Clasts are fine to coarse angular to subrounded. Occasional pockets of brown clayey silt from 2.95m bgl to 3.0m bgl.		3.00	2.53	SPT	3.00-3.45			N=16 (4,3/4,4,4,4)		3
End of Borehole at 3.00 m										4
										5
										6
										7
										8
										9
										10
										11
										12

Key:

D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
	Water Strike		
	Standing Water Level		

Remarks: No groundwater strike during drilling on 08/02/2011.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD): 5.81	Hole Diameter (mm): 100	Scale 1:65
Client: ASDA Stores Ltd		Easting: 508709 Northing: 103184	Well Diameter (mm): 50 Filter Material: Gravel	Logged by: E.Jarratt
Project: 80012.01	Date: 07/02/2011	Method: Percussive		Checked by:

STRATA RECORD				IN SITU TESTS / SAMPLES					Sheet 1 of 1	
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Concrete.		0.14	5.67	D	0.14-0.30					
Loose brown sandy very clayey GRAVEL (possibly made ground). Gravel is fine to coarse angular to rounded fragments of flint, chalk clasts, and mixed lithologies.		0.50	5.31	D	0.50-0.70		205			
		0.70	5.11	PPT	0.60		39			
		1.10	4.71	PPT	0.90					1
Stiff grey slightly gravelly CLAY. Gravel is fine to medium subangular to angular fragments of flint and chalk clasts.		1.00-1.20		U	1.00-1.20		95			
		1.10-1.30		D	1.10-1.30					
		1.10-1.80		PPT	1.10-1.80					
		1.40		D	1.40					2
Very soft light brown slightly gravelly silty CLAY. Gravel is fine to medium subangular to angular fragments of flint and chalk clasts.		1.80	4.01	PPT	1.80-2.20			8 / 75mm (2,2/2,2,2,2)		
		2.20	3.61	D	2.00-2.45					
		2.30	3.51	SPT	2.20-2.30					
Soft brown mottled orange/grey silty CLAY. Occasional fine chalk clast gravels.		3.00	2.81							3
Soft brown/orange/grey very gravelly CLAY. Gravel is fine to coarse subangular to angular fragments of flint.										
Loose GRAVEL of angular coarse flints.										4
No recovery.										
End of Borehole at 3.00 m										5
										6
										7
										8
										9
										10
										11
										12

Key:			
D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
▽	Water Strike		
■	Standing Water Level		

Remarks: No groundwater strike during drilling on 07/02/2011.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD): 6.05	Hole Diameter (mm): 100	Scale 1:65
Client: ASDA Stores Ltd		Easting: 508710 Northing: 103226	Well Diameter (mm): 50 Filter Material: Gravel	Logged by: E.Jarratt
Project: 80012.01	Date: 07/02/2011	Method: Percussive	Checked by:	

STRATA RECORD			IN SITU TESTS / SAMPLES						Sheet 1 of 1	
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Concrete.		0.17	5.88	D	0.30-0.50					
Loose brown very clayey sandy GRAVEL (possibly made ground). Gravel is fine to coarse subangular to angular fragments of flint and mixed lithologies.		0.50	5.55	D	0.50-0.55		225			
		0.60	5.45	PPT	0.50-0.60		45			
				D	0.50					
Firm grey slightly gravelly silty CLAY. Gravel is fine to medium subangular to angular fragments of mixed lithologies.		1.10	4.95	PPT	0.60-1.00					1
				U	0.80		135			
				D	1.00-1.20					
		1.70	4.35	PPT	1.10-1.70		77			
				D	1.40					
Soft brown/orange with black mottling slightly gravelly silty CLAY. Gravel is fine to medium subangular to angular mixed lithologies.				PPT	1.70-3.00		142			2
				PPT	1.80					
					2.20					
Soft to firm brown mottled orange/grey very gravelly silty CLAY. Gravel is fine to medium subangular to angular fragments of flint and chalk clasts.				PPT	2.70		162			
				D	2.70-2.90					
		3.00	3.05	SPT	3.00-3.45			N=24 (3,3/4,6,6,8)		3
Firm brown/grey slightly gravelly silty CLAY. Gravel is fine to medium subangular to angular fragments of flint and chalk clasts. Occasional coarse chalk clasts.										4
End of Borehole at 3.00 m										5
										6
										7
										8
										9
										10
										11
										12

Key:			
D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
	Water Strike		
	Standing Water Level		

Remarks: No groundwater strike during drilling 07/02/2011.

Site:
ASDA Worthing

 Location:
Littlehampton Road, Worthing,
West Sussex, BN12 6PB

 Client:
ASDA Stores Ltd

Ground Level (mASD): 6.65

Easting: 508756

Northing: 103273

Hole Diameter (mm): 100

Well Diameter (mm): 50

Filter Material: Gravel

 Scale
1:65

 Logged by:
E.Jarratt

Project: 80012.01

Date: 07/02/2011

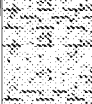
Method: Percussive

Checked by:

STRATA RECORD

IN SITU TESTS / SAMPLES

Sheet 1 of 1

Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Concrete.		0.20	6.65	PPT	0.20-0.25					
MADE GROUND: Soft brown gravelly CLAY. Gravel is fine to medium subangular to subrounded fragments of mixed lithologies, ceramic tile, and rare fragments of red brick.		0.25	6.60	D	0.30-0.50		89			
				PPT	0.40					
				D	0.50-1.00		84			
				PPT	0.80					
Soft brown slightly gravelly silty CLAY. Gravel is fine to coarse subangular to subrounded fragments of mixed lithologies, flints and chalk clasts.		1.40	5.45	SPT	1.00-1.45		45	N=9 (1,1/2,2,3,2)		1
				PPT	1.30					
				D	1.40-2.00		27			
				PPT	1.70					
Soft light brown mottled orange and occasionally black silty slightly gravelly CLAY. Gravel is fine to medium subangular to angular fragments of flints and chalk clasts. Occasional coarse flint gravels.		2.25	4.60							2
				D	2.50-2.70		112			
				PPT	2.60					
				D	2.70-2.90					
Soft brown mottled greyish orange occasionally black sandy very gravelly CLAY. Gravel is fine to medium subangular to subrounded fragments of chalk clasts and flints.		3.00	3.85							3
End of Borehole at 3.00 m										4
										5
										6
										7
										8
										9
										10
										11
										12

Key:

D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
	Water Strike		
	Standing Water Level		

Remarks: Groundwater strike encountered at 2.1m bgl during drilling.

Site:
ASDA Worthing

 Location:
Littlehampton Road, Worthing,
West Sussex, BN12 6PB

 Client:
ASDA Stores Ltd

Easting: 508747

Northing: 103304

Hole Diameter (mm): 100

Well Diameter (mm): 50

Filter Material: Gravel

 Scale
1:65

 Logged by:
E.Jarratt

Project: 80012.01

Date: 07/02/2011

Method: Percussive

Checked by:

STRATA RECORD

IN SITU TESTS / SAMPLES

Sheet 1 of 1

Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Concrete.		0.30	6.97							
MADE GROUND (poor recovery): Soft brown very gravelly CLAY. Gravel is fine to coarse subangular to subrounded hardcore fragments.		0.40	6.87	D	0.40-0.70		114			
		0.70	6.57	PPT	0.50					
				D	0.70-0.75		70			
				PPT	0.80					
Firm grey slightly gravelly silty CLAY. Gravel is fine to medium subangular to subrounded mixed lithologies. Frequent wood fragments.		1.40	5.87	U	1.00-1.20		57			1
		1.65	5.62	PPT	1.30					
Soft brown slightly gravelly silty CLAY. Gravel is fine fragments of mixed lithologies and flints.				D	1.80-2.00		145			2
				PPT	1.80					
				D	2.10-2.30		65			
				PPT	2.20					
Firm light brown very gravelly CLAY. Gravel is fine to coarse subangular to angular fragments of flint.				D	2.50-2.70		64			
				PPT	2.80					
Soft brown mottled grey slightly gravelly silty CLAY. Gravel is fine to medium subangular to subrounded fragments of flint and chalk clasts.		3.00	4.27							3
End of Borehole at 3.00 m										4
										5
										6
										7
										8
										9
										10
										11
										12

Key:

D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
	Water Strike		
	Standing Water Level		

Remarks: No groundwater strike during drilling on 07/02/2011.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD): 7.35	Hole Diameter (mm): 100	Scale 1:65
Client: ASDA Stores Ltd		Easting: 508669 Northing: 103311	Well Diameter (mm): 50 Filter Material: Gravel	Logged by: C.Ellison
Project: 80012.01	Date: 08/02/2011	Method: Percussive		Checked by:

STRATA RECORD			IN SITU TESTS / SAMPLES						Sheet 1 of 1	
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Concrete.		0.12	7.23	D	0.20-0.40					
MADE GROUND: Flint gravel subbase material recovered as brown slightly clayey GRAVEL. Gravel is fine to coarse angular flints with occasional chalk fragments. Large flint cobble at 0.27m bgl.		0.40	6.95	D	0.40-1.50					
		0.80	6.55	PPT	0.60		150			
Firm dark brownish grey slightly gravelly CLAY.				PPT	0.90		59			
				D	1.00-1.45			N=8 (2,1/2,2,2,2)		1
Soft light brown slightly gravelly CLAY with a single continuous root (1-3mm thick).		1.50	5.85	PPT	1.50		50			
				D	1.90					2
Firm sandy gravelly CLAY. Sand is coarse, gravel is fine fragments of chalk.				SPT	2.00-2.45			N=14 (3,2/3,3,4,4)		
		2.60	4.75	D	2.60-3.00					
Light brown gravelly SAND. Gravel is fine to coarse fragments of flint.				SPT	3.00-3.45			N=20 (5,5/4,6,5,5)		3
End of Borehole at 3.00 m		3.00	4.35							
										4
										5
										6
										7
										8
										9
										10
										11
										12

Key:			
D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
▽	Water Strike		
■	Standing Water Level		

Remarks: Groundwater strike encountered at 2.8m bgl during drilling on 08/02/2011.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD): 6.29	Hole Diameter (mm): 100	Scale 1:65
Client: ASDA Stores Ltd		Easting: 508645 Northing: 103261	Well Diameter (mm): Filter Material:	Logged by: E.Jarratt
Project: 80012.01	Date: 08/02/2011	Method: Percussive		Checked by:

STRATA RECORD			IN SITU TESTS / SAMPLES						Sheet 1 of 1	
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Soft brown to dark brown silty CLAY surfaced with moss and grass. Occasional fine subangular to subrounded chalk fragments. Frequent rootlets between 0.0m bgl and 0.3m bgl. Rare coarse subrounded flint fragments and rare decayed wood fragments.		0.10-0.30		D	0.10-0.30					
		0.40		PPT	0.40		90			
		0.60-0.80		D	0.60-0.80					
		0.90		PPT	0.90		37			
		1.00-1.45		SPT	1.00-1.45			N=6 (0,0/1,2,1,2)		1
MADE GROUND: No recovery.		1.25	5.04							
		1.60		PPT	1.60		27			
MADE GROUND: Very soft brown/dark brown silty CLAY surfaced with moss and grass. Occasional fine subangular to subrounded chalk fragments. Frequent rootlets between 0.0m bgl and 0.3m bgl. Rare coarse subrounded flint fragments and rare decayed wood fragments.		1.75-2.00		D	1.75-2.00		34			2
		1.90		PPT	1.90			N=14 (2,2/3,4,4,3)		
		2.00-2.45		SPT	2.00-2.45					
		2.30		PPT	2.30		50			
		2.40-3.00		D	2.40-3.00					
Fragments of black decayed wood.		3.00-3.45		SPT	3.00-3.45			47/225mm (9,12/14,16,17 for 75mm)		3
Soft greyish brown very gravelly sandy silty CLAY. Gravel is fine to medium subangular to subrounded fragments of chalk clasts and flints. Occasional fragments of decayed wood.										4
No recovery. Assumed as above.										
Soft greyish brown very gravelly sandy silty CLAY. Gravel is fine to medium subangular to subrounded fragments of chalk clasts and flints. Occasional fragments of decayed wood.										5
Off white sandy gravelly putty CHALK. Sand is fine. Gravel is fine to coarse subangular to subrounded chalk clasts and occasional flints.										6
End of Borehole at 3.00 m										

Key:			
D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
▽	Water Strike		
■	Standing Water Level		

Remarks: No groundwater strike encountered during drilling on 08/02/2011.

Site:
ASDA Worthing

Location:
Littlehampton Road, Worthing,
West Sussex, BN12 6PB

Ground Level (mASD):

Hole Diameter (mm): 100

Scale
1:65

Client:
ASDA Stores Ltd

Easting:

Well Diameter (mm):

Logged by:
C.Ellison

Northing:

Filter Material:

Project: 80012.01

Date: 07/02/2011

Method: Percussive

Checked by:

STRATA RECORD

IN SITU TESTS / SAMPLES

Sheet 1 of 1

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Key:

D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test
J	Jar Sample		(Uncorrected)
	Water Strike		
	Standing Water Level		

Remarks: Groundwater strike encountered at 0.5m bgl during drilling on 07/02/2011.
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Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD):	Hole Diameter (mm): 100	Scale 1:65
Client: ASDA Stores Ltd		Easting: Northing:	Well Diameter (mm): Filter Material:	Logged by: E.Jarratt
Project: 80012.01	Date: 07/02/2011	Method: Percussive		Checked by:

STRATA RECORD			IN SITU TESTS / SAMPLES						Sheet 1 of 1	
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Concrete.		0.14								
Loose brown sandy very clayey GRAVEL. Gravel is fine to coarse subangular to angular fragments of flint and mixed lithologies.		0.40		D PPT PPT SPT	0.40-1.00 0.50 0.80 1.00-1.45		212 79			
Stiff dark greyish brown slightly gravelly silty CLAY. Gravel is fine fragments of mixed lithologies and chalk clasts. Occasional bands of soft clay.		1.50		PPT D PPT SPT	1.50 1.50-2.00 1.80 2.00-2.45		29 77	N=7 (1,2/1,2,2,2)		1
Soft brown/orange/white very gravelly sandy CLAY. Gravel is fine to coarse subangular to angular fragments of flints and chalk clasts. Wet at 2.2m bgl.		2.60		D	2.60-2.90			N=11 (1,1/1,3,4,3)		2
Medium off white to brwnish white beige clayey very gravelly SAND. Gravel is fine to coarse subangular to angular fragments of flints and chalk clasts.		2.90 3.00 3.30 3.50		D SPT	2.90-3.00 3.00-3.45			N=49 (7,11/12,12,12,13)		3
White to off white matrix clasts dominated CHALK (60% clasts. 40% matrix). (Grade Dm)										4
No recovery.										5
Cobbles of CHALK.										6
End of Borehole at 3.50 m										7
										8
										9
										10
										11
										12

Key:			
D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
▽	Water Strike		
⊞	Standing Water Level		

Remarks: Groundwater strike encountered at 2.2m bgl during dilling on 07/02/2011. Water rose to 1.1m bgl approximately 20mn after strike.

Site: ASDA Worthing	Location: Littlehampton Road, Worthing, West Sussex, BN12 6PB	Ground Level (mASD): 7.07	Hole Diameter (mm): 100	Scale 1:65
Client: ASDA Stores Ltd		Easting: 508770 Northing: 103333	Well Diameter (mm): Filter Material:	Logged by: E.Jarratt
Project: 80012.01	Date: 08/02/2011	Method: Percussive	Checked by:	

STRATA RECORD			IN SITU TESTS / SAMPLES						Sheet 1 of 1	
Description	Legend	Depth (m)	Level (mASD)	Sample Type	Sample Depth (m)	PID (ppm)	PPT (kPa)	SPT N Value	Well Details	Water Level
MADE GROUND: Concrete. Plastic membrane at 0.1m bgl.		0.10	7.27	D	0.10-0.25					
		0.25	7.12							
MADE GROUND: Medium to coarse subangular to angular hardcore gravel.				PPT	0.50		204			
				D	0.60-0.80		190			
		0.95	6.42	PPT	0.80					
Stiff dark brown and black slightly gravelly silty CLAY. Becoming more gravelly with depth. Occasional thin bands of brown silt. Gravel is fine to coarse subangular to angular flint fragments and chalk clasts.				D	0.90-1.00			N=17 (2,2/3,3,5,6)		1
				D	0.95-2.30					
				SPT	1.00-1.45					
Medium dense grey mottled brown slightly silty gravelly very clayey SAND. Sand is coarse. Gravel is fine to medium fragments of flints and chalk clasts.		2.30	5.07	SPT	2.00-2.45			N=13 (3,3/3,3,3,4)		2
				D	2.10-2.30					
				PPT	2.60		74			
				D	2.60-4.00					
				PPT	2.95		120			
				SPT	3.00-3.45			N=20 (2,3/5,4,5,6)		3
				PPT	3.40		99			
Soft to firm brown mottled grey slightly gravelly silty CLAY. Becoming brown and more gravelly with depth. Gravel is fine to medium subangular to subrounded fragments of chalk clasts and flints. Slightly wet at 4.95m bgl.				PPT	3.80		162			
				SPT	4.00-4.45			N=19 (3,3/4,4,5,6)		4
				D	4.00-5.00					
End of Borehole at 5.00 m		5.00	2.37	SPT	5.00-5.45			N=23 (6,5/5,5,6,7)		5
										6
										7
										8
										9
				D	9.00					10
										11
										12

Key:			
D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test (Uncorrected)
J	Jar Sample		
▽	Water Strike		
■	Standing Water Level		

Remarks: Groundwater strike encountered at 4.95m bgl during drilling on 08/02/2011.

Scale
1:65

Logged by:
E. Jarratt

Filter Material:

Method: Percussive

Checked by:

IN SITU TESTS / SAMPLES

Sheet 1 of 1

Key:			
D	Disturbed Sample	PPT	Pocket Penetrometer Test
B	Bulk Sample	PID	Photoionisation Detector
U	Undisturbed Sample	SPT	Standard Penetration Test
J	Jar Sample		(Uncorrected)
	Water Strike		
	Standing Water Level		

Remarks: Groundwater strike encountered at 2.0m bgl during drilling on 08/02/2011. Water rose to 1.0m bgl approximately 20mn after strike.