St. Athan Northern Access Road

Phase I Geo-Environmental Assessment

Prepared for:
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Prepared by:
AECOM Limited

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0	September 2016	Original draft	Joshua Lewis Graduate Environmental Consultant	Geoffrey Jones Technical Director
1	December 2016	Inclusion of executive summary and site walkover details	Anita Venn Senior Geoenvironmental Engineer	Geoffrey Jones Technical Director

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EXECUTIVE SUMMARY

Introduction

AECOM Limited has been appointed by the Welsh Government to design a new access road to serve the Aerospace Business Park (ABP) in St. Athan. The new road, which is referred to as the Northern Access Road (NAR), will provide a link from the B4265 near Llantwit Major in the west to Eglwys Brewis Road in Picketston in the east.

This Phase I Geo-environmental Assessment has been prepared in relation to the NAR. The scheme is located in St. Athan, South Wales approximately 6.3 kilometres (km) west of Cardiff airport. The National Grid coordinates for the middle of the site are 299069E, 169035N and the approximate post code for the site is CF62 4DN. This report considers the implications of Part IIA of the Environmental Protection Act 1990 and the Contaminated Land Statutory Guidance for Wales 2012.

Site Walkover

A site walkover conducted by AECOM on the 28th July 2016 did not identify any potentially significant contamination sources.

Site History

Mapping since 1885 shows that the proposed route typically comprised undeveloped fields, surrounded by a mixture of residential and military land uses. In 1885 the historical maps for the eastern section of the site shows a church, farm and associated buildings, a smithy and an Old Rectory; by 1969 the hamlet had expanded to include an approximate area of 1km^2 of residential housing and RAF associated buildings as well as St Athan Airfield, constructed on agricultural land. By 1974, major residential development had taken place in Llantwit Major to the south of the Northern Access Road site, a caravan park had been developed approximately 100m north of the site and RAF Station St Athens had been developed. By 1983, the B4265 road was built, and surrounding land use started to increase in development density. Potentially contaminative land uses within 250m include Eglwys-Brewis village and farm, unknown tank and St. Athan airfield.

Unexploded Ordnance Risk

According to an existing assessment (PB 2008) the risk from unexploded ordnance is low in areas to the east as the area has already been developed and no UXO were encountered. The section of road covering agricultural land to the west has been assessed as low risk. Although UXO were dropped in this area, shallow bedrock means that deep penetration of munitions is unlikely. Rotary drilling and agricultural practices in the area have not revealed the presence of any UXO and therefore the likelihood of encounter is considered low. The central section of the route covers the Sale Field/Picketston area which is assessed to have a low-moderate risk rating. Anecdotal evidence suggested that this area was used as a waste deposit and arms testing range. Uncertainty over the nature of the fill material in this area resulted in a risk ranking of low-moderate. The assessment concluded that for all areas site ordnance awareness training is provided for construction supervision staff to identify risks within the development zone, that a competent person should be available to visit site at short notice during excavation. In low-moderate risk areas additional actions are recommended including excavation supervision by a competent person, hand clearance of areas where small arms or proofing rounds are present and topsoil screening for spent casings and artefacts before soil is removed or reused.

Environmental Setting

The underlying geology is considered to comprise Made Ground, in previously developed areas only, underlain by alluvium, in the vicinity of watercourses and interbedded limestones and mudstones of the Porthkerry Member. The site geology is classified as a Secondary A aquifer and is not located within, or in the close vicinity of, a Source Protection Zone.

There are no significant ground stability hazards and the site is no considered to be impacted by mining. There are two groundwater abstraction licences and one discharge to groundwater licence associated with the St. Athan site.

The site is noted as being at risk from flooding from surface waters with a flood water storage area located where the Llanmaes Brook crosses the route at chainage 480m and has a low risk (1000 year return) of extreme flooding without defences. Between chainages 1500m and 1600m in the middle of the route a low risk of extreme flooding without defences is also noted. A low risk of flooding is also noted between chainages 1700m and 2400m in the east of the proposed route.

The nearest recorded pollution incident to controlled waters is located 146m south east of the site (chainage 1180m) and relates to a 'Category 2 – Significant' to waters.

There are no Environmentally Sensitive Areas, Special Areas of Conservation within 1km of the site.

Regulated Processes

There are no permitted Local Authority Pollution Prevention and Controls (LAPPC), Enforcement and Prohibition Notices, Integrated Pollution Prevention and Control (IPPC), Local Authority Integrated Pollution Prevention and Control (LAIPPC) sites or Local Authority Pollution Prevention and Control Enforcements (LAPPCE) Substantiated Pollution Incident Register entries, Water Industry Act Referrals, Prosecutions Relating to Authorised Processes or Prosecutions Relating to Controlled Waters on site.

There are two licensed waste management facilities entries within 250m of the site and one between 250m and 500m of the site all linked to St. Athan. There are two Registered Radioactive Substances within 1km of the proposed route both located at St. Athan for disposal of radioactive waste

There are no Control of Major Accident Hazards Sites (COMAH), Explosive Sites, Notification of Installations Handling Hazardous Substances (NIHHS), Planning Hazardous Substance Consents, Planning Hazardous Substance Enforcements or fuel entries within 1km of the site. There are three potentially contaminative contemporary trade directories within 250m of the site; two cleaning services and a greeting card manufacturers.

Existing Site Reports

There have been numerous site investigations completed at the wider St Athan Airfield site including; an Environmental Statement completed by Entec in 2009 which detailed and summarised three environmental investigations completed by Enviros Aspinwall (2002), Parsons Brinkerhoff (PB) (2004) and WS Atkins (2005), a site investigation completed by WYG Environment at the Tremains Farm site, Picketston South West and North of West Camp in 2011, a phase of geo-environmental and geotechnical site investigation by Pell Frischman in 2010 and a site investigation completed by Capita Symonds also in 2009.

Conceptual Site Model & Preliminary Risk Evaluation

The following potentially complete contamination linkages were identified:

- Direct contact with contaminated soils or dusts (including organic or inorganic contaminants, disturbed asbestos fibres or elevated sulphate concentrations) by future users of landscaped areas, adjacent human receptors, buried concrete structures or services in plastic pipes;
- Leaching of contamination from soil to groundwater or adjacent site users;
- Migration or direct contact between contaminated groundwater and road infrastructure, controlled waters, adjacent site uses or areas of landscaping;
- The presence of unexploded ordnance or radioactive materials impacting site workers or materials associated with the proposed development.

The preliminary risk evaluation identified a very low risk to adjacent site users and controlled waters and a low risk to road infrastructure and areas of landscaping.

Conclusions

The assessment completed has identified a very low or low risk from contamination, within the context of the proposed development. Previous investigations, discussed in this document, have discovered localised contamination to both soil and groundwater across off site areas to the north and the south. However, there is a very low potential for significant organic soil contamination to be present on site and the areas of identified petroleum hydrocarbon contamination in groundwater have undergone remediation. There has been a low risk identified from the presence of unexploded ordnance as there is currently no available data related to this potential contamination source.

Recommendations

Additional intrusive investigation of the proposed route is recommended to verify the findings of the Preliminary Risk Evaluation and obtain classification of soil quality for soil management.

Whilst previous ground investigation information suggests a low potential for contamination and radioactive material from the Picketston area investigation (adjacent to proposed route's northern boundary chainages 1500m to 2400m), this cannot be concluded fully at this stage due to the limited available data to assess the potential risk. There is also currently limited information available regarding the status of any unexploded ordnance at the site.

1. INTRODUCTION

1.1 General

AECOM Limited (hereafter referred to as "AECOM") has been commissioned by the Welsh Government to complete a Phase I Geo-environmental Assessment for the St. Athan Northern Access Road (NAR) hereafter referred to as 'the site'.

This report is presented as the first stage of the investigation process and is prepared with a view to characterising the potential ground conditions and hazards, including the potential for contaminated land. This report has been prepared to meet the initial requirements of the Local Authority and is intended to support the planning application.

1.2 Proposed Scheme

The NAR will provide a link from the B4265 near Llantwit Major in the west to Eglwys Brewis Road in Picketston in the east. The scheme is located in St. Athan, South Wales approximately 6.3 kilometres (km) west of Cardiff airport. It is accessed from the B4265 via Eglwys-Brewis Road. The National Grid coordinates for the middle of the site are 299069E, 169035N and the approximate post code for the site is CF62 4DN. The location of the proposed scheme is detailed in Figure 1 and the layout is shown on the DTC St Athan Highway Improvements Location Plan (DRG No. 003622/PA/000).

1.3 Methodology

The assessment presented in this report, and the recommendations provided, have been prepared in accordance with the following guidance:

- National Planning Policy Framework;
- Association of Geotechnical and Geo-environmental Specialists 'Guidelines for Combined Geo-environmental and Geotechnical Investigations' (2000);
- British Standards 10175:2011+A1:2013 'Investigation of Potentially Contaminated Sites – Code of Practice';
- British Standards 5930: 1999+A2:2010 'Code of Practice for Site Investigations';
- Contaminated Land Report (CLR) 11 'Model Procedures for the Management of Land Contamination' (2004);
- DEFRA Circular 01/2006 'Environment Protection Act 1990 Part IIA Contaminated Land' (2006);
- Environment Agency (EA) TR P5-065/TR 'Technical Aspects of Site Investigation (Volumes I and II)' (2002); and
- Environment Agency (EA) GP3 'Groundwater Protection: Policy and Practice'.

This report considers the implications of Part IIA of the Environmental Protection Act 1990 and the Contaminated Land Statutory Guidance for Wales 2012.

The following tasks have been performed:

- A review of the geological, hydrological and hydrogeological setting at the site, and public domain geo-environmental information to build up an accurate understanding of the site and surrounding environmental setting/sensitivity;
- Review of historical land uses for the site and surrounds with a particular emphasis on identifying potential ground hazards and on-site and off-site contamination sources;
- An inspection of the site to review current and recent site activities, the condition of the site, potential ground related hazards and activities or areas that might have the potential to cause ground contamination as well as possible indicators of contamination;

- A review of a previous ground investigations undertaken in 2009; and
- Preparation of a Conceptual Site Model with a view to identifying any significant source-pathway-receptor linkages followed by a qualitative risk assessment.

1.4 Sources of Information

The information and documents reviewed for the purpose of this report are given below:

- British Geological Survey website (www.bgs.ac.uk) accessed August 2016
- Envirocheck Report from the Landmark Information Group. (Reference 91812710_1_1 dated 27th July 2016);
- WYG Environment: 'Service Family Accommodation – St Athan Tremains Farm Site. Ground Conditions Assessment Report' dated January 2011;
- WYG Environment: 'Proposed Service Family Accommodation at Picketston South West, RAF St Athan. Ground Conditions Assessment Report' dated January 2011;
- Pell Frischmann: 'St Athan; Geo-Environmental Validation Report' (Ref. SA-C100E-RP-CCC-PC-X-3129 dated March 2010);
- Entec UK Ltd.: 'Ministry of Defence, Metrix Ltd./Welsh Assembly Government. Defence Technical College and Aerospace Business Park – St. Athan Environmental Statement' dated May 2009; and
- Capita Symonds: 'Northern Access Road: Tremains Farm South West Picketston North of West Camp SFAs. Ecological Enhancement and Mitigation' dated 2009.

2. HISTORICAL REVIEW

2.1 General

Historical mapping has been reviewed to evaluate the potential for past activities, both on and adjacent to the proposed route, to have impacted upon the site's environmental and land quality. Historical Ordnance Survey (OS) maps of the site were obtained as part of an Envirocheck Report in July 2016.

Section 3.2 summarises the main features present on, and within 250m, of the route. Where dates are given, these refer to the dates of maps on which the features appear, and do not necessarily refer to the exact dates of operation of any particular facility.

Copies of the maps referenced are provided in **Appendix A**.

2.2 History

Since the earliest map available (1885) until 1947, the proposed route typically comprised undeveloped fields, surrounded by a mixture of residential and military land uses. The Vale of Glamorgan Railway was constructed between 1885 and 1900 located to the south east of the route. By 1947, residential development increased in Boverton in the form of the Tre-Beferad and Boverton Court housing estates, approximately 200m to the south of Ch. 150m. The historical maps for the eastern section of the site demonstrate extensive development of the Eglwys Brewis hamlet. In 1885 there was a church, farm and associated buildings, a smithy and an Old Rectory; by 1969 the hamlet had expanded to include an approximate area of 1km^2 of residential housing and RAF associated buildings as well as St Athan Airfield, constructed on agricultural land. By 1974, major residential development had taken place in Llantwit Major to the south of the Northern Access Road site and RAF Station St Athens had been developed. The development included sports grounds, schools and allotment gardens. At this point, a caravan park is shown on historical maps, approximately 100m north of the site. By 1983, the B4265 road was built, and surrounding land use started to increase in development density. There has been limited change since then with the exception of recent further industrial development of MOD St. Athan on the existing runway site.

Table 2.1 summarises the potentially contaminative historical land uses identified on and within 500m of the site.

TABLE 2.1 POTENTIAL HISTORICAL SOURCES OF CONTAMINATION ON AND WITHIN 500M OF THE PROPOSED ROUTE

LOCATION	*DESCRIPTION*
Within 250m	Eglwys-Brewis village including farm (1985-2016) (Ch. 2700m)
	Tank containing unknown substance (1921) (Ch. 2300m)
	St Athan Airfield (1969-2016)
Between 250 and 500m	Tank: approximately 350m south east (1972 -1996) (Ch. 2700m)
	Airfield including 3 potential tanks: 300m north (1999-2016) (Ch. 2100m)
	Great House Farm: 350m north (1885-2016) (Ch. 200m)
	Tremains Farm: approximately 350m north west (1972-2016) (Ch. 0m)
	Bridge House Farm: approximately 400m north west (1885-2016) (Ch. 0m)
	Boverton Place Farm: approximately 450m south (1885-2016) (Ch. 300m)

2.3 Unexploded Ordnance Risk

In 2008, Parsons Brinckerhoff Ltd (PB) was commissioned to undertake and Explosive Ordnance Phase 1 Desk Study of RAF St. Athan to assess the risk that potential explosive ordnance could have on development and construction activities. As part of the study, a site visit was undertaken by

PB and BAE Systems in October 2007 which included a site walkover, interviews with personnel and a review of available information.

Following a review of the available information, PB assessed the levels of risk in the areas of the site covered by the Northern Access Road to be low to low-moderate. The risk from unexploded ordnance is low in areas to the east. This area has already been developed and no UXO were encountered. The section of road covering agricultural land to the west has been assessed as low risk. Although ordnance were dropped in this area, the PB report states that shallow bedrock means that deep penetration of munitions is unlikely. Rotary drilling and agricultural practices in the area have not revealed the presence of any UXO and therefore the likelihood of encounter is considered low. The central section of the route covers the Sale Field/Picketston area which is assessed to have a low-moderate risk rating. Anecdotal evidence reviewed by PB suggested that this area was used as a waste deposit and arms testing range. Uncertainty over the nature of the fill material in this area resulted in a risk ranking of low-moderate.

PB recommended that for all areas site ordnance awareness training is provided for construction supervision staff to identify risks within the development zone, that a competent person should be available to visit site at short notice during excavation. In low-moderate risk areas additional actions are recommended including excavation supervision by a competent person, hand clearance of areas where small arms or proofing rounds are present and topsoil screening for spent casings and artefacts before soil is removed or reused.

3. SITE INSPECTION

3.1 General

A site walkover of the route alignment was undertaken by AECOM on 28th July 2016. The purpose of the site walkover survey was to assess the condition of the site, observe any geotechnical important features and to identify any potential sources of contamination.

3.2 Site Area Description

Generally, the site is predominantly located within an agricultural context. Due to the presence of horses, cattle and arable crops and the inability to contact some landowners, the majority of the site visit was conducted by observing the site from viewpoints along the Elgwys Brewis Road and unnamed farm roads.

Site photographs are presented in **Appendix B** with locations shown on Figure 3.

From west to east the site comprises the following areas:

- B4265 located west of the site (Ch.0).
- Llanmaes Brook is in the western extent of the site and passes through the riding school where there were horses in the fields. It will cross the proposed alignment between Ch. 400 – 420m. At the time of survey the water level in Llanmaes Brook was relatively high which was anticipated due to heavy rainfall on the day. The water was clean and the stream bed was visible.
- Boverton Brook runs south of the alignment from Ch. 0 – Ch.1570 where it also crosses the proposed alignment Ch. 1520 – Ch1570m.
- Millands Caravan Park is located approximately 30m south of the proposed road (Ch. 900m).

The Fire Training area and Nant y Stepsau were not observed due to hedgerows along Eglwyis Brewis Road and locked access gates belonging to the St. Athan MoD site.

4. ENVIRONMENTAL SETTING

4.1 General

The environmental setting is important because the topography, geology, hydrogeology and hydrology of the site are the main factors that influence the way in which contaminants in the soil or groundwater can be transported on or off site, and the ways in which contamination can affect users of the site.

The environmental setting of the site has been determined by making reference to the information sources detailed in Section 1.4.

4.2 Site Location

The planned access road is located in south-east Wales within the Vale of Glamorgan, approximately 11km west of Barry and 13km south-east of Bridgend. The route links the B4265, east of Llantwit Major, and MOD St Athan.

A site location plan is presented as Figure 1. The approximate National Grid Reference for the centre of the site location is SS 99150 69240.

4.3 Site Description

The route is approximately 2km in length and links the B4265, east of Llantwit Major, with MOD St. Athan. The route passes through open countryside which has a mainly agricultural use, including fields north of Eglwys-Brewis. There are a number of properties close to the route including farms, houses and a caravan park.

The eastern and western extent of the route occupies existing roadways. The western extent joins the route to the B4265. The eastern extent joins Eglwys Brewis Road, west and south of the Eglwys-Brewis housing estate.

4.4 Geology

4.4.1 *Published Geology and Borehole Data*

The geology of the site has been assessed by making reference to the British Geological Survey's (BGS) 1:50,000 geological map of Bridgend – Sheet 262 (Solid and Drift) and selected historical borehole records obtained from the BGS for the surrounding area.

The BGS borehole records, presented in **Appendix C**, generally support the published geology. The borehole locations relative to the site are presented as Figure 2.

Based on the published information available, Table 4.1 presents a summary of the anticipated geology for the site. All strata thicknesses are based on the geological map unless stated.

TABLE 4.1 SUMMARY OF GEOLOGY

GEOLOGY	*NAME*	*GEOLOGICAL MAP DESCRIPTION / ANTICIPATED PRESENCE*	*THICKNESS (M)*
Made Ground	N/A	Not mapped, but anticipated in areas that have been previously developed. Most of the area however is greenfield and it is therefore not anticipated in these areas.	Up to 1.3m
Superficial	Alluvium (Quaternary)	Clay, silt, sand and gravel. Appears to be only present in proximity to watercourses in the area.	Not indicated
Solid	Porthkerry Member	Interbedded limestone and mudstone.	120m+ *

* Only 15 m proven in BGS historical borehole record SSNE54 and SS96NE51.

4.4.2 *Ground Stability Hazards*

According to the Envirocheck Report (see **Appendix D**), there are no ground stability hazards in relation to compressible shrinking or swelling clay and running sand ground stability, across the route. A very low hazard potential has been identified on site in relation to collapsible, ground dissolution and landslide ground stability.

4.4.3 *Mining and Mineral Extraction*

According to the Envirocheck Report (see **Appendix D**), the site is not within an area affected by coal mining. There is no hazard listed in relation to the non-coal mining related mined areas of Great Britain.

There are a number of historical open cast limestone quarries along the proposed route which have now ceased operation. Within 250m of the proposed route they are located at Parwg, Boverton (40m to the south of the site at Ch. 420m) and Great Farm, Llanmaes (68m to the north of the site at Ch. 940m).

4.4.4 *Radon*

According to the Envirocheck Report (see **Appendix D**), the site is within a radon area as between 3% and 30% of homes are above the action level. As a result, it may be necessary to consider basic to full radon protective measures in the construction of new dwellings or extensions. It should be noted that no such works are proposed as part of the NAR development.

4.5 Hydrogeology

According to the Envirocheck Report (see **Appendix D**), the underlying bedrock across whole route is classified as a Secondary A Aquifer. This relates to the Porthkerry Member bedrock geology. The Environment Agency (EA) classifies Secondary A aquifers as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

There are no superficial deposits indicated along the proposed route. There are however alluvium deposits associated with surface water courses within 500m of the site, which are also designated as a Secondary A Aquifer.

The site is not in a groundwater source protection zone (SPZ) as defined by the EA and there are no SPZ limits identified within 1km.

The Envirocheck Report records two groundwater abstraction licenses within 1km of the site. Both water abstraction licenses are held by the Welsh Government at RAF St. Athan. There is one discharge consent to groundwater on site, and nine other discharge consents to groundwater listed within 1km of the site. The discharge consent on site is operated by Kelda Water Services and used for fire training at RAF St. Athan. The receiving water is a tributary of the Boverton Brook described as a freshwater stream/river. Discharge consents within 1km of the site have been held by Air Ministry Works (unspecified discharge), Kelda Water Services (trade effluent), De Smt (site drainage), and Dwr Cymru Cyfyngedig (sewage discharges).

4.6 Hydrology

Llanmaes Brook, which is classed as a primary river, crosses the proposed route running north to south at Ch. 480m, towards the western end of the route. At Ch. 1560m an un-named tertiary river runs north to south of the route, converging with Boverton Brook Ch. 1590m south of the route which then runs parallel to the route.

At the eastern extent of the proposed route, a spring is noted at Ch. 2200m flowing to the east, which becomes the Nant y Stepsau primary river at Ch. 2400m.

The site is noted as being at risk from flooding from surface waters according to the Envirocheck Report. A flood water storage area is indicated where the Llanmaes Brook crosses the route at Ch. 480m and classed as having a low risk (1000 year return) of extreme flooding without defences. Between Ch. 1500m and Ch. 1600m in the middle of the route a low risk of extreme flooding without defences is also noted. A low risk of flooding is also noted between Ch. 1700m and Ch. 2400m in the east of the proposed route.

There are four discharge consents to surface water listed within 1km of the site, of which two have expired and two were surrendered under EPR 2010.

There are fifteen recorded pollution incidents to controlled waters within 1km of the site, ten of which are located within 500 m. The nearest of these is located 146m south east of the site (Ch. 1180m)

and relates to a ‘Category 2 – Significant’ to waters. This occurred in 2011 and the pollutant is listed as ‘Organic Chemicals/Products: Surfactants and Detergents’.

4.7 Sensitive Sites

There are no Environmentally Sensitive Areas, Special Areas of Conservation, Special Protection Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones, National Parks, Areas of Outstanding Natural Beauty, Marine /National Nature Reserves, Forest Parks, Ramsar Sites, Sites of Special Scientific Interest (SSSI), Areas of Adopted Greenbelt or Areas of Unadopted Green Belt within 1km of the site.

5. REGULATED ACTIVITIES

5.1 Introduction

An Envirocheck Report was commissioned from the Landmark Information Group to provide environmental site sensitivity data, such as the various environmental permits, registered processes, groundwater abstractions, groundwater quality, river quality, known pollution incidents and landfill sites that may be on or in the vicinity of the site. The Envirocheck Report covers a 1km search radius around the boundary of the area enquired for and is produced by searching Landmark's database containing regulatory records and also outlines geological and hydrogeological information.

A copy of the report is provided in **Appendix D**. Only the key relevant features that characterise the site and surrounding area are summarised in this section, along with an indication of the risk to the land quality of the site.

Further information on discharge consents and abstractions to and from both groundwater and surface waters can be found in Section 2.

Generally, any regulated processes, registered radioactive substances, licensed waste management facilities and landfills, hazardous substances, fuel station entries and any other contemporary trade directory entries within 250m of the site could, depending upon the nature of their activities, represent potential off site sources of contamination. Whilst a 1km search area was generally adopted this section places emphasis on those activities present within 250m.

5.2 Regulated Processes

According to the Envirocheck Report, there are no permitted Local Authority Pollution Prevention and Controls (LAPPC) on site.

There are a further three LAAPC entries within between 250m and 1km of the site, one of which is permitted and two revoked.

There is one enforcement and prohibition notice 500m from the site (Ch. 2650m), two Integrated Pollution Controls (IPC) (one revoked) both 850m from the site (Ch. 2700m) and three Local Authority Pollution Prevention and Controls 270m (Ch. 2660m), 850m (CH. 2700m) and 950m (Ch. 2700m)from site.

There are no Integrated Pollution Prevention and Control (IPPC) or Local Authority Integrated Pollution Prevention and Control (LAIPPC) sites or Local Authority Pollution Prevention and Control Enforcements (LAPPCE) within 1km of the site. There are two Substantiated Pollution Incident Register entries 150m (Ch. 1190m) and 730m (Ch. 0m) from site and two Water Industry Act Referrals approximately 850m (Ch. 2700m) from site.

There are no Prosecutions Relating to Authorised Processes, Prosecutions Relating to Controlled Waters within 1km of the site.

5.3 Licensed Waste Management Facilities

There are two licensed waste management facilities entries within 250m of the site and one between 250m and 500m of the site all linked to St. Athan. Two licences have been surrendered/revoked and one modified. The modified entry is located 310m south from site (Ch.1830m).

5.4 Registered Radioactive Substances

According to the Envirocheck Report there are two Registered Radioactive Substances within 1km of the proposed route both located at St. Athan. One located 520m from Ch. 100m is for disposal of radioactive waste and the other located 858m east of Ch. 2700m has been superseded.

5.5 Hazardous Substances

According to the Envirocheck Report there are no Control of Major Accident Hazards Sites (COMAH), Explosive Sites, Notification of Installations Handling Hazardous Substances (NIHHS), Planning Hazardous Substance Consents or Planning Hazardous Substance Enforcements within 1km of the site.

5.6 Fuel Station Entries

There are no fuel station entries within 1km of the site.

5.7 Contemporary Trade Directory Entries

There are two active listings within 1 km of the site. Table 5.1 summarises listed companies that may have the potential to have caused contamination within a search radius of 250m of the site. There are no active listings within 250m of the site. Those inactive listings thought not to be covered by the historical review in Section 3 are noted below.

TABLE 5.1 POTENTIALLY CONTAMINATIVE CONTEMPORARY TRADE DIRECTORY ENTRIES ON AND WITHIN 250M OF THE PROPOSED ROUTE

LOCATION	*DESCRIPTION*
On Site	None
Off Site	Spick & Span: Cleaning Services – Domestic. Approximately 88m south west of the site (Ch. 110m).
	Independent Phoenix Trader: Greeting Card Publishers & Wholesalers. Approximately 112m south west of the site (Ch. 250m).
	Dustbusters Cleaning Services: Cleaning Services – Domestic. Approximately 218m south west of the site (Ch. 80m).

6. PREVIOUS GROUD INVESTIGATIONS

6.1 Introduction

There have been numerous investigations completed at the wider St Athan Airfield site.

- An Environmental Statement completed by Entec in 2009 detailed and summarised three environmental investigations completed by Enviros Aspinwall (2002), Parsons Brinkerhoff (PB) (2004) and WS Atkins (2005). AECOM has not seen these reports however the findings of the Entec report which relate to the proposed route are summarised in Section 6.2.1.
- WYG Environment completed site investigations at the Tremains Farm site, Picketston South West and North of West Camp in 2011. These reports are summarised in Section 6.2.2.
- Pell Frischman undertook a combined phase of geo-environmental and geotechnical site investigation to confirm the ground conditions at the site and to validate the previous works done by others across the St Athan site in 2010. This report is summarised in Section 6.2.3
- Capita Symonds also completed a site investigation in 2009 which is detailed in section 6.3.

A summary of intrusive locations detailed in these reports is presented in Table 6.1 and on Figure 2.

TABLE 6.1 SUMMARY OF INTRUSIVE LOCATIONS

Consultant	*Year*	*Area Assessed*	*Boreholes*	*Trial Pits*	*Window Samples*
Enviros Aspinwall*	2002	West Camp	31	6	53
		East Camp	41	0	34
		Picketston and Sale Field	8	37	34
		South and east of runway	20	44	66
Parsons	2004	West Camp	15	25	0

Brinkerhoff*		East Camp	22	0	21
		South of runway	3	30	0
		Picketston and Sale Field	1	0	0
WS Atkins*	2005	Runway	0	0	18
Pell Frischmann	2010	Castleton	-	4	-
		East Camp	12	96	8
		Picketston	5	69	13
WYG	2011	Tramains Farm	5	19	-
		Picketston South West	4	15	-
		North of West Camp	4	14	-

*(Information from Entec 2009)

6.2 Previous Geo-environmental Reports

6.2.1 *Entec 2009*

In May 2009 Entec prepared an environmental statement as part of an Environmental Impact Assessment (EIA) relating to the development across the St Athan site. Entec reviewed surveys conducted by Enviros Aspinwall (2002), Parsons Brinckerhoff (2004), WS Atkins (2005). It was reported that the geology comprised occasional thin superficial deposits and occasional Made Ground overlying interbedded limestones and mudstones of the Porthkerry Formation. The Lower Lias Porthkerry Formation extends down to approximately 85m below ground level (bgl) which overlies Folded Carboniferous Limestone. Soils were found to predominantly be coarse textured and classified as having a high leaching potential. The Environment Agency classified the Lower Lias formation as a minor aquifer and the Carboniferous Limestone as a major aquifer. Groundwater was encountered within the Porthkerry Formation between 0.3m and 3.0m bgl.

It was concluded from the soil analytical results that widespread soil contamination was not an issue across the site. However, the investigations found elevated concentrations of metals (including phytotoxic compounds) and sulphates in soils across East and West Camp (East Camp area adjacent to site extending approximately 1km south east of Ch. 2700m. West Camp area extends from c. 100m - >1000m south of the site Ch.1600m) as well as petroleum hydrocarbons across East Camp and around the former Bulk Fuel Installation in West Camp. Sulphate levels were also elevated and asbestos identified across the Beggars Pound waste burial area, the Batslays (approx. 1.2km south of the site Ch. 2100m) and the golf course (approx. 1.3km east of Ch. 2700m).

The principal findings from the Picketston area investigation (adjacent to proposed route's northern boundary Ch. 1500 – 2400m) was the presence of radiological contamination from the remnants of radium paint (used in luminised aircraft panels and instruments). In accordance with criteria and objectives agreed with National Resources Wales (NRW) (formerly EAW) surveys of this region have detected and removed shallow contamination. Additionally, locally elevated concentrations of metals, petroleum hydrocarbons and sulphate were identified across the area.

Entec concluded that the principal finding of both the 2002 and 2004 investigations was the presence of localised contamination in shallow groundwater in several locations associated with historical fuel handling and workshop activities. Petroleum hydrocarbons were identified adjacent to a number of buildings in both West and East Camp (PB 2004). Shallow groundwater remediation began in 2006 for petroleum hydrocarbons at the former BFI in West Camp, chlorinated solvents at the electroplating workshop (West Camp), petroleum hydrocarbons and chlorinated solvents at building 324 (East Camp) and petroleum hydrocarbons and PAHs at the aircraft hangar and fuel storage building at Batslays. Shallow groundwater remediation was carried out in accordance with the methods and objectives of NRW and was regarded as complete in the Entec report in 2009 with the

exception of the Batslays location. No adverse effects on groundwater quality were encountered in the deeper major aquifer.

The Entec report also noted that eight deep boreholes had been installed as potential emergency water supply boreholes between 1989 and 1992. Of these eight boreholes, two potentially reached the carboniferous limestone major aquifer. Six of the boreholes were sealed by 2006 with the remaining two wells were awaiting decision in 2009.

Entec reported that risks from potential unexploded ordnance were assessed by MoD and also by BAE Systems under contract to PB. Risks of finding explosive ordnance are considered by these reports to be generally low to low - moderate. The potential for discovery and detonation of ordnance is low.

6.2.2 *WYG Environmental 2011 Reports*

WYG produced three reports in 2011 which were made available to AECOM relating to the geo-environmental assessment of ground conditions for the Tramains Farm area, the Picketston South West area and North of West Camp (see Figure 2 for locations of these sites).

The WYG reports suggest that similar and uniform ground conditions have been encountered across the site, comprising generally thin Made Ground and sandy gravelly clay drift deposits overlying Lower Lias bedrock. Intrusive investigation locations for these reports are outlined in Table 6.1.

The report produced for the Tremains area did not identify any contaminants of concern with respect to human health in the shallow soils but it was noted that top soil and Made Ground in this region may be a potential source of leachable metals, PAHs and hydrocarbons that may pose a risk to controlled waters should they become mobilised.

With regards to the Picketston South West area, fluoranthene and a number of metals were identified as potential constituents of concern in the soil derived leachate samples. The risk to groundwater and local surface water bodies was considered to be low due to the lack of elevated levels of these determinants. It is also considered that the clay content of the underlying Porthkerry Formation will retard the migration of the contaminants.

The investigation at the site at North of the West Camp indicated elevated concentrations of a number of PAH species in samples taken from the shallow Made Ground in the southern area of the site above the residential screening values with regards human health. Phenol was identified in groundwater samples taken from one location also in the southern area.

Radiation levels were not detected above background levels for the surrounding area during the WYG investigations at any of the three sites.

All three reports discussed in this subsection categorise radon as a potentially significant risk at the site for new dwellings.

6.2.3 *Pell Frischmann 2010 Report*

The 2010 Pell Frischmann report details a geo-environmental and geotechnical site investigation to confirm the ground conditions at the site and to validate the previous works done by others across the St Athan site concentrating on the Picketston, East Camp and Castleton areas (see Figure 2 for locations of these sites).

The results of geochemical analysis undertaken by Pell Frischmann indicated that in the Picketston area, potential contaminants of concern in the Made Ground strata were Total Petroleum Hydrocarbons (TPH) and Perfluorooctane Sulfonate (PFOS). Polyaromatic Hydrocarbons (PAH) were also identified as a contaminant of concern in this area, as well as in the East Camp region. Geochemical results for the Castleton area did not indicate contamination concentrations in exceedance of human health criteria.

6.3 Ground Conditions

In 2009 Soil Mechanics was commissioned by Capita Symonds on behalf of Sodexo to carry out a site investigation at St Athan. The investigation obtained geotechnical and geoenvironmental

information for the proposed new Defence Technical College and associated infrastructure. A total of 22 trial pits, 2 boreholes and 3 windowless samples were completed as part of the ground investigation. The ground conditions generally comprised Made Ground underlain by the Blue Lias Formation. Made Ground was encountered along and in the vicinity of the existing Eglwys Brewis Road. The exploratory holes in the vicinity of the scheme encountered a maximum thickness of 0.6m of Made Ground. The thickness of the Blue Lias Formation was not proven. The top of the Blue Lias Formation was encountered between 0.3 to 0.6m bgl. The ground conditions encountered are summarised in Table 6.2.

TABLE 6.2 SUMMARY OF SITE-WIDE GROUND CONDITIONS

STRATA	*NAME*	*DESCRIPTION / PRESENCE*	*DEPTH RANGE TO TOP (m bgl)*	*PROVEN THICKNESS (m)*
Made Ground	N/A	Tarmacadam over grey brown silty sandy fine to coarse gravel of limestone with low cobble content. Cobbles are limestone (Sub-base).	Ground level	0.3 – 0.6
Natural Superficial	Porthkerry Member	Soft to firm dark brown slightly sandy slightly gravelly silty clay. Gravel is limestone.	Ground level	Not proven
		Strong to very strong light grey limestone recovered as fine to coarse gravel locally with >3mm of clay infill		
		Very strong locally strong light grey limestone locally with <2mm of clay infill		

7. CONCEPTUAL SITE MODEL

7.1 General

Current legislation relating to contaminated land in the UK is contained within Part IIA of the Environmental Protection Act 1990, which was inserted by Section 57 of the Environment Act 1995 and by Section 86 of the Water Act 2003. Further guidance in relation to Wales is presented in the Contaminated Land Statutory Guidance for Wales 2012.

The "suitable for use" approach is adopted for the assessment of contaminated land where remedial measures are only undertaken where unacceptable risks to human health or the environment are realised taking into account the use (or proposed use) of the land in question and the environmental setting.

Current best practice recommends that the determination of health hazards due to contaminated land is based on the principle of risk assessment, as outlined in Part IIA of the Environmental Protection Act 1990.

The risk assessment process for the environmental contaminants is based on a source-pathway-receptor analysis. These terms can be defined as follows:

Source: *Hazardous substance that has the potential to cause adverse impacts;*

Pathway: *Route whereby a hazardous substance may come into contact with the receptor: examples include ingestion of contaminated soil and leaching of contaminants from soil into watercourses;*

Receptor: *Target that may be affected by contamination: examples include human occupants/users of site, water resources (surface waters or groundwater), or structures.*

For a risk to be present, there must be a viable contaminant linkage; i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway.

The following sections detail the conceptual site model, which has been developed for the proposed route with a view to assessing the potential risks during construction and upon completion of the proposed new infrastructure. The potential sources of contamination, potential receptors and potential pollutant pathways are identified and presented in Sections 7.2 to 7.4 before being collated to form one overall CSM for the site. The associated contaminant linkages between these sources, pathways and receptors are presented in Table 7.1.

7.2 Sources of Potential Contamination

This section highlights those former/current on-site and off-site activities that have been identified as potential sources of contamination. These activities may have in turn impacted on soil, soil leachate, and groundwater. A buffer of 50m has been considered for potential off site sources as realistically it is these sites that pose the highest potential for any contamination to impact the development areas. Consideration has also selectively been given to potential sources within 250m, but only those deemed to be most significant (based on professional judgement) have been included.

Those sources with an asterisk (*) relate to classifications listed in the contemporary trade directory – it is possible that some of these entries correspond to some of those sources identified from historical mapping. Some of the activities listed are considered potential sources to both Areas 2 and 3 and as such are duplicated under each sub heading below.

7.2.1 *Site*

- **Made Ground** – possibly present as a feature of the historical stages of redevelopment at the site and containing contaminants including asbestos;
- **Roads** – fuel leakage from vehicles and run off;
- **Unexploded Ordnance** – potential for ordnance to be present due to the proximity to a military facility; and

- **Ground Gas** – The site is in a radon area as between 3% and 30% of homes are above the action level.

7.2.2 *Off Site*

- **Made Ground** – present off site as a feature of the historical stages of redevelopment of the MOD site;
- **Fuel Tanks** – of unknown contents related to the historical air field 100m north of Ch. 2100m**;**
- **Unexploded Ordnance** – potential for ordnance to be present due to the proximity to a military facility;
- **Radioactive Material** – radium has been identified in the Picketston area; and
- **Natural Strata** – previous ground investigations have identified elevated concentrations in the soils on adjacent sites.

The ground investigations previously completed at the site have identified soil contamination across the greater extent of St. Athan with remediation taken place in select locations. Additional sampling and testing would be required to the specific areas of proposed route to create a more detailed dataset.

7.3 Potential Pathways

The following sections provide a summary of the potential pathways by which the identified sources may come into contact with receptors that are considered most appropriate to the site in its developed condition.

7.3.1 *Soil Pathways*

The proposed redevelopment consists of constructing a new access road connecting the B4265, east of Llantwit Major, and MOD St. Athan.

The main way in which future site users, construction and maintenance workers may come into contact with potentially contaminated soils would be through exposure to areas of bare soil or soil dust during the construction period or future usage. Potential risks to construction and maintenance workers undertaking intrusive works should be managed by appropriate PPE, risk assessment and method statements. Waste management controls would also need to be considered to prevent soil dust generation. It may therefore be possible to dismiss at this stage risks to construction and maintenance workers excavating the ground. However, the creation of utility corridors may be considered for the safe installation and maintenance of services if there is a desire to protect future utility maintenance workers.

It is considered unlikely that future routine users would be impacted by contaminated soils as the roadway would be covered in hardstanding so no bare soil present and pedestrian access limited.

There is a direct contact pathway potential between chemically aggressive and/ or contaminated soil and buried concrete structures and plastic service pipes.

Therefore at this stage no soil pathways are considered to be applicable to the proposed route with respect to potentially contaminated soils, unless there is a requirement to protect future utility maintenance workers.

7.3.2 *Ground Gas Pathways*

Ground gases present at the site may have the potential to migrate via permeable strata (e.g. natural granular material) and service trench backfill and collect in confined spaces where they pose a potential risk from asphyxiation or, in the case of methane, explosion.

Whilst Made Ground represents a potential gas source, this is dependent on its extent and composition. Based on current information there is no evidence to suggest that a significant thickness of Made Ground is present on or adjacent to the site and so this is unlikely to represent a credible source of ground gas at the site.

There is the potential or Radon to issue from the underlying strata.

7.3.3 *Groundwater Pathways*

The contamination of groundwater (perched or otherwise) may occur as a result of on-site sources such as Made Ground and the flow of such water may provide a pathway transporting contaminants off site to nearby sensitive receptors.

Groundwater may also provide a pathway through which contaminants could be transported to surface water features. Llanmaes Brook crosses the proposed Northern Access Road approximately 500m south of Llanmaes (Ch. 480m) before it joins Boverton Brook (approximately 250m south of Northern Access Road Ch. 600m). Boverton Brook runs between the Northern Access Road and the Airfield site. Nant Y Stepsau runs adjacent to the eastern portion of the Northern Access Road (Ch. 2400m) into Eglwys-Brewis.

7.4 Potential Receptors

A number of potential receptors can be identified for the proposed route. These include:

- **Future Site Users** – Future/ current site users have a limited potential to encounter soil contamination due to the hard standing cover;
- **Construction/Maintenance/Ground Workers** – There is the potential for construction, maintenance or ground workers to come into contact with soils and groundwater during construction works for the proposed route. However, potential risks to construction workers undertaking intrusive works should be managed by appropriate PPE, risk assessment and method statements. Risks to construction workers excavating the ground were therefore not assessed, other than in the case of unexploded ordnance.
- **Adjacent Site Users** – The surrounding area includes a mixture of residential and military land use. There is limited potential for sensitive off-site receptors to be affected by wind-blown dust generated during the construction works and direct contact.
- **Controlled Waters** – Groundwater within the Porthkerry Formation is classified as Secondary A Aquifer. Surface waters including Llanmaes Brook which crosses the site (Ch. 480m) before joining Boverton Brook (approximately 250m south of Ch. 600m) and Nant-Stepsau that runs adjacent towards Eglwys-Brewis;
- **Road Infrastructure** – Concrete structures placed below ground may be degraded if elevated concentrations of sulphate and other aggressive conditions are present. Concrete cast in-situ may also be adversely affected by the presence of hydrocarbons. Plastic piped services can be adversely affected by the presence of hydrocarbons, where the integrity of the pipes can be compromised; and
- **Areas of Landscaping / Planting** – May be affected by the presence of elevated concentrations of phytotoxic determinands.

7.5 Potential Pollutant Linkages

The potential pollutant linkages and associated risks identified for the site in its proposed use as a mixed retail/leisure/residential development are summarised in Table 7.1.

TABLE 7.1 SUMMARY OF POTENTIAL POLLUTANT LINKAGES

SOURCE	*PATHWAY*	*RECEPTOR*
Inorganic and organic contamination within the Made Ground/soils (including asbestos fibres and elevated sulphates)	Direct contact with soils/dusts Wind-blown dust Inhalation	Road infrastructure Adjacent site users Piped services Areas of landscaping/planting
Generated leachate from contamination within Made	Leaching into groundwater Groundwater migration	Road infrastructure Controlled waters

SOURCE	*PATHWAY*	*RECEPTOR*
Ground	Direct contact	Adjacent site users
Contaminants in groundwater (perched or otherwise)	Groundwater migration Direct contact	Road infrastructure Adjacent site users Controlled waters Areas of landscaping/planting
Unexploded Ordnance	Direct contact	Road infrastructure Site workers
Radioactive materials	Direct contact	Road infrastructure

8. ENVIRONMENTAL RISK ASSESSMENT FRAMEWORK

8.1 Risk Assessment Principles

Current best practice recommends that the determination of hazards due to contaminated land is based on the principle of risk assessment, as outlined in Part IIA of the Environmental Protection Act 1990.

For a risk to be present, there must be a viable contaminant linkage; i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway. The potential contaminant linkages that have been identified for this site are presented in Section 7.

Assessments of risks associated with each of these contaminant linkages are discussed in the following sections.

Using criteria broadly based on those presented in Section 6.3 of the CIRIA Report "Contaminated Land Risk Assessment: A Guide to Good Practice" (CIRIA Report C552) the magnitude of the risk associated with potential contamination at the site has been assessed.

To do this an estimate is made of:

- the potential severity of the risk;
- the likelihood of the risk occurring.

The severity of the risk is classified according to the criteria in Table 8.1.

TABLE 8.1 SEVERITY OF RISK

SEVERITY	*Examples*
High	Acute risks to human health likely to result in "significant harm" (e.g. very high concentrations of contaminants/ground gases). Catastrophic damage to buildings/property (e.g. by explosion, sites with high gassing potential, extensive VOC contamination). Major pollution of controlled waters (e.g. surface watercourses or principal aquifers/source protection zones) Short term risk to a particular ecosystem.
Medium	Chronic (long-term) risk to human health likely to result in "significant harm" (e.g. elevated concentration of contaminants/ground gases). Pollution of sensitive controlled waters (e.g. surface watercourses or principal/secondary A aquifers). Significant effects on sensitive ecosystems or species.
Mild	Pollution of non-sensitive waters (e.g. smaller surface watercourses or secondary B aquifers or unproductive strata). Significant damage to crops, buildings, structures or services (e.g. by explosion, sites with medium gassing potential, elevated concentrations of contaminants).
Minor	Non-permanent human health effects (requirement for protective equipment during site works to mitigate health effects). Damage to non-sensitive ecosystems or species. Minor (easily repairable) damage to buildings, structures or services (e.g. by explosion, sites with low gassing potential).

The probability of the risk occurring is classified according to the criteria in Table 8.2.

TABLE 8.2 PROBABILITY OF RISK OCCURRENCE

LIKELIHOOD	*Description*
High	Pollutant linkage may be present that appears very likely in the short-term and risk is almost certain to occur in the long term, or there is evidence of harm to the receptor.
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term.

LIKELIHOOD	Description
Low	Pollutant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.

An overall evaluation of the level of risk is gained from a comparison of the severity and probability, as shown in Table 8.3.

TABLE 8.3 RISK BASED ON COMPARISON OF PROBABILITY AND SEVERITY

		SEVERITY			
		High	Medium	Mild	Minor
PROBABILITY	High	Very High	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low	Moderate	Moderate/Low	Low	Very Low
	Unlikely	Moderate/Low	Low	Very Low	Very Low

8.2 Preliminary Risk Evaluation

In accordance with the risk assessment principles outlined in Section 8.1, a preliminary evaluation of the potential risks associated with the identified sources at the site to the various potential receptors is discussed and presented in this section (Table 8.4). The level of risk is determined based on the current condition of the site (i.e. the effects of mitigation measures are not included). Mitigation is then proposed based on the significance of the risk. In some cases a degree of mitigation is assumed as part of legislative requirements or standard construction practice. This is acknowledged where these assumptions are made.

TABLE 8.4 PRELIMINARY RISK EVALUATION

RECEPTOR	*POTENTIAL CONTAMINANT LINKAGE*	*SEVERITY (Table 8.1)*	*LIKELIHOOD (Table 8.2)*	*RISK (Table 8.3)*	*MITIGATION / ADDITIONAL COMMENT*
Off-Site Receptors	Inhalation and direct contact of wind-blown contaminated soil derived dusts generated from the site	Minor	Low	Very Low	Measures to control the generation of soil derived dust should be outlined in the Construction Environmental Management Plan.
Controlled Waters	Impact to groundwater within the Porthkerry Formation	Minor	Low	Very Low	Preliminary risk assessment based on available data. Petroleum hydrocarbons have previously been detected in groundwater however these areas have undergone remediation works.
	Migration of contaminated groundwater and impact to surface water features (Llanmaes Brook, Boverton Brook, Nant-Stepsau)	Minor	Low	Very Low	
Road Infrastructure	Direct contact with contaminants within Made Ground / soils, leachate and groundwater, unexploded ordnance, sulphates and radioactive materials	Mild	Low	Low	From the available data, the potential risks to the road infrastructure are considered to be low. Whilst previous ground investigation information suggests a low potential for contamination and radioactive material, this cannot be concluded fully at this stage due to the limited available data to assess the potential risk. There is also currently limited information available regarding the status of any unexploded ordnance at the site.
Areas of Landscaping/ Planting	Direct contact with contaminants within Made Ground / soils, leachate and groundwater	Mild	Low	Low	Whilst previous ground investigation information suggests a low potential for contamination, this cannot be concluded fully at this stage due to the limited available data to assess the potential risk.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 General

This report has been presented as the first stage of the investigation process and has been prepared with a view to characterising the potential ground conditions and hazards, including the potential for contaminated land. This report has been prepared to meet the initial requirements of the Local Authority and is intended to support the planning application.

The proposed scheme involves the development of a new Northern Access Road (NAR) linking the B4265 to the Aerospace Business Park. The scheme is located in St. Athan, South Wales approximately 6.3km west of Cardiff airport. It is accessed from the B4265 via Eglwys-Brewis Road.

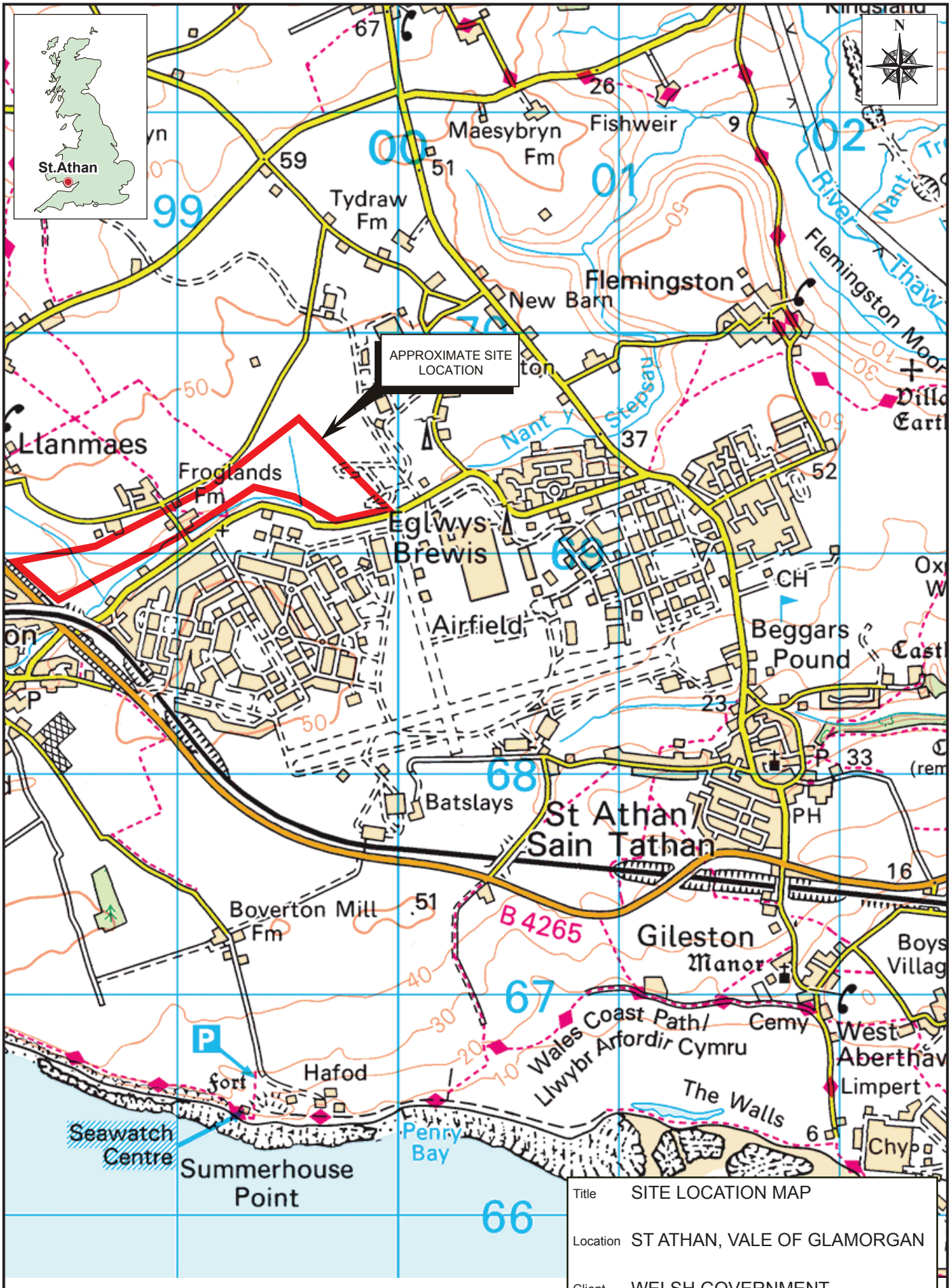
The assessment completed has identified a generally very low risk from contamination, within the context of the proposed development. Previous investigations, discussed in this document, have discovered localised contamination to both soil and groundwater across off site areas to the north and the south. However, there is a very low potential for significant organic soil contamination to be present on site and the areas of identified petroleum hydrocarbon contamination in groundwater have undergone remediation. There has been a low risk identified from the presence of unexploded ordnance as there is currently no available data related to this potential contamination source.

9.2 Recommendations

Additional intrusive investigation of the proposed route is recommended to verify the findings of the Preliminary Risk Evaluation and obtain classification of soil quality for soil management.

Whilst previous ground investigation information suggests a low potential for contamination and radioactive material from the Picketston area investigation (adjacent to proposed route's northern boundary Ch. 1500 – 2400m), this cannot be concluded fully at this stage due to the limited available data to assess the potential risk. There is also currently limited information available regarding the status of any unexploded ordnance at the site.

FIGURES



Title	SITE LOCATION MAP
Location	ST ATHAN, VALE OF GLAMORGAN
Client	WELSH GOVERNMENT

App'd:	Drawn:	Date:
JL	LCS	SEPT 2016
Status: DRAFT		Ref: JL/CDF/LCS/BRIS
Scale: AS SHOWN		Job No: 60509148
Drg. Size: A4		**FIGURE 1**

AECOM

APPROXIMATE SCALE
0 0.5 1km 1.5 2km

DO NOT SCALE

KEY

Borehole Depth

- 0 - 10m
- 10 - 30m

REV	DESCRIPTION	DRAWN	APPROVED	DATE

STATUS

DRAFT

CONSULTING ENGINEERS

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1 Callaghan Square, Cardiff CF10 5BT
TEL 029 2067 4600.

CLIENT
WELSH GOVERNMENT

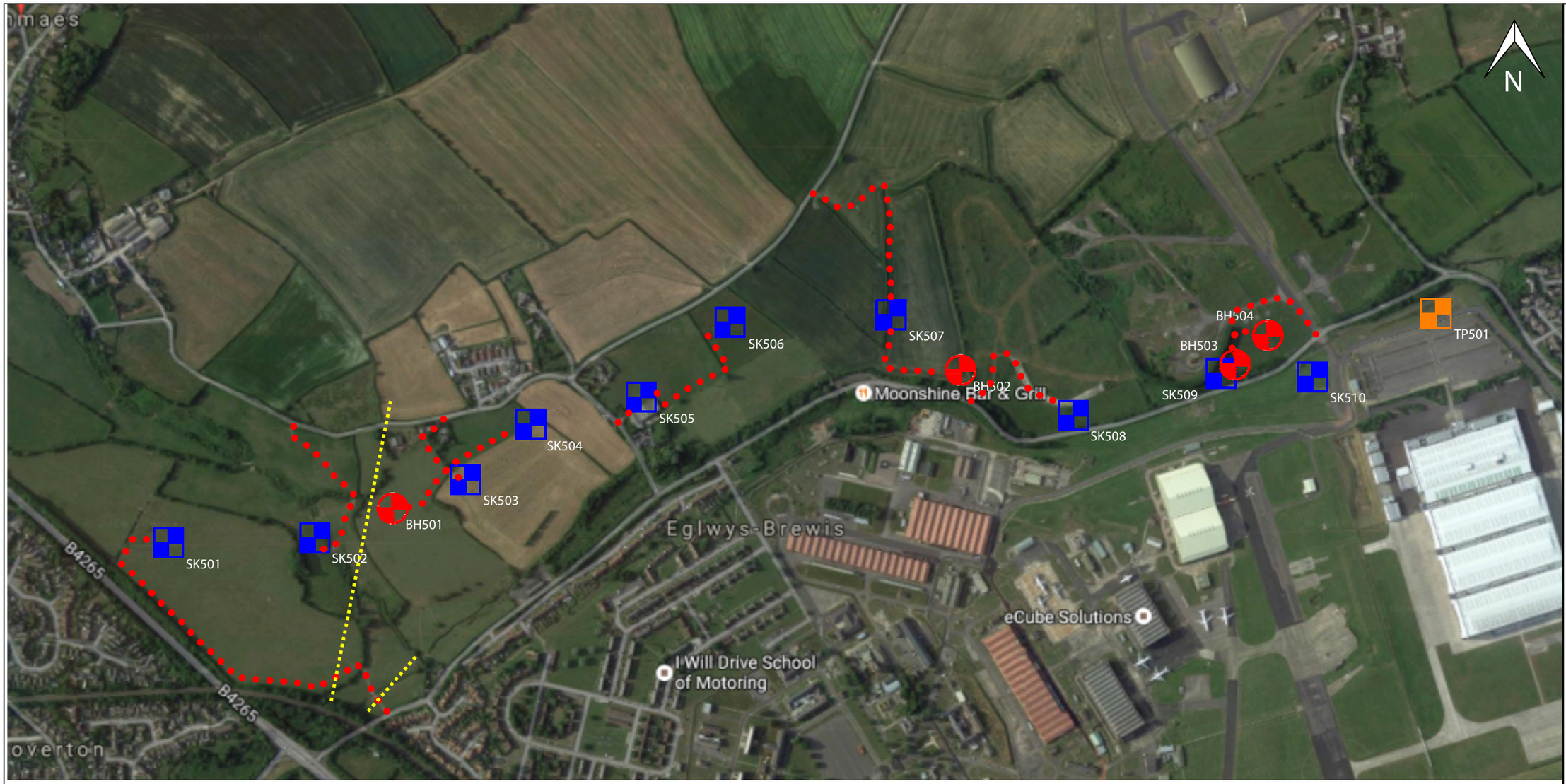
PROJECT
ST ATHAN, VALE OF GLAMORGAN

DRAWING TITLE
Borehole Location Plan
Figure 2

DRAWN	DESIGNED	CHECKED	APPROVED	DATE
LCS	JL	JL	JL	AUG 2016

SCALE	DRG No.	REV.
AS SHOWN	60509148/FIGURE 2	

ORIGINAL DRAWING A3



Notes

This drawing should be read in conjunction with the Ground Investigation specification, drawings and Pre-Construction Information.
The ground investigation locations shown on this drawing are indicative only and should be confirmed on site with the supervising engineer.
The access routes shown on this drawing are indicative only and should be confirmed on site by the Contractor prior to the start of works.

Key

- Trial Pit
- Borehole
- Access Route
- Overhead Power Line

Ref.	Location
SK501	Plot 17 Boverton Court Farm
SK502	Plot 16 Tremains Farm
BH501	Plot 14 Millands Farm
SK503	Plot 14 Millands Farm
SK504	Plot 14 Millands Farm
SK505	Plot 12 Froglands Farm
SK506	Plot 12 Froglands Farm
SK507	Plots 6&9 Great House Farm
BH502	Plots 6&9 Great House Farm
SK508	Plots 6&9 Great House Farm
SK509	Former MoD Site
BH503	Former MoD Site
BH504	Former MoD Site
SK510	Former MoD Site
TP501	Former MoD Site

CONSULTING ENGINEERS

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CLIENT
WELSH GOVERNMENT

PROJECT
ST ATHAN, VALE OF GLAMORGAN

DRAWING TITLE
Plot Locations –
Figure 3

DRAWN		CHECKED	APPROVED	DATE
AM		AV	AV	DEC 2016

SCALE	DRG No.	REV.
As Shown	60509148	

APPENDIX A – LANDMARK ENVIROCHECK HISTORICAL MAPS

APPENDIX B – SITE INSPECTION PHOTOGRAPHS

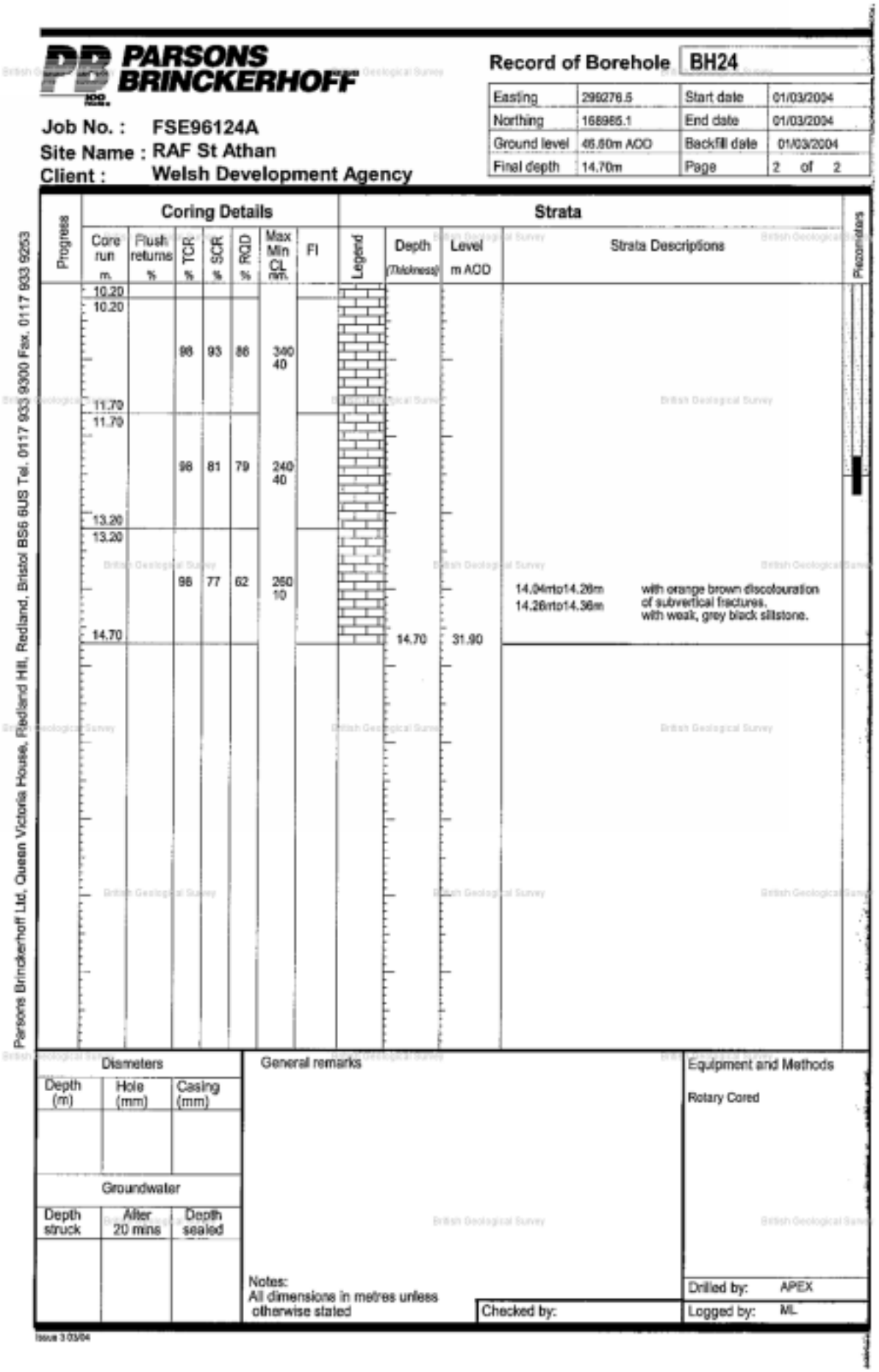
Photos 1 and 2 Llanmaes Brook looking South (photo 1) and west showing embankment along the brook (photo 2)

Photos 3 and 4 Millands Caravan Park approx. 30m south of and field in the vicinity of Ch. 900m

Photos 5 and 6 Proposed location of road alignment (Ch.1550m)

Photos 7 and 8 Eglwys Brewis Road in vicinity of proposed tie-in. St. Athan MOD base is located south of fence.

APPENDIX C – SUMMARY OF BGS BOREHOLE RECORDS



PARSONS BRINCKERHOFF

Record of Borehole BH24

Easting	299276.5	Start date	01/03/2004
Northing	168985.1	End date	01/03/2004
Ground level	46.60m AOD	Backfill date	01/03/2004
Final depth	14.70m	Page	2 of 2

Job No. : FSE96124A
Site Name : RAF St Athan
Client : Welsh Development Agency

Parsons Brinckerhoff Ltd, Queen Victoria House, Redland Hill, Redland, Bristol BS6 6US Tel. 0117 933 9300 Fax. 0117 933 9253

Coring Details								Strata				
Progress	Core run m	Flush returns %	TCR %	SCR %	RQD %	Max Min CL mm	FI	Legend	Depth (Thickness)	Level m AOD	Strata Descriptions	Piezometers
	10.20											
	10.20		98	93	86	340 40						
	11.70											
	11.70		98	81	79	240 40						
	13.20											
	13.20		98	77	62	260 10					14.04mto14.26m with orange brown discolouration of subvertical fractures. 14.26mto14.36m with weak, grey black siltstone.	
	14.70								14.70	31.90		

Diameters		
Depth (m)	Hole (mm)	Casing (mm)

Groundwater		
Depth struck	After 20 mins	Depth sealed

General remarks

Notes:
All dimensions in metres unless otherwise stated

Checked by:

Equipment and Methods
Rotary Cored

Drilled by: APEX
Logged by: ML

Issue 3 03/04

Parsons Brinckerhoff Ltd, Queen Victoria House, Redland Hill, Redland, Bristol BS6 6US Tel. 0117 933 9300 Fax. 0117 933 9253

PB PARSONS BRINCKERHOFF

Record of Borehole BH24

Easting	299276.5	Start date	01/03/2004
Northing	168985.1	End date	01/03/2004
Ground level	46.69m AOD	Backfill date	01/03/2004
Final depth	14.70m	Page	1 of 2

Job No. : FSE96124A
Site Name : RAF St Athan
Client : Welsh Development Agency

Coring Details								Strata				
Progress	Core run m.	Flush returns %	TCR %	SCR %	RQD %	Max Min CL mm.	FI	Legend	Depth (Thickness)	Level m AOD	Strata Descriptions	Piezometers
									(1.20)		CLAY. (Drillers description).	
	1.20								1.20	45.40		
	2.70		80	31	25	80 NI					Slightly weathered, moderately strong to strong, grey blue, fine to medium grained LIMESTONE. Subhorizontal, very closely to closely and occasionally medium spaced, stepped and undulating, rough, open with slightly sandy silty infill (<3mm).	
	2.70										1.67m to1.79m with orange brown, slightly sandy, clayey gravel. Gravel is medium to coarse, angular to subangular of limestone.	
	4.20		90	57	51	200 10					1.89m to1.99m with orange brown, slightly sandy clay.	
	4.20										3.80m to4.19m with soft to firm, orange brown, slightly sandy, gravelly clay. Gravel is medium angular to subangular of limestone.	
	5.20		98	71	68	290 30						
	5.20										6.03m to6.16m orange brown discolouration of subvertical fractures.	
	7.20		96	84	79	300 20					6.17m to6.22m with weak, light brown, siltstone.	
	7.20								(13.50)			
	8.70		98	84	78	40 35					8.40m to8.46m with grey black, slightly sandy, silty gravel. Gravel is angular to subangular medium of limestone.	
	8.70		93	83	71	420 45					9.73m to10.18m with highly weathered, weak, grey black, siltstone.	

Diameters		
Depth (m)	Hole (mm)	Casing (mm)

Groundwater		
Depth struck	After 20 mins	Depth sealed

General remarks

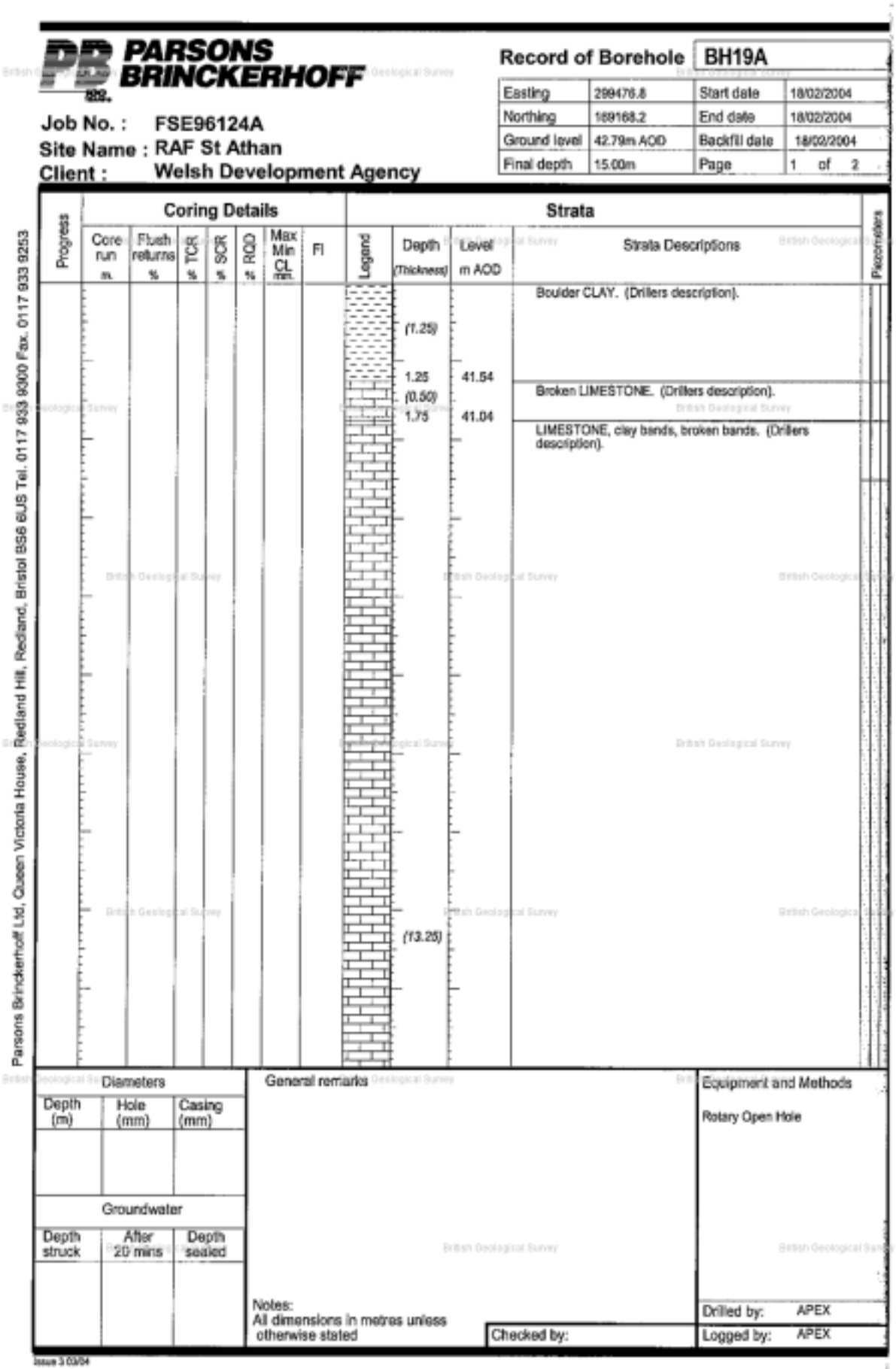
Notes:
All dimensions in metres unless otherwise stated

Checked by:

Equipment and Methods
Rotary Cored

Drilled by: APEX
Logged by: ML

Issue 3 03/04



PB PARSONS BRINCKERHOFF

Record of Borehole BH19A

Easting	299476.8	Start date	18/02/2004
Northing	169168.2	End date	18/02/2004
Ground level	42.79m AOD	Backfill date	18/02/2004
Final depth	15.00m	Page	1 of 2

Job No. : FSE96124A
Site Name : RAF St Athan
Client : Welsh Development Agency

Coring Details: Progress; Core run m; Flush returns %; TCR %; SCR %; RQD %; Max Min CL mm; FI

Strata: Legend; Depth (Thickness); Level m AOD; Strata Descriptions; Piezometers

Depth (Thickness)	Level m AOD	Strata Descriptions
(1.25)		Boulder CLAY. (Drillers description).
1.25	41.54	
(0.50)		Broken LIMESTONE. (Drillers description).
1.75	41.04	
(13.25)		LIMESTONE, clay bands, broken bands. (Drillers description).

Diameters

Depth (m)	Hole (mm)	Casing (mm)

Groundwater

Depth struck	After 20 mins	Depth sealed

General remarks

Notes:
All dimensions in metres unless otherwise stated

Checked by:

Equipment and Methods
Rotary Open Hole

Drilled by: APEX
Logged by: APEX

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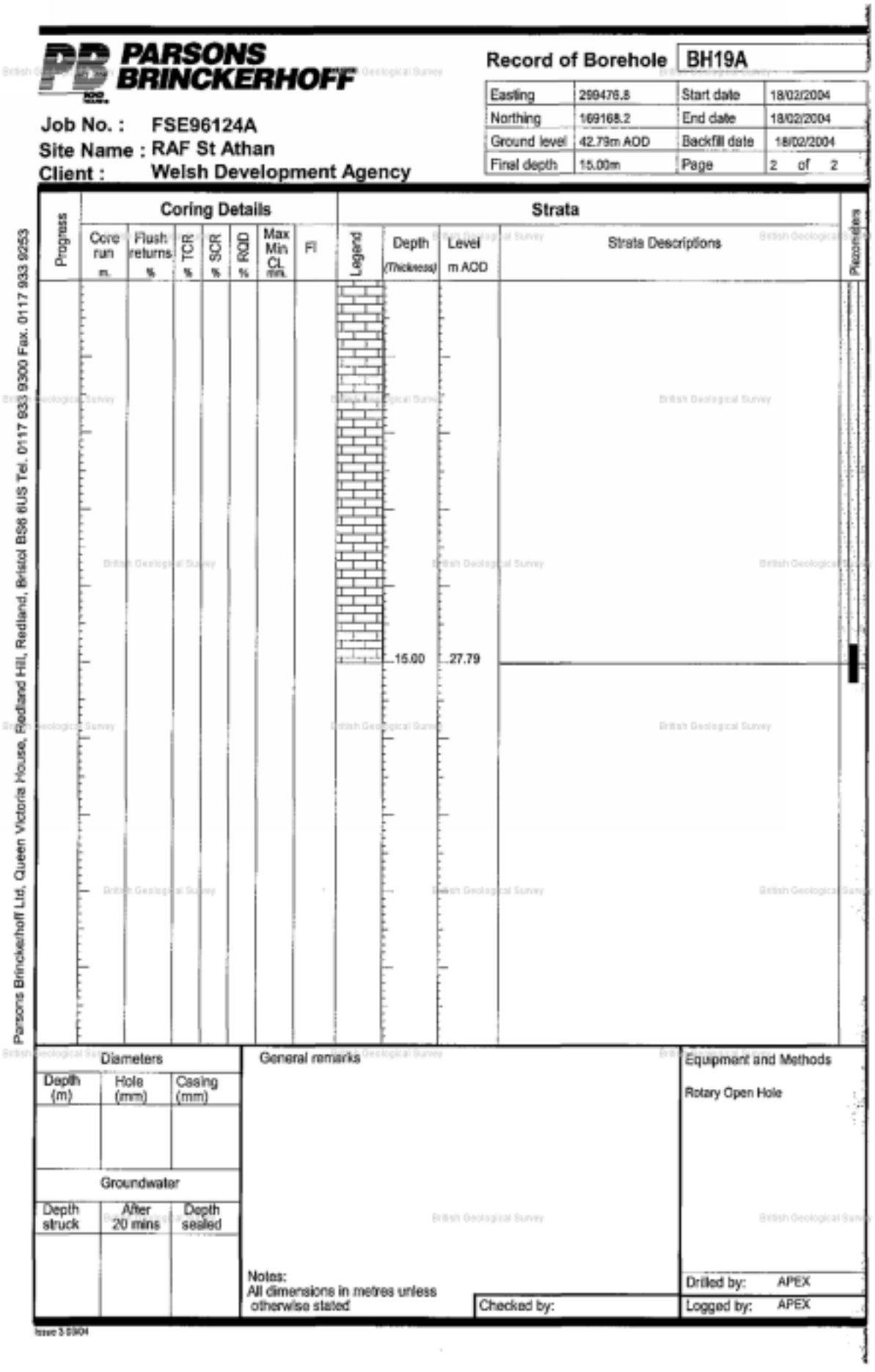

PARSONS BRINCKERHOFF

Record of Borehole BH19A

Easting	299476.8	Start date	18/02/2004
Northing	169168.2	End date	18/02/2004
Ground level	42.79m AOD	Backfill date	18/02/2004
Final depth	15.00m	Page	2 of 2

Job No. : FSE96124A
Site Name : RAF St Athan
Client : Welsh Development Agency

Coring Details: Progress; Core run m.; Flush returns %; TCR %; SCR %; RQD %; Max Min CL mm.; FI

Strata: Legend; Depth (Thickness); Level m AOD; Strata Descriptions

15.00 27.79

Piezometers

Diameters

Depth (m)	Hole (mm)	Casing (mm)

Groundwater

Depth struck	After 20 mins	Depth sealed

General remarks

Notes:
All dimensions in metres unless otherwise stated

Checked by:

Equipment and Methods
Rotary Open Hole

Drilled by: APEX
Logged by: APEX

Issue 3 03/04

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PARSONS BRINCKERHOFF

Record of Borehole BH19

Easting	299510.3	Start date	16/02/2004
Northing	169111.9	End date	16/02/2004
Ground level	43.66m AOD	Backfill date	16/02/2004
Final depth	13.50m	Page	1 of 2

Job No. : FSE96124A
Site Name : RAF St Athan
Client : Welsh Development Agency

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Coring Details								Strata				
Progress	Core run m	Flush returns %	TCR %	SCR %	RQD %	Max Min CL mm	FI	Legend	Depth (Thickness)	Level m AOD	Strata Descriptions	Piezometers
									(1.20)		CLAY. (Drillers description).	
									1.20	42.46		
									(0.30)		BOULDER. (Drillers description).	
									1.50	42.16	LIMESTONE and clay bands. (Drillers description).	
									(4.00)			
									5.50	38.16	CLAY. (Drillers description).	
									(1.00)			
									6.50	37.16	LIMESTONE. (Drillers description).	
									(0.60)			
									7.10	36.56	LIMESTONE and clay bands. (Drillers description).	
									(1.00)			
									8.10	35.56	LIMESTONE. (Drillers description).	
									(3.10)			

Diameters

Depth (m)	Hole (mm)	Casing (mm)

Groundwater

Depth struck	After 20 mins	Depth sealed

General remarks

Notes:
All dimensions in metres unless otherwise stated

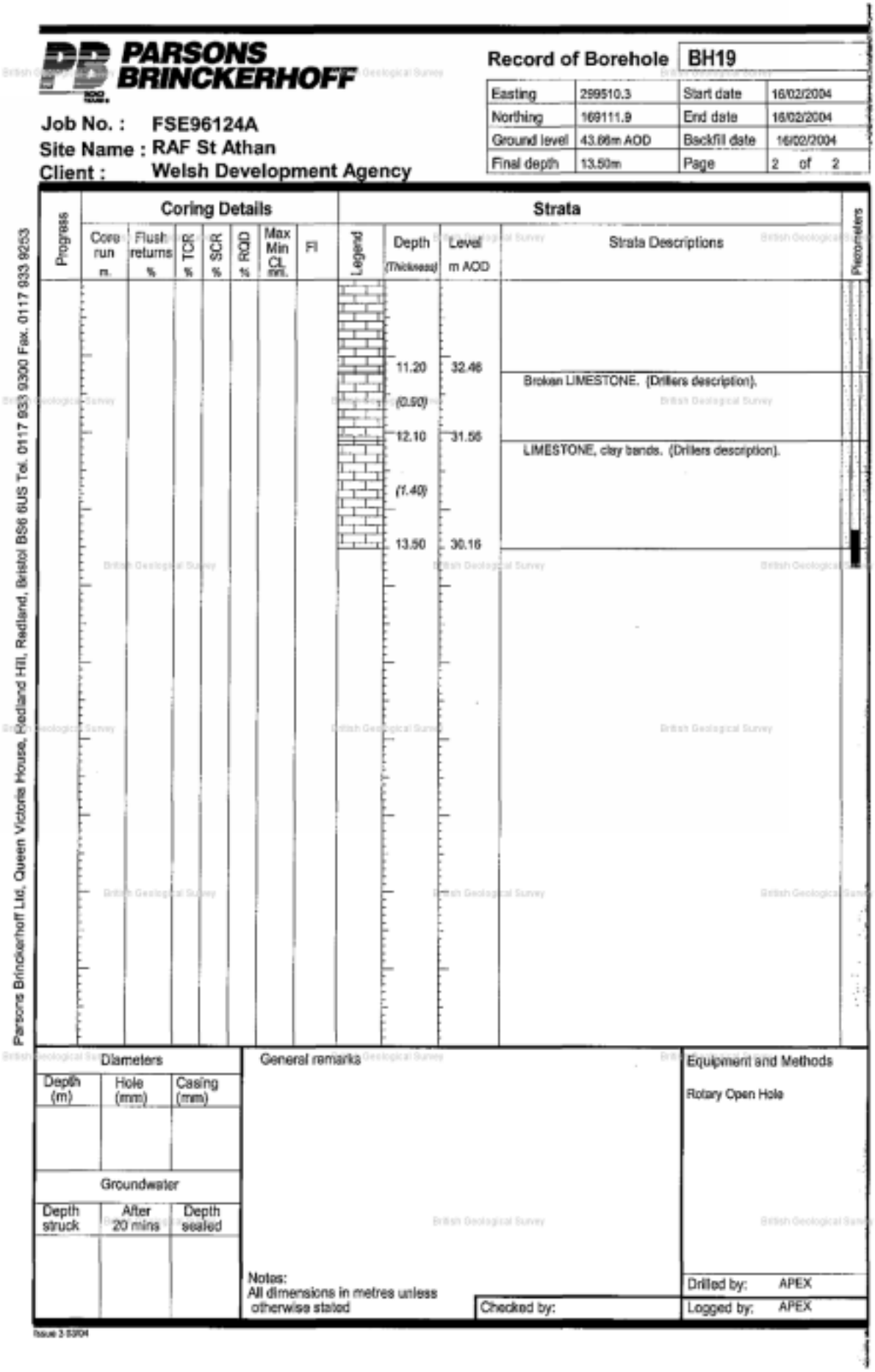
Checked by:

Equipment and Methods

Rotary Open Hole

Drilled by: APEX
Logged by: APEX

Issue 3 03/04



PARSONS BRINCKERHOFF

Record of Borehole BH19

Easting	299510.3	Start date	16/02/2004
Northing	169111.9	End date	16/02/2004
Ground level	43.66m AOD	Backfill date	16/02/2004
Final depth	13.50m	Page	2 of 2

Job No. : FSE96124A
Site Name : RAF St Athan
Client : Welsh Development Agency

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Coring Details: Progress; Core run m.; Flush returns %; TCR %; SCR %; RQD %; Max Min Cl. mm.; FI

Strata: Legend; Depth (Thickness); Level m AOD; Strata Descriptions; Piezometers

Depth (Thickness)	Level m AOD	Strata Descriptions
11.20	32.46	
(0.90)		Broken LIMESTONE. (Drillers description).
12.10	31.56	
(1.40)		LIMESTONE, clay bands. (Drillers description).
13.50	30.16	

Diameters

Depth (m)	Hole (mm)	Casing (mm)

Groundwater

Depth struck	After 20 mins	Depth sealed

General remarks

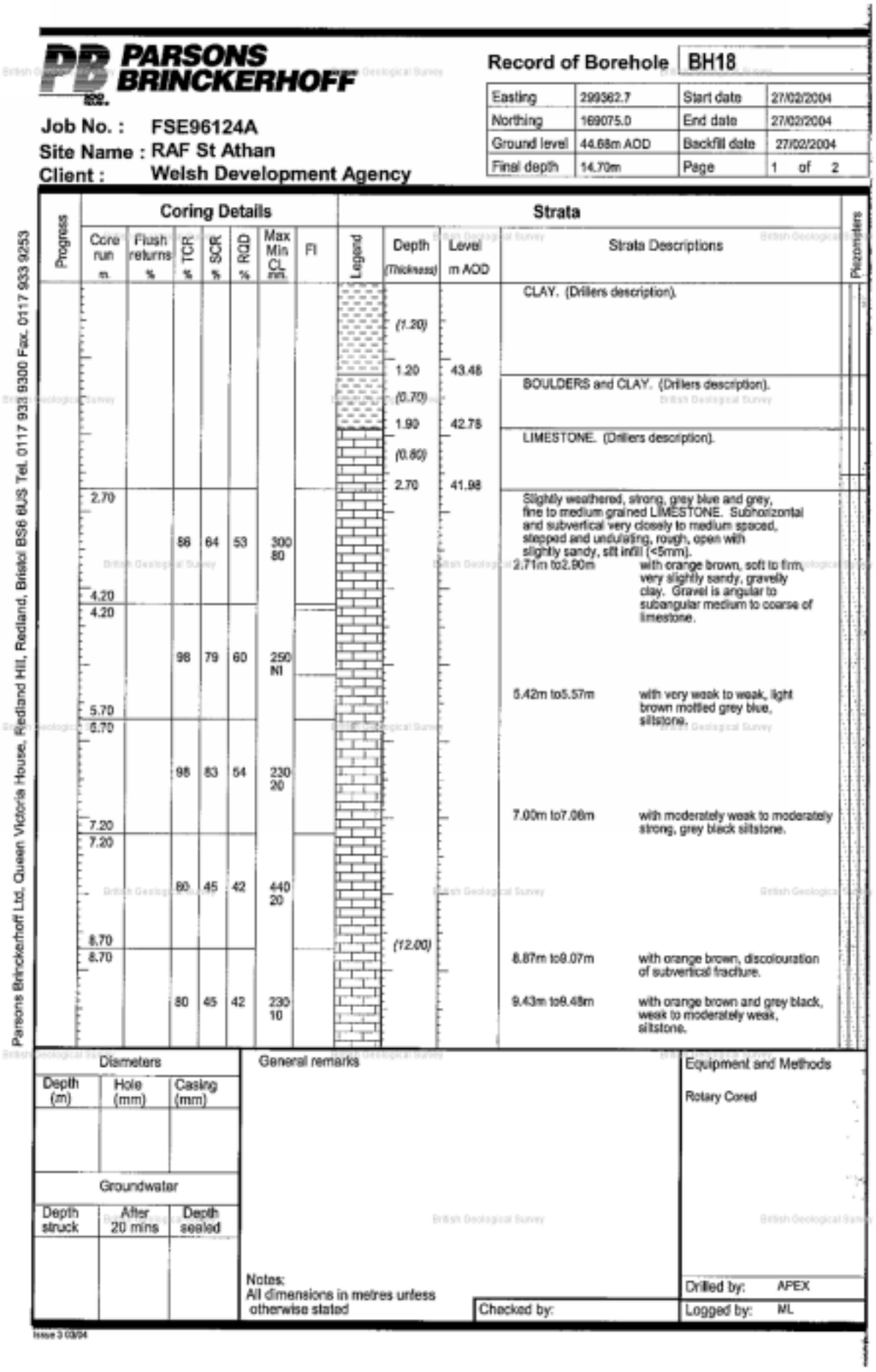
Notes:
All dimensions in metres unless otherwise stated

Checked by:

Equipment and Methods
Rotary Open Hole

Drilled by: APEX
Logged by: APEX

Issue 3 03/04



PARSONS BRINCKERHOFF

Record of Borehole BH18

Easting	299362.7	Start date	27/02/2004
Northing	169075.0	End date	27/02/2004
Ground level	44.68m AOD	Backfill date	27/02/2004
Final depth	14.70m	Page	1 of 2

Job No. : FSE96124A
Site Name : RAF St Athan
Client : Welsh Development Agency

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Coring Details								Strata				
Progress	Core run m	Flush returns %	TCR %	SCR %	RQD %	Max Min CL mm	FI	Legend	Depth (Thickness)	Level m AOD	Strata Descriptions	Piezometers
									(1.20)		CLAY. (Drillers description).	
									1.20	43.48		
									(0.70)		BOULDERS and CLAY. (Drillers description).	
									1.90	42.78		
									(0.80)		LIMESTONE. (Drillers description).	
	2.70								2.70	41.98		
	4.20		86	64	53	300 80					Slightly weathered, strong, grey blue and grey, fine to medium grained LIMESTONE. Subhorizontal and subvertical very closely to medium spaced, stepped and undulating, rough, open with slightly sandy, silt infill (<5mm).	
	4.20										2.71m to2.90m with orange brown, soft to firm, very slightly sandy, gravelly clay. Gravel is angular to subangular medium to coarse of limestone.	
	5.70		98	79	60	250 N1						
	6.70										5.42m to5.57m with very weak to weak, light brown mottled grey blue, siltstone.	
	7.20		98	83	54	230 20					7.00m to7.06m with moderately weak to moderately strong, grey black siltstone.	
	7.20											
	8.70		80	45	42	440 20			(12.00)		8.87m to8.07m with orange brown, discolouration of subvertical fracture.	
	8.70		80	45	42	230 10					9.43m to9.48m with orange brown and grey black, weak to moderately weak, siltstone.	

Dismeters		
Depth (m)	Hole (mm)	Casing (mm)

Groundwater		
Depth struck	After 20 mins	Depth sealed

General remarks

Notes:
All dimensions in metres unless otherwise stated

Checked by:

Equipment and Methods
Rotary Cored

Drilled by: APEX
Logged by: ML

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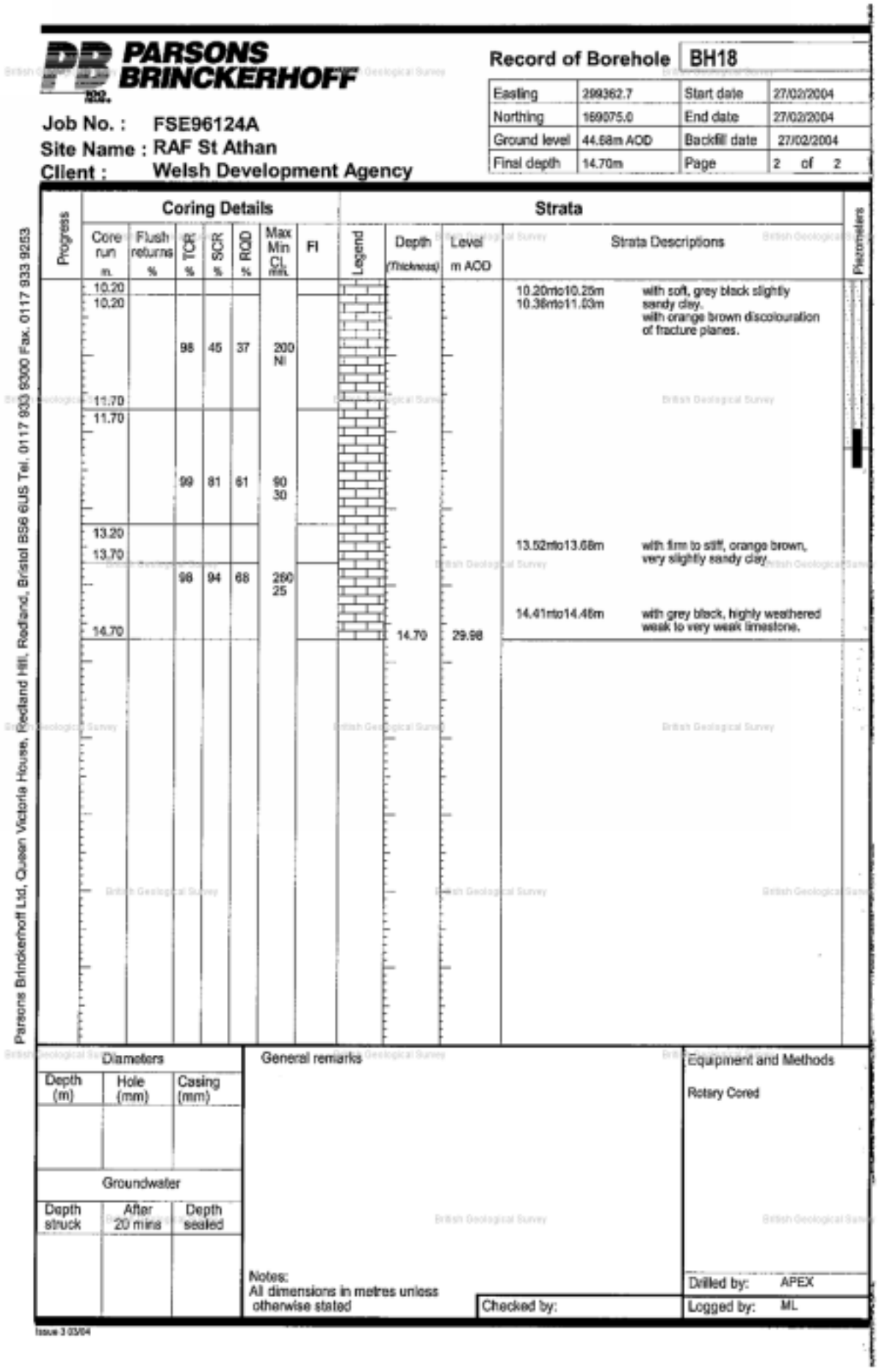

PARSONS BRINCKERHOFF

Record of Borehole BH18

Easting	299362.7	Start date	27/02/2004
Northing	169375.0	End date	27/02/2004
Ground level	44.68m AOD	Backfill date	27/02/2004
Final depth	14.70m	Page	2 of 2

Job No. : FSE96124A
Site Name : RAF St Athan
Client : Welsh Development Agency

Coring Details

Progress	Core run m.	Flush returns %	TCR %	SCR %	RQD %	Max Min Cl. mm.	FI
	10.20						
	10.20		98	45	37	200 NI	
	11.70						
	11.70		99	81	61	90 30	
	13.20						
	13.70		98	94	68	260 25	
	14.70						

Strata

Legend	Depth (Thickness)	Level m AOD	Strata Descriptions
			10.20mto10.25m with soft, grey black slightly sandy clay. 10.38mto11.03m with orange brown discolouration of fracture planes.
			13.52mto13.68m with firm to stiff, orange brown, very slightly sandy clay.
	14.70	29.98	14.41mto14.46m with grey black, highly weathered weak to very weak limestone.

Piezometers

Diameters

Depth (m)	Hole (mm)	Casing (mm)

Groundwater

Depth struck	After 20 mins	Depth sealed

General remarks

Equipment and Methods
Rotary Cored

Notes:
All dimensions in metres unless otherwise stated

Checked by:

Drilled by: APEX
Logged by: ML

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Record of Borehole BH17

Easting	299337.0	Start date	17/02/2004
Northing	169165.0	End date	17/02/2004
Ground level	42.22m AOD	Backfill date	17/02/2004
Final depth	15.00m	Page	1 of 2

Job No. : FSE96124A
Site Name : RAF St Athan
Client : Welsh Development Agency

Coring Details								Strata				
Progress	Core run m.	Flush returns %	TCR %	SCR %	RQD %	Max Min CL mm.	FI	Legend	Depth (Thickness)	Level m AOD	Strata Descriptions	Piezometers
									(1.30)			
									1.30	40.92	Boulder CLAY. (Drillers description).	
									(0.40)			
									1.70	40.52	Broken LIMESTONE, clay bands. (Drillers description).	
									(3.10)			
									4.80	37.42	LIMESTONE, broken bands, clay bands.	
									(10.20)			

Diameters		
Depth (m)	Hole (mm)	Casing (mm)

Groundwater		
Depth struck	After 20 mins	Depth sealed

General remarks

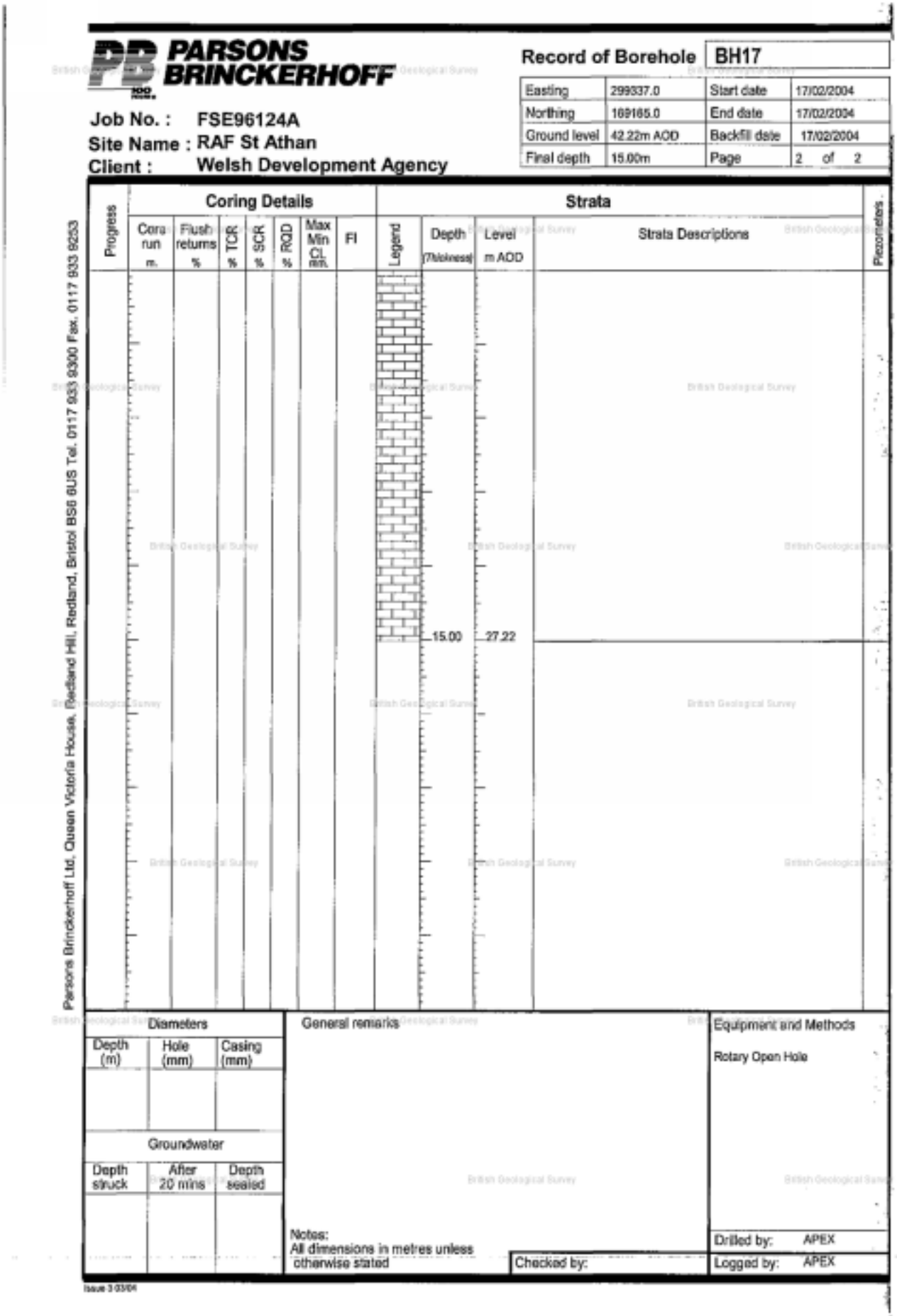
Notes:
All dimensions in metres unless otherwise stated

Checked by:

Equipment and Methods
Rotary Open Hole

Drilled by: APEX
Logged by: APEX

Issue 3 03/04



PARSONS BRINCKERHOFF

Record of Borehole BH17

Easting	299337.0	Start date	17/02/2004
Northing	169165.0	End date	17/02/2004
Ground level	42.22m AOD	Backfill date	17/02/2004
Final depth	15.00m	Page	2 of 2

Job No. : FSE96124A
Site Name : RAF St Athan
Client : Welsh Development Agency

Coring Details: Progress; Core run m.; Flush returns %; TCR %; SCR %; RQD %; Max Min CL mm; FI

Strata: Legend; Depth (Thickness); Level m AOD; Strata Descriptions

Piezometers

15.00 27.22

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Diameters

Depth (m)	Hole (mm)	Casing (mm)

Groundwater

Depth struck	After 20 mins	Depth sealed

General remarks

Notes:
All dimensions in metres unless otherwise stated

Checked by:

Equipment and Methods
Rotary Open Hole

Drilled by: APEX
Logged by: APEX

Issue 3 03/04

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PARSONS BRINCKERHOFF

Record of Borehole BH16

Easting	299244.8	Start date	26/02/2004
Northing	169080.1	End date	26/02/2004
Ground level	43.43m AOD	Backfill date	26/02/2004
Final depth	15.00m	Page	1 of 2

Job No. : FSE96124A
Site Name : RAF St Athan
Client : Welsh Development Agency

Coring Details								Strata				
Progress	Core run m	Flush returns %	TCR %	SCR %	RQD %	Max Min CL mm	FI	Legend	Depth (Thickness)	Level m AOD	Strata Descriptions	Piezometers
									(1.30)		Boulder CLAY and FILL. (Drillers description).	
									1.30	42.13		
									(0.70)		LIMESTONE, broken bands, odex to 2m. (Drillers description).	
									2.00	41.43		
	2.00 – 3.50		93	53	46	140 NI					Slightly weathered, generally strong to very strong, grey blue, fine grained LIMESTONE. Subhorizontal (0-5 degree) very closely to closely spaced, stepped and undulating, rough, open with a light brown, slightly sandy silt infill (<3mm).	
	3.50 – 4.30		75	48	32	100 NI						
	4.30 – 5.80		98	75	60	210 30					4.37m to4.39m with a moderately weak and moderatel strong, light brown, sandy siltstone.	
											5.45m to5.55m with a grey black, moderately weak to weak, siltstone.	
	5.80 – 7.30		99	60	37	310 NI			(9.80)			
	7.30 – 8.80		98	85	78	200 80					7.83m to7.88m with grey black, very weak, siltstone.	
											8.70m to8.80m with grey black, very weak, siltstone.	
	8.80 –		98	86	78	180 20					9.33m to9.39m with grey black, weak and moderately weak, siltstone. 9.46m to9.49m with grey black, very weak, siltstone.	

Diameters

Depth (m)	Hole (mm)	Casing (mm)

Groundwater

Depth struck	After 20 mins	Depth sealed

General remarks

Equipment and Methods

Rotary Cored

Notes:
All dimensions in metres unless otherwise stated

Checked by:

Drilled by: APEX
Logged by: ML

Issue 3 03/04

PARSONS BRINCKERHOFF

Record of Borehole BH16

Easting	299244.8	Start date	26/02/2004
Northing	169080.1	End date	26/02/2004
Ground level	43.43m AOD	Backfill date	26/02/2004
Final depth	15.00m	Page	2 of 2

Job No. : FSE96124A
Site Name : RAF St Athan
Client : Welsh Development Agency

Coring Details								Strata				
Progress	Core run m	Flush returns %	TCR %	SCR %	RQD %	Max Min Cl. mm	FI	Legend	Depth (Thickness)	Level m AOD	Strata Descriptions	Piezometers
	10.30											
	10.30		67	47	45	300 NI						
	11.80								11.80	31.63		
	11.80		98	45	31	160 20			(0.85)		Slightly weathered, generally strong to very strong, grey blue, smeared, light brown, fine to medium grained LIMESTONE. Subhorizontal and subvertical, very closely to closely spaced, occasionally medium spaced, stepped and undulating, rough and open with a slightly sandy silt infill (<5mm).	
	13.30								12.65	30.78	11.95mto12.08m with orange brown, soft to firm, gravelly clay. Gravel is angular to subangular, medium to coarse of limestone.	
	13.30		88	16	10	220 NI						
	15.00											

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Diameters

Depth (m)	Hole (mm)	Casing (mm)

Groundwater

Depth struck	After 20 mins	Depth sealed

General remarks

Notes:
All dimensions in metres unless otherwise stated

Checked by:

Equipment and Methods

Rotary Cored

Drilled by: APEX
Logged by: ML

Issue 3 03/04

DRILLHOLE No. WC/BH3

Client : Defence Estates	Ground Level m (A.O.D.) : 45.522	Hole Type : Open Hole/Cored
Project : RAF St.Athan, Phase II : CAN No. MD0990043F	Hole Depth m : 6.55	Co-ordinates : E 299266.282 N 169023.771
Location : West Camp	Well Height m (A.O.D.) : 45.484	Logged By : Enviros
Date : 23.01.02	Base of Exploratory Hole m (A.O.D.) : 39.522	Sheet No : 1 of 1

Depth (metres)	Elevation	Geological Description (BS5930:1999)	Strata Type	Well Detail	Core Run Depth (m)	Total Core Rec. %	Solid Core Rec. %	RQD %	Discontinuities/ Remarks
0	40.68	LIMESTONE GRAVEL (MADE GROUND)							
		Soft brown slightly sandy CLAY sand is medium to coarse of limestone brick and ceramic (MADE GROUND)							
	40.08	Slightly clayey slightly gravelly fine to coarse SAND of limestone brick and glass, gravel is fine to medium of limestone							
1		Firm to stiff brown mottled green CLAY at 0.7m firm to stiff brown mottled green gravelly CLAY gravel is coarse of limestone							
		Very dense pink grey fine grained LIMESTONE cobbles with little clay (NATURAL GROUND)							
	38.88								
2		Firm orange mottled brown CLAY with some limestone cobbles							
		Strong slightly fractured light grey banded dark grey fine grained LIMESTONE with some soft brown clay bands							
	38.03								
3		Moderately strong slightly fractured light grey fine grained LIMESTONE with some clay							
	37.63								
	37.43	Moderately dense slightly sandy slightly clayey angular medium to coarse LIMESTONE gravel sand is fine to coarse of limestone							
		Dense subrounded light grey fine grained LIMESTONE cobbles with little soft orange brown clay							
4	36.63								
		Moderately weak fractured light grey fine grained LIMESTONE with some bands of loose subangular to subrounded coarse gravel of limestone							
	36.33								
		Weak fractured light grey fine grained LIMESTONE with some clay. Weathering strong dark brown discolouration penetrating along fractures, slightly weathered							
5		Moderately weak fractured light grey fine grained LIMESTONE with numerous clay bands From 5.8-5.85m stiff dark brown very sandy CLAY sand is fine to coarse of limestone							
	34.88								
6		Moderately strong medium grey fine grained LIMESTONE with numerous bands of black shale							
	34.33								
7									
8									
9									
10									

Contractor : Apex Drilling	Hole Diameter (mm) : 105	APEX DRILLING SERVICES LTD.
Drill Type : Rotary air flush	Casing depth (m) : 1.5	01656 749 149 TEL
Bit Type : P.C.D.	Core Diameter (mm) : 76mm (HQ) 412	01656 749 896 FAX
Rig Type : Gryphon	Drilled By : MJ	

DRILLHOLE No. WC/BH2

Client : Defence Estates	Ground Level m (A.O.D.) : 45.077	Hole Type : Open Hole/Cored
Project : RAF SLAithan, Phase II : CAN No. MD0990043F	Hole Depth m : 7.20	Co-ordinates : E 299253.018 N 169042.830
Location : West Camp	Well Height m (A.O.D.) : 45.030	Logged By : Enviros
Date : 22.01.02	Base of Exploratory Hole m (A.O.D.) : 48.077	Sheet No : 1 of 1

Depth (metres)	Elevation	Geological Description (BS5930:1999)	Strata Type	Well Detail	Core Run Depth (m)	Total Core Rec. %	Solid Core Rec. %	RQD %	Discontinuities/ Remarks
0	40.88	LIMESTONE GRAVEL (MADE GROUND)							
		Firm orange mottled grey slightly gravelly CLAY gravel is fine of limestone From 0.5m firm orange CLAY (REWORKED)							
1	39.88	Soft to firm orange slightly gravelly CLAY gravel is fine to coarse of limestone (NATURAL GROUND)							
2	38.88	Stiff orange slightly sandy CLAY sand is fine to medium of limestone							
	38.38	Moderately dense light grey fine grained LIMESTONE cobbles with some clay							
3									
4	36.88	Strong fractured light grey fine grained LIMESTONE with numerous clay bands At 5.2m firm yellow brown gravelly CLAY gravel is medium to coarse of limestone							
5	35.48								
		Strong slightly fractured light grey banded pink fine grained LIMESTONE with some clay bands From 5.7-6m firm brown slightly gravelly CLAY gravel is coarse of limestone							
6	34.18								
7	33.68	Strong brown mottled grey gravelly CLAY gravel is fine to coarse of limestone from 7.0-7.2m strong light grey fine grained LIMESTONE							
8									
9									
10									

Contractor : Apex Drilling	Hole Diameter (mm) : 105	APEX DRILLING SERVICES LTD.
Drill Type : Rotary air flush	Casing depth (m) : 1.5	01656 249 149 TEL
Bit Type : P.C.D.	Core Diameter (mm) : 76mm (HQ) 412	01656 249 052 FAX
Rig Type : Gryphon	Drilled By : MJ	

DRILLHOLE No. WC/BH1

Client : Defence Estates	Ground Level m (A.O.D.) : 45.976	Hole Type : Open Hole/Cored
Project : RAF St.Athan, Phase II : CAN No. MD0990043F	Hole Depth m : 7.20	Co-ordinates : E 299246.701 N 169002.533
Location : West Camp	Well Height m (A.O.D.) : 45.896	Logged By : Enviros
Date : 21.01.02	Base of Exploratory Hole m (A.O.D.) : 48.976	Sheet No : 1 of 1

Depth (metres)	Elevation	Geological Description (BS5930:1999)	Strata Type	Well Detail	Core Run Depth (m)	Total Core Rec. %	Solid Core Rec. %	RQD %	Discontinuities/ Remarks
0		LIMESTONE GRAVEL (MADE GROUND)							
	40.38								
	40.08	Soft orange slightly sandy CLAY sand is medium of limestone (MADE GROUND)							
1		Dense light grey fine grained LIMESTONE cobbles with some soft orange mottled brown slightly sandy clay (REWORKED)							
	39.38								
2		Moderately strong slightly fractured medium grey fine grained LIMESTONE with numerous soft orange gravelly clay gravel is medium to coarse of limestone (NATURAL GROUND)							
	38.58								
	38.08	Moderately dense light grey fine grained LIMESTONE cobbles with some soft orange mottled brown clay From 2.3-2.4m soft orange slightly gravelly clay							
3	37.88	Strong slightly fractured light grey fine grained LIMESTONE with some clay							
		Strong slightly fractured light pink grey fine grained LIMESTONE with some stiff orange brown sandy gravelly clay and loose limestone cobbles At 4.6m firm brown mottled orange CLAY							
4									
	36.23								
5		Strong light grey fine grained LIMESTONE							
6									
7	33.68								
8									
9									
10									

Contractor : Apex Drilling	Hole Diameter (mm) : 105	APEX DRILLING SERVICES LTD.
Drill Type : Rotary air flush	Casing depth (m) : 1.5	01656 249 149 TEL
Bit Type : P.C.D.	Core Diameter (mm) : 76mm (HQ) 412	01656 249 095 FAX
Rig Type : Gryphon	Drilled By : MJ	

APPENDIX D – LANDMARK ENVIROCHECK DATA REPORT

About AECOM

AECOM (NYSE: ACM) is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries.

As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges.

From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. A Fortune 500 firm, AECOM companies had revenue of approximately US$19 billion during the 12 months ended June 30, 2015.

See how we deliver what others can only imagine at aecom.com and @AECOM.

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