

Ground Gas Addendum

Site: Fairways Lodge, Prestwich
Reference:17-206-R3-1
Date: July 2024



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QUALITY ASSURANCE

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This report has been prepared for the sole benefit, use, and information of the client. The liability of Environmental Engineering Partnership Limited T/A E3P with respect to the information contained in the report will not extend to any third party. This report has been prepared by the qualified persons as listed below.

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DRAWING LIST

17-206-001 - Site Location Plan
17-206-002 - Proposed Development Plan
17-206-003 - Historical Features Plan
17-206-004 - Site Features Plan
17-206-005 - Exploratory Hole Location Plan
17-206-006 - Depth of Made Ground Plan
17-206-010 - Conceptual Site Model
17-206-018 - Contamination Exceedances Plan



1. INTRODUCTION

1.1. BACKGROUND

E3P has previously completed a ground investigation at Fairways Lodge, George Street, Prestwich. The findings of the ground investigation are presented within the E3P report reference: 17-206-R2-1, dated December 2023.

During the investigation, E3P installed four ground gas monitoring wells, which were to be monitored over a period of three months after installation. The data collected from the gas monitoring wells are summarised in this report and this comprises the completed ground gas assessment.

1.2. PROPOSED DEVELOPMENT

McCarthy & Stone proposes to construct a retirement home comprising c. 32 one-bed apartments and 20 two-bed apartments with associated infrastructure, car parking and soft landscaping. Drawing 17 206-002 (Appendix III) identifies the proposed development layout.

A snapshot of the proposed development layout is indicated in Figure 1.1.

FIGURE 1.1 SNAPSHOT OF PROPOSED DEVELOPMENT



1.3. OBJECTIVES

The objectives of the ground gas addendum report are to provide a detailed assessment of ground gas risk based on all available data from the E3P ground investigation works.

1.4. LIMITATIONS

The limitations of this report are presented in Appendix I.

1.5. CONFIDENTIALITY

E3P has prepared this report solely for the use of the client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from E3P; a charge may be levied against such approval.



2. RATIONALE

Hazardous ground gas qualitative risk assessment is based on a conceptual site model (CSM) similar to that used for soil and groundwater contamination sources (i.e., source pathway receptor pollutant linkages).

The risk can be assessed based on knowledge of the ground conditions and CSM and a measure of hazardous gas concentrations and gas flow at the site within monitoring standpipes.

2.1. SOURCES AND PATHWAYS OF GROUND GAS

Table 2.1 summarises the potential sources and pathways of ground gas within the context of the recorded site setting and proposed development.

TABLE 2.1 IDENTIFIED POTENTIAL SOURCES OF GROUND GAS

SOURCE
Made Ground Made Ground deposits were encountered within all exploratory hole locations to depths of between 0.50 m and 3.80 m bgl although, in general, Made Ground was encountered to a depth of less than 1.00 m bgl. In WS105 in the location of the former reservoir, Made Ground was identified to 3.80 m bgl comprising reworked topsoil overlying dark brown to grey gravelly sand with mudstone, sandstone, ash and brick. Plant debris was noted in the very silty sand between 1.00 m – 2.60 m bgl which represents a potential source of ground gas.
Drift Strata Drift deposits were encountered within all exploratory hole locations at depths of between 0.50 m and 5.45 m bgl. The drift deposits generally comprise medium dense to dense slightly gravelly fine to medium SAND with mudstone and sandstone. Beneath the organic soils in WS105, brown sandy clayey SILT was encountered to the base of the borehole at 5.45 m bgl. The organic soils are considered a potential source of ground gas.
Solid Strata The solid bedrock geology was not encountered during the ground investigation. Historical (~1850) borehole records for the site adjacent to the south suggest that sandstone bedrock is present at ~25.0 m bgl. A deep borehole undertaken by E3P on the adjacent site identified red, weathered SANDSTONE at 26.50 m bgl. The site is not located within a Coal Authority deemed High-Risk Development Area. There are no outcrops or mine shaft entries in close proximity. No further assessment is required in relation to coal mining.
Landfill Sites Two historical landfill sites are located within 250 m. The closest is located 80 m south east at the former Mountheath Industrial Estate, however the site has now been remediated to form the Bellway Homes development. The landfill received waste from 1979 to 1980, the material is recorded as originating from general construction works and is not domestic refuse. A historical landfill is also recorded 195 m south west at Heathlands Drive. No further details are available.



SOURCE

Other Gases

The site is located within an area where less than 1% of homes are above the action level. BGS reports that radon protective measures are not necessary in the construction of new dwellings or extensions.

Elevated total mercury has been identified within one location on site (WS101: 3.1 mg/kg) however, speciation has not been undertaken to determine the levels of elemental mercury (volatile).

Further post-demolition investigations are required as and when full and unrestricted access is available.

The CIRIA C665 guidance on gas risk assessment includes recommendations for periods and frequencies for monitoring visits. These recommendations take into account the nature of the proposed development and the likely generation potential of the source.

The proposed development comprises retirement apartments, which would be classified as a Type B development (moderate sensitivity) in accordance with BS8485:2015+A1:2019. However, it is considered that the likely generation potential of the identified gas sources (taking into account the likelihood of future increases in gas generation) would be best classified as low.

Therefore within the context of the proposed residential end-use and ground gas generation potential, the gas assessment requires six visits over three months, with at least two sets of readings at low or falling atmospheric pressure.



3. GROUND GAS RISK ASSESSMENT

3.1. GROUND GAS RISK ASSESSMENT METHODOLOGY

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in:

- ✦ CIRIA Report 665 – *Assessing risks posed by hazardous ground gases to buildings (2007)*
- ✦ BS8485:2015+A1:2019 – *Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*

BS8485 provides guidance on the level of gas protection requirements based upon the characteristic situation (CS) and the proposed development based on building type.

Therefore, in accordance with BS8485, based on the measured flow rates and hazardous gas concentrations, individual hazardous gas flow rates (Q_{hg}) shall be derived for each monitoring point, from which the site characteristic hazardous gas flow rate (Q_{hgs}), and then the Characteristic Situation (CS) can be determined.

The following equation should be utilised:

$$Q_{hg} = q \left(\frac{C_{hg}}{100} \right)$$

Where:

q is the measured flow rate (in litres per hour) of combined gases from the monitoring standpipe
 C_{hg} is the measured hazardous gas concentration (in percentage volume/volume).

The subsequent derived gas screening value (GSV) should be the maximum Q_{hg} (flow rate x concentration as a percentage volume) for all the monitoring events.

A 'worst case check' may be carried out using the maximum recorded flow in any hole with the maximum concentration in any hole to present the plausible worst case conditions. Adoption of the worst case Q_{hg} requires thorough justification and reference to the CSM.

The final derived GSV can then be used to characterise the site as summarised in Table 3.1.



TABLE 3.1 SITE CHARACTERISATION BY GSV (BS8485:2015+A1 2019)

CS	HAZARD POTENTIAL	GSV (l/hr) FOR METHANE AND CARBON DIOXIDE	ADDITIONAL FACTORS
CS1	Very Low	< 0.07	Typically <1% methane concentration and <5% carbon dioxide concentration (otherwise consider an increase to CS2)
CS2	Low	< 0.70	Typical measured flow rate <70 l/h (otherwise consider an increase to CS3)
CS3	Moderate	< 3.5	N/A
CS4	Moderate to High	< 15	N/A
CS5	High	< 70	N/A
CS6	Very High	> 70	N/A

Notes

- 1) The CS is equivalent to the characteristic GSV in CIRIA C665.
- 2) The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter should be considered.
- 3) Gas Screening Value is the Borehole Gas Volume Flow Rate, in litres per hour, multiplied by the concentration in the air stream of the particular gas being considered.
- 4) The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

3.2. MONITORING METHODOLOGY

Concentrations of methane (CH₄), carbon dioxide (CO₂) and oxygen (O₂) (hydrogen sulphide) were measured using a calibrated infrared gas analyser (GFM435) with gas flow rates measured using an integrated flow meter.

Gas measurements were recorded for a minimum of 300 seconds (5 minutes) at each location, increasing to 600 seconds if elevated concentrations were identified, at which point the maximum concentration of CH₄ and CO₂, together with the lowest concentration of O₂ were recorded.

The results of the ground gas monitoring are presented in Table 3.2.

In addition to the raw data, the results for each individual standpipe have been assessed with reference to guidance provided in BS8485. Based on the initial peak measured flow rates and hazardous gas concentrations, individual hazardous gas flow rates (Q_{hg}) have been derived for each monitoring point, from which an individual Characteristic Situation (CS) can ultimately be determined.



TABLE 3.2 SUMMARY OF GROUND GAS MONITORING RESULTS

WELL	STRATA	DATE	CH ₄ PEAK (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ Q _{hg} (l/hr)	CO ₂ PEAK (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ Q _{hg} (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	PEAK FLOW (l/hr)	STEADY FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS101	Natural SAND	16/10/2023	0.10	0.10	0.0001	0.10	0.10	0.0001	21.10	1013	Falling	0.10	0.10	1.00-3.00	2.85	2.65
		10/11/2023	0.10	0.10	0.0001	7.30	7.20	0.0073	13.30	983	Rising	0.10	0.10		2.86	2.10
		27/11/2023	0.10	0.10	0.0001	0.10	0.10	0.0001	20.30	1000	Steady	0.10	0.10		2.85	2.30
		07/12/2023	0.10	0.10	0.0001	6.40	6.40	0.0064	13.60	996	Falling	0.10	0.10		2.85	1.90
		19/12/2023	0.10	0.10	0.0001	0.10	0.10	0.0001	20.00	1009	Steady	0.10	0.10		2.86	1.72
		04/01/2024	Monitoring Well Inaccessible												–	
WS103	Natural SAND	16/10/2023	0.10	0.10	0.0001	0.10	0.10	0.0001	20.60	1012	Falling	0.10	0.10	1.00-4.00	3.90	Dry
		10/11/2023	0.10	0.10	0.0001	6.80	6.80	0.0068	13.70	983	Rising	0.10	0.10		3.90	3.86
		27/11/2023	0.10	0.10	0.0001	0.10	0.10	0.0001	20.30	1000	Steady	0.10	0.10		3.90	3.85
		07/12/2023	0.10	0.10	0.0001	6.40	6.40	0.0064	13.50	996	Falling	0.10	0.10		3.92	3.90
		19/12/2023	0.10	0.10	0.0001	0.10	0.10	0.0001	19.90	1009	Steady	0.10	0.10		3.97	3.89
		04/01/2024	0.10	0.10	0.0001	9.20	9.10	0.0092	10.20	991	Steady	0.10	0.10		3.97	3.70
WS105	Made Ground	16/10/2023	0.10	0.10	0.0001	0.10	0.10	0.0001	20.50	1012	Falling	0.10	0.10	1.00-2.50	2.35	Dry
		10/11/2023	63.00	18.10	0.0630	23.00	6.90	0.0230	14.80	983	Rising	0.10	0.10		2.35	Dry
		27/11/2023	0.10	0.10	0.0001	0.10	0.10	0.0001	20.30	1000	Steady	0.10	0.10		2.35	Dry
		07/12/2023	66.30	19.00	0.0663	22.00	6.90	0.0220	14.20	995	Falling	0.10	0.10		2.35	Dry
		19/12/2023	0.10	0.10	0.0001	0.10	0.10	0.0001	19.80	1009	Steady	0.10	0.10		2.38	2.28
		04/01/2024	73.30	73.30	0.0733	22.80	22.70	0.0228	0.10	991	Steady	0.10	0.10		2.38	2.20



WELL	STRATA	DATE	CH ₄ PEAK (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ Q _{hg} (l/hr)	CO ₂ PEAK (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ Q _{hg} (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	PEAK FLOW (l/hr)	STEADY FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS106	Natural SAND	16/10/2023	Monitoring Well Inaccessible											1.00 – 4.00	–	
		10/11/2023													–	
		27/11/2023													–	
		07/12/2023													–	
		19/12/2023	0.10	0.10	0.0001	0.10	0.10	0.0001	20.00	1009	Steady	0.10	0.10		3.94	Dry
		04/01/2024	Monitoring Well Inaccessible												–	

Notes

CIRIA Characteristic Situation

Q_{hg}



CS1

<0.07

Typical Max CO₂ <5 % Typical Max CH₄ <1 %

Values in **BOLD** exceed CS1 Thresholds

CS2

<0.7

Flow rate not to exceed 70 l/hr otherwise consider increase to CS3

Values in **BLUE** denote water above level of response zone (flooded)

CS3

<3.5

CS4

<15

Quantitative Risk Assessment required to evaluate scope of protective measures



3.3. SUMMARY OF MONITORING RESULTS

3.3.1. GROUNDWATER

WS105 was noted to be dry during the first four monitoring visits, while WS103 and WS106 were recorded as dry during the first monitoring visit and fifth monitoring visits respectively.

Groundwater was recorded between 1.72 m and 3.90 m bgl. None of the monitoring wells were noted to be flooded.

3.3.2. BAROMETRIC PRESSURE

Visits 1 and 4 were undertaken during periods of falling pressure, with pressure recorded to be 1013 mbar and 996 mbar respectively.

Visit 2 was undertaken during a period of low, rising pressure, with pressure recorded to be 983 mbar.

Visits 3, 5 and 6 were undertaken during periods of steady pressure.

It is therefore considered that the visits have been undertaken over representative conditions.

3.3.3. GAS FLOW

Throughout the monitoring period, flow rates were recorded to be 0.10 l/hr (limit of detection of the analyser).

3.3.4. GAS CONCENTRATIONS

The maximum methane value recorded within the monitoring wells was 73.30 % v/v recorded in WS105 during visit 6. During visits 2 and 4 the recorded methane value in the monitoring wells was 66.30 % and 63.00 % v/v respectively. Every other recording at WS105 and the rest of the monitoring wells had a recorded methane value of 0.10 % v/v (limit of detection of the analyser).

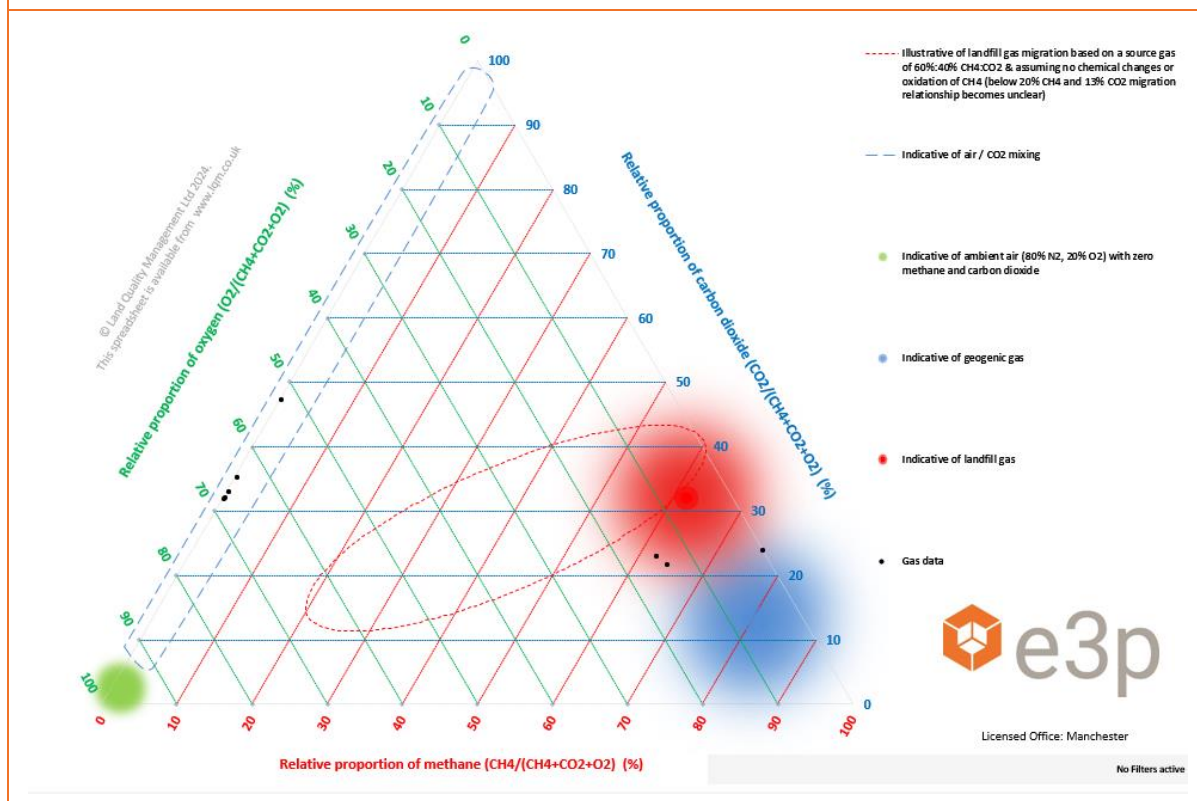
Carbon dioxide concentrations were recorded at concentrations ranging from 0.10 % v/v to 23.00 % v/v with the highest concentration recorded in WS105 during visit 2. Elevated levels of carbon dioxide were recorded across all monitoring wells during visits 2 and 4, noted to be during periods of low pressure.

3.4. TERNARY PLOT FOR GROUND GAS

A ternary gas plot is a triangular plot of three variables which equal 100%. They allow the composition of gas to be identified and can help to identify the potential source of gas. As carbon dioxide is present in natural soils (such as Glacial Till), this can lead to uncertainty about whether it is necessary to increase the gas regime. On this basis, a ternary plot has been used as an assessment tool for the gas monitoring data to identify if there is a true risk. Figure 3.1 shows the ternary gas plot for the gas monitoring data from WS101, WS103 and WS105.



FIGURE 3.1 TERNARY PLOT



The ternary gas plot indicates that the concentrations in WS101 and WS103 are indicative of air/ CO_2 mixing. The concentrations in WS105 plot close to the area indicative of landfill gas, and the ground gas source is considered to be the infilled reservoir.

3.5. CONCLUSION

The determined Characteristic Situation for each standpipe is presented in Table 3.3.

TABLE 3.3 GAS RISK PROFILE AND LOCATION

WELL	MAX FLOW (l/hr)	MAX CH_4 (%V/V)	MAX CH_4 Q_{hg} (l/hr)	MAX CO_2 (%V/V)	MAX CO_2 Q_{hg} (l/hr)	CHARACTERISTIC SITUATION
WS101	0.10	0.10	0.0001	7.30	0.0073	CS2
WS103	0.10	0.10	0.0001	9.20	0.0092	CS2
WS105	0.10	73.30	0.0733	23.00	0.0230	CS2
WS106	0.10	0.10	0.0001	0.10	0.0001	CS1 (only 1 visit)

E3P has assessed the previous variables and the following conclusions have been made:

- The site is predominantly SAND at depths of 0.50 m bgl to in access of 5.45 m bgl.
- Made Ground deposits were encountered within all exploratory hole locations to depths of between 0.50 m and 3.80 m bgl although, in general, Made Ground was encountered to a depth of less than 1.00 m bgl. Plant debris was noted in the very silty sand in WS105 between 1.00 – 2.60 m bgl.



- ✳ In the vicinity of WS101 and WS103, carbon dioxide has been identified above the 5 % v/v threshold during periods of low atmospheric pressure.
- ✳ Significantly elevated methane has been identified in WS105 during three monitoring visits (up to 73.30 % v/v) which is located within the infilled reservoir. Elevated carbon dioxide up to 23.00 % v/v has also been recorded in this location. The GSV is within a CS2 classification.
- ✳ The closest historical landfill is located 80 m south east, however the site has now been remediated to form the Bellway Homes development. A historical landfill is also recorded 195 m south west at Heathlands Drive.
- ✳ Further investigation will be required to determine the extent of organic materials within the location of the former infilled reservoirs.
- ✳ The monitoring completed to date suggests that the site can be classified as CS2, however post remediation ground gas monitoring will be required to confirm the ground gas classification.
- ✳ Assessment is also required to confirm whether elemental mercury is present which may pose a risk to future site users through vapour inhalation.

It is recommended that the full ground gas assessment and recommended protection measures (if applicable) are agreed with the local authority prior to their adoption on site. Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.

A Ground Gas Protection Design Report will be required. This report will consider the construction details and specific verification procedures.

END OF REPORT



APPENDIX I

LIMITATIONS

GENERAL

1. This report and any associated works (together comprising the "Services") were compiled and carried out by E3P for the client (as present in Section 1) under the E3P "Terms of Business" or with those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed and outlined in the body of the report.
2. Unless explicitly agreed otherwise, in writing, this report has been prepared under E3P Standard Terms and Business as included within our proposal to the Client.
3. Project-specific appointment documents may be agreed upon at our discretion and a charge may be levied for both the time to review and finalise appointment documents and also for associated changes to the appointment terms. E3P reserves the right to amend the fee should any changes to the appointment terms create an increased risk to E3P.
4. The report needs to be considered in light of the proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report and any previous works referenced within the report.

PHASE 1 GEOENVIRONMENTAL AND PRELIMINARY RISK ASSESSMENTS

5. Coverage: This section covers reports with the following titles or combination of titles: Phase 1; Desktop Study; Geoenvironmental Assessment; Development Appraisal; Preliminary Environmental Risk Assessment; Constraints Report; Due Diligence Report; Geotechnical Development Review; Environmental Statement; Environmental Chapter; Baseline Environmental Assessment; Project Scope Summary Report (PSSR), Program Environmental Impact Report (PEIR), Geotechnical Development Risk Register; Agricultural Land Assessment; Mineral Safeguarding Assessment; Desk Top Coal Mining Risk Assessment; Hydrogeological Appraisal; Construction Environmental Management Plan; and Site Water Management Plan.
6. The works undertaken to prepare this report comprised a study of available and easily documented information from a variety of sources (including the Client), together with (where appropriate) a brief walkover inspection of the Site and correspondence with relevant authorities and other interested parties. Due to the short timescales associated with these projects responses may not have been received from all parties. E3P cannot be held responsible for any disclosures that are provided post-production of our report and will not automatically update our report.
7. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only for the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, E3P reserves the right to review such information and, if warranted, to modify the opinions accordingly.
8. It should be noted that any risks identified in this report are perceived risks based on the information reviewed. Actual risks can only be assessed following intrusive investigations of the site.



9. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and does not constitute or replace full and proper surveys completed by suitably qualified and experienced specialists in these fields.
10. E3P does not warrant work/data undertaken/provided by others.

INTRUSIVE INVESTIGATION REPORTS

11. Coverage: The following report titles (or combination) may cover this category of work: Geoenvironmental Site Investigation; Geotechnical Assessment; GIR (Ground Investigation Reports); Preliminary Environmental And Geotechnical Risk Assessment; Preliminary Summary; Coal Mining Risk Assessment, Ground Gas Addendum; and, Geotechnical Risk Register.
12. The investigation has been undertaken to provide information concerning either:
 - I. The type and degree of contamination present at the site in order to allow a generic quantitative risk assessment to be undertaken; or
 - II. Information on the soil properties present at the site to allow for geotechnical development constraints to be considered.
13. The scope of the investigation was selected on the basis of the specific development and land use scenario proposed by the Client and may be inappropriate to another form of development or scheme. If the development layout was not known at the time of the investigation the report findings may need revisiting once the development layout is confirmed.
14. Unless otherwise specified in the scope of works, any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.
15. For contamination purposes, the objectives of the investigation are limited to establishing the risks associated with potential contamination sources with the potential to cause harm to human health, building materials, the environment (including adjacent land), or controlled waters.
16. For geotechnical investigations, the purpose is to broadly consider potential development constraints associated with the physical property of the soils underlying the site within the context of the proposed future or continued use of the site, as stated within the report.
17. The amount of exploratory work, soil property testing and chemical testing undertaken has necessarily been restricted by various factors which may include accessibility, the presence of services; existing buildings; current site usage or short timescales. The exploratory holes completed assess only a small percentage of the area in relation to the overall size of the Site, and as such can only provide a general indication of conditions.



18. The number of sampling points and the methods of sampling and testing do not preclude the possible existence of contamination where concentrations may be significantly higher than those actually encountered or ground conditions that vary from those identified. In addition, there may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.
19. The inspection, testing and monitoring records relate specifically to the investigation points and the timeframe that the works were undertaken. They will also be limited by the techniques employed. As part of this assessment, E3P has used reasonable skill and care to extrapolate conditions between these points based on assumptions to develop our interpretation and conclusions.
20. The assumption made in forming our conclusions is that the ground and groundwater conditions (both chemically and physically) are the same as have been encountered during the works undertaken at the specific points of investigation and at the time of the investigation.
21. Conditions can change between investigation points both spatially and over time and these interpretations should therefore be considered indicative. The assessment of extreme weather events and their impact on ground conditions is not within the scope of E3P's work.
22. The risk assessment and opinions provided are based on currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values. Specific assumptions associated with the risk assessment process have been outlined within the body or associated appendix of the report.
23. Additional investigations may be required in order to satisfy relevant planning conditions or to resolve any engineering and environmental issues.
24. Where soil contamination concentrations recorded as part of this investigation are used for commentary on the potential waste classification of soils for disposal purposes, these should be classed as indicative only. Due consideration should be given to the variability of contaminant concentrations taken from targeted samples versus bulk excavated soils and the potential variability of contaminant concentrations between sampling locations. Where major waste disposal operations are considered, targeted waste classification investigations should be designed and the waste classification and any subsequent disposal option agreed upon with licenced subcontractors and/or the relevant regulators.
25. The results of the asbestos testing are factually reported and interpretation is given as to how this relates to the previous use of the site, the types of ground encountered and site conceptualisation. This does not however constitute a formal asbestos assessment. These results should be treated cautiously and should not be relied upon to provide detailed and representative information on the delineation, type and extent of bulk ACMs and/or trace loose asbestos fibres within the soil matrix at the site.
26. If costs have been included in relation to additional site works, and/or site remediation works these must be considered as indicative only and must be confirmed by a qualified quantity surveyor.



EUROCODE 7: GEOTECHNICAL DESIGN

27. On 1st April 2010, BS EN 1997-1:2004 (Eurocode 7: Geotechnical Design – Part 1) became the mandatory baseline standard for geotechnical ground investigations.
28. In terms of geotechnical design for foundations, slopes, retaining walls and earthworks, EC7 sets guidance on design procedures including specific guidance on the numbers and spacings of boreholes for geotechnical design, there are limits to methods of ground investigation and the quality of data obtained and there are also prescriptive methods of assessing soil strengths and methods of design. Unless otherwise explicitly stated, the work has not been undertaken in accordance with EC7. A standard geotechnical interpretative report will not meet the requirements of the Geotechnical Design Report (GDR) under Eurocode 7. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. The report is likely to represent a Ground Investigation Report (GIR) under the Eurocode 7 guidance.

DETAILED QUANTITATIVE RISK ASSESSMENTS AND REMEDIATION AND ENABLING WORK STRATEGY REPORTS

29. These reports build upon previous report versions and associated notes. The scope of the investigation, further testing and monitoring and associated risk assessments were selected based on the specific development and land use scenario proposed by the Client and may not be appropriate to another form of development or scheme layout. The risk assessment and opinions provided are based on currently available approaches in the generation of Site Specific Assessment Criteria relating to contamination concentrations and are not considered to represent a risk in a specific land use scenario to a specific receptor. No liability can be accepted for the retrospective effects of any future changes or amendments to these values, associated models or associated guidance.
30. The outputs of the Detailed Quantitative Risk Assessments are based upon the manipulation of standard risk assessment models. These are our interpretation of the risk assessment criteria.
31. Before adoption on-site, assessment criteria will need to be discussed and agreed upon with the Regulatory Authorities prior to adoption on site. The regulatory discussion and engagement process may result in an alternative interpretation being determined and agreed. The process and timescales associated with the Regulatory Authority engagement are not within the control of E3P. All costs and programmes presented as a result of this process should be validated by a quantity surveyor and should be presumed to be indicative.
32. E3P does not accept liability for any subcontract work that has not been completed in strict accordance with an approved E3P Remediation and Enabling Works Strategy.

GEOTECHNICAL DESIGN REPORT (GDR)

33. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. All the relevant information needs to be provided to allow for a GDR to be produced.



MONITORING (INCLUDING REMEDIATION MONITORING REPORTS AND BUILD PHASE MITIGATION)

34. These reports are factual and comprise monitoring, normally groundwater and ground gas and data provided by contractors as part of earthworks or remedial works.
35. The data is presented and will be compared with assessment criteria.



APPENDIX II

GLOSSARY

TERMS

ACM	Asbestos containing material	MMP	Materials management plan
ADS	Acoustic design statement	ND	Not detected
AST	Aboveground storage tank	NDP	Nuclear density probe
BGS	British Geological Survey	NMP	Noise management plan
BSI	British Standards Institute	NPSE	Noise policy statement for England
BTEX	Benzene, toluene, ethylbenzene, xylenes	NR	Not recorded
CA	Coal Authority	PAH	Polycyclic aromatic hydrocarbon
CBR	California bearing ratio	PCB	Polychlorinated biphenyl
CIEH	Chartered Institute of Environmental Health	PI	Plasticity index
CIRIA	Construction Industry Research Association	PID	Photo ionisation detector
CLEA	Contaminated land exposure assessment	POS	Public open space
CML	Council of Mortgage Lenders	PPE	Personnel protective equipment
CoC	Contaminants of concern	ProPG	Professional practice guidance
CSM	Conceptual site model	QA	Quality assurance
DNAPL	Dense nonaqueous phase liquid (chlorinated solvents, PCB)	SGV	Soil guideline value
DWS	Drinking water standard	SPH	Separate phase hydrocarbon
EA	Environment Agency	SPT	Standard penetration test
EQS	Environmental quality standard	SVOC	Semi volatile organic compound
FFL	Finished floor level	TPH	Total and speciated petroleum hydrocarbon
GAC	General assessment criteria	TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group)
GL	Ground level	UKWIR	United Kingdom Water Infrastructure Risk
GSV	Gas screening value	UST	Underground storage tank
HCV	Health criteria value	VCC	Vibronaceae column
ICSM	Initial conceptual site model	VOC	Volatile organic compound
LEL	Lower explosive limit	VRSC	Vibroreplacement stone columns
LMRL	Lower method reporting limit	VSC	Vibrostone columns
LNAPL	Light nonaqueous phase liquid (petrol, diesel, kerosene)	WHO	World Health Organisation
MCV	Moisture condition value	WRAP	Waste and Resources Action Programme



Fairways Lodge, Prestwich

Ground Gas Addendum

July 2024

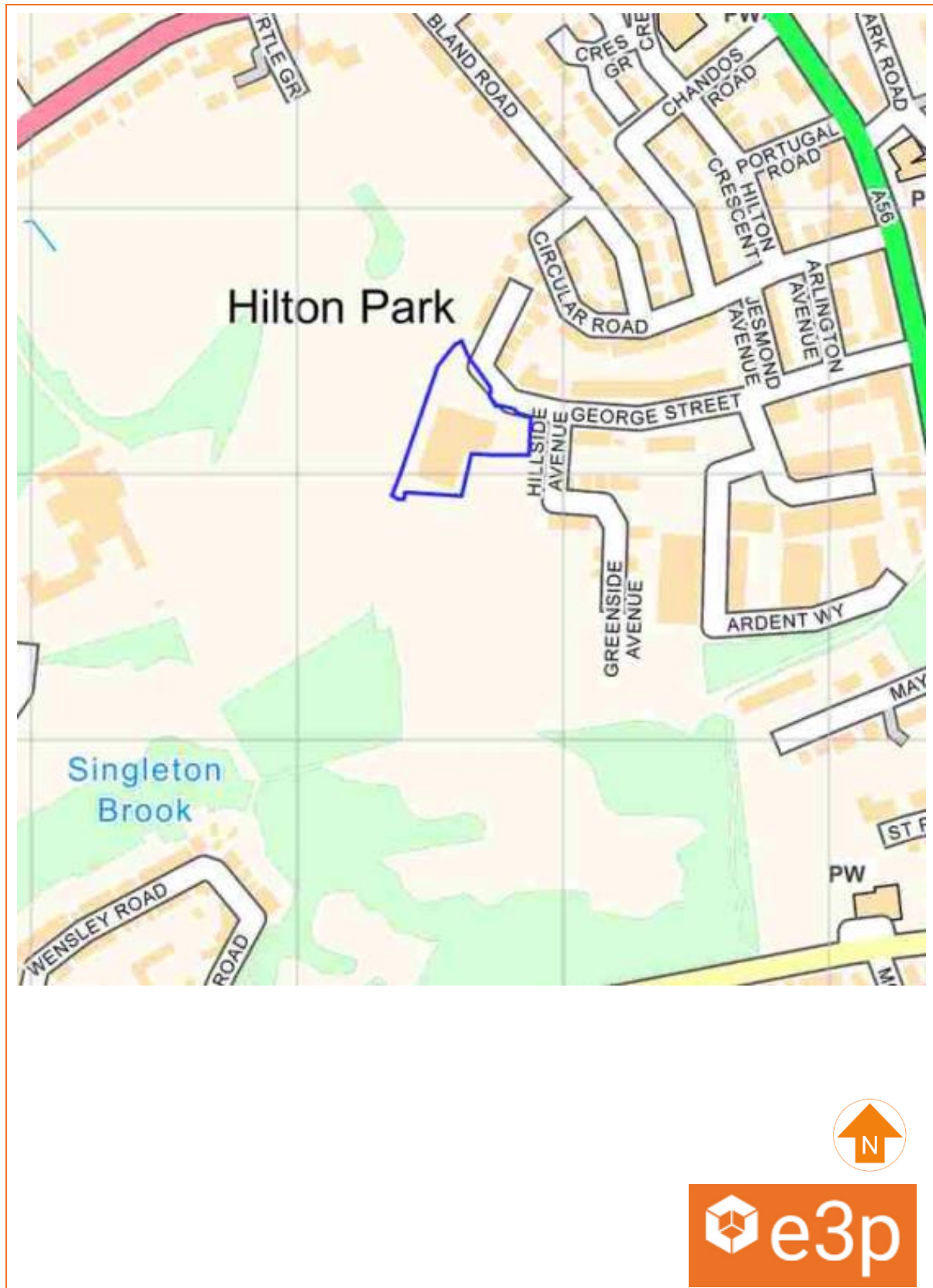
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	kN/m²	Kilonewtons per metre squared
ppb	Parts per billion	µm	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	SSRT	Site Specific Remediation Target
PSD	Particle Size Distribution	DD	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	Mc	Moisture Content
ρ	Bulk Density	GPR	Ground Penetrating Radar
NDP	Nuclear Density Probe	FFL	Finished Floor Level
LEL	Lower Explosive Limit	UKWIR	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	LOD	Limit of Detection



APPENDIX III

DRAWINGS

DRAWING 17-206-001 – SITE LOCATION PLAN





Notes:					
P1	REVA	18.09.2023	EB	NS	NS
Phase	Issue	Date	Drawn	Checked	PM

Client:	McCarthy & Stone
Job Title:	Fairways Lodge, Prestwich

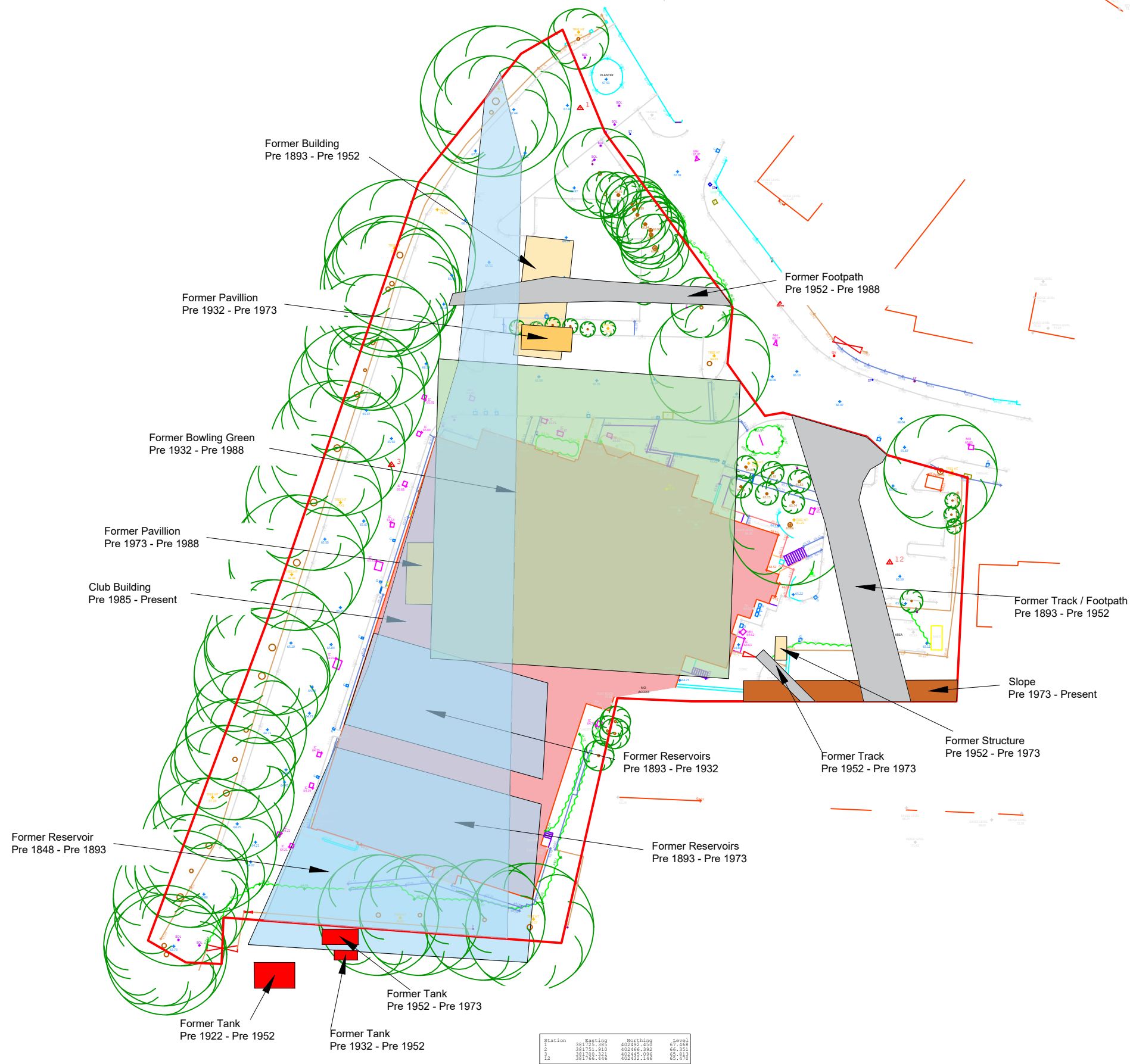
Job No:	17-206
Drawing No:	002

Date:	18.09.2023
Scale:	NTS@ A3



Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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Historical Features

- Former Reservoirs
- Club Building
- Former Bowling Green
- Former Pavilions
- Former Building / Structure
- Former Tanks
- Former Footpaths / Tracks
- Slope

Notes:

P1	REVB	19.09.2023	EB	NS	NS
	REVA	18.09.2023	EB	NS	NS
Phase	Issue	Date	Drawn	Checked	PM

Client:

McCarthy & Stone

Job Title:

Fairways Lodge,
Prestwich

Job No:

17-206

Drawing No:

003

Date:

19.09.2023

Scale:

NTS@ A3

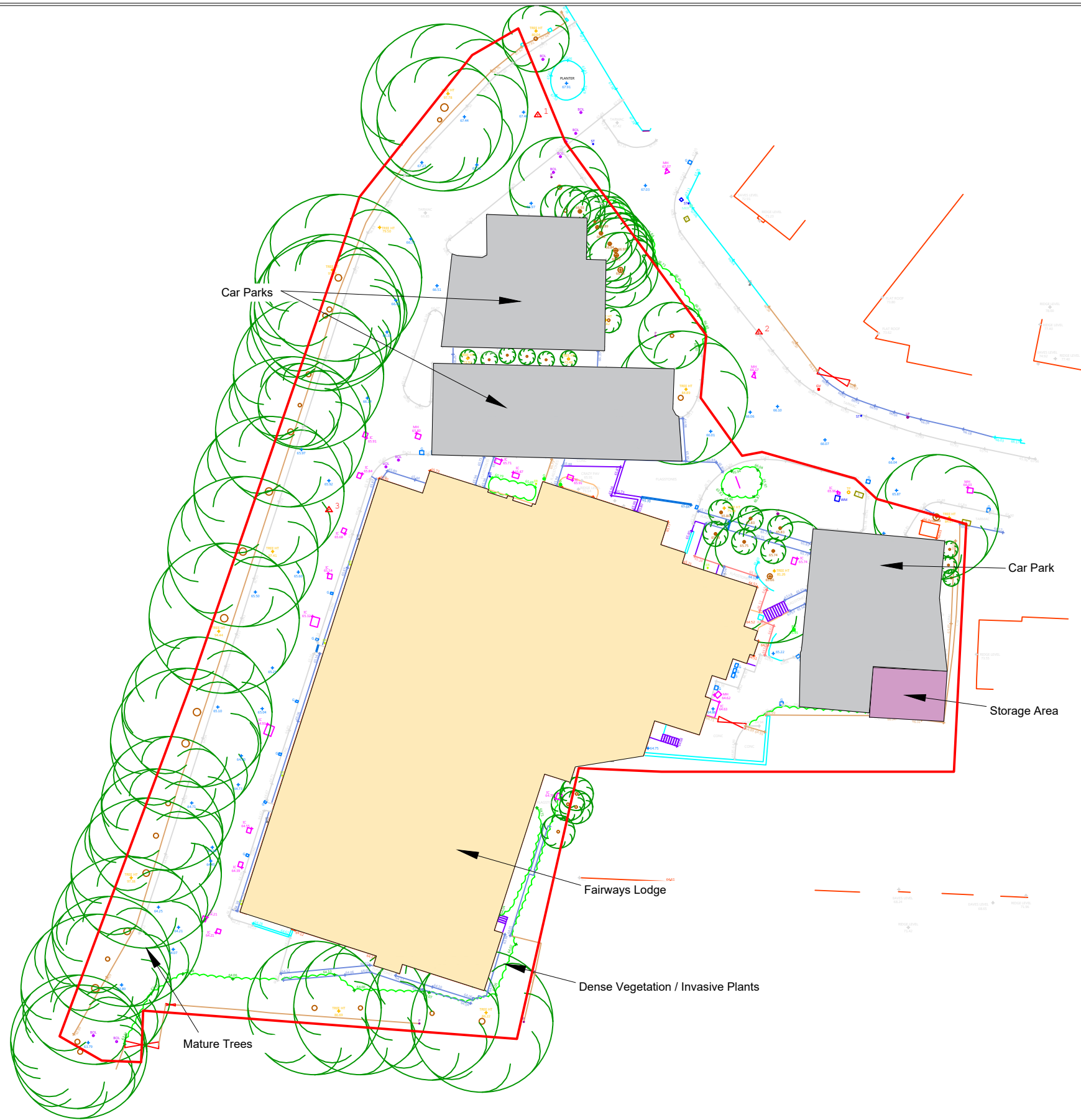
Drawing Title:

Historical Features
Plan



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Site Features

- Fairways Lodge
- Storage Area
- Car Parks
- Mature Trees

Notes:

P1	REVB	19.09.2023	EB	NS	NS
P1	REVA	18.09.2023	EB	NS	NS
Phase	Issue	Date	Drawn	Checked	PM

Client:

McCarthy & Stone

Job Title:

Fairways Lodge,
Prestwich

Job No:

17-206

Drawing No:

004

Date:

19.09.2023

Scale:

NTS@ A3

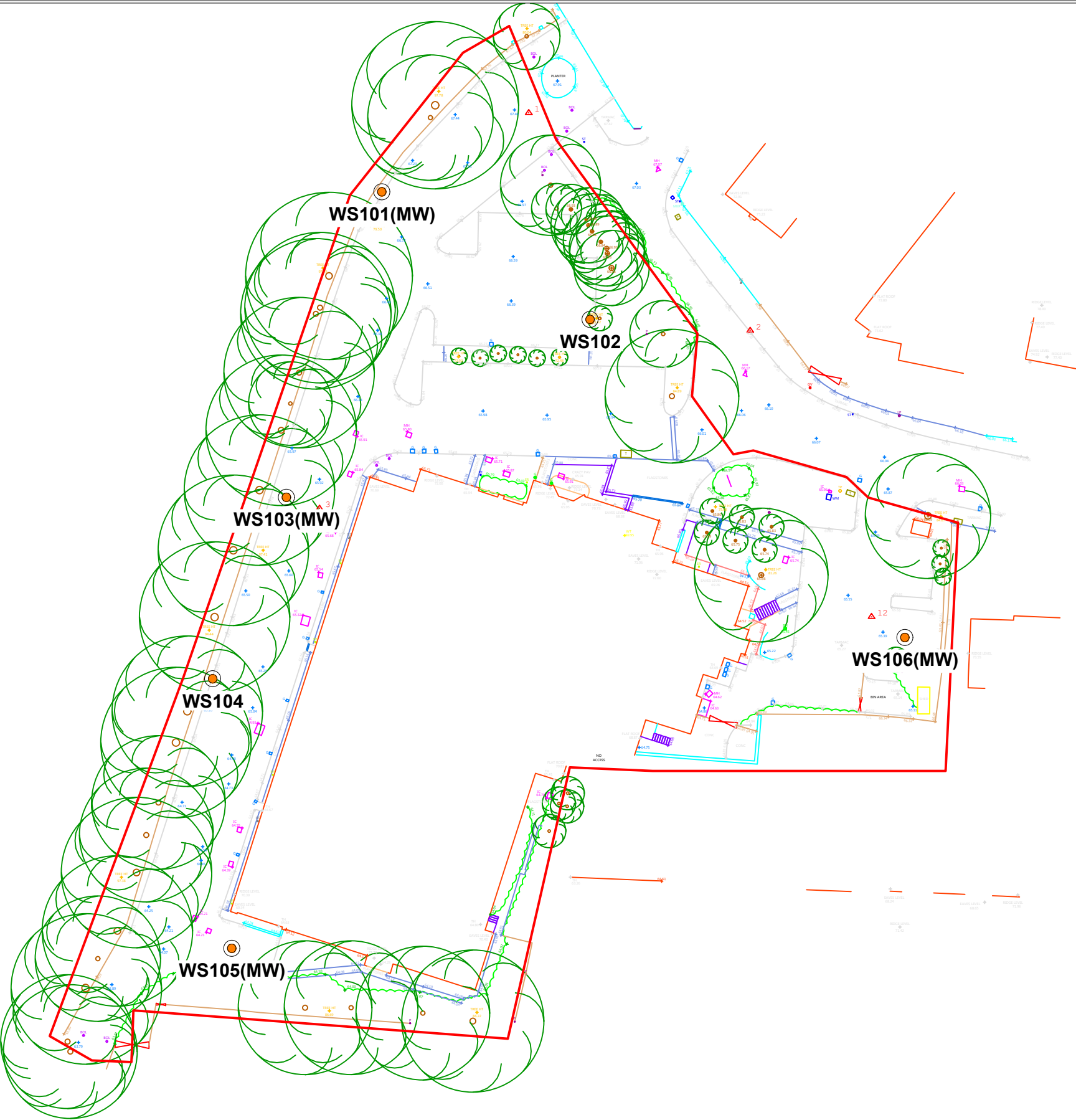


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Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

Drawing Title:

Site Features Plan

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Location Symbols

WS101 Approximate Window Sample Probehole Location

WS101(MW) Approximate Window Sample Probehole Location with Install

Notes:					
P1	REVC	20.11.2023	OW	NS	NS
P1	REVB	17.11.2023	OW	NS	NS
P1	REVA	20.09.2023	EB	ND	NS
Phase	Issue	Date	Drawn	Checked	PM

Client:	McCarthy & Stone
Job Title:	Fairways Lodge, Prestwich

Job No:	17-206
Drawing No:	005

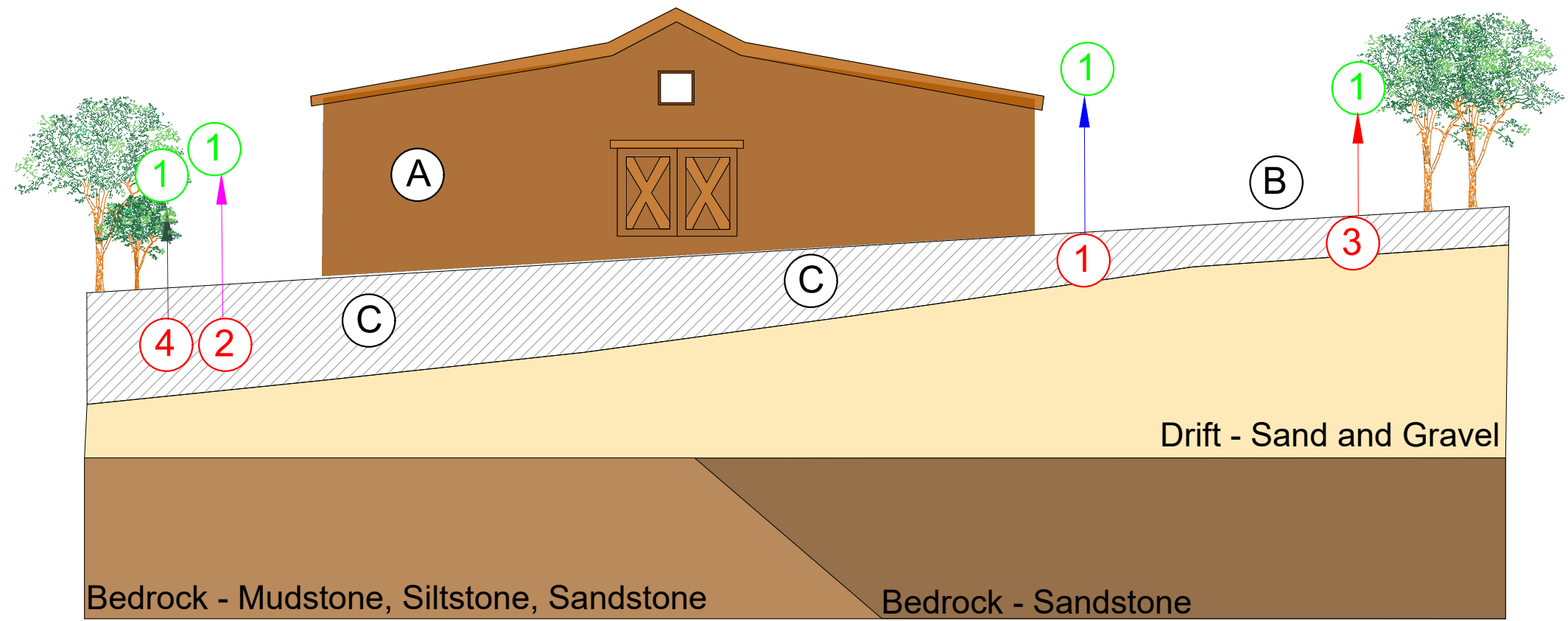
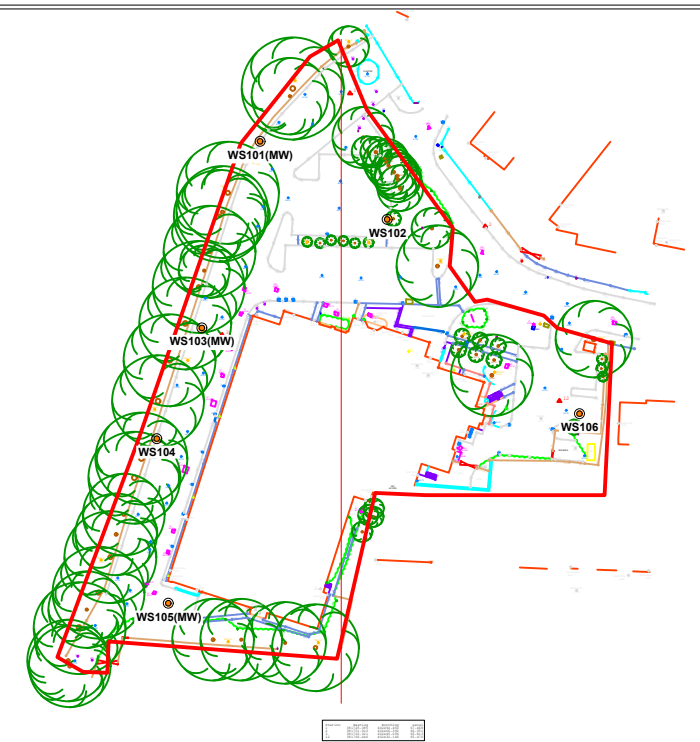
Date:	20.11.2023
Scale:	NTS@ A3



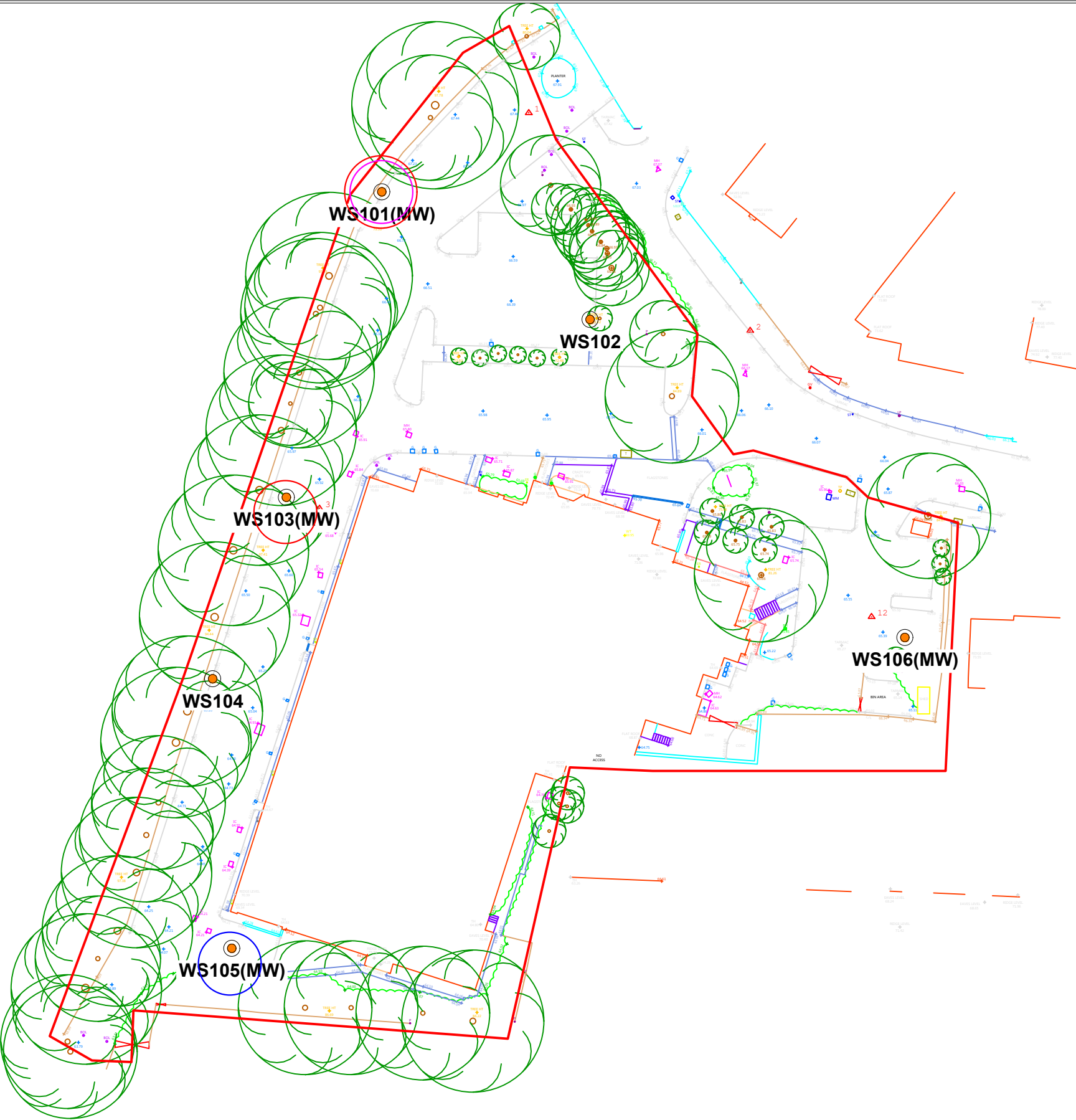
Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

Drawing Title:	Exploratory Hole Location Plan
----------------	--------------------------------

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Geology Key Made Ground Drift - Sand and Gravel Bedrock - Mudstone, Siltstone and Sandstone Bedrock - Sandstone		Sources ① Heavy Metals, Non Volatile PAH's, (Made Ground, Infilled Reservoirs) ② Asbestos (Made Ground, Infilled Pond, Existing Building) ③ Possible Volatile Mercury (MG) ④ Hazardous Ground Gases (MG, Infilled Pond)		Pathways Dermal Contact / Ingestion Vapour Inhalation Inhalation / Accumulation Dust Inhalation		Receptors ① Future End Users		Site Features A Lodge Buildings B Car Park C Infilled Reservoir		Notes:					Client: McCarthy & Stone		Job No: 17-206		Date: 17.11.2023		e3p Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JG Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk	
								Job Title: Fairways Lodge, Prestwich					Drawing No: 010		Scale: NTS							
										P1REVA17.11.2023OWNS					Job Title: Fairways Lodge, Prestwich		Drawing Title: Conceptual Site Model		The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.			
								PhaseIssueDateDrawnChecked														



Location Symbols

-  Approximate Window Sample Probehole Location
-  Approximate Window Sample Probehole Location with Install

Contamination Exceedances

-  Mercury
-  Asbestos
-  Non-volatile PAH

Notes:

P1	REVB	20.11.2023	OW	NS	NS
P1	REVA	17.11.2023	OW	NS	NS
Phase	Issue	Date	Drawn	Checked	PM

Client:

McCarthy & Stone

Job Title:

Fairways Lodge,
Prestwich

Job No:

17-206

Drawing No:

018

Date:

20.11.2023

Scale:

NTS@ A3



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APPENDIX IV EXPLORATORY HOLE LOGS

Borehole Log

Borehole No.

WS101

Sheet 1 of 1

Project Name: Fairways Lodge

Project No.
17206

Co-ords: 381710.22 - 402480.76

Hole Type
WS

Location: Prestwich

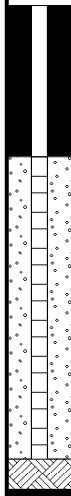
Level: 66.92

Scale
1:50

Client: McCarthy & Stone

Dates: 27/09/2023 -

Logged By
J. BEER

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10	66.82		MADE GROUND: Asphalt.	
		0.30	ES		0.40	66.52		MADE GROUND: Grey sandy gravel with cobbles. Gravel is fine to coarse, angular to subangular of mudstone and sandstone.	
		0.50	ES +TUB		0.60	66.32		MADE GROUND: Blackish red gravelly fine to coarse sand. Gravel is fine to medium, subangular to subrounded of brick and ash	
		1.00		N=17 (7,6/5,4,4,4)	1.00	65.92		Greyish brown slightly clayey slightly gravelly fine to medium SAND with rootlets. Gravel is fine, subangular to subrounded of mudstone (Relic Topsoil).	1
		1.70	ES					Brown slightly clayey slightly gravelly fine to medium SAND. Gravel is fine, subrounded of mudstone.	2
		2.00		N=34 (8,8/8,9,8,9)				Medium dense light brown fine to medium SAND. Becoming dense at 2.00 m bgl.	
		3.00		50 (10,13/50 for 240mm)					3
					3.39	63.53		End of borehole at 3.39 m	4
									5
									6
									7
									8
									9
									10

Remarks

1. Refusal on dense SAND 2. Monitoring Well Installed 3. Response Zone 1.00-3.00mbgl.

Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: Fairways Lodge

Project No.
17206

Co-ords: 381729.90 - 402474.24

Hole Type
WS

Location: Prestwich

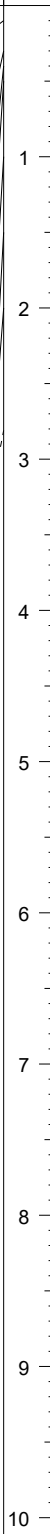
Level: 66.54

Scale
1:50

Client: McCarthy & Stone

Dates: 27/09/2023 -

Logged By
J. BEER

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10	66.44		MADE GROUND: Asphalt.	
		0.35	ES		0.30	66.24		MADE GROUND: Brown gravel. Gravel is fine to coarse, subangular to subrounded of mudstone and sandstone.	
		0.80	ES		0.40	66.14		MADE GROUND: Brown very gravelly fine to medium sand. Gravel is fine to medium, angular to subrounded of mudstone and slag.	
		1.00		N=18 (3,4/4,5,4,5)	0.50	66.04		MADE GROUND: Blackish grey slightly gravelly fine to medium sand. Gravel is fine, subangular to subrounded of ash.	
					1.00	65.54		Greyish brown slightly clayey slightly gravelly fine to medium SAND with rootlets. Gravel is fine, subangular to subrounded of mudstone (Relic Topsoil).	
		2.00		N=41 (7,9/9,11,10,11)	1.50	65.04		Medium dense brown slightly gravelly fine to medium SAND. Gravel is fine to medium, subangular to subrounded of mudstone and sandstone.	
		2.50		50 (25 for 110mm/50 for 200mm)	2.00	64.54		Light brown fine to medium SAND.	
					2.81	63.73		Dense light brown gravelly fine to medium SAND.	
								End of borehole at 2.81 m	

Remarks

1. Refusal on dense SAND 2.No monitoring well installed

Borehole Log

Borehole No.

WS103

Sheet 1 of 1

Project Name: Fairways Lodge

Project No.
17206

Co-ords: 381695.28 - 402438.97

Hole Type
WS

Location: Prestwich

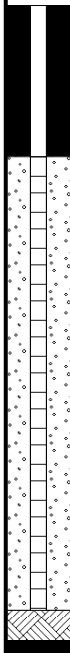
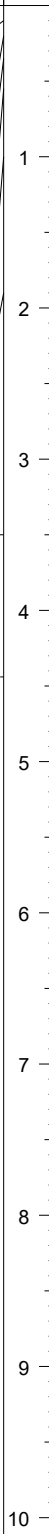
Level: 65.70

Scale
1:50

Client: McCarthy & Stone

Dates: 27/09/2023 -

Logged By
J. BEER

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.10	65.60		MADE GROUND: Asphalt.	
		0.20			0.20	65.50		MADE GROUND: Black very gravelly fine to medium sand. Gravel is fine to medium, subangular of ash and sandstone.	
		0.35			0.35	65.35		MADE GROUND: Red brick. Recovered as fine to coarse, angular to subangular gravel of brick.	
		0.55			0.55	65.15		MADE GROUND: Greyish black gravelly fine to medium sand. Gravel is fine to medium subangular to subrounded of mudstone.	
		0.90	ES	N=19 (4,5/4,5,5,5)	1.00	64.70		MADE GROUND: Greyish black gravelly fine to medium sand. Gravel is fine to medium subangular to subrounded of mudstone.	
		1.00						Greyish brown slightly gravelly fine to medium SAND. Gravel is fine, subangular-subrounded of mudstone.	
		2.00	ES	N=18 (4,4/4,5,4,5)	1.90	63.80		Medium dense orangish brown gravelly fine to medium SAND. Gravel is fine subangular to subrounded of mudstone.	
		2.50						Medium dense orangish brown fine to medium SAND	
		3.00							
		3.50							
		4.00		50 (9,12/50 for 290mm)				Dense brown gravelly fine to medium SAND. Gravel is fine to medium subangular to subrounded of mudstone, sandstone and coal.	
		4.44			4.44	61.26		End of borehole at 4.44 m	

Remarks

1. Refusal on dense SAND 2. Monitoring Well Installed 3. Response Zone 1.00-4.00mbgl.

Borehole Log

Borehole No.

WS104

Sheet 1 of 1

Project Name: Fairways Lodge

Project No.
17206

Co-ords: 381687.46 - 402415.94

Hole Type
WS

Location: Prestwich

Level: 64.97

Scale
1:50

Client: McCarthy & Stone

Dates: 27/09/2023 -

Logged By
J. BEER

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES	N=17 (5,4/4,5,4,4)	0.10	64.87		MADE GROUND: Asphalt.	1 2 3 4 5 6 7 8 9 10
		0.40			0.60	64.37		MADE GROUND: Blackish brown gravelly fine to medium sand. Gravel is fine to medium, subrounded of mudstone, brick and ash.	
		0.80			0.80	64.17		MADE GROUND: Concrete. (Recovered as subangular cobbles of concrete.)	
		1.00			1.00	63.97		Brown fine to medium SAND.	
		1.60	ES	N=35 (9,10/9,8,9,9)	2.00	62.97		Medium dense light brown fine to medium SAND.	
		2.00						Dense orangish brown gravelly fine to medium SAND. Gravel is fine to coarse, subrounded of mudstone, sandstone and coal. Becoming medium dense at 3.00 m bgl. Becoming dense at 4.00 m bgl.	
		3.00							
		4.00							
				50 (8,10/50 for 295mm)	4.45	60.52			
									

End of borehole at 4.45 m

Remarks

1. Refusal 2. No Monitoring Well Installed

Borehole Log

Borehole No.

WS105

Sheet 1 of 1

Project Name: Fairways Lodge

Project No.
17206

Co-ords: 381696.54 - 402391.48

Hole Type
WS

Location: Prestwich

Level: 64.17

Scale
1:50

Client: McCarthy & Stone

Dates: 27/09/2023 -

Logged By
J. BEER

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10	64.07		MADE GROUND: Brown slightly gravelly clayey fine to medium sand with rootlets. Gravel is fine, subangular to subrounded of mudstone (topsoil).	
		0.80	ES					MADE GROUND: Dark brown very gravelly fine to coarse sand. Gravel is fine to coarse, angular to subrounded of mudstone, sandstone, ash and brick.	1
		1.00		N=39 (1,13/22,15,1,1)	1.00	63.17		MADE GROUND: Brownish grey very silty fine to medium sand with plant debris and organic odour.	
		1.50	ES +TUB						
		2.00		N=5 (1,0/0,1,2,2)					2
		2.60			2.60	61.57		MADE GROUND: Grey gravelly clayey silty fine to medium sand. Gravel is fine to medium, angular to subrounded of mudstone, sandstone and brick.	3
		2.80	ES	N=22 (4,5/4,6,6,6)					
		3.00							
		3.80		N=27 (3,4/5,7,7,8)	3.80	60.37		Medium dense greyish brown sandy clayey SILT. No recovery 4.00-5.00 m bgl. (Dense from 5.00m bgl).	4
		4.00							
		5.00		N=38 (9,11/11,10,8,9)					5
		5.45			5.45	58.72		End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete 2. Monitoring Well Installed 3. Response Zone 1.00-2.50mbgl.

Borehole Log

Borehole No.

WS106

Sheet 1 of 1

Project Name: Fairways Lodge

Project No.
17206

Co-ords: 381770.05 - 402428.74

Hole Type
WS

Location: Prestwich

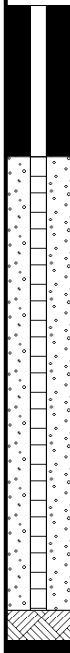
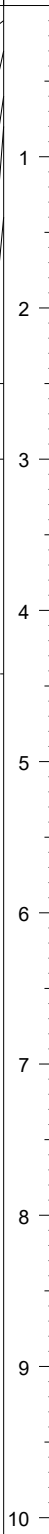
Level: 65.38

Scale
1:50

Client: McCarthy & Stone

Dates: 27/09/2023 -

Logged By
J. BEER

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES	N=18 (2,2/4,4,5,5)	0.10	65.28		MADE GROUND: Asphalt.	
		0.30			0.30	65.08		MADE GROUND: Brown gravel. Gravel is fine to coarse, subangular to subrounded of mudstone and sandstone.	
		0.60			0.60	64.78		MADE GROUND: Brownish black slightly gravelly fine to medium sand. Gravel is fine, subangular to subrounded of ash.	
		0.80			0.80	64.58		Greyish brown slightly clayey slightly gravelly fine to medium sand. Gravel is fine, subangular to subrounded of mudstone (Relic Topsoil).	
		1.40	ES	N=17 (3,5/4,4,4,5)	1.40	63.98		Medium dense yellowish brown slightly gravelly fine to medium sand. Gravel is fine to medium, subrounded-rounded of mudstone	
		1.80			1.80			Medium dense light brown fine to medium sand.	
		2.00			2.00			Brown gravelly fine to medium sand. Gravel is fine to medium, subangular to subrounded of mudstone, sandstone and coal	
		2.50			2.50	62.88		Medium dense brown sand and gravel. Gravel is fine to coarse, subangular to subrounded of mudstone and sandstone. Becoming dense at 4.00 m bgl.	
		3.00			3.00	62.38		Medium dense brown sand and gravel. Gravel is fine to coarse, subangular to subrounded of mudstone and sandstone. Becoming dense at 4.00 m bgl.	
		4.00			4.00			Medium dense brown sand and gravel. Gravel is fine to coarse, subangular to subrounded of mudstone and sandstone. Becoming dense at 4.00 m bgl.	
		4.42		50 (9,12/50 for 265mm)	4.42	60.96		End of borehole at 4.42 m	

Remarks

1. Refusal on SAND and GRAVEL 2. Monitoring Well Installed 3. Response Zone 1.00-4.00mbgl.