Submission ID: SEA3742A4

PFAS contamination and Oxfordshire Strategic Rail Freight Interchange

This OXSRFI site borders the former RAF/USAF base at Upper Heyford, the source of substantial PFAS contamination, where exceptionally high levels have been recorded even now, over three decades after it closed. Contamination risk cannot be ignored: intrusive testing is required to avoid spreading contamination further and putting the health of workers and members of the public at risk.

Bioaccumulating in our bodies, PFAS never leaves us and is reported in numerous cohort studies to be linked to various serious health conditions including different types of cancer. Children are widely acknowledged to be at the greatest risk from it.

PFAS contamination in the surrounding area is now widely documented:

• In2021, Hydrock acknowledged potential PFAS contamination in their Ground Conditions Report, desk study for OXSRFI. Hydrock also worked for Dorchester Living, owners of Heyford Park on the site of former RAF Upper Heyford. However, PFAS was not acknowledged as a potential contaminant at this site until 2025.

• In July 2026, [redacted] of Cherwell District Council also acknowledged that PFAS had been found in some local watercourses.

• [redacted] MP obtained historic MOD documents confirmed that highly toxic AFFF firefighting foam was literally 'washed down the drain' at RAF Upper Heyford following its extensive use in regular firefighting training on the base

And yet, despite this, no testing for PFAS by relevant authorities has been carried out either at the OXSRFI site, or at the former RAF Upper Heyford site, which is the most likely source of the contamination.

We are concerned that Steven Harley, the planning consultant speaking on behalf of the applicant Oxfordshire Rail Freight Limited at the OXSRFI IS2 hearing on 30.9.26, attempted to discuss evidence regarding PFAS testing (both on and off the site) that did not appear in any of the documents submitted to the Planning Inspectorate for display on the relevant project page, in accordance with the rules on written representations set out in the Infrastructure Planning (Examination Procedure) Rules 2010, section 10. He claimed that the applicant has carried out testing of groundwater and surface water on the OXSRFI site over the summer and referred to the levels of PFAS found in these tests. These results have not been presented as evidence to the Planning Inspectorate for scrutiny and we were not told who carried out these tests, so this evidence is completely unverified and therefore should be disregarded at this point.

The most recent relevant document that is on the project page, the Environmental Statement: Ground Conditions, Chapter 11, produced for Oxfordshire Rail Freight Limited by BWB consulting in 2026 (document 6.11D), states on page 71 that 'no testing for PFAS/PFOS has been undertaken to date'. Therefore, we assume this to be the most current position on PFAS testing at the site. However, at the ISH2 hearing on 30.9.26, the team representing the applicant, referred to results of sampling from ground and surface water on site in the summer of 2026. A surface water sample from the Gallos Brook of 42-43 micrograms of PFAS per litre was also discussed as a point of comparison, without stating the source of this data. We feel that this amounted to an attempt on behalf of the applicant to downplay the risks of PFAS contamination without a proper assessment of all the evidence.

We are also confused as to how surface water testing can have been undertaken on the site in summer 2026, as all the streams appeared to have dried up in the drought. This would make a full controlled waters assessment impossible.

Contamination migrating from former RAF Upper Heyford to the OXSRFI site

Contamination flowing from the base is not new or a surprise, it was detailed in the MoD's own reports and as well as independent testing in the last 12-24 months.

Contamination was even being acknowledged by the MoD as far back as 1995 in the Enviroclean and Aspinwall reports on ground conditions and ground water, commissioned after the base was closed.

The pathway from the likely contamination source on the flying field of former RAF Upper Heyford, leaching through the soil into groundwater and surface water on and around the site is described as 'likely' in the 2025 Hydrock Ground Conditions report for Heyford Park. Groundwater and surface water flowing through the adjacent OXSRFI site are also likely to be contaminated, as PFAS chemicals are highly mobile and can travel up to 10km in soil and water. The limestone Principal Aquifer under both sites, the Great Oolite, is described as 'vulnerable' to contamination and risk assessments and planning conditions for the Heyford Park site are supposed to protect it, in line with the National Planning Policy Framework. Two streams (tributaries of the Gagle and Padbury Brooks) flow from interceptors on the flying field of former RAF Upper Heyford, and the water appears to be coming from out of the ground. PFAS contamination will not be stopped by the interceptors.

The Flying Field: Likely contamination hotspot and source

The fire training area is probably the most significant source of PFAS contamination on the flying field where a mock F1-11 jet was repeatedly set on fire and doused in AFFF hosed on it from tankers stationed around, as well as the automatic fire suppression systems in hangars which were tested regularly by releasing large quantities of foam.

When foam was sprayed onto burning fuel during training, some of it would have been broken into fine droplets and aerosols. Heat, steam and smoke could then have lifted PFAS-bearing particles into the air, which later settled on land downwind. Over decades of weekly training, exposure of this kind would have built up in the soil and dust.

The Fire Training Area has never been remediated, despite this being recommended by the Planning Inspectorate in 2009, at the planning appeal for the initial redevelopment of the RAF Upper Heyford site (condition 33 of report APP/C3105/A/08/2080594).

PFAS Testing results

As part of a programme of systematic testing, The Environment Agency data collected from 2023 to 2025 revealed extremely high levels of PFAS in the Leys Farm Ditch, some 4.3 km south of former RAF Upper Heyford - 2,295 nanograms per litre. For context, this was the highest out of 700 water bodies tested nationwide – 3 times higher than RAF Fairford and 4 times higher than The National Fire Service College at Moreton in Marsh.

In 2026, BWB Consulting working for developer Richborough found high PFAS levels in Gallos Brook directly adjacent to Heyford Park site: the highest being 2,979 nanograms per litre.

The Gallos Brook Group in conjunction with Subadra Consulting and Veritas Laboratories (one of only 3 accredited labs in the country) have tested 10 sites across 9 different streams/ surface outfalls flowing from former RAF Upper Heyford, also 2 wells in the Upper and Lower Heyford.

• All streams flowing from the base are heavily contaminated with PFAS (hundreds or thousands of times above the statutory annual average Environmental Quality Standard for PFOS of 0.65 nanograms per litre).
• The highest result was at location 1 at 42,174 nanograms/litre of PFAS – the drainage path flowing directly from fire pit.
• The outfall from the Northern Bomb Stores at Kennel Copse is a tributary of the Padbury Brook which is part of the Bedford Ouse Catchment Area. This runs straight across the northern section of the OXFRI site – this measured 297 nanograms of PFAS per litre. This test site was on the boundary of the OXSRFI application site.
• An interceptor within the OXSRFI application site boundary was also tested above the Gagle Brook, which measured 170 nanograms per litre of PFAS. The Gagle Brook is part of the River Ray Catchment Area. The main body of the Freight Park would be constructed directly on top of the east and west tributaries of these waterways. Part of this construction would also be adjacent to a covered reservoir that is used for drinking water and vulnerable to leaching of contamination.
• It is important to note that testing was not possible in any more streams/ outfalls running across the OXSRFI site as they had completely dried up in recent months due to the drought. We anticipate these also to have unacceptable levels of contamination when they are tested.

The likely pathway from the source of contamination is the limestone aquifer that sits beneath a shallow layer of soil, contaminating both ground and surface water which washes across the OXSRFI site. Wherever you stand on the site of the freight park you will have contamination beneath your feet. The groundworks for OXSRFI risk disturbing and spreading PFAS contamination here and further downstream, threatening the construction workers, employees and members of the public on the site, as well as the green corridor beyond and protected SSSI wetlands further down when it meets the River Ray at Otmoor, the RSPB Nature Reserve.

As PFAS is such a significant issue at the site, with a working group involving both Cherwell District Council and the Environment Agency now investigating the contamination at Heyford Park, we also request that a specific hearing solely examining PFAS contamination be convened as part of the OXSRFI examination process. The National Planning Policy Framework requires developers to show that the risks from contamination are not unacceptable prior to permission being granted. Any decision made on the OXSRFI application must be fully informed of the risks from PFAS contamination. We therefore request that the applicant provides evidence of extensive testing for PFAS at the site, including an intrusive stage 2 ground investigation and a controlled waters assessment, in order to explain how these risks can be mitigated. This needs to be done before permission is granted.

PFAS Contamination Affecting Oxfordshire Strategic Rail Freight Interchange

- **PFAS is highly toxic and is linked to a range of serious health conditions** including cancer, immune suppression, liver and thyroid damage, high cholesterol and developmental issues in children.
- PFOS and PFOA are **banned worldwide and classed as carcinogenic.**
- People living near PFAS hotspots tend to have **elevated levels of PFAS in their blood** (recent examples are Bentham and Thornton-Cleveleys).
- PFAS is **highly mobile and spreads in a plume** of up to 10 km through air, soil, ground and surface water.
- **Extremely high levels of PFAS have been found in 9 streams** flowing from the former RAF Upper Heyford base (now Heyford Park) by the Environment Agency and environmental consultants BWB and Subadra. The highest was 42,174 nanograms per litre. This is thousands of times over the Environmental Quality Standard and significantly higher than other known PFAS hotspots such as RAF Fairford and the National Fire Service College.
- Levels of PFOS found in all streams far exceeded the statutory annual average Environmental Quality Standard of 0.65 ng/L.
- Groundworks for OXSRFI **risk disturbing PFAS contamination** and exposing the public and site workers.
- Two contaminated streams, tributaries of the Padbury Brook and the Gagle Brook **flow through the OXSRFI site.** The plans involve building on top of the Gagle Brook.
- Former airfields with fire training areas like RAF Upper Heyford are **well documented PFAS hotspots,** owing to large quantities of AFFF firefighting foams contaminating soil and waste-water runoff.
- Historic MOD documents obtained by Calum Miller MP recently confirmed that firefighting foam was '**washed down the drain'** at RAF Upper Heyford.
- Potential PFAS contamination in the area **has been acknowledged** by the 2021 Hydrock Ground Conditions report produced for OXSRFI and by Cherwell District Council in an email from Shawn Fleet.
- Risk assessments and planning conditions emphasise **protecting the Principal Aquifer** under the site, the Great Oolite Limestone Formation, which stretches for 200 miles across the south of England.
- However, **no testing for PFAS has ever been carried** out either at the OXSRFI site, or at the Heyford Park site.
- The **Fire Training Area has never been remediated**, despite this being recommended by the Planning Inspectorate in 2009, at the planning appeal for the initial redevelopment of the RAF Upper Heyford site.
- The National Planning Policy Framework **requires developers to show that the risks from contamination are not unacceptable** prior to permission being granted. In order to decide on the risks, extensive testing for PFAS including an intrusive ground investigation and controlled waters assessment will be necessary.

Water Resource Associates

A network of consultants in hydrology, water resources and environmental issues

Please reply to: [redacted]

PO Box 1674
Oxford
OX4 9QT

[redacted]

Gallos Brook PFAS Contamination
Upper Heyford, Oxfordshire

[redacted]

July 2026

Technical Note for the Initial Assessment of Catchment Hydrology, Hydrogeology Biotoxicity and Potential Catchment Water Quality Modelling



Executive Summary

An initial assessment has been undertaken to examine PFAS contamination in the Gallos Brook and to identify more detailed studies to better understand the problem. This current assessment included background hydrology, details on hydrogeology and groundwater abstractions, testing the toxicity of river water at locations in the Gallos Brook and River Cherwell and information on how PFAS contamination could be modelled at the catchment scale. The key findings are as follows:

1. The Gallos Brook is a tributary of the River Ray and drains an area of 35 km^2 with its source in the area of the former Upper Heyford airbase. It includes the Leys Farm Ditch, within its upper reaches which flows along the eastern edge of Upper Heyford, while the start of the Gallos Brook is further west through Caulcott.
2. Fieldwork within the catchment in June 2026 found some channels were flowing, such as the Leys Farm Ditch and at Weston Fen, but other channels were dry at Caulcott, the A4095 bridge, at the Weston-on-the-Green Church and near the River Ray confluence.
3. A significant proportion of the catchment is underlain by permeable limestone bedrock under the general classification of Jurassic Limestone, which dips from north-west to south-east. This means that groundwater movement from the airbase would be expected to flow towards the SE from the groundwater divide, except groundwater draining into the Cherwell Valley and Padbury Brook.
4. The depth of groundwater is variable across the area with shallow groundwater in the Leys Farm Ditch, but deeper groundwater further west in the upper reaches of the Gallos Brook accounting for the flow observed in Leys Farm Ditch compared to the lack of flow in the Gallos Brook at Caulcott.
5. The groundwater flow exhibits a divide at the area of the airbase, with 65% flowing towards the River Cherwell to the west, 30% flowing to the Gallos Brook and Leys Farm Ditch to the south and 5% flowing to the Padbury Brook to the east.
6. Interbedding of impermeable mudstones results mainly in a 2-tier water table beneath the Upper Heyford disused airbase. This means that there is shallow perched groundwater at 2 to 3 m bgl and the main water table in the White Limestone at greater depths of the order 12 to 28 m bgl. Contaminants will migrate firstly to the shallow water-bearing strata, followed by vertical leakage to the deeper layers.
7. There are 78 groundwater abstractions in the area around the airbase. PFAS measurements should be taken for those closest to the firepit location (the source of historic PFAS) at Manor Farm and Park Farm. As there would appear to be a scarcity of PFAS data in groundwater, sampling and analysis should be carried out at boreholes closest to the firepit location (the source of historic PFAS) including Manor Farm and Park Farm and any boreholes wells or springs in the Cherwell Valley.

8. The existing PFAS measurements in groundwater were taken further from the site and the only available sample down gradient to the south-east of the airbase is Promise Land Farm which is 8.5km away with PFAS well below the DWI guidelines.
9. Water samples taken from the Gallos Brook and River Cherwell for biotoxicity testing showed highest acute toxicity in the Leys Farm Ditch and Weston-on-the-Green. The lowest toxicity was measured in the River Cherwell and the Gallos Brook downstream near Islip, but still showing effects of poor water quality in relation to a control sample.
10. The results do not measure PFAS but give a rapid assessment of overall toxicity and the higher measurements demonstrate the need for more detailed monitoring and testing.
11. Catchment scale water quality modelling could be undertaken to demonstrate the movement of potential PFAS contamination throughout the catchment.

Background

Water Resource Associates (WRA) was engaged by the Gallos Brook Conservation Group to assist in highlighting the issue of Per- and poly fluoroalkyl substances (PFAS) contamination in surface and groundwater within the Gallos Brook catchment and neighbouring area in Oxfordshire. This technical note includes a review of the hydrology and hydrogeology of Gallos Brook, an assessment of the potential impact of PFAS and an outline of how a detailed water quality modelling programme could be undertaken to gain a better understanding of PFAS contamination. Information was provided by the Gallos Brook Conservations Group from previous testing for PFAS undertaken by Subadra Consulting and application documents associated with the redevelopment of the Upper Heyford Airbase. The work of this current study included referring to these documents but did not represent a full document review. In addition, spot samples from water courses were analysed for biotoxicity.

PFAS are a group of synthetic chemicals often referred to as forever chemicals as they do not readily degrade in the environment. They have been used since the 1940's and one particular application was in foams used for firefighting. Such foams were commonly used in fire-fighting operations at the former Upper Heyford airbase, and testing from the Environment Agency (EA) in 2023-2025 and by Subadra Consulting in April 2026 has found elevated levels of PFAS in water courses draining the Upper Heyford site.

Study Area

The Upper Heyford Airbase covers an area of some 3.6 km^2 in north Oxfordshire, 7km north-west of the town of Bicester, as shown in Figure 1. The airbase was decommissioned in 1994 and has since been redeveloped including residential and commercial areas. The airbase site is in an upland area above 120m in altitude on the eastern dip slope of the Cotswold Hills. The Gallos Brook is one of a number of watercourses draining from the site to the south and joining the River Ray near Islip, 12km to the south. Upper Heyford Airbase is located on the watershed of three catchments, the River Cherwell draining to the west, the River Ray draining to the south and the Bedford Ouse draining to the north. The topography and the catchment boundaries are shown in Figure 2. More detail on the Gallos Brook is given in the Hydrology section below.

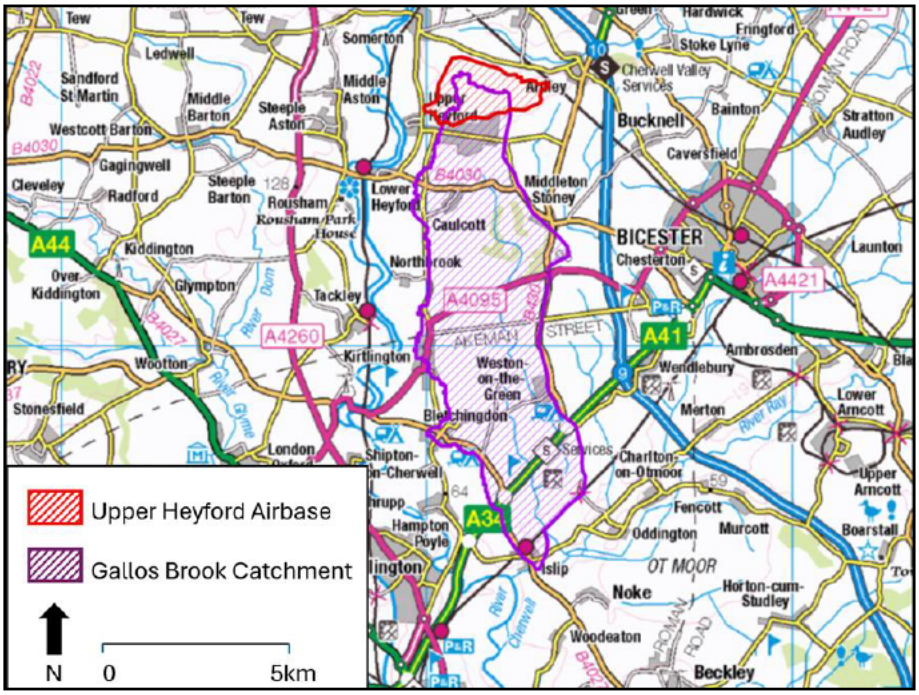


Figure 1. The study area showing the Upper Heyford Airbase extent outlined in red and the Gallos Brook catchment in green (background map OS Open Raster, scale 1:100,000).

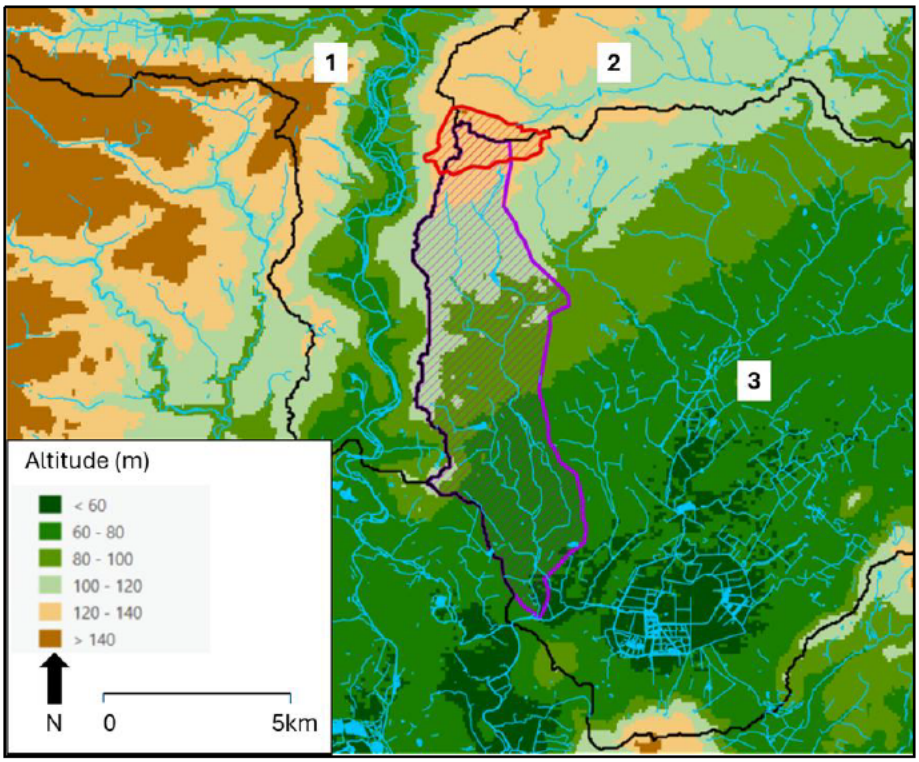


Figure 2. Topography of the study area with catchment boundaries for the Cherwell (1), Bedford Ouse (2) and Ray (3) shown in black.

Hydrology

As mentioned, the Gallos Brook is a tributary of the River Ray and drains an area of 35 km^2 in the western side of the Ray catchment. The Gallos Brook does not have any permanent flow monitoring, the closest gauging station is on the River Ray at Islip. The Standard annual average rainfall for the Ray catchment (incorporating the Gallos Brook) is given as 669mm (CEH, 2026) for the period 1991-2020, this is a 6% increase on the previous period (1961-1990) showing the impact of climate change. The Gallos brook is a largely rural catchment, a significant proportion underlain by the highly permeable Jurassic limestone bedrock. The lower reaches are underlain by impermeable clay. More detail on the underlying geology and its impact on groundwater is given in the hydrogeology section of this report.

The Gallos Brook drains from the southern side of the airbase site and includes a few channels and tributaries along its course to the River Cherwell. Fieldwork undertaken in the catchment in June 2026 inspected most of these channels as shown on the mapping in Figure 3 and the following photographs. The fieldwork was undertaken in the summer during a period of dry conditions which would have contributed to the low flows or lack of flow observed in some places.

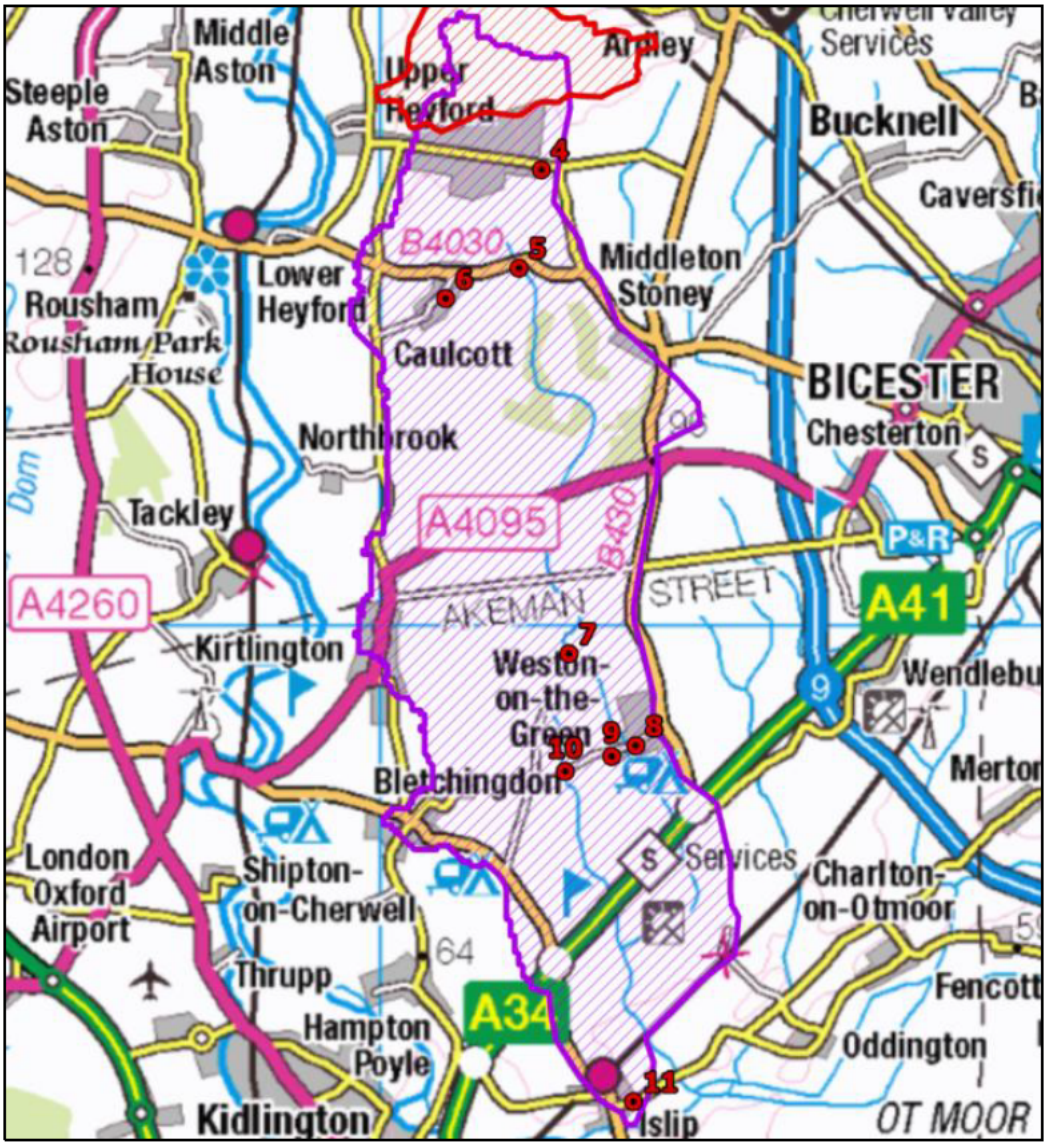


Figure 3. Locations of photos shown in Figures 4-11.

Two small streams form the headwaters, the Leys Farm Ditch to the east (Figure 4 and 5) and Gallos Brook to the west (Figure 6) through the village of Caulcott. During fieldwork the Leys Farm Ditch had a reasonable flow but the Gallos Brook at Caulcott was dry, with local residents suggesting water had been extracted as part of the constructions works at Upper Heyford. These converge 4.5km to the south just south of the A4095 road, although the channel from the Leys Farm Ditch just upstream of the confluence was also dry. The possible explanation of this was water being held up in within the grounds of Middleton Park. Downstream of the confluence, flow was restored as the Gallos Brook passed south through the Weston Fen SSSI (Figure 7), so water must have been present in the western Gallos Brook channel downstream of Caulcott. The Brook is split into two channels in the village of Weston-on-the-Green (Figure 8 and 9) and once again one of these, the eastern most channel was dry. Local residents had observed this for a few years and thought this was the result of some quarrying operations near Weston-on-the-Green.



Figure 4. Leys Farm Ditch at Upper Heyford.



Figure 5. Leys Farm Ditch at the B4030.



Figure 6. Gallos Brook at Caulcott.



Figure 7. Gallos Brook at Weston Fen SSSI.

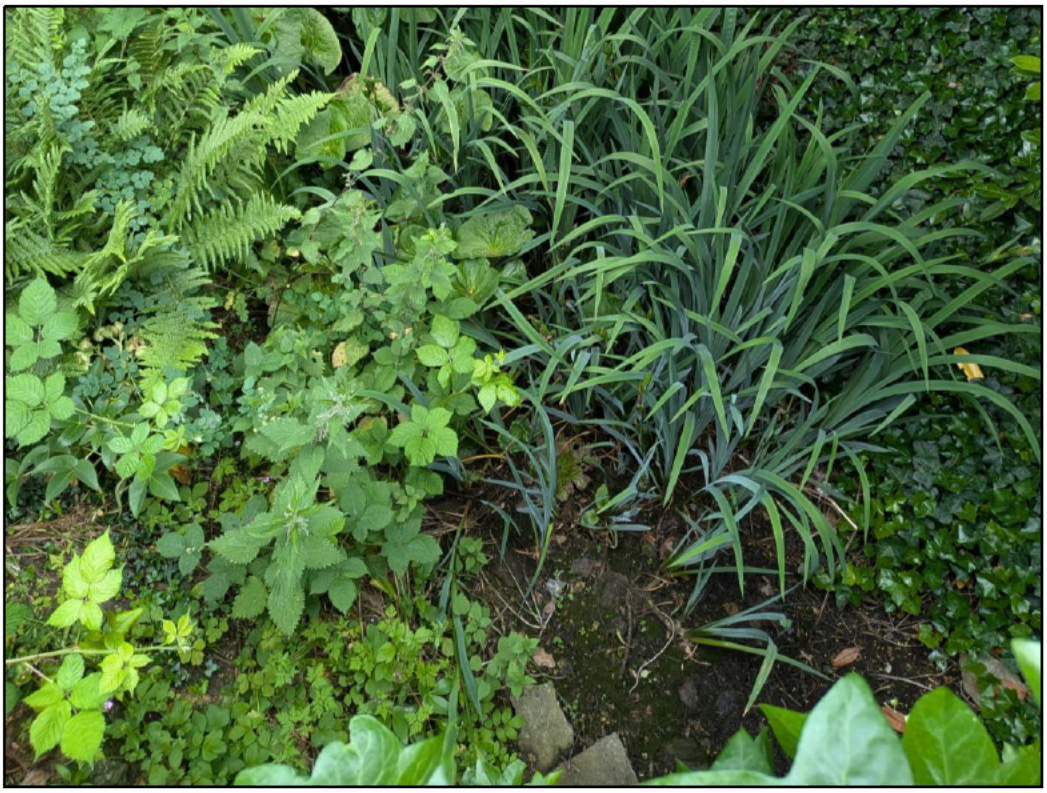


Figure 8. Dry side channel of Gallos Brook at Weston-on-the-Green



Figure 9. Gallos Brook main channel at Weston-on-the-Green.



Figure 10. Tributary channel west of Weston-on-the-Green.



Figure 11. The Gallos Brook near Islip.

A further tributary stream originating from Kirtlington on the western boundary of the catchment (Figure 10) joins the main channel just downstream of the A34. Near the catchment outlet the channel has been diverted by the railway line running through the southern portion of the catchment so that the main channel of the stream passes along the eastern side of Islip (Figure 11). The original stream channel as shown on the OS maps was dry, so it is assumed this only receives drainage from south of the railway line.

Hydrogeology

An assessment of geological conditions underlying Upper Heyford airbase and the surrounding area has been made using BGS generalised digital geological map data and the depth-to-groundwater dataset. Solid geology is based on both the New Series 1:50 000 and Old Series 1:63 360 scale mapping, using updated formation nomenclature: the distribution of local rock types and faultlines is shown in Figure 12 and stratigraphy is summarised in Figure 13. A geological cross-section has been drawn in Figure 14 along the Cotswold dip slope to demonstrate the regional dip of the rocks towards the south-east.

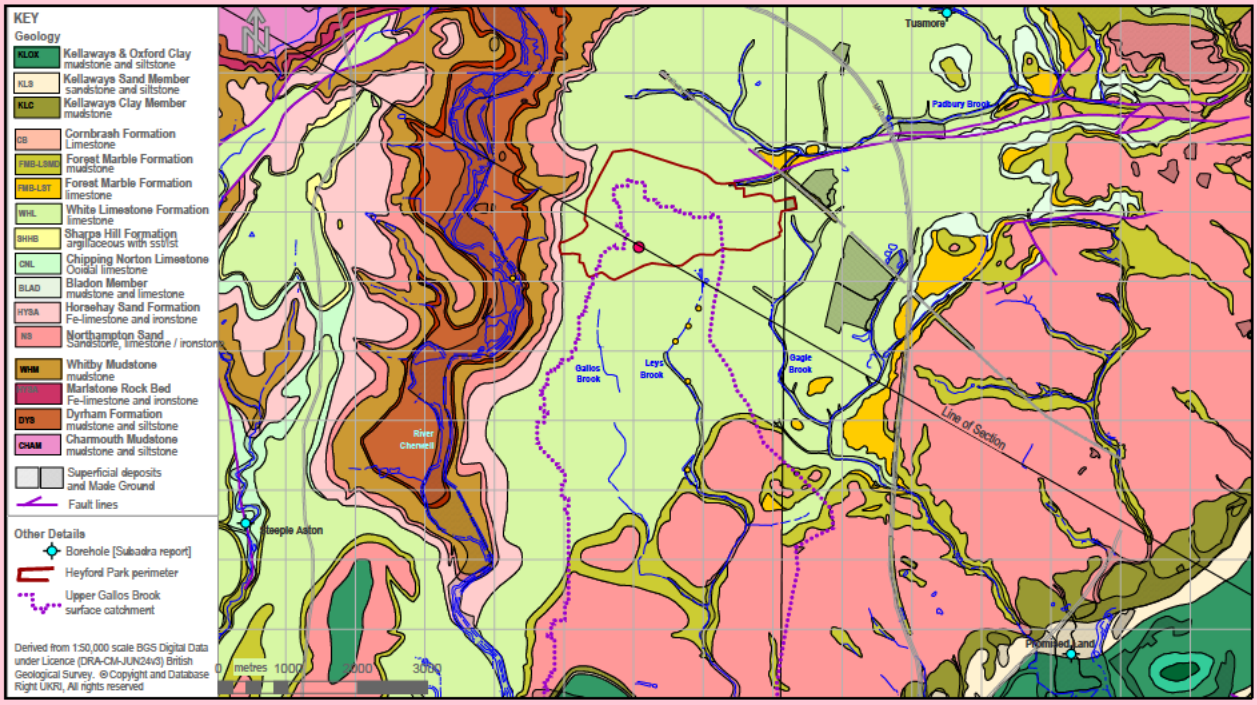


Figure 12. Geological map for the area around Upper Heyford.

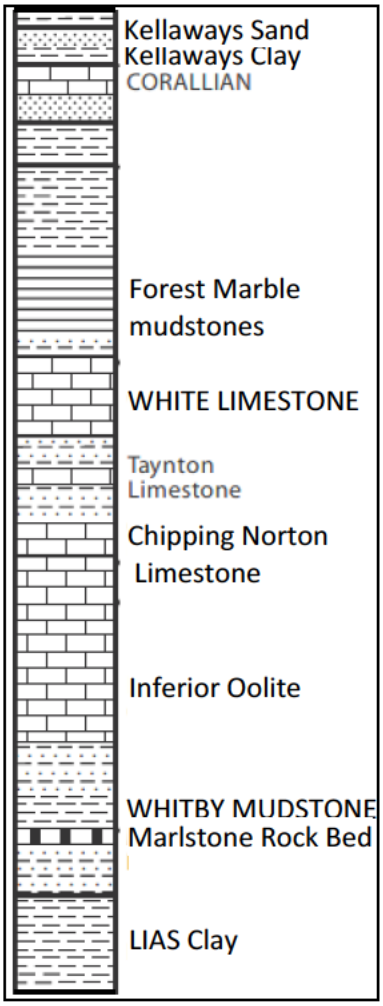


Figure 13. Detail of the strata around the Upper Heyford area.

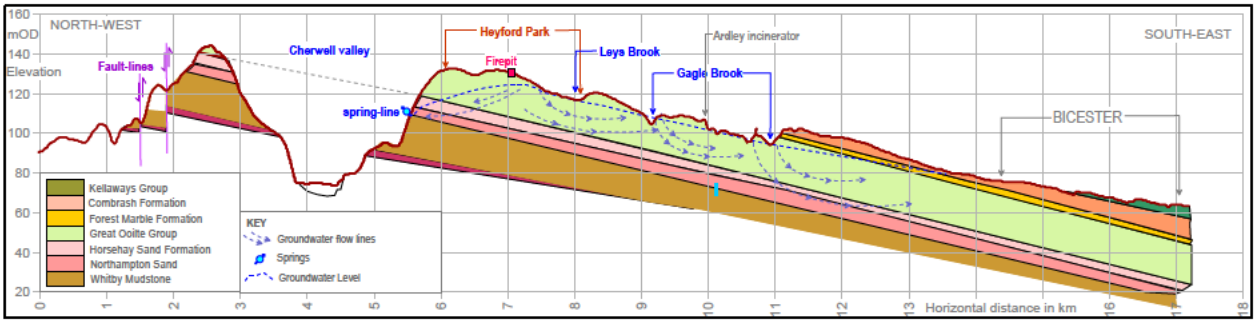


Figure 14. A cross section of the geology as shown by the line in Figure 12 from north-west to south-east.

The White Limestone and Chipping Norton Limestone are important water-bearing strata of the Cotswold Hill geology and present a thick permeable formation which is used for public water supply and irrigation agriculture. The Upper Heyford airbase is underlain by this rock sequence,

which is characterised by high transmissivity and storativity typical of fractured limestone. The complete sequence of permeable strata between the White Limestone and Whitby Mudstone are considered by the Environment Agency to be a single hydraulic unit and water resource licensing is accordingly based on output from this group as a whole. It would be expected that rain falling on the area would infiltrate and provide recharge of groundwater in this group. This would include rain on both the natural and artificial surfaces such as road, roofs and paved areas. Detention basins to attenuate surface runoff from impermeable surfaces were observed (such as Figure 15), and it is known that swales have been escavated as part of the new development which allow excess water to naturally infiltrate into the soil and underlying rock.



Figure 15. A detention basin to collect surface water runoff from impermeable surfaces of the new development at Upper Heyford.

However, with respect to contaminants, the sequence is characterised by frequent intercalation of mudstone beds with the limestone, which will impede and deflect downward and lateral movement of groundwater, with leakage through to greater depth. The Sharps Hill and Bladon strata are dominated by such mudstone intercalation, and there are thinner mudstone bands in the two principal limestone formations. This means that there is shallow perched groundwater at 2 to 3 m bgl and the main water table in the White Limestone at greater depths of the order 12 to 28 m bgl. Contaminants will migrate firstly to the shallow water-bearing strata, followed by vertical leakage to the deeper layers.

Information on soils for the area was obtained from the Soilscapes dataset from Cranfield University (2026). This shows that the White Limestone outcrop is characterised by free-draining lime-rich loamy soils, generally used for arable farming with grassland at higher elevation. Natural habitats include herb-rich chalk and limestone pastures and lime-rich deciduous woodlands. This suggests that rainfall would be expected to recharge limestone groundwater by direct infiltration.

BGS borehole archive data have been reviewed across the White Limestone outcrop to obtain an appreciation of the depth of groundwater in m bgl (below ground level) and characteristics of the ground surface. This information shows two important facts:

- Shallow geology consists of a fairly clayey and impermeable layer of made ground, silty sand-clay with some limestone rubble over soft to firm clay formed from limestone weathering to depths of 1 to 2 m bgl.
- Groundwater occurs in two distinct levels, a shallow water table at 2 to 3 m bgl and the main water table in the White Limestone at greater depths in the range 12 to 28 m bgl.

BGS Depth-to-Groundwater [DTGW] data have been used to generate the isolines in Figure 16. This shows that groundwater is at greatest depth on the NW side of Upper Heyford, while groundwater is close to the surface in the headwaters of Leys Farm Ditch and Gagle Brook. Similar interaction between groundwater and runoff in Gallos Brook only occurs downstream of Caulcott and Aves Ditch, which would also explain the observation of Gallos Brook being dry at Caulcott.

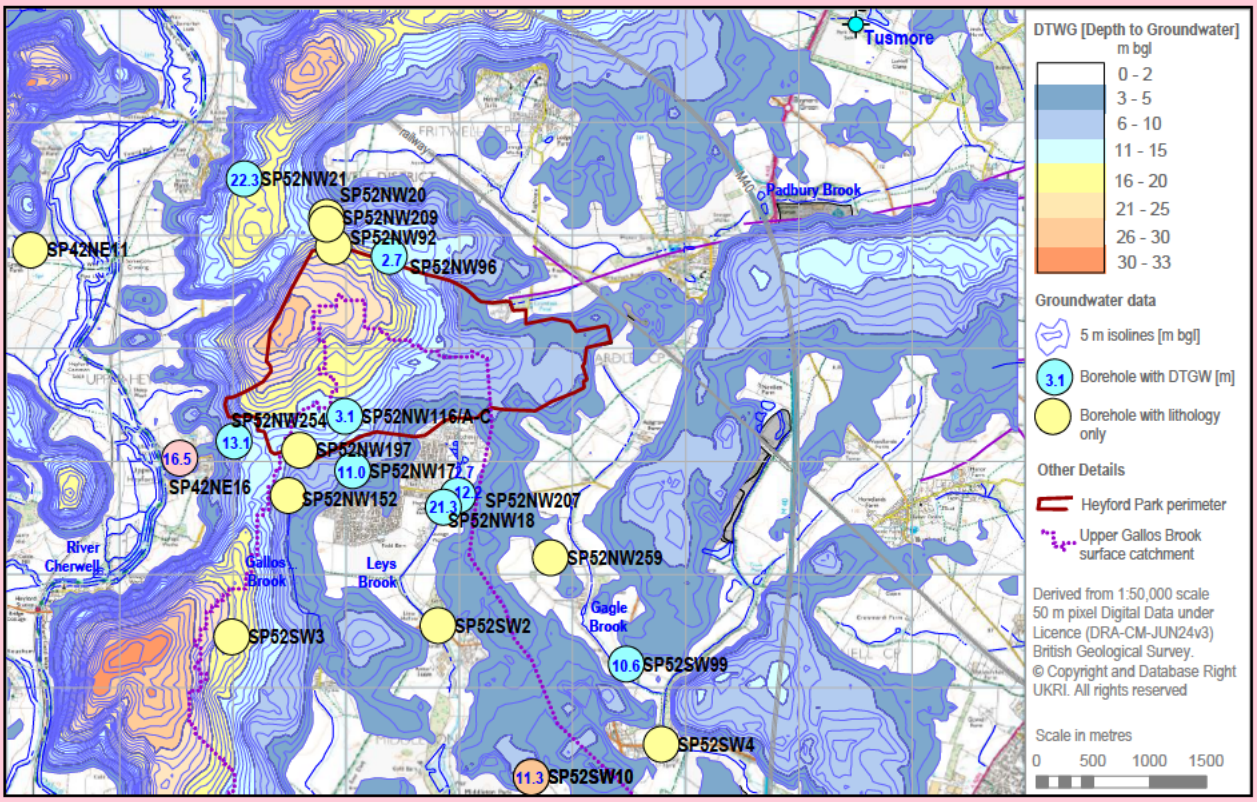


Figure 16. Depth to groundwater

Padbury Brook is an important feature which has developed along East-West faultlines in the White Limestone and Cornbrash. Hard-rock fracturing will be well-developed in association with these faults and will provide enhanced groundwater circulation. Impermeable material can also infill fault fractures through brecciation, and these can act to deflect groundwater movement. It is noteworthy that one of the fracture lines extends to the perimeter fence of the former airbase boundary, so this will likely intercept infiltration on the north-east corner of Upper Heyford. Higher transmissivities can be expected along the fault zone. On the Cotswold escarpment, these fracture systems are large enough to form small caves which can be penetrated for 100m or so, although they lack the stability of caves in Carboniferous limestone. Finally, it should be noted that the DTGW data are average values, and seasonal variation should be expected with higher levels in winter and lower in summer.

Groundwater Movement and Contamination

The DTWG data has been further used to obtain an estimate of groundwater movement by subtracting the DTGW 50 m pixel values from the LiDAR 1 m DTM, with resulting map shown in Figure 17. It can be seen that the groundwater divide between Cherwell valley drainage and dip-slope drainage lies close to the eastern and south-east perimeter of Heyford Airbase, which implies that contaminants entering groundwater on the western 65% of the site will move towards springs on the Cherwell valley-side. On the eastern part of the site, 30% would move into the Leys Farm Ditch and Gagle Brook area and 5% into the Padbury fault zone.

The National Abstraction Licensing Database [NALD] shows that there are 78 licensed groundwater sources in the area of the 1:50,000 geological map used for this review, of which 16 are used for private water supply. The others are used primarily for irrigation agriculture or general farming and domestic supply. Location of these boreholes is shown in Figure 18. The closest are located 2.0 and 2.3 km SE of the firepit, at Manor Farm on the Gagle Brook and Park Farm on the Leys Farm Ditch near Middleton Stoney and are used for general farming and domestic purposes. It would be logical to investigate water quality in these two boreholes. The other close borehole is most likely in the Northampton Sand on the Cherwell valley side, 1.9 km to the south-west. The next group of four boreholes is located 5 km away from the firepit, to the south and east. It is unlikely that the routine testing sent to the local health authority would analyse for PFAS.

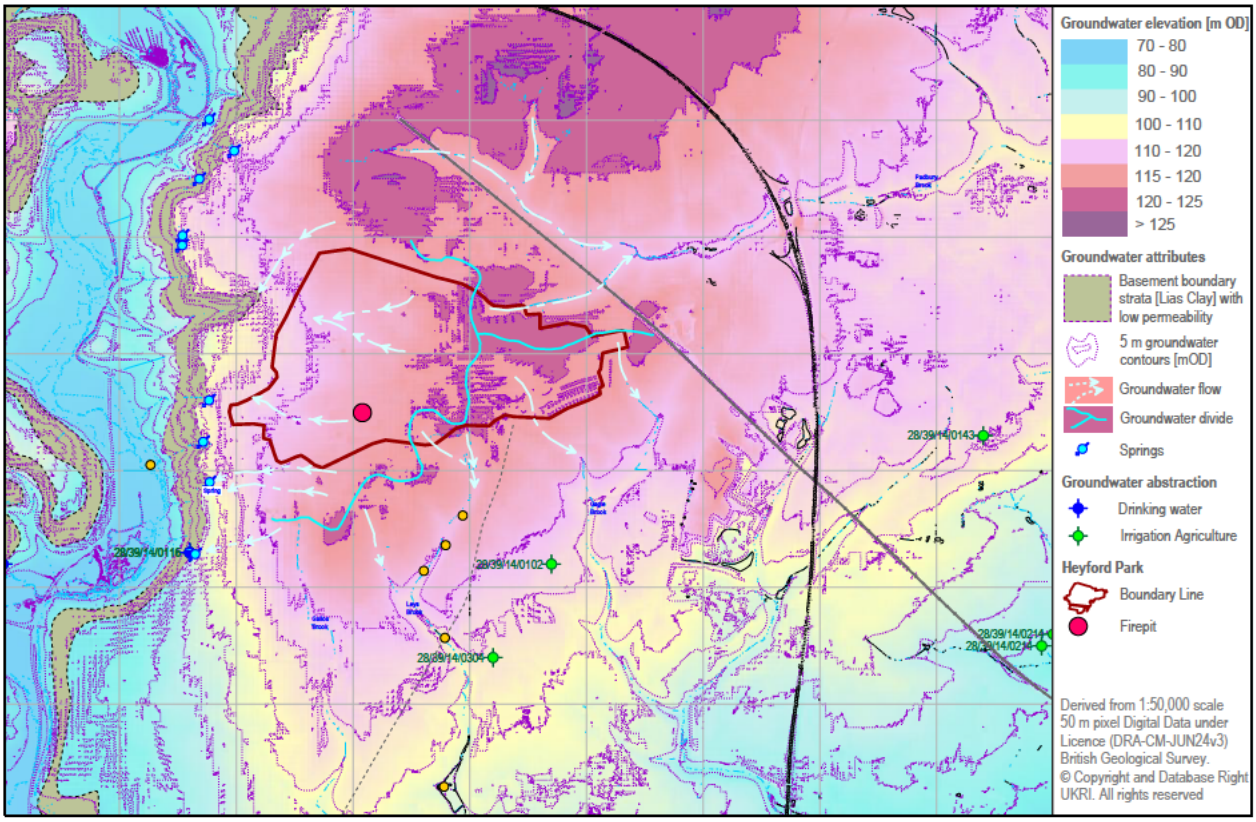


Figure 17. Groundwater divide and flow in the vicinity of the Heyford Airbase.

As there would appear to be a scarcity of PFAS data in groundwater, measurements sampling and analysis should be taken carried out those at boreholes closest to the firepit location (the source of historic PFAS) including at Manor Farm and Park Farm, and any boreholes, wells or springs in the Cherwell Valley.

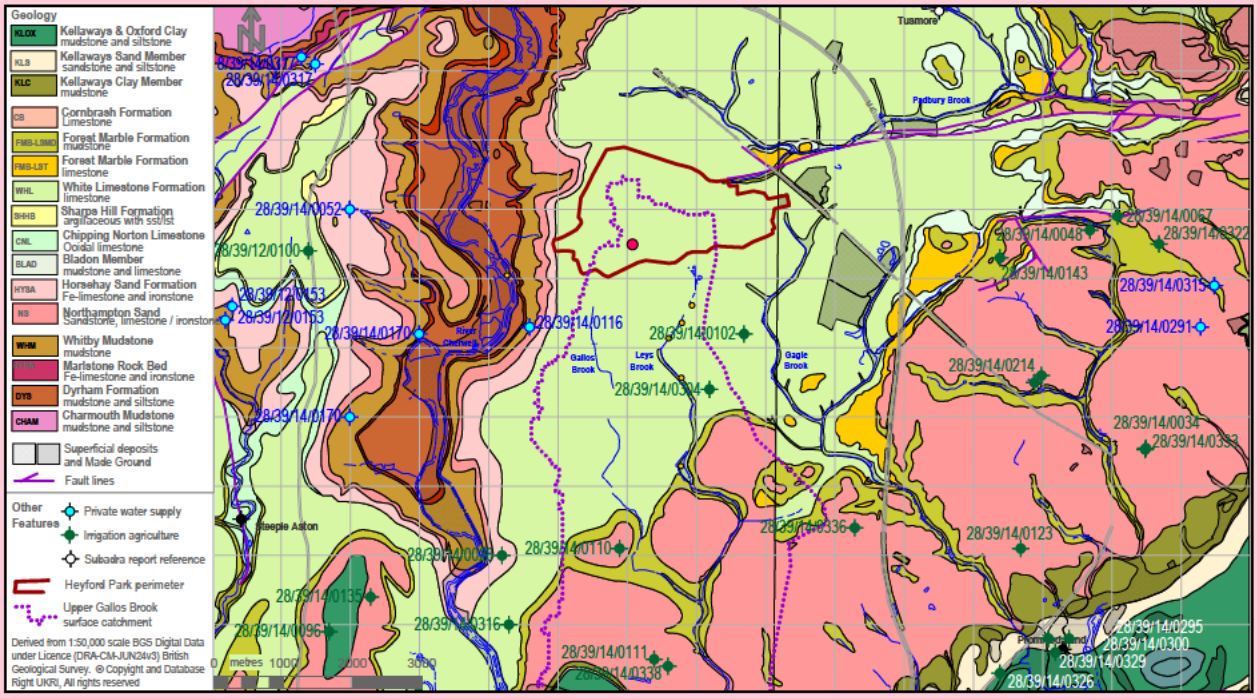


Figure 17. Licensed boreholes used for irrigation and private water supply.

Contaminated soil on site will contribute to groundwater contamination by direct infiltration. There would appear to be little information available on PFAS in groundwater at Upper Heyford. The Subadra report (2026) mentions three boreholes which were sampled by the EA, but they are a significant distance away from the site: Tusmore Estate (5.7 km NE), Steeple Aston (6.8 km SW on the opposite side of the River Cherwell and past the Whitby Mudstone barrier), and Promised Land (8.5 km SE in Bicester). The only relevant site is the Promised Land farm borehole, which would be expected to lie in the path of regional groundwater movement in the Great Oolite Group. However, testing found only trace concentrations as follows:

- Tusmore Estate zero
- Steeple Aston 0.00081 µg/l
- Promised Land 0.00076 µg/l

These values are well below the Drinking Water Inspectorate guidelines of 0.1 µg/l, and monitoring would be required if they exceed 0.01 µg/l.

Biotoxicity Measurements in the Gallos Brook

As part of this current study samples were taken in the Gallos Brook and River Cherwell for a biotoxicity assessment. This is a rapid assessment to identify whether the water would be toxic to any plant or animal life based on the response of natural bacteria to water samples. The samples were taken at 7 locations on the Gallos Brook and one location on the River Cherwell. These are shown on the map in Figure 18. Sampling was undertaken at sites where flow was observed in the

channel, namely those in Figures 4,5,7,9,10 and 11. In addition a further sample was taken from the River Cherwell at Cuttle Mill as a comparison (Figure 19). Sample number 5 was not possible as the river here was dry.

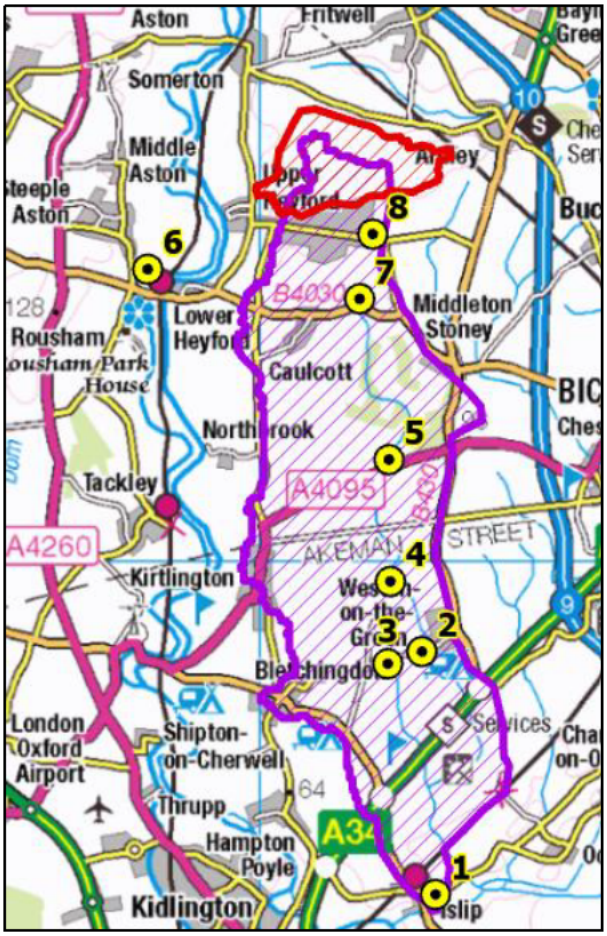


Figure 18. Sampling locations shown in yellow.



Figure 19. The River Cherwell at Cuttle Mill.

Oxford Molecular Biosensors Ltd, a spin-out company from the University of Oxford, has been developing whole-cell biosensors to assess toxicity of water pollution to living organisms. The technology has been engineered through targeted DNA editing of naturally occurring soil bacteria, so that changes in cellular responses triggered by changes in water quality (e.g. specific pollutants and nutrient changes) are relayed through the release of measurable light. This change in light over the 30-minute assay is measured to quantify acute toxicity from a biological organism perspective. This allows bioavailable toxicity to be measured directly, rather than inferred from chemical concentration alone. This way, the bio-impact of complex cocktails of chemicals can be rapidly assessed, which may impact biological life living in streams such a macroinvertebrates and fish. In summary, the biosensors are a new tool which can be deployed to monitor and manage environmental pollution.

The measured biosensor luminescence when in a water sample is compared with the luminescence with a set of positive and negative controls. Decreased light output infers acute toxicity. The design allows it to respond at very low concentrations of a toxic contaminant, with sensitivity over several orders of magnitude. The biosensors respond rapidly (<30 minutes) so can be used as an early warning of toxic pollution. The results of the testing are shown in Figure 20.

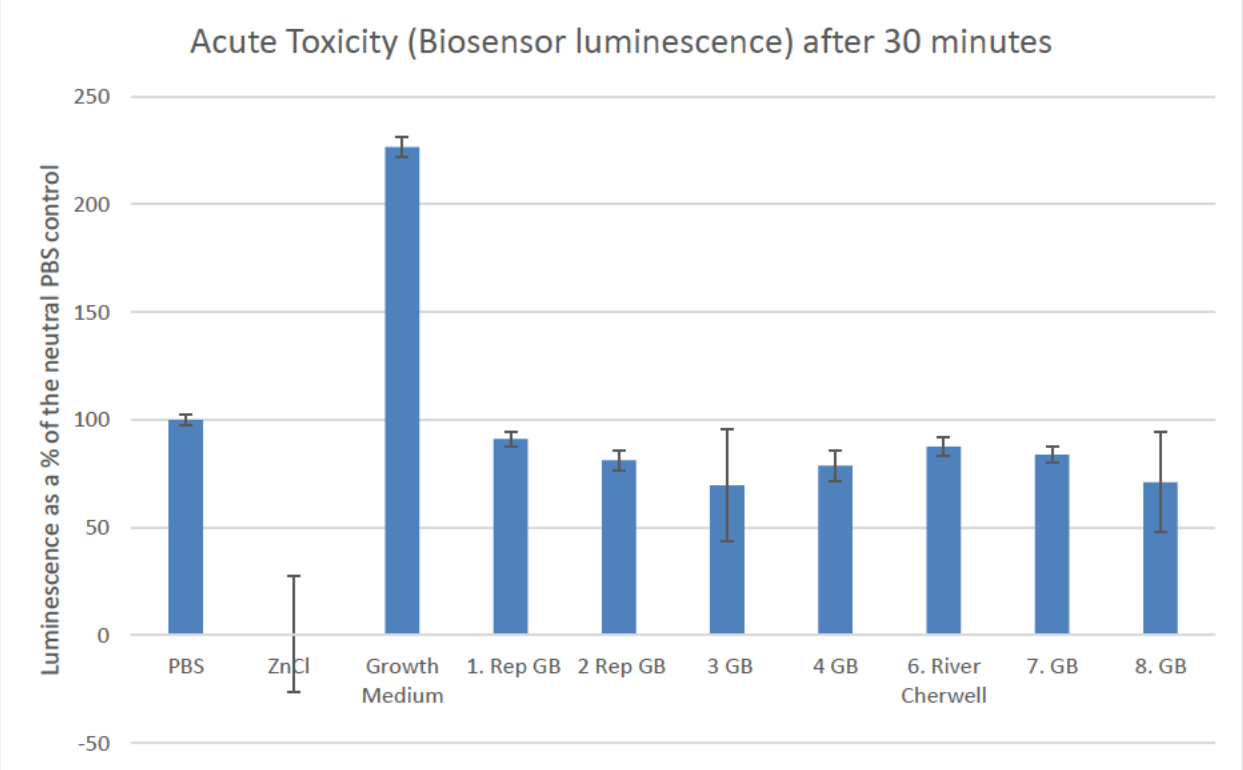


Figure 20. Results of the biotoxicity testing.

The water samples showed statistically significant ($P<0.05$) acute toxicity relative to the phosphate buffered saline (PBS) control. Negative (toxic) control ZnCl was included, as well as growth medium (positive control) for reference. Samples 3 and 8, located at Weston on the Green and the Leys Ditch at Upper Heyford respectively, demonstrated the highest acute toxicity with a 38% and 36% reduction in luminescence respectively compared to the PBS control. The least toxic samples measured were sample 1 near Islip and sample 6 on the River Cherwell, however these still demonstrated around 20% reduction in light relative to the neutral PBS control, so an overall reduction in water quality.

This is a moderate but significant toxicity result which would require further work to evaluate the cause of toxicity. Potential causes of toxicity may include chemical pollutants such as metals, PFAS/PFOS or other sources e.g. effluent discharge (BOD or high Ammonia) from the base and housing developments at Upper Heyford. Note for the labels on the x-axis in Figure 20 the number given corresponds to the number on the map in Figure 18.

Catchment Scale Water Quality Modelling

One approach to understanding the movement and distribution of such chemicals is to make use of combined hydrological and chemical models. Such a model has been developed by Prof Paul Whitehead at WRA. The INCA (Integrated Catchment) suite of dynamic, processed based models cover a range of water quality constituents including nutrients (Nitrogen and Phosphorus), sediments, dissolved oxygen and biochemical oxygen demand and organic pollutants such as PCBs and POPs.

The INCA (Integrated Catchment) models are a family of complex, process based, dynamic flow and water quality models designed for water quality assessment (Whitehead et al., 1998a, 1998b). In summary, the discretization of catchment and river structure is provided by determining the order of streams, their length and width between reach points, and by compiling dimensions and characteristics of individual sub-catchments (including soil properties, chemical characteristics and land use information). INCA has been applied widely to 25 catchments across the UK and 70 globally. The models have been applied extensively to the River Thames catchments for all the water quality variables using a reach structure as shown in Figure 21. The INCA Organics version of the model incorporates the hydrological flows and the chemistry of PFAS to simulate the exchange between the water, the sediments in the streams and biology in the streams such as fish, as illustrated in Figure 22 for PCBs in the Thames.

It would be a worthwhile project to apply the INCA model to simulate PFAS in the Upper Heyford Streams. Once established this would give a clearer understanding of the contamination and the distribution of PFAS in the area.

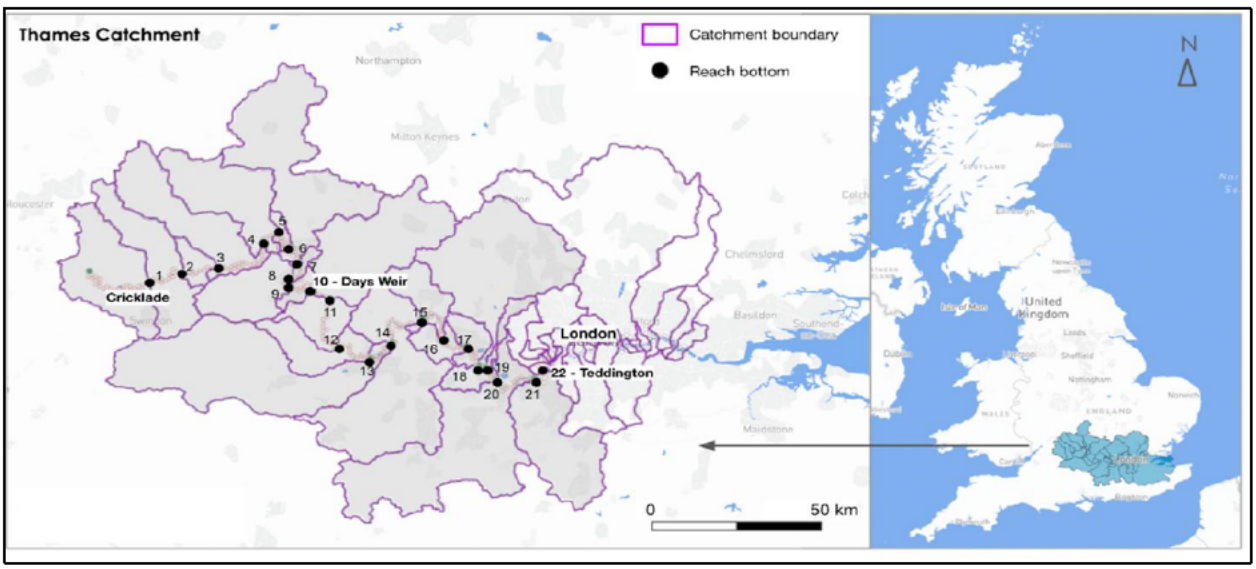


Figure 21. INCA application to the River Thames catchment.

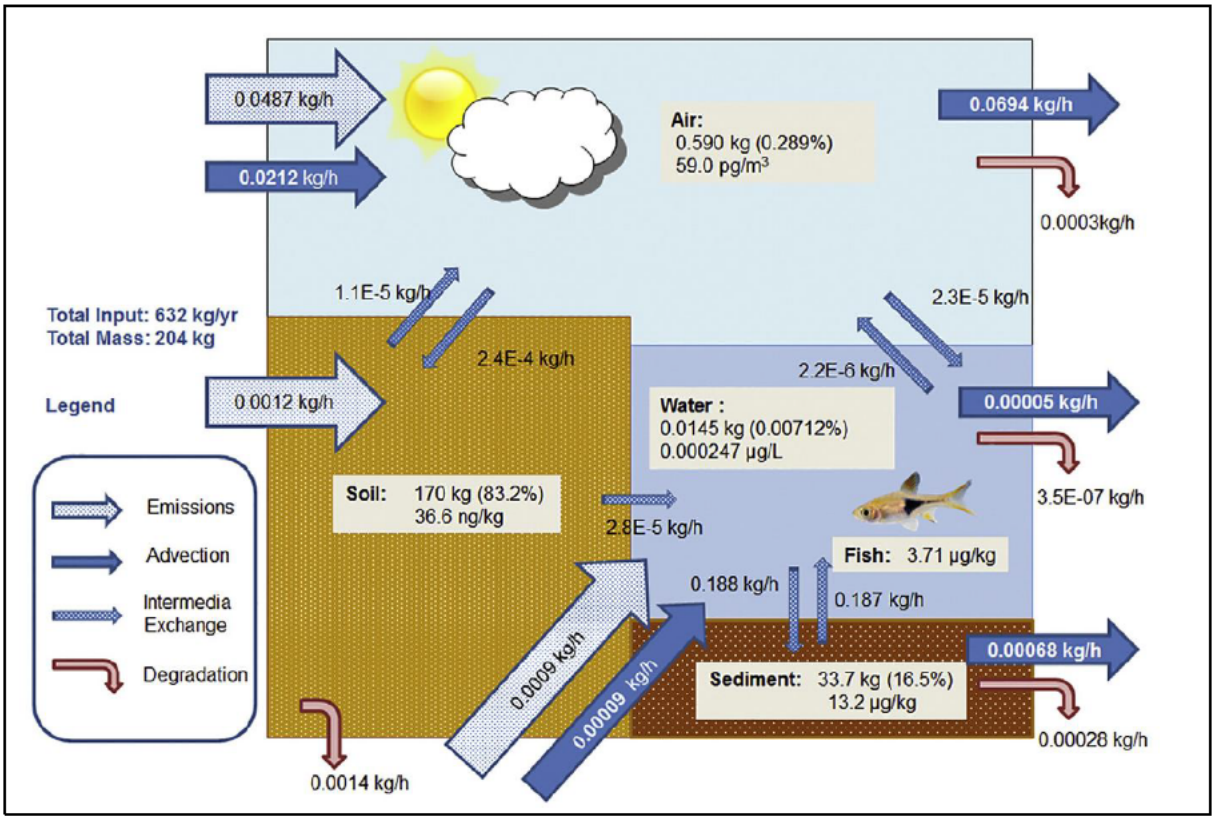


Figure 22. INCA modelled distribution of PCBs in the Thames.

References

British Geological Survey (2026) https://geologyviewer.bgs.ac.uk/

Cranfield University (2026) http://www.landis.org.uk/soilscapes/

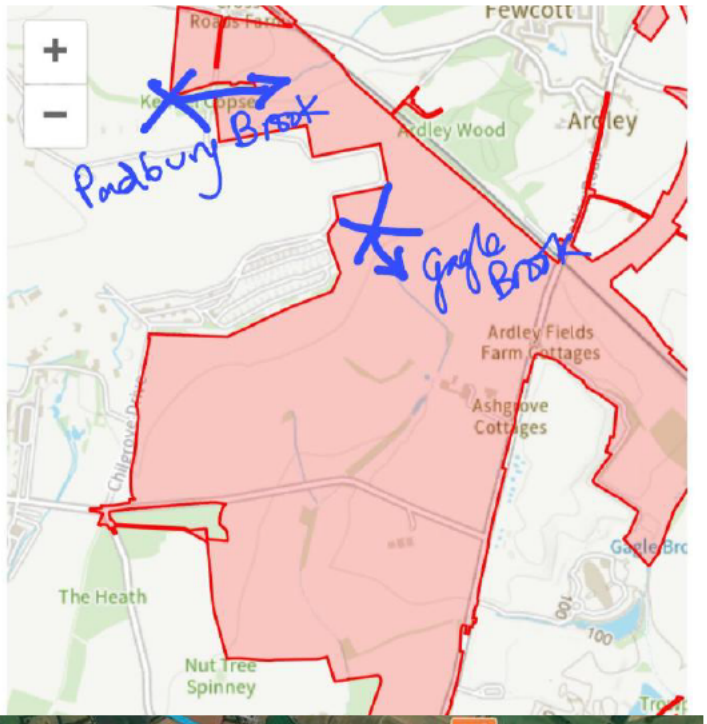
Centre for Ecology and Hydrology (2026) National River Flow Archive Gauging Station Search http://nrfa.ceh.ac.uk/data/search

Subadra (2026) PFAS Data Review for Former RAF Heyford and Surrounding Area Near Bicester.

Whitehead, P.G., Wilson, E.J. and Butterfield, D. (1998a) A semi-distributed Integrated Nitrogen Model for Multiple source assessment in Catchments (INCA): Part I - Model Structure and Process Equations, Science of the Total Environment, 210/211 pp. 547-558.

Whitehead, P.G., Wilson, E.J., Butterfield, D. and Seed K. (1998b) A Semi-distributed Integrated Nitrogen Model for Multiple source assessment in Catchments (INCA): Part II Application to large River Basins in South Wales and Eastern England, Science of the Total Environment 210/211 pp. 559-583

PFAS testing sites shown by blue crosses below on red line boundary of OXSRFI application site.





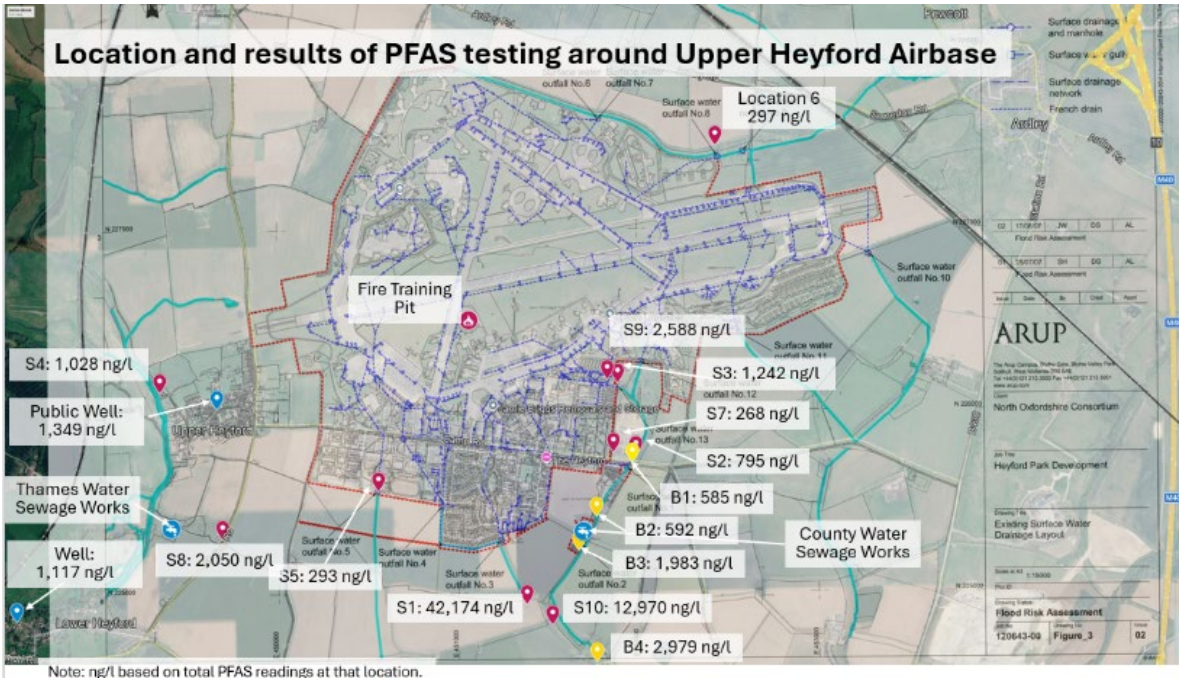


MEMO - PFAS Contamination at Heyford Park, Oxfordshire - 6.9.2026

- Site of RAF Upper Heyford, operated by US Airforce throughout Cold War & First Gulf War until 1994
- Located on Great Oolite limestone plateau, above a Principal Aquifer; Groundwater classed as 'vulnerable'
- Multiple surface water outfalls from underground streams flow into Gallos & Gagle Brooks, then Rivers Cherwell and Ray to the west and south, as well as Padbury Brook and Bedford Ouse Catchment to NE
- Partially redeveloped by Dorchester Living; housing to South (1,300 houses), light industry on the flying field

Map of Testing Locations

- EA test data on Gallos Brook 4.3km from site shows high levels of PFAS from 2023- 25 (2021 ng/l), the worst of 700 water bodies tested across UK (compare RAF Fairford 763ng/l and Moreton Fire College at 579 ng/l)



- Surface Water: 10 further locations tested in 2026 by Subadra Consulting and 4 more by BWB, commissioned by the developer Richborough, on application site to E of Heyford Pk (25/03343/OUT) (see Test Results)
- 2x wells used for drinking water tested by Extractus Laboratories >10 times safe limit of 100ng/l
- PFOS levels at all surface locations significantly above EQS for surface water of 0.65 ng/l- worst affected stream (S1) approx 43,000 times the EQS for PFOS (42,174ng/l total PFAS, 27,823 ng/l PFOS)
- Livestock and people drink from highly contaminated streams/boreholes and nearby homes regularly flood

Source of Contamination

- Most likely source is AFFF firefighting foam used at the Fire Training Area (shown on map above), also automatic fire suppression systems in hangars, crash sites and hot pit for re-fuelling running aircraft
- Foam very regularly discharged in massive quantities directly into the soil and literally 'washed down drains'
- Confirmed by historic MOD documents obtained by Calum Miller the local MP

Planning Process

- Dorchester Living ("DL") application for 9,000 homes (25/02190/HYBRID) pending decision from Cherwell District Council (not included in the Local Plan)
- Hydrock Ground Conditions Report 2025 (part of DL application) describes contaminant pathway of migration from fire training area to surface water as 'likely'; no schedule for testing and remediation included
- **No PFAS testing ever carried out on site** despite airfields being known hotspots and contaminant profiles published by Department for the Environment on Airports and Airfields (1995), CL:AIRE TB19 PFAS (2019) listing PFAS/firefighting foam as contaminants that should be investigated
- Planning Inspectorate in the 2009 report APP/C3105/A/08/2080594 recommended planning condition stipulating testing and remediation of the fire training area, but this was not imposed – why not?
- Similar sites such as RAF Dunsfold extensively tested for PFAS since 2020 and Wurtsmith Air Force Base since 2010, so why not Heyford?
- DL granted permission to build a primary school 390m from the fire pit in 2025 25/01443/REM no mention of PFAS in risk assessment or planning conditions and yet children known to be the biggest receptors of PFAS

TEST REPORT

Report Number: 2026-4888

Customer Name :	Subadra Consulting Ltd
Customer Address :	13 Triangle Business Park Stoke Mandeville HP22 SBL
Order Number :	37945
Additional Reference:	-
Issue :	0
Date of Receipt :	10/09/2026
Date of Analysis :	10/09/2026
Date of Report :	16/09/2026
Sample Type :	Surface Water
Customer Sample Identifier :	Gagle Brook - East tanks 03/09/2026
Sample Condition :	Conforming

Comments:
Any opinions or interpretations are outside the laboratory's scope of accreditation. The results included within the report are representative of the samples submitted for analysis and are expressed on as received basis, unless otherwise stated. This certificate shall not be reproduced, except in full, without the prior written approval of VLS. Customer name, address, order number, additional reference and sample identifier as provided by the customer.

Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

UKAS TESTING
26667

Results PFAS

Sample Type : Surface Water
Test Report Number : 2026-4888
Customer Sample Identifier : Gagle Brook - East tanks 03/09/2026
Sample Condition : Conforming
Test Method : VLS SOP 021

PFAS Compound	MDLs	Units	Conc.
3:3 FTCA	2	ng/l	ND
4:2 FTSA; 4:2 FTS	1	ng/l	ND
PFecHS	1	ng/l	ND
5:3 FTCA	2	ng/l	ND
6:2 FTSA; 6:2 FTS	1	ng/l	2.4
7:3 FTCA	2	ng/l	ND
8:2 FTSA; 8:2 FTS ^	1	ng/l	ND
6:2 Cl-PFESA; 9Cl-PF3ONS	1	ng/l	ND
10:2 FTS	1	ng/l	ND
8:2 Cl-PFESA; 11Cl-PF3OUdS	1	ng/l	ND
DONA; ADONA	1	ng/l	ND
EtFOSE ^	1	ng/l	ND
FBSA	1	ng/l	ND
FHxSA	1	ng/l	3.29
FOSAA	1	ng/l	ND
HFPO-DA (Gen X)	1	ng/l	ND
HFPO-TA	1	ng/l	ND
EtFOSA; N-EtFOSA	1	ng/l	ND
NEtFOSAA; EtFOSAA	1	ng/l	ND
NFDHA	1	ng/l	ND
MeFOSA; N-MeFOSA	1	ng/l	ND
NMeFOSAA; MeFOSAA	1	ng/l	ND
MeFOSE	1	ng/l	ND
PFBA	1	ng/l	6.01
PFBS	1	ng/l	ND
PFDA	1	ng/l	ND
PFDoA	1	ng/l	ND
PFDoS	1	ng/l	ND
PFDS	1	ng/l	ND
PFEESA	1	ng/l	ND
PFHpA	1	ng/l	2.62
PFHpS	1	ng/l	ND
PFHxA	1	ng/l	5.52
PFHxDA ^	1	ng/l	ND
PFHxS Linear	1	ng/l	9.34
PFHxS Branched #	1	ng/l	ND
PFHxS Total #	1	ng/l	9.34
PFMOBA	1	ng/l	ND
PFMOPrA	1	ng/l	ND

Results PFAS

Sample Type : Surface Water
Test Report Number : 2026-4888
Customer Sample Identifier : Gagle Brook - East tanks 03/09/2026
Sample Condition : Conforming
Test Method : VLS SOP 021

PFAS Compound	MDLs	Units	Conc.
PFNA	1	ng/l	ND
PFNS	1	ng/l	ND
PFOA Linear	1	ng/l	4.78
PFOA Branched #	1	ng/l	ND
PFOA Total #	1	ng/l	4.78
PFODA	1	ng/l	ND
PFOS Linear	1	ng/l	102
PFOS Branched #	1	ng/l	14.9
PFOS Total #	1	ng/l	117
FOSA (PFOSA)	1	ng/l	7.64
PFPeA	1	ng/l	7.17
PFPeS	1	ng/l	ND
PFTeA ^	1	ng/l	ND
PFTrDA (PFTriA)	1	ng/l	ND
PFUdA; PFUnA	1	ng/l	ND
PFUnDS	1	ng/l	ND
6:2 FTAB #	5	ng/l	21

ND - not detected

 # Non Accredited

^ The recovery of ES standard either <70% or >130%

NB - The above does not affect the results as recoveries % within EPA1633 method range.

TEST REPORT

Report Number: 2026-3108

Customer Name :	Subadra Consulting Ltd
Customer Address :	13 Triangle Business Park Stoke Mandeville HP22 SBL
Order Number :	37447
Additional Reference:	-
Issue :	0
Date of Receipt :	12/06/2026
Date of Analysis :	15/06/2026
Date of Report :	16/06/2026
Sample Type :	Surface Water
Customer Sample Identifier :	NBS Stream (S2) 09/06/26
Sample Condition :	Conforming

Comments:
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Approved by : Karolina Pettit
Position : Director

Signature : K. Pettit

UKAS TESTING
26667

Results PFAS

Sample Type : Surface Water
Test Report Number : 2026-3108
Customer Sample Identifier : NBS Stream (S2) 09/06/26
Sample Condition : Conforming
Test Method : VLS SOP 021

PFAS Compound	MDLs	Units	Conc.
3:3 FTCA	2	ng/l	ND
4:2 FTSA; 4:2 FTS	1	ng/l	ND
PFecHS	1	ng/l	ND
5:3 FTCA	2	ng/l	ND
6:2 FTSA; 6:2 FTS ^	1	ng/l	8.39
7:3 FTCA	2	ng/l	ND
8:2 FTSA; 8:2 FTS	1	ng/l	ND
6:2 Cl-PFESA; 9Cl-PF3ONS	1	ng/l	ND
10:2 FTS	1	ng/l	ND
8:2 Cl-PFESA; 11Cl-PF3OUdS	1	ng/l	ND
DONA; ADONA	1	ng/l	ND
EtFOSE ^	1	ng/l	ND
FBSA	1	ng/l	ND
FHxSA	1	ng/l	ND
FOSAA	1	ng/l	ND
HFPO-DA (Gen X) ^	1	ng/l	ND
HFPO-TA	1	ng/l	ND
EtFOSA; N-EtFOSA ^	1	ng/l	ND
NEtFOSAA; EtFOSAA	1	ng/l	ND
NFDHA	1	ng/l	ND
MeFOSA; N-MeFOSA ^	1	ng/l	ND
NMeFOSAA; MeFOSAA	1	ng/l	ND
MeFOSE ^	1	ng/l	ND
PFBA ^	1	ng/l	4.45
PFBS	1	ng/l	1.52
PFDA	1	ng/l	ND
PFDoA	1	ng/l	ND
PFDoS	1	ng/l	ND
PFDS	1	ng/l	1.18
PFEESA	1	ng/l	ND
PFHpA	1	ng/l	3.01
PFHpS	1	ng/l	1.06
PFHxA	1	ng/l	6.85
PFHxDA ^	1	ng/l	ND
PFHxS Linear	1	ng/l	22.7
PFHxS Branched #	1	ng/l	2.29
PFHxS Total #	1	ng/l	25
PFMOBA	1	ng/l	ND
PFMOPrA	1	ng/l	ND

Results PFAS

Sample Type : Surface Water
Test Report Number : 2026-3108
Customer Sample Identifier : NBS Stream (S2) 09/06/26
Sample Condition : Conforming
Test Method : VLS SOP 021

PFAS Compound	MDLs	Units	Conc.
PFNA	1	ng/l	ND
PFNS	1	ng/l	ND
PFOA Linear	1	ng/l	9.1
PFOA Branched #	1	ng/l	ND
PFOA Total #	1	ng/l	9.1
PFODA	1	ng/l	ND
PFOS Linear	1	ng/l	50.6
PFOS Branched #	1	ng/l	17.8
PFOS Total #	1	ng/l	68.4
FOSA (PFOSA) ^	1	ng/l	ND
PFPeA	1	ng/l	6.4
PFPeS	1	ng/l	1.01
PFTeA ^	1	ng/l	ND
PFTrDA (PFTriA)	1	ng/l	ND
PFUdA; PFUnA	1	ng/l	ND
PFUnDS	1	ng/l	ND
6:2 FTAB #	5	ng/l	161

ND - not detected

 # Non Accredited

^ The recovery of ES standard either <70% or >130%

NB - The above does not affect the results as recoveries % within EPA1633 method range.

OP/LQA/00068A

DEFENCE ESTATE ORGANISATION (WORKS)

RAF UPPER HEYFORD

LAND QUALITY ASSESSMENT
PHASE ONE : DESK STUDY
INTERPRETIVE REPORT

PROJECT NO: 07686
REPORT

March 1997

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Sutton Coldfield
West Midlands
B75 7RL

Prepared by
ERM EnviroClean Ltd for
Ministry of Defence
Defence Estate Organisation
(Works) under commission
WS13/1982/3 June 1995

ERM

REPORT RELEASE SHEET

DEFENCE ESTATE ORGANISATION (WORKS)

RAF UPPER HEYFORD

LAND QUALITY ASSESSMENT
PHASE ONE : DESK STUDY
INTERPRETIVE REPORT

PROJECT NO: 07686 - REPORT

Task Officer
[redacted] Environmental Engineer
Defence Estate Organisation (Works)
Blakemore Drive
Sutton Coldfield
West Midlands
B75 7RL

Tel: [redacted]

Prepared by
ERM EnviroClean Ltd
for the Ministry of Defence
Defence Estate Organisation (Works)
under commission WS13/1982/3
June 1995

Reference 3377.19

For and on behalf of
ERM [redacted]
Appr[redacted]
Signe[redacted]
Positi[redacted]
Date: 10/3/97

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Approved by Task Officer:-
[redacted]

Approved by Sponsor:-
.....

ERM EnviroClean Ltd, Eaton House, Wallbrook Court, North Hinksey Lane, Oxford, OX2 0QS, England. Tel. [redacted] Fax. [redacted] Email post@ermuk.com http://www.ermuk.com

1 INTRODUCTION

ERM were appointed on 5th August 1996, by Defence Works Services, under the terms of the three year commission ref WS13/1982/3, to undertake a Land Quality Assessment of RAF Upper Heyford, Cambridgeshire.

The objectives of the Land Quality Assessment are as follows:

- *To provide information relating to the environmental quality of the ground conditions present on the establishment.*
- *To consider the potential for future ground contamination occurring as a result of demolition of the existing buildings.*
- *To assess the potential human health and environmental risks at the site.*

This section forms the executive summary of the interpretative report and provides a summary of the environmental conditions at RAF Upper Heyford, the suitability of the site for re-use and the effects of contamination on development potential.

2 ENVIRONMENTAL SETTING

The environmental setting of the site has been described with reference to the following sources of information.

- *Geological Sheet 218, Chipping Norton 1:50000, published by the British Geological Survey, 1968.*
- *Ordnance Survey Landranger Sheet 164, Oxford and surrounding area 1989, published at a scale of 1:50000.*
- *The Quality of Rivers and Canals in England and Wales (1990-1992), NRA River Quality Map, 1:750000.*
- *Policy and Practice for the Protection of Groundwater, Regional Appendix Thames Region, published by the National Rivers Authority (NRA), 1992.*
- *Policy and Practice for the Protection of Groundwater, Regional Appendix Anglian Region, published by the National Rivers Authority (NRA), 1992.*
- *Groundwater Vulnerability Map Series, Sheet 30 Northern Cotswolds, 1:100000, published by the Environment Agency (EA), 1996.*
- *EA database of licensed surface water and groundwater abstractions (1996).*

RAF Upper Heyford is situated approximately 5km to the north-west of Bicester, Oxfordshire. The 494 hectare site is located at approximately 130 metres above ordnance datum (mAOD) on a plateau structure and is bounded to the east and southwest by the communities of Ardley and Upper Heyford, respectively (national

grid reference: SP 51 27). On the western edge of the airfield, the elevation drops approximately 50m over 1 km down to the River Cherwell and the Oxford Canal. The site comprises of runways, aircraft hangars, offices, workshops, fuel installation and weapons storage facilities.

In addition to the Oxford Canal and River Cherwell to the west, several surface water courses drain radially away from the plateau. Gallos Brook and Gagle Brook are noted to the south and further small brooks are observed around the site area in the north, north-west and westward towards the Oxford Canal. Several of these small streams are spring fed and are therefore dependant on groundwater discharges for flow. The Oxford Canal and the River Cherwell are classified as Class C (fair) according to the NRA's General Quality Assessment (GQA) Scheme.

One spring water abstraction is situated in close proximity of the site at national grid reference SP496253. The supply is used for domestic and agricultural use.

The site is immediately underlain by approximately 3m of silty clays with minor sandy and gravelly horizons. This unconsolidated superficial material is underlain by the weathered top of the 20 to 34 m thick, Great Oolite Limestone unit. The limestone is in turn underlain by several hundred metres of mudstones, limestones and sandstones of the Lias group.

Groundwater is used extensively throughout the region for industrial purposes, public water supply and domestic use. Most large scale abstraction comes from the Great Oolite Limestone although the Lower Lias and the unconsolidated drift deposits may contain locally important minor aquifers where permeable horizons are sufficiently thick and continuous.

Hydraulic continuity between the superficial material and the underlying limestone bedrock is considered likely across the site. Given the prominence of the plateau feature and relative high exposure of the Oolite, it is expected that the limestone aquifer receives recharge water in the form of infiltrating precipitation. The groundwater elevation in the limestone is not known, although the presence of spring issues on the flanks of the plateau surrounding the site indicate the likely elevation of the water table. Five licensed groundwater abstractions are situated within 3km of the site and used for both domestic purposes and supplies.

3 *SITE HISTORY*

The history of the site has been described with reference to the following historical maps held at the Bodleian Map Library in Oxford.

- *Ordnance Survey County Series, 1:2500, editions Oxfordshire Sheets: XXII.3, XVI.10, XVI.11, XVI.14, XVI.15, from: 1875, 1900, 1922.*
- *Ordnance Survey County Series, 1:10 560, edition Oxfordshire Sheet: XVI from 1885.*

- *Ordnance Survey County Series, 1:10 560, editions Oxfordshire Sheets: XVI.SW, XVI.SE from 1900, 1923.*

- *Ordnance Survey SP 52 NW, 1:10 560, from 1955, 1966, 1982, 1993.*

- *Ordnance Survey SP 42 NE, 1:10 560, from 1955, 1979.*

- *Ordnance Survey SP 4826-4926, SP 5025-5125, SP 5226-5326, SP 5227-5327, SP 5026-5126, SP 5027-5127, 1:2500, 1974.*

The site had a 'greenfield' landuse prior to being occupied by Canadian Airforce in 1916. RAF Upper Heyford covers an area of 494 hectares and was originally laid down in the traditional 'A' shape pattern. Only the main runway remains from the original configuration.

The site closed in 1920 and was then re-opened as a bomber station in 1927 and later utilized for leaflet dropping sorties in 1940. The base was taken over by the USAF in 1951 and the main runway was then increased to 10,000ft. Further extensive modifications were carried out with the arrival in 1970 of the 20th Tactical Fighter Wing and the first F-111E swing wing bombers. Base population levels have peaked at 4,500 including non-military personnel. The base closed and was passed back to the RAF in 1994.

4 POTENTIAL CONTAMINATION AND ENVIRONMENTAL RISK

4.1 CONTAMINANT SOURCES, PATHWAYS AND RECEPTORS

The current most sensitive receptors to the potential release of contaminants from past and/or present activities at the site are ground and surface waters and the abstractions that rely on them. The soil cover provided by the superficial deposits is thin and as such it provides only limited protection to the underlying limestone aquifer. As such the aquifer unit is susceptible to impaction from surface or sub-surface releases of site-related constituents.

The on-site surface water drainage network, feeds into a series of oil interceptors across the site and, as such, the discharge of free phase oil product is prevented. It should be noted, however, that dissolved phase contaminants are not prevented from draining off-site by these interceptors. As such, the surface water drainage network may historically have and in the event of shallow groundmass contaminant source areas, may continue to provide off-site containment migration pathways.

Any future site personnel/construction workers may also be potential receptors due to direct contact with on-site contaminant source areas within the shallow groundmass. Grazing animals may also be receptors of concern due to grazing in source areas located on the site, and by drinking potentially contaminated surface waters on the flanks of the plateau (off-site).

The ESR states that there are no historical records of significant spillage incidents occurring at the Upper Heyford site since the USAF began using the site in 1950. The ESR does indicate, however, that there have been a number of fuel spill incidents over the years, as well as two aircraft mishaps, one of which occurred off-base.

The only documented evidence of these spillages and aircraft mishaps were included in the ESR report and the information supplied is limited in detail. The report indicates fuel leaks and spills at POL 17 and on the south side of Facility 221 and states that all potential contamination was cleaned up to 'above standards'. Whilst the ESR was being prepared, POL 19 was in the process of investigation by Miller Environmental Limited. Miller Environmental were undertaking an investigation in order to assess the degree of potential contamination within the subsurface deposits at POL 19 located in Area A. This was carried out following the loss of 1,145 US gallons (4.3m^3) of unleaded fuel to the groundmass from an offset fill pipe of which only 2.63m^3 of emulsified product were recovered from an adjacent interceptor. Investigation of POL 19 was still being carried out at the time of the ESR publication.

The 'on-site' aircraft incident involved an aircraft over-run to the '09' (west) end of the runway. It is reported that all contaminated soils resulting from the incident were disposed of to a site licensed by the Oxfordshire County Council under the Environmental Protection Act 1990 and the site of the incident was cleaned up to the satisfaction of the National Rivers Authority (NRA), now part of the EA. No other details of the incident, including nature of contaminant impact, its extent or impact on underlying groundwaters were available. Further discussions with the EA highlighted a potential contamination incident resulting from integrity failure of the POL supply pipeline at Upper Heyford. No further details on the incident were available.

MOD supplied anecdotal evidence indicated two further spill incidents relating to the POL fuel storage facilities. The only information on the spill incidents is as follows:

- *Fuel spill at POL 21 (May 1990). Some contaminated soil removed.*
- *Fuel spill at POL 23 (1992). 350m^3 spillage.*

No visual evidence of contamination was observed during the site reconnaissance.

During the site history several potential contamination incidents were documented by the EA. Their records include a POL supply pipeline failure at RAF Upper Heyford and several further POL fuel spillages. They were, however, unable to supply details of the incidents or locations of the spillage events.

There are a number of potential sources of contamination located within RAF Upper Heyford. The areas of most immediate concern are tabulated in Table 4.1a below.

Table 4.1a *Potential Sources of Human/Environmental Risk*

POL site	Human Health	Groundwater	Surface Water
POL 1 Area A Fac 270	E	C	C
POL 2 Area A Fac 254	E	C	C
POL 3 Area A Fac 274	E	C	C
POL 5 Area D Fac 385	E	C	C
POL 6 Area D Fac 382	E	C	C
POL 7 Area D Fac 385	E	C	C
POL 8 Area D Fac 386	E	C	C
POL 9 Area C Fac 215	E	C	C
POL 10 Area C Fac 219	E	C	C
POL 11 Area C Fac 229	E	C	C
POL 13 Area B Fac 283	E	C	C
POL 14 Area B Fac 284	E	C	C
POL 15 Area B Fac 241	E	C	C
POL 16 Area B Fac 242	E	C	C
POL 17 Area B Fac 245	E	C	C

POL site	Human Health	Groundwater	Surface Water
POL 19 Area A Fac 614	E	C	C
POL 20 Area D Fac 375	E	C	C
POL 21A Area A Fac 392	E	C	C
POL 21B Area A Fac 393	E	C	C
POL 21C Area A Fac 394	E	C	C
POL 22 Area C Fac 395	E	C	C
POL 23A Area B Fac 285	E	C	C
POL 23B Area B Fac 269	E	C	C
POL 24 Area A Fac 269	E	C	C
POL 25A Area D Fac 376	E	C	C
POL 25B Area D Fac 377	E	C	C
Fuel Tank Area C Fac. un-named	E	C	C
POL fuel supply pipeline	E	C	C
Former Waste Area adjacent to POL 20.	C/D	C	C
Fire Training Area A	C/D	C	C
Fuel Supply Station Fac. 493	C/D	C	C

KEY:

A: Immediate significant risk to human health
B: Immediate significant risk of damage to the environment
C: Major Remediation Liability
D: Minor Remediation Liability
E: Minor Significance, no remediation required
F: No effect on re-use options or site value

4.2 ENVIRONMENTAL RISK

ERM consider that the nature of the activities carried out on-site since 1916, the presence of the potential contaminant sources identified at RAF Upper Heyford, together with its location on a major aquifer unit (Great Oolite Limestone) and the presence of nearby potable supply abstractors suggest that the site represents a potentially serious risk to the environment.

Due to the absence of any extensive superficial cover, the limestone aquifer will have been vulnerable to spillage/leakage of contaminants on-site. The rate of groundwater flow within limestone deposits, generally controlled by fractures and fissures, permits the rapid transfer of contamination through the saturated groundmass. In addition, the site is situated on a plateau area and all groundwater and surface water flow is expected to flow down gradient into several catchments areas. From the reviewing the Ordnance Survey mapping of the site area, and from discussions within the EA, it is apparent that several spring issues exist on the plateau flanks supported from groundwater flow. As such off-site impacts may already have occurred, although no documented impacts are known.

Surface water drainage systems leaving the site are a further potential contaminant pathways for impact of surrounding surface water resources. Although interceptors were present on the drains at the periphery of the site. Such units will not intercept dissolved phase contaminants. As such off-site impacts could have occurred. In the event of groundmass source areas being present, the surface drains could continue to provide a pathway for contaminant seepages from source areas.

Given the sensitivity of the setting and nature of operations, intrusive investigations are required to confirm, or otherwise, the potential for detrimental impacts on groundwater/surface water resources. In terms of the potential redevelopment of the site, this will be a requirement of the Environment Agency, as statutory consultee to any planning permission process (per discussions between ERM and EA). Additionally, even without redevelopment proposals, the EA would in all likelihood require evaluation of impacts, in their primary role of protection of water resources.

Such investigations for environmental risk evaluation could initially be focused on the sampling of surface water/springs on the periphery of the plateau. Given the predicted groundwater flows, analysis of such water would provide an initial indicator of site impacts on groundwater resources. Supporting information from the installation of a small number of groundwater monitoring wells, down hydraulic gradient of the identified potentail source areas is also likely to be required by the EA. In the event of impacts being identified, further and more detailed groundwater investigations will be required to understand impacts and allow risks posed to be evaluated and appropriate remedial actions scoped.

5 SUITABILITY FOR RE-DEVELOPMENT

The site clearly has high redevelopment potential. However, the results of the LQA suggest potentially significant sources of groundmass impact from site activities, particularly associated with the POL installations and POL distribution ring main pipeline. Given the nature of the activities on-site therefore, the current suitability of the site for a range of redevelopment end users (without remedial action) cannot be predicted without confirmation of groundmass quality. Therefore intrusive investigations are required, focused on areas of contaminant concern. Such investigation in parallel with the groundwater/surface water investigations identified above, are likely to be required to demonstrate the suitability of the site for redevelopment (with or without remediation) based on risk to future end-users and impacts on water resources.

Such information is likely to be a major component of any potential purchaser's due-diligence programme, will allow the MOD to assess the liability exposure as land owner and is likely to be requirement of any planning process related to redevelopment of the site. The data will also allow decision's to be made on the need for remedial action, either to allow redevelopment for intended land use or mitigate impacts on water resources, and allow costs for such actions to be provisionally set.

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1 INTRODUCTION

This report outlines ERM EnviroClean's interpretive analysis of the environmental setting at RAF Upper Heyford, along with the nature and location of potential sources of contamination at the site. It makes an assessment of the anticipated contaminants present and their potential fate and migration within the environment.

Based on an analysis of the environmental risks prevailing at the site, the report assesses the need for, and extent of, any further work at the site to determine potential liability exposure to the MOD, particularly given the MOD's desire to divest of the property.

The recommended phased programme of works, together with cost implications to the MOD are provided within *Section 4*.

The remainder of this report is structured as follows:

- *Section 2* - Contamination Model
- *Section 3* - Options and Recommendations for Further Investigations
- *Section 4* - Recommended Option, Costs & Timescale

- *Annex A* - Technical Brief
- *Annex B* - Site Index
- *Annex C* - Environmental Risk Assessment - Existing Use
- *Annex D* - Environmental Risk Assessment - Housing and Gardens
- *Annex E* - Environmental Risk Assessment - Agriculture
- *Annex F* - Proposed Timescale

2 CONTAMINATION MODEL

2.1 INTRODUCTION

This section identifies the potential sources, pathways and receptors related to any potential environmental contamination from RAF Upper Heyford. The list of potential sources has been compiled from site walkover observations and after the review of all relevant documents concerning the environmental status and history of the site.

The groundmass at the site area consists of a thin superficial unit recorded to a depth of approximately 3m below ground level (bgl) which in turn rests directly on limestone deposits that represent a regionally important aquifer. The site is situated on groundmass highly sensitive to potential contaminants. Rapid transfer and migration of these contaminants is anticipated should surface and subsurface spillage occur.

The limestone aquifer is afforded only minimal protection from the overlying superficial deposits from surface and near surface contaminant impact. Consequently, the most sensitive receptor at the RAF Upper Heyford site is the groundwater resource and the surface abstractions and groundwater abstraction wells in close proximity to the site.

RAF Upper Heyford is surrounded by an extensive network of surface water drains (with associated oil traps) and springs that lead into streams and brooks.

Should impaction of the groundmass and groundwater have occurred further receptors at potential risk from contamination include current and future site users/construction workers. In this instance, human health could be adversely affected by dermatological contact, inhalation and ingestion of both soils and groundwater. Grazing animals, currently on-site and situated in the surrounding farmland may also be potential receptors, impacted directly from ingestion of impacted soils and/or spring waters.

The site layout plan and accompanying index are presented as *Annex B.*

2.2 SOURCE-PATHWAY-RECEPTOR RELATIONSHIP

2.2.1 *Potential Contaminant Source Areas*

From the site reconnaissance visit undertaken at the RAF Upper Heyford site, it was apparent that the airbase has undergone a thorough surface clean-up programme on cessasation of USAF flight activities. In addition to the surface clean-up, the cleansing and drainage of POL facilities, UST's, AST's, and POL ring main pipelines on-site is also documented. Little visual evidence of surface groundmass contamination was apparent during the

visual inspection and there was no evidence of associated features such as vegetation die-back.

However, the potential does exist for previous site activities to have impacted the underlying groundmass and groundwaters. Of particular concern are the POL facilities, the POL supply ring main and the fire practise area. In addition, underground and semi-buried tanks and pipelines are anticipated to rest directly on the underlying weathered limestone and limestone bedrock and could potentially be in contact with shallow groundwaters. As such, surface clean-up operations do not in themselves imply that no sub-surface impacts have occurred historically.

It is not possible to confirm whether the groundmass has been impacted from previous site activities without intrusive investigations. The remainder of this sub-section reviews the locations on-site considered to have the potential to have impacted the groundmass and/or underlying and surrounding groundwater and surface water resources. In addition, the risk to a number of identified potential receptors has been assessed. For ease of reference the site has been divided into five areas A, B, C, D & E. A diagram showing the location of these areas is presented as *Figure 2.2a*. More detail on potential source areas in each Area are provided in *Sections* 2.3 to 2.6.

Area A

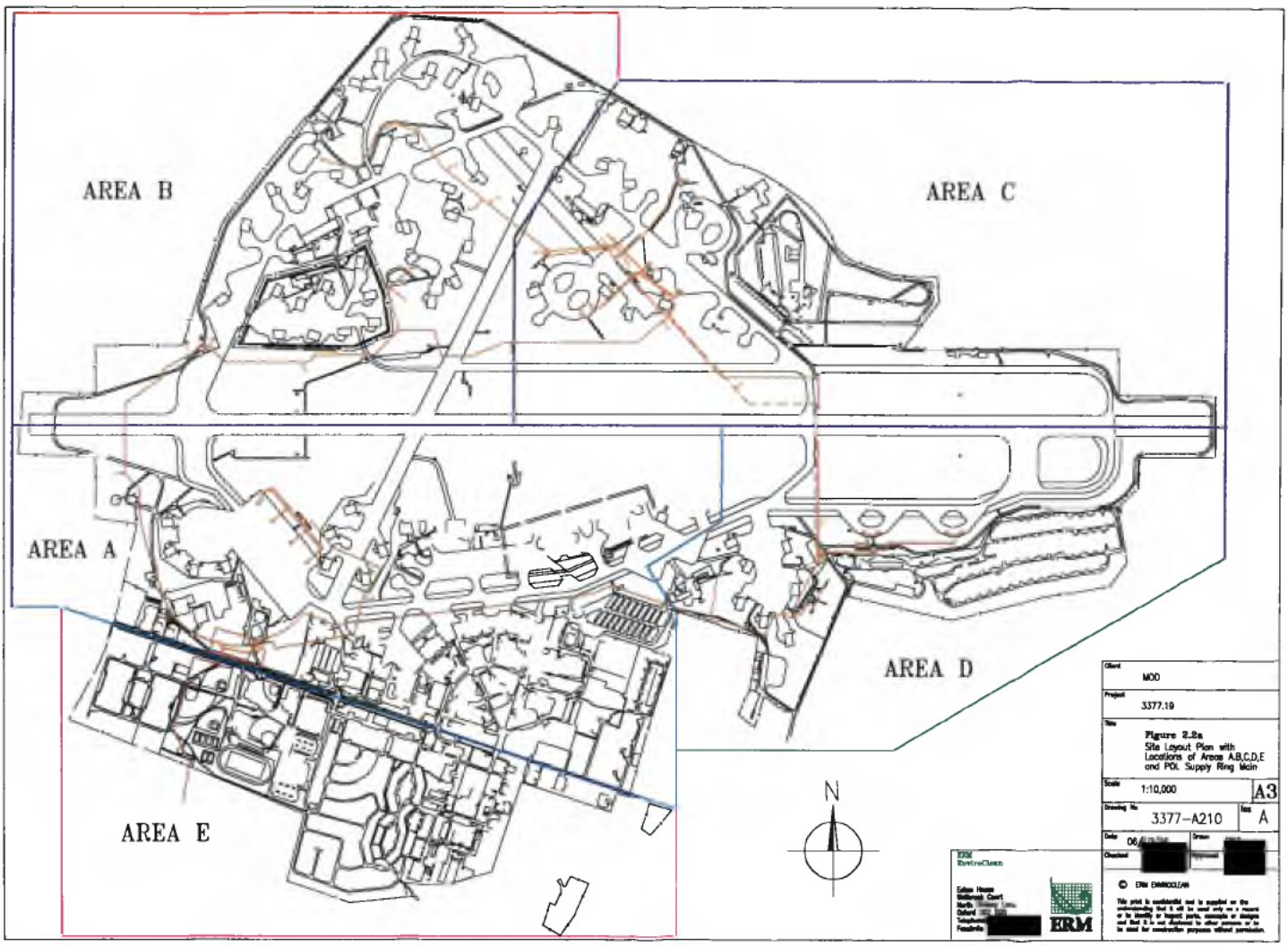
The main activities undertaken in Area A included the maintenance, refuelling, painting and storage of aircraft, and the storage of POL. Various engine and truck maintenance workshops are situated within this area, together with deicing agent storage tanks.

The majority of potential source areas within Area A are therefore associated with the possibility of leaks/spills of jet fuel, diesel, and heating oil from underground and above ground storage tanks and underground pipelines. Minor leakage of hydraulic oils from plant located within the hangars and evidence of paint spraying was also observed at the time of the site reconnaissance. Further potential contaminants include paints, paint thinning and stripping chemicals and degreasing agents.

A spillage incident occurring at POL 19 was investigated by Miller Environmental Limited in 1994. The conclusions of the investigation was that both soil and groundwater had been locally impacted by the loss of unleaded fuel from the bulk storage facility. No record of remedial action has been available to ERM.

Area B

The main activities undertaken in Area B included the maintenance, refuelling, painting and storage of aircraft, and the storage of POL. As with Area A, the majority of potential source areas are associated with the possibility of leaks or spills of jet fuel, diesel, and heating oil from underground and above ground storage tanks and underground pipelines. Minor leakage of hydraulic oils from plant located within the hangars and


AREA B
AREA C
AREA A
AREA D
AREA E
N
MOD
3377.19
Figure 2.2a
Site Layout Plan with
Locations of Areas A,B,C,D,E
and PDL Supply Ring Main
1:10,000
A3
3377-A210
A
ERM
EnviroClean
ERM

evidence of paint spraying was again observed during the site reconnaissance.

Area C

The main activities undertaken in Area C included the maintenance, refuelling, painting and storage of aircraft, the storage of POL and the storage of munitions. The majority of potential sources within Area C are again associated with the possibility of leaks or spills of jet fuel, diesel, and heating oil from underground and above ground storage tanks and underground pipelines. No visual evidence of contamination arising from the storage of munitions was observed.

Area D

As above, the main potential sources of contamination are associated with the possibility of spillages or leakages of POL. Additionally, munitions storage was undertaken in this area of the site within concrete lined facilities. The risk associated with the munitions storage relates to the continued presence of munitions in unsuitable facilities. No visual degradation of the storage areas was observed at the site, and no remaining munitions or evidence of contamination was noted.

From the results of the site audit it is felt that no current/future risk is associated with the former storage of munitions.

Area E

Area E is predominantly an area of residential property and as such the potential for contaminative activities to have occurred is considerably lower than the other areas. There were, however, some facilities whose operations could cause environmental risk. These include the former base petrol and diesel filling station, the laundry/dry cleaning facility, and a photographic processing facility. In addition, several UST and AST locations were present within the area.

POL Supply Ring Main

MOD personnel informed ERM that the POL supply ring main had been replaced and re-routed during USAF operations. In addition, the EA informed ERM that leakage to the groundmass from the supply line had occurred previously, although no details were available on the spillage incident.

Asbestos

The asbestos Register and Management Plan for RAF Upper Heyford confirmed Chrysotile, Crocidolite and Amosite (white, blue and brown) were present within several facilities across the site. The condition of the asbestos at the time of preparation of the ESR varied around the site from good to

poor and was observed to be brittle or friable in many cases. Weathering of the asbestos where it had been used for roofing materials was also noted. In order to fully assess the current status of the asbestos present within the site area it is considered necessary to carry out an up to date field survey.

Current Site Usage

Most buildings on the RAF Upper Heyford site are currently unoccupied although much of the site was utilized by private tenants at the time of site reconnaissance.

Grazing of sheep is currently carried out over much of the central and eastern area of the site as is the storage of motor vehicles by two large car distribution companies. Other site activities currently carried out on-site include crane repair and maintenance workshop and firework storage.

2.2.2 *Potential Contaminant Migration Pathways*

The potential exists for any contaminant releases from the aforementioned sources to enter the groundwater of the superficial deposits and groundwaters of the limestone aquifer. Superficial soil cover at the site is minimal and as such can only afford limited protection to the underlying limestone aquifer.

The main site lies on a plateau feature and the groundwater table is considered to follow topography to some degree. Spring discharge points are recorded around the plateau edge and this is expected to be the surface manifestation of the limestone groundwater table.

The main potential migration pathway for potential contaminants released within the sub-surface on-site is therefore groundwater and contamination transfer down gradient, away from the plateau area. Due to the nature of the topography and the lateral extent of the site, the groundwater and any potential associated contamination could migrate to various surface water catchment areas surrounding the site, particularly those fed by the springs on the plateau edge. Groundwater flow is considered to be strongly controlled by localised fractures within the limestone aquifer and therefore preferential flow via fracture systems is expected. Seasonal fluctuation of groundwater levels will vary considerably with recharge conditions.

The surface water drainage network on-site feeds into a series of oil interceptors across the site and, as such, the discharge of free phase oil product is likely to have been prevented. It should be noted, however, that dissolved phase contaminants are not prevented from draining off-site by these interceptors, and any such compounds within the surface waters could have therefore impacted off-site surface water resources.

In addition to the potential migration of contaminants from the source areas into the environment, there is also potential direct exposure pathways that could impact directly upon human health. Given the extensive surface clean-up carried out as part of Base closure, it is considered likely that such pathways would only exist during disturbance of the impacted groundmass during site redevelopment works.

The potential pathways associated with impacts on human health are considered to be as follows:

- ingestion of contaminated soil, food produce grown in, or on, impacted areas, and contaminated waters;
- inhalation of contaminated dust and vapours;
- dermatological contact with contaminated soils, waters and chemical product.

Given the proposals for the redevelopment of the site, these pathways are expected to play an important role in defining the significance of any observed source areas, and the need for remedial action to render the site suitable for the envisaged new land-use.

2.2.3 *Receptors*

The principal receptors of any contamination originating from the site area will be groundwater, spring and surface water abstractions situated around the site. Potential receptors include abstractions sourced within the superficial deposits and the underlying major limestone aquifer. Water from abstractions within the area are utilized for both potable and agricultural supply.

Given the potentially high permeability of the limestone groundmass it is considered likely that rapid migration of potential impacted waters could occur. Consequently, impaction of water quality at receptors in close proximity to the site could occur within a relatively short space of time. It should be noted however, that no documented evidence of receptor water quality problems was identified during this LQA.

In addition to receptors identified above, direct exposure to humans as a consequence of the use and development of the site is possible should the shallow groundmass/groundwater be found to have been impacted. These are identified as follows:

- human dermatological contact, inhalation and ingestion of impacted soils through recreational and everyday activity, particularly if impacted areas do not have restricted access (potential exists for inhalation of asbestos fibres (if present); and

- construction workers working in and around impacted groundmass.

2.3 SOURCE/PATHWAY/RECEPTOR: AREA A

A review of potential sources, pathways and receptors specific to Area A is provided below.

2.3.1 Potential Source Areas

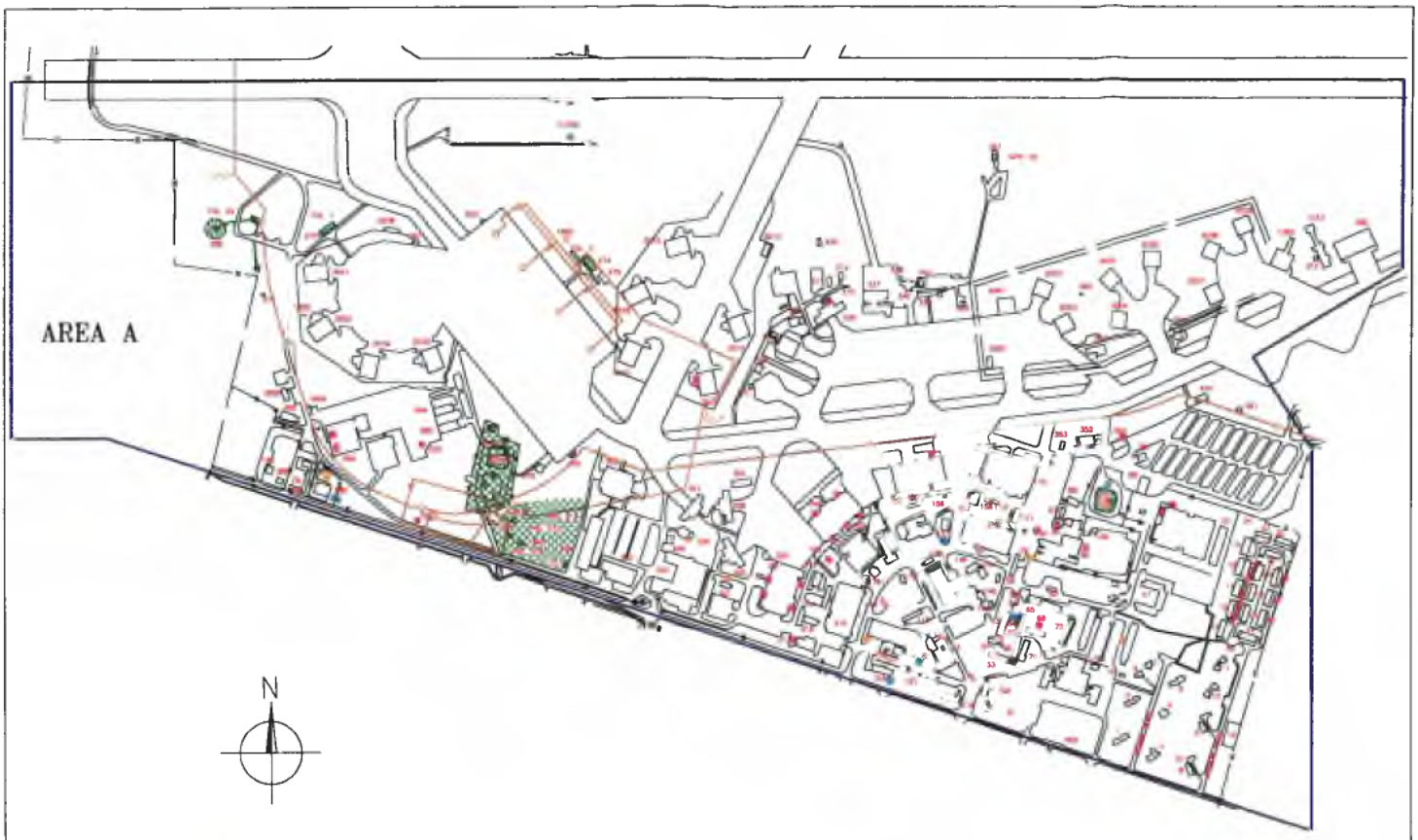
The potential source areas identified within Area A are illustrated in *Figure 2.3a*. Previously identified potential sources of contamination located within Area A are described in *Table 2.3a*. From the site reconnaissance ERM have identified potential sources at the POL sites (*Table 2.3b*), AST's (*Table 2.3c*), UST's (*Table 2.3d*), and maintenance areas and workshops (*Table 2.3e*). In addition to these, further potential sources of contamination are described in *Table 2.3f*.

Table 2.3a ***Previously Identified Potential Sources of Contamination, 1992 and 1993***

Area	Date	Description	Status at time of ERM site visit
A	1993	POL 19: Leakage of Petroleum and diesel to the groundmass.	No evidence of contamination
A	1993	Gravel area behind the special purpose section is oil stained at Facility 80	No evidence of contamination
A	1993	Car wash at the auto hobby shop (Fac 80) is located on a slope and the discharge of soap, water, oil and grease drains to the storm drain adjacent to the base commissary.	Car wash no longer operational. No evidence of contamination.

Table 2.3b ***POL sites***

POL site	Volume (m^3) and DEO Status Details, 1996	Original Contents	Comments[1] and Status at time of ERM site reconnaissance
POL 1/ Area A Fac 270	1x141.9 Underground Tank (UST) Tank cleaned and water filled in 1993.	Diesel	No visual evidence of contamination.
POL 2/ Area A Fac 254	6x54.9 (UST) Tanks cleaned and water filled in 1993.	Diesel	No visual evidence of contamination.
POL 3/ Area A Fac 274	2x378.5 (UST) Tanks cleaned and water filled in 1993.	JP-8[2]	No visual evidence of contamination.



Key:

- AST's
- Former Site of AST's
- UST's
- POL Facilities and Bulk Fuel Storage Locations
- POL Supply Ring Main

Client: MOD

Project: 3377.19

Figure 2.3a
POL Facilities, POL Supply Mains, AST's and UST's.
Area A

Scale: 1:5,000 Approx

A3

Drawing No: 3377-A199

Issue: A

ERM
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[redacted]

ERM

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POL site	Volume (m^3) and DEO Status Details, 1996	Original Contents	Comments[1] and Status at time of ERM site reconnaissance
POL 19/ Area A Fac 614	3x54.5 3x54.5 In use by contractor. Tanks 1 and 6 filled with concrete. Tanks 2 and 3 diesel. Tanks 4 and 5 unleaded petrol.	MOGAS[3] DIESEL	No visual evidence of contamination or of former spillage incident. On going use as fuel store for by car distribution company.
POL 21A Area A Fac 392	1x736.2 (Semi-buried) Tank cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.
POL 21B Area A Fac 393	1x736.2 (Semi-buried) Tank cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.
POL 21C Area A Fac 394	1x1453.4 (Semi-buried) Tank cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.
POL 24 Area A Fac 269	1x4753.8 (Semi-buried) Tank cleaned and water filled.	JP-8	No visual evidence of contamination.

[1] In addition to the POL facilities the POL supply pipeline is partially situated within this area.

[2] JP-8 is primarily composed of a middle distillate group of kerosene based product with the following known additives:

Icing Inhibitors: ethylene glycol monoethyl ether, diethylene glycol monomethyl ether.
Static Dissipators: toluene, isopropanol, xylene and chromium
Metal Deactivator: N, N-Disalieylidine-1, 2-Propane Diamine, xylene
Corrosion inhibitors.

[3] MOGAS (motor gasoline) is American terminology for 'petrol' for use in road vehicles.

Table 2.3c ***Above Ground Storage Tanks (AST's)***

Building	Area	Contents/Capacity	Comments
32	A	2 boiler houses with possible former AST's. Details unknown.	Former diesel fuel heating supply. No visual evidence of contamination.
68	A	Possible site of two former AST's.	No visual evidence of contamination.
Approx. 100m to north of Fac. 68.	A	2 x 22.71m^3 fuel oil AST's in brick bund.	Bulk fuel installation drained in 1994. No visual signs of contamination.
77	A	Boiler House and associated fuel AST of approximately 4m^3.	No visual evidence of contamination.

Building	Area	Contents/Capacity	Comments
78	A	Boiler House and associated fuel AST of approximately $4m^3$.	No visual evidence of contamination.
80	A	Unknown.	Former workshops with associated former boilers and possible AST inside.
81	A	Unknown.	As 80.
85	A	Unknown.	As 80.
86	A	Possible site of two former AST's.	Associated plant rooms attached to former maintenance shop. Former AST/below ground pipework.
101 Fire Station	A	Possible site of former AST.	No visual evidence of contamination.
106	A	Former AST of $2.5m^3$ capacity.	No visual evidence of contamination.
114	A	3 x $5m^3$ fuel oil AST's	Former boiler house/generator building. Inside concrete floor stained with oil.
151	A	Unknown.	Empty warehouse facility with associated boiler house and former AST. No visual evidence of contamination.
250	A	Unknown.	No visual evidence of contamination.
288	A	Unknown.	Associated site of former AST. Only bund remains. No visual evidence of contamination.
299	A	Unknown.	Associated boiler house with two oil fuel fill points and former AST's. No visual evidence of contamination.
301	A	Redundant $22.73m^3$ oil fuel tank.	Tank cleaned and water filled March 1994. No visual evidence of contamination.
313	A	Unknown.	Associated site of a former boiler house and AST. No visual evidence of contamination.
320	A	Unknown.	Associated five small boiler houses and locations of five (now removed) AST's.
326	A	Facility adjacent to 326 with boiler house containing 3 x $11.66m^3$ oil fuel AST's	No visual evidence of contamination.
335	A	Unknown.	Boiler room to rear of building with possible AST. Details unknown. No evidence of contamination.
338	A	Unknown.	Boiler room to rear with possible AST. Details unknown. No evidence of contamination.
345	A	Unknown.	Associated five small boiler houses and locations of five (now removed) AST's.
350	A	Unknown.	Possible location of former AST. No visual evidence of contamination.

Building	Area	Contents/Capacity	Comments
354	A	Unknown.	Former workshops and associated former boilers and possible AST. No evidence of contamination.
1368	A	Unknown.	former Hush House. Site of former AST noted along with associated below ground pipework.
1443	A	Unknown.	Former Hush House. Site of former AST noted along with associated below ground pipework.
1403	A	1 x $6m^3$ fuel oil AST and possibly another two since removed.	Location of the incoming external POL ring main. Underground pipework in area and oil interceptors. No visual evidence of contamination.
3043	A	1 x metal bunded oil fuel AST, volume unknown.	Associated with decontamination area of hardened shelter. no visual evidence of contamination.

Table 2.3d ***Underground Storage Tanks (UST's)***

Building	Area	Contents/Capacity	Comments
69	A	2 x UST's and two former pumps.	No visual evidence of contamination.
88	A	1 x UST and one oil fill point.	Oily odour and limited staining around entrance to UST.
103	A	2 x UST's.	No visual evidence of contamination except for minor oil stains on the concrete hardstanding.
126	A	UST	Diesel Fuel. No visual evidence of contamination.
131	A	4 x UST's	Associated boiler house with UST's. No visual evidence of contamination.
198	A	5 x UST's and associated pipework.	Hydrocarbon odour and some oil noted within UST chamber. Two re-fill points (diesel and petrol) were unbunded although no visual evidence of contamination.
268	A	1 x possible UST.	No visual evidence of contamination.
299	A	UST	Fuel Oil. No visual evidence of contamination.
346	A	At least 12 x UST's	Deicing fluid, oils, water UST's at former truck service area. No visual evidence of contamination.

Table 2.3e ***Workshops and Maintenance Facilities.***

Facility N°.	Facility	Potential Contaminants	ERM Observations & Comments on Contamination
56 Area A	Maintenance workshop	Unknown.	No visual evidence of contamination.
79 Area A	Vehicle Maintenance Shop.	POL, Solvents and unknowns.	No visual evidence of contamination.
80 Area A	Vehicle Maintenance Shop.	POL, Solvents and unknown.	No visual evidence of contamination.
85 Area A	Vehicle Maintenance Shop.	POL, Solvents and unknown.	No visual evidence of contamination.
86 Area A	Maintenance Shop.	Unknown.	No visual evidence of contamination.
88 Area A	Refuel Vehicle Maintenance Shop.	POL, Solvents, Acids, Alkalis.	No visual evidence of contamination.
316 Area A	Workshop.	Unknown.	No visual evidence of contamination.
318 Area A	Paint Spray Shop	Thinners, and Paint and Paint Stripping Chemicals.	No visual evidence of contamination.
324 Area A	Warehouse/ Workshop	Unknown.	No visual evidence of contamination.
325 Area A	Warehouse/ workshop	Unknown.	No visual evidence of contamination.
327 Area A	Maintenance Dock.	Oils and other unknowns.	No visual evidence of contamination.
328 Area A	Maintenance Dock.	Unknown.	No visual evidence of contamination.
335 Area A	Maintenance Dock.	Unknown.	No visual evidence of contamination.
336 Area A	Hangar Wash Down.	Degreasers, Oils Detergents and other unknowns.	No visual evidence of contamination.
341 Area A	Maintenance Shop - General Purpose.	Unknown.	No visual evidence of contamination.
354 Area A	Garage Refuelling Workshop.	POL, Solvents, Acids and Alkalis	No visual evidence of contamination.
1368 Area A	Hush House.	POL, solvents, unknown.	No visual evidence of contamination.
1443 Area A	Hush House.	POL, solvents, unknown.	No visual evidence of contamination.

Table 2.3f ***Further Potential Sources of Contamination within Area A***

Facility	Facility Use	Potential Contamination	ERM Observations
38	Car Wash Facility	POL waste and detergents.	No visual evidence of contamination.
86	Automobile Hobby Shop	POL, Solvents, Acids, Alkalis.	No visual evidence of contamination.
156	Hazard Store	Unknown.	No visual evidence of contamination.
302	Hazard Store	Unknown.	No visual evidence of contamination.
Adjacent to 330	Fire Practise Pond and Building	POL, Solvents, Fire Fighting Chemicals. Fire pond area drained to storm water drainage.	No visual evidence of contamination.
354	Garage Refuelling Facility	POL, Solvents	Concrete base stained from oil. Central sump shows thin oil film.
424	Hazardous Waste Facility	Unknown	No visual evidence of contamination.

2.3.2 *Pathways, Area A*

Area A lies to the central south of the airfield site and is situated on the shallow gradient of southern flank of the plateau area. Surface water drains to the south. Groundwater is also anticipated to flow in a generally southerly direction (although localized fractures within the limestone may influence the overall direction of groundwater flow).

2.3.3 *Area A Receptors*

Human and Environmental receptors as identified in *Section 2.2.3* above.

2.4 *SOURCE/PATHWAY/RECEPTOR: AREA B*

2.4.1 *Potential Source Areas*

The potential source areas identified within Area B are illustrated in *Figure 2.4a*. Previously identified potential sources of contamination located within Area B are described in *Table 2.4a*. From the site reconnaissance ERM have identified potential sources at the POL sites (*Table 2.4b*), AST's (*Table 2.4c*), UST's (*Table 2.4d*), and maintenance areas and workshops (*Table 2.4e*).

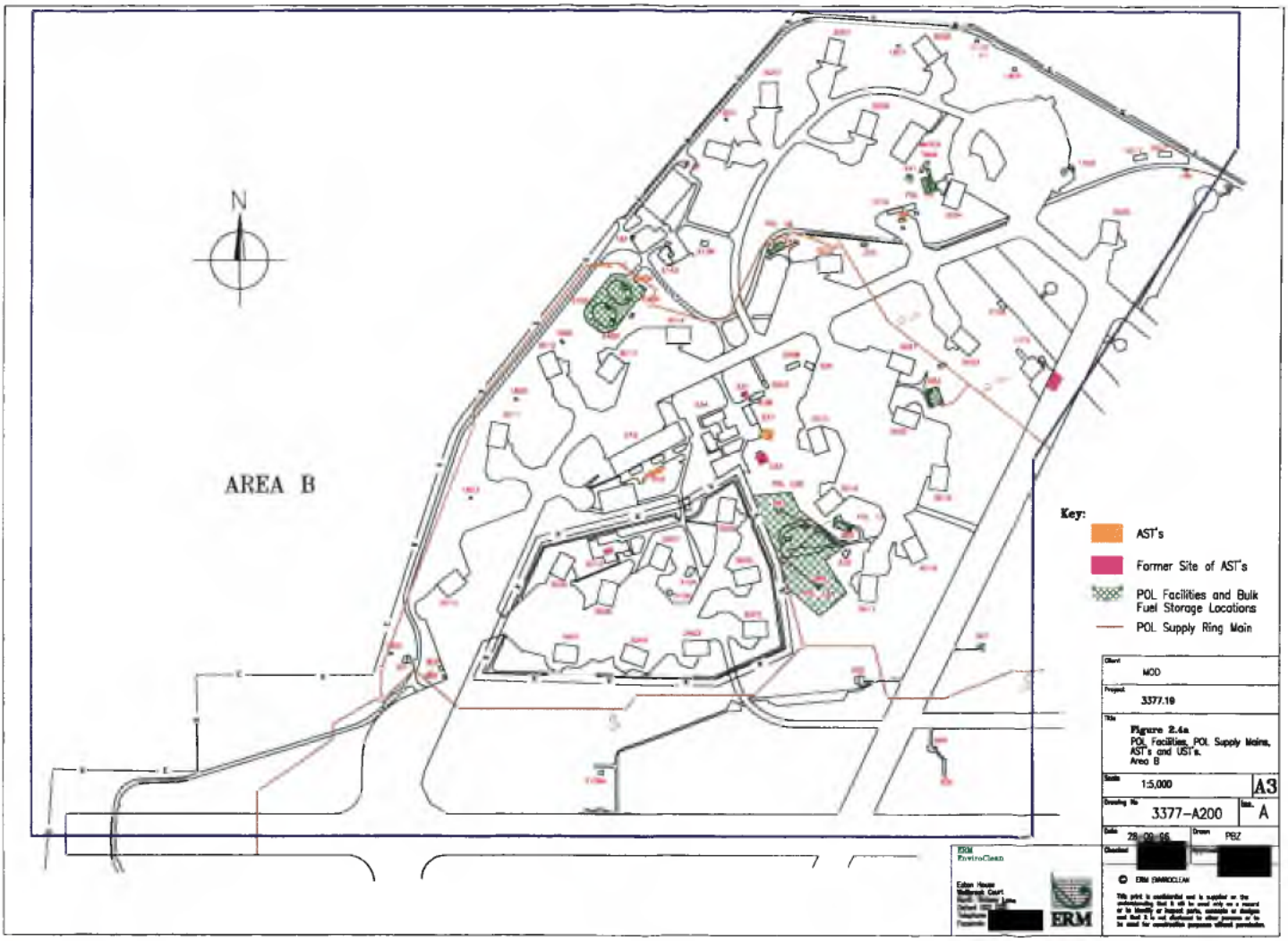

N
AREA B
Key:
AST's
Former Site of AST's
POL Facilities and Bulk Fuel Storage Locations
POL Supply Ring Main
MOD
3377.19
Figure 2.4a
POL Facilities, POL Supply Mains, AST's and UST's.
Area B
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Table 2.4a ***Previously Identified Potential Sources of Contamination, 1992 and 1993***

Area	Date	Description	Status at time of ERM site visit
B	1993	Unidentified material was dumped at the POL 17 disposal facility during site operations.	No evidence of contamination.
B	1993	Oil spill on grass at POL 17. No obvious spill clean-up material located at the site. Subsequent concrete pad built to prevent direct spillage to the natural ground.	No evidence of contamination

Table 2.4b ***POL sites***

POL site	Volume (m3) and DEO Status Details, 1996	Original Contents	Comments[1] and Status at time of ERM site reconnaissance
POL 13/ Area B Fac 283	1x189.3 (UST) Tank cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.
POL 14/ Area B Fac 284	2x189.3 (UST) Tanks cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.
POL 15/ Area B Fac 241	Volume not known (UST)	Not known	No visual evidence of contamination.
POL 16/ Area B Fac 242	1x189.3 (UST) Tank cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.
POL 17/ Area B Fac 245	12x54.9 (UST) Tanks 7,8,9,10,11 cleaned and water filled. Tank 12 contained lead product but now concrete filled. Tanks 1,2,3,4,5,6 still operational.	PRODUCT WASTE	No visual evidence of contamination.
POL 23A Area B Fac 285	1x4440.5 (Semi-buried) Tank cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.
POL 23B Area B Fac 269	1x1946.6 (Semi-buried) Tank cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.

[1] In addition to the POL facilities the POL supply pipeline is partially situated within this area.

Table 2.4c *Above Ground Storage Tanks*

Building	Area	Contents/Capacity	Comments
231	B	Unknown.	Associated former plant room and potential for former AST. No visual evidence of contamination.
233	B	Unknown.	Associated former AST site (now removed). No visual evidence of contamination.
239	B	Unknown.	Associated fuel oil AST with concrete bund. No visual evidence of contamination.
253	B	2 x 15.14m3 fuel oil AST's	No visual evidence of contamination. Two adjacent former re-fuelling points observed.
1319	B	Unknown.	Former test cell and former AST (details unknown). No visual evidence of contamination.
1372	B	Unknown	Former Hush House. Site of former AST noted.

Table 2.4d *Underground Storage Tanks*

Building	Area	Contents/Capacity	Comments
234	B	UST within Squadron Building.	Fuel Oil. No visual evidence of contamination.
2010	B	2 x UST's	Details unknown. No visual evidence of contamination.

Table 2.4e *Workshops and Maintenance Facilities.*

Facility N°.	**Facility**	**Potential Contaminants**	**Observations & Comments on Contamination**
237 Area B	Maintenance Shop.	Unknown.	No visual evidence of contamination.
238 Area B	Workshop.	Unknown.	No visual evidence of contamination.
1372 Area B	Hush House.	POL, solvents, unknown.	No visual evidence of contamination

2.4.2 *Area B Pathways*

Area B is situated to the north-west of the site and is situated on the approximately level and flat plateau top. Surface water drainage is to the

south and to the east of the site and feeds to a series of oil interceptors before discharging off-site.

The potential contaminant migration pathways are considered to be the same as those identified in *Section* 2.3.2 above.

2.4.3 *Area B Receptors*

As per *Section* 2.2.3 above.

2.5 *SOURCE/PATHWAY/RECEPTOR: AREA C*

2.5.1 *Potential Source Areas*

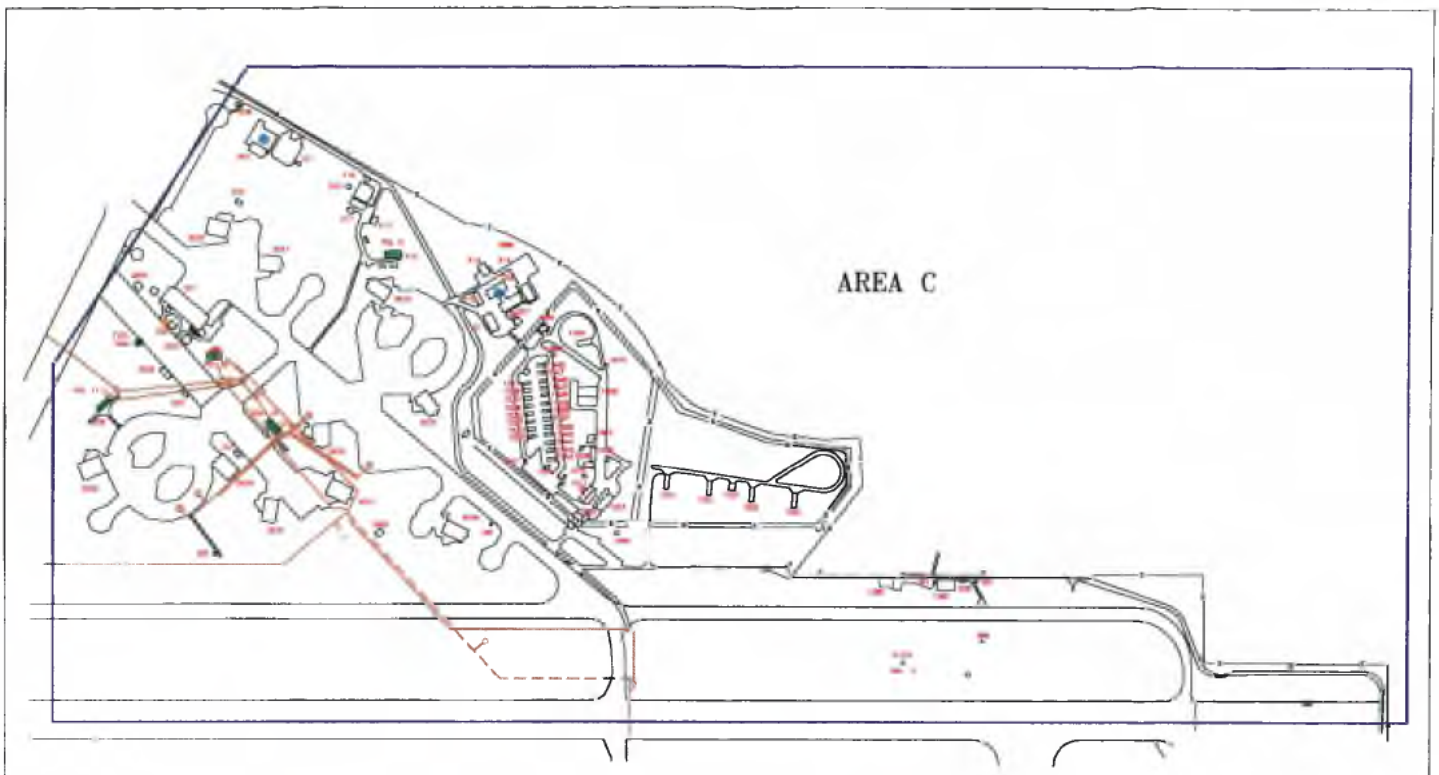
The potential source areas identified within Area C are illustrated in *Figure 2.5a*. Previously known potential sources of contamination, located within Area C are described in *Table 2.5a* below. ERM have further identified potential sources at POL sites (*Table 2.5b*), AST's and UST's (*Tables 2.5c&d*) and Engineering Workshops (*Table 2.5e*). In addition, a number of other sites were identified as potential sources of contamination, and are described in *Table 2.5f*.

Table 2.5a ***Previously Identified Potential Sources of Contamination, 1992 and 1993***

Area	Date	Description	Status at time of ERM site visit
C	1993	North side sewage treatment facilities (Fac 214 and the WSA area) were not constantly operating. The National Rivers Authority were constantly monitoring water quality of the local water course.	Not Applicable

Table 2.5b ***POL sites***

POL site	Volume (m^3) and DEO Status Details, 1996	Original Contents	Comments[1] and Status at time of ERM site reconnaissance
POL 9/ Area C Fac 215	2x189.3 (UST) Tanks cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.
POL 10/ Area C Fac 219	2x189.3 (UST) Tanks cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.
POL 11/ Area C Fac 229	1x189.3 (UST) Tank cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.



Key:

- POL Facilities and Bulk Fuel Storage Locations
- POL Supply Ring Main
- POL Supply Ring Main Re-routed from this Previous Location
- AST's
- Former Site of AST's
- UST's

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Project: 3377.19

Figure 2.5a.
POL Facilities, POL Supply Mains, AST's and UST's.
Area C

Scale: 1:5,000 Approx | A3

Drawing No.: 3377-A197 | Issue: A

Date: 28/[illegible]/14 | Drawn: PSZ

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POL site	Volume (m^3) and DEO Status Details, 1996	Original Contents	Comments[1] and Status at time of ERM site reconnaissance
POL 22 Area C Fac 395	1x1456.8 (Semi-buried) Tank cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.
Fuel Tank Area C Fac. un-named	Unknown.	Unknown	No visual evidence of contamination at this area for potential bulk storage.

[1] In addition to the POL facilities the POL supply pipelines is partially situated within this area.

Table 2.5c ***Above Ground Storage Tanks***

Building	Area	Contents/Capacity	Comments
207	C	Unknown.	Associated former oil-fired boiler (AST possibly inside or below ground pipework). No visual signs of contamination.
255	C	Redundant 22.71m^3 diesel tank.	Redundant tank shows little visual evidence of contamination other than approximately 1cm in concrete sump of bund.
1011	C	Unknown.	Boiler house and former AST for office area.

Table 2.5d ***Underground Storage Tanks***

Building	Area	Contents/Capacity	Comments
209	C	UST within Squadron Building.	Fuel Oil. No visual evidence of contamination.
383	C	UST within Squadron Building.	Fuel Oil. No visual evidence of contamination.

Table 2.5e ***Workshops and Maintenance Facilities.***

Facility N°.	**Facility**	**Potential Contaminants**	**Observations & Comments on Contamination**
239 Area C	Engine Shop.	POL, Solvents Acids, Alkalis.	No Visual evidence of contamination.

Table 2.5f ***Further Potential Sources of Contamination, Area C***

Facility	Facility Use	Potential Contamination	Observed Contamination
3200	Hardened Vehicle Refuelling Shelter.	POL	No visual evidence of contamination.
3201	Hardened Vehicle Refuelling Shelter.	POL	No visual evidence of contamination.
3202	Hardened Vehicle Refuelling Shelter.	POL	No visual evidence of contamination.
3203	Hardened Vehicle Refuelling Shelter.	POL	No visual evidence of contamination.

2.5.2 *Area C Pathways*

Area C lies in the north-east quadrant of the site on the top and north-eastern flank of the topographical plateau area. The surface drainage path is to the east and south-east via oil interceptors before drainage off-site.

The potential contaminant migration pathways are considered to be the same as those identified in *Section* 2.3.2 above.

2.5.3 *Area C Receptors*

As per *Section* 2.2.3 above.

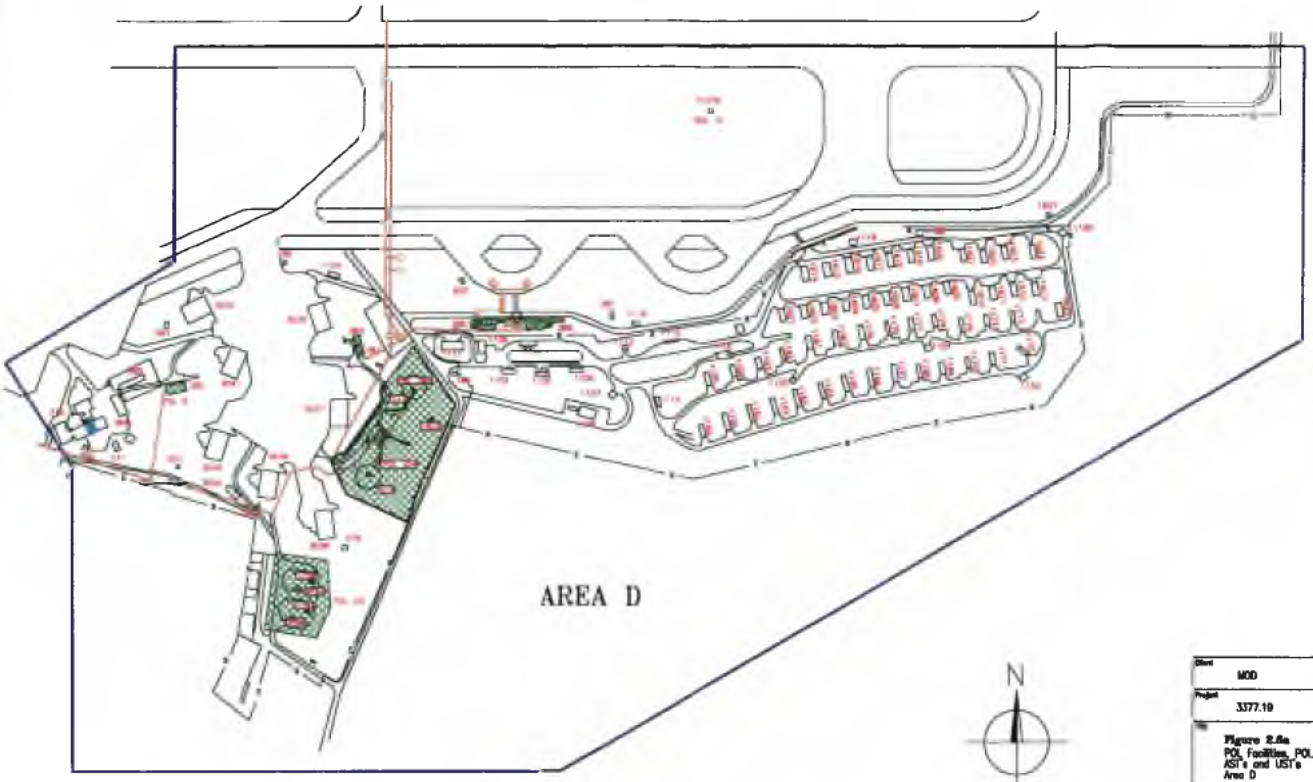
2.6 *SOURCE/PATHWAY/RECEPTOR: AREA D*

2.6.1 *Potential Source Areas*

The potential source areas identified within Area D are illustrated in *Figure 2.6a*. Based on site documentation and field observations ERM have identified potential sources at POL sites and UST's (*Tables 2.6a&b*).

Table 2.6a ***POL sites***

POL site	Volume (m3) and DEO Status Details, 1996	Original Contents	Comments[1] and Status at time of ERM site reconnaissance
POL 5/ Area D Fac 385	2x378.5 (UST) Tanks cleaned and water filled in 1993.	MOGAS	No visual evidence of contamination.
POL 6/ Area D Fac 382	1x189.3 (UST) Tank cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.



Key:

- POL Facilities and Bulk Fuel Storage Locations
- POL Supply Ring Main
- POL Supply Ring Main Re-routed from this Previous Location
- UST's

Client	MOD
Project	3377.19
	Figure 2.6a POL Facilities, POL Supply Mains, AST's and UST's Area D
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Date	28-09-10 Drawn PBZ

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Eden House
Wallbrook Court
North Hinksey Lane
Oxford OX2 0QS
Telephone [redacted]
Facsimile [redacted]

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POL site	Volume (m3) and DEO Status Details, 1996	Original Contents	Comments[1] and Status at time of ERM site reconnaissance
POL 7/ Area D Fac 385	1x189.3 (UST) Tank cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.
POL 8/ Area D Fac 386	1x189.3 (UST) Tank cleaned and water filled in 1993.	JP-8	No visual evidence of contamination.
POL 20/ Area D Fac 375	6x56.0 (UST) 6x56.4 (UST) All tanks with the exception of 5 and 9 cleaned and water filled. Tank 5 contains MOGAS Tank 9 contains DIESEL.	DIESEL MOGAS	No visual evidence of contamination.
POL 25A Area D Fac 376	1x4507.9 (Semi-buried) Tank cleaned and water filled in 1994.	JP-8	No visual evidence of contamination.
POL 25B Area D Fac 377	1x4503.2 (Semi-buried) Tank cleaned and water filled in 1994.	JP-8	No visual evidence of contamination.

[1] In addition to the POL facilities the POL supply pipeline is partially situated within this area.

Table 2.6b ***Underground Storage Tanks***

Building	Area	Contents/Capacity	Comments
370	D	UST within Squadron Building.	Fuel Oil. No visual evidence of contamination.

Table 2.6c ***Potential Sources of Contamination***

Facility	Facility Use	Potential Contamination	Observed Contamination
Near POL 20. Heavy equipment yard	Large above ground waste site.	Many Unknown	Site removed. No visual evidence of contamination.

2.6.2 Area D Pathways

Area D lies to the east of the site, to the top and on the eastern flank of the plateau area. The surface drainage path is to the south-east and south via oil interceptors before drainage off-site.

The potential contaminant migration pathways are considered to be the same as those identified in *Section* 2.3.2 above.

2.6.3 *Area D Receptors*

As per Section 2.2.3 above.

2.7 *SOURCE/PATHWAY RECEPTOR: AREA E*

2.7.1 *Potential Source Areas*

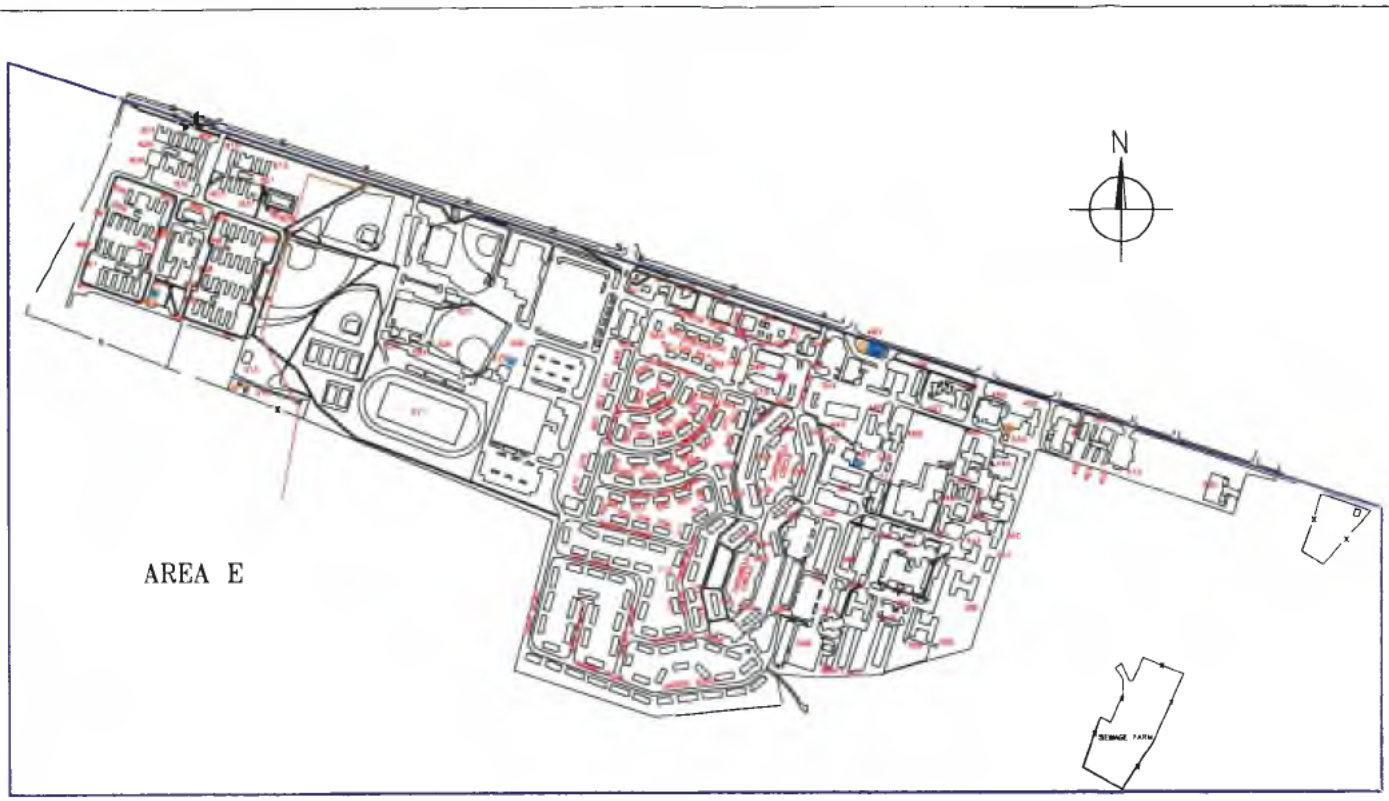
The potential source areas identified within Area E are illustrated in *Figure 2.7a*. Based on site documentation and field observations, ERM have identified potential sources at AST's and UST's (*Table 2.7a&b*) and in addition to these locations a number of other sites were identified as potential source of contamination, and are described in *Table 2.7c*.

Table 2.7a ***Previously Identified Potential Sources of Contamination, 1992 and 1993***

Area	Date	Description	Status at time of ERM site visit
E	1993	Dried sewage, residue from tank cleaning at the water treatment plant, was stockpiled on site.	No evidence of contamination.

Table 2.7b ***Above Ground Storage Tanks***

Building	Area	Contents/Capacity	Comments
401	E	Petroleum Volume unknown.	Between buildings 401 and 455 is one drained (May 1994) AST and a bunded area that may have formerly contained another. The associated fill points show fuel staining. Underground pipework.
441	E	Unknown	Two small, now removed AST's. No visual evidence of contamination.
492	E	0.34m^3 bunded and drained heating oil AST.	No evidence of contamination.
570	E	Small oil fuel AST; volume unknown.	Empty metal tank, bunded. No visual evidence of contamination.
826	E	Unknown.	Former boiler house with possible associated bulk storage facility for fuel oil. No visual evidence of contamination.
867	E	Fuel Oil/Capacity Unknown.	Former boiler house with three AST's for fuel oil. No visual evidence of contamination.
1368	A	Unknown.	Former Hush House. Site of former AST noted along with associated below ground pipework.



Key:

- AST's
- Former Site of AST's
- UST's
- POL Supply Ring Main

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Client: MOD

Project: 3377.19

Title: Figure 2.7a
POL Facilities, POL Supply Mains, AST's and UST's.
Area E

Scale: 1:5,000 A3

Drawing No: 3377-A198 Iss. A

Date: 28/09/[illegible]

Checked: [redacted]

Table 2.7c ***Underground Storage Tanks***

Building	Area	Contents/Capacity	Comments[1]
467	E	4 x 12,000 gallon fuel oil UST's.	Former boiler house. No visual evidence of contamination.
579	E	4 x UST's and four re-fill points and an additional possible UST to rear.	As 467.
493 Petrol Station	E	8 x UST's	Former diesel and petrol supply. No visual evidence of contamination.

[1] In addition the POL supply pipeline passes through Area E.

Table 2.7d ***Further Potential Sources of Contamination, Area E***

Facility	Facility Use	Potential Contamination	Observed Contamination
408	Laundry/Dry Cleaners.	Solvents	No visual evidence of contamination.
455	Photographic Laboratory.	Metals, Solvents, Photographic developing and printing chemicals	No visual evidence of contamination.

2.8 ENVIRONMENTAL RISK ASSESSMENT

An environmental risk assessment has been completed for the site on the basis of three different potential end uses. These are:

- existing landuse/light industrial;
- housing with gardens;
- agriculture.

The results of these assessments are presented in the form of summary tables in *Annex C, Annex D* and *Annex E*, respectively. *Annex D* and *E* relate to both existing and future redevelopment uses of the site.

There are a number of potential sources of contamination that represent areas of immediate concern to the environment and these are summarised below in *Table 2.8a*.

Table 2.8a ***Potential Sources and Human/Environmental Risk***

POL site	Human Health	Groundwater	Surface Water
POL 1 Area A Fac 270	E	C	C

POL site	Human Health	Groundwater	Surface Water
POL 2 Area A Fac 254	E	C	C
POL 3 Area A Fac 274	E	C	C
POL 5 Area D Fac 385	E	C	C
POL 6 Area D Fac 382	E	C	C
POL 7 Area D Fac 385	E	C	C
POL 8 Area D Fac 386	E	C	C
POL 9 Area C Fac 215	E	C	C
POL 10 Area C Fac 219	E	C	C
POL 11 Area C Fac 229	E	C	C
POL 13 Area B Fac 283	E	C	C
POL 14 Area B Fac 284	E	C	C
POL 15 Area B Fac 241	E	C	C
POL 16 Area B Fac 242	E	C	C
POL 17 Area B Fac 245	E	C	C
POL 19 Area A Fac 614	E	C	C
POL 20 Area D Fac 375	E	C	C

POL site	Human Health	Groundwater	Surface Water
POL 21A Area A Fac 392	E	C	C
POL 21B Area A Fac 393	E	C	C
POL 21C Area A Fac 394	E	C	C
POL 22 Area C Fac 395	E	C	C
POL 23A Area B Fac 285	E	C	C
POL 23B Area B Fac 269	E	C	C
POL 24 Area A Fac 269	E	C	C
POL 25A Area D Fac 376	E	C	C
POL 25B Area D Fac 377	E	C	C
Fuel Tank Area C Fac. un-named	E	C	C
POL fuel supply pipeline	E	C	C
Former Waste Area adjacent to POL 20.	C/D	C	C
Fire Training Area A	C/D	C	C
Fuel Supply Station Fac. 493	C/D	C	C

KEY:
A: Immediate significant risk to human health
B: Immediate significant risk of damage to the environment
C: Major Remediation Liability
D: Minor Remediation Liability
E: Minor significance, no remediation required
F: No effect on re-use options or site value

2.9 *SOURCE-PATHWAY-RECEPTOR RELATIONSHIP, ASBESTOS*

From the information on the site area it was apparent that asbestos was present in several of the facilities on site. The nature and condition of the asbestos was recorded to be variable across the site at the time of the

preparation of the ESR report. In order to fully assess the full degree of risk associated within the asbestos present it is considered necessary to carry out a further, up to date, survey of the facilities. The potential exists for asbestos dust to affect human health by inhalation. The risk associated with the presence of asbestos the site cannot be assessed until an up to date survey has been carried out.

The potential sources of pollution and their associated risks to human health, and the surrounding environment have been described in *Annexes B, C & D.* From the site reconnaissance assessment of potential source areas it is apparent that the major potential threats to the environment exist from the POL facilities located across the site area, the POL supply ring main, the fire practise area and the former above ground waste area.

If contaminant sources are present within the groundmass underlying the site, the potential exists for the impaction of underlying groundwaters. Due to the nature of the groundmass and anticipated high permeabilities and flow rates within the limestone bedrock, it is considered likely that the migration of contaminants to the groundwaters and within the groundwater resource is relatively rapid. In addition, there is potential for contaminant migration from source areas to surface drains and/or migration via permeable backfill around storm drains.

Risk to human health from site contamination is only considered likely if either potentially impacted sources area are excavated during redevelopment or if surface waters and/or groundwaters potable abstractions are, or become, impacted.

As no extensive intrusive investigations have been carried out at RAF Upper Heyford, it is not currently known therefore whether considerable contamination is present within the groundmass or groundwater. The site has clearly undergone extensive surface clean-up operations since the completion of USAF aviation activities and little visual evidence of surface contamination exists. However, considering the vulnerability of the groundmass, the long term historic use of the site and the nature of the activities involved, it is recommended that investigation of the major potential sources be carried out to evaluate the presence and extent of any impaction and the implications of such impact on the divestitive/redevelopment of the site on surrounding sensitive receptors, and the liability exposure to MOD from current ownership of the site. In addition, the EA confirmed that prior to redevelopment, it would require an extensive intrusive investigation be undertaken due to the vulnerability of the groundwater within the site area, to demonstrate either the lack of impacts, or if present, their implications and the need for remedial action to protect groundwater resources.

The results of such "baseline quality" investigations will, it is envisaged, be an integral part of due diligence works carried out by prospective purchasers and will be needed to facilitate the redevelopment of the site.

From the assessment of the site topography, geology and hydrogeology it is apparent that the site is situated on a limestone plateau and surface waters and groundwaters are expected to flow down the plateau flanks towards neighbouring valleys. From a review of existing data, the water table is

observed to intersect the surface on the plateau side slopes and manifest itself as spring issues. As groundwater is likely to be the source of the spring issues, much of the assessment of the quality of groundwaters migrating off-site can be established from the analysis of spring waters.

ERM recommend sampling and quality analysis of spring and surface water drainage sources, both on the site and in close proximity to it to provide an initial indication of the presence of groundwater impact from site operations. Information on the quality of surface and spring waters migrating off-site can be quickly established from such sampling. This will highlight whether any current contamination of sensitive receptors is occurring, resulting from previous site activity and will provide guidelines for any subsequent phase of work. Should little or no evidence of contamination be observed within the springs and surface water courses, it is considered likely that the intrusive investigation can be limited to confirmation of shallow groundmass quality in and around major potential contaminant source areas (such as the POL facilities) to provide data for redevelopment purposes.

In advance of spring/surface water sampling, it is envisaged that a more detailed review of the hydraulics of the plateau area is undertaken. The objective of such a review would be to check that all likely migration pathways from the plateau had been identified. In the event that catchment areas exist that do not feed spring issues (or that as yet unidentified spring issues are suggested), the advancement and sampling of groundwater monitoring wells would be prudent to assess impacts from the site in such catchment areas. In addition, a reconnaissance visit of the spring line would be prudent to confirm the spring and surface watercourse locations.

Should the initial quality assessment indicate impaction of water resources, then it is considered likely that further groundwater investigations would be required in order to identify sources of the contamination and the extent of impact. The scope of this further investigation (if any) would be defined on completion of the quality assessment and would be presented in interim reporting.

The groundmass underlying the site is particularly 'vulnerable' to the effects of contamination, as only a thin protective soil cover overlies the limestone aquifer. In addition, potentially rapid migration of potential contamination is expected within the fissure flow controlled limestone hydraulic regime increasing the risk of impact at nearby groundwater and spring fed receptors. Therefore, at a minimum, intrusive investigation of the main POL facilities, the POL supply ring main (at least areas around major junctions and where repairs or replacements may have occurred) and the fire practise area is considered necessary in order to establish the degree of groundmass impact from former site activities, and its implications on site redevelopment.

Full quantification of the degree, type and condition of asbestos present at the site is not included within the details of the recommended further investigations below. However, full details and associated costings for an asbestos survey at the site can be provided, as required. A survey of

asbestos present and the degree of associated risk is recommended prior to any redevelopment of the site facilities.

4 DETAILS OF RECOMMENDED FURTHER INVESTIGATIONS

4.1 SCOPE OF WORKS PROPOSED

The two main environmental concerns at the RAF Upper Heyford site are firstly, the actual impact site activities have had on groundwater, surface water and spring receptors down hydraulic gradient of the site, and secondly, the impact on the groundmass from previous site activities and the suitability of the site for re-development (with or without remedial action). ERM's recommended scheme of intrusive works are based upon providing initial indicators of the extent of impacts from site activities for both of these issues in focused screening level investigations carried out in parallel. The results of such investigations are designed to provide a level of initial data sufficient to assess the level of risk to off-site receptors and the implications of site activities on redevelopment.

It is recommended that the investigation should comprise of the tasks summarised below and described in more detail in this section.

Objective 1
Assessment of Groundwater, Surface Water and Spring Issues

- *Task 1 - Assessment of Spring and Surface Water Drainage Quality*
- *Task 2 - Installation of Groundwater Monitoring Wells*
- *Task 3 - Groundwater Sampling*
- *Task 4 - Hydrogeological Testing*
- *Task 5 - Reporting*

Objective 2
Assessment of On-Site, Near Surface, Contamination

- *Task 1 - Near Surface Soil and Groundwater Sampling*
- *Task 2 - Detailed Building (Asbestos) Survey*
- *Task 3 - Reporting*

Objective 1 : Impacts on Water Resources
Assessment of Groundwater, Surface Water and Spring Issues

The measurement of the groundwater, surface water and spring quality, coupled with evaluation of hydraulic parameters within the limestone aquifer will provide the necessary information for the assessment of the impact on these receptors from the activities carried out at RAF Upper Heyford. In addition, the data from the investigation will permit development of a conceptual contaminant transfer model and highlight migration pathways and likely levels of impacts.

Task 1 - Assessment of Spring and Surface Water Drainage Quality

Quality assessment of the spring issues will provide an initial indicator of the quality of the groundwaters from beneath the site. By targeting the spring discharges surrounding RAF Upper Heyford, a rapid insight into the potential for off-site contaminant migration will be available and an investigative strategy leading to remedial measures (if required) can be more clearly defined. All information on spring quality in the vicinity of the site held by the Environment Agency is included within the RAF Upper Heyford Factual Report. Spring sampling and analysis was carried out on only one occasion in March 1995 and did not include any analysis of organic contaminant concentrations. A further assessment of the spring quality is required in order to assess the continued impact (if any) of potential contaminant sources on the hydrogeological and hydrological regime.

The type of contamination present in the spring issues (if any) will enable ERM to focus clearly on probable contaminant source areas and provide ERM with information on the potential risk to off-site receptors. In addition, it is recommended that surface water samples be collected from the off-site drainage discharge points in order to confirm surface water quality.

It is proposed that repeat sampling of the eight spring locations originally sampled by the EA is carried out, in conjunction with the collection of up to fifteen surface waters samples. It is recommended that the surface water analytical suite includes the following parameters: Ionic balance, total petroleum hydrocarbons (TPH), semi-volatile organics (SVOC's), ammoniacal nitrogen and chromium concentrations and volatile organic carbon (VOC) concentrations.

In addition, analysis of ethylene glycol concentrations will be carried out on the spring samples. The degradation half-life of ethylene glycol is short so the presence of ethylene glycol in the springs would indicate on-going impact on off-site receptors from free product JP-8 contaminant source areas. If no impact on off-site receptors is noted then it is not envisaged that ethylene-glycol analysis will be required on soil or groundwater samples.

Task 2 - Installation of Groundwater Monitoring Wells

In order to further establish whether groundwater within the limestone aquifer flowing down gradient, away from the plateau, has been impacted by site activities it is recommended that a network of groundwater monitoring wells is installed around the Air Base. The analysis of groundwater samples from such wells will provide information on the presence and nature of groundwater contamination down gradient of key potential source areas identified by the LQA and will confirm the presence of potential contamination migration pathways.

As such, it is proposed that ten groundwater monitoring boreholes are installed into the limestone aquifer around the perimeter of the site and a further borehole installed towards the centre of the site in order to provide information on the groundwater quality and the flow regime. A walk-over

survey with relevant site personnel would be carried out to finalize locations prior to commencement of drilling. It is currently envisaged that borehole locations will be sited down hydraulic gradient of the main potential contaminant source areas. (see *Figure 4.1a* for provisional locations).

It is recommended that the boreholes are advanced using mist flush rotary drilling techniques. During drilling the superficial deposits should be cased off in order to isolate any perched water located within the superficial deposits during advancement through the limestone. Due to the potential for large fluctuations of groundwater level within limestone aquifers drilling should be continued to a depth of 10m below groundwater strike or to the base of the limestone unit. All wells will be screened within the limestone unit. The geological strata in each borehole should be logged by an experienced geologist to include full visual and olfactory assessments of the material encountered. Total drilling depth is anticipated to be less than 40m bgl.

The boreholes will be typically installed as follows. The installation details quoted assume depth to groundwater in the limestone is 30m.

- Approximately 0.0m-0.5m bgl; lockable, steel access cover.

- Approximately 0.0m-30.0m bgl; plain 110mm I.D. poly-propylene well casing sealed by a bentonite plug at approximately 27.5m-29.0m bgl and bentonite/cement grout to surface.

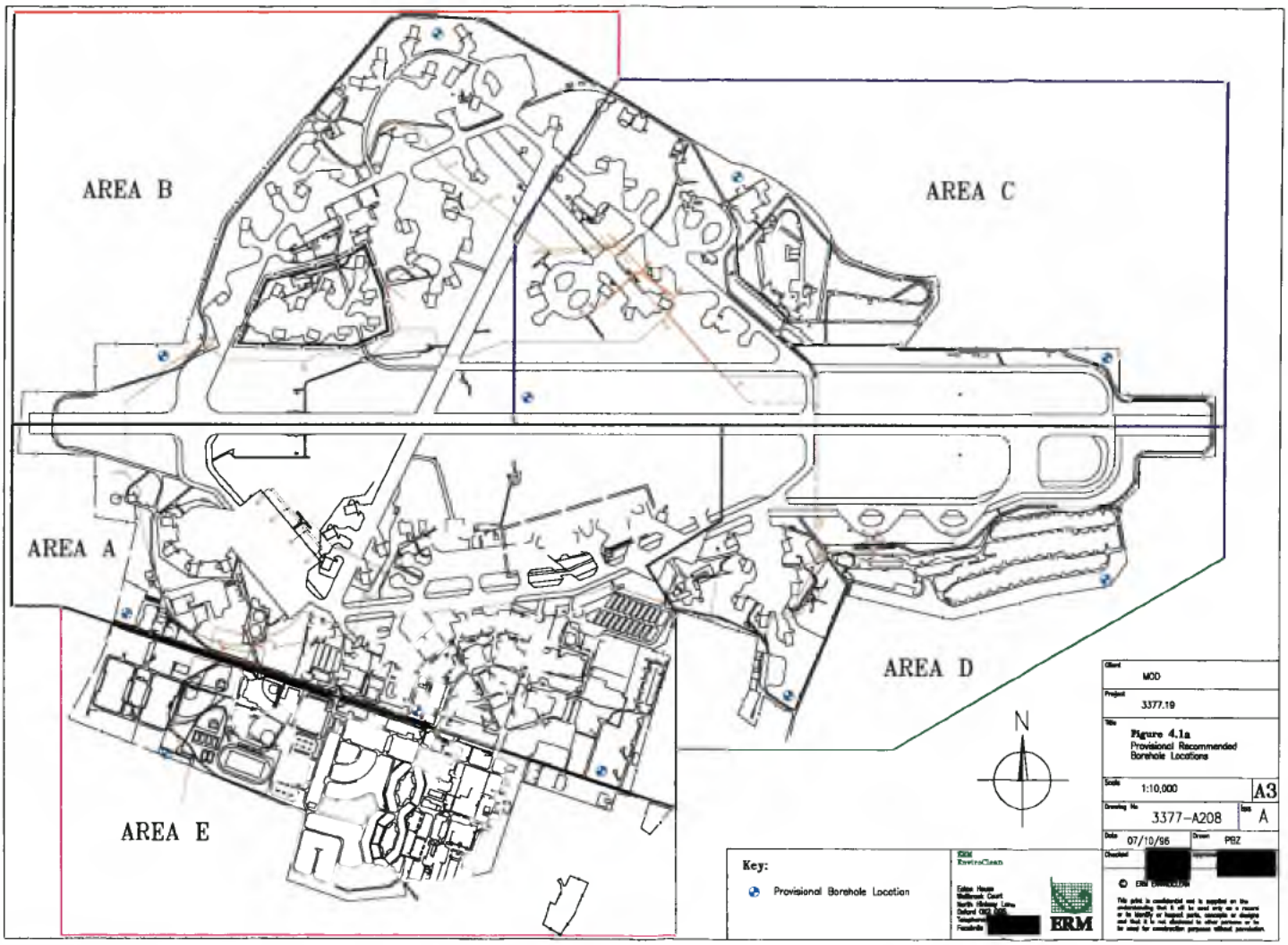
- Approximately 30.0m-<40.0m bgl; 110mm I.D. slotted, poly-propylene well casing incorporating a graded and washed sand pack to stabilise the formation, and an end cap to prevent the vertical migration of fines into the borehole.

Final installations details will depend on lithology, the thickness of the limestone unit, and the depth to groundwater in the limestone.

Following completion and development of all borehole installations, each borehole will be topographically surveyed in order to establish the spatial positioning and its elevation in relation to Ordnance Datum. This will allow comparison of geological logs and development of groundwater contour plots. The exact locations will be decided on review of the spring and surface water sampling results and with discussions between ERM and relevant site personnel.

Task 3 - Groundwater Sampling

Groundwater samples will be obtained from each of the boreholes. Prior to sampling a minimum of ten well volumes will be pumped to develop and purge the well using a submersible pump. This is to remove any remaining material introduced during drilling and enables a representative sample of groundwater to be obtained. During pumping, continuous measurement of conductivity and redox should be taken to ascertain whether a return to representative 'formation' water has been achieved. It should be assumed


AREA B
AREA C
AREA A
AREA D
AREA E
N
Key:
Provisional Borehole Location
MOD
3377.19
Figure 4.1a
Provisional Recommended
Borehole Locations
1:10,000
A3
3377-A208
A
07/10/96
PBZ
ERM

that such conditions have been achieved once readings for conductivity and redox are stabilised within +/- 10%.

Sampling and decontamination procedures used in the course of the groundwater sampling are designed to allow the collection of representative samples and to minimise the potential for cross contamination between samples. The pump will be subject to decontamination between locations which will consist of:

- Manual scrub and 'pump through' with a non-phosphate soap solution.
- Rinse and 'pump through' with tap water.

All groundwater sampling will be carried out using fully decontaminated, stainless steel, bailers in order to ensure minimal volatilization of contaminants during the sampling recovery. Decontamination of the bailers between locations will be carried out as follows:

- Manual Scrub with a non-phosphate solution.
- Tap water rinse.
- 10% nitric acid rinse.
- Distilled water rinse.
- Pesticide grade methanol rinse.
- Triple rinse with distilled water.
- Air dry.

During sampling and decontamination activities, dedicated disposable latex gloves will be worn at each location to prevent transfer of contaminants from other source. Disposable equipment such as latex gloves and bailer twine will be discarded after each use.

Quality Assurance/Quality Control (QA/QC) Protocols

Groundwater samples will be immediately transferred to pre-labelled bottles, and then placed in sample coolers and stored at temperatures nominally at 4°C±2°C. As part of the overall sampling QA/QC package, 'Chain of Custody' travel documents will be completed for each sample. This will allow tracking of the samples from acquisition, through analysis, to reporting of results. These forms will be enclosed in the sample coolers shipped to the laboratory.

Task 4 - Hydrogeological Testing

This task aims to assess the permeability at the borehole locations at the site undertaking recovery tests in a number of wells. During both pumping and recovery water levels were measured using a pressure transducer and data logger.

The data obtained from the recovery tests will be analysed using rising head test methodologies outlined in *BS5930, Code of Practise for Site Investigations, 1981* and the permeability of the groundmass established.

Hydrogeological testing of these wells and analysis of springs and surface water quality will provide information on groundwater levels, aquifer permeability, the rate of groundwater flow, and assist in defining the location of potential pathways.

Following completion of the field programme the results will be presented as a factual report incorporating the following key sections:

- Site Investigation Programme - detailing the field programme and general observations.

- Environmental Setting- this section will use the results of the investigation programme to produce a detailed geological/hydrogeological assessment of the site, indicating the likely direction and the rate of groundwater migration. This will be achieved by means of potentiometric contour plots and detailed geological sections.

- Analytical Results - this section will provide a factual report of the analytical results obtained and indicate the location and extent of the key elevated parameters encountered either in spring and surface waters and/or groundwater.

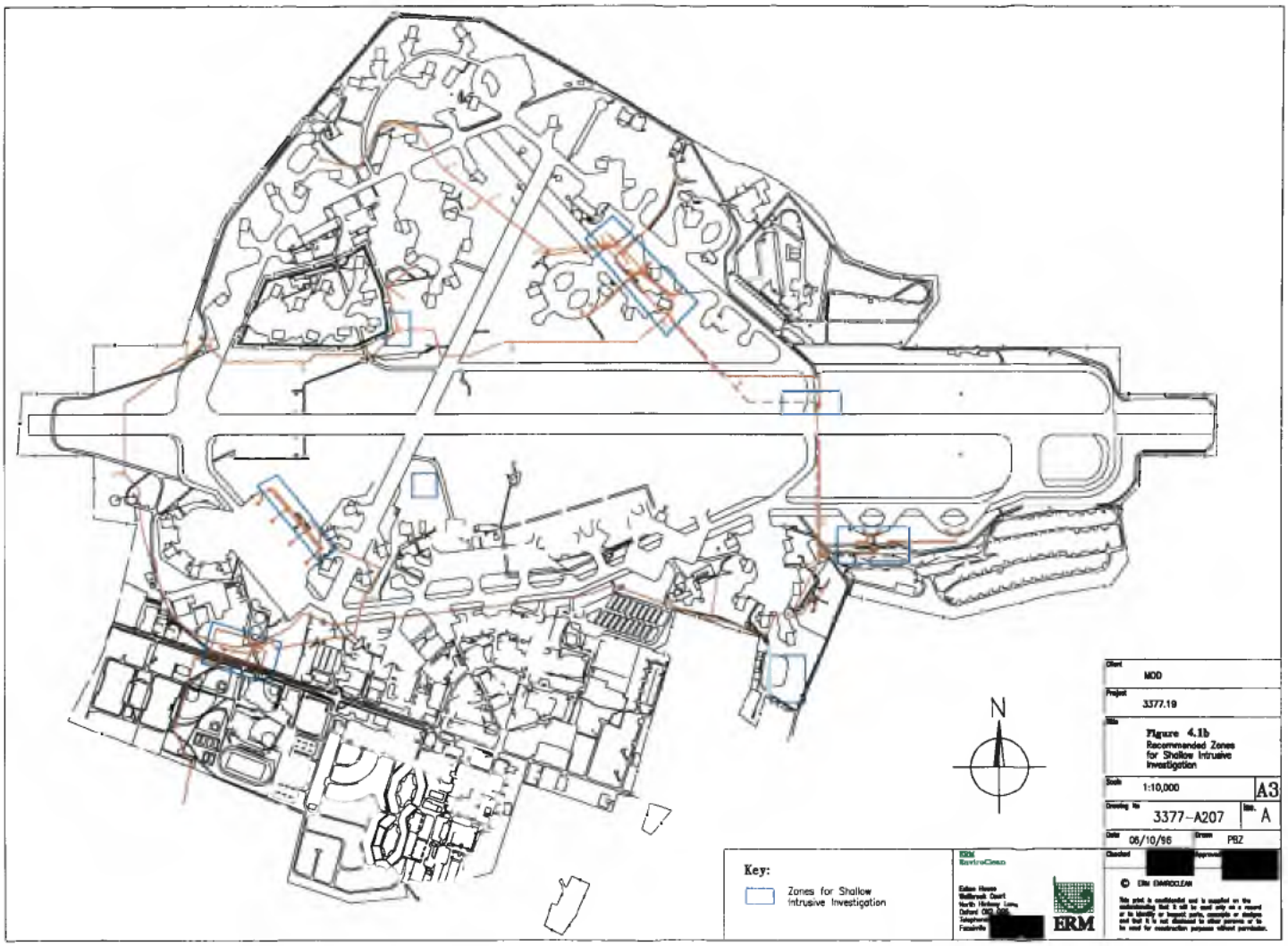
- Conclusions and Recommendations - this section will draw together the key hydrological and hydrogeological parameters relating to the site and indicate the likely longer term behaviour of the elevated compounds detected and make recommendations for any further work required.

In addition to the factual report, a summary interpretive report will be produced detailing the likely further work, including any remedial measures required, based on the results obtained. This report, as necessary, will recommend a series of options and costs, and include the implications associated with each option.

Objective 2 : Redevelopment Potential and Building (Asbestos) Assessment of On-site, Near Surface Soil Quality

RAF Upper Heyford covers a surface area of 494 hectares and as such a comprehensive assessment of soil quality across the Base is impractical in timeframe and cost terms. Therefore it is recommended that the assessment of near surface soil quality be targeted on the major areas of particular concern identified by the LQA. The site reconnaissance survey highlighted the POL facilities, the POL supply ring main, the fire practise area and the former waste storage area adjacent to POL 20 as locations on site which are considered to have a major potential impact on the groundmass.

ERM recommend that as an initial screen of on-site soil quality, a shallow intrusive survey should be carried out at the target zones as shown on *Figure 4.1b.* These zones incorporate the major valve and junction areas along the POL ring main facilities (mostly associated with the transfer of


N
Key:
Zones for Shallow Intrusive Investigation
Client
MOD
Project
3377.19
Figure 4.1b
Recommended Zones for Shallow Intrusive Investigation
Scale
1:10,000
A3
Drawing No
3377-A207
Rev.
A
Date
06/10/96
Drawn
PBZ
Checked
Approved
ERM
© ERM ENVIROCLEAN

fuels into POL bulk storage facilities), the fire practise area and the waste storage area.

A review of the asbestos survey (undated) contained within the ESR identified a number of key issues regarding asbestos and asbestos containing materials within remaining buildings structures. As such a more detailed asbestos survey of all key buildings is strongly recommended. This work would include the visual assessment of buildings and confirmatory sampling of building fabric where asbestos containing material is suspected.

Task 1 - Near Surface Soil Gas Survey and Soil and Groundwater Sampling

It is proposed that a soil gas survey (utilising the *Geoprobe* system) be undertaken at the eight target areas highlighted on *Figure 4.1b*. These locations are considered to be areas of increased potential risk and, as such, are the first recommended for investigation. Prior to the commencement of the investigation, further detailed discussions will be held with appropriate site personnel to ensure that the currently identified target areas truly represent the likeliest areas of contaminant concern.

It is envisaged currently that up to 20 gas survey points per area should be carried out in order to assess the potential for volatile organic/hydrocarbon impact of the shallow groundmass. The *Geoprobe* system will enable the mapping of elevated volatile compounds using a portable Photoionisation Detector (PID) which measures total volatile organic compounds (TVOC). The soil gas analysis will identify areas of volatile organic contamination, a major constituent of JP-8, the main source of potential risk to the environment and the soil gas mapping will identify areas that require further contamination.

Borings are advanced by driving hollow one metre lengths of threaded steel probes to the selected sampling depths. Dedicated detachable steel points enable the probe to be driven into the subsurface using the *Geoprobes* integral rotary, percussion, hydraulic hammer. Samples of soil gas are taken by withdrawing the probe away from the steel drive point, thereby creating a void and allowing soil gas from the surrounding groundmass to enter the probe.

The validity of the soil gas sample is checked by analysing the vacuum applied to the probe to withdraw a sample of soil gas. Should the vacuum recover rapidly to ambient conditions a breach in the integrity of the seal between the probe and the formation would be suspected and the soil gas tested for CO_2 and O_2 to ascertain whether ambient surface air had diluted the sample. A total of up to 160 locations are recommended for the screening soil gas survey and probings would be advanced to a maximum depth of 3m or refusal. Gas readings should be taken at 1m intervals.

In addition, to the soil gas survey up to 60 shallow soil borings (again utilizing the *Geoprobe* system) should be advanced to a depth of 3m or refusal and soil cores recovered and geologically logged. The location of the soil borings will be dependant of the results of the soil gas survey within the

target areas and locations displaying elevated volatile gas concentrations would be investigated.. One to two soil samples should be taken per hole (to a maximum 120) with the sample depth dependant on the field screening and visual and olfactory evidence of contamination observed during drilling. These soil samples would be analysed in the field with *Hanby* test kits to establish benzene, toluene, ethyl-benzene and xylene (BTEX) concentrations within the groundmass.

It is considered likely that the number of soil samples required to fully classify the soil quality in areas identified from the soil gas survey will be 20. However, provision for up to 40 soil samples has been made in the costings in order to cover the possibility of extensive soil mass contamination. Exact numbers of soil samples required will be decided on-site from the results of the initial screening by the *EnviroClean* field specialist.

Up to 40 samples will therefore be sent for laboratory analysis for VOC's, SVOC's, TPH, and chromium (fuel additive). The BTEX compounds are included within this sampling suite. Ethylene glycol is present as a further additive within JP-8, although due to fast degradation rates it is felt that there is no longer any requirement for concentration analysis to be carried out (as no JP-8 has been stored at the site for some time). On other significant JP-8 additive is chromium, and this has been included in the analytical programme.

During the shallow soil boring investigation it is recommended that where groundwater is observed within the shallow groundmass, a sample be recovered for analysis. It is, therefore, anticipated that up to 60 groundwater samples would be collected and sent for the following suite: ionic balance, VOC's, SVOC's, TPH, ammoniacal nitrogen and ethylene glycol analysis.

Task 2 - Building (Asbestos) Survey

It is proposed that an up to date detailed building asbestos survey be conducted in all main buildings with confirmatory sampling where asbestos containing material is suspected (up to 1000 samples). As any redevelopment plans are likely to include some renovation works and possible demolition of structures we consider that a detailed survey of this stage will provide invaluable information to facilitate the costs required to make safe any asbestos containing materials prior to renovation/demolition.

Task 3 - Reporting

Following the completion of the shallow groundmass the groundwater investigation a factual report covering the shallow site investigation and will incorporate the following key sections:

- Site Investigation Programme - detailing the field programme, methodologies and observations.

- Environmental Setting - the results of the investigation programme will be utilised to provide a detailed geological and hydrogeological assessment of

the shallow groundmass and to assess shallow, perched, groundwater systems. In addition, the result of visual and olfactory evidence will be presented.

- Analytical Results - factual assessment of the analytical parameters obtained from the soil gas survey, soil and groundwater sampling will be presented. Comparison with current soil and water concentration guidelines will be carried out.

- Conclusions and Recommendations - this section will draw together the key parameters relating to the site and indicate the likely longer term behaviour of the elevated compounds detected in the soil and shallow groundwater and make recommendations for any further work required.,

In addition to the factual reports a summary interpretive report will be produced detailing the likely further work, including any remedial measure required, based on the results obtained. This report, as necessary will recommend a series of options and costs, and include the implications associated with each option. Assessment of the environmental suitability of the site for re-development will also be carried out.

4.2 *COSTS AND TIMESCALES*

The proposed costs estimate for the above recommended option are presented as *Table 4.2a*. A breakdown of the proposed soil and water sample analytical schedule and costs are presented as *Table 4.2b*. The costs for each task have been estimated separately and include ERM labour, expenses, travel, subcontractors and laboratory costs. Care has been taken to ensure all costs are at competitive market rates. **All costs are exclusive of VAT.**

The proposed timescale is included as *Annex F*. The timescale for the recommended Phase II option has been designed to minimise downtime, and to allow the safe and steady progression of the investigation.

It is envisaged that both investigations will run concurrently. Reporting will commence once all the intrusive investigations have been completed and field data validated.

Table 4.2a Proposed Costs for the Recommended Phase II Option

Objective 1

Task 1 - Spring and Surface Water Drainage Quality Report

Item	*Unit*	*Unit Cost*	*Number*	*Total*
Field Technician	*hour*	*35*	*52.5*	*1837.5*
Expenses	*day*	*59.3*	*6*	*355.8*
Car Hire/Fuel	*day*	*25*	*6*	*150*
Contract Lab Analyses				
Spring Waters	*No.*	*350*	*8*	*2800*
Surface Waters	*No.*	*220*	*15*	*3300*
			sub-total	*8443.30*

Task 2 - Installation of Groundwater Monitoring Wells

Item	*Unit*	*Unit Cost*	*Number*	*Total*
Walk Over Survey				
*Geologist **	*hour*	*35*	*15*	*525*
Investigation				
Geologist	*hour*	*55*	*300*	*16500*
Drilling	*No.*	*30000*	*1*	*30000*
Expenses	*day*	*59.3*	*40*	*2372*
Car Hire/Fuel	*day*	*25*	*40*	*1000*
Surveyors	*No.*	*1100*	*1*	*1100*
			sub-total	*51497*

** Based on 2 people supervising 2 rigs on a time and expenses basis up to a maximum 4 weeks on-site for this task.*

Task 3 - Well Development and Groundwater Sampling

Item	*Unit*	*Unit Cost*	*Number*	*Total*
*Field Technician***	*hour*	*35*	*37.5*	*1312.5*
Hydrogeologist	*hour*	*55*	*37.5*	*2062.5*
Pump	*day*	*30*	*5*	*150*
Generator	*day*	*12*	*5*	*60*
Filters	*-*	*8*	*11*	*88*
Decon Chemicals	*-*	*223*	*1*	*223*
Consumables	*-*	*122*	*1*	*122*
pH meter	*day*	*10*	*5*	*50*
EC meter	*day*	*10*	*5*	*50*
Dip meter	*day*	*5*	*5*	*25*
Expenses	*day*	*59.3*	*10*	*593*
Car Hire/Fuel	*day*	*25*	*5*	*125*
Groundwater Analysis	*No.*	*370*	*11*	*4070*
			sub-total	*8931*

*** Two people are required on-site in order to install and operate pumps and carry out sampling*

Task 4 - Hydraulic Testing

Item	*Unit*	*Unit Cost*	*Number*	*Total*
Hydrogeologist	*hour*	*55*	*30*	*1650*
Expenses	*day*	*59.3*	*4*	*237.2*
Loggers/Equipment	*day*	*65*	*4*	*260*
Car Hire	*day*	*25*	*4*	*100*
			sub-total	*2247.20*

Task 5 - Reporting

Item	*Unit*	*Unit Cost*	*Number*	*Total*
Researcher	*hour*	*35*	*100*	*3500*
Consultant	*hour*	*55*	*80*	*4400*
Tech Director	*hour*	*70*	*22.5*	*1575*
Director	*hour*	*90*	*7.5*	*675*
			sub-total	*10150*

Objective 2

Task 1 - Near Surface Soil and Groundwater Sampling

Item	*Unit*	*Unit Cost*	*Number*	*Total*
Walk Over Survey				
Geologist	*hour*	*35*	*15*	*525*
Investigation				
Field Technician	*hour*	*20*	*140*	*2800*
Geologist	*hour*	*55*	*140*	*7700*
Expenses	*day*	*59.3*	*36*	*2134.8*
Car Hire/Fuel	*day*	*25*	*20*	*500*
Geoprobe Hire	*week*	*1500*	*3.5*	*5250*
BTEX Hanby Test Kits	*No.*	*25*	*120*	*3000*
Cutting Shoes	*No.*	*6*	*80*	*480*
Liners	*metre*	*3.5*	*240*	*840*
Fuel	*week*	*50*	*3.5*	*175*
PID	*week*	*225*	*3.5*	*787.5*
CAT	*day*	*10*	*18*	*180*
Corers	*No.*	*20*	*40*	*800*
Soil Analysis	*No.*	*260*	*40*	*10400*
Groundwater Analysis	*No.*	*280*	*60*	*16800*
			sub-total	*52372.30*

Task 2 - Detailed Building Asbestos Survey

Item	*Unit*	*Unit Cost*	*Number*	*Total*
Consultant	*hour*	*55*	*262.5*	*14437.5*
Technician	*hour*	*35*	*262.5*	*9187.5*
Car Hire	*day*	*25*	*20*	*500*
Day Subsistence	*day*	*9.3*	*40*	*372*
Equipment	*day*	*50*	*20*	*1000*
Building Masonry/Asbestos Analysis	*sum*	*22.50*	*1000*	*22500*
			sub-total	*47997*

Task 3 - Reporting

Item	*Unit*	*Unit Cost*	*Number*	*Total*
Researcher	*hour*	*35*	*112.5*	*3937.5*
Consultant	*hour*	*55*	*112.5*	*6187.5*
Tech Director	*hour*	*70*	*50*	*3500*
Director	*hour*	*90*	*20*	*1800*
			sub-total	*15425*

Project Management

PM during field work	*hour*	*55*	*22.5*	*1237.5*
Consultant (Project Manager)	*hour*	*55*	*15*	*825*
QA/QC (Project Manager)	*hour*	*55*	*67.5*	*3712.5*
QA/QC (Project Director)	*hour*	*70*	*22.5*	*1575*
Technician Mobilization	*hour*	*35*	*7.5*	*262.5*
Technician Demobilization	*hour*	*35*	*15*	*525*
PM during mobilzation	*hour*	*55*	*15*	*825*
Couriers	*sum*	*700*	*1*	*700*
Invoicing	*hour*	*35*	*7.5*	*262.5*
PM Meeting	*hour*	*35*	*7.5*	*262.5*
PD Meeting	*hour*	*70*	*7.5*	*525*
Expenses	*day*	*30*	*3*	*90*
			sub-total	*10802.50*

GRAND TOTAL (£ excl. VAT) ***207,865.30***

Table 4.2b Analytical Schedule

Parameter	Ionic Balance	pH	SVOC's	VOC's	TPH	chromium	Ammoniacal Nitrogen	Target Metals	Ethylene Glycol	Nitrate, Sulphate, Chloride	Cyanide	Unit Cost (£)	Total Cost (£)
Springs	8	8	8	8	8	8	8		8			350	2,240
Surface Waters	15	15	15		15	15	15					220	3,300
Groundwaters (Deep)	11	11	11	11	11	11	11	11		11	11	370	4,070
Soils	40		40	40	40	40						260	10,400
Groundwaters (Shallow)	60	60	60	60	60	60	60					280	16,800
												Total (excl. VAT)	36,810

Annex A

Technical Brief

MINISTRY OF DEFENCE

DEFENCE ESTATE ORGANISATION (WORKS)

RAF UPPER HEYFORD

LAND QUALITY ASSESSMENT

PHASE ONE: DESK STUDY

Project No. 07686

CONSULTANT'S DIRECTIVE

Client's Representative:

[redacted]

Infrastructure & Organisation Branch - [redacted]
RAF Benson, Wallingford
Oxon OX10 6AA

DEO(W) Officer:

[redacted]
[redacted] Environmental Engineer
Defence Estate Organisation (Works)
Blakemore Drive
Sutton Coldfield
W Midlands
B75 7RL

Date: 5 August 1996
DEO Project Ref: 07686
Clients Ref:

LAND QUALITY ASSESSMENT: PHASE ONE - DESK STUDY

RAF UPPER HEYFORD

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4	LOCATION
5	Additional Information
6	**PROJECT OBJECTIVE**
7	**SCOPE OF THE WORKS**
	REQUIREMENTS OF THE STUDY
10	HAZARD ASSESSMENT
11	RECONNAISSANCE
13	DESK STUDY
14	COLLATERAL WARRANTY
15	PRESENTATION OF INFORMATION
16	FACTUAL REPORT
17	INTERPRETATIVE REPORT
18	Environmental Risk Assessment
20	Options and Recommendations for Further Work
23	Recommended Option
30	Financial Appraisal
31	LAND QUALITY STATEMENT
	LIMITATIONS AND STANDARDS
32	CONSTRAINTS
33	CONTACT WITH ENVIRONMENT AGENCY / SCOTTISH ENVIRONMENTAL PROTECTION AGENCY / RIVER PURIFICATION BOARD
34	HEALTH AND SAFETY
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LAND QUALITY ASSESSMENT: PHASE ONE - DESK STUDY

RAF UPPER HEYFORD

BACKGROUND

1. RAF UPPER HEYFORD is no longer be required by the MOD and in order to release the sites for sale the MOD needs to know more details of the land quality on the site and the health & environmental risk that any contamination may present in association with changing the use of the land.

2. MOD propose to achieve this by undertaking a phased investigation of the site as described in DWS Technical Bulletin 95/28 entitled Land Quality Assessment Management Guide. Phase One comprises a Desk Study assessment and site reconnaissance. Phase Two will only proceed if a requirement is identified at Phase One and it may include intrusive physical investigation of the site using trial excavations and boreholes. This Directive initiates the Phase One study.

3. The reports which result from this study (the Land Quality Assessment and Statement (LQA and LQS)) will be used by MOD's selling agent and as such may be relied upon by purchasers.

LOCATION

4 RAF UPPER HEYFORD is located at the following address:

RAF UPPER HEYFORD

A site location plan is (to be) provided in Annex A

ADDITIONAL INFORMATION

5 MOD held information pertinent to the study is available through the Site Liaison Officer and may include:-

- USAF Environmental Status Report
- Plans, maps and technical/process drawings (all available dates).
- Deeds and other estate records.
- Existing aerial and other photographs.
- Records/files detailing former and current uses/activities on the site.
- Anecdotal evidence from former and present employees.

PROJECT OBJECTIVE

6 The objectives of the study are to provide information, in the form of reports, relating to the environmental quality of the ground conditions present on the establishment. Information should also be gathered relating to the potential for future ground contamination occurring as a result of demolition of the existing buildings. Assessment is to be made of the potential health and environmental risks at the site and the degree of confidence in the assessment. If this assessment shows that further work is required then outlines of a follow up sampling and analysis regime should be designed in order to allow prediction of risks with reasonable confidence.

SCOPE OF THE WORKS

7 The assessment comprises a Phase One Land Quality Assessment relating to the whole of the RAF UPPER HEYFORD establishment as shown on the Site Plan and also its interaction with neighbouring land.

8 The scope of work includes an option study relating to future management of the land and buildings, financial and environmental risk assessments and the design of a phase two LQA if required as a result of the risk assessment.

9 The scope of work also includes the provision of Collateral Warranties.

REQUIREMENTS OF THE STUDY

HAZARD ASSESSMENT

10 Before entry is made to the site, the Consultant should make an assessment to ensure that adequate Health and Safety safeguards are employed by his personnel at all times.

RECONNAISSANCE

11 An initial walk over reconnaissance of the site should be undertaken by the Consultant in order to gain an understanding of the establishment and all matters pertaining to the Land Quality Assessment This is likely to include an appraisal of the site infrastructure, drainage, services and site operating procedures past and present. Any environmental issues requiring urgent attention should be reported immediately.

12. Information should also be gathered relating to the potential for future ground contamination occurring as a result of any demolition or re-furbishment of the existing buildings.

DESK STUDY

13 The Consultant should collect and appraise all relevant desk based information on the site to enable assessment of all previous uses and misuses of the site, the potential for contamination to exist and the susceptibility of the site to the migration of contaminants. This should include a radiological risk assessment undertaken in conjunction with the Defence Radiological Protection Service (DRPS).

COLLATERAL WARRANTY

14 The Land Quality Assessment and Statement (LQA and LQS) produced under this directive will be used by MOD's selling agent and may be relied upon by purchasers. The Consultant shall therefore provide a Collateral Warranty, acceptable to MOD, regarding their professional work. The Warranty must be assignable to purchasers and their funders as required.

PRESENTATION OF INFORMATION

15 Information from the Investigation should be provided by way of three separate reports . The first report; The Land Quality Assessment (LQA) Factual Report, should comprise the factual information and other evidence gathered relating to the environmental quality of the site. The second report; The LQA Interpretive Report, should comprise interpretation and opinions on liability, costs, remediation and disposal options. It should include the Land Quality Statement, the Environmental Risk Assessment and an Option Study into future handling of the site. The third report; The Land Quality Statement, should comprise a short non-technical summary of the environmental condition of the site.

FACTUAL REPORT

16 Typical information to be presented within the desk study Factual Report will include:-

A General

- All information considered relevant by the Consultant

B. MOD usage of the site including:

- EOD Clearance reports
- Plans indicating the site boundary, site area and building locations past and present
- Locations of dumping areas including official, unofficial and anecdotal reports
- Description of the uses of the site past and present including individual building usage, Petrol, Oil and Lubricant areas, Military Transport areas, chemical stores, workshops, transformers, boilers, cleaning equipment etc
- Plans showing past and present drainage and sewerage arrangements including any soakaways and oil

traps etc
- Usage of burning grounds
- Asbestos Register
- COSHH Register
- Records which may detail any spills etc or statements saying records have been carefully checked and no instances recorded etc.
- Records of previous Site Investigations or contamination remediation
- Interviews with long standing staff giving job titles (not names), work histories and knowledge of processes / past incidents
- Records from museums and historical information held centrally

C Pre MOD history of the site including:

- Previous editions of OS Maps showing the history of the site back to "green field" status.
- Details of the location and history of any previous industrial usage of the site
- Council records of any waste disposal or similar activities taking place on or near the site.
- British Geological Survey plans and borehole records indicating the geology and hydro-geology of the site.
- Environment Agency records

D Neighbouring land use including:

- Any land use past or present which may have polluted the site or vice-versa.

INTERPRETIVE REPORT

17 The information gathered as a result of the above work should be interpreted to develop a contamination model of the site which gives a clear indication of the areas where there is the potential for contamination to exist and those areas likely to be clean.

Environmental Risk Assessment

18 The Consultant should incorporate into the study an Environmental Risk Assessment. This should consider individual potential pollutants and their potential hazards, pathways and receptors for different types of afteruse. The key objective is to identify issues which may lead to significant harm or a significant possibility of such harm or pollution or likely pollution of controlled waters. Hence all areas of potential contamination should be prioritised in terms of health and environmental risk. This information should be shown on a clear plan and related to a summary table as outlined in Annex B.

19 Not used.

Options and Recommendations For Further Work

20 The study should include an assessment of the options for how to proceed and the potential consequences of each option.

Options will include:

. All options considered potentially valuable by the Consultant
. Do nothing / minimum
. Undertake a risk management based or phased investigation
. Undertake an extended or single pass intrusive investigation

21 Potential consequences shall include the effects on:

. All factors considered important by the Consultant
. Timescale

- Cost
- Disruption of the site
- Risk and liability
- Future development proposals

22 A recommended option should be identified together with specific reasons for the recommendation.

23 Where the Environmental Significance is considered to be high then recommendations should be made regarding any remediation required to meet different types of land use. This should include outline costs and timescales of any remediation for each scenario.

Recommended Option

24 Where the recommended option includes elements of physical ground investigation the Consultant should provide outline proposals for a sampling and analysis regime, together with an outline description of the procedures to be followed. The Consultant should consider and suggest the location of trial holes and other investigation techniques, identifying them on a plan and schedule, and obtain preliminary agreement from the Property Manager, to ensure no hazards or services exist in the immediate vicinity.

25 The report should include details of the aims of the follow-up investigation, showing clearly for each option how the investigation locations relate to the findings of the environmental risk assessment. A rough order of costs for the physical site investigation should be given, identifying the individual costs of excavation, reinstatement, sampling and appropriate analysis. A programme for the works should also be included.

26 The proposed excavation and sampling regime should employ industry's best practice for investigation, sample extraction and preservation. Laboratory analysis should be planned to be undertaken by laboratories with appropriate NAMAS or similar accreditation.

27 The objective if proposing a physical (Phase Two) investigation is to undertake any investigation on a logical and rational basis to enable the maximum value to be drawn from the information obtained in order to achieve economy in the expenditure of resources and confidence in the end result.

28 Conversely, the evidence may suggest that the site is unlikely to be contaminated, or if contaminated, not significantly so. In this case further investigation may be un-warranted or limited to low-density sampling and analysis to confirm the Desk Study conclusions.

29 The report should conclude with discussion and recommendations relating to the contaminated land issues and the most appropriate way to release the site from MOD ownership.

Financial Appraisal

30 A reliable Order of Cost Estimate (OCE) is required for each option, and shall be carried out in accordance with DWS Technical Bulletin 6/94, entitled Order of Cost Estimates, dated February 1994. Costs are to be current quarter price levels without inflation and the relevant cost index and its source should be quoted. VAT and fees should be itemised clearly. The OCE should include a Financial Risk Analysis, carried out and presented in accordance with DWS Technical Bulletin 7/94, entitled Estimating using Risk Analysis, dated February 1994. Costs for both "Average Risk" and "Maximum Likely Risk" cases are required and full details of the risks and their individual contribution to the risk element shall be identified in the Report.

LAND QUALITY STATEMENT

31 The model developed above should be used to form the basis for an Environmental Land Quality Statement. This statement should summarize in layman's terms the environmental condition of the site, its suitability for re-use and the effects of any contamination on development potential. It should also include a summary of the sources of information together with a site boundary plan and other useful summary plans. The LQS should also form the basis for an executive summary within the main interpretative report.

LIMITATIONS AND STANDARDS

CONSTRAINTS

32 The following constraints must be taken into consideration:-

a. Prior to any work commencing on site, a Method Statement is to be provided for approval by the Client, in consultation with the Water and Environmental Engineering Branch of Defence Estate Organisation (Works). Health and safety aspects are to be addressed at all stages of the work.
b. Any investigations must be undertaken at such times and in such a manner as to avoid disruption to routine operation and maintenance of the Site.
c. A photographic pass for the site will be required before photographs of the site are taken.
d. Although the reconnaissance will take place mainly within the establishment's boundary it shall be undertaken in such a manner as to avoid concern to the general public. In the event of any approach by the press or broadcasting media they are to be referred immediately to the Property Manager and no comment whatsoever shall be made.

CONTACT WITH THE ENVIRONMENT AGENCY / SCOTTISH ENVIRONMENTAL PROTECTION AGENCY

33 Any contact with the Environment Agency or the Scottish Environmental Protection Agency must be made only after receiving the written approval of the Water and Environmental Engineering Branch of Defence Estate Organisation (Works).

HEALTH AND SAFETY

34 All members of the study team are to be suitably briefed and a written Method Statement shall be required before any site work is undertaken. All MOD regulations and instructions concerning safe working procedures shall be rigorously adhered to.

35 Recommendations made shall comply fully with all relevant Health and Safety Legislation.

36 The Study shall identify any special health and safety hazards which should be considered when operating on the Site.

DELIVERABLES

TIMESCALE

37 4no. copies of the First Draft Land Quality Assessment Factual, Interpretive and Land Quality Statement reports are to be delivered by 16 September, for discussion at a meeting to be arranged. The target for issue of the final Desk Study Reports is 10 working days following the above meeting.

DISTRIBUTION

38 8 no. copies of the Final Land Quality Assessment and Land Quality Statement Reports are to be delivered to the Task Officer.

FORMAT OF REPORTS

39 The format of the report for this Land Quality Assessment is to conform with the DEO(W) "Standard Framework", attached at Annex C. When the DEO(W) Task Officer is satisfied that this commission has been completed, the Report is to be signed by both the Consultant and the Task Officer.

ADMINISTRATION OF THE STUDY

SECURITY

40 This assessment is classified as RESTRICTED - COMMERCIAL. The Factual Report and the Land Quality Statement are however unrestricted but should only be discussed with staff nominated by the Client's Representative. Each page of the Interpretative report should be marked RESTRICTED - COMMERCIAL.

41 The names of individual MOD staff connected with this project should not appear within the body of the report but should instead be provided in a letter to accompany the report. It is acceptable for post titles to be mentioned within the main text of the report.

ACCESS

42 Entry to RAF UPPER HEYFORD is strictly controlled, and all personnel requiring repeated access must be in possession of MOD Security Clearance.

43 When the Consultant wishes to visit the Site all study team members are required to obtain visitor's passes for each visit, notwithstanding any security clearances already held, and to give prior notice of intended visits to the Site Liaison Officer.

POINTS OF CONTACT

44 Details of the MOD staff connected with this project, their duties and their responsibilities will be provided in an accompanying letter.

LOCATION PLAN FOR RAF UPPER HEYFORD

ANNEX B

LAND QUALITY ASSESSMENT: ENVIRONMENTAL RISK ASSESSMENT: SUMMARY TABLE

AREA / BUILDING	POTENTIAL POLLUTANT	POTENTIAL RECEPTORS	POTENTIAL PATHWAYS TO RECEPTOR	ASSOCIATED HAZARD	RISK (LIKELIHOOD) OF OCCURRENCE	POTENTIAL SIGNIFICANCE
		(specific to pollutant)	(specific to pollutant)	(specific to pollutant)	Certain High Medium Low Very Low Negligible	e.g A: Immediate significant risk of health hazard occurring B: Immediate significant risk of unacceptable damage to environment C: Large Remediation liability D: Minor Remediation liability E: Minor significance, no remediation required F: No effect on re-use options or site value

REPORT - STANDARD FRAMEWORK

1. **Content**

a. Terms of Reference A copy of the Client's written instruction to DEO(W) to carry out an Investigatory Study should be included, along with the scope of the Study.

b. Background Brief details of the site, or sites, giving location(s), MOD. unit, any environmental constraints, including details of any historical listings, any anticipated geotechnical problems and any operational, time or security needs stipulated by the Client. Where the aspects can be more clearly shown in the drawn form then drawings and/or diagrams should be included.

c. Summary of Options A very brief comparison of advantages and disadvantages of each option considered presented on one page, including the cost.

d. Conclusion and Recommendation Giving clear cut recommendations. the option preferred and the operational and economic advantages (including timescales) that justify the recommendation(s).

e. Options Each option dealt with in depth, including the costs and the contractual approach (if any) inherent in each option. Drawings sufficient to explain the option(s) to those unfamiliar with the site should be included.

2. **Face Sheet**

This should contain:

a. DEO(W) title "DEFENCE ESTATE ORGANISATION (WORKS)" centred at the top of the sheet.

b. Name and address of the relevant DEO(W) office in the bottom left hand corner of the sheet.

c. Title as shown on the Directive in the centre of the sheet, with the Project No immediately below.

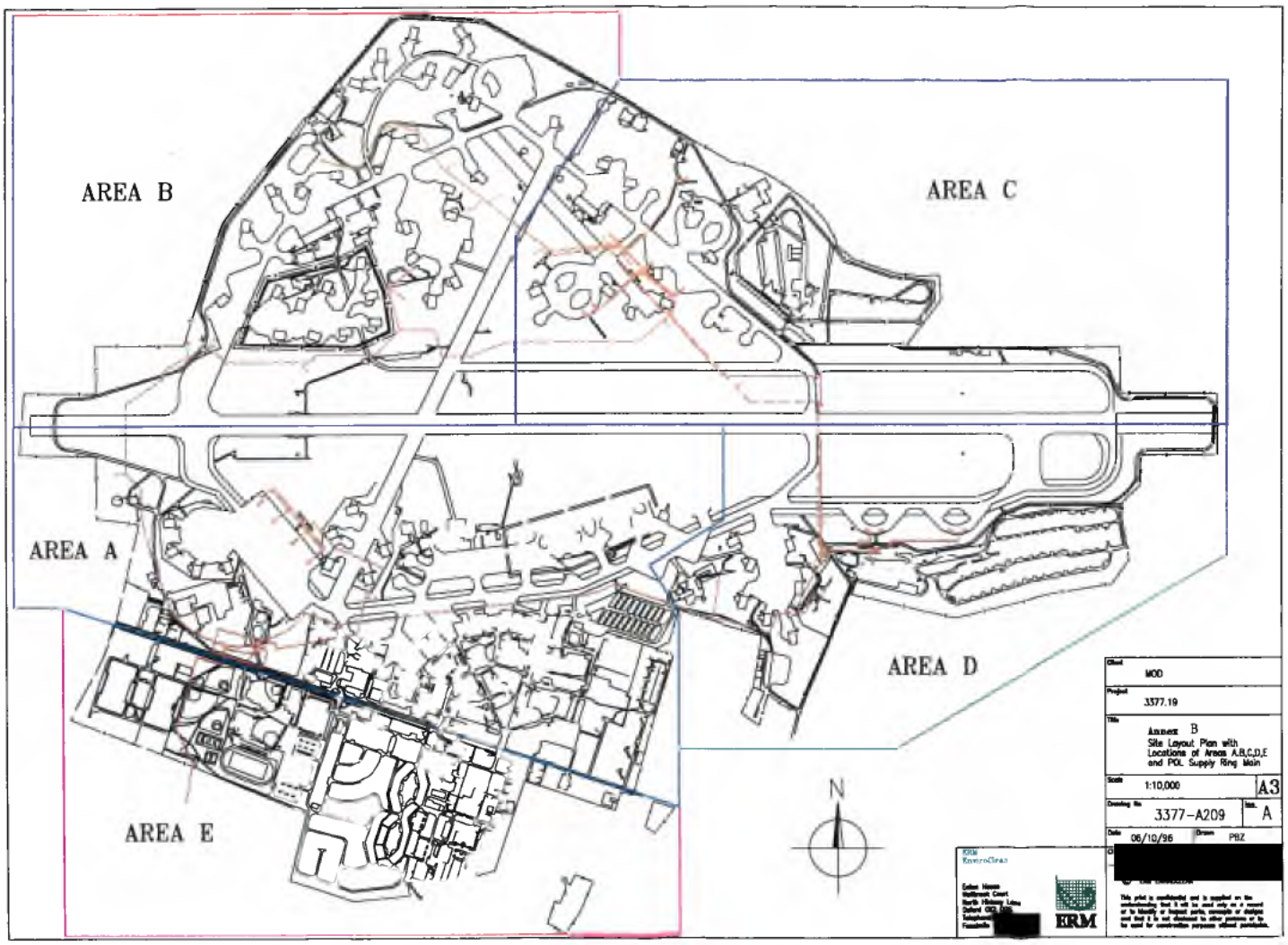
d. The legend "Prepared by (the Consultant's name) for the Ministry of Defence, Defence Estate Organisation (Works), under commission (number)" in the bottom right hand corner of the sheet along with the month and year in which the Study was produced.

3. **Size**

This should always be A4 vertical format, but may contain folded A3 or larger sized sheets in clear A4 pocket inserts in the case of the Summary of Options and drawings.

Annex B

Site Index



Client	MOD
Project	3377.19
Title	Annex B Site Layout Plan with Locations of Areas A,B,C,D,E and POL Supply Ring Main
Scale	1:10,000 A3
Drawing No	3377-A209 Iss. A
Date	06/10/96 Drawn PBZ

ERM EnviroClean

[redacted]

ERM

This print is confidential and is supplied on the understanding that it will be used only on a need to know basis and that it will not be disclosed to other persons or be used for construction purposes without permission.

Annex C

Environmental Risk Assessment - Existing Use

Existing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
POL 1 *Area A* *Fac. 270*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*C* *C* *E*
POL 2 *Area A* *Fac. 254*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*C* *C* *E*
POL 3 *Area A* *Fac. 274*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*C* *C* *E*
POL 5 *Area D* *Fac. 385*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*C* *C* *E*
POL 6	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*

Existing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 382	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 7	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 385	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 8	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 386	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 9	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area C	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 215	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 10	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area C	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 219	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			

Existing

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
	polycarboxylic acids					
POL 11 Area C Fac. 229	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	C C E
POL 13 Area B Fac. 283	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	C C E
POL 14 Area B Fac. 284	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	C C E
POL 15 Area B Fac. 241	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	C C E
POL 16	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	C

Existing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
Area B	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 242	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 17	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area B	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 245	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 19	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area A	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 614	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 20	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 375	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 21A	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area A	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 392	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			

Existing

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
	polycarboxylic acids					
POL 21B *Area A* *Fac. 393*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*C* *C* *E*
POL 21C *Area A* *Fac. 394*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*C* *C* *E*
POL 22 *Area C* *Fac. 395*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*C* *C* *E*
POL 23A *Area B* *Fac. 285*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*C* *C* *E*
POL 23B	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*

Existing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
Area B	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 281	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 24	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area A	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 269	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 25A	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area A	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 270	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 25B	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 377	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
Fuel Tank	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area C	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. un-named	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
	isopropanol, chromium		*Inhalation, Ingestion*			

Existing

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
	polycarboxylic acids					
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 32		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 68		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
100m north of		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
Fac. 68			*Inhalation, Ingestion*			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 77		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 78		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			

Existing

Area	***Potential Pollutant***	***Potential Receptors***	***Potential Pathways***	***Associated Hazard***	***Risk of Occurrence***	***Potential Significance***
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 80		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 81		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 85		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 86		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 101		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*

Existing

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
Fac. 106		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Low	E
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 114		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Low	E
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 151		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Low	E
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area C		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 207		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Low	E
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area B		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 231		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Low	E
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area B		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 233		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Low	E

Existing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area B		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 239		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 250		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area B		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 253		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area C		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 255		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 288		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*

Existing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 299		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 301		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 313		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 320		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 326		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 335		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*

Existing

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 338		Human Health	Dermatological Contact	odour/taste	Low	E
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 345		Human Health	Dermatological Contact	odour/taste	Low	E
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 350		Human Health	Dermatological Contact	odour/taste	Low	E
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 354		Human Health	Dermatological Contact	odour/taste	Low	E
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area E		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 401		Human Health	Dermatological Contact	odour/taste	Low	E
			Inhalation, Ingestion			

Existing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 441		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 492		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 570		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 826		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 827		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area C		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*

Existing

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
Fac. 1011		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Low	E
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area B		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 1319		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Low	E
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 1368		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Low	E
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area B		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 1372		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Low	E
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 1443		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Low	E
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Low	E
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Low	E
Fac. 1403		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Low	E

Existing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Low*	*E*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Low*	*E*
Fac. 3043		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 69		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 88		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 103		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 126		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*

Existing

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 131		Human Health	Dermatological Contact	odour/taste	Low	E
			Inhalation, Ingestion			
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 198		Human Health	Dermatological Contact	odour/taste	Low	E
			Inhalation, Ingestion			
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area C		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 209		Human Health	Dermatological Contact	odour/taste	Low	E
			Inhalation, Ingestion			
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area B		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 234		Human Health	Dermatological Contact	odour/taste	Low	E
			Inhalation, Ingestion			
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 268		Human Health	Dermatological Contact	odour/taste	Low	E
			Inhalation, Ingestion			
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 299		Human Health	Dermatological Contact	odour/taste	Low	E

Existing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A	*glycol's, Urea*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 346		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area D		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 370		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area C		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 383		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 467		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 579		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*E*
			Inhalation, Ingestion			

Existing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
UST(s) *Area E* *Fac. 493* *Fuel Station*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *E*
UST(s) *Area B* *Fac. 2010*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *E*
Car Wash Facility *Area A* *Fac. 38*	*BTEX, hydrocarbons* *ethylene glycol,* *diethylene glycol,* *isopropanol, chromium* *polycarboxylic acid* *waste and lead and* *detergents*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *E*
Auto Hobby Shop *Area A* *Fac. 38*	*BTEX, hydrocarbons* *ethylene glycol,* *diethylene glycol,* *isopropanol, chromium* *polycarboxylic acid*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *E*
Hazard Store *Area A* *Fac. 156*	*Unknown*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Unknown*	

Existing

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
			Inhalation, Ingestion			
Hazard Store Area A Fac. 302	Unknown	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Unknown	
Fire Practise Area Area A Adjacent to 330	Hydrocarbons, organic solvents, heavy metals ordnance, astbestos unknown chemicals	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	C C C/D
Garage Refuelling Facility Area A Fac. 354	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	D D E
Vehicle Refuelling Area C Fac. 3200	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	D D E
Vehicle Refuelling Area C Fac. 3201	BTEX, hydrocarbons ethylene glycol, diethylene glycol,	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	D D E

Existing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
	isopropanol, chromium polycarboxylic acid		*Inhalation, Ingestion*			
Vehicle Refuelling Area C Fac. 3202	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid*	*Surface Water Groundwater Human Health*	*Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium Medium Low*	*D D E*
Vehicle Refuelling Area C Fac. 3203	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid*	*Surface Water Groundwater Human Health*	*Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium Medium Low*	*D D E*
Laundry Area E Fac. 408	*Solvents*	*Surface Water Groundwater Human Health*	*Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium Medium Low*	*D D E*
Photographic Laboratory Area E Fac. 408	*Metals, solvents, SVOC's*	*Surface Water Groundwater Human Health*	*Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium Medium Low*	*D D E*

Annex D

Environmental Risk Assessment - Housing

Housing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
POL 1 *Area A* *Fac. 270*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *High*	*C* *C* *C*
POL 2 *Area A* *Fac. 254*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *High*	*C* *C* *C*
POL 3 *Area A* *Fac. 274*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *High*	*C* *C* *C*
POL 5 *Area D* *Fac. 385*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *High*	*C* *C* *C*
POL 6	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*

Housing

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 382	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*High*	*C*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 7	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 385	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*High*	*C*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 8	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 386	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*High*	*C*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 9	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area C	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 215	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*High*	*C*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 10	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area C	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 219	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*High*	*C*
	isopropanol, chromium		*Inhalation, Ingestion*			

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Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
	polycarboxylic acids					
POL 11	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area C	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 229	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*High*	*C*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 13	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area B	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 283	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*High*	*C*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 14	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area B	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 284	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*High*	*C*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 15	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area B	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 241	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*High*	*C*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 16	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
Area B	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 242	*diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*High*	*C*
POL 17	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area B	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 245	*diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*High*	*C*
POL 19	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area A	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 614	*diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*High*	*C*
POL 20	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 375	*diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*High*	*C*
POL 21A	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area A	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 392	*diethylene glycol, isopropanol, chromium*	*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*High*	*C*

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
	polycarboxylic acids					
POL 21B Area A Fac. 393	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium High	C C C
POL 21C Area A Fac. 394	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids	Surface Water Groundwater Human Health	Drains. streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium High	C C C
POL 22 Area C Fac. 395	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium High	C C C
POL 23A Area B Fac. 285	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium High	C C C
POL 23B	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	C

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Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
Area B	ethylene glycol,	Groundwater	Groundwater, springs	toxin, irritant &	Medium	C
Fac. 281	diethylene glycol,	Human Health	Dermatological Contact	odour/taste	High	C
	isopropanol, chromium polycarboxylic acids		Inhalation, Ingestion			
POL 24	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	C
Area A	ethylene glycol,	Groundwater	Groundwater, springs	toxin, irritant &	Medium	C
Fac. 269	diethylene glycol,	Human Health	Dermatological Contact	odour/taste	High	C
	isopropanol, chromium polycarboxylic acids		Inhalation, Ingestion			
POL 25A	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	C
Area A	ethylene glycol,	Groundwater	Groundwater, springs	toxin, irritant &	Medium	C
Fac. 270	diethylene glycol,	Human Health	Dermatological Contact	odour/taste	High	C
	isopropanol, chromium polycarboxylic acids		Inhalation, Ingestion			
POL 25B	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	C
Area D	ethylene glycol,	Groundwater	Groundwater, springs	toxin, irritant &	Medium	C
Fac. 377	diethylene glycol,	Human Health	Dermatological Contact	odour/taste	High	C
	isopropanol, chromium polycarboxylic acids		Inhalation, Ingestion			
Fuel Tank	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	C
Area C	ethylene glycol,	Groundwater	Groundwater, springs	toxin, irritant &	Medium	C
Fac. un-named	diethylene glycol,	Human Health	Dermatological Contact	odour/taste	High	C
	isopropanol, chromium		Inhalation, Ingestion			

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
	polycarboxylic acids					
AST(s) Area A Fac. 32	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
AST(s) Area A Fac. 68	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
AST(s) Area A 100m north of Fac. 68	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
AST(s) Area A Fac. 77	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
AST(s) Area A Fac. 78	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D

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Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 80		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 81		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 85		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 86		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 101		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D

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Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
Fac. 106		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Medium	D
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 114		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Medium	D
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 151		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Medium	D
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area C		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 207		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Medium	D
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area B		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 231		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Medium	D
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area B		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 233		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Medium	D

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area B		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 239		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 250		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area B		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 253		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area C		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 255		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 288		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*

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Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 299		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 301		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 313		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 320		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 326		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 335		Human Health	Dermatological Contact	odour/taste	Medium	D

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 338		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 345		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*C*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 350		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 354		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 401		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			

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Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area E		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 441		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area E		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 492		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area E		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 570		Human Health	Dermatological Contact	odour/taste	Medium	C
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area E		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 826		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 827		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area C		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D

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Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
Fac. 1011		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Medium	D
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area B		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 1319		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Medium	D
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 1368		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Medium	D
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area B		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 1372		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Medium	D
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 1443		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Medium	D
AST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 1403		Human Health	Dermatological Contact Inhalation, Ingestion	odour/taste	Medium	D

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Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
AST(s) Area A Fac. 3043	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
UST(s) Area A Fac. 69	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
UST(s) Area A Fac. 88	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
UST(s) Area A Fac. 103	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
UST(s) Area A Fac. 126	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D

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Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 131		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 198		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area C		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 209		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area B		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 234		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 268		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 299		Human Health	Dermatological Contact	odour/taste	Medium	D

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Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A	*glycol's, Urea*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 346		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area D		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 370		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area C		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 383		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 467		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 579		*Human Health*	*Dermatological Contact*	*odour/taste*	*Medium*	*D*
			Inhalation, Ingestion			

Housing

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area E		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 493		Human Health	Dermatological Contact	odour/taste	Medium	D
Fuel Station			Inhalation, Ingestion			
UST(s)	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area B		Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 2010		Human Health	Dermatological Contact	odour/taste	Medium	D
			Inhalation, Ingestion			
Car Wash Facili	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A	ethylene glycol,	Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 38	diethylene glycol,	Human Health	Dermatological Contact	odour/taste	Medium	D
	isopropanol, chromium		Inhalation, Ingestion			
	polycarboxylic acid					
	waste and lead and					
	detergents					
Auto Hobby Sho	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	D
Area A	ethylene glycol,	Groundwater	Groundwater, springs	toxin, irritant &	Medium	D
Fac. 38	diethylene glycol,	Human Health	Dermatological Contact	odour/taste	Medium	D
	isopropanol, chromium		Inhalation, Ingestion			
	polycarboxylic acid					
Hazard Store	Unknown	Surface Water	Drains, streams,	Teratogen, carcinogen	Unknown	
Area A		Groundwater	Groundwater, springs	toxin, irritant &		
Fac. 156		Human Health	Dermatological Contact	odour/taste		

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
			Inhalation, Ingestion			
Hazard Store Area A Fac. 302	Unknown	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Unknown	
Fire Practise Ar Area A Adjacent to 330	Hydrocarbons, organic solvents, heavy metals ordnance, astbestos unknown chemicals	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	C C C
Garage Refuelli Facility Area A Fac. 354	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
Vehicle Refuelli Area C Fac. 3200	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
Vehicle Refuelli Area C Fac. 3201	BTEX, hydrocarbons ethylene glycol, diethylene glycol,	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
	isopropanol, chromium polycarboxylic acid		Inhalation, Ingestion			
Vehicle Refuelli Area C Fac. 3202	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
Vehicle Refuelli Area C Fac. 3203	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
Laundry Area E Fac. 408	Solvents	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D
Photographic Laboratory Area E Fac. 408	Metals, solvents, SVOC's	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Medium	D D D

Annex E

Environmental Risk Assessment - Agriculture

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
POL 1 *Area A* *Fac. 270*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium* *Medium* *Low*	*C* *C* *D/E*
POL 2 *Area A* *Fac. 254*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium* *Medium* *Low*	*C* *C* *D/E*
POL 3 *Area A* *Fac. 274*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium* *Medium* *Low*	*C* *C* *D/E*
POL 5 *Area D* *Fac. 385*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium* *Medium* *Low*	*C* *C* *D/E*
POL 6	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*

Agriculture

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 382	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 7	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 385	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 8	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 386	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 9	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area C	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 215	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 10	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area C	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 219	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
	polycarboxylic acids					
POL 11 Area C Fac. 229	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	C C D/E
POL 13 Area B Fac. 283	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	C C D/E
POL 14 Area B Fac. 284	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	C C D/E
POL 15 Area B Fac. 241	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acids	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	C C D/E
POL 16	BTEX, hydrocarbons	Surface Water	Drains, streams,	Teratogen, carcinogen	Medium	C

Agriculture

Area	***Potential Pollutant***	*Potential Receptors*	***Potential Pathways***	*Associated Hazard*	*Risk of Occurrence*	***Potential Significance***
Area B	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 242	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 17	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area B	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 245	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 19	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area A	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 614	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 20	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 375	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 21A	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area A	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 392	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
	polycarboxylic acids					
POL 21B	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area A	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 393	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 21C	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area A	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 394	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 22	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area C	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 395	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 23A	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area B	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 285	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 23B	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*

Agriculture

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
Area B	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 281	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 24	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area A	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 269	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 25A	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area A	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 270	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
POL 25B	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area D	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. 377	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			
	polycarboxylic acids					
Fuel Tank	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*C*
Area C	*ethylene glycol,*	*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*C*
Fac. un-named	*diethylene glycol,*	*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
	isopropanol, chromium		*Inhalation, Ingestion*			

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
	polycarboxylic acids					
AST(s) *Area A* *Fac. 32*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
AST(s) *Area A* *Fac. 68*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
AST(s) *Area A* *100m north of* *Fac. 68*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
AST(s) *Area A* *Fac. 77*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
AST(s) *Area A* *Fac. 78*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*

Agriculture

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 80		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 81		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 85		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 86		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 101		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*

Agriculture

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
Fac. 106		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*D/E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 114		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*D/E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 151		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*D/E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area C		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 207		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*D/E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area B		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 231		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*D/E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area B		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 233		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*D/E*

Agriculture

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
AST(s) *Area B* *Fac. 239*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
AST(s) *Area A* *Fac. 250*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
AST(s) *Area B* *Fac. 253*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
AST(s) *Area C* *Fac. 255*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
AST(s) *Area A* *Fac. 288*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*

Agriculture

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 299		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 301		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 313		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 320		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 326		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 335		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*

Agriculture

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
			Inhalation, Ingestion			
AST(s) Area A Fac. 338	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	D D D/E
AST(s) Area A Fac. 345	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	D D D/E
AST(s) Area A Fac. 350	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	D D D/E
AST(s) Area A Fac. 354	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	D D D/E
AST(s) Area E Fac. 401	BTEX, hydrocarbons	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	D D D/E

Agriculture

Area	***Potential Pollutant***	***Potential Receptors***	***Potential Pathways***	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 441		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 492		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 570		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area E		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 826		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 827		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area C		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*

Agriculture

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
Fac. 1011		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*D/E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area B		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 1319		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*D/E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 1368		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*D/E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area B		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 1372		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*D/E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 1443		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*D/E*
AST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 1403		*Human Health*	*Dermatological Contact Inhalation, Ingestion*	*odour/taste*	*Low*	*D/E*

Agriculture

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
AST(s) *Area A* *Fac. 3043*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
UST(s) *Area A* *Fac. 69*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
UST(s) *Area A* *Fac. 88*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
UST(s) *Area A* *Fac. 103*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
UST(s) *Area A* *Fac. 126*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*

Agriculture

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 131		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 198		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area C		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 209		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area B		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 234		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 268		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*
			Inhalation, Ingestion			
UST(s)	*BTEX, hydrocarbons*	*Surface Water*	*Drains, streams,*	*Teratogen, carcinogen*	*Medium*	*D*
Area A		*Groundwater*	*Groundwater, springs*	*toxin, irritant &*	*Medium*	*D*
Fac. 299		*Human Health*	*Dermatological Contact*	*odour/taste*	*Low*	*D/E*

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
			Inhalation, Ingestion			
UST(s) *Area A* *Fac. 346*	*BTEX, hydrocarbons* *glycol's, Urea*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
UST(s) *Area D* *Fac. 370*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
UST(s) *Area C* *Fac. 383*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
UST(s) *Area E* *Fac. 467*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
UST(s) *Area E* *Fac. 579*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen* *toxin, irritant &* *odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*

Agriculture

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
UST(s) *Area E* *Fac. 493* *Fuel Station*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
UST(s) *Area B* *Fac. 2010*	*BTEX, hydrocarbons*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
Car Wash Facility *Area A* *Fac. 38*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid waste and lead and detergents*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
Auto Hobby Shop *Area A* *Fac. 38*	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact* *Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium* *Medium* *Low*	*D* *D* *D/E*
Hazard Store *Area A* *Fac. 156*	*Unknown*	*Surface Water* *Groundwater* *Human Health*	*Drains, streams,* *Groundwater, springs* *Dermatological Contact*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Unknown*	

Area	Potential Pollutant	Potential Receptors	Potential Pathways	Associated Hazard	Risk of Occurrence	Potential Significance
			Inhalation, Ingestion			
Hazard Store Area A Fac. 302	Unknown	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Unknown	
Fire Practise Area Area A Adjacent to 330	Hydrocarbons, organic solvents, heavy metals ordnance, asbestos unknown chemicals	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	C C D/E
Garage Refuelling Facility Area A Fac. 354	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	D D D/E
Vehicle Refuellin Area C Fac. 3200	BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	D D D/E
Vehicle Refuellin Area C Fac. 3201	BTEX, hydrocarbons ethylene glycol, diethylene glycol,	Surface Water Groundwater Human Health	Drains, streams, Groundwater, springs Dermatological Contact	Teratogen, carcinogen toxin, irritant & odour/taste	Medium Medium Low	D D D/E

Agriculture

Area	*Potential Pollutant*	*Potential Receptors*	*Potential Pathways*	*Associated Hazard*	*Risk of Occurrence*	*Potential Significance*
	isopropanol, chromium polycarboxylic acid		*Inhalation, Ingestion*			
Vehicle Refuelling Area C Fac. 3202	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid*	*Surface Water Groundwater Human Health*	*Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium Medium Low*	*D D D/E*
Vehicle Refuelling Area C Fac. 3203	*BTEX, hydrocarbons ethylene glycol, diethylene glycol, isopropanol, chromium polycarboxylic acid*	*Surface Water Groundwater Human Health*	*Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium Medium Low*	*D D D/E*
Laundry Area E Fac. 408	*Solvents*	*Surface Water Groundwater Human Health*	*Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium Medium Low*	*D D D/E*
Photographic Laboratory Area E Fac. 408	*Metals, solvents, SVOC's*	*Surface Water Groundwater Human Health*	*Drains, streams, Groundwater, springs Dermatological Contact Inhalation, Ingestion*	*Teratogen, carcinogen toxin, irritant & odour/taste*	*Medium Medium Low*	*D D D/E*

Annex F

Proposed Timescale

Week	1	2	3	4	5	6	7	8	9	10

Objective 1: Assessment of Groundwater, Surface Water and Spring Issues

Task 1 *Assessment of Spring and Surface Water Drainage Quality*										
Task 2 *Installation of Groundwater Monitoring Wells*										
Task3 *Groundwater Sampling*										
Task 4 *Hydrogeological Testing*										
Task 5 *Reporting (Draft)*										

Objective 2: Assessment of On-Site, Near Surface, Contamination

Task 1 *Near Surface soil and Groundwater Sampling*										
Task 2 *Building (Asbestos) Survey*										
Task 3 *Reporting (Including Analysis)*										

DEFENCE ESTATE ORGANISATION

RAF UPPER HEYFORD
GROUNDWATER QUALITY MONITORING ASSESSMENT

PROJECT NO: 07686 - FINAL REPORT

Technical Report
September 1998
by
Aspinwall & Company Ltd

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under Commission WS13/1982/2

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12 October 1998

RAF UPPER HEYFORD: Groundwater Quality Monitoring Assessment

1. I enclose one copy of the Groundwater Quality Monitoring Assessment for RAF Upper Heyford. The report comprises one volume.

2. Please archive this report under 'Land Quality Assessment'. This should also be archived under the following key words

   contaminated land

3. Please contact me if I can be of further assistance.

[redacted]
Environmental Engineer
SC 4e, DEO HQ
SB G2 2453SB

MD3333C
SLHSep98.DOC

REPORT RELEASE SHEET

DEFENCE ESTATE ORGANISATION

RAF UPPER HEYFORD GROUNDWATER QUALITY MONITORING ASSESSMENT

PROJECT NO: 07686 - FINAL REPORT

Task Officer
[redacted] Environmental Engineer
Defence Estate Organisation
Blakemore Drive
Sutton Coldfield
West Midlands
B75 7RL
Tel: [redacted]

Prepared by Aspinwall & Company Limited
for the Ministry of Defence Estate
Organisation
under Commission WS13/1982/2

Main Contributors
[redacted]

Report Issued by:
[redacted]

[redacted]

Approved by Task Officer:
[redacted] Oct 98

Approved by Sponsor:

Walford Manor, Baschurch, Shrewsbury, Shropshire, SY4 2HH, England
Tel: [redacted] Fax: [redacted]

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Summary

1. Aspinwall & Company was commissioned by Defence Estate Organisation to undertake groundwater and spring water sampling, analysis and assessment at RAF Upper Heyford. The work was required following completion of a land quality assessment in 1997.

2. Samples were taken from eleven springs and seven boreholes (two of which have dual completions) and submitted to Geochem Laboratory for analysis. Each sample was analysed for a range of inorganic and organic compounds. The specification for the analyses was agreed with the Environment Agency prior to commencement.

3. The results indicate that the groundwater beneath the site is generally of good quality, with only limited significant changes in chemistry between 1997 and 1998. These changes include:

- a substantial increase in ammoniacal nitrogen concentration in all boreholes;
- an increase in phosphate concentration at a number of boreholes;
- elevated arsenic in borehole 7 with substantial reductions in boreholes 2 and 3B;
- the isolated instances of slightly elevated boron, cadmium, chromium and copper identified in 1997 were not repeated in 1998;
- a significant reduction in BOD at borehole 1; and
- diesel range organics were identified at all locations, although these were only slightly elevated at three locations. No other hydrocarbons were detected and the source of the diesel range organics could not be positively identified. They may be due to "naturally" occurring compounds or surfactants, plasticisers, detergents etc. which can be present at low concentrations.

4. Most of the determinands measured in groundwater beneath the site were at concentrations less than the maximum admissible concentration (MAC) detailed in the UK Drinking Water Standards relating to the quality of water for human consumption. The main exception was ammoniacal nitrogen which exceeded the MAC at 5 out of 9 locations. The MAC's for nitrate and sulphate were also exceeded at isolated locations, but by less than 10%, whilst the MAC for arsenic was exceeded at one location (borehole 7) by an order of magnitude.

5. The spring water quality is generally reasonable with a small number of significant changes from 1997 to 1998 including:

- an increase in phosphate concentration at a number of locations;

Summary *continued*

- a slight increase in heavy metal concentrations, especially at spring M; and
- diesel range organics were detected at all locations, positively identified as diesel and weathered diesel at springs N and I respectively.

6. Most of the determinands in spring water were present at concentrations less than the EC MAC, although three locations exceeded the MAC for nitrate and one for ammoniacal nitrogen. The MAC's for arsenic, chromium, lead and selenium were exceeded at a small number of locations.

7. In summary the groundwater beneath the Upper Heyford site is generally of good quality although there is one isolated instance where arsenic exceeds the standard for potable water quality. Volatile and semi volatile organics are low. Diesel range organics are present although the source of these could not be identified. The spring water around the site is of reasonable quality although arsenic, chromium, lead and zinc exceed potable water quality standards in isolated instances. Diesel range organics are present at all springs although the source of these could not be identified.

8. Only by undertaking long term monitoring will any trends in groundwater quality be identifiable. Of particular concern are diesel range organics, heavy metals, phosphate and ammoniacal nitrogen. The increase in the latter was especially significant. Its coincidence with an increase in phosphate suggests fertiliser as a source. This has been confirmed by farmers using the airfield for grazing, the large increase being due to fertiliser application prior to a very wet period.

9. Excepting the recent impact of fertiliser application, operations at RAF Upper Heyford do not appear to have significantly impacted upon the sensitive groundwater regime beneath the base. It is recommended that regular groundwater quality monitoring be undertaken throughout any redevelopment of the site to confirm that this remains the case.

Introduction 1

1.1 In March 1997 Aspinwall & Company (Aspinwall) was commissioned by Defence Estate Organisation (DEO) to undertake a Land Quality Assessment at RAF Upper Heyford near Bicester in Oxfordshire. The assessment, which was undertaken in late April 1997, included excavation of trial pits and boreholes with subsequent laboratory analysis of soil and water samples to determine the nature and extent of any contamination present. The investigation identified a small number of slightly contaminated areas although groundwater and surface water monitored beneath and around the site was, excepting a small number of anomalous results, generally good. Due to these anomalies, and the fact that the above interpretation is based on analysis of a single set of water samples, it was recommended that a further series of samples be taken.

1.2 In May 1998, following consultation with the Environment Agency, Aspinwall was commissioned to collect and analyse a second series of samples and to produce this interpretative report. The 1997 sampling was undertaken at a similar time of year to the 1998 sampling, and although climate conditions (and therefore hydrological conditions) vary, taking the samples at a similar time of year provides a degree of consistency for comparison.

1.3 The purpose of the repeat sampling was to confirm that the results obtained from analysis of the 1997 water samples were a true reflection of the groundwater quality in the area around and beneath the site. Furthermore, the Environment Agency requested that additional determinands be monitored and that lower limits of detection be used for the heavy metals analysis. The latter was required to enable direct comparison of the results with potable water quality standards. This, and a comparison between 1997 and 1998 data, has been undertaken in this report.

1.4 The Consultants Directive, issued by DEO, is included as Appendix 1.

Water Sample Collection and Analysis 2

Introduction

2.1 The water samples collected have been divided into those from springs/outfalls around the site and those from boreholes within the site boundary which were drilled during the 1997 investigation. The location of these points is shown on Figure 1.

Groundwater Sampling

2.2 In 1998, groundwater samples were obtained from boreholes 1, 2, 3, 4, 5, 6 and 7. At boreholes 1 and 3 two sets of samples were taken, one from the shallow completion and one from the deep completion. These locations were all sampled in 1997, detailed discussion of the results from which are included in Reference 1. All samples were analysed for the following suite of determinands:

Major ions:	calcium, magnesium, sodium, potassium, bicarbonate (alkalinity), sulphate, nitrate, chloride, ammoniacal nitrogen and phosphate;
Metals:	arsenic, cadmium, chromium, lead, mercury, copper, nickel and zinc;
Others:	pH (*in situ* & laboratory), electrical conductivity (EC - *in situ* & laboratory), solvent extractable matter (SEM), chemical oxygen demand (COD), biochemical oxygen demand (BOD), total organic carbon (TOC), mineral oil, non volatile aromatics (NVA), nitrogen/sulphur/oxygen & resins (NSO), petrol range organics (PRO) and diesel range organics (DRO); and
EA specified additional determinands	benzene, toluene, ethyl benzene, xylene, carbon tetrachloride, dichloromethane, trichloroethene, tetrachloroethene, 1,1,1 trichloroethane, vinyl chloride.

2.3 At each borehole an electronic dip meter was first used to determine the depth to water, data from which are summarised in Appendix 2. Following water level measurement a variable frequency electric submersible pump was installed in each borehole in turn. The pump allows purging to be undertaken at a high frequency (i.e. high discharge) rate to minimise the purge time, following which the frequency (and therefore discharge) can be reduced to minimise water disturbance during sampling.

2.4 In order to determine when purging was complete the following well head parameters were monitored using a multi-parameter probe : temperature, pH, electrical conductivity, dissolved oxygen, redox and turbidity. The results of this purging are presented in Appendix 3. Following sampling at each location the pump was cleaned with Decon 90, a laboratory grade detergent, then rinsed with tap water.

Water Sample Collection and Analysis 2
continued

2.5 Because some of the samples were to be analysed for volatile compounds these were collected with a disposable bailer following purging. The bailer minimises the potential for sample disturbance and loss of volatiles whilst use of a new bailer at each location prevents cross contamination.

2.6 The exception to the above sampling method was at borehole 1A where problems encountered during sampling in 1997 indicated that the electric pump could not be utilised. This borehole was therefore bailed prior to sampling. At borehole 2 the method was also varied slightly as the hole was rapidly dewatered by the pump. It was therefore allowed to recover before being pumped again and then sampled.

2.7 Each sample comprised six sub-samples which were stored in a variety of containers as recommended by the laboratory and as detailed in Appendix 4. All samples were stored in cool boxes on site and transported by courier to Geochem laboratory on a daily basis.

Spring Water Sampling

2.8 During the 1997 investigation twenty four locations were visited which had been identified from Ordnance Survey Maps of the area as being potential springs. Each location was visited and the major springs were sampled. A detailed discussion of the results is presented in Reference 1.

2.9 Twelve of the springs were revisited in 1998 and eleven samples (spring C2 being dry) were taken, each of which comprised six sub-samples. The locations visited (shown on Figure 1) are springs A, B, C2, D, F, G1, I, L, M, N, P1 and R2. As with the groundwater samples all spring water samples were stored in cool boxes and transported to the laboratory on the day of collection. The determinands analysed are as per the groundwater samples, except that the Environment Agency did not require analysis for volatile organic compounds.

2.10 At each location *in situ* measurements were made to determine water temperature, pH, electrical conductivity, dissolved oxygen, redox and turbidity. These results are presented in Appendix 5.

Laboratory Analysis

2.11 The results of the laboratory analysis are presented in Appendix 6. These have been divided into four sub-sets as follows:

- Appendix 6a - miscellaneous data including major ions, heavy metals and "general indicators" of contamination such as total organic carbon and biochemical oxygen demand;

Water Sample Collection and Analysis 2
continued

- Appendix 6b - hydrocarbon analyses including diesel range organics, petrol range organics and BTEX (benzene, toluene, ethyl-benzene and xylene) compounds;
- Appendix 6c - phenol analyses which include nine major compounds; and
- Appendix 6d - volatile organic compounds which include fifty-nine major compounds.

2.12 These results including a comparison with the 1997 results, are discussed in Chapter 3.

Results 3

Introduction

3.1 A detailed discussion of the groundwater/spring water chemistry at Upper Heyford, based on the 1997 data, has already been undertaken (Reference 1), a copy of which is included here for completeness as Appendix 6. This report discusses any major changes observed between the 1997 and 1998 data, and any instances where potable water quality standards (Reference 2) are exceeded. The additional data requested by the Environment Agency in 1998 is also discussed.

3.2 The data, excepting detailed organic analyses, has been summarised in Tables 1 and 2 for borehole and spring samples respectively. The tables each include 4 sub-tables, the first indicating UK potable water quality standards (Maximum Admissible Concentration - MAC), the second the 1997 data, the third the 1998 data and the fourth a table showing percentage change from 1997 to 1998 (calculated as the 1998 concentration minus the 1997 concentration divided by 1997 concentration). Within this a negative value indicates a decrease in concentration from 1997 to 1998. A comparison of the 1997 and 1998 diesel range organics results is presented in Table 3.

Results of Chemical Analysis of Groundwater from Boreholes

Major Ions/Heavy Metals

3.3 The 1998 results broadly follow the trend of the 1997 results indicating neutral to slightly alkaline pH with a slightly elevated electrical conductivity. A piper plot for the 1998 data (Figure 2) demonstrates a similar pattern as for 1997 with groundwater quality dominated by calcium and bicarbonate ions at all locations. The water encountered at borehole 2 is of a slightly different quality with sulphate and chloride being important, although the difference is not as great as in 1997.

3.4 With regard to the major ions and heavy metals there is no significant general overall change in water quality except for the following:

- a substantial increase in ammoniacal nitrogen concentrations at all locations; and
- an increase in phosphate concentration at five locations, although the increase is only substantial at three of these.

3.5 There are increases in some determinands such as nitrate at borehole 3A, alkalinity at borehole 2 and chloride at boreholes 1A and 1B although these are isolated instances. There is no location at which a significant number of determinands have all increased in concentration.

Table 1 Comparison of 1997 and 1998 Water Quality Data from the on site Boreholes

Potable Water Quality Standards

	EC mS/cm	pH	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Cl mg/l	NO_3 mg/l	Phos mg/l	SO_4 mg/l	Amm N mg/l	ALK mg/l	HCO3 mg/l	COD mg/l	BOD mg/l	TOC mg/l	As mg/l	B mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Hg mg/l	Ni mg/l	Pb mg/l	Se mg/l	Zn mg/l	M.Oil mg/l	NVA mg/l	NSO mg/l	TPH mg/l	DCM mg/l	TSE mg/l	DRO ug/l
MAC			150	12	250	50	400	50	2.2	250	0.39						0.05	2	0.005	0.05	3	0.001	0.05	0.05	0.01	5	0.01						
IV																	0.01		4E - 04	0.001	0.015	5E - 05	0.015	0.015		0.085	0.05						
IV																	0.06		0.006	0.03	0.075	3E - 04	0.075	0.075		0.8	0.8						

Groundwater Quality - Boreholes, 1997 Data

BH	EC mS/cm	pH	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Cl mg/l	NO_3 mg/l	Phos mg/l	SO_4 mg/l	Amm N mg/l	ALK mg/l	HCO3 mg/l	[HCO3] mg/l	COD mg/l	BOD mg/l	TOC mg/l	As mg/l	B mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Hg mg/l	Ni mg/l	Pb mg/l	Se mg/l	Zn mg/l	M.Oil mg/l	NVA mg/l	NSO mg/l	TPH mg/l	DCM mg/l	TSE mg/l	DRO ug/l
1A	0.845	7.27	40	6	178.2	11.97	30	23.3	0.12	101	0.04	480	480	585	478	11.1	2	< 0.05	0.12	< 0.05	< 0.05	< 0.05	0.14	< 0.05	0.06	< 0.1	< 0.05	2	< 1	1	2	3	3	< 10
1B	0.549	7.25	12	< 3	197.8	2.87	19	93.4	0.06	56	< 0.01	330	330	402	< 10	20.5	2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.08	< 0.05	< 0.05	< 0.1	< 0.05	1	< 1	1	1	2	2	< 10
2	1.029	8.11	96	7	115.3	8.13	46	52.6	0.63	324	0.26	90	90	110	30	1.2	7	0.71	0.37	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.05	< 1	< 1	1	3	< 1	3	2	77
3A	0.572	7.38	14	< 3	124.4	2.46	13	41.3	0.07	53	< 0.01	480	480	585	14	0.7	2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.05	< 1	< 1	1	2	< 1	2	2	< 10
3B	0.814	7.21	12	< 3	164	2.13	13	14.1	0.18	42	< 0.08	400	400	488	10	< 0.5	5	2.28	< 0.05	< 0.05	< 0.05	0.13	< 0.05	0.21	0.11	< 0.1	0.55	< 1	< 1	1	3	< 1	3	3	< 10
4	0.557	7.43	21	< 3	113.4	6.58	15	< 0.5	0.03	58	< 0.01	280	280	341	< 10	< 0.5	9	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.06	< 0.05	< 0.05	< 0.1	< 0.05	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 10
5	0.624	7.21	14	< 3	141.8	2.71	53	< 0.5	0.02	29	< 0.01	300	300	366	< 10	< 0.5	5	< 0.05	0.22	0.22	0.07	< 0.05	< 0.05	< 0.05	0.23	< 0.1	0.15	< 1	< 1	1	1	< 1	1	1	10
6	0.602	7.32	19	5	152.5	9.31	5	< 0.5	0.11	82	0.02	1400	1400	1707	77	2.8	6	< 0.05	0.8	0.1	< 0.05	< 0.05	0.09	< 0.05	< 0.05	< 0.1	0.08	< 1	< 1	1	< 1	< 1	< 1	< 1	17
7	0.587	7.14	12	< 3	135	2.78	10	< 0.5	0.02	10	0.04	400	400	488	< 10	< 0.5	5	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.09	< 0.1	0.08	< 1	< 1	1	< 1	< 1	< 1	< 1	< 10
																												< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 10

Groundwater Quality - Boreholes, 1998 Data

BH	EC mS/cm	pH	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Cl mg/l	NO_3 mg/l	Phos mg/l	SO_4 mg/l	Amm N mg/l	ALK mg/l	HCO3 mg/l	[HCO3] mg/l	COD mg/l	BOD mg/l	TOC mg/l	As mg/l	B mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Hg ug/l	Ni mg/l	Pb mg/l	Se mg/l	Zn mg/l	M.Oil mg/l	NVA mg/l	NSO mg/l	SEM mg/l
1A	0.996	7.38	23.8	2.5	210	8.96	74	28.3	0.1	142	1.09	400	400	488	124	11	3	0.05	0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	0.05	< 1	< 1	< 1	1
1B	0.744	7.49	13.8	2	145	5.22	43	54	0.1	27	0.6	420	420	512	47	2	6	0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	< 0.05	< 1	< 1	< 1	< 1
2	0.992	7.9	71.3	5.4	138	10	46	7.1	0.08	271	0.67	340	340	414	89	6	5	< 0.05	0.49	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.005	< 0.05	< 1	< 1	< 1	< 1
3A	0.679	7.21	12.5	1.6	109	1.94	15	32.7	0.04	48	0.1	290	290	354	< 10	< 1	3	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	< 0.05	< 1	< 1	1	-
3B	0.594	7.28	13.1	1.1	127	1.78	10	23.3	1.67	38	0.09	250	250	305	22	< 1	3	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	< 0.05	< 1	< 1	1	1
4	0.585	7.38	20	4.1	83.7	11	10	< 0.05	0.07	51	0.6	270	270	329	73	2	3	< 0.05	0.08	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	< 0.05	< 1	< 1	1	1
5	0.671	7.21	19	1.7	127	2.01	29	1.5	1.4	54	0.36	310	310	378	16	< 1	2	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.016	< 0.05	< 1	< 1	< 1	1
6	0.433	7.59	12.5	3.6	156	7.3	NDP	NDP	0.03	45	0.09	320	320	390	16	< 1	1	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	< 0.05	< 1	< 1	< 1	1
7	0.375	7.38	11.8	0.8	191	3.31	28	3.1	0.02	20	1.11	380	380	463	< 10	< 1	4	0.44	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	< 0.05	< 1	< 1	< 1	1

Notes: * - based sample, GL - EC Guide Level, MAC - EC Maximum Admissible Concentration, TV - Dutch target value, IV - Dutch Intervention Value
EC - electrical conductivity, Amm N - ammoniacal nitrogen, ALK - alkalinity, COD - chemical oxygen demand, BOD - biochemical oxygen demand, TOC - total organic carbon, M.Oil - mineral oil/paraffin, NVA - total non-volatile aromatics
NSO - NSO'ressins, TPH - total petroleum hydrocarbons, DCM - DCM/MeOH extract, TSE - total soluble extract, DRO - diesel range organics, Phos - phosphate (note MAC & GL expressed as P).
[HCO3] - calculated by multiplying alkalinity by 1.219, NDP - no determination possible.

Percentage change from 1997 to 1998

BH	EC mS/cm	pH	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Cl mg/l	NO_3 mg/l	Phos mg/l	SO_4 mg/l	Amm N mg/l	ALK mg/l	HCO3 mg/l	[HCO3] mg/l	COD mg/l	BOD mg/l	TOC mg/l	As mg/l	B mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Hg mg/l	Ni mg/l	Pb mg/l	Se mg/l	Zn mg/l	M.Oil mg/l	NVA mg/l	NSO mg/l	SEM mg/l
1A	54	1	-41	-58	18	-25	147	21	-17	41	2625	-17	-17	-17	-74	-1		0	-58		0	0		0	-17		0	-50	0	0	-67
1B	36	3	15		-27	82	126	-42	67	-52	5900	27	27	27	370	-90	200	0	0		0	0		0	0		0	0	0	0	-50
2	-4	-3	-26	-23	20	23	0	-87	-87	-16	158	278	278	278	197	400	-29	-93	32		0	0		0	0		0	0	0	-67	-67
3A	19	-2	-11		-12	-21	15	-21	1243	-9	900	-40	-40	-40	-29		50	0	0		0	0		0	-17		0	0	0	-50	
3B	-3	1	9		-23	-15	-23	65	828	-10	13	-38	-38	-38	120		-40	-96	0		0	-62		-76	-55		-91	0	0	-67	-67
4	5	-1	-5		-26	67	-33	-90	133	-12	5900	-4	-4	-4	630		-67	0	60		0	0		0	0		0	0	0	0	0
5	8	0	36		-10	-26			6900	88	3500	3	3	3	60		-60	0	-77		-29	0		0	-78		-67				0
6	-28	4	-34	-28	2	-22		-73	-45	350	-77	-77	-77	-77	-77			0	-94		0	0		0	0		-17				0
7	-36	3	-2		41	19	180	520	0	100	2675	-5	-5	-5	0		-20	780	0		0	0		0	-44		-38	0	0	0	0

Table 2 Comparison of 1997 and 1998 Water Quality Data from Springs/Outfalls around the Site

Potable Water Quality Standards

	EC mS/cm	pH	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Cl mg/l	NO_3 mg/l	Phos mg/l	SO_4 mg/l	Amm N mg/l	ALK mg/l	HCO_3 mg/l	COD mg/l	BOD mg/l	TOC mg/l	As mg/l	B mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Hg mg/l	Ni mg/l	Pb mg/l	Se mg/l	Zn mg/l	MLOB mg/l	MVA mg/l	NSO mg/l	TPH mg/l	DCM mg/l	TSE mg/l	DRO ug/l
MAC		<5.5->9.5	150	12	250	50	400	50	2.2	250	0.39								< 0.003			0.001											
TV																			4E - 04			5E - 06											
IV																						2E - 04											

Groundwater Quality - Springs, 1997 Data

Spring	EC mS/cm	pH	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Cl mg/l	NO_3 mg/l	Phos mg/l	SO_4 mg/l	Amm N mg/l	ALK mg/l	HCO_3 mg/l	[HCO_3] mg/l	COD mg/l	BOD mg/l	TOC mg/l	As mg/l	B mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Hg mg/l	Ni mg/l	Pb mg/l	Se mg/l	Zn mg/l	MLOB mg/l	MVA mg/l	NSO mg/l	TPH mg/l	DCM mg/l	TSE mg/l	DRO ug/l
A	Dry																																
B	0.885	7.52	18	< 3	173	276	25	27.5	0.02	44	0.49	300	300	366	< 10	< 0.5	2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.05	< 1	< 1	1	< 1	1	< 10
C2	0.898	7.72	24	< 3	208	285	36	119.1	0.07	35	0.95	233	233	284	< 10	< 0.5	3	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.05	< 1	< 1	1	< 1	1	24
D	0.918	7.79	18	10	208	3.99	34	9.72	< 0.01	69	0.95	100	100	366	< 10	< 0.5	3	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.05	< 1	< 1	< 1	0.53	< 1	17
E	Inside																																
G1	0.701	7.67	15	< 3	248	3.33	28	30.1	0.02	71	0.61	400	400	488	< 10	< 0.05	3	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.05	< 1	< 1	1	< 1	1	< 10
H	0.362	7.67	13	< 3	58	1.37	17	4.7	0.04	17	0.04	550	550	670	< 10	< 0.05	8	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.07	< 0.1	0.1	< 1	< 1	< 1	< 1	< 1	
J	0.854	7.76	20	< 3	184	2.88	64	3.6	0.07	27	0.05	260	260	317	< 10	< 0.05	3	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.05	< 1	< 1	< 1	< 1	0.53	< 1	31
M	0.667	7.58	18	< 3	177	2.05	35	31	0.01	47	0.09	250	250	305	< 10	< 0.05	3	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.05	< 1	< 1	< 1	< 1	0.46	< 1	< 10
N	Dry																																
P1	0.706	7.94	29	6	215	3.72	34	36	0.02	77	0.04	367	367	447	< 10	< 0.05	3	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.05	< 1	< 1	< 1	< 1	1	< 1	< 10
P2	0.748	7.92	12	< 3	248	3.18	18	17.7	< 0.01	68	0.18	420	420	548	< 10	< 0.05	1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.05	< 1	< 1	2	< 1	2	< 1	< 10

Groundwater Quality - Springs, 1998 Data

Spring	EC mS/cm	pH	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Cl mg/l	NO_3 mg/l	Phos mg/l	SO_4 mg/l	Amm N mg/l	ALK mg/l	HCO_3 mg/l	[HCO_3] mg/l	COD mg/l	BOD mg/l	TOC mg/l	As mg/l	B mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Hg ug/l	Ni mg/l	Pb mg/l	Se mg/l	Zn mg/l	MLOB mg/l	MVA mg/l	NSO mg/l	SEM mg/l
A	0.884	7.7	103	0.8	197	1.89	31	24.7	0.02	14	0.05	260	260	317	< 10	< 1	3	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	0.11	< 0.005	< 0.05	< 1	< 1	1	1
B	0.853	7.43	11	1.4	150	2.45	37	30.7	0.03	25	< 0.01	300	300	366	< 10	< 1	3	0.19	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.03	< 0.005	< 0.05	< 1	< 1	1	1
C2	Dry																														
D	0.921	7.34	18.5	18.6	210	3.41	45	78.4	0.02	45	0.2	300	300	366	< 10	< 1	4	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	< 0.05	< 1	< 1	< 1	1
E	0.63	7.12	15	1.8	187	2.78	37	59.5	0.02	47	0.1	310	310	378	< 10	< 1	3	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	< 0.05	< 1	< 1	< 1	1
G1	0.611	7.42	20	2.9	234	3.88	27	27.4	0.02	56	0.05	330	330	402	< 10	< 1	3	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	< 0.05	< 1	< 1	< 1	1
H	0.694	7.68	18.3	4.9	170	2.54	39	7.6	0.01	19	0.07	320	320	390	< 10	< 1	5	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.007	< 0.05	< 1	< 1	< 1	1
J	0.566	7.68	21.4	2	150	2.19	49	7.1	0.02	26	0.1	260	260	341	< 10	< 1	7	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	< 0.05	< 1	< 1	< 1	1
M	0.606	7.62	12.3	0.9	144	1.8	20	32.3	0.04	35	0.1	260	260	341	< 10	< 1	3	0.24	< 0.05	< 0.0004	0.12	< 0.05	< 0.05	< 0.05	0.18	< 0.005	0.06	< 1	< 1	< 1	1
N	0.809	7.63	13	0.9	215	2.78	34	52.3	0.08	32	0.52	350	350	427	71	< 1	6	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	0.14	< 1	< 1	< 1	2
P1	0.815	7.06	21.5	8.2	183	3.84	48	45.5	0.01	54	0.06	310	310	378	14	< 1	3	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	< 0.05	< 1	< 1	< 1	< 1
P2	0.793	7.37	14	1.5	207	3.28	19	23.8	0.02	50	0.12	350	350	427	< 10	< 1	2	< 0.05	< 0.05	< 0.0004	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.005	< 0.05	< 1	< 1	< 1	< 1

Notes: GL - EC Guide Level, MAC - EC Maximum Admissible Concentration TV - Dutch target value, IV - Dutch Intervention Value
EC - electrical conductivity, Amm-N - ammoniacal nitrogen, ALK - alkalinity, COD - chemical oxygen demand, BOD - biochemical oxygen demand, TOC - total organic carbon, M Oil - mineral oil/paraffin, MVA - total non-volatile aromatics,
NSO - NSO'ness, TPH - total petroleum hydrocarbons, DCM - DCM/silicH extract, TSE - total soluble extract, DRO - diesel range organics, Phos - phosphate (note MAC & GL expressed as P)
[HCO_3] - calculated by multiplying alkalinity by 1.219

Percentage change from 1997 to 1998

Spring	EC mS/cm	pH	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Cl mg/l	NO_3 mg/l	Phos mg/l	SO_4 mg/l	Amm N mg/l	ALK mg/l	HCO_3 mg/l	[HCO_3] mg/l	COD mg/l	BOD mg/l	TOC mg/l	As mg/l	B mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Hg mg/l	Ni mg/l	Pb mg/l	Se mg/l	Zn mg/l	MLOB mg/l	MVA mg/l	NSO mg/l	SEM mg/l
A																															
B	-5	-1	-31	-50	-10	9	48	19	50	-43	98	0	0	0	0		50	280	0		0	0		0	80		0	0	0	0	0
C2																															
D	0	-8	-3	6	-27	8	-17	18	150	-35	300	0	0	0	0		33	0	0		0	0		0	0		0	0	0	0	88
E																															
G1	2	-5	33	-13	-6	17	-4	-19	0	21	92	-18	-18	-18	0		56	0	0		0	0		0	0		0	0	0	0	0
H	64	5	48	63	122	115	124	57	75	12	75	-42	-42	-42	0		-17	0	0		0	0		0	29		-50	0	0	0	0
J	-14	-1	7	-33	-16	-8	29	-87	986	4	100	8	8	8	0		133	0	0		0	0		0	0		0	0	0	0	253
M	-9	6	23	-78	-18	-12	-26	4	5000	-23	11	12	12	12	0		0	380	0		280	0		0	260		20	0	0	0	117
N																															
P1	2	-11	-2	23	-10	3	35	28	-50	-25	0	-16	-16	-16	40		0	0	0		0	0		0	0		0	0	0	0	0
P2	-1	1	17	-50	-15	2	0	34	100	-28	33	-19	19	-19	0		100	0	0		0	0		0	0		0	0	0	-50	-50

Results *continued*

Table 3. Diesel Range Hydrocarbons (ug/l) identified in 1997 and 1998

Location	Apr-97	May-98	Comments
BH1A	<10	37	
BH1B	<10	36	
BH1B(bailed)	<10	-	additional bailed samples not taken in 1998
BH2	77	33	
BH3A	<10	204	
BH3B	<10	217	
BH4	<10	501	
BH4(bailed)	<10	-	additional bailed samples not taken in 1998
BH5	10	14	
BH5(bailed)	<10	-	additional bailed samples not taken in 1998
BH6	17	45	
BH7	<10	22	
Spring A	-	27	
Spring B	<10	28	
Spring C (C2)	24	-	spring dry in 1998
Spring D	17	38	
Spring F	-	42	spring only a trickle in 1997
Spring G (G1)	<10	29	
Spring I	-	783	Weathered diesel, spring dry in 1987
Spring L	31	33	
Spring M	<10	26	
Spring N	-	2489	Diesel, spring dry in 1997
Spring P (P1)	<10	40	
Spring R (R2)	<10	44	

3.6 Comparison of the major ion concentrations with potable water quality standards (where present - Table 1) indicates the following:

sodium - all results less than the MAC;

potassium - all results less than the MAC;

calcium - all results less than the MAC;

magnesium - all results less than the MAC;

chloride - all results less than the MAC;

nitrate - concentration of 54 mg/l at borehole 1B slightly greater than the MAC of 50 mg/l. All other locations less than the MAC;

phosphate - all results less than the MAC;

Results *continued* 3

sulphate - all results less than the MAC, except borehole 2 which at 271 mg/l exceeded the MAC of 250 mg/l; and,

ammoniacal nitrogen - the MAC of 0.39 mg/l was exceeded at 5 locations (boreholes 1A, 1B, 2, 4 and 7).

3.7 The detection limits for heavy metals were reduced for the 1998 analysis to allow comparison of the results with potable water quality standards (Reference 2). In all instances except four, the results demonstrate heavy metal concentrations at or less than the limit of detection (i.e. less than the potable water quality standards). The four exceptions are:

- selenium in water from borehole 5 which is present at a concentration of 0.016 mg/l, just greater than the 0.01 mg/l maximum admissible concentration (MAC) in groundwater (Reference 2); and
- arsenic, which was present in the water from borehole 7 at a concentration of 0.44 mg/l (MAC of 0.05 mg/l). The elevated arsenic concentrations of 0.7 and 2.3 mg/l measured in 1997 at boreholes 2 and 3B (respectively) was not repeated.

3.8 The slightly elevated concentrations of copper, mercury, nickel, lead and zinc detected in the 1997 water samples were not detected in 1998.

Organic Determinands

3.9 The screening tests for organic contamination including mineral oil, non-volatile aromatics, NSO and solvent extractable material were all at or less than the limit of detection of 1 mg/l and were in all instances the same or less than the 1997 results.

3.10 Other screening tests undertaken include those to determine chemical oxygen demand (COD), biochemical oxygen demand (BOD) and total organic carbon (TOC). Both BOD and TOC were low in all instances although BOD in water from borehole 2 and TOC in water from borehole 1B had increased. COD has increased at a number of locations, although at borehole 1A which had the highest COD in 1997 the concentration has significantly reduced.

3.11 Detailed organic analyses undertaken are outlined in Chapter 2 with results presented in Appendix 6b, c and d. The analyses for gasoline range organics, BTEX compounds, phenols and volatile organic compounds did not identify any of these compounds at concentrations greater than the limit of detection or greater than the UK drinking water standards (where determinands are specified). No gasoline range organics were identified in 1997 whilst the BTEX, phenols and volatiles analyses were not undertaken in 1997.

Results *continued*

3.12 The analyses undertaken for diesel range organics indicated that these are present at all locations, albeit generally at relatively low concentrations. The highest concentration detected was 0.5 mg/l at borehole 4. The only location where diesel range organics were detected in 1997 at a concentration significantly greater than the limit of detection was borehole 2. In 1998 the concentration at this location had declined. These results are discussed further below.

Results of Chemical Analysis of Spring Water

Major Ions/Heavy Metals

3.13 The spring water quality measured in 1998 varies very little from that measured in 1997. The water is of neutral pH with a slightly elevated EC. The piper plot for 1998 (Figure 3) is very similar to that for 1997 albeit with a reduced spread in the points plotted.

3.14 The only determinand which has changed significantly at a number of locations is phosphate which has increased at five locations, although only substantially at two. Other determinands have increased such as calcium, magnesium and chloride at Spring I and ammoniacal nitrogen at Springs D and L.

3.15 Comparison of the major ion concentrations with potable water quality standards (where present - Table 2) indicates the following:

sodium	-	all results less than the MAC;
potassium	-	all results less than the MAC;
calcium	-	all results less than the MAC;
magnesium	-	all results less than the MAC;
chloride	-	all results less than the MAC;
nitrate	-	the MAC for nitrate of 50 mg/l is exceeded at three locations - spring D (79 mg/l), spring F (61 mg/l) and spring N (52 mg/l);
phosphate	-	all results less than the MAC;
sulphate	-	all results less than the MAC; and
ammoniacal nitrogen	-	the MAC of 0.39 mg/l is only exceeded at spring N (0.6 mg/l).

3.16 As with the borehole water the spring samples were analysed to lower limits of detection for heavy metals in 1998 compared with 1997. In 1997, excepting lead and zinc at Spring I, no heavy metals were detected at concentrations greater than the limit of detection. However, in 1998 this was not the case with a number of heavy metals present at slightly elevated concentrations as follows:

Results *continued*

- arsenic at 0.19 and 0.24 mg/l at springs B and M respectively. The MAC for potable water is 0.05 mg/l;
- chromium at 0.19 mg/l at spring M (MAC = 0.05 mg/l);
- lead at 0.11, 0.09 and 0.18 mg/l at springs A, B and M respectively (MAC = 0.05 mg/l); and
- selenium at 0.007 mg/l at spring I (MAC = 0.01 mg/l).

The majority of the cases where water quality standards for heavy metals were exceeded were at spring M.

Organic Analysis

3.17 The indicator analyses undertaken include those for mineral oil, non-volatile aromatics, NSO, solvent extractable matter, COD, BOD and TOC. All, except TOC and COD at spring N were at or very close to the limit of detection. The COD at spring N was slightly elevated, but none of the TOC concentrations were elevated, although those at springs L and R2 had increased significantly since 1997 (TOC has also increased slightly at three other locations).

3.18 The specific organic analyses for petrol range organics, BTEX and phenols, as with the borehole samples, all indicate concentrations less than the limit of detection and also less than the MAC for potable water (where specified). The diesel range organics analysis indicates these compounds to be present at all locations, albeit at low concentrations, except at springs I and N where weathered diesel and diesel respectively were identified. These are discussed further below.

Discussion

3.19 The results of the 1998 sampling exercise indicate that the groundwater beneath and around the site is generally of good quality with little change from 1997 to 1998. The main exceptions are the increase in ammoniacal nitrogen in the boreholes and phosphate at several boreholes and springs. In addition to these, diesel range organics were identified at all locations.

3.20 The increase in ammoniacal nitrogen and phosphate suggests fertiliser as a source. Its increase on site but not in the springs suggests that it is being applied by at least one of the farmers utilising the airfield for grazing. The North Oxfordshire Consortium contacted the farmers, at least two of whom are using nitrogen, phosphorous, potassium (NPK) fertilisers. The farmers also confirmed that although the application of these involves "relatively" small amounts of fertiliser, they were applied prior to a particularly wet period. The result of this is that much of the nitrogen and to a lesser extent the phosphorous moved into solution and entered the groundwater. Of interest is the fact that the lowest

increase in ammoniacal nitrogen was at borehole 3B which is separated from 3A by a thin mudstone band. However, at boreholes 1A and 1B the lower completion, which is separated by much thicker bands of mudstone than at 3A/3B, both exhibited large increases in ammoniacal nitrogen concentration. This indicates that not all of the mudstone bands beneath the site act as low permeability barriers.

3.21 Although the diesel range organics analysis has indicated that compounds are present with carbon chains which are also found in diesel the results only indicate that diesel fuel oil (*sensu stricto*) is present at two locations - spring I (as weathered diesel - possibly from POL21, which is known to be contaminated with fuels) and spring N. At other locations the compounds present and their source materials could not be identified, but could include substances such as "naturally" occurring hydrocarbons, detergents, surfactants and plasticisers. Values less than 50 µg/l should be treated essentially as "background". Locations where this background concentration have been exceeded are springs I and N (see above) and boreholes 3A, 3B and 4 (see below).

3.22 The UK drinking water standards do not cite a MAC for diesel range organics. However, the EC directive relating to potable water (Reference 3) cites the guide level for substances extractable in chloroform (similar to the extraction used by Geochem Laboratory for diesel range organics) as 100 µg/l. All analyses were less than this except boreholes 3A, 3B, 4, spring I & spring N, the latter two of which were the locations where diesel was positively identified. Although not strictly comparable to diesel range organics, the Dutch intervention Value for Mineral Oil is 600 µg/l. The diesel range organics detected in boreholes 3A, 3B and 4 are all less than this value. Thus, although the results may indicate some hydrocarbon contamination the concentrations are not thought to be significant.

3.23 The 1997 results for diesel range organics were greater than the limit of detection at only five locations compared to all locations in 1998. No compounds could be positively identified at any of the five locations in 1997. The laboratory confirmed that this could be due to the volume of sample analysed and may have been prompted by our more detailed requests for the 1998 analyses.

3.24 The diesel which has been positively identified cannot be unequivocally attributed to Upper Heyford, especially that from spring N. This spring is dry for part of the year and when flowing rises at an elevation greater than the water level in the nearest on site borehole (borehole 2). Furthermore, given that all fuel storage on the northern side of the airfield ceased at least four years ago any diesel resurging at spring N would be more likely to be weathered rather than the unweathered diesel detected. It is therefore postulated that the diesel is from a local, more recent source.

3.25 The elevated heavy metals detected at some of the springs may be due to "local" sources outwith RAF Upper Heyford, or they may be due to contaminants moving

through the aquifer. With further monitoring it will be possible to better determine the source of these variations.

3.26 It is not possible to determine any trends with only two years of monitoring data. Only by undertaking long term monitoring would such trends be identifiable. Of particular concern are diesel range organics, heavy metals, phosphate and ammoniacal nitrogen. Given than the site is no longer an operational airbase and that MOD POL storage and transfer facilities have been drained of fuel then decreasing trends in diesel range organics and heavy metals would be expected, assuming of course, that any existing contamination is not disturbed.

Conclusions and Recommendations

3.27 In conclusion the monitoring data confirm that the groundwater beneath the site:

- is not contaminated with hydrocarbon based fuels, although hydrocarbon containing compounds are present at low concentrations;
- with a very limited number of exceptions, is not contaminated with heavy metals;
- is not contaminated with gasoline range organics, phenols or volatile organic compounds; and
- is sensitive to land use, such as agriculture, which involves the direct addition of soluble substances to the land surface.

3.28 Excepting fertiliser derived compounds, the very limited exceedence of potable water quality standards of a small number of determinands does not require any groundwater remediation. Furthermore, it confirms that there are no water quality issues which should limit the redevelopment of the site for housing. However, it is recommended that the groundwater be regularly monitored during any demolition or redevelopment of the site to determine if this remains the case.

References

4

1. Aspinwall & Company Ltd, June 1997, RAF Upper Heyford Land Quality Assessment - Factual Report, Interpretive Report and Appendices, Report Reference MD3333A.

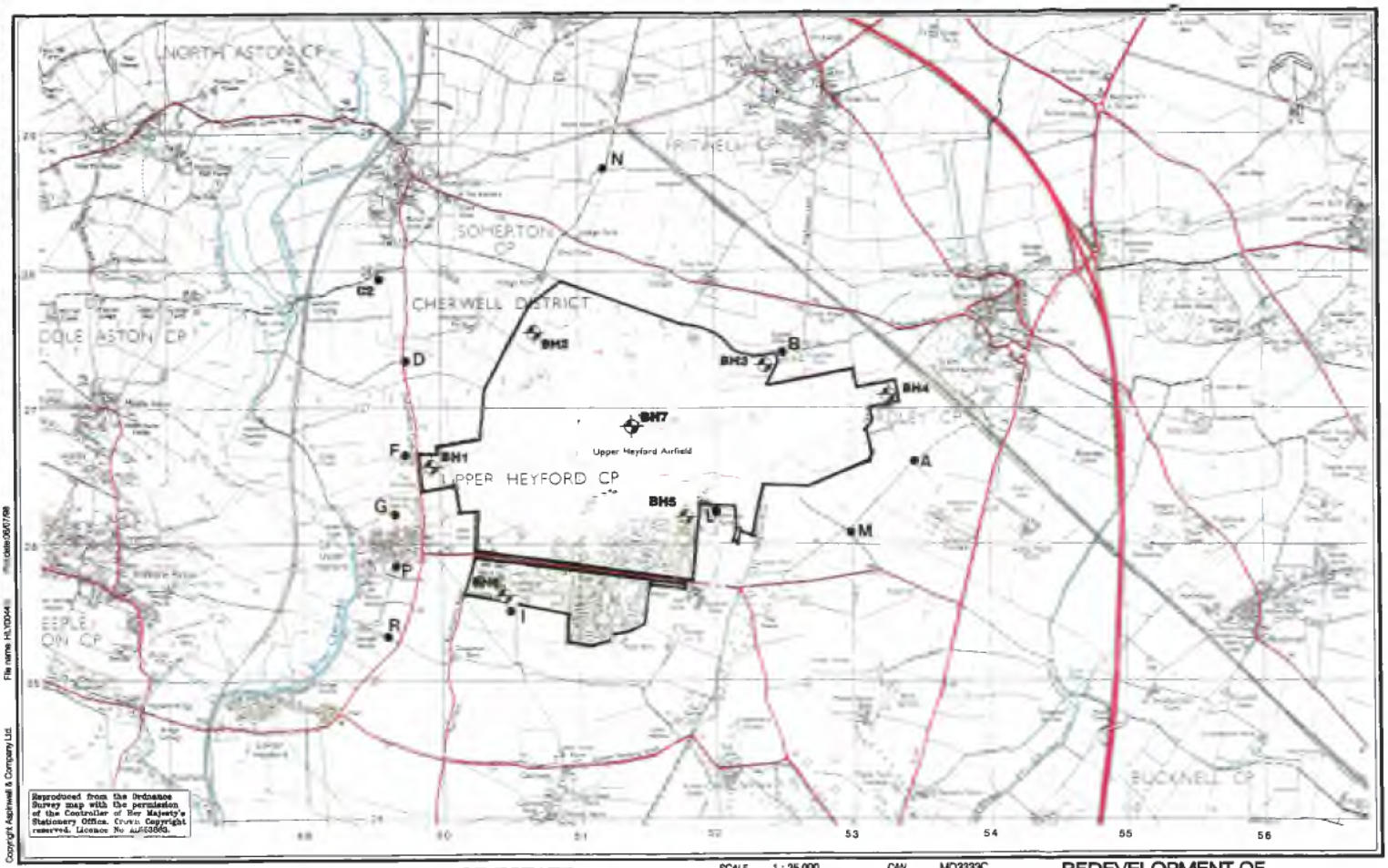
2. DoE/Welsh Office, 1989, The Water Supply (Water Quality) Regulations 1989, Statutory Instruments No. 1147, Water, England and Wales.

3. Department of the Environment/Welsh Office, 1982, EC Directive Relating To The Quality of Water Intended For Human Consumption, Ref. 80/778/EEC.

Figures

Figure 1

Groundwater and Surface Water Sampling Locations



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KEY

Borehole locations

Surface water sampling locations

NOTES

G is downstream of springs G1, G2, & G3

T is downstream of springs / outfalls K & L

P is downstream of springs P1 & P2

A, F & N will only be sampled if flowing (dry during April 1997)

Boreholes as referred to in the investigation completed for DEO

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SCALE 1 : 25,000

CONTENT [redacted]

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CAN MO2333C

DRAWN HLY

DATE JULY 1998

REDEVELOPMENT OF UPPER HEYFORD

FIGURE 1

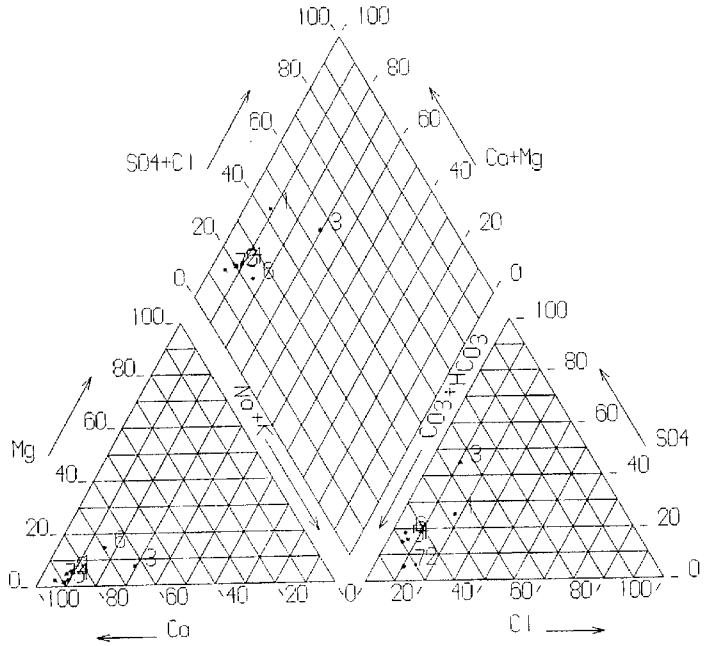
GROUNDWATER AND SURFACE WATER SAMPLING LOCATIONS

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Figure 2

Groundwater Quality - Boreholes

#	Date YYMMDD	Zone	Well I.D.
1	980512	1,3,5	BH1A
2	980512	1,3,5	BH1B
3	980512	1,4,9	BH2
4	980512	1,3,5	BH3A
5	980512	1,3,5	BH3B
6	980512	1,3,5	BH4
7	980512	1,3,5	BH7



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Plot date:06/07/98

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CONTENT DRAWN HLY

CHECKED DATE JULY 1998

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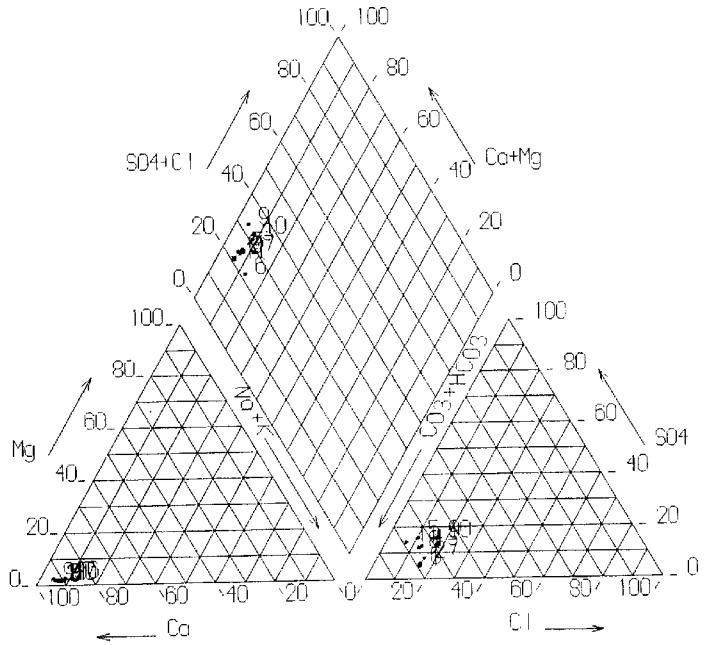
REDEVELOPMENT OF UPPER HEYFORD

FIGURE 2
GROUNDWATER QUALITY - BOREHOLES

Figure 3

Groundwater Quality - Springs

#	Date YYMMDD	Zone	Well I.D.
1	980512	1,3,5	SPRING A
2	980512	1,3,5	SPRING B
3	980512	1,3,5	SPRING D
4	980512	1,3,5	SPRING F
5	980512	1,3,5	SPRING G1
6	980512	1,3,5	SPRING I
7	980512	1,3,5	SPRING L
8	980512	1,3,5	SPRING M
9	980512	1,3,5	SPRING N
10	980512	1,3,5	SPRING P1
11	980512	1,3,5	SPRING R2



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KEY:

SCALE

CONTENT

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REDEVELOPMENT OF UPPER HEYFORD

FIGURE 3
GROUNDWATER QUALITY - SPRINGS

Appendices

Appendix 1

Consultants Directive

Ministry of Defence
DEFENCE ESTATE ORGANISATION
St George's House, Blakemore Drive, Sutton Coldfield, West Midlands, B75 7RL
Telephone: Direct Dialling
ATN Sutton Coldfield
GTN
Switchboard
Fax
[redacted]

Aspinwall & Co. Ltd
Walford Manor
Baschurch
Shrewsbury
Shropshire SY4 2HH

Your Reference: MD3333C

Our Reference: D/DEO/27/104/4/07686

Date: 8 May 1998

fac[redacted]

De[redacted]

RAF UPPER HEYFORD: Groundwater Quality Monitoring

References

A. Phase Two LQA report, MD3333B, dated June 1997
B. Minutes of Meeting at Upper Heyford, G381, dated 26 February 1998
C. Letter, A&Co to EA, TA2501A, dated 27 February 1998
D. Letter, EA to A&Co, SD/G/CL/OX, dated 17 April 1998
E. Letter, A&Co to EA, TA2502A, dated 27 April 1998
F. Letter, MD3333C/SLH, dated 28 April 1998
G. C2 Order No. 114, dated 8 May 1998

1. Sampling and analysis of groundwater at RAF Upper Heyford was recommended by the Phase Two LQA (ref. A) and requested by the Environment Agency (EA) at a meeting held on 26 February 1998 (ref. B). With reference to your letter (ref. F) and your Term Commission WS13/1982/2, enclosed is a C2 Order (ref. G) for sampling and analysis of groundwater from boreholes and springs on and around RAF Upper Heyford. Please sign and return the original C2 Order to me indicating your acceptance of this task. Please notify me of the start date for sampling and of progress to issue of the draft report.

2. The scope of work is as presented in the Interpretive Report (ref. A) with additions and clarifications by the EA and Aspinwall & Co (refs B, C, D and E). The resulting scope for this single round groundwater sampling exercise is set out below. This Order is placed on the basis of the following scope of works and is intended to augment the information provided in the LQA. The following scope of works represents an accumulation of intentions expressed by Aspinwall & Co and the EA in documents referred to above. The scope of works is accepted as suitable based on advice given to DEO by those parties. Any subsequent works to assess or monitor the land quality of the site will be the responsibility of the joint venture consortium for development of this site.

3. The groundwater quality monitoring exercise will comprise collection of one sample of groundwater from each nominated spring and borehole on and around the site. Each borehole will be purged sufficiently to ensure that the sample collected is representative of formation water. The assessment of adequate purging should be determined preferably by measurement of appropriate properties or alternatively by the calculated borehole volume method. Measures must be taken to ensure that there is no cross-contamination between samples. Samples for VOC analysis are to collected and transferred to the laboratory in a manner which minimises loss of volatiles. All samples must be collected and stored in an appropriate manner which minimises sample degradation. The details of sample collection must be recorded and presented with the other data from this exercise. A water level must be recorded for each borehole in a manner which allows calculation of depth below ground level and elevation above

Ordnance Datum. All sample locations are shown on Figure 4 of the Phase Two LQA Factual Report; an annotated copy of this map is enclosed.

4. Locations to be sampled are as follows:

   - Boreholes: 1A, 1B, 2, 3A, 3B, 4, 5, 6 and 7.
   - Springs: B, C2, D, G1, P1, R2, I, L, M and (if flowing) A, F and N.

5. The analytical suite for each sample is to be as follows with detection limits :

   - Major Ions: Ca, Mg, K, Na, HCO_3, SO_4, NO_3, Cl and Ammoniacal Nitrogen.
   - Metals: As, Cd, Cr, Pb, Hg, Cu, Ni, Zn (limit of detection appropriate to drinking water MACs)
   - Others: pH (*in situ* and lab), Electrical Conductivity (*in situ* and lab), Solvent Extractable Matter (SEM), Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Total Organic Carbon (TOC), Total Petroleum Hydrocarbons (diesel and petrol range), Total Alkalinity and phosphate.
   - Additional EA requested determinands: phenol (all samples) and Volatile Organic Compounds by GCMS (VOCs) (borehole samples only). The VOC suite as agreed with the Environment Agency (Ref. D) is to be as follows:

Benzene	Dichloromethane (DCM)
Toluene	Trichloroethene (TCE)
Ethylbenzene	Tetrachloroethene (TeCE)
Xylene	1,1,1-trichloroethane (TCA)
Carbon Tetrachloride	Vinyl Chloride

6. Analytical data and interpretation will be presented in a single volume report which will be issued initially in draft form. The final report will be issued after receipt of comments. The report will include tabulation of analytical data in a manner which allows comparison with previous data. As for the LQA report, 4 copies of the draft report and 8 copies of the Final report will be required. Following issue of the report, a meeting will be held with the Environment Agency to discuss the conclusions of this monitoring exercise. That meeting is not included in this commission and will be funded from the development budget through NOC.

7. Please contact me if I can be of further assistance.

Yours sincerely,

[redacted]

Environmental Engineer
SC 4e, DEO HQ
SB19 2453SB

cc. DEO[redacted]
RAFIO, Infra Pol 3b

encl.. Figure 4 Site Plan with annotations

Appendix 2

Water Level Measurements

Water Levels at Upper Heyford

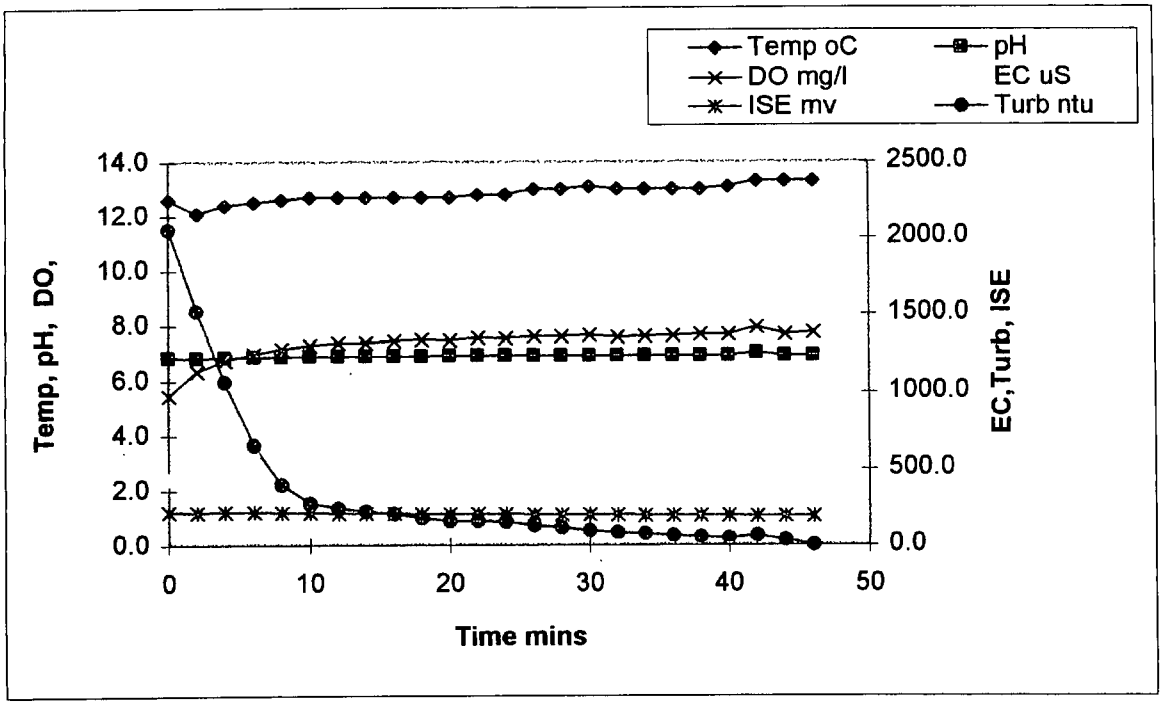
Location	Ground Elevation m AOD	Water level 09-May-97 m AOD	Water level 11-May-98 m AOD
1A	116.42	81.4	81.46
1B	116.42	103.57	105.51
2	137.98	113.67	116.7
3A	121.71	120.04	120.12
3B	121.71	120.03	120.09
4	121.88	109.72	111.63
5	120.2	118.92	118.97
6	121.56	112.88	116.86
7	131.01	129.07	128.38

Appendix 3

Details of Purging

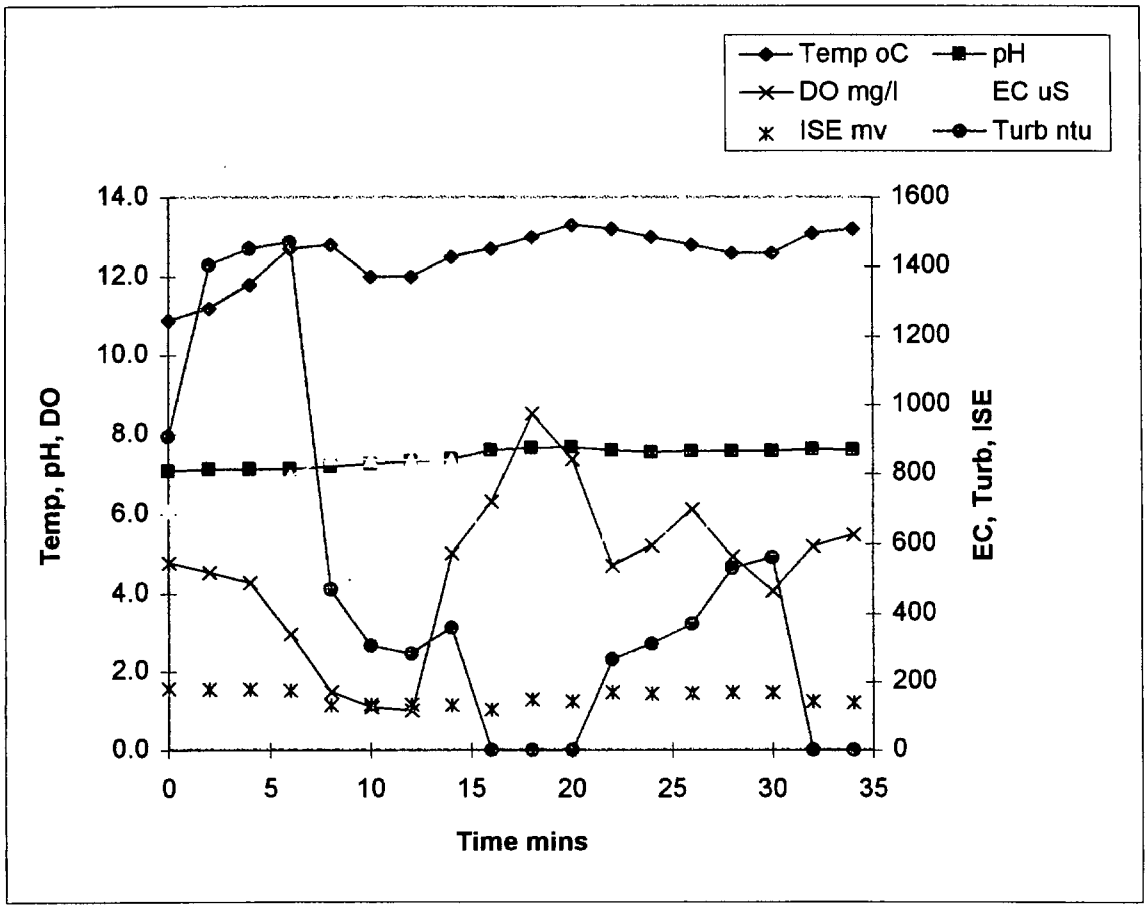
Borehole 1B

Time		Pt100 øC Temp oC	pH/mV pH pH	conduct uS EC uS	DO Salin mg/l DO mg/l	ISE mid mV ISE mv	turbid NTU Turb ntu
13/05/98 11:12	0	12.6	6.85	432.3	5.48	214.7	2050
13/05/98 11:14	2	12.1	6.83	563.2	6.36	214.2	1518
13/05/98 11:16	4	12.4	6.86	594.3	6.76	214.6	1063
13/05/98 11:18	6	12.5	6.87	620.0	7.00	214.6	652
13/05/98 11:20	8	12.6	6.88	627.2	7.18	213.0	397
13/05/98 11:22	10	12.7	6.89	631.8	7.30	211.6	276
13/05/98 11:24	12	12.7	6.89	636.6	7.39	210.0	243
13/05/98 11:26	14	12.7	6.90	637.1	7.38	208.5	221
13/05/98 11:28	16	12.7	6.90	639.3	7.45	207.1	205
13/05/98 11:30	18	12.7	6.90	640.5	7.51	205.9	178
13/05/98 11:32	20	12.7	6.91	639.9	7.48	204.7	159
13/05/98 11:34	22	12.8	6.91	640.4	7.56	203.2	157
13/05/98 11:36	24	12.8	6.91	640.2	7.54	201.8	152
13/05/98 11:38	26	13.0	6.91	640.7	7.62	200.2	129
13/05/98 11:40	28	13.0	6.92	642.4	7.61	199.6	115
13/05/98 11:42	30	13.1	6.92	644.2	7.66	199.1	95
13/05/98 11:44	32	13.0	6.92	643.0	7.60	198.3	84
13/05/98 11:46	34	13.0	6.92	643.8	7.61	197.5	75
13/05/98 11:48	36	13.0	6.92	642.4	7.64	196.7	61
13/05/98 11:50	38	13.0	6.92	643.6	7.68	195.7	56
13/05/98 11:52	40	13.1	6.92	643.4	7.68	194.7	44
13/05/98 11:54	42	13.3	7.02	635.2	7.94	193.0	62
13/05/98 11:56	44	13.3	6.93	642.5	7.69	192.4	32
13/05/98 11:58	46	13.3	6.93	644.4	7.76	192.0	0



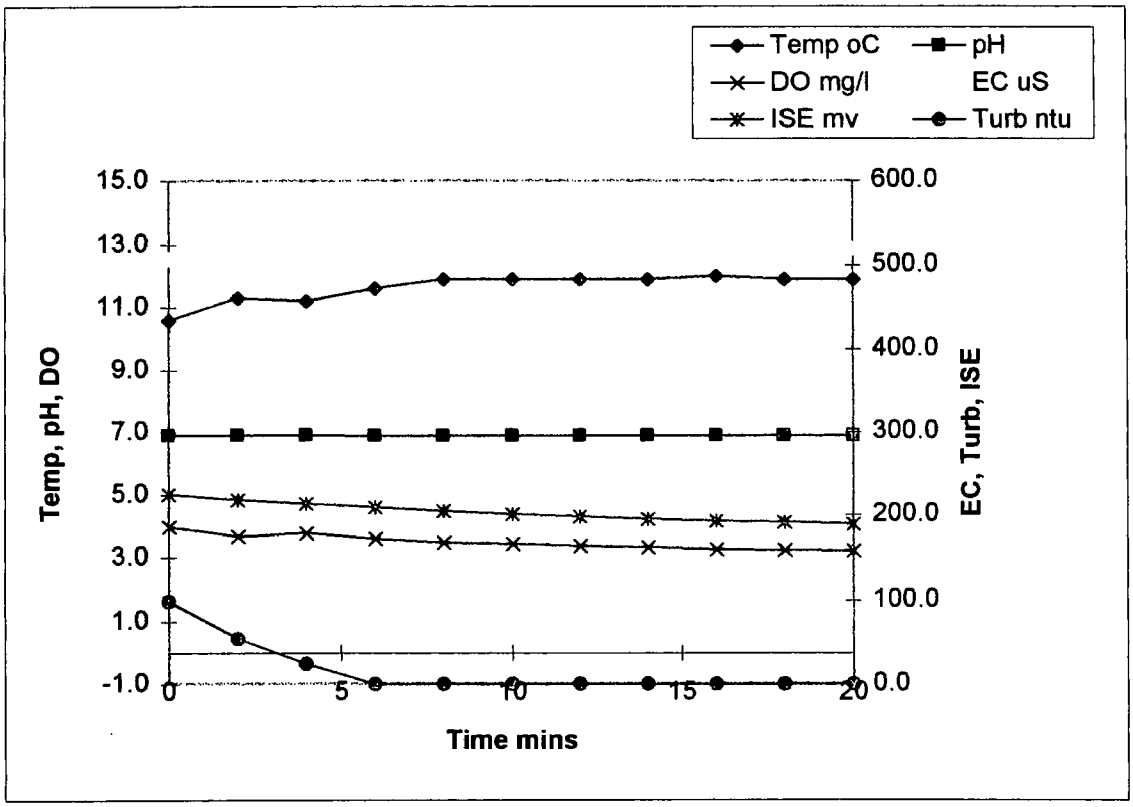
Borehole 2

Time		Pt100 øC Temp oC	pH/mV pH pH	conduct uS EC uS	DO Salin mg/l DO mg/l	ISE mid mV ISE mv	turbid NTU Turb ntu
13/05/98 08:44	0	10.9	7.07	694.4	4.79	180.6	908
13/05/98 08:46	2	11.2	7.11	716.6	4.54	179.8	1405
13/05/98 08:48	4	11.8	7.12	742.9	4.29	179.8	1452
13/05/98 08:50	6	12.7	7.11	792.4	2.98	175.9	1471
13/05/98 08:52	8	12.8	7.17	845.5	1.51	133.4	469
13/05/98 08:54	10	12.0	7.25	838.6	1.12	134.9	305
13/05/98 08:56	12	12.0	7.31	838.1	1.03	135.3	281
13/05/98 08:58	14	12.5	7.36	839.4	5.02	133.6	359
13/05/98 09:00	16	12.7	7.58	547.1	6.32	119.4	0
13/05/98 09:02	18	13.0	7.65	423.9	8.53	149.1	0
13/05/98 09:04	20	13.3	7.66	384.7	7.37	144.5	0
13/05/98 09:06	22	13.2	7.58	685.7	4.70	170.0	265
13/05/98 09:08	24	13.0	7.54	648.2	5.22	167.1	311
13/05/98 09:10	26	12.8	7.57	609.3	6.12	168.1	370
13/05/98 09:12	28	12.6	7.56	714.7	4.95	170.2	530
13/05/98 09:14	30	12.6	7.56	761.6	4.07	169.8	562
13/05/98 09:16	32	13.1	7.62	714.6	5.20	143.8	0
13/05/98 09:18	34	13.2	7.60	702.8	5.50	140.0	0



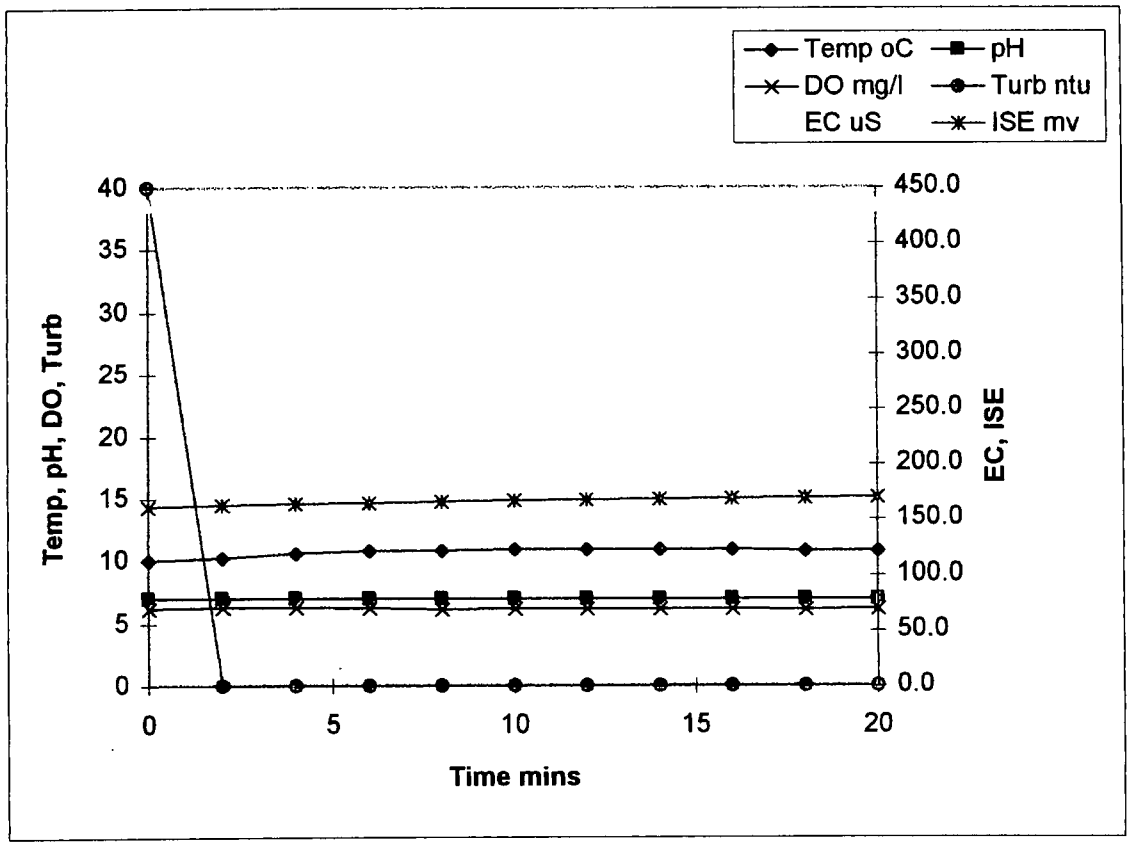
Borehole 3A

Time		Pt100 øC Temp oC	pH/mV pH pH	conduct uS EC uS	DO Salin mg/l DO mg/l	ISE mid mV ISE mv	turbid NTU Turb ntu
11/05/98 11:51	0	10.6	6.89	507.8	3.97	225.1	98
11/05/98 11:53	2	11.3	6.89	510.0	3.66	218.7	54
11/05/98 11:55	4	11.2	6.89	509.2	3.78	213.8	24
11/05/98 11:57	6	11.6	6.88	525.7	3.58	209.5	0
11/05/98 11:59	8	11.9	6.88	525.6	3.47	204.9	0
11/05/98 12:01	10	11.9	6.88	525.6	3.42	201.2	0
11/05/98 12:03	12	11.9	6.88	524.9	3.36	198.1	0
11/05/98 12:05	14	11.9	6.88	522.8	3.33	195.3	0
11/05/98 12:07	16	12.0	6.88	523.8	3.26	192.8	0
11/05/98 12:09	18	11.9	6.88	522.1	3.24	190.8	0
11/05/98 12:11	20	11.9	6.88	520.2	3.22	189.1	0



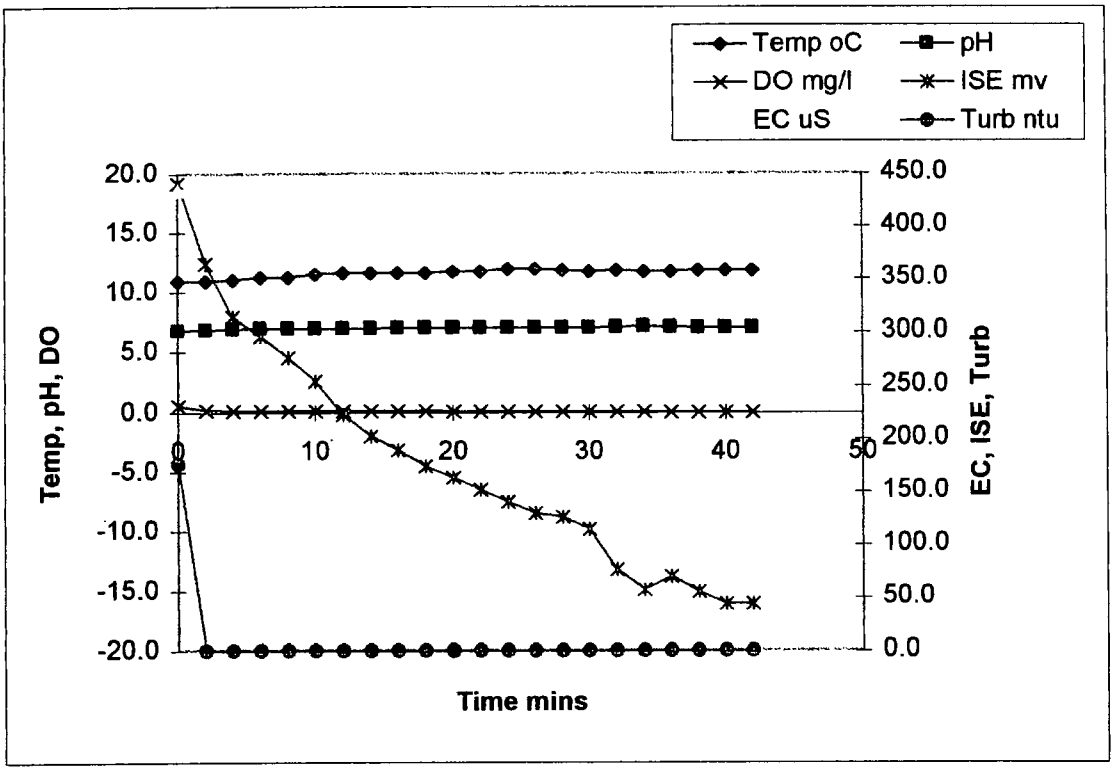
Borehole 3B

Time		Pt100 øC Temp oC	pH/mV pH pH	conduct uS EC uS	DO Salin mg/l DO mg/l	ISE mid mV ISE mv	turbid NTU Turb ntu
11/05/98 11:13	0	10	6.98	434.2	6.23	161.2	40
11/05/98 11:15	2	10.2	6.99	433.0	6.30	163.0	0
11/05/98 11:17	4	10.6	6.99	431.8	6.31	164.0	0
11/05/98 11:19	6	10.8	6.99	432.9	6.25	164.7	0
11/05/98 11:21	8	10.8	6.99	432.9	6.18	165.7	0
11/05/98 11:23	10	10.9	6.99	434.2	6.23	166.7	0
11/05/98 11:25	12	10.9	6.99	433.5	6.19	167.5	0
11/05/98 11:27	14	10.9	6.99	433.5	6.23	168.1	0
11/05/98 11:29	16	10.9	6.99	432.9	6.23	168.9	0
11/05/98 11:31	18	10.8	6.99	434.2	6.18	169.5	0
11/05/98 11:33	20	10.8	6.99	433.6	6.22	170.0	0



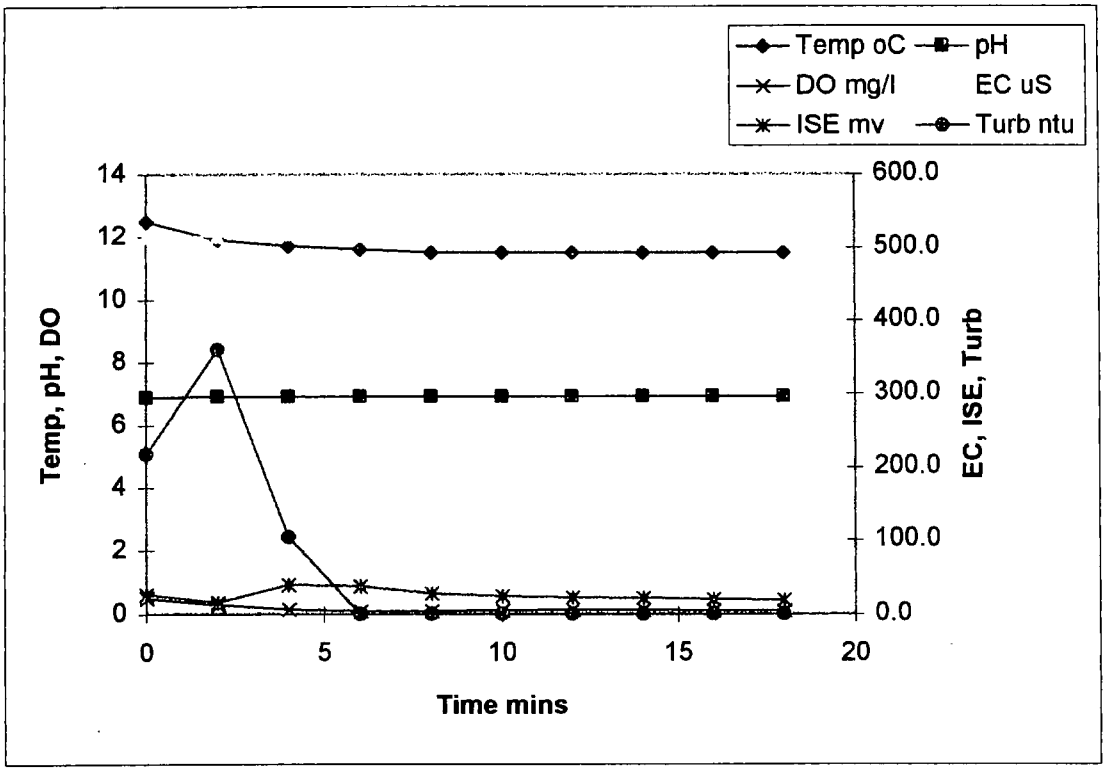
Borehole 4

Time		Pt100 øC Temp oC	pH/mV pH pH	conduct uS EC uS	DO Salin mg/l DO mg/l	ISE mid mV ISE mv	turbid NTU Turb ntu
11/05/98 09:35	0	10.9	6.77	434.2	0.57	19.2	176
11/05/98 09:37	2	10.9	6.85	437.7	0.18	12.4	0
11/05/98 09:39	4	11.0	6.88	438.9	0.12	7.9	0
11/05/98 09:41	6	11.2	6.92	439.3	0.16	6.3	0
11/05/98 09:43	8	11.2	6.93	439.2	0.13	4.5	0
11/05/98 09:45	10	11.5	6.95	441.4	0.13	2.6	0
11/05/98 09:47	12	11.6	6.95	441.5	0.12	-0.2	0
11/05/98 09:49	14	11.6	6.96	443.2	0.12	-2.0	0
11/05/98 09:51	16	11.6	6.97	442.7	0.11	-3.2	0
11/05/98 09:53	18	11.6	6.98	443.1	0.11	-4.5	0
11/05/98 09:55	20	11.7	6.98	443.0	0.10	-5.5	0
11/05/98 09:57	22	11.7	6.99	443.5	0.10	-6.5	0
11/05/98 09:59	24	11.9	6.99	443.9	0.09	-7.5	0
11/05/98 10:01	26	11.9	6.99	443.4	0.09	-8.5	0
11/05/98 10:03	28	11.8	7.00	443.5	0.08	-8.8	0
11/05/98 10:05	30	11.7	7.00	444.2	0.06	-9.8	0
11/05/98 10:07	32	11.8	7.02	433.0	0.06	-13.2	0
11/05/98 10:09	34	11.7	7.11	436.0	0.06	-14.9	0
11/05/98 10:11	36	11.7	7.02	443.0	0.03	-13.8	0
11/05/98 10:13	38	11.8	7.01	444.7	0.03	-15.1	0
11/05/98 10:15	40	11.8	7.01	445.2	0.03	-16.1	0
11/05/98 10:17	42	11.8	7.01	443.9	0.03	-16.1	0



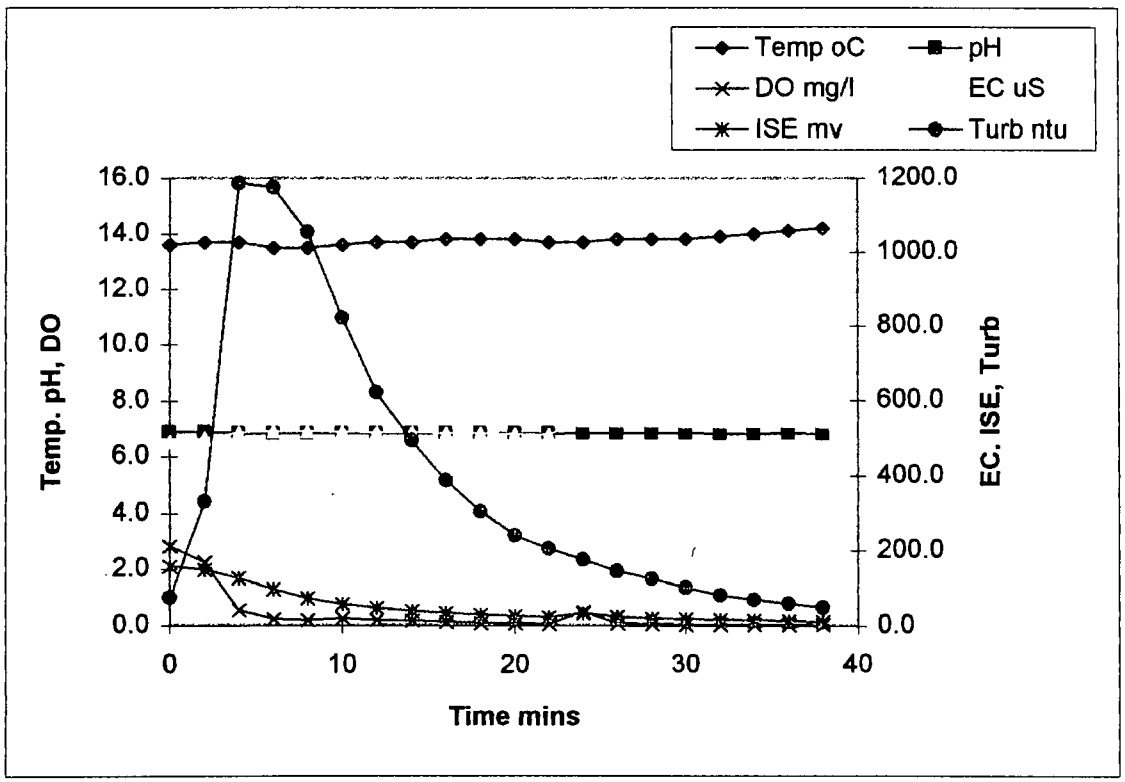
Borehole 5

Time		Pt100 øC Temp oC	pH/mV pH pH	conduct uS EC uS	DO Salin mg/l DO mg/l	ISE mid mV ISE mv	turbid NTU Turb ntu
11/05/98 13:19	0	12.5	6.88	514.8	0.50	26.1	217
11/05/98 13:21	2	11.9	6.89	515.1	0.30	15.7	360
11/05/98 13:23	4	11.7	6.90	517.6	0.16	39.2	104
11/05/98 13:25	6	11.6	6.89	516.2	0.11	37.3	0
11/05/98 13:27	8	11.5	6.89	517.0	0.10	27.7	0
11/05/98 13:29	10	11.5	6.89	516.4	0.12	24.3	0
11/05/98 13:31	12	11.5	6.89	517.0	0.14	22.6	0
11/05/98 13:33	14	11.5	6.89	516.4	0.15	21.6	0
11/05/98 13:35	16	11.5	6.89	516.4	0.13	20.4	0
11/05/98 13:37	18	11.5	6.89	517.0	0.12	19.0	0



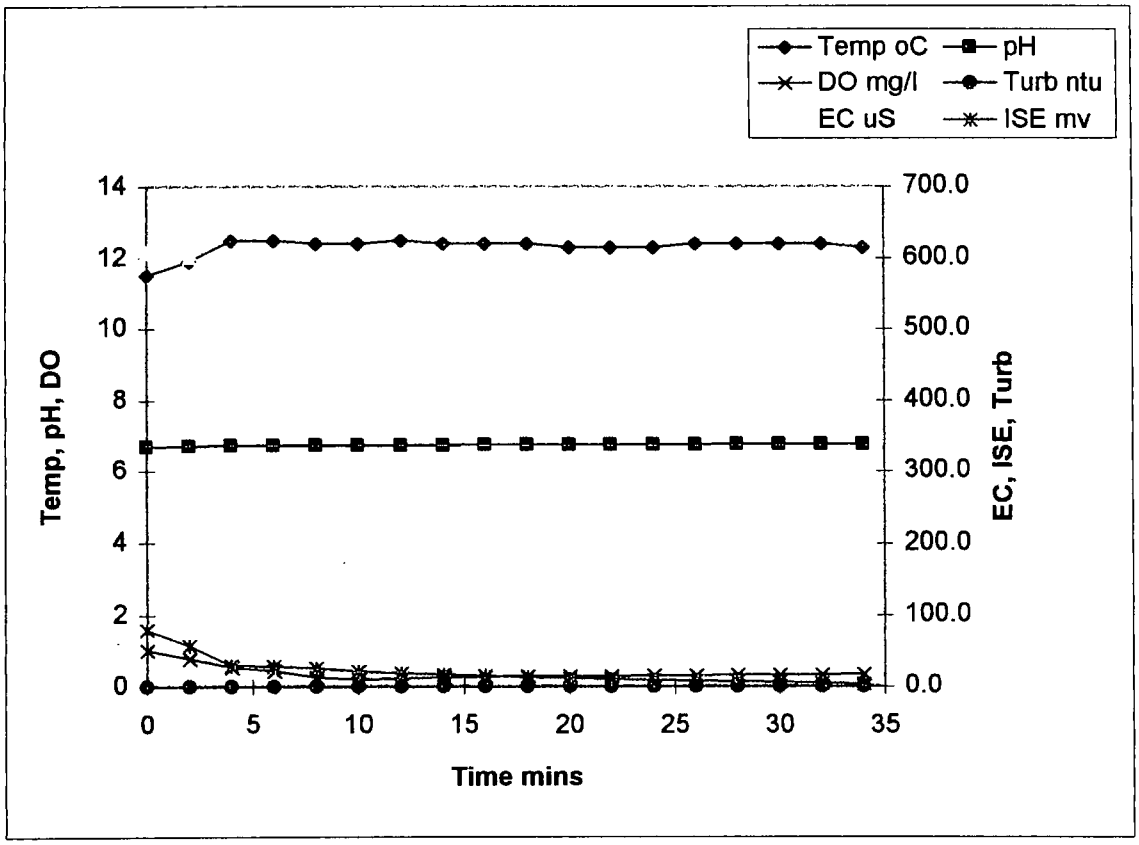
Borehole 6

Time		Pt100 øC Temp oC	pH/mV pH pH	conduct uS EC uS	DO Salin mg/l DO mg/l	ISE mid mV ISE mv	turbid NTU Turb ntu
11/05/98 15:01	0	13.6	6.88	489.8	2.83	157.9	75
11/05/98 15:03	2	13.7	6.87	498.4	2.26	149.6	332
11/05/98 15:05	4	13.7	6.83	514.2	0.58	126.9	1186
11/05/98 15:07	6	13.5	6.82	517.0	0.25	97.3	1176
11/05/98 15:09	8	13.5	6.82	516.5	0.20	74.1	1054
11/05/98 15:11	10	13.6	6.82	515.9	0.28	58.1	821
11/05/98 15:13	12	13.7	6.82	514.2	0.21	47.5	623
11/05/98 15:15	14	13.7	6.82	514.2	0.18	40.0	493
11/05/98 15:17	16	13.8	6.82	512.0	0.13	34.1	389
11/05/98 15:19	18	13.8	6.82	511.4	0.10	29.4	304
11/05/98 15:21	20	13.8	6.82	509.8	0.09	25.3	240
11/05/98 15:23	22	13.7	6.82	509.0	0.07	22.4	205
11/05/98 15:25	24	13.7	6.85	547.7	0.50	32.4	176
11/05/98 15:27	26	13.8	6.84	548.1	0.09	23.6	145
11/05/98 15:29	28	13.8	6.84	547.2	0.06	19.6	125
11/05/98 15:31	30	13.8	6.84	545.9	0.05	16.9	101
11/05/98 15:33	32	13.9	6.83	546.5	0.05	14.7	81
11/05/98 15:35	34	14.0	6.83	547.0	0.04	13.0	69
11/05/98 15:37	36	14.1	6.84	547.3	0.04	11.2	58
11/05/98 15:39	38	14.2	6.83	546.2	0.04	9.8	48



Borehole 7

Time		Pt100 øC Temp oC	pH/mV pH pH	conduct uS EC uS	DO Salin mg/l DO mg/l	ISE mid mV ISE mv	turbid NTU Turb ntu
13/05/98 14:00	0	11.5	6.69	607.5	1.03	79.6	0
13/05/98 14:02	2	11.9	6.71	601.1	0.79	57.5	0
13/05/98 14:04	4	12.5	6.72	587.3	0.56	30.0	0
13/05/98 14:06	6	12.5	6.73	589.2	0.44	29.0	0
13/05/98 14:08	8	12.4	6.73	588.2	0.27	25.7	0
13/05/98 14:10	10	12.4	6.73	587.1	0.22	21.8	0
13/05/98 14:12	12	12.5	6.73	586.3	0.24	19.0	0
13/05/98 14:14	14	12.4	6.73	586.0	0.26	16.9	0
13/05/98 14:16	16	12.4	6.74	585.3	0.28	15.1	0
13/05/98 14:18	18	12.4	6.74	583.6	0.30	13.6	0
13/05/98 14:20	20	12.3	6.74	583.6	0.31	12.0	0
13/05/98 14:22	22	12.3	6.74	581.9	0.31	10.8	0
13/05/98 14:24	24	12.3	6.74	580.1	0.32	9.4	0
13/05/98 14:26	26	12.4	6.74	580.7	0.33	8.3	0
13/05/98 14:28	28	12.4	6.75	579.0	0.34	7.1	0
13/05/98 14:30	30	12.4	6.75	578.3	0.34	6.1	0
13/05/98 14:32	32	12.4	6.75	577.8	0.34	4.7	0
13/05/98 14:34	34	12.3	6.75	576.6	0.35	3.8	0



Appendix 4

Details of Samples Collected

GEOCHEM

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	1
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	
CONTACT	[redacted]	**ORDER NUMBER**	
DATE OF RECEIPT	12/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF UPPER HEYFORD		

Nonhazardous ☐
Hazardous ☐
Type .....

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Arsenic	Hg Low Dutch T	Nickel	Cd low level	Lead	Chromium	Se low level	Copper	Zinc	Boron	Phenol by HPLC	Solv. Ext. W	Diesel rng orgs	Petrol rng orgs	BTEX by GC	MTBE	Conductivity	pH (water)	Sodium	Potassium
1	BH3A	1lglass	3.50	WATER											✔	✔	✔							
2	BH3A	1lglass	3.50	WATER											✔									
3	BH3A	1lplastic	3.50	WATER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
4	BH3A	H2SO4	3.50	WATER																				
5	BH3A	Vial	3.50	WATER														✔	✔	✔				
6	BH3A	Vial	3.50	WATER																				
7	BH3B	1lglass	2.00	WATER												✔	✔							
8	BH3B	1lglass	2.00	WATER											✔									
9	BH3B	1lplastic	2.00	WATER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
10	BH3B	H2SO4	2.00	WATER																				
11	BH3B	Vial	2.00	WATER														✔	✔	✔				
12	BH3B	Vial	2.00	WATER																				
13	BH4	1lglass	15.00	WATER												✔	✔							
14	BH4	1lglass	15.00	WATER											✔									
15	BH4	1lplastic	15.00	WATER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
16	BH4	H2SO4	15.00	WATER																				
17	BH4	Vial	15.00	WATER														✔	✔	✔				
18	BH4	Vial	15.00	WATER																				
19	BH5 [redacted]	1lglass	2.00	WATER												✔	✔							

Checked by ..... [redacted] Name: [redacted]

GEOCHEM

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	1
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	
CONTACT	[redacted]	**ORDER NUMBER**	
DATE OF RECEIPT	12/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF UPPER HEYFORD		

Nonhazardous ☐
Hazardous ☐
Type .....

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Calcium	Magnesium	Chloride Kone	Nitrate Kone	Phosphate Kone	Sulphate Kone	Ammon N2 (Kj)	Alkalinity Total	Bicarbonate	COD (unfiltered)	BOD (unfiltered)	T.O.C. in water	Trihalomethanes	H space (HSD)						
1	BH3A	1lglass	3.50	WATER												✓	✓							
2	BH3A	1lglass	3.50	WATER																				
3	BH3A	1lplastic	3.50	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
4	BH3A	H2SO4	3.50	WATER							✓													
5	BH3A	Vial	3.50	WATER																				
6	BH3A	Vial	3.50	WATER														✓						
7	BH3B	1lglass	2.00	WATER												✓	✓							
8	BH3B	1lglass	2.00	WATER																				
9	BH3B	1lplastic	2.00	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
10	BH3B	H2SO4	2.00	WATER							✓													
11	BH3B	Vial	2.00	WATER																				
12	BH3B	Vial	2.00	WATER														✓						
13	BH4	1lglass	15.00	WATER												✓	✓							
14	BH4	1lglass	15.00	WATER																				
15	BH4	1lplastic	15.00	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
16	BH4	H2SO4	15.00	WATER							✓													
17	BH4	Vial	15.00	WATER																				
18	BH4	Vial	15.00	WATER														✓						
19	BH5 [redacted]	1lglass	2.00	WATER												✓	✓							

Checked by ..... [redacted] Name: [redacted]

NAMAS Accredited

GEOCHEM

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

Nonhazardous	☐
Hazardous	☐
Type	

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	1
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	
CONTACT	[redacted]	**ORDER NUMBER**	
DATE OF RECEIPT	12/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF UPPER HEYFORD		

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Arsenic	Hg Low Dutch T	Nickel	Cd low level	Lead	Chromium	Se low level	Copper	Zinc	Boron	Phenol by MS	Solv. Ext. W	Diesel rng orgs	Petrol rng orgs	BTEX by GC	MTBE	Conductivity	pH (water)	Sodium	Potassium
20	BH5	1lglass	2.00	WATER											✔									
21	BH5	1lplastic	2.00	WATER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
22	BH5	H2SO4	2.00	WATER																				
23	BH5	Vial	2.00	WATER														✔	✔	✔				
24	BH5	Vial	2.00	WATER																				
Tota[redacted]of tests					4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Checked by ......[redacted]..... Name: [redacted]

NAMAS Accredited

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	1
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	
CONTACT	[redacted]	**ORDER NUMBER**	
DATE OF RECEIPT	12/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF UPPER HEYFORD		

Nonhazardous ☐
Hazardous ☐
Type .....

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Calcium	Magnesium	Chloride Kone	Nitrate Kone	Phosphate Kone	Sulphate Kone	Ammo. N2 (W)	Alkalinity Total	Bicarbonate	COD (unfiltered)	BOD (unfiltered)	T.O.C. in water	Thin-layer chro.	Hypaco (MSD)						
20	BH5	1lglass	2.00	WATER																				
21	BH5	1lplastic	2.00	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
22	BH5	H2SO4	2.00	WATER							✓													
23	BH5	Vial	2.00	WATER																				
24	BH5	Vial	2.00	WATER														✓						
Total [redacted] ests					4	4	4	4	4	4	4	4	4	4	4	4	4	4						

Checked by [redacted] Name: [redacted]

NAMAS Accredited

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	2
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	TA2502A
CONTACT	[redacted]	**ORDER NUMBER**	17011
DATE OF RECEIPT	13/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF Upper Heyford		

Nonhazardous ☐
Hazardous ☐
Type .....

NAMAS TESTING No. 1291

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Arsenic	Hg Low Dutch T	Nickel	Cd low level	Lead	Chromium	Se low level	Copper	Zinc	Boron	Phenol by HS	Solv. Ext. W	Diesel rng orgs	Petrol rng orgs	BTEX by GC	MTBE	Conductivity	pH (water)	Sodium	Potassium
25	BH6	1lglass	14.00	WATER		✔										✔	✔							
26	BH6	1lglass	14.00	WATER											✔									
27	BH6	1lplastic	14.00	WATER	✔		✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
28	BH6	H2SO4	14.00	WATER																				
29	BH6	Vial	14.00	WATER														✔	✔	✔				
30	BH6	Vial	14.00	WATER																				
31	D	1lglass	SURFACE	WATER		✔										✔	✔							
32	D	1lglass	SURFACE	WATER											✔									
33	D	1lplastic	SURFACE	WATER	✔		✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
34	D	H2SO4	SURFACE	WATER																				
35	D	Vial	SURFACE	WATER														✔	✔	✔				
36	F	1lglass	SURFACE	WATER		✔										✔	✔							
37	F	1lglass	SURFACE	WATER											✔									
38	F	1lplastic	SURFACE	WATER	✔		✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
39	F	H2SO4	SURFACE	WATER																				
40	F	Vial	SURFACE	WATER														✔	✔	✔				
41	G1 STREAM	1lglass	SURFACE	WATER		✔										✔	✔							
42	G1 STREAM	1lglass	SURFACE	WATER											✔									
43	G1 STREAM	1lplastic	SURFACE	WATER	✔		✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔

Checked by ..... [redacted] ... Name: [redacted]

NAMAS Accredited

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

Nonhazardous ☐
Hazardous ☐
Type .....

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	2
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	TA2502A
CONTACT	[redacted]	**ORDER NUMBER**	17011
DATE OF RECEIPT	13/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF Upper Heyford		

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Calcium	Magnesium	Chloride Kone	Nitrate Kone	Phosphate Kone	Sulphate Kone	Ammn N2 (W)	Alkalinity Total	Bicarbonate	COD (unfiltered)	BOD (unfiltered)	T.O.C. in water	Thin-layer chro.	H'space (MSD)						
25	BH6	1lglass	14.00	WATER												✓	✓							
26	BH6	1lglass	14.00	WATER																				
27	BH6	1lplastic	14.00	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
28	BH6	H2SO4	14.00	WATER							✓													
29	BH6	Vial	14.00	WATER																				
30	BH6	Vial	14.00	WATER														✓						
31	D	1lglass	SURFACE	WATER												✓	✓							
32	D	1lglass	SURFACE	WATER																				
33	D	1lplastic	SURFACE	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
34	D	H2SO4	SURFACE	WATER							✓													
35	D	Vial	SURFACE	WATER																				
36	F	1lglass	SURFACE	WATER												✓	✓							
37	F	1lglass	SURFACE	WATER																				
38	F	1lplastic	SURFACE	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
39	F	H2SO4	SURFACE	WATER							✓													
40	F	Vial	SURFACE	WATER																				
41	G1 STREAM	1lglass	SURFACE	WATER												✓	✓							
42	G1 STREAM	1lglass	SURFACE	WATER																				
43	G1 STREAM	1lplastic	SURFACE	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									

Checked by [redacted] Name: [redacted]

NAMAS Accredited

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	2
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	TA2502A
CONTACT	[redacted]	**ORDER NUMBER**	17011
DATE OF RECEIPT	13/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF Upper Heyford		

Nonhazardous ☐
Hazardous ☐
Type .....

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Arsenic	Hg Low Dutch T	Nickel	Cd low level	Lead	Chromium	Se low level	Copper	Zinc	Boron	Phenol by HS	Solv. Ext. W	Diesel rng orgs	Petrol rng orgs	BTEX by GC	MTBE	Conductivity	pH (water)	Sodium	Potassium
44	G1 STREAM	H2SO4	SURFACE	WATER														✔	✔	✔				
45	G1 STREAM	Vial	SURFACE	WATER																				
46	N	1lglass	SURFACE	WATER		✔										✔	✔							
47	N	1lglass	SURFACE	WATER											✔									
48	N	1lplastic	SURFACE	WATER	✔		✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
49	N	H2SO4	SURFACE	WATER																				
50	N	Vial	SURFACE	WATER														✔	✔	✔				
51	P1 SPRING	1lglass	SURFACE	WATER		✔										✔	✔							
52	P1 SPRING	1lglass	SURFACE	WATER											✔									
53	P1 SPRING	1lplastic	SURFACE	WATER	✔		✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
54	P1 SPRING	H2SO4	SURFACE	WATER																				
55	P1 SPRING	Vial	SURFACE	WATER														✔	✔	✔				
56	R2 STREAM	1lglass	SURFACE	WATER		✔										✔	✔							
57	R2 STREAM	1lglass	SURFACE	WATER											✔									
58	R2 STREAM	1lplastic	SURFACE	WATER	✔		✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
59	R2 STREAM	H2SO4	SURFACE	WATER																				
60	R2 STREAM	Vial	SURFACE	WATER														✔	✔	✔				
Total number of tests					7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7

Checked by ..... [redacted] . Name: [redacted]

NAMAS Accredited

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

Nonhazardous ☐
Hazardous ☐
Type .....

Numeric values indicate additional scheduling

** Indicates test subcontracted*

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	2
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	TA2502A
CONTACT	[redacted]	**ORDER NUMBER**	17011
DATE OF RECEIPT	13/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF Upper Heyford		

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Calcium	Magnesium	Chloride Kone	Nitrate Kone	Phosphate Kone	Sulphate Kone	Amm. N2 (M)	Alkalinity Total	Bicarbonate	COD (undiluted)	BOD (undiluted)	T.O.C. in water	Thin-layer chro.	H'space (HSD)						
44	G1 STREAM	H2SO4	SURFACE	WATER							✓													
45	G1 STREAM	Vial	SURFACE	WATER																				
46	N	1lglass	SURFACE	WATER												✓	✓							
47	N	1lglass	SURFACE	WATER																				
48	N	1lplastic	SURFACE	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
49	N	H2SO4	SURFACE	WATER							✓													
50	N	Vial	SURFACE	WATER																				
51	P1 SPRING	1lglass	SURFACE	WATER												✓	✓							
52	P1 SPRING	1lglass	SURFACE	WATER																				
53	P1 SPRING	1lplastic	SURFACE	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
54	P1 SPRING	H2SO4	SURFACE	WATER							✓													
55	P1 SPRING	Vial	SURFACE	WATER																				
56	R2 STREAM	1lglass	SURFACE	WATER												✓	✓							
57	R2 STREAM	1lglass	SURFACE	WATER																				
58	R2 STREAM	1lplastic	SURFACE	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
59	R2 STREAM	H2SO4	SURFACE	WATER							✓													
60	R2 STREAM	Vial	SURFACE	WATER																				
Total number of tests					7	7	7	7	7	7	7	7	7	7	7	7	7	1						

Checked by .... [redacted] ..... Name: [redacted]

TESTS **NAMAS Accredited**

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	3
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	TA 2502A
CONTACT	[redacted]	**ORDER NUMBER**	17011
DATE OF RECEIPT	14/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF UPPER HEYFORD		

Nonhazardous ☐
Hazardous ☐
Type .....

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Arsenic	Hg Low Dutch T	Nickel	Cd low level	Lead	Chromium	Se low level	Copper	Zinc	Boron	Phenol by HS	Solv. Ext. W	Diesel mg orgs	Petrol mg orgs	BTEX by GC	MTBE	Conductivity	pH [water]	Sodium	Potassium
61	BH1 A	1lglass	35.00	WATER												✓	✓							
62	BH1 A	1lglass	35.00	WATER											✓									
63	BH1 A	1lplastic	35.00	WATER	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							✓	✓	✓	✓
64	BH1 A	H2SO4	35.00	WATER																				
65	BH1 A	Vial	35.00	WATER														✓	✓	✓				
66	BH1 A	Vial	35.00	WATER																				
67	BH1 B	1lglass	14.00	WATER												✓	✓							
68	BH1 B	1lglass	14.00	WATER											✓									
69	BH1 B	1lplastic	14.00	WATER	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							✓	✓	✓	✓
70	BH1 B	H2SO4	14.00	WATER																				
71	BH1 B	Vial	14.00	WATER														✓	✓	✓				
72	BH1 B	Vial	14.00	WATER																				
73	BH 2	1lglass	23.00	WATER												✓	✓							
74	BH 2	1lglass	23.00	WATER											✓									
75	BH 2	1lplastic	23.00	WATER	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							✓	✓	✓	✓
76	BH 2	H2SO4	23.00	WATER																				
77	BH 2	Vial	23.00	WATER														✓	✓	✓				
78	BH 2	Vial	23.00	WATER																				
	Tot[redacted]ests				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Checked by .....[redacted].. Name: [redacted]

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

Nonhazardous ☐
Hazardous ☐
Type .....

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	3
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	TA 2502A
CONTACT	[redacted]	**ORDER NUMBER**	17011
DATE OF RECEIPT	14/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF UPPER HEYFORD		

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Calcium	Magnesium	Chloride Kone	Nitrate Kone	Phosphate Kone	Sulphate Kone	Ammn. N2 (PF)	Alkalinity Total	Bicarbonate	COD (unfiltered)	BOD (unfiltered)	T.O.C. in water	Thin-layer chro.	Hspace (MSD)						
61	BH1 A	1lglass	35.00	WATER												✓	✓							
62	BH1 A	1lglass	35.00	WATER																				
63	BH1 A	1lplastic	35.00	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
64	BH1 A	H2SO4	35.00	WATER							✓													
65	BH1 A	Vial	35.00	WATER																				
66	BH1 A	Vial	35.00	WATER														✓						
67	BH1 B	1lglass	14.00	WATER												✓	✓							
68	BH1 B	1lglass	14.00	WATER																				
69	BH1 B	1lplastic	14.00	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
70	BH1 B	H2SO4	14.00	WATER							✓													
71	BH1 B	Vial	14.00	WATER																				
72	BH1 B	Vial	14.00	WATER														✓						
73	BH 2	1lglass	23.00	WATER												✓	✓							
74	BH 2	1lglass	23.00	WATER																				
75	BH 2	1lplastic	23.00	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
76	BH 2	H2SO4	23.00	WATER							✓													
77	BH 2	Vial	23.00	WATER																				
78	BH 2	Vial	23.00	WATER														✓						
Total number of tests					3	3	3	3	3	3	3	3	3	3	3	3	3	3						

Checked by ..... [redacted] ... Name: [redacted]

NAMAS Accredited

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

Nonhazardous ☐
Hazardous ☐
Type .....

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	4
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	TA 2502A
CONTACT	[redacted]	**ORDER NUMBER**	17011
DATE OF RECEIPT	15/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF UPPER HEYFORD		

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Arsenic	Hg Low Dutch T	Nickel	Cd low level	Lead	Chromium	Se low level	Copper	Zinc	Boron	Phenol by HS	Solv. Ext. IR	Diesel rng orgs	Petrol rng orgs	BTEX by GC	MTBE	Conductivity	pH (water)	Sodium	Potassium
79	BH7	1lglass	4.00	WATER											✔	✔	✔							
80	BH7	1lglass	4.00	WATER											✔									
81	BH7	1lplastic	4.00	WATER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
82	BH7	H2SO4	4.00	WATER																				
83	BH7	Vial	4.00	WATER														✔	✔	✔				
84	BH7	Vial	4.00	WATER																				
85	SPRING I	1lglass	SURFACE	WATER												✔	✔							
86	SPRING I	1lglass	SURFACE	WATER											✔									
87	SPRING I	1lplastic	SURFACE	WATER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
88	SPRING I	H2SO4	SURFACE	WATER																				
89	SPRING I	Vial	SURFACE	WATER														✔	✔	✔				
90	SPRING A	1lglass	SURFACE	WATER												✔	✔							
91	SPRING A	1lglass	SURFACE	WATER											✔									
92	SPRING A	1lplastic	SURFACE	WATER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
93	SPRING A	H2SO4	SURFACE	WATER																				
94	SPRING A	Vial	SURFACE	WATER														✔	✔	✔				
95	SPRING B	1lglass	SURFACE	WATER												✔	✔							
96	SPRING B	1lglass	SURFACE	WATER											✔									
97	SPRING B	1lplastic	SURFACE	WATER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔

Checked by [redacted] Name: [redacted]

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

Nonhazardous ☐
Hazardous ☐
Type .....

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	4
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	TA 2502A
CONTACT	[redacted]	**ORDER NUMBER**	17011
DATE OF RECEIPT	15/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF UPPER HEYFORD		

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Calcium	Magnesium	Chloride Kone	Nitrate Kone	Phosphate Kone	Sulphate Kone	Acid. N2 (W)	Alkalinity Total	Bicarbonate	COD (unfiltered)	BOD (unfiltered)	T.O.C. in Water	Thin-layer chro	Hspace (HS0)						
79	BH7	1lglass	4.00	WATER												✓	✓							
80	BH7	1lglass	4.00	WATER																				
81	BH7	1lplastic	4.00	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
82	BH7	H2SO4	4.00	WATER							✓													
83	BH7	Vial	4.00	WATER																				
84	BH7	Vial	4.00	WATER														✓						
85	SPRING I	1lglass	SURFACE	WATER												✓	✓							
86	SPRING I	1lglass	SURFACE	WATER																				
87	SPRING I	1lplastic	SURFACE	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
88	SPRING I	H2SO4	SURFACE	WATER							✓													
89	SPRING I	Vial	SURFACE	WATER																				
90	SPRING A	1lglass	SURFACE	WATER												✓	✓							
91	SPRING A	1lglass	SURFACE	WATER																				
92	SPRING A	1lplastic	SURFACE	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
93	SPRING A	H2SO4	SURFACE	WATER							✓													
94	SPRING A	Vial	SURFACE	WATER																				
95	SPRING B	1lglass	SURFACE	WATER												✓	✓							
96	SPRING B	1lglass	SURFACE	WATER																				
97	SPRING B	1lplastic	SURFACE	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									

Checked by [redacted] Name: [redacted]

NAMAS Accredited

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

Nonhazardous ☐
Hazardous ☐
Type .....

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	4
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	TA 2502A
CONTACT	[redacted]	**ORDER NUMBER**	17011
DATE OF RECEIPT	15/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF UPPER HEYFORD		

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Arsenic	Hg Low Dutch T	Nickel	Cd low level	Lead	Chromium	Se low level	Copper	Zinc	Boron	Phenol by HS	Solv. Ext. W	Diesel rng orgs	Petrol rng orgs	BTEX by GC	MTBE	Conductivity	pH (water)	Sodium	Potassium
98	SPRING B	H2SO4	SURFACE	WATER														✔	✔	✔				
99	SPRING B	Vial	SURFACE	WATER																				
100	SPRING L	1lglass	SURFACE	WATER												✔	✔							
101	SPRING L	1lglass	SURFACE	WATER											✔									
102	SPRING L	1lplastic	SURFACE	WATER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
103	SPRING L	H2SO4	SURFACE	WATER																				
104	SPRING L	Vial	SURFACE	WATER														✔	✔	✔				
105	SPRING M	1lglass	SURFACE	WATER												✔	✔							
106	SPRING M	1lglass	SURFACE	WATER											✔									
107	SPRING M	1lplastic	SURFACE	WATER	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔							✔	✔	✔	✔
108	SPRING M	H2SO4	SURFACE	WATER																				
109	SPRING M	Vial	SURFACE	WATER														✔	✔	✔				
	[redacted] r of tests				6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Checked by ... [redacted] ..... Name: [redacted]

NAMAS Accredited

GEOCHEM

GEOCHEM ANALYTICAL SERVICES
TEST SCHEDULE

NAMAS TESTING No. 1291

JOB NUMBER	98/01468/02/01	**BATCH NUMBER**	4
CLIENT	Aspinwall & Company	**CLIENT REF/CODE**	TA 2502A
CONTACT	[redacted]	**ORDER NUMBER**	17011
DATE OF RECEIPT	15/5/1998	**TURNAROUND**	12 Days
LOCATION	RAF UPPER HEYFORD		

Nonhazardous ☐
Hazardous ☐
Type .....

Numeric values indicate additional scheduling

** Indicates test subcontracted*

Sample No.	Sample Identity	P / V	Depth (m)	Sample Type	Calcium	Magnesium	Chloride Kone	Nitrate Kone	Phosphate Kone	Sulphate Kone	Amm. N2 (M)	Alkalinity Total	Bicarbonate	COD (unfiltered)	BOD (unfiltered)	T.O.C. in Water	Trihalo'ane chrg	Phenol (HPLC)						
98	SPRING B	H2SO4	SURFACE	WATER							✓													
99	SPRING B	Vial	SURFACE	WATER																				
100	SPRING L	1lglass	SURFACE	WATER												✓	✓							
101	SPRING L	1lglass	SURFACE	WATER																				
102	SPRING L	1lplastic	SURFACE	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
103	SPRING L	H2SO4	SURFACE	WATER							✓													
104	SPRING L	Vial	SURFACE	WATER																				
105	SPRING M	1lglass	SURFACE	WATER												✓	✓							
106	SPRING M	1lglass	SURFACE	WATER																				
107	SPRING M	1lplastic	SURFACE	WATER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
108	SPRING M	H2SO4	SURFACE	WATER							✓													
109	SPRING M	Vial	SURFACE	WATER																				
Tota [redacted]					6	6	6	6	6	6	6	6	6	6	6	6	6	1						

Checked by ..... [redacted] Name: [redacted]

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Appendix 5

In situ Water Quality Measurements at Spring Sampling Locations

In Situ Chemistry at Springs/Outfalls around Upper Heyford

Date/time	Spring	Parameters					
		Temperature	pH	Electrical Conductivity	Dissolved Oxygen	Redox	Turbidity
		oC		uS/cm	mg/l	mv	ntu
14/05/98 10:00	A *	14	7.28	490	6.93	224	0
14/05/98 11:40	B	11.1	7.01	508	7.02	217	0
12/05/98 12:00	C1 & C2	DRY					
12/05/98 11:30	D	10.5	7	728	8.96	205	0
12/05/98 11:10	F	10.8	6.89	648	7.98	224	0
12/05/98 10:00	G1	11	7.04	660	8.19	209	0
14/05/98 08:40	I *	14.2	7.62	543	8.39	220	0
14/05/98 09:20	L	11.9	6.98	552	6.96	198	0
14/05/98 10:30	M	11.8	7.05	486	8.76	228	0
12/05/98 12:30	N	11.3	7.39	635	7.42	195	0
12/05/98 12:30	P1	10.8	7.18	640	9.12	209	0
12/05/98 12:00	R2	10.2	6.99	626	8.65	187	0

Notes: * parameters not measured at source

Appendix 6

Laboratory Results

Appendix 6a

Miscellaneous Data

Laboratory Analysis Notes

Geochem were unable to determine a chloride or nitrate determination for borehole 6 as all of the sample had been used when these came to be tested (even though Geochem specified the sample volume requirements).

Geochem have quoted bicarbonate as being equal to alkalinity (only alkalinity is analysed for). At neutral pH the bicarbonate is approximately equal to the alkalinity multiplied by 1.22. Ion balance errors have been computed for both sets of figures. The piper plots have been drawn up using the data supplied by Geochem.

The ion balance errors (IBE) for the data have been calculated as detailed below. It is normally expected that the IBE will be in the range -10 % to + 10 %.

Location	IBE (%) - HCO_3 = Alk	IBE (%) HCO_3 = Alk x 1.2	Comments
BH1A	3	-3	
BH1B	-2	-10	
BH2	-7	-11	
BH3A	0	-8	
BH3B	16	8	
BH4	2	-5	
BH5	2	-5	
BH6	19	10	Chloride and nitrate not determined
BH7	16	8	
Spring A	16	8	
Spring B	13	6	
Spring D	27	20	
Spring F	20	13	
Spring G1	28	21	
Spring I	6	-1	
Spring L	15	8	
Spring M	13	5	
Spring N	21	14	
Spring P1	27	20	
Spring R2	21	13	

The ion balance is improved when alkalinity is converted to bicarbonate using standard methods such that the IBE for borehole samples are within a reasonable error band. However, the spring waters generally have higher errors, especially springs D, G1 and P1. The error in all cases is positive indicating an underestimate of anions or an overestimate of cations.

GEOCHEM

GEOCHEM ANALYTICAL SERVICES
TABLE OF RESULTS

Job Number : 98/01468/02/01
Client : ASPINWALL & COMPANY
Date of Receipt : 12/05/98
(of first sample)

Sample Type : WATER
Location : RAF UPPER HEYFORD
Client Contact : [redacted]
Client Ref. No. : TA 2502A

NAMAS TESTING No. 1291

☐ Preliminary
☑ Validated
☐ NAMAS Accredited

Sample Number	Sample Identity	Depth (m)	Arsenic	Boron	Calcium	Chromium	Copper	Magnesium	Nickel	Lead	Zinc	Min. Oil / Paraffin by TLC	Total Non-Volatile Aromatics	NSO / Resins	COD On Unfiltered Sample	BOD in unfiltered water	Mercury Low Dutch Target	Ammoniacal Nitrogen In Water
Units			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb	ppm
Detection Method			ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	TLC	TLC	TLC	Spectro	ATU	CVAAS	Colour
Detection Limits			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	<1	<1	<10	<1	<0.05	<0.01
1	BH3A	3.50	-	-	-	-	-	-	-	-	-	<1	<1	1	-	-	-	-
2	BH3A	3.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	BH3A	3.50	<0.05	<0.05	109.1	<0.05	<0.05	1.94	<0.05	<0.05	<0.05	-	-	-	<10	<1	<0.05	-
4	BH3A	3.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10
5	BH3A	3.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	BH3A	3.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	BH3B	2.00	-	-	-	-	-	-	-	-	-	<1	<1	1	-	-	-	-
8	BH3B	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	BH3B	2.00	<0.05	<0.05	127.0	<0.05	<0.05	1.78	<0.05	<0.05	<0.05	-	-	-	22	<1	<0.05	-
10	BH3B	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.09
11	BH3B	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	BH3B	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	BH4	15.00	-	-	-	-	-	-	-	-	-	<1	<1	1	-	-	-	-
14	BH4	15.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	BH4	15.00	<0.05	0.08	83.7	<0.05	<0.05	11.0	<0.05	<0.05	<0.05	-	-	-	73	2	<0.05	-
16	BH4	15.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.60
17	BH4	15.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	BH4	15.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	BH5	2.00	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	-	-
20	BH5	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Printed on 15 June 1998

Checked by ..... [redacted] ..... [redacted]

GEOCHEM

GEOCHEM ANALYTICAL SERVICES
TABLE OF RESULTS

Job Number : 98/01468/02/01
Client : ASPINWALL & COMPANY
Date of Receipt : 12/05/98
(of first sample)

Sample Type : WATER
Location : RAF UPPER HEYFORD
Client Contact : [redacted]
Client Ref. No. : TA 2502A

NAMAS TESTING No. 1291

☐ Preliminary
☑ Validated
☐ NAMAS Accredited

Sample Number	Sample Identity	Depth (m)	Arsenic	Boron	Calcium	Chromium	Copper	Magnesium	Nickel	Lead	Zinc	Min. Oil / Paraffin by TLC	Total Non-Volatile Aromatics	NSO / Resins	COD On Unfiltered Sample	BOD in unfiltered water	Mercury Low Dutch Target	Ammoniacal Nitrogen In Water
Units			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb	ppm
Detection Method			ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	TLC	TLC	TLC	Spectro	ATU	CVAAS	Colour
Detection Limits			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	<1	<1	<10	<1	<0.05	<0.01
21	BH5	2.00	<0.05	<0.05	127.0	<0.05	<0.05	2.01	<0.05	<0.05	<0.05	-	-	-	16	<1	<0.05	-
22	BH5	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.36
23	BH5	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	BH5	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	BH6	14.00	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	<0.05	-
26	BH6	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	BH6	14.00	<0.05	<0.05	156.0	<0.05	<0.05	7.30	<0.05	<0.05	<0.05	-	-	-	18	<1	-	-
28	BH6	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.09
29	BH6	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	BH6	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	D	SURFACE	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	<0.05	-
32	D	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	D	SURFACE	<0.05	<0.05	219.0	<0.05	<0.05	3.91	<0.05	<0.05	<0.05	-	-	-	<10	<1	-	-
34	D	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.20
35	D	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	F	SURFACE	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	<0.05	-
37	F	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	F	SURFACE	<0.05	<0.05	187.0	<0.05	<0.05	2.76	<0.05	<0.05	<0.05	-	-	-	<10	<1	-	-
39	F	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10
40	F	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Printed on 15 June 1998

Checked by ..... [redacted] .....

GEOCHEM ANALYTICAL SERVICES

TABLE OF RESULTS

NAMAS TESTING No. 1291

Job Number : 98/01468/02/01
Client : ASPINWALL & COMPANY
Date of Receipt : 12/05/98
(of first sample)

Sample Type : WATER
Location : RAF UPPER HEYFORD
Client Contact : [redacted]
Client Ref. No. : TA 2502A

☐ Preliminary
☑ Validated
☐ NAMAS Accredited

Sample Number	Sample Identity	Depth (m)	Arsenic	Boron	Calcium	Chromium	Copper	Magnesium	Nickel	Lead	Zinc	Min. Oil / Paraffin by TLC	Total Non-Volatile Aromatics	NSO / Resins	COD On Unfiltered Sample	BOD in unfiltered water	Mercury Low Dutch Target	Ammoniacal Nitrogen In Water
Units			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb	ppm
Detection Method			ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	TLC	TLC	TLC	Spectro	ATU	CVAAS	Colour
Detection Limits			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	<1	<1	<10	<1	<0.05	<0.01
41	G1 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	<0.05	-
42	G1 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	G1 STREAM	SURFACE	<0.05	<0.05	234.0	<0.05	<0.05	3.88	<0.05	<0.05	<0.05	-	-	-	<10	<1	-	-
44	G1 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05
45	G1 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
46	N	SURFACE	-	-	-	-	-	-	-	-	-	1	<1	1	-	-	<0.05	-
47	N	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48	N	SURFACE	<0.05	<0.05	216.0	<0.05	<0.05	2.36	<0.05	<0.05	0.14	-	-	-	71	<1	-	-
49	N	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.62
50	N	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51	P1 SPRING	SURFACE	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	<0.05	-
52	P1 SPRING	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	P1 SPRING	SURFACE	<0.05	<0.05	193.0	<0.05	<0.05	3.84	<0.05	<0.05	<0.05	-	-	-	14	<1	-	-
54	P1 SPRING	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.08
55	P1 SPRING	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
56	R2 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	<0.05	-
57	R2 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	R2 STREAM	SURFACE	<0.05	<0.05	207.0	<0.05	<0.05	3.28	<0.05	<0.05	<0.05	-	-	-	<10	<1	-	-
59	R2 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.12
60	R2 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Printed on 15 June 1998

Checked by ..... [redacted] ..... [redacted]

GEOCHEM

GEOCHEM ANALYTICAL SERVICES
TABLE OF RESULTS

NAMAS TESTING No. 1291

Job Number : 98/01468/02/01
Client : ASPINWALL & COMPANY
Date of Receipt : 15/05/98
(of first sample)

Sample Type : WATER
Location : RAF UPPER HEYFORD
Client Contact : [redacted]
Client Ref. No. : TA 2502A

☐ Preliminary
☐ Validated
☐ NAMAS Accredited

Sample Number	Sample Identity	Depth (m)	Arsenic	Boron	Calcium	Chromium	Copper	Magnesium	Nickel	Lead	Zinc	Min. Oil / Paraffin by TLC	Total Non-Volatile Aromatics	NSO / Resins	COD On Unfiltered Sample	BOD in unfiltered water	Mercury Low Dutch Target	Ammoniacal Nitrogen In Water
Units			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb	ppm
Detection Method			ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	TLC	TLC	TLC	Spectro	ATU	CVAAS	Colour
Detection Limits			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	<1	<1	<10	<1	<0.05	<0.01
61	BH1 A	35.00	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	-	-
62	BH1 A	35.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	BH1 A	35.00	0.05	0.05	210.0	<0.05	<0.05	8.96	<0.05	<0.05	0.05	-	-	-	124	11	<0.05	-
64	BH1 A	35.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.09
65	BH1 A	35.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
66	BH1 A	35.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	BH1 B	14.00	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	-	-
68	BH1 B	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
69	BH1 B	14.00	0.05	<0.05	145.00	<0.05	<0.05	5.22	<0.05	<0.05	<0.05	-	-	-	47	2	<0.05	-
70	BH1 B	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.60
71	BH1 B	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
72	BH1 B	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
73	BH 2	23.00	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	-	-
74	BH 2	23.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	BH 2	23.00	<0.05	0.49	138.00	<0.05	<0.05	10.00	<0.05	<0.05	<0.05	-	-	-	89	6	<0.05	-
76	BH 2	23.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.67
77	BH 2	23.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
78	BH 2	23.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
79	BH7	4.00	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	-	-
80	BH7	4.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

GEOCHEM

GEOCHEM ANALYTICAL SERVICES
TABLE OF RESULTS

NAMAS TESTING No. 1291

Job Number : 98/01468/02/01
Client : ASPINWALL & COMPANY
Date of Receipt : 12/05/98
(of first sample)

Sample Type : WATER
Location : RAF UPPER HEYFORD
Client Contact : [redacted]
Client Ref. No. : TA 2502A

☐ Preliminary
☑ Validated
☐ NAMAS Accredited

Sample Number	Sample Identity	Depth (m)	Arsenic	Boron	Calcium	Chromium	Copper	Magnesium	Nickel	Lead	Zinc	Min. Oil / Paraffin by TLC	Total Non-Volatile Aromatics	NSO / Resins	COD On Unfiltered Sample	BOD in unfiltered water	Mercury Low Dutch Target	Ammoniacal Nitrogen in Water
Units			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb	ppm
Detection Method			ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	TLC	TLC	TLC	Spectro	ATU	CVAAS	Colour
Detection Limits			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	<1	<1	<10	<1	<0.05	<0.01
81	BH7	4.00	0.44	<0.05	191.0	<0.05	<0.05	3.31	<0.05	<0.05	<0.05	-	-	-	<10	<1	<0.05	-
82	BH7	4.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.11
83	BH7	4.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
84	BH7	4.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
85	SPRING I	SURFACE	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	-	-
86	SPRING I	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
87	SPRING I	SURFACE	<0.05	<0.05	129.0	<0.05	<0.05	2.94	<0.05	0.05	<0.05	-	-	-	<10	<1	<0.05	-
88	SPRING I	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.07
89	SPRING I	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90	SPRING A	SURFACE	-	-	-	-	-	-	-	-	-	<1	<1	1	-	-	-	-
91	SPRING A	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
92	SPRING A	SURFACE	<0.05	<0.05	137.0	<0.05	<0.05	1.89	<0.05	0.11	<0.05	-	-	-	<10	<1	<0.05	-
93	SPRING A	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05
94	SPRING A	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
95	SPRING B	SURFACE	-	-	-	-	-	-	-	-	-	<1	<1	1	-	-	-	-
96	SPRING B	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
97	SPRING B	SURFACE	0.19	<0.05	156.0	<0.05	<0.05	2.46	<0.05	0.09	<0.05	-	-	-	<10	<1	<0.05	-
98	SPRING B	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01
99	SPRING B	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	SPRING L	SURFACE	-	-	-	-	-	-	-	-	-	<1	<1	1	-	-	-	-

GEOCHEM

GEOCHEM ANALYTICAL SERVICES
TABLE OF RESULTS

Job Number : 98/01468/02/01
Client : ASPINWALL & COMPANY
Date of Receipt : 12/05/98
(of first sample)

Sample Type : WATER
Location : RAF UPPER HEYFORD
Client Contact : [redacted]
Client Ref. No. : TA 2502A

NAMAS TESTING No. 1291

☐ Preliminary
☑ Validated
☐ NAMAS Accredited

Sample Number	Sample Identity	Depth (m)	Arsenic	Boron	Calcium	Chromium	Copper	Magnesium	Nickel	Lead	Zinc	Min. Oil / Paraffin by TLC	Total Non-Volatile Aromatics	NSO / Resins	COD On Unfiltered Sample	BOD in unfiltered water	Mercury Low Dutch Target	Ammoniacal Nitrogen In Water
Units			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb	ppm
Detection Method			ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	TLC	TLC	TLC	Spectro	ATU	CVAAS	Colour
Detection Limits			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1	<1	<1	<10	<1	<0.05	<0.01
101	SPRING L	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
102	SPRING L	SURFACE	<0.05	<0.05	150.0	<0.05	<0.05	2.79	<0.05	<0.05	<0.05	-	-	-	<10	<1	<0.05	-
103	SPRING L	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10
104	SPRING L	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
105	SPRING M	SURFACE	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	-	-
106	SPRING M	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
107	SPRING M	SURFACE	0.24	<0.05	144.0	0.19	<0.05	1.80	<0.05	0.18	0.06	-	-	-	<10	<1	<0.05	-
108	SPRING M	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01
109	SPRING M	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Printed on 15 June 1998

Checked by ..... [redacted] ..... [redacted]

GEOCHEM

GEOCHEM ANALYTICAL SERVICES
TABLE OF RESULTS

NAMAS TESTING No. 1291

Job Number : 98/01468/02/01
Client : ASPINWALL & COMPANY
Date of Receipt : 12/05/98
(of first sample)

Sample Type : WATER
Location : RAF UPPER HEYFORD
Client Contact : [redacted]
Client Ref. No. : TA 2502A

☐ Preliminary
☑ Validated
☐ NAMAS Accredited

Sample Number	Sample Identity	Depth (m)	Potassium	Sodium	Cadmium Low Level	Selenium Low Level	Solvent Ext. Matter Water	Tot. Org. Carbon in Water	Chloride (soluble)	Nitrate (soluble)	Phosphate (soluble)	Sulphate (soluble)	Electrical Conductivity	pH Value in Water	Alkalinity Total as CaCO3	Bicarbonate		
Units			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	mS/cm		ppm	ppm		
Detection Method			Flame P	Flame P	GFAAS	GFAAS	Grav	IR	KONE	KONE	KONE	KONE	Meter	Meter	Titrat	Titre		
Detection Limits			<0.2	<0.2	<0.0004	<0.005	<1	<1	<5	<0.5	<0.01	<3	<0.001	<0.01	<1	<1		
1	BH3A	3.50	-	-	-	-	1	3	-	-	-	-	-	-	-	-		
2	BH3A	3.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
3	BH3A	3.50	1.6	12.5	<0.0004	<0.005	-	-	15	32.7	0.94	48	0.679	7.21	290	290		
4	BH3A	3.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
5	BH3A	3.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
6	BH3A	3.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
7	BH3B	2.00	-	-	-	-	1	3	-	-	-	-	-	-	-	-		
8	BH3B	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
9	BH3B	2.00	1.1	13.1	<0.0004	<0.005	-	-	10	23.3	1.67	38	0.594	7.28	250	250		
10	BH3B	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
11	BH3B	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
12	BH3B	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
13	BH4	15.00	-	-	-	-	1	3	-	-	-	-	-	-	-	-		
14	BH4	15.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
15	BH4	15.00	4.1	20.0	<0.0004	<0.005	-	-	10	<0.5	0.07	51	0.585	7.38	270	270		
16	BH4	15.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
17	BH4	15.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
18	BH4	15.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
19	BH5	2.00	-	-	-	-	<1	3	-	-	-	-	-	-	-	-		
20	BH5	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

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GEOCHEM ANALYTICAL SERVICES

TABLE OF RESULTS

NAMAS TESTING No. 1291

Job Number : 98/01468/02/01
Client : ASPINWALL & COMPANY
Date of Receipt : 12/05/98 (of first sample)

Sample Type : WATER
Location : RAF UPPER HEYFORD
Client Contact : [redacted]
Client Ref. No. : TA 2502A

☐ Preliminary
☑ Validated
☐ NAMAS Accredited

Sample Number	Sample Identity	Depth (m)	Potassium	Sodium	Cadmium Low Level	Selenium Low Level	Solvent Ext. Matter Water	Tot. Org. Carbon in Water	Chloride (soluble)	Nitrate (soluble)	Phosphate (soluble)	Sulphate (soluble)	Electrical Conductivity	pH Value in Water	Alkalinity Total as CaCO3	Bicarbonate		
Units			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	mS/cm		ppm	ppm		
Detection Method			Flame P	Flame P	GFAAS	GFAAS	Grav	IR	KONE	KONE	KONE	KONE	Meter	Meter	Titrat	Titre		
Detection Limits			<0.2	<0.2	<0.0004	<0.005	<1	<1	<5	<0.5	<0.01	<3	<0.001	<0.01	<1	<1		
21	BH5	2.00	1.7	19.0	<0.0004	0.016	-	-	29	1.5	1.40	54	0.671	7.21	310	310		
22	BH5	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
23	BH5	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
24	BH5	2.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
25	BH6	14.00	-	-	-	-	<1	2	-	-	-	-	-	-	-	-		
26	BH6	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
27	BH6	14.00	3.6	12.5	<0.0004	<0.005	-	-	NDP	NDP	0.03	45	0.433	7.59	320	320		
28	BH6	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
29	BH6	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
30	BH6	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
31	D	SURFACE	-	-	-	-	<1	4	-	-	-	-	-	-	-	-		
32	D	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
33	D	SURFACE	10.6	18.5	<0.0004	<0.005	-	-	45	79.4	0.02	45	0.921	7.14	300	300		
34	D	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
35	D	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
36	F	SURFACE	-	-	-	-	<1	3	-	-	-	-	-	-	-	-		
37	F	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
38	F	SURFACE	1.8	18.0	<0.0004	<0.005	-	-	32	60.5	0.02	42	0.830	7.12	310	310		
39	F	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
40	F	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

Checked by ..... [redacted] ..... [redacted]

GEOCH

GEOCHEM ANALYTICAL SERVICES
TABLE OF RESULTS

NAMAS TESTING No. 1291

Job Number : 98/01468/02/01
Client : ASPINWALL & COMPANY
Date of Receipt : 12/05/98 (of first sample)

Sample Type : WATER
Location : RAF UPPER HEYFORD
Client Contact : [redacted]
Client Ref. No. : TA 2502A

☐ Preliminary
☑ Validated
☐ NAMAS Accredited

Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	mS/cm		ppm	ppm		
Detection Method	Flame P	Flame P	GFAAS	GFAAS	Grav	IR	KONE	KONE	KONE	KONE	Meter	Meter	Titrat	Titre		
Detection Limits	<0.2	<0.2	<0.0004	<0.005	<1	<1	<5	<0.5	<0.01	<3	<0.001	<0.01	<1	<1		

Sample Number	Sample Identity	Depth (m)	Potassium	Sodium	Cadmium Low Level	Selenium Low Level	Solvent Ext. Matter Water	Tot. Org. Carbon In Water	Chloride (soluble)	Nitrate (soluble)	Phosphate (soluble)	Sulphate (soluble)	Electrical Conductivity	pH Value In Water	Alkalinity Total as CaCO3	Bicarbonate		
41	G1 STREAM	SURFACE	-	-	-	-	<1	3	-	-	-	-	-	-	-	-		
42	G1 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
43	G1 STREAM	SURFACE	2.6	20.0	<0.0004	<0.005	-	-	27	27.4	0.02	56	0.811	7.45	330	330		
44	G1 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
45	G1 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
46	N	SURFACE	-	-	-	-	2	6	-	-	-	-	-	-	-	-		
47	N	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
48	N	SURFACE	0.9	13.0	<0.0004	<0.005	-	-	34	52.3	0.08	33	0.809	7.63	350	350		
49	N	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
50	N	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
51	P1 SPRING	SURFACE	-	-	-	-	<1	3	-	-	-	-	-	-	-	-		
52	P1 SPRING	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
53	P1 SPRING	SURFACE	6.2	21.5	<0.0004	<0.005	-	-	46	45.5	0.01	58	0.815	7.06	310	310		
54	P1 SPRING	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
55	P1 SPRING	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
56	R2 STREAM	SURFACE	-	-	-	-	<1	2	-	-	-	-	-	-	-	-		
57	R2 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
58	R2 STREAM	SURFACE	1.5	14.0	<0.0004	<0.005	-	-	19	23.8	0.02	50	0.793	7.37	350	350		
59	R2 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
60	R2 STREAM	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

GEOCHEM

GEOCHEM ANALYTICAL SERVICES
TABLE OF RESULTS

Job Number : 98/01468/02/01
Client : ASPINWALL & COMPANY
Date of Receipt : 12/05/98
(of first sample)

Sample Type : WATER
Location : RAF UPPER HEYFORD
Client Contact : [redacted]
Client Ref. No. : TA 2502A

NAMAS TESTING No. 1291

☐ Preliminary
☑ Validated
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Sample Number	Sample Identity	Depth (m)	Potassium	Sodium	Cadmium Low Level	Selenium Low Level	Solvent Ext. Matter Water	Tot. Org. Carbon In Water	Chloride (soluble)	Nitrate (soluble)	Phosphate (soluble)	Sulphate (soluble)	Electrical Conductivity	pH Value In Water	Alkalinity Total as CaCO3	Bicarbonate		
Units			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	mS/cm		ppm	ppm		
Detection Method			Flame P	Flame P	GFAAS	GFAAS	Grav	IR	KONE	KONE	KONE	KONE	Meter	Meter	Titrat	Titre		
Detection Limits			<0.2	<0.2	<0.0004	<0.005	<1	<1	<5	<0.5	<0.01	<3	<0.001	<0.01	<1	<1		
61	BH1 A	35.00	-	-	-	-	1	3	-	-	-	-	-	-	-	-		
62	BH1 A	35.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
63	BH1 A	35.00	2.5	23.8	<0.0004	<0.005	-	-	74	28.3	0.10	142	0.996	7.36	400	400		
64	BH1 A	35.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
65	BH1 A	35.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
66	BH1 A	35.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
67	BH1 B	14.00	-	-	-	-	1	6	-	-	-	-	-	-	-	-		
68	BH1 B	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
69	BH1 B	14.00	2.0	13.8	<0.0004	<0.005	-	-	43	54.0	0.10	27	0.744	7.49	420	420		
70	BH1 B	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
71	BH1 B	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
72	BH1 B	14.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
73	BH 2	23.00	-	-	-	-	<1	5	-	-	-	-	-	-	-	-		
74	BH 2	23.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
75	BH 2	23.00	5.4	71.3	<0.0004	0.005	-	-	46	7.1	0.08	271	0.992	7.90	340	340		
76	BH 2	23.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
77	BH 2	23.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
78	BH 2	23.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
79	BH7	4.00	-	-	-	-	1	4	-	-	-	-	-	-	-	-		
80	BH7	4.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

Printed on 15 June 1998

Checked by [redacted]

GEOCHEM ANALYTICAL SERVICES
TABLE OF RESULTS

Job Number : 98/01468/02/01
Client : ASPINWALL & COMPANY
Date of Receipt : 12/05/98
(of first sample)

Sample Type : WATER
Location : RAF UPPER HEYFORD
Client Contact : [redacted]
Client Ref. No. : TA 2502A

NAMAS TESTING No. 1291

☐ Preliminary
☑ Validated
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Sample Number	Sample Identity	Depth (m)	Potassium	Sodium	Cadmium Low Level	Selenium Low Level	Solvent Ext. Matter Water	Tot. Org. Carbon In Water	Chloride (soluble)	Nitrate (soluble)	Phosphate (soluble)	Sulphate (soluble)	Electrical Conductivity	pH Value In Water	Alkalinity Total as CaCO3	Bicarbonate		
Units			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	mS/cm		ppm	ppm		
Detection Method			Flame P	Flame P	GFAAS	GFAAS	Grav	IR	KONE	KONE	KONE	KONE	Meter	Meter	Titrat	Titre		
Detection Limits			<0.2	<0.2	<0.0004	<0.005	<1	<1	<5	<0.5	<0.01	<3	<0.001	<0.01	<1	<1		
81	BH7	4.00	0.8	11.8	<0.0004	<0.005	-	-	28	3.1	0.02	20	0.375	7.38	380	380		
82	BH7	4.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
83	BH7	4.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
84	BH7	4.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
85	SPRING I	SURFACE	-	-	-	-	1	5	-	-	-	-	-	-	-	-		
86	SPRING I	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
87	SPRING I	SURFACE	4.9	19.3	<0.0004	0.007	-	-	38	7.6	0.01	19	0.594	7.48	320	320		
88	SPRING I	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
89	SPRING I	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
90	SPRING A	SURFACE	-	-	-	-	1	1	-	-	-	-	-	-	-	-		
91	SPRING A	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
92	SPRING A	SURFACE	0.8	10.3	<0.0004	<0.005	-	-	31	24.7	0.02	14	0.604	7.70	260	260		
93	SPRING A	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
94	SPRING A	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
95	SPRING B	SURFACE	-	-	-	-	1	3	-	-	-	-	-	-	-	-		
96	SPRING B	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
97	SPRING B	SURFACE	1.4	11.0	<0.0004	<0.005	-	-	37	30.7	0.03	25	0.653	7.43	300	300		
98	SPRING B	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
99	SPRING B	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
100	SPRING L	SURFACE	-	-	-	-	1	7	-	-	-	-	-	-	-	-		

Printed on 15 June 1998

Checked by ..... [redacted] ..... [redacted]

GEOCHEM ANALYTICAL SERVICES

TABLE OF RESULTS

Job Number : 98/01468/02/01
Client : ASPINWALL & COMPANY
Date of Receipt : 12/05/98
(of first sample)

Sample Type : WATER
Location : RAF UPPER HEYFORD
Client Contact : [redacted]
Client Ref. No. : TA 2502A

NAMAS TESTING No. 1291

☐ Preliminary
☑ Validated
☐ NAMAS Accredited

Sample Number	Sample Identity	Depth (m)	Potassium	Sodium	Cadmium Low Level	Selenium Low Level	Solvent Ext. Matter Water	Tot. Org. Carbon in Water	Chloride (soluble)	Nitrate (soluble)	Phosphate (soluble)	Sulphate (soluble)	Electrical Conductivity	pH Value in Water	Alkalinity Total as CaCO3	Bicarbonate		
Units			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	mS/cm		ppm	ppm		
Detection Method			Flame P	Flame P	GFAAS	GFAAS	Grav	IR	KONE	KONE	KONE	KONE	Meter	Meter	Titrat	Titre		
Detection Limits			<0.2	<0.2	<0.0004	<0.005	<1	<1	<5	<0.5	<0.01	<3	<0.001	<0.01	<1	<1		
101	SPRING L	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
102	SPRING L	SURFACE	2.0	21.4	<0.0004	<0.005	-	-	46	7.1	0.55	28	0.565	7.68	280	280		
103	SPRING L	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
104	SPRING L	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
105	SPRING M	SURFACE	-	-	-	-	1	3	-	-	-	-	-	-	-	-		
106	SPRING M	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
107	SPRING M	SURFACE	0.9	12.3	<0.0004	<0.005	-	-	26	32.3	0.51	36	0.606	7.62	280	280		
108	SPRING M	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
109	SPRING M	SURFACE	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

Printed on 15 June 1998

Checked by ..... [redacted] ..... [redacted]

Appendix 6b

Hydrocarbon Analyses

[redacted]

Geochem Analytical Services

Diesel Range Organics

by

G.C.

Client Ref:= -
Sample Matrix= Water
Job Number:= 98/01468/02/01

Date Sample Received:= 12/5/98
Date Extracted/Prepared:= 20/5/98
Date Analysed:= 20/5/98

Separatory Funnel Ext:= Yes
Soxtec Extraction:= No
Column Extraction:= Yes

Internal Standard:= A :- 2,2,4,4,6,8,8, HEPTAMETHYLNONANE B :- 1-CHLOROOCTADECANE C :- SQUALANE

Sample number	Sample Identity	Depth	Total Soluble Extract (mg/litre)	Diesel Range Hydrocarbons (µg/litre)	Interpretation
001	BH3A	3.50	1	204	No Identification Possible
007	BH3B	2.00	1	217	No Identification Possible
013	BH4	15.00	1	501	No Identification Possible
019	BH5	2.00	<1	14	No Identification Possible

Checked by [redacted]

Geochem Analytical Services

Diesel Range Organics
by
G.C.

Client Ref:= TA2502A
Sample Matrix= Water
Job Number:= 98/1468/02/01

Date Sample Received:= 13/05/98
Date Extracted/Prepared:= 26/05/98
Date Analysed:= 26/05/98

Separatory Funnel Ext:= Yes
Soxtec Extraction:= No
Column Extraction:= Yes

Internal Standard:= A :- 2,2,4,4,6,8,8, HEPTAMETHYLNONANE B :- 1-CHLOROOCTADECANE C :- SQUALANE

Sample number	Sample Identity	Depth	Total Soluble Extract (mg/litre)	Diesel Range Hydrocarbons (µg/litre)	Interpretation
025	BH6	14.00	<1	45	No Identification Possible
031	D	SURFACE	<1	38	No Identification Possible
036	F	SURFACE	<1	42	No Identification Possible
041	G 1 STREAM	SURFACE	<1	29	No Identification Possible
046	N	SURFACE	2	2489	Diesel
051	P 1 SPRING	SURFACE	<1	40	No Identification Possible
056	R2 STREAM	SURFACE	<1	44	No Identification Possible

Checked by [redacted]

Geochem Analytical Services

Diesel Range Organics
by
G.C.

Client Ref:= TA 2502A
Sample Matrix= Water
Job Number:= 98/1468/02/01

Date Sample Received:= 14/5/98
Date Extracted/Prepared:= 21/5/98
Date Analysed:= 21/5/98

Separatory Funnel Ext:= Yes
Soxtec Extraction:= No
Column Extraction:= Yes

Internal Standard:= A :- 2,2,4,4,6,8,8, HEPTAMETHYLNONANE B :- 1-CHLOROOCTADECANE C :- SQUALANE

Sample number	Sample Identity	Depth	Total Soluble Extract (mg/litre)	Diesel Range Hydrocarbons (µg/litre)	Interpretation
061	BH1 A	35.00	1	37	No Identification Possible
067	BH1 B	14.00	1	36	No Identification Possible
073	BH 2	23.00	<1	33	No Identification Possible

Checked by [redacted]

Geochem Analytical Services

Diesel Range Organics
by
G.C.

Client Ref:= TA 2502A
Sample Matrix= Water
Job Number:= 98/1468/02/01

Date Sample Received:= 15/05/98
Date Extracted/Prepared:= 00/01/00
Date Analysed:= 27/05/98

Separatory Funnel Ext:= Yes
Soxtec Extraction:= No
Column Extraction:= Yes

Internal Standard:= A :- 2,2,4,4,6,8,8, HEPTAMETHYLNONANE B :- 1-CHLOROOCTADECANE C :- SQUALANE

Sample number	Sample Identity	Depth	Total Soluble Extract (mg/litre)	Diesel Range Hydrocarbons (µg/litre)	Interpretation
079	BH7	4.00	1	22	No Identification Possible
085	SPRING I	SURFACE	1	783	Weathered Diesel
090	SPRING A	SURFACE	1	27	No Identification Possible
095	SPRING B	SURFACE	1	28	No Identification Possible
100	SPRING L	SURFACE	1	33	No Identification Possible
105	SPRING M	SURFACE	1	26	No Identification Possible

Checked by [redacted]

Geochem Analytical Services

Gasoline Range Organics

By

GC

Job No: 98/1468/02/01

Client: Aspinwall & Company

Matrix: Water

Units: µg/l

Sample No	Sample Ref	Depth m/ft	Total Volatiles
005	BH 3A	3.5	<10
011	BH 3B	2.0	<10
017	BH 4	15.0	<10
023	BH 5	2.0	<10

Checked by.....

Geochem Analytical Services

Gasoline Range Organics

By

GC

Job No: 98/1468/02/01

Client: Aspinwall & Company

Matrix: Water

Units: µg/l

Sample No	Sample Ref	Depth m/ft	Total Volatiles
029	BH 6	14.0	<10
035	D	SURF	<10
040	F	SURF	<10
045	G1 STREAM	SURF	<10
050	N	SURF	<10
055	P1 SPRING	SURF	<10
060	R2 STREAM	SURF	<10

Checked by.....

Geochem Analytical Services

Gasoline Range Organics

By

GC

Job No: 98/1468/02/01

Client: Aspinwall & Company

Matrix: Water

Units: µg/l

Sample No	Sample Ref	Depth m/ft	Total Volatiles
065	BH 1A	35.0	<10
071	BH 1B	14.0	<10
077	BH 2	23.0	<10

Checked by.....

Geochem Analytical Services

Gasoline Range Organics

By

GC

Job No: 98/1468/02/01

Client: Aspinwall & Company

Matrix: Water

Units: µg/l

Sample No	Sample Ref	Depth m/ft	Total Volatiles
083	BH 7	4.0	<10
089	SPRING I	SURF	<10
094	SPRING A	SURF	<10
099	SPRING B	SURF	<10
104	SPRING L	SURF	<10
109	SPRING M	SURF	<10

Checked by [redacted]

Geochem Analytical Services

BTEX Analysis

By

G.C.

Job No: 98/1468/02/01

Client: Aspinwall & Company

Matrix: Water

Units: µg/l

Sample No	Sample Ref	Depth m/ft	Benzene	Toluene	Ethyl Benzene	Total Xylene
005	BH 3A	3.5	<10	<10	<10	<10
011	BH 3B	2.0	<10	<10	<10	<10
017	BH 4	15.0	<10	<10	<10	<10
023	BH 5	2.0	<10	<10	<10	<10

Checked by.....

Geochem Analytical Services

BTEX (MTBE) Analysis

By

G.C.

Job No: 98/1468/02/01

Client: Aspinwall & Company

Matrix: Water

Units: µg/l

Smpl No	Sample Ref	Depth m/ft	MTBE	Benzene	Toluene	Ethyl Benzene	Total Xylene
029	BH 6	14.0	<10	<10	<10	<10	<10
035	D	SURF	<10	<10	<10	<10	<10
040	F	SURF	<10	<10	<10	<10	<10
045	G1 STREAM	SURF	<10	<10	<10	<10	<10
050	N	SURF	<10	<10	<10	<10	<10
055	P1 SPRING	SURF	<10	<10	<10	<10	<10
060	R2 STREAM	SURF	<10	<10	<10	<10	<10

Checked by.....

Geochem Analytical Services

BTEX (MTBE) Analysis

By

G.C.

Job No: 98/1468/02/01

Client: Aspinwall & Company

Matrix: Water

Units: µg/l

Smpl No	Sample Ref	Depth m/ft	MTBE	Benzene	Toluene	Ethyl Benzene	Total Xylene
065	BH 1A	35.0	<10	<10	<10	<10	<10
071	BH 1B	14.0	<10	<10	<10	<10	<10
077	BH 2	23.0	<10	<10	<10	<10	<10

Checked by.....

Geochem Analytical Services

BTEX (MTBE) Analysis

By

G.C.

Job No: 98/1468/02/01

Client: Aspinwall & Company

Matrix: Water

Units: µg/l

Smpl No	Sample Ref	Depth m/ft	MTBE	Benzene	Toluene	Ethyl Benzene	Total Xylene
083	BH 7	4.0	<10	<10	<10	<10	<10
089	SPRING I	SURF	<10	<10	<10	<10	<10
094	SPRING A	SURF	<10	<10	<10	<10	<10
099	SPRING B	SURF	<10	<10	<10	<10	<10
104	SPRING L	SURF	<10	<10	<10	<10	<10
109	SPRING M	SURF	<10	<10	<10	<10	<10

Checked by. [redacted]

Appendix 6c

Phenol Analyses

Geochem Analytical Services

Phenols
By
G.C.M.S.

Sample Matrix :	Water
Our Reference:	98/1468/02/01
Date Sample Received:	12/05/98
Date Extracted/Prepared:	20/05/98
Separatory Funnel Ext:	No
Soxtec Extraction:	No
Column Extraction:	Yes
Date Analysed:	22/05/98
GC-MS Mode:	SIM
Internal Standard:	External

CAS Number	Sample No.	002	008	014	020	
	Client Ref.	BH3A	BH3B	H4 15.	BH5 2.0	
	P.Q.L.	001	001	001	001	
	Units	µg/l	µg/l	µg/l	µg/l	
108-95-2	Phenol	<0.5	<0.5	<0.5	<0.5	
95-57-8	2-Chlorophenol	<0.5	<0.5	<0.5	<0.5	
88-75-5	2-Nitrophenol	<0.5	<0.5	<0.5	<0.5	
105-67-9	2,4-Dimethylphenol	<0.5	<0.5	<0.5	<0.5	
120-83-2	2,4-Dichlorophenol	<0.5	<0.5	<0.5	<0.5	
59-50-7	4-Chloro-3-methylphenol	<0.5	<0.5	<0.5	<0.5	
88-06-2	2,4,6-Trichlorophenol	<0.5	<0.5	<0.5	<0.5	
100-02-7	4-Nitrophenol	<0.5	<0.5	<0.5	<0.5	
87-86-5	Pentachlorophenol	<0.5	<0.5	<0.5	<0.5	

Approved by [redacted].....

Geochem Analytical Services

Phenols
By
G.C.M.S.

Sample Matrix :	Water
Our Reference:	98/1468/02/02
Date Sample Received:	13/05/98
Date Extracted/Prepared:	26/05/98
Separatory Funnel Ext:	No
Soxtec Extraction:	No
Column Extraction:	Yes
Date Analysed:	26/05/98
GC-MS Mode:	SIM
Internal Standard:	External

	Sample No.	026	032	037	042	047
	Client Ref.	BH6 14	D Surfac	F Surfac	1strea	N Surfac
	P.Q.L.	001	001	001	001	001
CAS Number	Units	µg/l	µg/l	µg/l	µg/l	µg/l
108-95-2	Phenol	<0.5	<0.5	<0.5	<0.5	<0.5
95-57-8	2-Chlorophenol	<0.5	<0.5	<0.5	<0.5	<0.5
88-75-5	2-Nitrophenol	<0.5	<0.5	<0.5	<0.5	<0.5
105-67-9	2,4-Dimethylphenol	<0.5	<0.5	<0.5	<0.5	<0.5
120-83-2	2,4-Dichlorophenol	<0.5	<0.5	<0.5	<0.5	<0.5
59-50-7	4-Chloro-3-methylphenol	<0.5	<0.5	<0.5	<0.5	<0.5
88-06-2	2,4,6-Trichlorophenol	<0.5	<0.5	<0.5	<0.5	<0.5
100-02-7	4-Nitrophenol	<0.5	<0.5	<0.5	<0.5	<0.5
87-86-5	Pentachlorophenol	<0.5	<0.5	<0.5	<0.5	<0.5

Approved by :.....



Geochem Analytical Services

Phenols
By
G.C.M.S.

Sample Matrix :	Water
Our Reference:	98/1468/02/02
Date Sample Received:	13/05/98
Date Extracted/Prepared:	26/05/98
Separatory Funnel Ext:	No
Soxtec Extraction:	No
Column Extraction:	Yes
Date Analysed:	26/05/98
GC-MS Mode:	SIM
Internal Standard:	External

CAS Number	Sample No.	052	057			
	Client Ref.	P1spring	R2strea			
	P.Q.L.	001	001			
	Units	µg/l	µg/l			
108-95-2	Phenol	<0.5	<0.5			
95-57-8	2-Chlorophenol	<0.5	<0.5			
88-75-5	2-Nitrophenol	<0.5	<0.5			
105-67-9	2,4-Dimethylphenol	<0.5	<0.5			
120-83-2	2,4-Dichlorophenol	<0.5	<0.5			
59-50-7	4-Chloro-3-methylphenol	<0.5	<0.5			
88-06-2	2,4,6-Trichlorophenol	<0.5	<0.5			
100-02-7	4-Nitrophenol	<0.5	<0.5			
87-86-5	Pentachlorophenol	<0.5	<0.5			

Approved by :.....



Geochem Analytical Services

Phenols
By
G.C.M.S.

Sample Matrix :	Water
Our Reference:	98/1468/02/03
Date Sample Received:	14/05/98
Date Extracted/Prepared:	22/05/98
Separatory Funnel Ext:	No
Soxtec Extraction:	No
Column Extraction:	Yes
Date Analysed:	23/05/98
GC-MS Mode:	SIM
Internal Standard:	External

CAS Number	Sample No.	062	068	074		
	Client Ref.	BH1A 3	BH1B 1	BH2 23		
	P.Q.L.	001	001	001		
	Units	µg/l	µg/l	µg/l		
108-95-2	Phenol	<0.5	<0.5	<0.5		
95-57-8	2-Chlorophenol	<0.5	<0.5	<0.5		
88-75-5	2-Nitrophenol	<0.5	<0.5	<0.5		
105-67-9	2,4-Dimethylphenol	<0.5	<0.5	<0.5		
120-83-2	2,4-Dichlorophenol	<0.5	<0.5	<0.5		
59-50-7	4-Chloro-3-methylphenol	<0.5	<0.5	<0.5		
88-06-2	2,4,6-Trichlorophenol	<0.5	<0.5	<0.5		
100-02-7	4-Nitrophenol	<0.5	<0.5	<0.5		
87-86-5	Pentachlorophenol	<0.5	<0.5	<0.5		

Approved by :....[redacted]

Geochem Analytical Services

Phenols
By
G.C.M.S.

Sample Matrix :	Water
Our Reference:	98/01468/02/01
Date Sample Received:	15/05/98
Date Extracted/Prepared:	27/05/98
Separatory Funnel Ext:	No
Soxtec Extraction:	Yes
Column Extraction:	No
Date Analysed:	01/06/98
GC-MS Mode:	SIM
Internal Standard:	External

CAS Number	Sample No.	080	086	091	096	101
	Client Ref.	BH7	Spring I	Spring A	Spring B.	Spring L
	P.Q.L.	0.5	0.5	0.5	0.5	0.5
	Units	µg/l	µg/l	µg/l	µg/l	µg/l
108-95-2	Phenol	<0.5	<0.5	<0.5	<0.5	<0.5
95-57-8	2-Chlorophenol	<0.5	<0.5	<0.5	<0.5	<0.5
88-75-5	2-Nitrophenol	<0.5	<0.5	<0.5	<0.5	<0.5
105-67-9	2,4-Dimethylphenol	<0.5	<0.5	<0.5	<0.5	<0.5
120-83-2	2,4-Dichlorophenol	<0.5	<0.5	<0.5	<0.5	<0.5
59-50-7	4-Chloro-3-methylphenol	<0.5	<0.5	<0.5	<0.5	<0.5
88-06-2	2,4,6-Trichlorophenol	<0.5	<0.5	<0.5	<0.5	<0.5
100-02-7	4-Nitrophenol	<0.5	<0.5	<0.5	<0.5	<0.5
87-86-5	Pentachlorophenol	<0.5	<0.5	<0.5	<0.5	<0.5

Approved by :.....

Geochem Analytical Services

Phenols
By
G.C.M.S.

Sample Matrix :	Water
Our Reference:	98/01468/02/01
Date Sample Received:	15/05/98
Date Extracted/Prepared:	27/05/98
Separatory Funnel Ext:	No
Soxtec Extraction:	Yes
Column Extraction:	No
Date Analysed:	01/06/98
GC-MS Mode:	SIM
Internal Standard:	External

	Sample No.	106				
	Client Ref.	Spring M				
	P.Q.L.	0.5				
CAS Number	Units	µg/l				
108-95-2	Phenol	<0.5				
95-57-8	2-Chlorophenol	<0.5				
88-75-5	2-Nitrophenol	<0.5				
105-67-9	2,4-Dimethylphenol	<0.5				
120-83-2	2,4-Dichlorophenol	<0.5				
59-50-7	4-Chloro-3-methylphenol	<0.5				
88-06-2	2,4,6-Trichlorophenol	<0.5				
100-02-7	4-Nitrophenol	<0.5				
87-86-5	Pentachlorophenol	<0.5				

Approved by : [redacted]

Appendix 6d

Volatile Organic Compounds

GEOCHEM

Geochem Analytical Services

Volatile Organic Compounds (EPA 624/8260)

NAMAS TESTING No. 1291

Sample Identity - 1468-006 BH3A 3.50m
Client / Sample matrix - Aspinwall & Company/Water
Date Acquired - 05/16/98 02:57
Instrument Name - MSD Vols5
Units - ppb

CAS No.	Compound	Conc.	CAS No.	Compound	Conc.
75-71-8	Dichlorodifluoromethane	< 1	127-18-4	Tetrachloroethene	< 1
74-87-3	Chloromethane	< 1	630-20-6	1,1,1,2-Tetrachloroethane	< 1
75-01-4	Vinyl chloride	< 1	108-90-7	Chlorobenzene	< 1
74-83-9	Bromomethane	< 1	100-41-4	Ethylbenzene	< 1
75-00-3	Chloroethane	< 1	108-38-3*	p/m-Xylene	< 1
75-69-4	Trichlorofluoromethane	< 1	75-25-2	Bromoform	< 1
156-60-5	trans-1,2-Dichloroethene	< 1	100-42-5	Styrene	< 1
75-09-2	Dichloromethane	< 1	79-34-5	1,1,2,2-Tetrachloroethane	< 1
75-35-4	1,1-Dichloroethene	< 1	95-47-6	o-Xylene	< 1
75-34-3	1,1-Dichloroethane	< 1	96-18-4	1,2,3-Trichloropropane	< 1
156-59-2	cis-1,2-Dichloroethene	< 1	98-82-8	Isopropylbenzene	< 1
74-97-5	Bromochloromethane	< 1	108-86-1	Bromobenzene	< 1
67-66-3	Chloroform	< 1	95-49-8	2-Chlorotoluene	< 1
594-20-7	2,2-Dichloropropane	< 1	103-65-1	Propylbenzene	< 1
107-06-2	1,2-Dichloroethane	< 1	106-43-4	4-Chlorotoluene	< 1
71-55-6	1,1,1-Trichloroethane	< 1	95-63-6	1,2,4-Trimethylbenzene	< 1
563-58-6	1,1-Dichloropropene	< 1	99-87-6	4-Isopropyltoluene	< 1
71-43-2	Benzene	< 1	108-67-6	1,3,5-Trimethylbenzene	< 1
56-23-5	Carbontetrachloride	< 1	95-50-1	1,2-Dichlorobenzene	< 1
74-95-3	Dibromomethane	< 1	106-46-7	1,4-Dichlorobenzene	< 1
78-87-5	1,2-Dichloropropane	< 1	135-98-8	sec-Butylbenzene	< 1
75-27-4	Bromodichloromethane	< 1	98-06-6	tert-Butylbenzene	< 1
79-01-6	Trichloroethene	< 1	541-73-1	1,3-Dichlorobenzene	< 1
10061-01-5	cis-1,3-Dichloropropene	< 1	104-51-8	n-Butylbenzene	< 1
10061-02-6	trans-1,3-Dichloropropene	< 1	96-12-8	1,2-Dibromo-3-chloropropane	< 1
79-00-5	1,1,2-Trichloroethane	< 1	120-82-1	1,2,4-Trichlorobenzene	< 1
108-88-3	Toluene	< 1	91-20-3	Naphthalene	< 1
142-28-9	1,3-Dichloropropane	< 1	87-61-6	1,2,3-Trichlorobenzene	< 1
124-48-1	Dibromochloromethane	< 1	87-68-3	Hexachlorobutadiene	< 1
106-93-4	1,2-Dibromoethane	< 1			

N.B. * also CAS No. 106-42-3

** [redacted]

Approved by - ...[redacted]

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Geochem Analytical Services

Volatile Organic Compounds (EPA 624/8260)

NAMAS TESTING No. 1291

Sample Identity - 1468-012 BH3B 2.00m
Client / Sample matrix - Aspinwall & Company/Water
Date Acquired - 05/16/98 03:31
Instrument Name - MSD Vols5
Units - ppb

CAS No.	Compound	Conc.	CAS No.	Compound	Conc.
75-71-8	Dichlorodifluoromethane	< 1	127-18-4	Tetrachloroethene	< 1
74-87-3	Chloromethane	< 1	630-20-6	1,1,1,2-Tetrachloroethane	< 1
75-01-4	Vinyl chloride	< 1	108-90-7	Chlorobenzene	< 1
74-83-9	Bromomethane	< 1	100-41-4	Ethylbenzene	< 1
75-00-3	Chloroethane	< 1	108-38-3*	p/m-Xylene	< 1
75-69-4	Trichlorofluoromethane	< 1	75-25-2	Bromoform	< 1
156-60-5	trans-1,2-Dichloroethene	< 1	100-42-5	Styrene	< 1
75-09-2	Dichloromethane	< 1	79-34-5	1,1,2,2-Tetrachloroethane	< 1
75-35-4	1,1-Dichloroethene	< 1	95-47-6	o-Xylene	< 1
75-34-3	1,1-Dichloroethane	< 1	96-18-4	1,2,3-Trichloropropane	< 1
156-59-2	cis-1,2-Dichloroethene	< 1	98-82-8	Isopropylbenzene	< 1
74-97-5	Bromochloromethane	< 1	108-86-1	Bromobenzene	< 1
67-66-3	Chloroform	< 1	95-49-8	2-Chlorotoluene	< 1
594-20-7	2,2-Dichloropropane	< 1	103-65-1	Propylbenzene	< 1
107-06-2	1,2-Dichloroethane	< 1	106-43-4	4-Chlorotoluene	< 1
71-55-6	1,1,1-Trichloroethane	< 1	95-63-6	1,2,4-Trimethylbenzene	< 1
563-58-6	1,1-Dichloropropene	< 1	99-87-6	4-Isopropyltoluene	< 1
71-43-2	Benzene	< 1	108-67-6	1,3,5-Trimethylbenzene	< 1
56-23-5	Carbontetrachloride	< 1	95-50-1	1,2-Dichlorobenzene	< 1
74-95-3	Dibromomethane	< 1	106-46-7	1,4-Dichlorobenzene	< 1
78-87-5	1,2-Dichloropropane	< 1	135-98-8	sec-Butylbenzene	< 1
75-27-4	Bromodichloromethane	< 1	98-06-6	tert-Butylbenzene	< 1
79-01-6	Trichloroethene	< 1	541-73-1	1,3-Dichlorobenzene	< 1
10061-01-5	cis-1,3-Dichloropropene	< 1	104-51-8	n-Butylbenzene	< 1
10061-02-6	trans-1,3-Dichloropropene	< 1	96-12-8	1,2-Dibromo-3-chloropropane	< 1
79-00-5	1,1,2-Trichloroethane	< 1	120-82-1	1,2,4-Trichlorobenzene	< 1
108-88-3	Toluene	< 1	91-20-3	Naphthalene	< 1
142-28-9	1,3-Dichloropropane	< 1	87-61-6	1,2,3-Trichlorobenzene	< 1
124-48-1	Dibromochloromethane	< 1	87-68-3	Hexachlorobutadiene	< 1
106-93-4	1,2-Dibromoethane	< 1			

N.B. * also CAS No. 106-42-3

Approved by - [redacted]

Geochem Analytical Services

Volatile Organic Compounds (EPA 624/8260)

NAMAS TESTING No. 1291

Sample Identity - 1468-018 BH4 15.00m
Client / Sample matrix - Aspinwall & Company/Water
Date Acquired - 05/16/98 04:05
Instrument Name - MSD Vols5
Units - ppb

CAS No.	Compound	Conc.	CAS No.	Compound	Conc.
75-71-8	Dichlorodifluoromethane	< 1	127-18-4	Tetrachloroethene	< 1
74-87-3	Chloromethane	< 1	630-20-6	1,1,1,2-Tetrachloroethane	< 1
75-01-4	Vinyl chloride	< 1	108-90-7	Chlorobenzene	< 1
74-83-9	Bromomethane	< 1	100-41-4	Ethylbenzene	< 1
75-00-3	Chloroethane	< 1	108-38-3*	p/m-Xylene	< 1
75-69-4	Trichlorofluoromethane	< 1	75-25-2	Bromoform	< 1
156-60-5	trans-1,2-Dichloroethene	< 1	100-42-5	Styrene	< 1
75-09-2	Dichloromethane	< 1	79-34-5	1,1,2,2-Tetrachloroethane	< 1
75-35-4	1,1-Dichloroethene	< 1	95-47-6	o-Xylene	< 1
75-34-3	1,1-Dichloroethane	< 1	96-18-4	1,2,3-Trichloropropane	< 1
156-59-2	cis-1,2-Dichloroethene	< 1	98-82-8	Isopropylbenzene	< 1
74-97-5	Bromochloromethane	< 1	108-86-1	Bromobenzene	< 1
67-66-3	Chloroform	< 1	95-49-8	2-Chlorotoluene	< 1
594-20-7	2,2-Dichloropropane	< 1	103-65-1	Propylbenzene	< 1
107-06-2	1,2-Dichloroethane	< 1	106-43-4	4-Chlorotoluene	< 1
71-55-6	1,1,1-Trichloroethane	< 1	95-63-6	1,2,4-Trimethylbenzene	< 1
563-58-6	1,1-Dichloropropene	< 1	99-87-6	4-Isopropyltoluene	< 1
71-43-2	Benzene	< 1	108-67-6	1,3,5-Trimethylbenzene	< 1
56-23-5	Carbontetrachloride	< 1	95-50-1	1,2-Dichlorobenzene	< 1
74-95-3	Dibromomethane	< 1	106-46-7	1,4-Dichlorobenzene	< 1
78-87-5	1,2-Dichloropropane	< 1	135-98-8	sec-Butylbenzene	< 1
75-27-4	Bromodichloromethane	< 1	98-06-6	tert-Butylbenzene	< 1
79-01-6	Trichloroethene	< 1	541-73-1	1,3-Dichlorobenzene	< 1
10061-01-5	cis-1,3-Dichloropropene	< 1	104-51-8	n-Butylbenzene	< 1
10061-02-6	trans-1,3-Dichloropropene	< 1	96-12-8	1,2-Dibromo-3-chloropropane	< 1
79-00-5	1,1,2-Trichloroethane	< 1	120-82-1	1,2,4-Trichlorobenzene	< 1
108-88-3	Toluene	< 1	91-20-3	Naphthalene	< 1
142-28-9	1,3-Dichloropropane	< 1	87-61-6	1,2,3-Trichlorobenzene	< 1
124-48-1	Dibromochloromethane	< 1	87-68-3	Hexachlorobutadiene	< 1
106-93-4	1,2-Dibromoethane	< 1			

N.B. * also CAS No. 106-42-3 **

Approved by - ....

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Geochem Analytical Services

Volatile Organic Compounds (EPA 624/8260)

NAMAS TESTING No. 1291

Sample Identity - 1468-024 BH5 2.00m
Client / Sample matrix - Aspinwall & Company/Water
Date Acquired - 05/16/98 04:40
Instrument Name - MSD Vols5
Units - ppb

CAS No.	Compound	Conc.	CAS No.	Compound	Conc.
75-71-8	Dichlorodifluoromethane	< 1	127-18-4	Tetrachloroethene	< 1
74-87-3	Chloromethane	< 1	630-20-6	1,1,1,2-Tetrachloroethane	< 1
75-01-4	Vinyl chloride	< 1	108-90-7	Chlorobenzene	< 1
74-83-9	Bromomethane	< 1	100-41-4	Ethylbenzene	< 1
75-00-3	Chloroethane	< 1	108-38-3*	p/m-Xylene	< 1
75-69-4	Trichlorofluoromethane	< 1	75-25-2	Bromoform	< 1
156-60-5	trans-1,2-Dichloroethene	< 1	100-42-5	Styrene	< 1
75-09-2	Dichloromethane	< 1	79-34-5	1,1,2,2-Tetrachloroethane	< 1
75-35-4	1,1-Dichloroethene	< 1	95-47-6	o-Xylene	< 1
75-34-3	1,1-Dichloroethane	< 1	96-18-4	1,2,3-Trichloropropane	< 1
156-59-2	cis-1,2-Dichloroethene	< 1	98-82-8	Isopropylbenzene	< 1
74-97-5	Bromochloromethane	< 1	108-86-1	Bromobenzene	< 1
67-66-3	Chloroform	< 1	95-49-8	2-Chlorotoluene	< 1
594-20-7	2,2-Dichloropropane	< 1	103-65-1	Propylbenzene	< 1
107-06-2	1,2-Dichloroethane	< 1	106-43-4	4-Chlorotoluene	< 1
71-55-6	1,1,1-Trichloroethane	< 1	95-63-6	1,2,4-Trimethylbenzene	< 1
563-58-6	1,1-Dichloropropene	< 1	99-87-6	4-Isopropyltoluene	< 1
71-43-2	Benzene	< 1	108-67-6	1,3,5-Trimethylbenzene	< 1
56-23-5	Carbontetrachloride	< 1	95-50-1	1,2-Dichlorobenzene	< 1
74-95-3	Dibromomethane	< 1	106-46-7	1,4-Dichlorobenzene	< 1
78-87-5	1,2-Dichloropropane	< 1	135-98-8	sec-Butylbenzene	< 1
75-27-4	Bromodichloromethane	< 1	98-06-6	tert-Butylbenzene	< 1
79-01-6	Trichloroethene	< 1	541-73-1	1,3-Dichlorobenzene	< 1
10061-01-5	cis-1,3-Dichloropropene	< 1	104-51-8	n-Butylbenzene	< 1
10061-02-6	trans-1,3-Dichloropropene	< 1	96-12-8	1,2-Dibromo-3-chloropropane	< 1
79-00-5	1,1,2-Trichloroethane	< 1	120-82-1	1,2,4-Trichlorobenzene	< 1
108-88-3	Toluene	< 1	91-20-3	Naphthalene	< 1
142-28-9	1,3-Dichloropropane	< 1	87-61-6	1,2,3-Trichlorobenzene	< 1
124-48-1	Dibromochloromethane	< 1	87-68-3	Hexachlorobutadiene	< 1
106-93-4	1,2-Dibromoethane	< 1			

N.B. * also CAS No. 106-42-3 **

Approved by - ...

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Geochem Analytical Services

Volatile Organic Compounds (EPA 624/8260)

NAMAS TESTING No. 1291

Sample Identity - 1468-030 BH6 14.00m
Client / Sample matrix - Aspinwall & Company/Water
Date Acquired - 05/16/98 05:14
Instrument Name - MSD Vols5
Units - ppb

CAS No.	Compound	Conc.	CAS No.	Compound	Conc.
75-71-8	Dichlorodifluoromethane	< 1	127-18-4	Tetrachloroethene	< 1
74-87-3	Chloromethane	< 1	630-20-6	1,1,1,2-Tetrachloroethane	< 1
75-01-4	Vinyl chloride	< 1	108-90-7	Chlorobenzene	< 1
74-83-9	Bromomethane	< 1	100-41-4	Ethylbenzene	< 1
75-00-3	Chloroethane	< 1	108-38-3*	p/m-Xylene	< 1
75-69-4	Trichlorofluoromethane	< 1	75-25-2	Bromoform	< 1
156-60-5	trans-1,2-Dichloroethene	< 1	100-42-5	Styrene	< 1
75-09-2	Dichloromethane	< 1	79-34-5	1,1,2,2-Tetrachloroethane	< 1
75-35-4	1,1-Dichloroethene	< 1	95-47-6	o-Xylene	< 1
75-34-3	1,1-Dichloroethane	< 1	96-18-4	1,2,3-Trichloropropane	< 1
156-59-2	cis-1,2-Dichloroethene	< 1	98-82-8	Isopropylbenzene	< 1
74-97-5	Bromochloromethane	< 1	108-86-1	Bromobenzene	< 1
67-66-3	Chloroform	< 1	95-49-8	2-Chlorotoluene	< 1
594-20-7	2,2-Dichloropropane	< 1	103-65-1	Propylbenzene	< 1
107-06-2	1,2-Dichloroethane	< 1	106-43-4	4-Chlorotoluene	< 1
71-55-6	1,1,1-Trichloroethane	< 1	95-63-6	1,2,4-Trimethylbenzene	< 1
563-58-6	1,1-Dichloropropene	< 1	99-87-6	4-Isopropyltoluene	< 1
71-43-2	Benzene	< 1	108-67-6	1,3,5-Trimethylbenzene	< 1
56-23-5	Carbontetrachloride	< 1	95-50-1	1,2-Dichlorobenzene	< 1
74-95-3	Dibromomethane	< 1	106-46-7	1,4-Dichlorobenzene	< 1
78-87-5	1,2-Dichloropropane	< 1	135-98-8	sec-Butylbenzene	< 1
75-27-4	Bromodichloromethane	< 1	98-06-6	tert-Butylbenzene	< 1
79-01-6	Trichloroethene	< 1	541-73-1	1,3-Dichlorobenzene	< 1
10061-01-5	cis-1,3-Dichloropropene	< 1	104-51-8	n-Butylbenzene	< 1
10061-02-6	trans-1,3-Dichloropropene	< 1	96-12-8	1,2-Dibromo-3-chloropropane	< 1
79-00-5	1,1,2-Trichloroethane	< 1	120-82-1	1,2,4-Trichlorobenzene	< 1
108-88-3	Toluene	< 1	91-20-3	Naphthalene	< 1
142-28-9	1,3-Dichloropropane	< 1	87-61-6	1,2,3-Trichlorobenzene	< 1
124-48-1	Dibromochloromethane	< 1	87-68-3	Hexachlorobutadiene	< 1
106-93-4	1,2-Dibromoethane	< 1			

N.B. * also CAS No. 106-42-3

Approved by - [redacted]

Geochem Analytical Services

Volatile Organic Compounds (EPA 624/8260)

NAMAS TESTING No. 1291

Sample Identity - 1468-066 BH1A 35.00m
Client / Sample matrix - Aspinwall & Company/Water
Date Acquired - 05/16/98 05:48
Instrument Name - MSD Vols5
Units - ppb

CAS No.	Compound	Conc.	CAS No.	Compound	Conc.
75-71-8	Dichlorodifluoromethane	< 1	127-18-4	Tetrachloroethene	< 1
74-87-3	Chloromethane	< 1	630-20-6	1,1,1,2-Tetrachloroethane	< 1
75-01-4	Vinyl chloride	< 1	108-90-7	Chlorobenzene	< 1
74-83-9	Bromomethane	< 1	100-41-4	Ethylbenzene	< 1
75-00-3	Chloroethane	< 1	108-38-3*	p/m-Xylene	< 1
75-69-4	Trichlorofluoromethane	< 1	75-25-2	Bromoform	< 1
156-60-5	trans-1,2-Dichloroethene	< 1	100-42-5	Styrene	< 1
75-09-2	Dichloromethane	< 1	79-34-5	1,1,2,2-Tetrachloroethane	< 1
75-35-4	1,1-Dichloroethene	< 1	95-47-6	o-Xylene	< 1
75-34-3	1,1-Dichloroethane	< 1	96-18-4	1,2,3-Trichloropropane	< 1
156-59-2	cis-1,2-Dichloroethene	< 1	98-82-8	Isopropylbenzene	< 1
74-97-5	Bromochloromethane	< 1	108-86-1	Bromobenzene	< 1
67-66-3	Chloroform	< 1	95-49-8	2-Chlorotoluene	< 1
594-20-7	2,2-Dichloropropane	< 1	103-65-1	Propylbenzene	< 1
107-06-2	1,2-Dichloroethane	< 1	106-43-4	4-Chlorotoluene	< 1
71-55-6	1,1,1-Trichloroethane	< 1	95-63-6	1,2,4-Trimethylbenzene	< 1
563-58-6	1,1-Dichloropropene	< 1	99-87-6	4-Isopropyltoluene	< 1
71-43-2	Benzene	< 1	108-67-6	1,3,5-Trimethylbenzene	< 1
56-23-5	Carbontetrachloride	< 1	95-50-1	1,2-Dichlorobenzene	< 1
74-95-3	Dibromomethane	< 1	106-46-7	1,4-Dichlorobenzene	< 1
78-87-5	1,2-Dichloropropane	< 1	135-98-8	sec-Butylbenzene	< 1
75-27-4	Bromodichloromethane	< 1	98-06-6	tert-Butylbenzene	< 1
79-01-6	Trichloroethene	< 1	541-73-1	1,3-Dichlorobenzene	< 1
10061-01-5	cis-1,3-Dichloropropene	< 1	104-51-8	n-Butylbenzene	< 1
10061-02-6	trans-1,3-Dichloropropene	< 1	96-12-8	1,2-Dibromo-3-chloropropane	< 1
79-00-5	1,1,2-Trichloroethane	< 1	120-82-1	1,2,4-Trichlorobenzene	< 1
108-88-3	Toluene	< 1	91-20-3	Naphthalene	< 1
142-28-9	1,3-Dichloropropane	< 1	87-61-6	1,2,3-Trichlorobenzene	< 1
124-48-1	Dibromochloromethane	< 1	87-68-3	Hexachlorobutadiene	< 1
106-93-4	1,2-Dibromoethane	< 1			

N.B. * also CAS No. 106-42-3 **

Approved by - .....

Geochem Analytical Services

Volatile Organic Compounds (EPA 624/8260)

NAMAS TESTING No. 1291

Sample Identity - 1468-072 BH1B 14.00m
Client / Sample matrix - Aspinwall & Company/Water
Date Acquired - 05/16/98 06:23
Instrument Name - MSD Vols5
Units - ppb

CAS No.	Compound	Conc.	CAS No.	Compound	Conc.
75-71-8	Dichlorodifluoromethane	< 1	127-18-4	Tetrachloroethene	< 1
74-87-3	Chloromethane	< 1	630-20-6	1,1,1,2-Tetrachloroethane	< 1
75-01-4	Vinyl chloride	< 1	108-90-7	Chlorobenzene	< 1
74-83-9	Bromomethane	< 1	100-41-4	Ethylbenzene	< 1
75-00-3	Chloroethane	< 1	108-38-3*	p/m-Xylene	< 1
75-69-4	Trichlorofluoromethane	< 1	75-25-2	Bromoform	< 1
156-60-5	trans-1,2-Dichloroethene	< 1	100-42-5	Styrene	< 1
75-09-2	Dichloromethane	< 1	79-34-5	1,1,2,2-Tetrachloroethane	< 1
75-35-4	1,1-Dichloroethene	< 1	95-47-6	o-Xylene	< 1
75-34-3	1,1-Dichloroethane	< 1	96-18-4	1,2,3-Trichloropropane	< 1
156-59-2	cis-1,2-Dichloroethene	< 1	98-82-8	Isopropylbenzene	< 1
74-97-5	Bromochloromethane	< 1	108-86-1	Bromobenzene	< 1
67-66-3	Chloroform	< 1	95-49-8	2-Chlorotoluene	< 1
594-20-7	2,2-Dichloropropane	< 1	103-65-1	Propylbenzene	< 1
107-06-2	1,2-Dichloroethane	< 1	106-43-4	4-Chlorotoluene	< 1
71-55-6	1,1,1-Trichloroethane	< 1	95-63-6	1,2,4-Trimethylbenzene	< 1
563-58-6	1,1-Dichloropropene	< 1	99-87-6	4-Isopropyltoluene	< 1
71-43-2	Benzene	< 1	108-67-6	1,3,5-Trimethylbenzene	< 1
56-23-5	Carbontetrachloride	< 1	95-50-1	1,2-Dichlorobenzene	< 1
74-95-3	Dibromomethane	< 1	106-46-7	1,4-Dichlorobenzene	< 1
78-87-5	1,2-Dichloropropane	< 1	135-98-8	sec-Butylbenzene	< 1
75-27-4	Bromodichloromethane	< 1	98-06-6	tert-Butylbenzene	< 1
79-01-6	Trichloroethene	< 1	541-73-1	1,3-Dichlorobenzene	< 1
10061-01-5	cis-1,3-Dichloropropene	< 1	104-51-8	n-Butylbenzene	< 1
10061-02-6	trans-1,3-Dichloropropene	< 1	96-12-8	1,2-Dibromo-3-chloropropane	< 1
79-00-5	1,1,2-Trichloroethane	< 1	120-82-1	1,2,4-Trichlorobenzene	< 1
108-88-3	Toluene	< 1	91-20-3	Naphthalene	< 1
142-28-9	1,3-Dichloropropane	< 1	87-61-6	1,2,3-Trichlorobenzene	< 1
124-48-1	Dibromochloromethane	< 1	87-68-3	Hexachlorobutadiene	< 1
106-93-4	1,2-Dibromoethane	< 1			

N.B. * also CAS No. 106-42-3 ** V[redacted]

Approved by - .....[redacted]

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Geochem Analytical Services

Volatile Organic Compounds (EPA 624/8260)

NAMAS TESTING No. 1291

Sample Identity - 1468-078 BH2 23.00m
Client / Sample matrix - Aspinwall & Company/Water
Date Acquired - 05/16/98 06:57
Instrument Name - MSD Vols5
Units - ppb

CAS No.	Compound	Conc.	CAS No.	Compound	Conc.
75-71-8	Dichlorodifluoromethane	< 1	127-18-4	Tetrachloroethene	< 1
74-87-3	Chloromethane	< 1	630-20-6	1,1,1,2-Tetrachloroethane	< 1
75-01-4	Vinyl chloride	< 1	108-90-7	Chlorobenzene	< 1
74-83-9	Bromomethane	< 1	100-41-4	Ethylbenzene	< 1
75-00-3	Chloroethane	< 1	108-38-3*	p/m-Xylene	< 1
75-69-4	Trichlorofluoromethane	< 1	75-25-2	Bromoform	< 1
156-60-5	trans-1,2-Dichloroethene	< 1	100-42-5	Styrene	< 1
75-09-2	Dichloromethane	< 1	79-34-5	1,1,2,2-Tetrachloroethane	< 1
75-35-4	1,1-Dichloroethene	< 1	95-47-6	o-Xylene	< 1
75-34-3	1,1-Dichloroethane	< 1	96-18-4	1,2,3-Trichloropropane	< 1
156-59-2	cis-1,2-Dichloroethene	< 1	98-82-8	Isopropylbenzene	< 1
74-97-5	Bromochloromethane	< 1	108-86-1	Bromobenzene	< 1
67-66-3	Chloroform	< 1	95-49-8	2-Chlorotoluene	< 1
594-20-7	2,2-Dichloropropane	< 1	103-65-1	Propylbenzene	< 1
107-06-2	1,2-Dichloroethane	< 1	106-43-4	4-Chlorotoluene	< 1
71-55-6	1,1,1-Trichloroethane	< 1	95-63-6	1,2,4-Trimethylbenzene	< 1
563-58-6	1,1-Dichloropropene	< 1	99-87-6	4-Isopropyltoluene	< 1
71-43-2	Benzene	< 1	108-67-6	1,3,5-Trimethylbenzene	< 1
56-23-5	Carbontetrachloride	< 1	95-50-1	1,2-Dichlorobenzene	< 1
74-95-3	Dibromomethane	< 1	106-46-7	1,4-Dichlorobenzene	< 1
78-87-5	1,2-Dichloropropane	< 1	135-98-8	sec-Butylbenzene	< 1
75-27-4	Bromodichloromethane	< 1	98-06-6	tert-Butylbenzene	< 1
79-01-6	Trichloroethene	< 1	541-73-1	1,3-Dichlorobenzene	< 1
10061-01-5	cis-1,3-Dichloropropene	< 1	104-51-8	n-Butylbenzene	< 1
10061-02-6	trans-1,3-Dichloropropene	< 1	96-12-8	1,2-Dibromo-3-chloropropane	< 1
79-00-5	1,1,2-Trichloroethane	< 1	120-82-1	1,2,4-Trichlorobenzene	< 1
108-88-3	Toluene	< 1	91-20-3	Naphthalene	< 1
142-28-9	1,3-Dichloropropane	< 1	87-61-6	1,2,3-Trichlorobenzene	< 1
124-48-1	Dibromochloromethane	< 1	87-68-3	Hexachlorobutadiene	< 1
106-93-4	1,2-Dibromoethane	< 1			

N.B. * also CAS No. 106-42-3

** Water blank subtracted

Approved by - [redacted]

Geochem Analytical Services

Volatile Organic Compounds (EPA 624/8260)

NAMAS TESTING No. 1231

Sample Identity - 1468-084 SPRING
Client / Sample matrix - Aspinwall & Company / Water
Date Acquired - 05/28/98 03:37
Instrument Name - MSD Vols5
Units - ppb

CAS No.	Compound	Conc.	CAS No.	Compound	Conc.
75-71-8	Dichlorodifluoromethane	< 1	127-18-4	Tetrachloroethene	< 1
74-87-3	Chloromethane	< 1	630-20-6	1,1,1,2-Tetrachloroethane	< 1
75-01-4	Vinyl chloride	< 1	108-90-7	Chlorobenzene	< 1
74-83-9	Bromomethane	< 1	100-41-4	Ethylbenzene	< 1
75-00-3	Chloroethane	< 1	108-38-3*	p/m-Xylene	< 1
75-69-4	Trichlorofluoromethane	< 1	75-25-2	Bromoform	< 1
156-60-5	trans-1,2-Dichloroethene	< 1	100-42-5	Styrene	< 1
75-09-2	Dichloromethane	< 1	79-34-5	1,1,2,2-Tetrachloroethane	< 1
75-35-4	1,1-Dichloroethene	< 1	95-47-6	o-Xylene	< 1
75-34-3	1,1-Dichloroethane	< 1	96-18-4	1,2,3-Trichloropropane	< 1
156-59-2	cis-1,2-Dichloroethene	< 1	98-82-8	Isopropylbenzene	< 1
74-97-5	Bromochloromethane	< 1	108-86-1	Bromobenzene	< 1
67-66-3	Chloroform	< 1	95-49-8	2-Chlorotoluene	< 1
594-20-7	2,2-Dichloropropane	< 1	103-65-1	Propylbenzene	< 1
107-06-2	1,2-Dichloroethane	< 1	106-43-4	4-Chlorotoluene	< 1
71-55-6	1,1,1-Trichloroethane	< 1	95-63-6	1,2,4-Trimethylbenzene	< 1
563-58-6	1,1-Dichloropropene	< 1	99-87-6	4-Isopropyltoluene	< 1
71-43-2	Benzene	< 1	108-67-6	1,3,5-Trimethylbenzene	< 1
56-23-5	Carbontetrachloride	< 1	95-50-1	1,2-Dichlorobenzene	< 1
74-95-3	Dibromomethane	< 1	106-46-7	1,4-Dichlorobenzene	< 1
78-87-5	1,2-Dichloropropane	< 1	135-98-8	sec-Butylbenzene	< 1
75-27-4	Bromodichloromethane	< 1	98-06-6	tert-Butylbenzene	< 1
79-01-6	Trichloroethene	< 1	541-73-1	1,3-Dichlorobenzene	< 1
10061-01-5	cis-1,3-Dichloropropene	< 1	104-51-8	n-Butylbenzene	< 1
10061-02-6	trans-1,3-Dichloropropene	< 1	96-12-8	1,2-Dibromo-3-chloropropane	< 1
79-00-5	1,1,2-Trichloroethane	< 1	120-82-1	1,2,4-Trichlorobenzene	< 1
108-88-3	Toluene	< 1	91-20-3	Naphthalene	< 1
142-28-9	1,3-Dichloropropane	< 1	87-61-6	1,2,3-Trichlorobenzene	< 1
124-48-1	Dibromochloromethane	< 1	87-68-3	Hexachlorobutadiene	< 1
106-93-4	1,2-Dibromoethane	< 1			

N.B. * also CAS No. 106-42-3 ** Water blank subtracted

Approved by - .....[redacted].....

Appendix 7

Discussion of Groundwater Chemistry (copied from Reference 1)

Appendix *continued* 7

Results of Chemical Analysis of Groundwater from Boreholes

Table 2.7 indicates that the groundwater beneath the site is generally of good quality. It is of neutral to slightly alkaline pH with slightly elevated electrical conductivity (EC), indicative of a high total dissolved solids. This is not unusual given the nature of the geology beneath the site. However, excepting nitrate in Borehole 1B and sulphate in Borehole 2 none of the major ions exceed the EC maximum admissible concentration (MAC) in drinking water (where a value is given - Ref 4). The elevated nitrate may be due to local agricultural use, whilst the sulphate may be naturally derived from mudstone strata. Bicarbonate at Borehole 6 is also elevated, although the reason for this is unclear.

The major ions have been plotted as a piper diagram (Appendix 2) and indicate the similarity between the groundwater at all locations except borehole 2. The determinands are dominated by calcium and bicarbonate ions typical of limestone groundwaters. Borehole 2 is the exception as although calcium in the groundwater at this location is high, bicarbonate is low, whilst sodium, sulphate, phosphate and ammoniacal nitrogen are elevated compared to the other locations. This may be a facet of the nature of the borehole as much as the aquifer - limited water was encountered at this location, permeability was low and borehole purging/ development was not extensive. Of the metals for which analysis was undertaken, the majority were present at concentrations less than the limit of detection. The exceptions are discussed below.

Arsenic can be found naturally in groundwaters at concentrations in excess of 50 µg/l, although the norm is less than 1 µg/l (Ref 6). The concentration of 710 µg/l measured in Borehole 2 is therefore elevated in comparison, whilst the 2280 µg/l in Borehole 3B is greatly elevated. It can be much higher in geothermal waters, values of 40 mg/l being recorded in the US (Ref 7). No trial pits were dug in the close vicinity of Borehole 3 to indicate local soil concentrations.

Boron is greater than the limit of detection in Boreholes 1A, 2, 5 and 6, however, it was nowhere detected at a concentration greater than the EC guide level. Cadmium was only detected in Boreholes 5 and 6, at 0.1 and 0.2 mg/l respectively, only just greater than the limit of detection of 0.05 mg/l. The natural background concentration is around 1 µg/l (Ref 6). Chromium was not significantly greater than the limit of detection at any location.

Copper was only present at greater than the limit of detection at Borehole 3B and then not significantly greater than the EC GL. Mercury concentrations detected in Boreholes 1B, 4 and 6 are elevated compared to the EC MAC, but are less than twice the limit of detection and must therefore be interpreted with caution. The concentration of 140 µg/l measured at Borehole 1A is elevated compared to the

Appendix *continued* 7

MAC of 1 µg/l. No natural sources can be suggested for its origin, whilst analysis of shallow soils near Borehole 1 do not indicate elevated concentrations.

Nickel was only detected at greater than the limit of detection (and the EC MAC) in Borehole 3B. However, the concentration was only four times the limit of detection. Nickel can be found naturally occurring in groundwaters in the UK at over 0.1 mg/l, although typically concentrations are less than 0.01 mg/l (Ref 6). Nickel concentrations in soil across the site are very low.

Lead was detected at a concentration slightly greater than the limit of detection (and the EC MAC) at four locations, although only at one of these was the concentration slightly greater than four times the limit of detection. Natural concentrations of lead in groundwater are generally below 1 µg/l (Ref 6). Selenium was not detected at any location greater than the limit of detection.

Zinc was present at a concentration greater than the limit of detection at four locations, but only at Borehole 3B was the concentration significantly greater than the limit. There is no EC MAC for zinc, although the concentration exceeds the EC GL, but not the Dutch Intervention value.

Although at the majority of locations the metal concentrations in groundwater do not exceed the limit of detection there are a number of instances where this does occur. In general the concentrations are not significant being only up to four times the limit of detection. Furthermore comparison has been made to guideline concentrations for potable water which are not necessarily applicable to contaminated land assessments such as this. The only exception is in Borehole 3B where arsenic appears to be anomalously high.

Organic Determinands

A number of screening tests were undertaken in order to identify, in broad terms, if organic contaminants were present in the groundwater. These included COD, BOD, TOC, Mineral Oil, TPH and NSO/resins. In addition, analysis for diesel range organics (DRO) was carried out to improve the detection limits for hydrocarbons.

COD was only elevated in Borehole 1A at 478 mg/l and slightly elevated in Borehole 6 at 77 mg/l. The cause of the very high concentrations in Borehole 1A could not be determined by the laboratory and was not paralleled by elevated concentrations of any other "indicator" tests, including TOC and BOD. COD is generally used as an indicator of the presence of "polluting" material, although in this instance such material could not be identified.

BOD was slightly elevated in Borehole 1B, although not to an extent to cause any great concern. Of the remaining "indicators" used, all were less than, at, or close

Appendix *continued* 7

to, the limit of detection, indicating that the groundwaters are not significantly contaminated by organic material. The analysis for diesel range organics also indicates no significant contamination.

The DRO analysis indicates that the groundwater sampled from the boreholes is not contaminated by hydrocarbons. The slightly elevated concentration measured in Borehole 2 is not significant, especially given that it was not possible to effectively purge the borehole due to the slow groundwater inflow rate.

Results of Chemical Analysis of Spring Water

Inorganic Determinands

The spring water chemistry is detailed in Table 2.8. This indicates good quality water with a neutral pH and slightly elevated EC typical of groundwater from oolite strata. As with the borehole waters the major ion concentrations are generally less than the MAC for potable water (where a value is given). The exceptions are from springs C2 and D where nitrate concentrations of 119 and 97 mg/l respectively were measured. These are probably associated with inputs from agricultural sources.

The piper plot (Appendix 2) indicates that the springs are all of a similar chemical type, as with the borehole waters, being dominated by calcium and bicarbonate ions. Only spring I appears to have a slightly different chemistry with calcium, chloride and sulphate being generally lower. This is likely to be a reflection of the conditions under which spring I was sampled (i.e. following heavy overnight rain) compared to all other locations (stable conditions).

There are slight differences in the chemistry of the borehole and spring waters. The spring waters tend to have higher calcium, potassium, chloride, and ammoniacal nitrogen concentrations and lower magnesium and sodium. This may be a reflection of bedrock quality variations, groundwater residence times in the aquifer, and equilibration of dominant ionic species.

Of the metals, all except lead and zinc at Spring I are less than the limit of detection. The concentrations at spring I are less than or equal to twice the limit of detection and should therefore be treated with caution. In both instances, if the values are true, they are not significant in terms of environmental contamination.

Organic Determinands

All of the indicators of organic contamination are either less than the limit of detection, or close to it, suggesting that there is not significant pollution of spring

Appendix *continued* 7

water. Although DRO was detected at greater than the limit of detection at three locations these concentrations are not considered to be significant.