

**SUPPLEMENTARY GEO-ENVIRONMENTAL ASSESSMENT
(GROUND INVESTIGATION)
REPORT**

PHASE 9, UPPER HEYFORD, OX25 5BS

Report Title: Supplementary Geo-environmental Assessment Report for Phase 9, Upper Heyford, OX25 5BS

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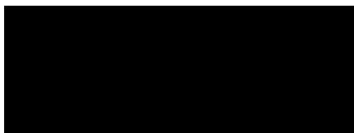
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QUALITY CONTROL - PREVIOUS VERSIONS

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EXECUTIVE SUMMARY

Site Details	Site Address	Phase 9, Upper Heyford, OX25 5BS
	National Grid Reference	E: 450392, N:225769
Encountered Conditions	Scope of Works	The assessment comprised an intrusive investigation comprising 5no rotary boreholes to a maximum depth of 10m bgl, installation of groundwater monitoring wells, and 2no return groundwater sampling visits, with laboratory testing of retrieved groundwater samples. Jomas were provided with a site investigation scope by the client.
	Ground Conditions	The ground conditions encountered broadly consistent with those anticipated from the third party reports, and comprised Made Ground, to depths of up to 0.2m, underlain by weathered deposits of White Limestone Formation to the base of the boreholes (maximum depth of 10m bgl).
	Groundwater	During return monitoring, groundwater was encountered at depths of between 2.36m to 7.32m bgl within the White Limestone Formation.
Geo-environmental Assessment Summary and Recommendations	No significant concentrations of contamination have been recorded in any of the water samples tested. The groundwater sampled is not considered to be impacted with petroleum hydrocarbons arising from historic uses of the site.	
<p><i>This Executive Summary is intended to provide a brief summary only of the main findings and conclusions of the investigation.</i></p>		

1 INTRODUCTION

1.1 Terms of Reference

1.1.1 Elgin Investments LLP (“The Client”) has commissioned Jomas Associates Ltd (‘Jomas’) to undertake a geo-environmental ground investigation to provide further assessment of the risks to controlled waters at a site referred to as Phase 9, Upper Heyford, OX25 5BS (herein referred to as ‘the site’). The site’s location is presented in Figure 1.

1.1.2 Several reports have been produced for the site by third parties (detailed in Table 1.1 below).

1.1.3 Jomas’ intrusive investigation has been undertaken in accordance with proposal dated 18th May 2021.

1.2 Objectives

1.2.1 The objectives of Jomas’ investigation are as follows:

- To drill and install monitoring wells and undertake groundwater sampling to assess risks to controlled waters, in accordance with the procedures set out within Part IIA of the Environmental Protection Act 1990, associated statutory guidance and current best practice including the EA land contamination risk management (LCRM);

1.3 Scope of Works

1.3.1 The following tasks were undertaken to achieve the objectives listed above:

- Intrusive ground investigation to determine ground conditions, and potential for pollutant linkages to controlled waters at the site;
- Return Groundwater monitoring/sampling;
- Undertaking of laboratory chemical testing upon groundwater samples obtained;
- The compilation of this report, which collects and discusses the above data, and presents an assessment of the site conditions, conclusions and recommendations.

1.4 Supplied Documentation

1.4.1 A number of relevant reports and documents were supplied to Jomas Associates prior to the commencement of this investigation are detailed in Table 1.1:

Table 1.1: Supplied Reports/Documents

Title	Author	Reference	Date
Heyford Park – Western Development, Phase 9, 10, 16 and 16A Desk Study and Ground Investigation	Hydrock Consultants Ltd	HPW-HYD-MS-ZZ-RP-G-0001	10 th February 2017

Title	Author	Reference	Date
Upper Heyford – Dorchester Phase 9 – Supplementary Site Investigation (Basketball Pitch)	Smith Grant Environmental Consultancy LLP	R1742B-L07	7 th August 2018
Heyford Park, Dorchester Phase 9 Remediation Strategy	Smith Grant Environmental Consultancy LLP	R1742d-R03-v1	21 st December 2020
Heyford Park, Dorchester Phase 9 Supplementary Site Investigation Report (POL Pipeline)	Smith Grant Environmental Consultancy LLP	R1742b-R21-1	26 th January 2021
Discharge of condition 10 (contamination remediation strategy) of 16/02446/F (for phase 9) Heyford Park, Camp Road, Upper Heyford, Bicester	Environment Agency	WA/2021/128935/01-L01	26 th March 2021
Heyford Park, Dorchester Phase 9 Remediation Earthworks Completion Report	Smith Grant Environmental Consultancy LLP	R1742b-R23	20 th August 2021

1.5 Limitations

- 1.5.1 Jomas has prepared this report for the sole use of Elgin Investments LLP, in accordance with the generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon by any other party without the explicit written agreement of Jomas. No other third party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.
- 1.5.2 The records search was limited to information available from public sources; this information is changing continually and frequently incomplete. Unless Jomas has actual knowledge to the contrary, information obtained from public sources or provided to Jomas by site personnel and other information sources, have been assumed to be correct. Jomas does not assume any liability for the misinterpretation of information or for items not visible, accessible or present on the subject property at the time of this study.
- 1.5.3 Whilst every effort has been made to ensure the accuracy of the data supplied, and any analysis derived from it, there may be conditions at the site that have not been disclosed by the investigation, and could not therefore be taken into account. As with any site, there may be differences in soil conditions between exploratory hole positions. Furthermore, it should be noted that groundwater conditions may vary due to seasonal and other effects and may at times be significantly different from those measured by the investigation. No liability can be accepted for any such variations in these conditions.

- 1.5.4 Any reports provided to Jomas have been reviewed in good faith. Jomas cannot be held liable for any errors or omissions in these reports, or for any incorrect interpretation contained within them.
- 1.5.5 This investigation and report has been carried out in accordance with the relevant standards and guidance in place at the time of the works. Future changes to these may require a re-assessment of the recommendations made within this report.
- 1.5.6 This report is not an engineering design and the figures and calculations contained in the report should be used by the Structural Engineer, taking note that variations may apply, depending on variations in design loading, in techniques used, and in site conditions. Our recommendations should therefore not supersede the Engineer's design.

2 BACKGROUND

2.1.1 As detailed in Table 1.1, several reports have been produced and issued separately by third party authors. The findings of these reports are presented in the following section. Reference should be made to the original reports and documents for further details. Comments made in the following section regarding possible ground conditions on the site and within the surrounding area are based purely on these reports. Where appropriate, this information will be used in the later sections of this report as supplementary information to assist in the evaluation of the ground conditions and aid the identification of geochemical constraints and hazards that could impact on the scheme.

2.1.2 Some reports cover multiple plots of land which encompass Jomas' study site (referred to as "Phase 9"). The summary below refers to the Phase 9 site only, and with specific focus on land contamination risks to controlled waters.

2.2 Desk Study and Ground Investigation (Hydrock, February 2017)

Desk Study Information

2.2.1 The earliest historical map (1875) shows the site as open fields. The first indication of the Upper Heyford air base is shown on the 1954 1:10,560 historical map. However, research has indicated that the surrounding land had a military use from as early as 1916. The United States Air Force took over the running of the air base from 1950; it was then in use until it closed in 1994. The Phase 9 site was used as an education facility associated with the airbase.

2.2.2 The site was reported to be directly underlain by the Great Oolite Group. This is classified by the Environment Agency as a Principal aquifer.

2.2.3 The site is not within a groundwater source protection zone (SPZ).

2.2.4 An historical potable water abstraction was reported 510m west of site. No other abstractions were reported within 1000m.

2.2.5 Gallos Brook (a Tertiary River) traverses north-south through a plot of land south of the site and was considered likely to be culverted beneath the site.

2.2.6 Potential sources of contamination identified were:

- Made Ground possibly including metals, metalloids, asbestos, PAH and petroleum hydrocarbons.
- Hydrocarbon fuels and lubricants associated with the fuel storage tanks and former land use.
- VOCs and SVOCs associated with the former land use.
- Ground gas from nearby backfilled quarries.
- Ethylene glycol – potentially used as a de-icer on the air base runway and associated infrastructure.

Ground Investigation

2.2.7 A ground investigation was undertaken in November 2016 and comprised 29No. trial pits and 4No. rotary open boreholes.

- 2.2.8 The site was reported to be underlain by 0.05-1.60m of Topsoil and/or Made Ground. These deposits were in turn underlain by deposits of Great Oolite Group, fine and coarse soils of weathered limestone becoming intact limestone with depth, to the base of the deepest borehole at 8.0m bgl.
- 2.2.9 Black staining and tar odours were recorded in TP101, TP102 and TP104. No other visual or olfactory evidence of gross contamination was recorded.
- 2.2.10 3No. groundwater monitoring visits were undertaken between 23rd November and 19th December 2016. Groundwater was reported within BH01-04 between depths of 2.49m and 7.37m bgl.
- 2.2.11 Elevated concentrations of metals and PAH (above the EQS) and petroleum hydrocarbons (above the DWS) were reported in groundwater. Hydrocarbons were below detection limits in BH03 and BH04 whilst elevated concentrations were reported within BH01 and BH02 with maximum concentrations recorded in the aliphatic C12-C16 range with concentrations of 13,000 µg/l (BH01) and 83,000 µg/l (BH02). However, the risk to controlled waters was considered negligible given the closest groundwater receptor (abstraction) was more than 1km from the site.
- 2.2.12 Hydrock were also provided with a previous ground investigation report: 'Preliminary Generic Quantitative Environmental Risk Assessment' (Waterman Energy, Environment and Design Ltd, Ref: EED10658 - 13.2.2_FA, May 2012) for the wider Heyford Park development. Jomas were not provided with this report. Hydrock concluded that concentrations of petroleum hydrocarbons that they recorded on the Phase 9 site were not recorded significantly higher than those recorded and presented in the Waterman report.
- 2.2.13 Water samples were also obtained from Gallos Brook, the results of which only reported elevated concentrations of copper and was not attributed to impacted soils/groundwater under Phase 9 site.
- 2.2.14 It was concluded that the recorded groundwater contamination did not represent a significant risk of pollution to the groundwater beneath the site but that existing fuel stores (tanks / pipelines) and impacted soils should be removed.
- 2.3 Remediation Strategy (Smith Grant, December 2020)**
- 2.3.1 Groundwater movement beneath the site was considered likely to be significant with groundwater flow direction to the southeast. Smith Grant cited another report by Watermans (ref. EED10658-109-R-14.1.7.FA).
- 2.3.2 Off-site groundwater impacts were not considered to be significant on the monitoring evidence although the results from BH01 suggested some impact from an upgradient source. The presence of a UST associated with the boiler house could hold a significant volume of fuel and was considered to remain a significant potential primary pollution source. The POL pipelines which cross the east of the site were disconnected from the NFP, emptied and filled with foam as per an approved Method Statement and were considered unlikely to contain any residual fuels, however care should be taken during its removal to confirm this.
- 2.3.3 The key remediation objectives comprised:

- Create a significant betterment of the groundwater environment by removing remaining primary pollutant sources thereby protecting groundwater quality at and beyond the site boundary;
- Remove / remediate significant secondary pollution sources such as soil hydrocarbon hotspots, if present, that pose a risk to man and the environment, to the extent feasible;
- Break significant or potentially significant future pollutant linkages resulting from the change of land use, in particular related to shallow garden soils and human exposure;
- Carry out further targeted soil investigations / inspections to complete gaps in the existing investigation coverage;
- Respond appropriately to contingencies in particularly the discovery of previously undisclosed contamination;
- Remove development constraints and prepare the site physically to enable residential development with associated infrastructure;
- Manage all emissions to air and water to protect surface waters and groundwater and the atmosphere during the remediation works;
- Provide appropriate additional protection measures where necessary, to be implemented during construction, including building gas barriers, water mains protection and garden / open space soil quality and thickness.

2.4 Discharge of Condition 10 of 16/02446/F for Phase 9 Heyford Park, Camp Road, Upper Heyford, Bicester (Environment Agency, March 2021)

2.4.1 Planning Consent has been granted by Cherwell Valley District Council under reference 16/02446/F. Condition 10 required risk assessment, and where necessary remediation, in relation to potential contaminated land.

2.4.2 The EA did not recommend discharge of Condition 10 due to uncertainties relating to groundwater quality and contradictory statements within previous reports. The EA required further groundwater investigation following demolition and tank removal and stated that groundwater remedial works should not be excluded from the remedial strategy.

2.5 Remediation Earthworks Completion Report (Smith Grant, August 2021)

2.5.1 Smith Grant attended site throughout January-May 2021 in order to undertake various remedial works at the site. This included demolition of the boiler house and removal of underground storage tanks and associated infrastructure; and removal of contaminated soil 'hotspots' including one referred to as the baseball pitch hotspot.

3 GROUND INVESTIGATION

3.1 Scope of Works

3.1.1 Jomas were tasked by the client to conduct a site investigation scoped by Smith Grant Environmental, following the reported removal of USTs and hotpots.

3.1.2 An area referred to as the “baseball pitch hotspot” is located in the north-east of the site adjacent to BH04, the client/Smith Grant reportedly encountered an area of contaminated material during demolition and removal of an existing oil pipeline. The client/Smith Grant also recently found contamination adjacent to BH03.

3.1.3 Jomas were provided with a mark-up of proposed borehole locations as shown in Figure 2 of Appendix 1; the boreholes were positioned by Smith Grant Environmental to target the following:

JBH1 - baseball pitch hotspot

JBH2 - downgradient of baseball pitch hotspot

JBH3 - boiler house.

JBH4 - replacement of Hydrock BH02 which has been destroyed

JBH5 – down-gradient of recent hotspot around proposed southern pond

3.1.4 Jomas’ ground investigation was undertaken on the 2nd & 3rd August 2021; the completed borehole positions are as shown in Figure 3, Appendix 1. Return groundwater sampling events were undertaken on the 12th August and the 24th August.

3.1.5 A summary of the fieldwork carried out at the site, with justifications for exploratory hole positions, is presented in Table 3.1 below.

Table 3.1: Scope of Intrusive Investigation

Investigation Type	Number of Exploratory Holes Achieved	Exploratory Hole Designation	Depth Achieved	Justification
Rotary Boreholes	5	JBH1-5	Up to 10m bgl	To allow installation of groundwater monitoring/sampling wells. Targets identified in Section 3.1.3.
Monitoring Wells	5	JBH1-5	Up to 10m bgl	Groundwater monitoring/sampling wells.

3.1.6 The ground investigation was undertaken in accordance with British Standard BS5930:2015+A1:2020 “Code of practice for ground investigations”, British Standard BS10175:2011+A2:2017 “Investigation of potentially contaminated sites - code of practice”, NHBC Standards, Chapter 4.1 and AGS Guidelines for Good Practice in Site Investigations.

3.1.7 The boreholes were advanced using open hole drilling techniques. Rock core was not obtained or logged during the investigation.

3.1.8 Exploratory hole positions are shown on the exploratory hole location plan presented in Figure 3, Appendix 1 and were positioned by the client and their consultant. The exploratory hole records are included in Appendix 2.

3.2 Sampling Rationale

3.2.1 Our soil sampling rationale for the site investigation was developed with reference to EA guidance 'Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination' (Technical Report P5-066/TR).

3.2.2 Soil samples were taken from across the site at various depths as shown in the exploratory hole logs.

3.2.3 Jomas Associates Limited's engineers normally collect samples at appropriate depths based on field observations such as:

- appearance, colour and odour of the strata and other materials, and changes in these;
- the presence or otherwise of sub-surface features such as pipework, tanks, foundations and walls; and,
- areas of obvious damage, e.g. to the building fabric.

3.2.4 A number of the samples were taken from the top 0-1m to aid in the assessment of the pollutant linkages identified at the site. In addition, some deeper samples were taken to aid in the interpretation of fate and transport of any contamination identified.

3.2.5 Soil samples were taken from across the site at various depths as shown in the exploratory hole logs (copies of which are provided in Appendix 2).

3.2.6 During return groundwater monitoring visits, groundwater samples were obtained by low flow sampling. Sampling records are presented in Appendix 4.

3.2.7 Samples were stored in cool boxes (<4°C) and preserved in accordance with laboratory guidance, and dispatched to a UKAS and Mcerts accredited laboratory. Samples were scheduled for TPHCWG including BTEX compounds.

4 GROUND CONDITIONS ENCOUNTERED

4.1 General

4.1.1 A factual record of the conditions encountered during the physical investigation of the site is presented in the following section.

4.2 Ground Conditions

4.2.1 The ground conditions encountered were broadly consistent with those anticipated, i.e. a thickness of Made Ground overlying weathered deposits of White Limestone Formation (part of the Great Oolite Group), and are summarised in Table 4.1 below.

Table 4.1 : Ground Conditions Encountered

Stratum and Description	Encountered from (mbgl)	Base of strata (mbgl)	Thickness range (m)
Brown sandy gravelly clay. Gravel consists of brick, flint and asphalt. (MADE GROUND)	0.00	0.2	0.2
Recovered as LIMESTONE with clay. (WHITE LIMESTONE FORMATION)	0.2	6.0	5.8
Recovered as grey CLAY. (WHITE LIMESTONE FORMATION)	6.0	>10.0 [base not proven]	>4.0 [thickness not proven]

4.2.2 Due to the method of open hole drilling technique drilling with water flush, poor recovery of soils was experienced BS5930.

4.2.3 No visual or olfactory evidence of potential contamination was identified within the investigation positions.

4.3 Groundwater

4.3.1 Groundwater was not reported during drilling.

4.3.2 The return groundwater monitoring results are presented in Appendix 4 and are summarised below.

Table 4.2: Groundwater Monitoring Summary

Exploratory Hole ID	Depth Encountered (m bgl)	Depth to Base of Well (m bgl)	Stratum
JBH1 (Jomas, 2021)	2.36 - 2.40	9.63 – 9.72	White Limestone Formation
JBH2 (Jomas, 2021)	4.23 - 4.37	9.58 – 9.64	White Limestone Formation
JBH3 (Jomas, 2021)	5.16 - 5.26	9.67 - 9.74	White Limestone Formation
JBH4 (Jomas, 2021)	5.49 - 5.61	9.55 – 9.84	White Limestone Formation
JBH5 (Jomas, 2021)	2.97 - 3.01	9.15 - 9.28	White Limestone Formation
BH01 (Hydrock, 2017)	7.13 - 7.22	7.90 – 7.91	White Limestone Formation

4.3.3 Wells were dipped using an oil/water interface meter. No free phase product was detected.

4.3.4 It should be noted that changes in groundwater levels can occur for a number of reasons including seasonal effects and variations in drainage. Such fluctuations may only be recorded by the measurement of the groundwater level within a standpipe or piezometer installed within appropriate response zones. Changes in groundwater level can have a direct effect on excavation stability and dewatering requirements, and cohesive soils can soften under rising or high groundwater levels.

4.4 Limitations

4.4.1 JBH2 could not be drilled where originally proposed due to the presence of temporary site buildings and roadways. Whilst on site, the client re-positioned JBH2 to a different location as shown in Figure 3.

5 RISK ASSESSMENT – ANALYTICAL FRAMEWORK

5.1 Context and Objectives

5.1.1 This section seeks to evaluate the level of risk pertaining to controlled waters which may result from both the existing use and proposed future use of the site. It makes use of the ground investigation findings, as described in the previous sections, to evaluate further the potential pollutant linkages. A combination of qualitative and quantitative techniques is used, as described below.

5.1.2 The purpose of generic quantitative risk assessment is to compare concentrations of contaminants found on site against generic assessment criteria (GAC) to establish whether there are actual or potential unacceptable risks. It also determines whether further detailed assessment is required. The approaches detailed all broadly fit within a tiered assessment structure in line with the framework set out in the Department of Environment, Food and Rural Affairs (DEFRA), EA and Institute for Environment and Health Publication, Guidelines for Environmental Risk Assessment and Management.

5.2 Analytical Framework – Groundwater

5.2.1 The requirement to protect groundwater from pollution is outlined in Groundwater protection: Principles and practice (GP3, EA, August 2013, v1.1).

5.2.2 Where undertaken, the groundwater quality analysis comprises a Level 1 assessment in accordance with the EA Remedial Targets Methodology Document (EA, 2006).

5.2.3 The criteria used by Jomas' in the Level 1 assessment of groundwater and leachate quality are shown in Table 5.2.

Table 5.2: Selected Assessment Criteria – Contaminants in Water

Substance Group	Determinand(s)	Assessment Criteria Selected
Total Petroleum Hydrocarbons	Aliphatic C5-C6, Aliphatic >C6-C8, Aliphatic >C8-C10, Aliphatic >C10-C12, Aliphatic >C12-C16, Aliphatic >C16-C21, Aromatic C5-C7, Aromatic >C7-C8, Aromatic >C8-C10, Aromatic >C10-C12, Aromatic >C12-C16, Aromatic >C16-C21, Aromatic > C21-C35	DWS/WHO
Benzene	Benzene	DWS
Toluene	Toluene	EQS
Ethylbenzene	Ethylbenzene	EQS
Xylene	Xylene	EQS
Oxygen Demand	Chemical Oxygen Demand and Biological Oxygen Demand	Urban Waste Water Treatment (England and Wales) Regulations

Environmental Quality Standards EQS

Environmental Quality Standards (EQS) have been released by the EA for dangerous substances, as identified by the EC Dangerous Substances Directive. EQS can vary for each substance, for the hardness of the water and can be different for fresh, estuarine or coastal waters.

WHO Health

These screening criteria have been taken from the World Health Organisation Guidelines for Drinking Water Quality (1984). The health value is a guideline value representing the concentration of a contaminant that does not result in any significant risk to the receptor over a lifetime of exposure.

Further criteria have been obtained from 'Petroleum Products in Drinking-water' - Background document for development of WHO Guidelines for Drinking-water Quality (2005).

UK Drinking Water Standards (DWS)

These comprise screening criteria provided by the Drinking Water Inspectorate (DWI) in the Water Supply (Water Quality) Regulations 2006,

Urban Waste Water Treatment (England and Wales) Regulations - UWWT Regs

The Urban Waste Water Treatment (England and Wales) Regulations SI/1994/2841 as amended by SI/2003/1788 sets down minimum standards for the discharge of treated effluent from waste water treatment works to inland surface waters, groundwater, estuaries or coastal waters. Standards of (125mg/L) COD and (25mg/L) BOD have been set.

6 GENERIC QUANTITATIVE RISK ASSESSMENT – GROUNDWATER DATA

6.1 Groundwater sampling

6.1.1 Samples of groundwater obtained from the borehole installations installed within exploratory locations JBH1-5 were submitted for chemical analysis. 2No. sampling events were undertaken on 12th and 24th August 2021.

6.1.2 The samples were obtained by means of low flow methodology. Groundwater sampling records are presented in Appendix 4.

6.1.3 Groundwater from BH01 could not be sampled given the depth of water encountered (>7m).

6.2 Assessment of Groundwater Analytical Data with Respect to Controlled Waters

6.2.1 The results of the laboratory testing are summarised in Table 6.1 below and compared to GAC for controlled waters receptors. Analytical laboratory certificates are presented in Appendix 3.

Table 6.1: Groundwater Analysis Results – TPHCWG & BTEX

Determinand	Unit	No. Samples tested	Screening Criteria		Min.	Max.	No. of Exceedances
Benzene	µg/l	10	1.0	DWS	<1.0	<1.0	0
	µg/l	10	10	EQS	<1.0	<1.0	0
Toluene	µg/l	10	74	EQS	<1.0	<1.0	0
Ethyl benzene	µg/l	10	300	WHO	<1.0	<1.0	0
Xylenes (total)	µg/l	10	30	EQS	<2.0	<2.0	0
MTBE	µg/l	10	15	WHO	<1.0	<1.0	0
>C5-C6 Aliphatic	µg/l	10	15000	WHO	<1.0	<1.0	0
>C6-C8 Aliphatic	µg/l	10	15000	WHO	<1.0	<1.0	0
>C8-C10 Aliphatic	µg/l	10	300	WHO	<1.0	<1.0	0
>C10-C12 Aliphatic	µg/l	10	300	WHO	<10	<10	0
>C12-C16 Aliphatic	µg/l	10	300	WHO	<10	<10	0
>C16-C21 Aliphatic	µg/l	10	-	-	<10	<10	0
>C21-C35 Aliphatic	µg/l	10	-	-	<10	<10	0
>C5-C7 Aromatic	µg/l	10	10	WHO	<1.0	<1.0	0
>C7-C8 Aromatic	µg/l	10	700	WHO	<1.0	<1.0	0
>C8-C10 Aromatic	µg/l	10	300	WHO	<1.0	<1.0	0
>C10-C12 Aromatic	µg/l	10	90	WHO	<10	<10	0
>C12-C16 Aromatic	µg/l	10	90	WHO	<10	<10	0
>C16-C21 Aromatic	µg/l	10	90	WHO	<10	<10	0
>C21-C35 Aromatic	µg/l	10	90	WHO	<10	<10	0

- 6.2.2 As shown in the Table 6.1, concentrations of BTEX, MTBE, and TPHCWG fraction were not detected above laboratory detection limits. The groundwater sampled is not considered to be impacted with petroleum hydrocarbons arising from historic uses of the site.

7 REFERENCES

- British Standards Institution (2011) BS 10175:2011 *Code of practice for the investigation of potentially contaminated sites*. Milton Keynes: BSI
- British Standards Institution (2013) BS 8576:2013 *Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOC's)*, Milton Keynes: BSI
- British Standards Institution BS 5930:2015+A1:2020 *Code of practice for ground investigations*. Milton Keynes: BSI
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- Environment Agency (2006) *Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination* Environment Agency
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APPENDICES

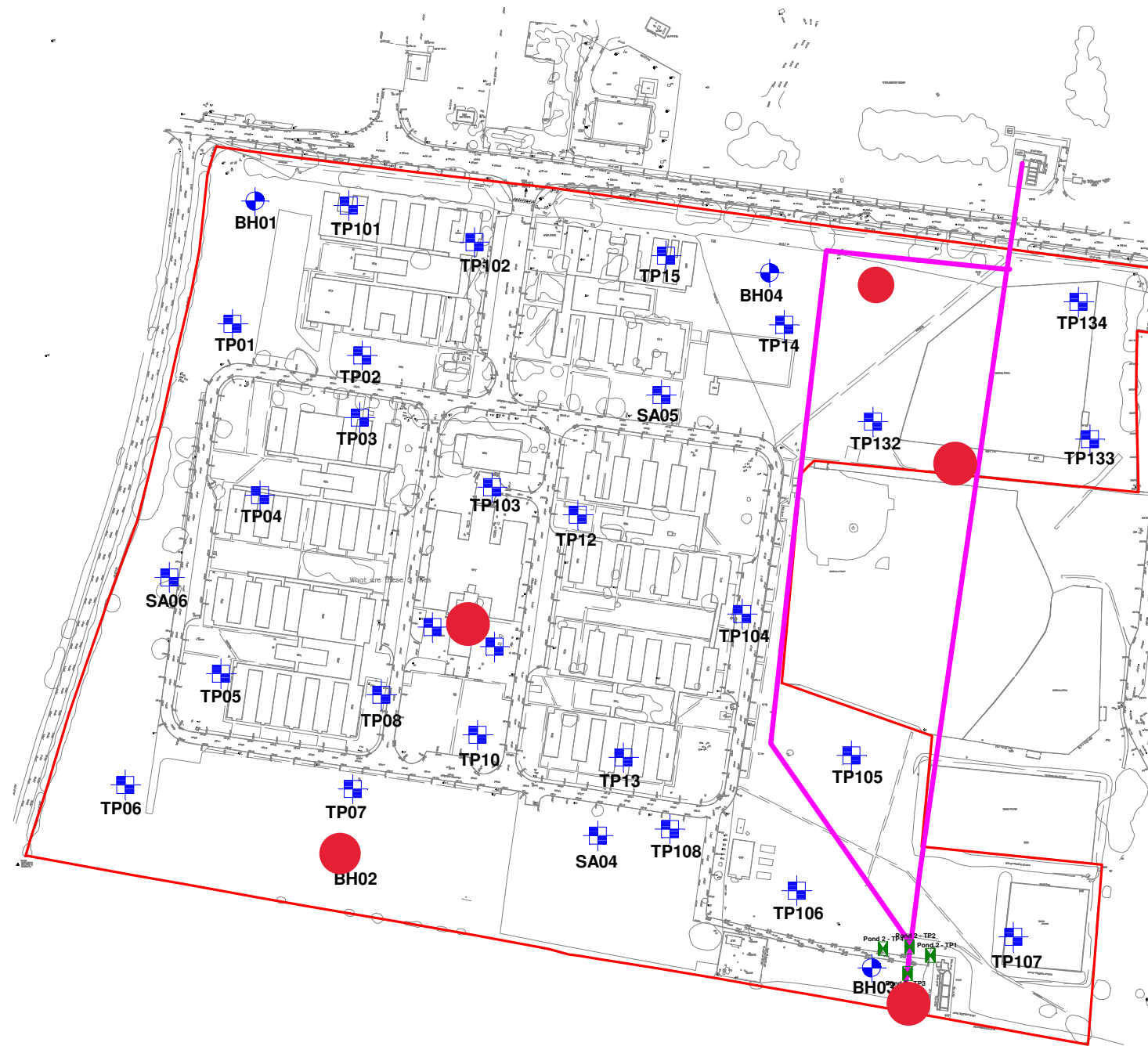
APPENDIX 1 – FIGURES

PROJECT NAME	Upper Heyford - Phase 9 – OX25 5AB	CLIENT	Elgin Investments LLP
TITLE	Location Plan	PROJECT NO.	P3087J2052b
DATE	July 2021	FIGURE NO.	1



FIGURE 2: Well Locations as Proposed by Smith Grant Environmental

● Proposed GW monitoring Location



— Approx Line of POL pipeline

■ Hydrock Trial-Pit

⊕ Hydrock Borehole

⊠ SGP Pond-2 Trial-Pit

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Smith Grant LLP
Station House, Station Road
Ruabon, Wrexham LL14 6DL

Tel: 01978 822367
Fax: 01978 8247182

www.smithgrant.co.uk
email: consult@smithgrant.co.uk

Project:
Heyford Park: Phase 9

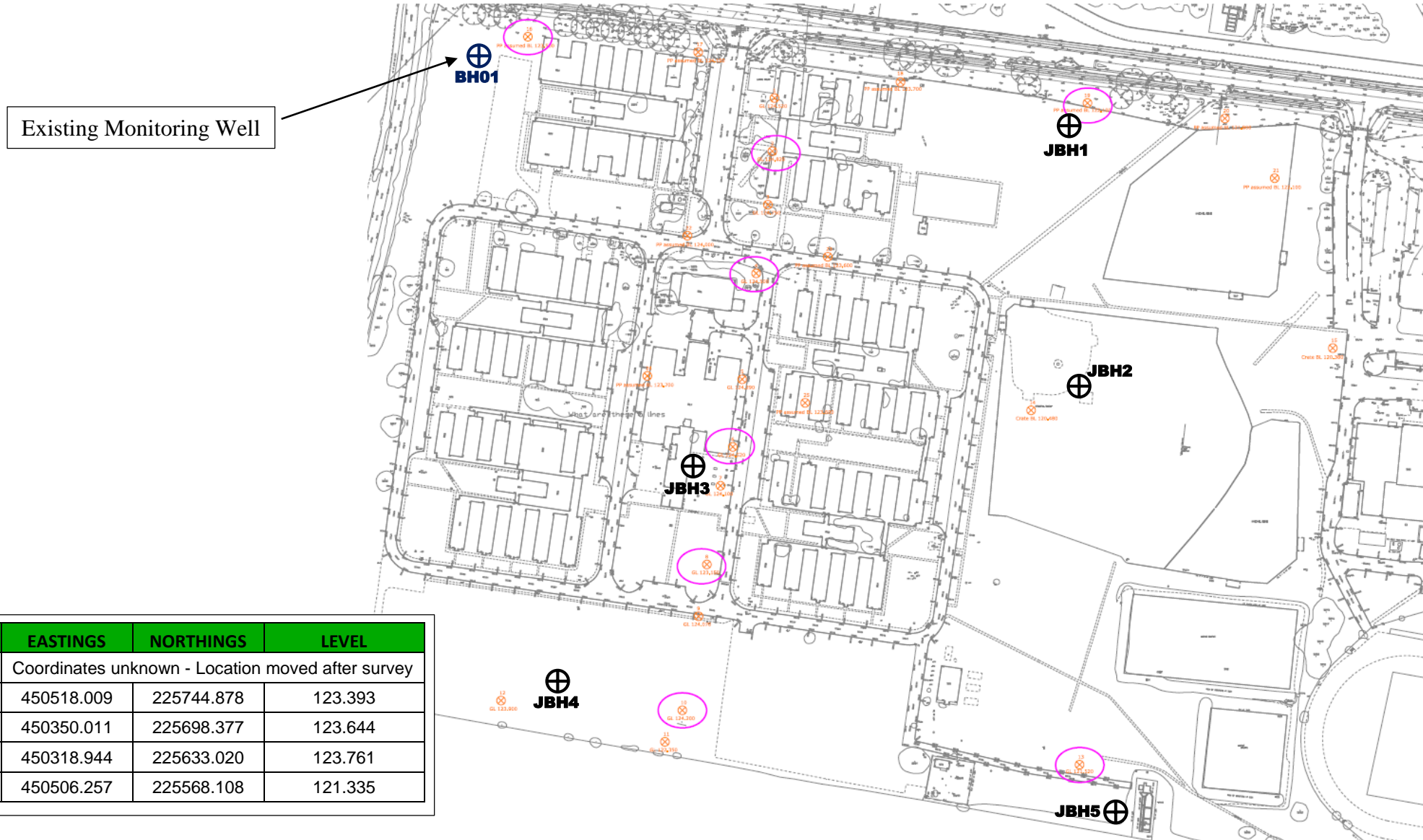
Drawing:

Drawn: DW	Checked: BJT
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Date: 04.05.21	Scale: 1:2,500 @ A3
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Job No: R1742d	Drg No:
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PROJECT NAME	Upper Heyford - Phase 9 – OX25 5AB	CLIENT	Elgin Investments LLP
TITLE	Jomas Rotary Borehole Locations	PROJECT NO.	P3087J2052b
DATE	July 2021	FIGURE NO.	3



ID	EASTINGS	NORTHINGS	LEVEL
JBH1	Coordinates unknown - Location moved after survey		
JBH2	450518.009	225744.878	123.393
JBH3	450350.011	225698.377	123.644
JBH4	450318.944	225633.020	123.761
JBH5	450506.257	225568.108	121.335

APPENDIX 2 – EXPLORATORY HOLE RECORDS



ROTARY BOREHOLE RECORD

Exploratory Hole No:

JBH01

Site Address: Upper Heyford - Phase 9

Project No: P2087J2052b

Client: Elgin Investments LLP

Ground Level:

Logged By: JF

Date Commenced: 03/08/2021

Checked By: sc

Date Completed: 03/08/2021

Type and diameter of equipment: Rotary Drilling - Comacchio 205

Sheet No: 1 Of 2

Water levels recorded during boring, m

Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

- 1: Drillers observations from drill arisings
- 2: Poor recovery due to water flush
- 3:
- 4:

Type	Depth (mbgl)	Sample or Tests							Strata			Strata Description	Installation
		Result							Legend	Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N					
	0.00									0.20		Brown sandy gravelly clay. Gravel consists of flint, brick and asphalt. (MADE GROUND)	
	0.50									0.80		Recovered as highly fractured LIMESTONE with clay bands. (WHITE LIMESTONE FORMATION)	
	1.00											Recovered as LIMESTONE. (WHITE LIMESTONE FORMATION)	
	1.50												
	2.00												
	2.50												
	3.00												
	3.50												
	4.00												
	4.50												
	5.00												



ROTARY BOREHOLE RECORD

Exploratory Hole No:

JBH01

Site Address:	Upper Heyford - Phase 9	Project No:	P2087J2052b
Client:	Elgin Investments LLP	Ground Level:	
Logged By:	JF	Date Commenced:	03/08/2021
Checked By:	sc	Date Completed:	03/08/2021
Type and diameter of equipment:	Rotary Drilling - Comacchio 205	Sheet No:	2 Of 2

Water levels recorded during boring, m					
Date:					
Hole depth:					
Casing depth:					
Level water on strike:					
Water Level after 20mins:					

Remarks

1: Drillers observations from drill arisings

2: Poor recovery due to water flush

3:

4:

Type	Depth (mbgl)	Sample or Tests							Strata			Strata Description	Installation
		Result							Legend	Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N					
	5.00											Recovered as LIMESTONE. (WHITE LIMESTONE FORMATION)	
	5.50												
	6.00									6.00		Recovered as grey CLAY. (WHITE LIMESTONE FORMATION)	
	6.50												
	7.00												
	7.50												
	8.00												
	8.50												
	9.00												
	9.50												
	10.00									10.00			



ROTARY BOREHOLE RECORD

Exploratory Hole No:

JBH02

Site Address:	Upper Heyford - Phase 9	Project No:	P2087J2052b
Client:	Elgin Investments LLP	Ground Level:	
Logged By:	JF	Date Commenced:	03/08/2021
Checked By:	sc	Date Completed:	03/08/2021
Type and diameter of equipment:	Rotary Drilling - Comacchio 205	Sheet No:	1 Of 2

Water levels recorded during boring, m					
Date:					
Hole depth:					
Casing depth:					
Level water on strike:					
Water Level after 20mins:					

Remarks

1: Drillers observations from drill arisings

2: Poor recovery due to water flush

3:

4:

Type	Depth (mbgl)	Sample or Tests							Strata			Strata Description	Installation
		Result							Legend	Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N					
	0.00									0.20		Brown sandy gravelly clay. Gravel consists of flint, brick and asphalt. (MADE GROUND)	
	0.50									0.80		Recovered as highly fractured LIMESTONE with clay bands. (WHITE LIMESTONE FORMATION)	
	1.00											Recovered as LIMESTONE. (WHITE LIMESTONE FORMATION)	
	1.50												
	2.00												
	2.50												
	3.00												
	3.50												
	4.00												
	4.50												
	5.00												



ROTARY BOREHOLE RECORD

Exploratory Hole No:

JBH02

Site Address:	Upper Heyford - Phase 9	Project No:	P2087J2052b
Client:	Elgin Investments LLP	Ground Level:	
Logged By:	JF	Date Commenced:	03/08/2021
Checked By:	sc	Date Completed:	03/08/2021
Type and diameter of equipment:	Rotary Drilling - Comacchio 205	Sheet No:	2 Of 2

Water levels recorded during boring, m					
Date:					
Hole depth:					
Casing depth:					
Level water on strike:					
Water Level after 20mins:					

Remarks

1: Drillers observations from drill arisings

2: Poor recovery due to water flush

3:

4:

Type	Depth (mbgl)	Sample or Tests							Legend	Strata		Strata Description	Installation
		Result								Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N					
	5.00										Recovered as LIMESTONE. (WHITE LIMESTONE FORMATION)		
	5.50												
	6.00								6.00		Recovered as grey CLAY. (WHITE LIMESTONE FORMATION)		
	6.50												
	7.00												
	7.50												
	8.00												
	8.50												
	9.00												
	9.50												
	10.00								10.00				



ROTARY BOREHOLE RECORD

Exploratory Hole No:

JBH03

Site Address:	Upper Heyford - Phase 9	Project No:	P2087J2052b
Client:	Elgin Investments LLP	Ground Level:	
Logged By:	JF	Date Commenced:	02/08/2021
Checked By:	sc	Date Completed:	02/08/2021
Type and diameter of equipment:	Rotary Drilling - Comacchio 205	Sheet No:	1 Of 2

Water levels recorded during boring, m					
Date:					
Hole depth:					
Casing depth:					
Level water on strike:					
Water Level after 20mins:					

Remarks

1: Drillers observations from drill arisings

2: Poor recovery due to water flush

3:

4:

Type	Depth (mbgl)	Sample or Tests							Strata			Strata Description	Installation
		Result							Legend	Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N					
	0.00									0.20		Brown sandy gravelly clay. Gravel consists of flint, brick and asphalt. (MADE GROUND)	
	0.50									0.80		Recovered as highly fractured LIMESTONE with clay bands. (WHITE LIMESTONE FORMATION)	
	1.00											Recovered as LIMESTONE. (WHITE LIMESTONE FORMATION)	
	1.50												
	2.00												
	2.50												
	3.00												
	3.50												
	4.00												
	4.50												
	5.00												



ROTARY BOREHOLE RECORD

Exploratory Hole No:

JBH03

Site Address: Upper Heyford - Phase 9

Project No: P2087J2052b

Client: Elgin Investments LLP

Ground Level:

Logged By: JF

Date Commenced: 02/08/2021

Checked By: sc

Date Completed: 02/08/2021

Type and diameter of equipment: Rotary Drilling - Comacchio 205

Sheet No: 2 Of 2

Water levels recorded during boring, m

Date:					
Hole depth:					
Casing depth:					
Level water on strike:					
Water Level after 20mins:					

Remarks

- 1: Drillers observations from drill arisings
- 2: Poor recovery due to water flush
- 3:
- 4:

Type	Depth (mbgl)	Sample or Tests							Legend	Strata		Strata Description	Installation
		Result								Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N					
									5.00			Recovered as LIMESTONE. (WHITE LIMESTONE FORMATION)	
									5.50				
									6.00	6.00		Recovered as grey CLAY. (WHITE LIMESTONE FORMATION)	
									6.50				
									7.00				
									7.50				
									8.00				
									8.50				
									9.00				
									9.50				
									10.00	10.00			



ROTARY BOREHOLE RECORD

Exploratory Hole No:

JBH04

Site Address:	Upper Heyford - Phase 9	Project No:	P2087J2052b
Client:	Elgin Investments LLP	Ground Level:	
Logged By:	JF	Date Commenced:	02/08/2021
Checked By:	sc	Date Completed:	02/08/2021
Type and diameter of equipment:	Rotary Drilling - Comacchio 205	Sheet No:	1 Of 2

Water levels recorded during boring, m					
Date:					
Hole depth:					
Casing depth:					
Level water on strike:					
Water Level after 20mins:					

Remarks

1: Drillers observations from drill arisings

2: Poor recovery due to water flush

3:

4:

Type	Depth (mbgl)	Sample or Tests							Legend	Strata		Strata Description	Installation
		Result								Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N					
	0.00												
	0.20												
	0.50												
	0.80												
	1.00												
	1.50												
	2.00												
	2.50												
	3.00												
	3.50												
	4.00												
	4.50												
	5.00												



ROTARY BOREHOLE RECORD

Exploratory Hole No:

JBH04

Site Address:	Upper Heyford - Phase 9	Project No:	P2087J2052b
Client:	Elgin Investments LLP	Ground Level:	
Logged By:	JF	Date Commenced:	02/08/2021
Checked By:	sc	Date Completed:	02/08/2021
Type and diameter of equipment:	Rotary Drilling - Comacchio 205	Sheet No:	2 Of 2

Water levels recorded during boring, m					
Date:					
Hole depth:					
Casing depth:					
Level water on strike:					
Water Level after 20mins:					

Remarks

1: Drillers observations from drill arisings

2: Poor recovery due to water flush

3:

4:

Type	Depth (mbgl)	Sample or Tests							Strata			Strata Description	Installation
		Result							Legend	Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N					
	5.00											Recovered as LIMESTONE. (WHITE LIMESTONE FORMATION)	
	5.50												
	6.00									6.00		Recovered as grey CLAY. (WHITE LIMESTONE FORMATION)	
	6.50												
	7.00												
	7.50												
	8.00												
	8.50												
	9.00												
	9.50												
	10.00									10.00			



ROTARY BOREHOLE RECORD

Exploratory Hole No:

JBH05

Site Address:	Upper Heyford - Phase 9	Project No:	P2087J2052b
Client:	Elgin Investments LLP	Ground Level:	
Logged By:	JF	Date Commenced:	02/08/2021
Checked By:	sc	Date Completed:	02/08/2021
Type and diameter of equipment:	Rotary Drilling - Comacchio 205	Sheet No:	1 Of 2

Water levels recorded during boring, m					
Date:					
Hole depth:					
Casing depth:					
Level water on strike:					
Water Level after 20mins:					

Remarks

1: Drillers observations from drill arisings

2: Poor recovery due to water flush

3:

4:

Type	Depth (mbgl)	Sample or Tests							Legend	Strata		Strata Description	Installation
		Result								Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N					
	0.00										Brown sandy gravelly clay. Gravel consists of flint, brick and asphalt. (MADE GROUND)		
	0.20										Recovered as highly fractured LIMESTONE with clay bands. (WHITE LIMESTONE FORMATION)		
	0.50												
	0.80										Recovered as LIMESTONE. (WHITE LIMESTONE FORMATION)		
	1.00												
	1.50												
	2.00												
	2.50												
	3.00												
	3.50												
	4.00												
	4.50												
	5.00												



ROTARY BOREHOLE RECORD

Exploratory Hole No:

JBH05

Site Address:	Upper Heyford - Phase 9	Project No:	P2087J2052b
Client:	Elgin Investments LLP	Ground Level:	
Logged By:	JF	Date Commenced:	02/08/2021
Checked By:	sc	Date Completed:	02/08/2021
Type and diameter of equipment:	Rotary Drilling - Comacchio 205	Sheet No:	2 Of 2

Water levels recorded during boring, m					
Date:					
Hole depth:					
Casing depth:					
Level water on strike:					
Water Level after 20mins:					

Remarks

1: Drillers observations from drill arisings

2: Poor recovery due to water flush

3:

4:

Type	Depth (mbgl)	Sample or Tests							Legend	Strata		Strata Description	Installation
		Result								Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N					
	5.00										Recovered as LIMESTONE. (WHITE LIMESTONE FORMATION)		
	5.50												
	6.00								6.00		Recovered as grey CLAY. (WHITE LIMESTONE FORMATION)		
	6.50												
	7.00												
	7.50												
	8.00												
	8.50												
	9.00												
	9.50												
	10.00								10.00				

APPENDIX 3 – CHEMICAL LABORATORY TEST RESULTS



Shaw Carter

Jomas Associates Ltd
Lakeside House
1 Furzeground Way
Stockley Park
UB11 1BD

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

e: Jomas Associates -

Analytical Report Number : 21-92971

Project / Site name:	Upper Heyford - Phase 9	Samples received on:	13/08/2021
Your job number:	JJ2052B	Samples instructed on/ Analysis started on:	13/08/2021
Your order number:	P2087JJ2052B.5	Analysis completed by:	20/08/2021
Report Issue Number:	1	Report issued on:	20/08/2021
Samples Analysed:	5 water samples		

Signed: 

Karolina Marek
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 21-92971
 Project / Site name: Upper Heyford - Phase 9

Your Order No: P2087JJ2052B.5

Lab Sample Number	1972657			1972658			1972659			1972660			1972661		
Sample Reference	JHB1			JHB2			JHB3			JHB4			JHB5		
Sample Number	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Depth (m)	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Date Sampled	12/08/2021			12/08/2021			12/08/2021			12/08/2021			12/08/2021		
Time Taken	None Supplied			None Supplied			None Supplied			None Supplied			None Supplied		
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status												

Monoaromatics & Oxygenates

Parameter	Units	Limit of detection	Accreditation Status	1972657	1972658	1972659	1972660	1972661
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

Parameter	Units	Limit of detection	Accreditation Status	1972657	1972658	1972659	1972660	1972661
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10

Parameter	Units	Limit of detection	Accreditation Status	1972657	1972658	1972659	1972660	1972661
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 21-92971
Project / Site name: Upper Heyford - Phase 9

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	NONE
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

**Accounts**

Jomas Associates Ltd
Lakeside House
1 Furzeground Way
Stockley Park
UB11 1BD

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

e: Jomas Associates -

Analytical Report Number : 21-95817

Project / Site name:	Upper hayford - Phase 9	Samples received on:	27/08/2021
Your job number:	JJ2052B	Samples instructed on/ Analysis started on:	27/08/2021
Your order number:	P2087JJ2052B.6	Analysis completed by:	06/09/2021
Report Issue Number:	1	Report issued on:	06/09/2021
Samples Analysed:	5 water samples		

Signed: 

Karolina Marek
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 21-95817
 Project / Site name: Upper hayford - Phase 9

Your Order No: P2087JJ2052B.6

Lab Sample Number	1990209	1990210	1990211	1990212	1990213
Sample Reference	JBH1	JBH2	JBH3	JBH4	JBH5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled	24/08/2021	24/08/2021	24/08/2021	24/08/2021	24/08/2021
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics & Oxygenates

Parameter	Unit	Limit of detection	Accreditation Status	1990209	1990210	1990211	1990212	1990213
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

Parameter	Unit	Limit of detection	Accreditation Status	1990209	1990210	1990211	1990212	1990213
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10

Parameter	Unit	Limit of detection	Accreditation Status	1990209	1990210	1990211	1990212	1990213
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 21-95817
Project / Site name: Upper hayford - Phase 9

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	NONE
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

APPENDIX 4 – GROUNDWATER SAMPLING RECORDS

LOW FLOW GROUNDWATER MONITORING BOREHOLE RECORD SHEET

Site: Upper Heyford	Operative(s): JRO	Date: 12/08/2021	Time: 10:00	Round: 1	Page: 1 of
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MONITORING EQUIPMENT

Instrument Type	Instrument Make	Serial No.	Date Last Calibrated
<i>SmarTROLL MP</i>	In-Situ	448904	26/06/2019
<i>Dip Meter Interface Probe</i>	In-Situ		

MONITORING CONDITIONS

Weather Conditions: Overcast/sunny	Ground Conditions: Dry	Temperature: 19°C
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Hole ID	Temperature (°C)	Specific Conductivity (µS/cm)	pH	(ORP) Oxidation-Reduction Potential (mV)	(RDO) Rugged Dissolved Oxygen Concentration (mg/L)	Depth to product – NB do not sample if present	Water Level (Start of testing)	Water Level (End of testing)	Hole Depth	Comments
BH01	-	-	-	-	-	Not Detected	7.22	-	7.90	Historic well. Unsuccessfully tried to collect grab sample - water too deep for pump
JBH1	16.45	815.37	8.34	124.5	0.58	Not Detected	2.40	2.42	9.63	Hole very silty at bottom. Readings stable and samples obtained after 20 minutes. Slightly turbid
JBH2	14.69	708.35	6.22	129.5	0.31	Not Detected	4.37	4.37	9.58	Hole very silty at bottom. Readings stable and samples obtained after 18 minutes. Slightly turbid
JBH3	13.54	622.56	6.92	131.2	0.33	Not Detected	5.26	5.26	9.74	Hole very silty at bottom. Readings stable and samples

Hole ID	Temperature (°C)	Specific Conductivity (µS/cm)	pH	(ORP) Oxidation-Reduction Potential (mV)	(RDO) Rugged Dissolved Oxygen Concentration (mg/L)	Depth to product – NB do not sample if present	Water Level (Start of testing)	Water Level (End of testing)	Hole Depth	Comments
										obtained after 20 minutes. Slightly turbid
JBH4	14.17	653.14	6.91	138.4	0.84	Not Detected	5.61	5.62	9.55	Hole very silty at bottom. Readings stable and samples obtained after 20 minutes. Low turbidity
JBH5	14.74	674.53	6.84	140.4	0.77	Not Detected	3.01	3.03	9.28	Hole silty at bottom. Readings stable and samples obtained after 17 minutes. Low turbidity

LOW FLOW GROUNDWATER MONITORING BOREHOLE RECORD SHEET

Site: Upper Heyford	Operative(s): JRO	Date: 24/08/2021	Time: 09:30	Round: 2	Page: 1 of
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MONITORING EQUIPMENT

Instrument Type	Instrument Make	Serial No.	Date Last Calibrated
<i>SmarTROLL MP</i>	In-Situ	448904	26/06/2019
<i>Dip Meter Interface Probe</i>	In-Situ		

MONITORING CONDITIONS

Weather Conditions: Overcast	Ground Conditions: Dry	Temperature: 15°C
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Hole ID	Temperature (°C)	Specific Conductivity (µS/cm)	pH	(ORP) Oxidation-Reduction Potential (mV)	(RDO) Rugged Dissolved Oxygen Concentration (mg/L)	Depth to product – NB do not sample if present	Water Level (Start of testing)	Water Level (End of testing)	Hole Depth	Comments
BH01	-	-	-	-	-	Not Detected	7.13	-	7.91	Historic well. Unsuccessfully tried to collect grab sample - water too deep for pump
JBH1	17.23	757.13	7.47	209.5	0.26	Not Detected	2.36	2.37	9.72	Hole silty at bottom. Readings stable and samples obtained after 12 minutes. Slightly turbid
JBH2	15.41	764.89	7.01	209.0	0.83	Not Detected	4.23	4.25	9.64	Hole very silty at bottom. Readings stable and samples obtained after 12 minutes. Slightly turbid
JBH3	14.49	642.39	7.17	209.0	0.77	Not Detected	5.16	5.17	9.67	Hole silty at bottom. Readings stable and samples obtained after 10 minutes.

Hole ID	Temperature (°C)	Specific Conductivity (µS/cm)	pH	(ORP) Oxidation-Reduction Potential (mV)	(RDO) Rugged Dissolved Oxygen Concentration (mg/L)	Depth to product – NB do not sample if present	Water Level (Start of testing)	Water Level (End of testing)	Hole Depth	Comments
										Low turbidity
JBH4	14.38	655.51	7.25	212.9	2.66	Not Detected	5.49	5.50	9.84	Hole silty at bottom. Readings stable and samples obtained after 12 minutes. Slightly turbid
JBH5	15.38	656.34	7.45	212.4	0.49	Not Detected	2.97	2.97	9.15	Hole silty at bottom. Readings stable and samples obtained after 10 minutes. Low turbidity

Specific Conductivity (µS/cm)

This is a measure of the capability of a solution such as water in a stream to pass an electric current. This is an indicator of the concentration of dissolved electrolyte ions in the water. It doesn't identify the specific ions in the water. However, significant increases in conductivity may be an indicator that polluting discharges have entered the water.

Every creek will have a baseline conductivity depending on the local geology and soils. Higher conductivity will result from the presence of various ions including nitrate, phosphate, and sodium.

The basic unit of measurement for conductivity is micromhos per centimetre (µmhos/cm) or micro Siemens per centimetre (µS/cm). Either can be used, they are the same. It is a measure of the inverse of the amount of resistance an electric charge meets in traveling through the water. Distilled water has a conductivity ranging from 0.5 to 3 µS/cm, while most streams range between 50 to 1500 µS/cm. Freshwater streams ideally should have a conductivity between 150 to 500 µS/cm to support diverse aquatic life.

pH

A measure of a solution's acidity. In water, small numbers of water molecules (H₂O) will break apart or disassociate into hydrogen ions (H⁺) and hydroxide ions (OH⁻). Other compounds entering the water may react with these, leaving an imbalance in the numbers of hydrogen and hydroxide ions. When more hydrogen ions react, more hydroxide ions are left in solution and the water is basic; when more hydroxide ions react, more hydrogen ions are left and the water is acidic. pH is a measure of the number of hydrogen ions and thus a measure of acidity.

pH is measured on a logarithmic scale between 1 and 14 with 1 being extremely acid, 7 neutral, and 14 extremely basic. Because it is a logarithmic scale there is a tenfold increase in acidity for a change of one unit of pH, e.g. 5 is 100 times more acid than 7 on the pH scale. The largest variety of freshwater aquatic organisms prefer a pH range between 6.5 to 8.0.

(RDO) Rugged Dissolved Oxygen Concentration (mg/L)

Dissolved oxygen is oxygen gas molecules (O₂) present in the water. Plants and animals cannot directly use the oxygen that is part of the water molecule (H₂O), instead depending on dissolved oxygen for respiration. Oxygen enters streams from the surrounding air and as a product of photosynthesis from aquatic plants. Consistently high levels of dissolved oxygen are best for a healthy ecosystem.

Levels of dissolved oxygen vary depending on factors including water temperature, time of day, season, depth, altitude, and rate of flow. Water at higher temperatures and altitudes will have less dissolved oxygen. Dissolved oxygen reaches its peak during the day. At night, it decreases as photosynthesis has stopped while oxygen consuming processes such as respiration, oxidation, and respiration continue, until shortly before dawn.

Human factors that affect dissolved oxygen in streams include addition of oxygen consuming organic wastes such as sewage, addition of nutrients, changing the flow of water, raising the water temperature, and the addition of chemicals.

Dissolved oxygen is measured in mg/L.

0-2 mg/L: not enough oxygen to support life.

2-4 mg/L: only a few fish and aquatic insects can survive.

4-7 mg/L: good for many aquatic animals, low for cold water fish

7-11 mg/L: very good for most stream fish

(ORP) Oxidation- Reduction Potential (mV)

ORP is a measure of the cleanliness of the water & its ability to break down contaminants". It has a range of -2,000 to + 2,000 and units are in "mV" (millivolts).

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