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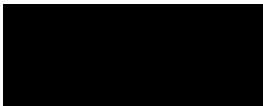
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FORMER GASWORKS, PARK ROAD, WORTHING VERIFICATION REPORT

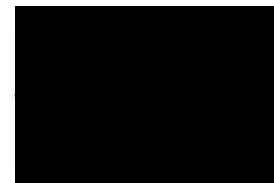
FORMER GASWORKS, PARK ROAD, WORTHING VERIFICATION REPORT

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Date **17th April 2025**
Made by **Ben Stride**
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EXECUTIVE SUMMARY

Ramboll UK Limited ("Ramboll") was instructed by Berkeley Homes (Southern) Limited ("the Client") to produce a Verification Report of remediation activities relating to the redevelopment of the former Gasworks site, Park Road, Worthing, West Sussex ('the site'). The works were required in association with the redevelopment of the site for residential use, comprising five blocks ranging in height from 3-7 storeys, associated access, parking, open space and landscaping under a Planning Application granted by Adur & Worthing Council (ADC) in June 2024 (LCC Ref: AWD/0083/24).

Remediation Objectives

The purpose of this report is to demonstrate that remediation activities have been completed in accordance with Ramboll's Remediation Options Appraisal and Outline Remediation Strategy ('Remediation Strategy') and the contractor (Toureen Group 'Toureen's') Remediation Implementation Plan (RIP). The report documents the results of validation sampling and monitoring carried out throughout the remediation phase, with the aim of demonstrating that pollutant linkages identified at investigation phase have been broken.

Pollutant Linkages Identified

Ramboll has carried out several phases of investigation and assessment at the site, including a desk study, site investigations, qualitative and quantitative risk assessments. The process of assessment has followed Land Contamination: Risk Management (LCRM) EA guidance¹ and included a sustainability assessment of the remediation options applicable for contamination identified at the site.

Human Health

Ramboll's assessments identified that in soil, concentrations of benzene, naphthalene, TPH Aromatic C5-7 and trimethylbenzenes posed a potential risk to future site residents if mitigation measures are not undertaken (through a vapour migration pathway). These were primarily recorded at investigation locations in the north of the site, with an isolated 'hot spot' in the south.

In groundwater, concentrations of benzene and naphthalene were identified as a potential risk to future residents. The elevated concentrations were identified north-western area of the site around the historic gas holder. Without mitigation, a potential vapour risk is present within discrete areas of the site associated with volatile contaminants within soil and groundwater.

Controlled Water

Ramboll's DQRA² concluded that the current dissolved phase groundwater conditions do not represent an unacceptable risk to receptors such as controlled waters; however, it was acknowledged that piling (in the north of the site) would likely mobilise further contamination into the dissolved phase. *Ramboll's Remediation Options Appraisal included a sustainability assessment of methods to mitigate this pathway. Installation of a permeable reactive barrier (PRB) at the approximate centre of the site (dividing the north and south) was recommended. However, the client subsequently lowered the design building heights, thereby omitting the requirement for a piled foundation. Accordingly, a PRB was not required.*

Remediation

Due the omission of piled foundations in the north of the site, remediation was limited to hot spot removal (four localised areas) and removal of grossly contaminated soils and water encountered.

¹ <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-stage-2-options-appraisal>

² Detailed Quantitative Risk Assessment (DQRA), Former Worthing Gasworks, Park Road, Worthing, Ref: 1620009339_DQRA_02, February 2021, prepared for St William Homes LLP.

Associated activities included a watching brief, validation testing of excavations and soils for re-use, waste characterisation and classification, groundwater monitoring and borehole decommissioning.

A vapour membrane is a requirement for buildings located in the north of the site (Blocks C and D), to mitigate the vapour migration pathway from potential residual contamination in soil and groundwater. This will be verified in due course, i.e. the construction phase.

Ramboll met with the Environment Agency (EA) to discuss the remediation approach (January 2024) and ADC (March 2024). Both regulators agreed with principal with the proposed remediation approach.

Verification

Remediation was carried out by Toureen, appointed directly by the Client. Toureen also fulfilled the role of Principal Contractor. Ramboll provided oversight in the role of environmental consultant, this included: a watching brief during hotspot removal and when unexpected contamination was encountered; consultancy relating to odour management and monitoring; weekly reporting to the client; supervision of borehole decommissioning; groundwater sampling; review of the waste transfer and consignment documentation provided by Toureen for off-site waste disposal; and a review of analytical data certification provided for the verification samples.

Validation

Validation comprised:-

- Soil sampling: Toureen undertook sampling of soils from the excavated materials and faces of excavations which were submitted for chemical analytical testing in line with the RIP and Materials Management Plan (MMP). Samples were screened against Ramboll's assessment criteria for residential land use to determine suitability to remain on-site or waste classification purposes for off-site disposal. Only one exceedance was noted in the south side of WS14 due to high concentrations of Napthalene (63 mg/kg) and TPHCWG – Aromatic >EC5-EC35 (8200 mg/kg) on the southern side of the excavation. As a result, further soil volume was removed from the hotspot to the south and additional samples were taken which passed the validation criteria.
- Soil disposal: Throughout the course of the redevelopment works, 4,386 m³ of waste was disposed off-site: 141 m³ of hazardous materials; 3,411 m³ of concrete; 689 m³ of subsoil; and 286 m³ of hardcore were transported to appropriate licenced treatment / disposal facilities.
- Groundwater sampling: Ramboll undertook groundwater sampling, to provide information on boundary groundwater conditions before, during and after the remediation. Napthalene, benzene, and select TPHs were above Ramboll's GACs for human health in the north of the site, both before and during remediation (in line with previous investigation data). Elevated PAHs were identified during one of the post-enabling works monitoring rounds. *Given that hotspots and areas of gross contamination have been removed, we would anticipate an overall improvement in groundwater quality in the long term; furthermore, a vapour membrane will be installed in the north of the site to mitigate this pathway.*
- Borehole Decommissioning: Ramboll supervised two separate rounds of borehole decommissioning. In total 24 boreholes were decommissioned, including six additional vapour wells discovered during decommissioning in line with the Borehole Management Plan (BMP).

Conclusions

Remediation has been carried out to mitigate risks to human health and controlled waters from contamination identified in soil and groundwater. This comprised removal of 'hot spots' of contamination along with additional areas of previously unidentified areas of 'gross' contamination encountered during the enabling works. Mitigation from volatile compounds within soil and groundwater will be through the installation of a vapour resistant membrane in the north of the site.

Ramboll undertook a watching brief during the main excavations of hotspots and has reviewed validation sampling data provided by Toureen. Ramboll is satisfied that all works have been undertaken using appropriate environmental management protocols, and that no significant environmental risks remain at the site in relation to the future residential development. *It should be noted that a theoretical pathway from vapour migration remains; however, this will be addressed through the installation of a vapour resistant membrane in due course.*

Ramboll considers that the key objectives of the remediation programme have been met thus far, and that the Planning Condition associated with the remedial works can be partially discharged. Addendums to this report will follow in due course, to enable to full discharge of conditions, following:

- 1) Installation of the vapour resistant membrane in the north.
- 2) Groundwater monitoring pre, during and after piling (in the south of the site only).
- 3) Validation of imported materials for landscaping.

1. INTRODUCTION

Ramboll UK Limited ("Ramboll") was instructed by Berkeley Homes (Southern) Limited ("the Client") to produce a Verification Report of remediation activities relating to the redevelopment of the former Gasworks site, Park Road, Worthing, West Sussex ('the site').

1.1 Background

The works were required in association with the redevelopment of the site for residential use, comprising five blocks ranging in height from 3-7 storeys, associated access, parking, open space and landscaping under a Planning Application granted by Adur & Worthing Councils (ADC), Ref: LCC Ref: AWDM/0083/24³.

Within the application, Planning Conditions 9 to 11 and 13 to 14 relate to land contamination. The Conditions are summarised below.

9. "Remediation:

- i) Carry out development in accordance with approved Site Remediation Reports.
- ii) **Verification Report demonstrating completion of the works set out in the approved remediation strategy and the effectiveness of the remediation, to include results of sampling and monitoring carried out in accordance with the approved verification plan."**

10. "Contamination not previously found:

Requirement for a strategy to deal with previously unidentified contamination; and reporting even if no such contamination is identified, e.g., a statement to this effect."

11. "Odour Management Plan: carry out development in accordance with approved Odour Management Plan."

13. "Foundation Works and Groundwater Risk Assessment: Requirement for the submission of a foundation works & groundwater risk assessment."

14. "Borehole Management Plan, including decommissioning:

Submission of a scheme for managing any borehole installed for the investigation of soils, groundwater or geotechnical purposes, e.g., protection and decommissioning."

*This report is intended to complete the requirements of Condition 9, part 'ii', to facilitate satisfactory discharge.

This report should be read in conjunction with the following documents previously produced for the site:-

- Foundations Works Risk Assessment (FWRA). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: Ramboll_FWRA_REH2024N02019-RAM-RP-00002_311024, Issue 01, dated October 2024.

³ Land At Former Gas Works Site Park Road Worthing West Sussex. Ref: AWDM/0083/24. Dated June 2024.

- Materials Management Plan (MMP). Former Gasworks, Park Road, Worthing. Toureen, Report Ref: TCL1437 REV.0, dated October 2024.
- Definition of Waste Code of Practice (DoW CoP) Declaration Receipt. DoW CoP, dated August 2024 (Appendix 3).
- Borehole Management Plan (BMP). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref 1620016977-RAM-RP-SS-00001_0.3, Issue 01, dated August 2024.
- Odour Management Plan (OMP). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: 1620013887-004_Worthing Gasworks OMP_2.0, Issue 2.0, dated January 2024.
- Remediation Options Appraisal & Outline Remediation Strategy (RS). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: Remediation Options Appraisal and Remediation Strategy 17-1, Issue 02, dated January 2024.
- Baseline Monitoring Report and Natural Attenuation Assessment (MNA). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: R1620009339_Baseline NAPL & NA Assessment_01, Issue 01, dated January 2024.
- Ground Contamination Interpretative Report (GCIR). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: R1620009339_GCIR_02, Issue 02, dated February 2021.
- Detailed Quantitative Risk Assessment (DQRA). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: R1620009339_DQRA_02, Issue 02, dated February 2021.
- Verification Report. Land at Former Gas Works Site, Park Road, Worthing. Toureen, Report Ref: TCL1321-WOR-VFR-001.
- Remediation Implementation Plan (RIP). Worthing Gasworks. Toureen, Report Ref: TCL-1437-RIP-REV01.
- Project Environmental Management Plan (EMP). Land at Former Gas Works Site. Toureen, Report Ref: TCLXXXX – PEMP – REV1.

1.2 Objective

The objective of this Verification Report is to demonstrate completion of the remediation work set out in Ramboll's Remediation Options Appraisal and Outline Remediation Strategy (herein referred to as the 'Remediation Strategy'. The report documents the results of validation sampling and monitoring carried out in accordance with the Remediation Strategy and verification plan.

Where considered relevant (or where information is available in more detail within another of the reports listed in Section 1.1 above), Ramboll has summarised the information in this report.

1.3 General Limitations and Reliance

This report has been prepared by Ramboll exclusively for the intended use by the Client in accordance with the 'Appointment' (Ref: THL.160937652.2⁴) between Ramboll and the Client defining, among others, the purpose, the scope and the terms and conditions for the services. No other warranty, expressed or implied, is made as to the professional advice included in this report or in respect of any matters outside the agreed scope of the services or the purpose for which the report and the associated agreed scope were intended or any other services provided by Ramboll.

Ramboll did not undertake full time supervision of the enabling works and has relied upon information provided by the Client and the Remediation Contractor, Toureen Contractors ('Toureen'). Accordingly, the conclusions in this report are valid only to the extent that the

⁴ Ramboll – Construction Phase Appointment (Master). Worthing Gasworks. Ref: THL.160937652.2. Dated June 2023.

information provided to Ramboll was accurate, complete and available to Ramboll within the reporting schedule.

This report and accompanying documents are intended solely for the use and benefit of the Client and may not be used by or disclosed to, in whole or in part, any other person without the express written consent of Ramboll. Ramboll neither owes nor accepts any duty to any third party, unless formally agreed by Ramboll through that party entering into, at Ramboll's sole discretion, a written reliance agreement.

1.4 Report Layout

The report is structured in the following way:-

- Section 1: sets out the objectives of the remedial works;
- Section 2: describes the background to the project;
- Section 3: summarises the previous investigations on-site;
- Section 4: describes the remediation strategy and verification plan;
- Section 5: details the implementation of the remediation strategy; and
- Section 6: provides evidence of the strategy's verification, and gives details on the validation sampling conducted.

2. PROJECT BACKGROUND

2.1 Site Description

The site is located off Park Road, Worthing BN11 2AN approximately 500m south-east of Worthing town centre and 400m north of the sea front, at National Grid Reference 515244E, 102977N. The site is under the jurisdiction of the Adur & Worthing Councils (ADC) and comprises a reversed 'L' shaped parcel of land situated in a mixed residential and commercial area. Access to the site is gained via Park Road, located to the east of site.

The site prior to redevelopment comprised an area of 2.7 acres (1.09 hectares) and contained an above ground gasholder in the north-east and two tenanted buildings in the south-west. The north-east of the site was occupied by a Southern Gas Network (SGN) compound housing small buildings and metal containers and the remainder of the site occupied by car parking space.

Planning consent was granted in December 2016 for the proposed demolition of the above-ground gasholder located in the north-east of site. Demolition works commenced in 2018, and the scope of works undertaken comprised dewatering, desludging, dismantling the large metal frame and columns, removal of the lifts and external tank structure. Infilling works were completed as necessary to facilitate a level, free draining site.

Prior to Ramboll's work, planning consent was granted in June 2024 for the proposed demolition of the two remaining buildings in the south-west portion of the site. Demolition was carried out in June and July 2024, and the scope of works undertaken comprised of the demolition of existing structures, partial removal of boundary walls (LCC Ref: AWD/0083/24⁵).

The surrounding land comprises mixed commercial and residential area including houses, offices, and retail.

A site plan is provided in Figure 1, presented in Appendix 1. An original (pre-development) layout of the site is included as Figure 2 in Appendix 1, along with a pre-development Drawing TCL1437_EN003_BH_A_L1⁶, presented in Appendix 1.

2.2 Post-Enabling Works Development Layout

Post enabling works, the site was occupied by portable site cabins in the west, along with remnants of the former gasholder base and an SGN metal container in the north-east. The remainder of site has been infilled with (validated) site-won material. The northern boundary wall has been demolished and replaced with temporary metal fencing.

The last site progress layout plan included in Toureen's report is included as Drawing TCL1437_EN003_BH_I_L1⁷ in Appendix 1.

2.3 Proposed Development Layout

As stated in Section 1.1, the site is being redeveloped for residential use comprising five blocks (labelled A, B, C, D, and E) ranging in height from 3-7 storeys, along with associated access, parking, open space and landscaping.

⁵ Land At Former Gas Works Site Park Road Worthing West Sussex. Ref: AWD/0083/24. Dated June 2024.

⁶ Site progress and stockpile survey 8th August 2024. Ref: TCL1437_EN003_BH_A_L1. Dated October 2024.

⁷ Site progress and stockpile survey 25th October 2024. Ref: TCL1437_EN003_BH_I_L1. Dated October 2024.

A proposed development plan with the accompanied grid layout is included in Drawing TCL1437_EN003_BH_J_L1⁸ and visually displayed in 3D in Figure 3 below.

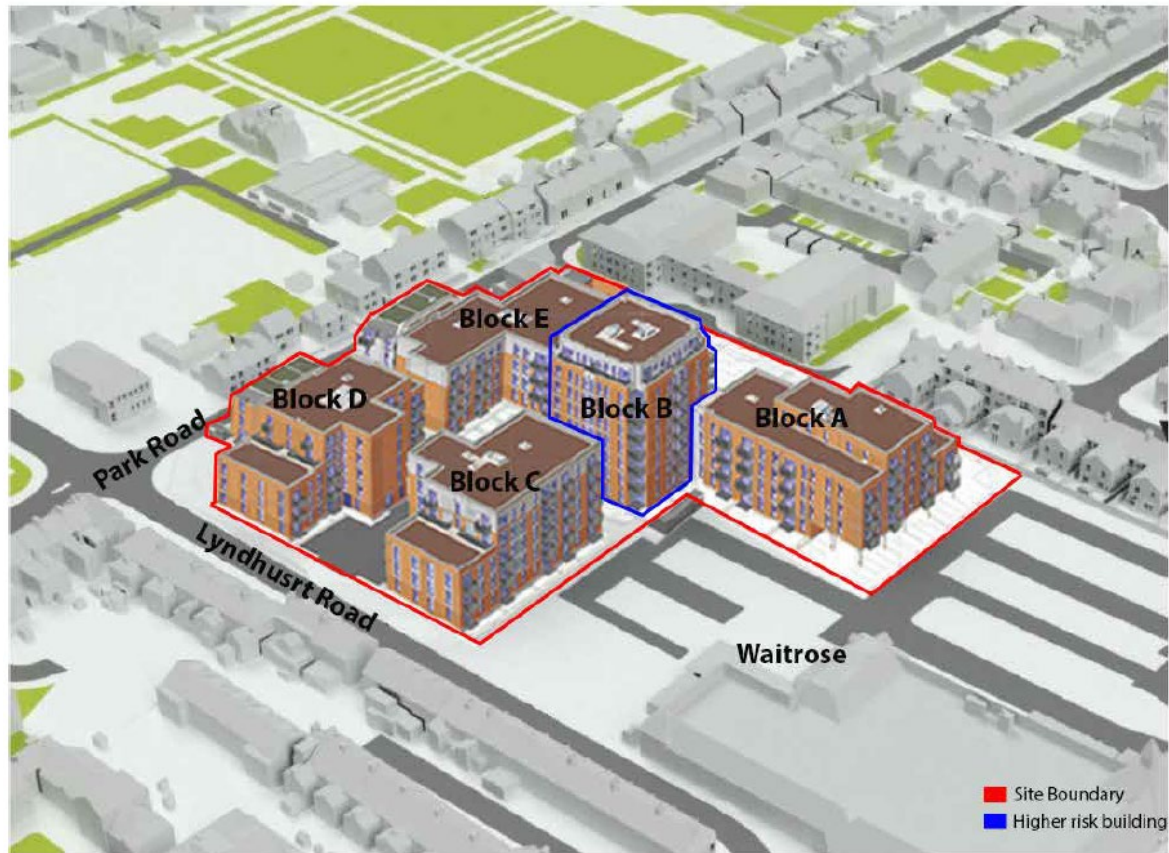


Figure 3. 3D view of the proposed development from the north-west

⁸ As-built handover levels check survey 7th Nov 2024. Ref: TCL1437_EN003_BH_J_L1. Dated November 2024.

3. SUMMARY OF PREVIOUS INVESTIGATIONS

A summary of key environmental information from Ramboll's DQRA⁹, GCIR¹⁰, MNA¹¹, and RS¹² (see Section 1.1 above for reference), is presented below.

The investigation locations overlain onto the new site are shown on Figure 4, presented in Appendix 1.

3.1 Site History

From at least the 1870s, the site was occupied by a small gasworks which contained two gasholders, located in the north-east and north-west of site, along with a coal store and retort house located between the two gasholders. Several tanks were depicted in the north-west of the site. In the 1890s the gasworks extended off-site to the west with the presence of a gasometer and associated buildings. By the 1940s two more tanks were located in the centre of the site. In the 1970s, several of the small buildings in the north-west and east of the site were demolished, and by the 1990s the gasometer and buildings in the north-west of the site were demolished and the south of the site was now utilized as a depot. The gasholder in the north-east of the site was demolished in 2018.

3.2 Investigation history

Ramboll has carried out several phases of investigation and assessment at the site:

- Ground Contamination Interpretative Report, Former Worthing Gasworks, Park Road, Worthing, Ref. 1620009339_GCIR_02, February 2021, prepared for St William Homes LLP. *This report summarises the results of multiple previous investigations carried out between 1996 and 2017 (by third parties).*
- Detailed Quantitative Risk Assessment, Former Worthing Gasworks, Park Road, Worthing, Ref. 1620009339_DQRA_02, February 2021, prepared for St William Homes LLP.
- Baseline Monitoring Report and Monitored Natural Attenuation Assessment, Former Worthing Gasworks, Park Road, Worthing, Ref. 1620013887, issued by Ramboll November 2022, prepared for St William Homes LLP.

3.3 Ground Conditions

3.3.1 Geology

The geological sequence is as follows:

- Made Ground, comprising clayey gravels and gravelly clay with varying degrees of anthropogenic materials including ash, clinker, brick and concrete rubble, and chalk fill is variable in thickness, generally ranging from 0.45 m up to 5.2 m in thickness;
- The superficial geology (classified by British Geological Society as River Terrace Deposits and referenced by third parties as Brickearth, Head Deposits or Alluvium; herein collectively referred to as 'superficial geology') underlying the Made Ground, comprises silty sandy clay with varying proportions of gravel and silt, encountered to depths of 8.7 mbgl; and
- Weak structureless Chalk is present beneath the superficial deposits, becoming structured between depths of 7.7 mbgl to 12.7 mbgl with an average thickness of around 3.75 m. Below

⁹ Detailed Quantitative Risk Assessment (DQRA), Former Worthing Gasworks, Park Road, Worthing, Ref: 1620009339_DQRA_02, February 2021, prepared for St William Homes LLP.

¹⁰ Ground Contamination Interpretative Report (GCIR). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: R1620009339_GCIR_02, Issue 02, dated February 2021.

¹¹ Baseline Monitoring Report and Monitored Natural Attenuation Assessment (MNA), Former Worthing Gasworks, Park Road, Worthing, Ref: 1620013887, issued by Ramboll November 2022, prepared for St William Homes LLP.

¹² Remediation Options Appraisal & Outline Remediation Strategy (RS). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: Remediation Options Appraisal and Remediation Strategy 17-1, Issue 02, dated January 2024.

this the Chalk is generally very weak to weak with beds of coarse gravel sized flints and rare lenses of Chalky Clay.

3.3.2 Hydrogeology

Groundwater is present in the Chalk and typically standing groundwater levels were recorded between 1.09 m and 7.1 mbgl (between 1.3 m AOD and 6.8 m AOD); groundwater is inferred as being confined by the overlying superficial geology. Localised, discontinuous perched groundwater also exists within the Made Ground. The general groundwater flow direction in the wider Chalk is to the south/south-east towards the sea. The flow direction on site is generally southerly, but more complex; the groundwater potentiometric surface follows the contours of the surface of the Chalk deposits on site, rather than a general flow direction across the site. Furthermore, existing underground structures likely influence the local groundwater flow across the site. The groundwater on-site is tidally influenced, with a clear semi-diurnal variation in levels. This is more pronounced in the south of the site and more muted in the north.

The EA classifies the superficial deposits as a Secondary B Aquifer and the Chalk as a Principal Aquifer. The site is not situated within an EA designated groundwater Source Protection Zone, the closest groundwater abstraction for potable use is located 1.6km north of the site.

3.4 Conceptual Site Model (CSM)

Reference should be made to previous reports (GCIR¹³; DQRA¹⁴; Baseline Monitoring and MNA Assessment¹⁵) relating to the site for a detailed understanding of the issues and the potential risk posed to receptors by contamination. These risks are summarised below.

3.4.1 Human Health

In soil, concentrations of benzene, naphthalene, TPH Aromatic C5-7 (benzene) and trimethylbenzenes were identified as a potential risk to future site residents if mitigation measures are not undertaken (through a vapour migration pathway). These were primarily recorded at investigation locations in the north of the site (BH02, BH14, TP08). WS14 located in the south of site recorded soil exceedances and was considered to be an isolated hotspot in the shallow soils.

Ramboll's investigation also identified asbestos within sub-surface soils in the vicinity of TP08 and other (third party) investigations had also reported the presence of asbestos fragments in the north-west of the site.

In groundwater, concentrations of benzene and naphthalene were identified as a potential risk to future residents. The elevated concentrations were recorded in the north-western area of the site around the historic gas holder, MW14-02, MW14-03 and BH04.

Ground gas monitoring has identified the site as very low risk (Characteristic Situation 1- CS1), whereby no gas protection measures would be required as part of a future residential development, in-line with BS8485:2015+A15:2019. Volatile Organic Contaminant (VOC's) protection has been identified as a requirement for Block's C and D in the northern portion of the site.

¹³ Ground Contamination Interpretative Report (GCIR). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: R1620009339_GCIR_02, Issue 02, dated February 2021.

¹⁴ Detailed Quantitative Risk Assessment (DQRA), Former Worthing Gasworks, Park Road, Worthing, Ref: 1620009339_DQRA_02, February 2021, prepared for St William Homes LLP.

¹⁵ Baseline Monitoring Report and Monitored Natural Attenuation Assessment (MNA), Former Worthing Gasworks, Park Road, Worthing, Ref: 1620013887, issued by Ramboll November 2022, prepared for St William Homes LLP.

The proposed detailed design and specification of the ground gas / vapour membrane is required to be submitted to the Council for approval prior to commencement of construction works.

Without mitigation, a potential vapour risk is present within discrete areas of the site associated with volatile contaminants within soil and groundwater. Ramboll understands that the detailed design has been carried out by Premcrete.

3.4.2 Controlled Waters

Free Product (Coal Tar)

Measurable thickness of DNAPL was observed in only two monitoring wells in the north-west of the site during investigations carried out in 2020 and 2022. Both wells were installed within the structureless Chalk, indicating that DNAPL is present within the Chalk aquifer. A total of 1.25L of DNAPL was removed by Ramboll from these wells in May 2022 for additional testing and assessment of the speed of product recovery; no measurable product recovery had taken place by subsequent visits up to five weeks after removal, thereby indicating that the extent of the DNAPL on the site is limited, with no extensive DNAPL plume present.

Whole Oil Trace analysis from 2020 and 2022 indicated that the DNAPL present in both MW14-02 and BH04 was a black viscous oil with a carbon range of C6-C35 and was interpreted as PAHs (Coal Tar). Subsequent whole hydrocarbon fingerprint testing in 2022 showed that there was an element of more soluble, mobile hydrocarbons present within the DNAPL.

To summarise, the measurable thicknesses of DNAPL identified in MW14-02 and BH04 has been removed. Residual DNAPL was noted to remain in globules and trapped within the fractures of the Chalk. Ramboll concluded that if disturbed (e.g. by piling), the remaining trace DNAPL may present an ongoing source to the groundwater with movement of the more soluble carbon chains (including benzene, toluene and naphthalene) from the DNAPL phase into the groundwater. *This was relevant to piling, if undertaken, which would reach the depths where DNAPL was found in the north of the site.*

Dissolved Phase Concentrations

Dissolved phase concentrations of hydrocarbons were identified in two main areas of the site, Borehole BH02 in the north-east, and BH04 and surrounding boreholes in the west, both installed in the Chalk aquifer and within the deeper Made Ground. Elevated ammoniacal nitrogen and cyanide were also recorded in the groundwater across the majority of the site together with metals in some locations.

The DQRA¹⁶ concluded that that a significant risk to Controlled Waters was not identified from contaminant sources including Total Petroleum Hydrocarbons (TPHs), Polycyclic aromatic hydrocarbons (PAHs), Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) and phenols. The concentrations of styrene in the soil and ammoniacal nitrogen and benzene (TPH Aromatic 5-7) in the groundwater exceed target values at set compliance points. However, from empirical data at hydraulically downgradient wells and a calibration of the model, it was clear that the theoretical and conservative model over-predicted contaminant migration.

Utilising the model calibration and concentrations recorded from hydraulically downgradient wells, Ramboll concluded that no remedial action was necessary to address dissolved phase contamination. However, the possibility exists that in association with development activities (e.g. enabling works, piling) contaminants above the water table may be inadvertently drawn into the saturated zone or disturbance of the groundwater could cause an increase in mobilisation

¹⁶ Detailed Quantitative Risk Assessment (DQRA), Former Worthing Gasworks, Park Road, Worthing, Ref: 1620009339_DQRA_02, February 2021, prepared for St William Homes LLP.

of dissolved phase contamination. This increase in overall concentrations of the dissolved phase may then pose a risk to groundwater off-site.

3.4.3 Summary of Issues Requiring Remediation

Human Health

Where potential pollutant linkages relating to human exposure of dissolved substances through the vapour pathway are present, these should be addressed by the inclusion of a vapour membrane as part of the development (only required in the north of the site (Blocks C and D), since elevated concentrations were not recorded in the south).

Where isolated areas of significant shallow soil impact were recorded, these were required to be removed to reduce potential risks to future site users and controlled waters. A total of four hot spots of contamination were identified for removal (described in detail in the following section). In addition to these known areas of contamination, Ramboll advised that 'gross contamination' also be removed where encountered during development.

Controlled Waters

Although Ramboll's DQRA¹⁷ concluded that the current dissolved phase groundwater conditions do not represent an unacceptable risk to receptors such as controlled waters, it was acknowledged that there was potential for disturbance caused during piling to mobilise further contamination into the dissolved phase. The outcome of Ramboll's MNA assessment¹⁸ did not provide confidence in the 'in-built' capacity of the groundwater to treat further contaminant loading above that already present in groundwater, should this occur. *Piling was since omitted from the design and accordingly this risk is unlikely to be realised.*

¹⁷ Detailed Quantitative Risk Assessment (DQRA), Former Worthing Gasworks, Park Road, Worthing, Ref: 1620009339_DQRA_02, February 2021, prepared for St William Homes LLP.

¹⁸ Baseline Monitoring Report and Monitored Natural Attenuation Assessment (MNA), Former Worthing Gasworks, Park Road, Worthing, Ref: 1620013887, issued by Ramboll November 2022, prepared for St William Homes LLP.

4. REMEDIATION STRATEGY

4.1 Objectives

Remediation was completed in accordance with Ramboll's RS¹⁹ and Toureen's RIP.

The overall objective was to mitigate risks to human health and controlled waters posed by contaminants of concern, allowing the site to be redeveloped for residential use.

Due to the potential pollution linkages between future site users and the previously identified ground contamination, there was a need to identify the most suitable method to break these pollution linkages whilst outlining the typical good practice procedures with regards to contamination and construction in the RS¹⁹.

On the basis of the above considerations, the following remedial objectives were proposed:

- To provide mitigation to human health in association with a proposed residential land use from the identified soil and groundwater contaminant concentrations through excavation of hot spots and areas of 'gross contamination' (see definition in the following section). Mitigation from volatile compounds within soils or groundwater by the installation of a vapour resistant membrane where required.
- To provide a reasonable degree of mitigation to off-site migration of contaminants potentially mobilised during piling. This mitigation should be commensurate with the risks posed to groundwater (i.e. a significant risk from current dissolved phase contamination was not identified; only a theoretical risk of piling mobilising contaminants has been assumed). *Subsequently, the Client omitted the need for piling by reducing the overall height of the proposed buildings in the north. Accordingly, the permeable reactive barrier (PRB) referred to in the RS¹⁹ was not required and the revised approach was approved by ADC. A piled foundation solution will be used for the buildings in the south; however, since elevated concentrations were not identified in the south, a risk to controlled waters was not identified.*

Overall, remediation activities were reduced to the removal of the identified hot spots and any encountered unforeseen gross contamination. The specific scope of works remedial works undertaken are outlined in Section 4.2 below.

4.2 Scope of Works

The remedial works comprised:

- Removal of the following four previously identified 'hot spots' of contamination:
 - **Soil Impact at WS14:** elevated hydrocarbon concentrations at WS14 in the south of the site. The elevated concentrations were isolated to the shallow Made Ground (elevated concentrations were not recorded in the sample from the Superficial Deposits). *This was the only identified impacted area in the south of the site.*
 - **Soil Impact at TP08:** visual observations of contamination around an underground structure.
 - **Soil Impact at BH14:** tarry deposits were noted in the Made Ground beneath the base of Gasholder No.3. This observation was made during drilling; however, no NAPL was noted when the borehole was subsequently monitored. Elevated concentrations were also recorded in the shallow Made Ground.
 - **Soil Impact at BH02:** Frequent lenses and pockets of black tar were noted below 2.9 m bgl within the clay. This observation was made during drilling; however, no NAPL was

¹⁹ Remediation Options Appraisal & Outline Remediation Strategy (RS). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: Remediation Options Appraisal and Remediation Strategy 17-1, Issue 02, dated January 2024.

noted when the borehole was subsequently monitored. Some TPH fractions were elevated in samples collected from the overlying Made Ground and from the clay at 3.6 m.

- The removal of grossly contaminated soil or materials encountered during the redevelopment in accordance with the remediation contractor's methodology for monitoring, inspecting, recording, and removing gross contamination. The Remediation Strategy defined grossly contaminated soil or other materials as:
 - LNAPL or DNAPL, including tar. This includes LNAPL and DNAPL saturated soils; LNAPL or DNAPL on or in groundwater or perched water; LNAPL and DNAPL within tanks or other below ground structures.
 - Blue Billy, Foul Lime and Spent Oxide (for example blue discoloured soil).
 - Visible asbestos fragments or products.
 - Where encountered or known, underground structures, pipes and tanks that may contain gross contamination should be removed and chased out.
- A watching brief by Ramboll during excavation of the aforementioned hot spots and areas of unforeseen contamination encountered during enabling works (outlined in the watching brief/discovery strategy (Ramboll's RS²⁰)).
- Validation testing of soils in areas surrounding the removal of any encountered gross contamination, screened against appropriately selected assessment criteria, along with further characterisation of site won and imported soils/aggregate by means of chemical testing, prior to and during importation/filling (Toureen).
- Crush hardcore arisings to produce 6F2 for reuse in accordance with the EA Quality Protocol to produce Aggregate from Inert Waste.
- Duty of Care of excavated materials and compliance with CL:AIRE.
- Where required, moisture control of general fill backfilled materials to allow adequate compaction and engineering performance.
- Environmental management (by Toureen) throughout the duration of the works to lower the potential risks to off-site receptors, as outlined in the mobile plant permit²¹ in Appendix 3.
- Soil bunding, covering and quarantine where required.
- Groundwater monitoring pre-, during-, and post-enabling works (by Ramboll).

Figure 5 displays the locations of the identified hotspots and the encountered areas of unforeseen contamination during the enabling works in relation to the site investigation locations below:

²⁰ Remediation Options Appraisal & Outline Remediation Strategy (RS). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: Remediation Options Appraisal and Remediation Strategy 17-1, Issue 02, dated January 2024.

²¹ Mobile Plant Permit. Land at Former Gas Works Site, Park Road, Worthing, West Sussex, BN11 2A. Environmental Agency, Ref: FB3501TZ/W0006. Dated July 2024.



Figure 5. Locations of the identified hotspots and unforeseen contamination areas

4.3 Interested Parties

The following parties were directly involved in the management of ground conditions during remediation:

- Client: Berkeley Homes (Southern) Limited.
- Principal Contractor for remediation works: Toureen Group.
- Principal Contractor for civils works: Landmark Limited.
- Contractor for vapour monitoring: Plowman Craven Limited.

4.4 Verification Plan

The Verification Plan in the RS²⁰ indicated that the following additional assessments or remediation related activities were required:

- Records of the installation of the PRB including photographs. *Not required given that a PRB was not part of the final remediation.*
- Records of the implementation of clean capping including demonstration of the chemical compliance, thickness placed and the presence of gravel break layer and geotextile membrane (including photographs). *To be completed in due course, i.e. when landscaping is developed at the site.*
- Records, chemical testing results and information on remediation excavation works.
- Quantities of material imported to site. *Not required given no materials were imported to site.*
- Chemical testing results and information on the source of any imported material and plans showing where this material has been used.

- Chemical testing results and information on any re-used materials and plans showing where this material has been used.
- Details of any areas of unexpected contamination and the actions undertaken, plus plans showing locations of any additional samples obtained for testing due to unforeseen contamination along with any delineation of materials and quantities.
- Results of any additional chemical and Waste Acceptance Criteria (WAC) testing undertaken along with method of sample collection and transportation to laboratory, laboratory quality assurance and accreditation.
- Quantities of any material disposed off-site as waste classification and details of the receiving site/s and copies of all Waste Transfer Notes.
- Records of the groundwater monitoring programme, including Quality Assurance (QA)/Quality Checks (QC).
- Records of the borehole decommissioning works (including photographs).
- Records of any asbestos management measures employed.
- Records of the ground gas or vapour protection measures installed at the site (including inspection records and photographs). *To be completed in due course, i.e. when building foundations are developed at the site.*
- Details of any contaminated water removed from excavations and disposed off-site, including chemical testing.
- Details and demonstration of any relevant permits or exemptions required for the works.
- Details on any protection measures installed for contamination and monitoring (if applicable) of such measures – in particular records will be required to confirm whether protection measures were required for contaminants present in excavations or water supply pipes.
- Details of regular dialogue and any additional liaison and agreements with regulators.

5. IMPLEMENTATION OF REMEDIATION STRATEGY

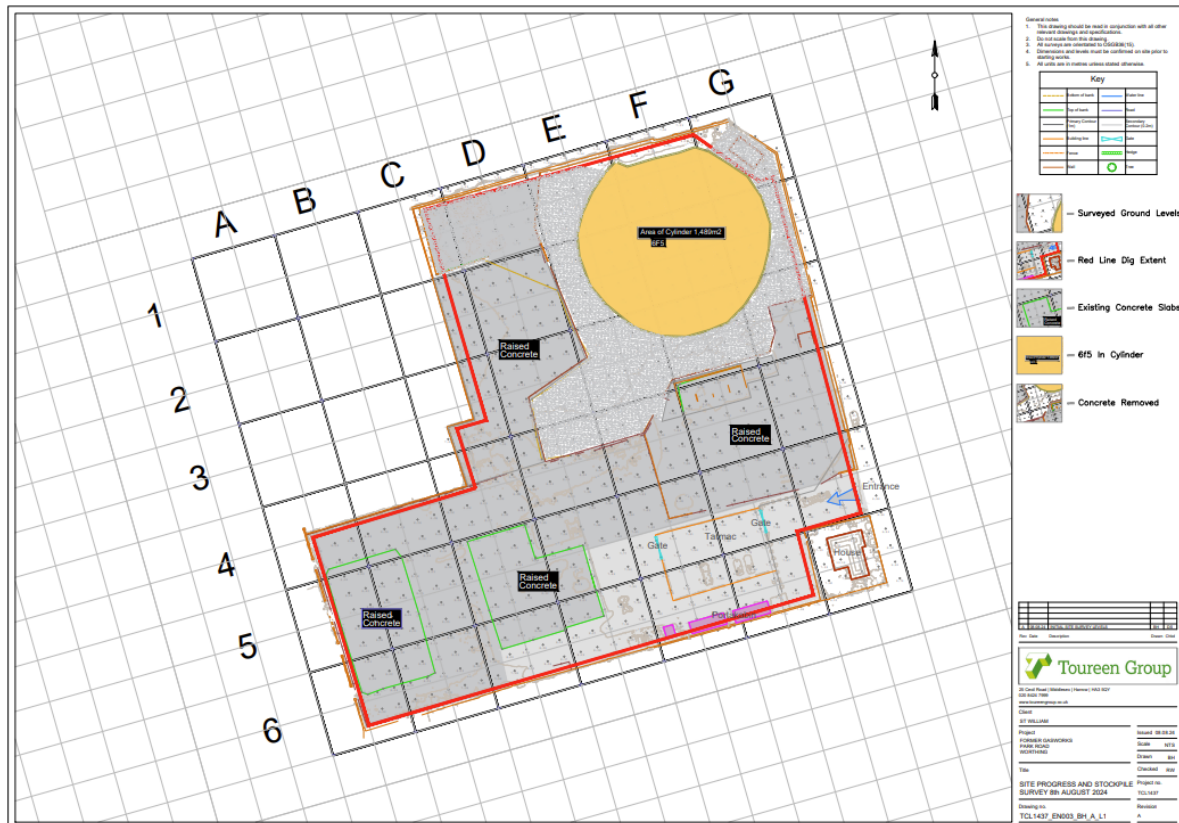
This section details the remedial works activities conducted, and how they were implemented as part of the redevelopment.

Odour monitoring also took place on site in accordance with Ramboll's Odour Management Plan (OMP²²). The results are presented in Toureen's Verification Report²³.

No visual asbestos containing materials (ACMs) were identified throughout the remediation works, but the asbestos discovery strategy is outlined in Toureen's RIP²⁴.

Toureen confirmed no materials were imported to site and a PRB was not installed. Clean capping was yet to be implemented on site at the time this report was written. The destination of all excavated materials for both hotspots and unforeseen contamination is explained in Section 6.1.

All laboratory sample results mentioned below are presented in Appendix 4. All grid reference numbers refer to locations displayed in Toureen's drawings shown in Appendix 1 and on Drawing TCL1437_EN003_BH_A_L1 below showing the site layout at the beginning of the enabling works (8th of August 2024).



²² Odour Management Plan (OMP). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: 1620013887-004_Worthing Gasworks OMP_2.0, Issue 2.0, dated January 2024.

²³ Verification Report. Land at Former Gas Works Site, Park Road, Worthing. Toureen, Report Ref: TCL1321-WOR-VFR-001.

²⁴ Remediation Implementation Plan (RIP). Worthing Gasworks. Toureen, Report Ref: TCL-1437-RIP-REV01.

5.1 Hotspot Excavations

5.1.1 WS14 Shallow Soil Hotspot

Ramboll attended site for a watching brief to supervise the removal of the shallow soil hotspot in the south-west of site at WS14 on the 28th of August where elevated hydrocarbon concentrations were previously identified during Ramboll's GCIR²⁵.

5 m³ of material was excavated until uncontaminated natural ground was encountered at 1 mbgl (meter below ground level). Staining from hydrocarbon contamination in the Made Ground was noted during the excavation from ground level through till the bottom 0.5 mbgl. Staining from Blue Billy contamination was noted by Ramboll during the excavation within the Made Ground.

Photographs are presented in Appendix 2.

5.1.2 BH14 'Tar Pit' Soil Hotspot

Ramboll attended site for a watching brief to supervise the removal of the soil hotspot in the natural ground in the north-east of site at BH14 on the 3rd of October where hydrocarbons with an oily sheen was previously identified within the concrete along with black viscous tar pockets in Made Ground beneath during Ramboll's GCIR²⁰.

50 m³ of material was excavated until uncontaminated natural ground was encountered at approximately 2.5m bgl. A layer of hydrocarbon staining was noted at 1.5-2.0m bgl between a large number of brickwork walls and foundations of a former structure beneath the gasholder. The layer was chased out northwards where it thinned out and was no longer visible post-excavation. Perched water was located on top of the concrete base of the former gasholder and is discussed in more detail in Section 5.2.

As part of legacy decommissioning works at the site the gasholder structure had been filled with quarried 6F5. This material was surplus to requirement for the cut/fill balance at the site and as such much of this material was disposed of off-site under suitable duty of care.

Ground conditions encountered during the excavation of the presumed tar pit were observed to be similar to those encountered during Ramboll's previous GCIR¹⁸. However, no actual 'tar pit' was identified as assumed in the RS¹⁶ and the contaminated area affected was larger than expected. Ground conditions are summarised in Table 3 below and photographs are presented in Appendix 2.

5.1.3 BH02 Soil Hotspot

Ramboll attended site for a watching brief to supervise the removal of the soil hotspot in the natural ground in the north-east of site at BH02 on the 7th and 8th of October where tarry pockets / lenses within the clay were recorded from 2.2 mbgl to 4.8 mbgl previously during Ramboll's GCIR²⁶.

25 m³ of material was excavated until uncontaminated natural ground was encountered at approximately 2.9 mbgl. Hydrocarbon staining was noted within the Made Ground with pockets noted 1.9-2.2 mbgl beneath the gravelly clayey loam and sitting on top of the clayey loam beneath which were chased out until no visual contamination was present.

Ground conditions encountered during the excavation of BH02 were observed to be similar to those encountered during Ramboll's previous GCIR²⁶ (2021), but the presence of tar pockets /

²⁵ Ground Contamination Interpretative Report (GCIR). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: R1620009339_GCIR_02, Issue 02, dated February 2021.

²⁶ Ground Contamination Interpretative Report (GCIR). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: R1620009339_GCIR_02, Issue 02, dated February 2021.

lenses as assumed in the RS²⁷ and was less than expected. Ground conditions for BH02 are summarised in Table 3 below and photographs are presented in Appendix 2.

5.1.4 TP08 Soil Hotspot

Toureen confirmed a suitably qualified person was present on site to supervise the removal of the soil hotspot in the natural ground in the north-east of site at TP08 on the 9th of October where a structure and asbestos was previously identified in subsurface soils and elevated hydrocarbon concentrations in the Made Ground were previously identified during Ramboll's GCIR²⁶.

Toureen confirmed 50 m³ of material was excavated until uncontaminated natural ground was encountered at 3.5 mbgl. No contamination was noted during the excavation.

Ground conditions encountered during the excavation of TP08 were observed to be cleaner than those encountered during Ramboll's previous GCIR²⁶ due to no black viscous tar within the Made Ground or asbestos in subsurface soils being identified. Ground conditions for TP08 are summarised in Table 3 below and photographs are presented in Appendix 2.

5.2 Unforeseen Contamination

5.2.1 A3 Blue Billy

Toureen's remedial works began in August 2024 and started with breaking the approximately 0.5 m thick raised concrete hardstanding. The excavated concrete was temporarily stored in stockpile SP HC- (1) located in the centre of the site.

Ramboll identified a thin layer of Blue Billy in the west of the site beneath the concrete hardstanding within the Made Ground in grid numbers A4 and B4 (hotspot number A3) whilst performing a watching brief on the 22nd of August.

Toureen confirmed 10 m³ of material was excavated until uncontaminated natural ground was encountered at 1.5 mbgl. Staining from hydrocarbon contamination was noted during the excavation from 0.5-1.5 mbgl. The source of the Blue Billy was unknown but likely related to former gasworks activities in the west of the site.

5.2.2 D1 Hydrocarbon Staining

Toureen informed Ramboll of a thin layer of Blue Billy in the top 0.5 mbgl and hydrocarbon staining >0.5 mbgl during excavation in the north-west of the site at grid reference D1 on the 20th of September.

Toureen confirmed 15 m³ of material was excavated until uncontaminated natural ground was encountered. The source of the Blue Billy was once again unknown, but likely related to former gasworks activities in the west of the site.

Ground conditions for D1 are summarised in Table 3 below and photographs are presented in Appendix 2.

5.2.3 G2 Interceptor Tank Contamination

Hydrocarbon contamination was encountered surrounding an interceptor tank 1.0-1.5 mbgl that was removed during excavation in the north-east of the site at grid reference G2 on the 5th of November 2024.

²⁷ Remediation Options Appraisal & Outline Remediation Strategy (RS). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: Remediation Options Appraisal and Remediation Strategy 17-1, Issue 02, dated January 2024.

Toureen confirmed 10 m³ of material was excavated until uncontaminated natural ground was encountered, all of which was removed from site as contaminated material.

Ground conditions for G2 are summarised in Table 3 below and photographs are presented in Appendix 2.

5.2.4 E1 Tree Pit Excavation

After completion of the enabling works, the follow-on contractor, Landmark, was carrying out excavation for the installation of two tree pits (labelled west and east) in grid reference E1 on the 16th of December 2024. Ramboll consultants were at the site performing the final round of post-enabling groundwater monitoring and observed visual and olfactory contamination in the excavated soils. Ramboll notified Landmark and the Client of the suspected contamination on site.

Strong visual and olfactory observations were noted in the western tree pit excavation. The source of the hydrocarbon staining likely related to the discovery of a vertical pipe approximately 300 mm in diameter and 500 mm into the ground (2.5 mbgl). The pipe was removed during the excavation and approximately 12.5 m³ of material was excavated, of which the non-visually or olfactory contaminated soil was used as backfill on site in line with the Materials Management Plan²⁸ (MMP).

Ground conditions for E1 are summarised in Table 3 below and photographs during the excavation are presented in Appendix 2.

5.3 Ground Conditions Summary

Table 3: Summary of Ground Conditions During Excavations

Location ID	Approximate Contamination Depth (mbgl)	Approximate Excavation Depth (mbgl)	Strata
WS14	0.0 – 0.5	0.0-0.5	Hydrocarbon-stained Made Ground with pockets of Blue Billy
		>0.5	Made Ground
BH14	1.5-2.0	0.0-0.5	Concrete.
		0.5-1.5	Made Ground with former foundations and brickwork.
		1.5-2.0	Grossly contaminated hydrocarbon stained gravels with a viscous hydrocarbon film.
		>2.0	Light brown sandy CLAY.
BH02	1.9-2.2	0.0-1.1	Brown slightly sandy CLAY.
		1.10-1.90	Dark brown with greyish flecks gravelly clayey LOAM with some stones.

²⁸ Materials Management Plan (MMP). Former Gasworks, Park Road, Worthing. Toureen, Report Ref: TCL1437 REV.0, dated October 2024.

Location ID	Approximate Contamination Depth (mbgl)	Approximate Excavation Depth (mbgl)	Strata
		1.90-2.20	Pockets of tar with dark brown slightly clayey LOAM
		2.20-2.90	Dark brown slightly silty clayey LOAM
TP08	None identified	0-3.5	Made Ground
		>3.5	Light brown CLAY
A3	0.5-1.5	0.0-0.5	Made Ground
		0.5-1.5	Hydrocarbon stained Made Ground
		>1.5	Silty clayey LOAM
D1	0.5	0.0-0.5	Sandy CLAY with a thin layer of Blue Billy
	>0.5	>0.5	Sandy CLAY with pockets/layers of hydrocarbon staining
G2	1.0-1.5	0.0-1.0	Made Ground and a former interceptor tank incased in concrete
		1.0-1.5	Sandy CLAY with hydrocarbon staining from around the interceptor tank
		>1.5	Sandy CLAY
E1	1.0	1.5	Brown clay and sand with gravel with stones and brick with layers of hydrocarbon staining

5.4 Surface Water / Groundwater Management

5.4.1 Surface and Perched Water

Upon breaking open the base of the gasholder in the excavation of the presumed tar pit in BH14, perched water was located on top of the concrete slab. The perched water was pumped through settlement tanks before the contaminated soils below were disturbed. Groundwater samples were taken to ensure the water quality met the criteria stated in the discharge permit²⁹ obtained from Southern Water in Appendix 3.

²⁹ Temporary consent to discharge effluent. Berkeley construction site, former gasworks, Park Road, Worthing, BN11 2AN. Southern Water, Consent ID: 18289. Dated August 2024.

5.4.2 Groundwater Monitoring

Groundwater monitoring was performed by Ben Stride and Palak Joshi of Ramboll and is detailed below. Monitoring was undertaken pre-, during-, and post-enabling works on site for the boreholes referenced below. The monitoring reports for each phase have been provided to the Environment Agency for comment/ agreement of changes from the original proposed scope.

- BH01
- BH02 until 20th August 2024
- BH07
- BH10
- BH11 until 19th July 2024 when it was replaced with MW12-02
- BH12
- MW14-01 until 19th July 2024.

The locations of monitoring boreholes are provided in Figure 6 in Appendix 1. These groundwater monitoring wells were originally intended to remain in place for the duration of the construction works, to provide information on boundary groundwater conditions during the works.

It was determined during a site visit on 21st August 2024 that due to the nature of programmed enabling works, monitoring wells BH02 and BH11 were no longer suitable as long-term monitoring wells. As such these wells were decommissioned in line with Ramboll's BMP³⁰ on the 22nd of August 2024. Monitoring well MW12-02 formed part of the ongoing groundwater monitoring programme in place of BH11. Given the compact nature of the development site, a suitable alternative for BH02 was not available. As such, this location was removed from the monitoring programme without replacement. It was not possible to obtain samples from MW14-01 as planned after the pre-enabling works, due to damage caused to sampling equipment at the beginning of the enabling works. No suitable replacement could be identified for MW14-01, however BH01 was located 20m east and was also up-hydraulic gradient of the identified contamination areas.

The samples were to be scheduled for a suite of contaminants comprising the contaminants of concern as well as a MNA suite throughout the pre- and-during enabling works, but not the post-enabling works. These suites are depicted below:

- TPH CWG, speciated PAHs and BTEX.
- MNA suite (pH, alkalinity, sulphate, sulphide, ammonium as NH₄, nitrate and nitrite, manganese, Fe²⁺ and Fe³⁺).

A series of QA/QC samples were taken at appropriate intervals including Trip Blanks, Field Blanks and duplicates/matrix spikes.

Only TPHs and PAHs are highlighted below as the key contaminants of concern based upon the results. Groundwater monitoring samples were taken by Ramboll and sent to Element Materials Technology for laboratory testing. All groundwater monitoring results, including for BTEX and the MNA suite are shown in Appendix 4.

Pre-Enabling Groundwater Monitoring

Pre-enabling monitoring rounds occurred a total of three times, approximately once every two weeks on the 20th of June, 5th of July, and 19th of July 2024.

³⁰ Borehole Management Plan (BMP). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref 1620016977-RAM-RP-SS-00001_0.3, Issue 01, dated August 2024.

Results obtained during the pre-enabling groundwater monitoring programme were compared to results obtained during a monitoring programme that was carried out by Ramboll in 2022. As summarised below in Table 4, the majority of monitoring locations recorded total TPH and total PAH within the range of concentrations recorded in 2022. However, concentrations in BH01 and BH02 had increased slightly.

Table 4: Summary of Hydrocarbons in Groundwater in 2022 and 2024 Pre-Enabling Works

Monitoring Well	Total TPH 2022 Baseline Monitoring (range, µg/l)	Total TPH 2024 Pre-Enabling Monitoring (range, µg/l)	Total PAH 2022 Baseline Monitoring (range, µg/l)	Total PAH 2024 Pre-Enabling Monitoring (range, µg/l)
BH01	<MRL – 151	<MRL – 416	0.387 – 1.787	2.576 – 7.321
BH02	25,568 – 31,412	33,345 – 39,705	758.7 – 4,882	477.4 – 4,798
BH07	<MRL	<MRL	0.291 – 4.345	<MRL – 1.281
BH10	<MRL	<MRL – 90	<MRL – 1.692	<MRL – 0.199
BH11	<MRL – 21	<MRL	<MRL – 1.512	<MRL – 1.502
BH12	<MRL	<MRL	<MRL – 1.459	<MRL – 0.201
MW14-01	1,104 – 13,158	489 – 4,033	<MRL – 2,156	4.580 – 1,211

During-Enabling Groundwater Monitoring

During-enabling monitoring rounds were carried out on three occasions, approximately once every month on the 20th of August, 18th of September, and 30th of October 2024.

Results obtained throughout the during-enabling groundwater monitoring round were compared to results obtained during the pre-enabling groundwater programme. As summarised below in Table 5, all monitoring locations recorded total TPH within the range of concentrations recorded during pre-enabling. Elevated concentrations of total PAH, compared to the baseline monitoring rounds, were recorded in four of the five monitoring locations (excluding BH12).

Table 5: Summary of Hydrocarbons in Groundwater in 2022 and 2024 During-Enabling Works

Monitoring Well	Total TPH 2024 During-Enabling Monitoring (range, µg/l)	Total TPH 2024 Pre-Enabling Monitoring (range, µg/l)	Total PAH 2024 During-Enabling Monitoring (range, µg/l)	Total PAH 2024 Pre-Enabling Monitoring (range, µg/l)
BH01	<MRL - 182	<MRL – 416	0.728-7.962	2.576 – 7.321
BH02	50,053	33,345 – 39,705	2,139	477.4 – 4,798
BH07	<MRL-14	<MRL	<MRL-2.567	<MRL – 1.281
BH10	<MRL	<MRL – 90	0.364-0.974	<MRL – 0.199
BH11 / MW12-02	<MRL	<MRL	<MRL-4.34	<MRL – 1.502
BH12	<MRL	<MRL	<MRL-0.191	<MRL – 0.201

Post-Enabling Groundwater Monitoring

Post-enabling monitoring rounds occurred a total of three times, approximately once every two weeks on the 12th of November, 2nd of December, and 16th of December 2024

Results obtained throughout the post-enabling groundwater monitoring round were compared to results obtained during the pre-enabling groundwater programme. As summarised below in Table 6, all monitoring locations have recorded total TPH within the range of concentrations recorded during pre-enabling. Elevated concentrations of total PAH, compared to the baseline monitoring rounds, were recorded in four of the five monitoring locations (excluding BH01). These exceedances were mainly from the monitoring round on the 12th of November 2024 where high concentrations were observed in the south of the site, especially for MW12-02 and BH12.

The final post-enabling works monitoring round, undertaken on 16th December 2024, recorded concentrations of PAHs in the same order of magnitude as the baseline/ pre-enabling works monitoring.

Table 6: Summary of Hydrocarbons in Groundwater in 2022 and 2024 Post-Enabling Works

Monitoring Well	Total TPH Post-Enabling Monitoring (range, µg/l)	Total TPH 2024 Pre-Enabling Monitoring (range, µg/l)	Total PAH Post-Enabling Monitoring (range, µg/l)	Total PAH 2024 Pre-Enabling Monitoring (range, µg/l)
BH01	<MRL	<MRL - 416	0.442-3.703	2.576 – 7.321
BH07	<MRL	<MRL	0.252-10.582	<MRL – 1.281
BH10	<MRL	<MRL – 90	5.046-14.291	<MRL – 0.199
BH11 / MW12-02	<MRL	<MRL	0.224-208.392	<MRL – 1.502
BH12	<MRL	<MRL	<MRL-153.934	<MRL – 0.201

5.5 Vapour Monitoring

Toureen monitored volatile hydrocarbons three times a day using a photo-ionisation detector (PID) which provided instantaneous concentration readings for VOCs and was calibrated for benzene. A continuous VOC monitoring system was also installed at the north-east boundary of the site. Locations of these monitoring points are provided in Figure 7 below.

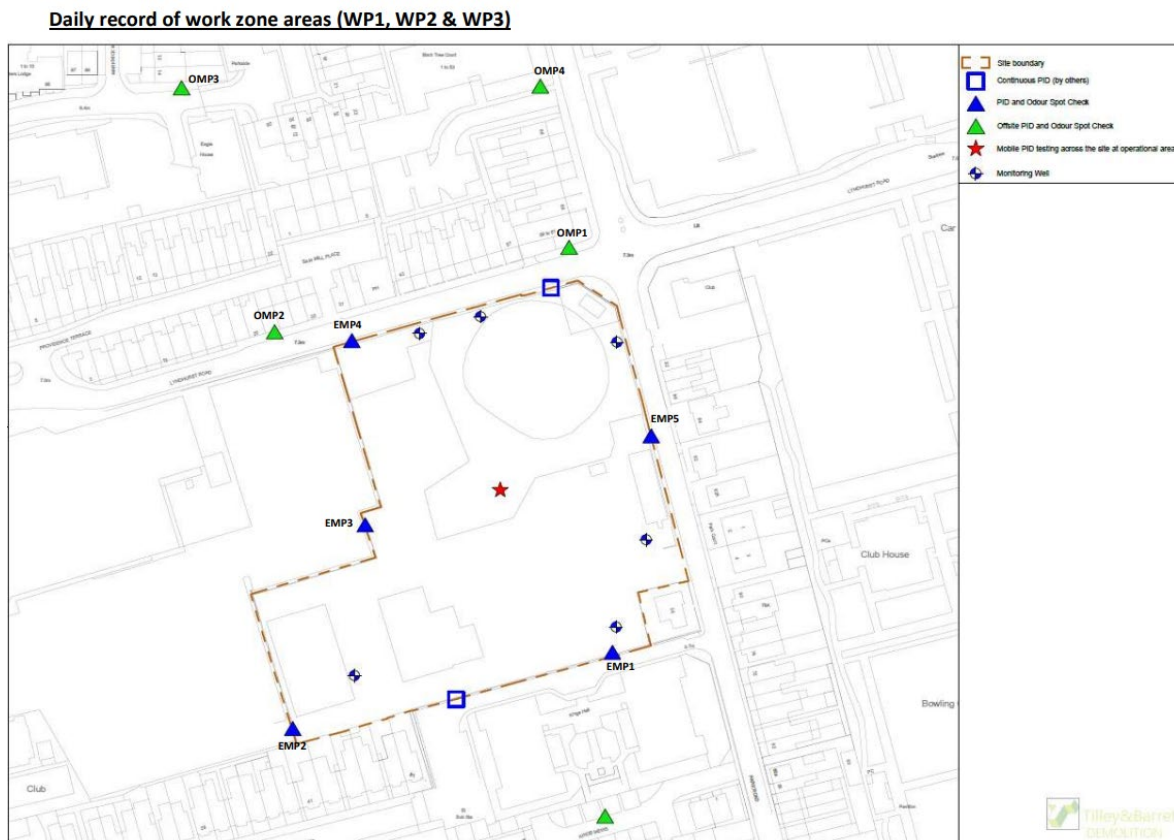


Figure 7. Continuous VOC monitoring points

No significant concentrations of VOCs were registered during the works. Results from the continuous VOC monitoring are provided in Appendix 4.

5.6 Borehole Decommissioning

A total of 24 boreholes have been decommissioned in two phases, including six additional vapour wells discovered during decommissioning. Decommissioning was carried out in line with the BMP³¹. 16 boreholes could not be located (eight of these were installed in Made Ground / superficial deposits and did not intercept the Chalk aquifer). A summary of the borehole decommissioning is provided in Appendix 6.

5.6.1 First Round – 22nd August 2024

Ramboll attended site to supervise the borehole decommissioning works undertaken by Environmental Sampling Ltd. (ESL). A total of 20 boreholes were grouted (six including six additional vapour wells discovered during decommissioning) and 17 could not be located, where eight of these were installed in Made Ground / superficial deposits and did not intercept the Chalk aquifer. Efforts were made to locate these boreholes, but many were drilled a long time ago by third parties and are assumed to have been lost to both historical and recent site activity.

5.6.2 Second Round – 16th December 2024

Ramboll also attended site to supervise the borehole decommissioning works of four boreholes undertaken by ESL. MW14-01 was no longer serviceable and BH01 and BH12 were located within building footprints during the proceeding construction works and were therefore decommissioned. BH2 (not to be mistaken with BH02) was also discovered during the enabling works in the south-

³¹ Borehole Management Plan (BMP). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref 1620016977-RAM-RP-SS-00001_0.3, Issue 01, dated August 2024.

east of the site and was decommissioned. BH07, BH10, and MW12-02 have been left as part of the long-term groundwater monitoring programme for the piling works estimated to begin towards the end of 2025.

5.7 Other Site Visits

Additional watching briefs during the enabling works were undertaken by Ben Stride of Ramboll and are detailed below. Photographs from the watching briefs are located in Appendix 2.

Site Visit – 22nd August 2024

Ramboll attended site to supervise the borehole decommissioning works undertaken by ESL. During Ramboll's visit Blue Billy contamination was identified in the Made Ground beneath the former concrete hardstanding in the west of the site (between grid numbers A4 and B4) that had been broken and removed prior. Berkeley Homes Ltd. and Toureen were subsequently informed and the Blue Billy was excavated and stockpiled as gross contamination as stated in section 5.2.1.

Site Visit – 29th August 2024

Ramboll attended site to perform a watching brief of the remediation activities. Small amounts of Blue Billy were still identified between grid numbers A4 and B4 which Toureen were requested to remove and add to the stockpile in B5.

Perched water was identified within a trial pit in the gasholder base and confirmation of a discharge permit for the removal of the water was later confirmed by Toureen.

No other visual or olfactory evidence of contamination was noted during the watching brief.

Site Visit – 4th September 2024

Ramboll attended site to perform a watching brief of the remediation activities. A localized patch of Blue Billy was identified on top of the yellow pipe recently excavated in grid number A4. Toureen was requested to remove and add to the stockpile in B5.

No other visual or olfactory evidence of contamination was noted during the watching brief.

Site Visit – 27th September 2024

Ramboll attended site to perform a watching brief of the remediation activities.

No visual or olfactory evidence of contamination was noted during the watching brief.

Site Visit – 30th September 2024

Ramboll attended site to perform a watching brief during the excavation of the infilled material within the former gasholder. A pocket of hydrocarbon staining and odour was noted in the Made Ground within the vicinity of BH14.

Toureen confirmed the removal and stockpiling of any stained soils within the former gasholder in grid number D2 and bubblegum odour suppressants were actively used within the area.

6. VERIFICATION AND VALIDATION

6.1 Excavations and Unforeseen Contamination

6.1.1 Sampling Strategy and Analytical Suite

Soil sampling was undertaken by Toureen in general accordance with standards outlined within BS ISO 18400- 102:2017 and the RS³². Per the RS³², Toureen confirmed side (labelled through each cardinal direction) and base validation sampling were undertaken to validate the removal of hotspots and any unforeseen contaminated areas on site. The position and extent of the hotspot and unforeseen contamination excavations is presented on Drawing TCL1437_EN007_BH_A_L1³³ in Appendix 1 except the G2 and E1 unforeseen contamination hotspots which were encountered after Toureen drafted their verification report.

Toureen confirmed soil samples were collected from each of the aforementioned areas in Sections 5.1 and 5.2. Details of the samples collected are summarised in the Soil Sampling Register in Appendix 7.

The validation samples were submitted to i2 Analytical for analysis in line with Toureen's RIP³⁴. A summary table of hotspot and unforeseen contaminated soil samples collected, analysis scheduled, and laboratory results are included in Table 7 in Appendix 4. Laboratory certificates for the stockpile samples are provided as Appendix 5.

A summary table of stockpile soil samples collected, analysis scheduled, and laboratory certificates is included in Table 8 in Appendix 5.

6.1.2 Validation Sample Results – Hotspot Excavations

Validation samples were collected following removal of all visually impacted soils. The sampling frequency, as outlined in the MMP³⁵ for hotspot excavations was:

- One sample per 10 m length excavation.
- One sample per 100 m² base excavation.

For re-use of site-won material:

- One sample per 500 m³ soil. According to the MMP³⁵.

The validation of the sampled materials was undertaken in line with Ramboll's GAC for residential land use (as detailed in the Appendix 4 of the RS²⁷ and Toureen's RIP²⁸); with the screening table (Table 9) presented in Appendix 5.

WS14 Shallow Soil Hotspot

Validation soil samples were taken by Toureen and sent to i2 Analytical for laboratory testing (Lab Sample Ref: 24-040614-1) and the excavated contaminated soil was stockpiled and banded in grid number B5.

Toureen reported the initial validation was failed due to high concentrations of Napthalene (63 mg/kg) and TPHCWG – Aromatic >EC5-EC35 (8200 mg/kg) on the southern side of the excavation. As a result, further soil volume was removed from the hotspot to the south and additional samples were taken which passed the validation criteria (Lab Sample Ref: 24-047813).

³² Remediation Options Appraisal & Outline Remediation Strategy (RS). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: Remediation Options Appraisal and Remediation Strategy 17-1, Issue 02, dated January 2024.

³³ Hotspot removal locations. Ref: TCL1437_EN007_BH_A_L1, dated August 2024.

³⁴ Remediation Implementation Plan (RIP). Worthing Gasworks. Toureen, Report Ref: TCL-1437-RIP-REV01.

³⁵ Materials Management Plan (MMP). Former Gasworks, Park Road, Worthing. Toureen, Report Ref: TCL1437 REV.0, dated October

All other soil hotspot validation samples collected were compliant with the re-use criteria but are briefly summarised below.

BH14 'Tar Pit' Soil Hotspot

Validation soil samples were taken by Toureen and sent to i2 Analytical for laboratory testing (Lab Sample Ref: 24-046202). The 15 m³ excavated material was labelled as 'grossly contaminated soil' and stockpiled and banded in grid number D2. Toureen confirmed 50 m³ of site won soils were used to backfill the excavated area.

BH02 Soil Hotspot

Validation soil samples were taken by Toureen and sent to i2 Analytical for laboratory testing (Lab Sample Ref: 24-047395) and the 25 m³ of the excavated material was stockpiled and banded in grid number C5 and D5. Toureen confirmed 25 m³ of site-won soils and crushed concrete were used to backfill the excavated area.

TP08 Hotspot

No contamination was noted during the excavation. Validation soil samples were taken by Toureen and sent to i2 Analytical for laboratory testing (Lab Sample Ref: 24-052869) and the excavated soils were tested and used as backfill.

6.1.3 Validation Sample Results – Unforeseen Contamination

A3 Blue Billy

Validation soil samples were taken by Toureen and sent to i2 Analytical for laboratory testing (Lab Sample Ref: 24-039340-1, 24-047813) and the 10 m³ of excavated contaminated soil was stockpiled and banded in grid number B5. Toureen confirmed 10 m³ of site won soils were used to backfill the excavated area.

Despite also being visible in Made Ground across other areas in the west of the site (e.g. WS14 and D1) free cyanide was not detected above Ramboll's GAC for residential land use in soil samples collected by Toureen during their enabling works.

D1 Hydrocarbon Staining

Validation soil samples were taken by Toureen and sent to i2 Analytical for laboratory testing (Lab Sample Ref: 24-043373) and the 15 m³ of excavated contaminated soil was removed from site. After the design area excavation was completed Toureen confirmed 35 m³ of site won material was used as backfill.

G2 Interceptor Tank

Validation soil samples were taken by Toureen and sent to i2 Analytical for laboratory testing (Lab Sample Ref: 24-052121) and the 10 m³ of excavated contaminated soil was removed from site. Toureen confirmed 50 m³ of site won material was used as backfill.

E1 Hotspot

Validation soil samples were taken by Toureen and sent to i2 Analytical for laboratory testing (Lab Sample Ref: 25-001478-1, 25-002519-1) and the non-visually or olfactory contaminated soil was used as backfill on site after passing the validation criteria. The suspected contaminated soil and 300 mm diameter and 500 mm length pipe were stockpiled and banded on site (as shown in Appendix 2), where, as of completion of this report it remains awaiting removal.

6.1.4 Validation Sample Results – Groundwater Monitoring

Pre-Enabling Groundwater Monitoring

Where available, GAC for human health in residential land use (volatilisation pathway), have been compared against recorded groundwater concentrations where exceedances were noted for the following contaminants:

- Naphthalene exceeded the GAC of 1,400µg/l in BH02 at concentrations between 3,985.5µg/l (20th June) and 4,257.5µg/l (5th July).
- Benzene exceeded the GAC of 500µg/l in BH02 at concentrations between 9,075µg/l (20th June) and 10,535µg/l (5th July); and in MW14-01 at concentrations of between 815µg/l (5th July) and 1,755µg/l (19th July).
- Aliphatic TPH C6-C8 exceeded the GAC of 1,500µg/l in BH02 at concentrations of between 3,458µg/l (20th June) and 4,028µg/l (5th July).
- Aliphatic TPH C8-C10 exceeded the GAC of 57µg/l in BH02 at concentrations of between 1,475µg/l (20th June) and 1,761µg/l (19th July); and MW14-01 at concentrations of between 60µg/l (5th July) and 147µg/l (19th July).
- Aromatic TPH C8-C10 exceeded the GAC of 1,900µg/l in BH02 at concentrations of between 5,765µg/l (20th June) and 7,130µg/l (5th July).
- Aromatic TPH C10-C12 exceeded the GAC of 6,800µg/l in BH02 at concentrations of between 7,635µg/l (20th June) and 9,053µg/l (5th July).

No GAC exceedances were noted in the other boreholes outside of BH02 and MW14-01 (located in the north of the site) within the monitoring programme.

During-Enabling Groundwater Monitoring

Where available, GAC for human health in residential land use (volatilisation pathway), have been compared against recorded groundwater concentrations and exceedances were noted for the following contaminants in BH02 for the monitoring round undertaken in August:

- Benzene exceeded the GAC of 500µg/l in BH02 at a concentration of 8,387µg/l.
- Aliphatic TPH C6-C8 exceeded the GAC of 1,500µg/l in BH02 at a concentration of 2,852µg/l.
- Aliphatic TPH C8-C10 exceeded the GAC of 57µg/l in BH02 at a concentration of 1,611µg/l.
- Aromatic TPH C8-C10 exceeded the GAC of 1,900µg/l in BH02 at a concentration of 5,957µg/l.
- Aromatic TPH C10-C12 exceeded the GAC of 6,800µg/l in BH02 at a concentration of 20,217µg/l.

No GAC exceedances were noted in the September and October monitoring rounds, now that BH02 has been removed from groundwater monitoring; this has included BH01, despite visual observations of DNAPL. There were no exceedances of human health screening criteria for speciated PAHs.

A field blank (sample of distilled water provided by the laboratory, decanted into sample containers on site, and returned to the laboratory for analysis) identified a measurable concentration of Total TPH (48µg/l). This suggests that there is some potential for variation within the sampling and analysis procedure with potential to impact low concentrations.

Post-Enabling Groundwater Monitoring

Where available, GAC for human health in residential land use (volatilisation pathway), have been compared against recorded groundwater concentrations. No exceedances were recorded,

despite elevated concentrations of Total PAHs being recorded during the 12th of November 2024 monitoring round when compared to the pre-enabling groundwater monitoring rounds.

The elevated concentrations detected during the 12th of November 2024 monitoring round are in the same order of magnitude as those specified in previous investigations across the site and the DQRA³⁶. The residual risk is expected to be mitigated through the installation of a vapour resistant membrane in the north of the site.

A summary of the groundwater monitoring validation results is provided in Appendix 4 Table 10.

6.1.5 Waste Characterisation Results

Several additional samples were also collected (by Toureen) of the grossly impacted soils from excavations, which are summarised in Table 7 Appendix 4 with the sample reference 'HS'. These samples were collected for the purpose of facilitating material characterisation for waste disposal.

Toureen informed Ramboll of a detection of 0.691 % of Chrysotile asbestos (Lab Sample Ref: 24-047395) along the northern boundary of the site in sample NB C1. No further action was undertaken as no visible or friable asbestos was noted. Asbestos fibres (mainly Chrysotile) were positively detected across the site in 11 samples at low concentrations < 0.02 %. No further action was undertaken as no visible or friable asbestos was noted and therefore these results were in line with the asbestos strategy outlined in Toureen's RIP³⁷.

According to Toureen's Table provided in Appendix 8 (Table 11), fifteen total samples were submitted for WAC, of which:

- Two samples from WS14 (24-040876) and E1-HS-EX near the northern boundary (24-043374) were submitted for WAC testing, which indicated that they should be classified as hazardous waste due to loss on ignition percentages being >10 % and the Total organic carbon (TOC) percentage being >6 % for E1-HS-EX.
- Nine samples including WS14 and E1-HS-EX were submitted for WAC testing, which indicated they should be classified as stable non-reactive hazardous waste mainly due to elevated mineral oil (TPH >500 mg/kg) and PAH (>100 mg/kg) concentrations and alkaline pH's (>6).

All WAC laboratory certificates are provided in Appendix 8.

6.2 Soil Reuse

According to information provided by Toureen, all materials not transferred off-site as waste were re-used as site won soils. The re-use of site won soils were permitted and managed in accordance with Toureens MMP³⁸ where a total 45 samples were taken for re-use across the site (Table 8). All samples were compliant with the re-use criteria except Napthalene for 'SP-HC-Fines 2' (Lab Sample Ref: 24-043261) which wasn't compliant for re-use anywhere on the site, but was for re-use in car parks/roadways.

As per the RS³⁹, Toureen undertook validation sampling on site won soils under the reuse criteria. Laboratory samples were collected from stockpiles and by grid referencing. Stockpile and grid validation sample test results are summarised in Table 8 Appendix 5. Samples collected on a grid basis have been referenced as such in the Sample ID. Samples collected from stockpile

³⁶ Detailed Quantitative Risk Assessment (DQRA), Former Worthing Gasworks, Park Road, Worthing, Ref: 1620009339_DQRA_02, February 2021, prepared for St William Homes LLP.

³⁷ Remediation Implementation Plan (RIP). Worthing Gasworks. Toureen, Report Ref: TCL-1437-RIP-REV01.

³⁸ Materials Management Plan (MMP). Former Gasworks, Park Road, Worthing. Toureen, Report Ref: TCL1437 REV.0, dated October 2024.

³⁹ Remediation Options Appraisal & Outline Remediation Strategy (RS). Former Gasworks, Park Road, Worthing. Ramboll, Report Ref: Remediation Options Appraisal and Remediation Strategy 17-1, Issue 02, dated January 2024.

subsequently correlate to Toureen's material Drawings TCL1437_EN003_BH_A_L1 to TCL1437_EN003_BH_I_L1⁴⁰.

Material excavated from TP08 was backfilled *in-situ* due to no visible or chemically tested contamination being found.

For the sub-base reinstatement 2% Ordinary Portland Cement (OPC) was added to the soils and 3% OPC for piling mat stabilisation. This was for the purpose of moisture control and to allow adequate compaction to be achieved.

In total approximately 9,663 m³ of material was excavated from site and 5,136 m³ was re-used as site won soils, of which:

- 4146 m³ was used to backfill the gasholder.
- 540 m³ was used to backfill the northern service trench.
- 450 m³ was used to backfill the southern service trench.

Toureen's finished levels across the site are presented in Drawing TCL1437_EN003_BH_J_L1⁴¹ in Appendix 1.

6.3 Waste Disposal

Following classification of waste material; metals, inert materials, waste aggregates (concrete), bricks, soil and stone, mixed construction and demolition waste, and hazardous material were kept segregated and loaded into licensed six- or eight-wheel sheeted tippers (6WT or 8WT) and transported off-site. Quantities, destinations of material exported off-site along with details of the waste carriers and landfills are presented in the Waste Documentation Tracker, Appendix 8 provided by Toureen.

Waste consignment notes and landfill deposit tickets were retained by Toureen in accordance with the Duty of Care Regulations (S34 of the EPA 1990) with a summary table provided in Appendix 9.

The remaining 4,527 m³ from the 9,663 m³ of excavated material from site (highlighted in Section 6.2 above) was disposed off-site, of which:

- 4,386 m³ was disposed off-site as non-hazardous waste including:
 - 3,411 m³ of concrete (including 6F4/6F5) sent to Eurogreen Environmental Ltd. - North Barn Farm (CB3707UL) and DAY GROUP LTD (trading as Day Aggregates) - Day Aggregates Murphy's Wharf (EPR/DP3490EU).
 - 689 m³ of subsoil sent to PJ Brown (Civil Engineering Limited) - Bolney Park Farm Recycling Facility (JB3502UD).
 - 286 m³ of hardcore sent to Eurogreen Environmental Ltd.
- 141 m³ was disposed off-site as hazardous waste including: 10 m³ of soils from WS14, 25 m³ of soils from BH14, 25 m³ of soils from BH02, 25 m³ of soils from TP08, 21 m³ of soils from A3, 25 m³ of soils from D1, and 10 m³ of soils from G2.

Site won (6F4/6F5) was readily available as a quarried aggregate from the legacy filling of Gasholder 1 (located in the northeast of site). No detections of asbestos were determined in the

⁴⁰ Site progress and stockpile surveys 8th Aug 2024 – 25th October 2024. Former Gasworks, Park Road, Worthing. Toureen, Ref: TCL1437_EN003_BH_A_L1, TCL1437_EN003_BH_B_L1, TCL1437_EN003_BH_C_L1, TCL1437_EN009_BH_D_L1, TCL1437_EN009_BH_E_L1, TCL1437_EN009_BH_F_L1, TCL1437_EN003_BH_G_L1, TCL1437_EN003_BH_H_L1, TCL1437_EN003_BH_I_L1.

⁴¹ As-built handover levels check survey 7th Nov 2024. Former Gasworks, Park Road, Worthing. Toureen, Ref: TCL1437_EN003_BH_J_L1.

laboratory samples, with the WAC summary for chemical testing provided in Table 10 in Appendix 8. WAC testing results demonstrated conformance to 6F5 by means of PSD, and less than 1% Class X materials in the aggregate matrix. Geotechnical laboratory results are summarised in Table 12 in Appendix 8.

In total, Toureen reported a total of 17 loads of hazardous soils were disposed off-site (European Waste Code 170301*), labelled as 'Bituminous mixtures containing coal tar' on the waste consignment notes (Appendix 9). All hazardous waste was sent to MAC Contracting Limited - Griff Clara Industrial Estate (facility license YP3938DY).

Temporary stockpiling was undertaken throughout the enabling works with the larger stockpiles between August and October being labelled on Toureen's material Drawings TCL1437_EN003_BH_A_L1 to TCL1437_EN003_BH_I_L1⁴² in Appendix 1.

- SP SUB-(1): Subsoil located in grid references A5 and A6.
- SP SUB-(2): Subsoil located in grid references C4, D3, and D4.
- SP HC-(1): Concrete located in grid references C4, D3, D4, E3, and E4.
- SP HC-(2): Hardcore located in grid references D4 and E4.
- SP6F5-(1): Crushed aggregates located in grid references F3, F4, G3, and G4.
- SP FNS-(1): Concrete fines located in grid references D3, D4, E3, and E4.

Hazardous stockpiles are discussed for each hotspot and unforeseen contamination excavation in Sections 5.1 and 5.2 above and are also displayed in Tables 13-20 Appendix 10 within Toureen's Verification Report⁴³. Specifically, the hazardous waste stockpiles were labelled as:

- WS14-HS: Soils located in grid reference B5.
- BH14-HS: Soils located in grid reference D2.
- BH02-HS: Soils located in grid reference C5 and D5.
- A3-HS: Soils located in grid reference B5.

6.4 Regulatory Liaison

In total, six odour complaints were made, predominantly during the gasholder excavation. The Environmental Health Technician visited the site on two occasions and confirmed all available measures were being followed to minimize the impact to local residents, as outlined in the OMP. Details of all correspondence with the Environmental Health Technician for ADC are provided in Appendix 11.

Ramboll provided the results of pre, during and post-remediation groundwater monitoring to the EA following each phase of sampling and analysis. Ramboll subsequently liaised with the EA regarding borehole substitution, replacement and decommissioning as the enabling works progressed. E.g. some boreholes were located in the vicinity of hot-spots; others in the footprint of the development. These were decommissioned in line with the BMP. Three boreholes remain for pre, during and post piling activities in the south of the site (one of these, BH10, is required to be replaced with a new borehole).

⁴² Site progress and stockpile survey 8th Aug 2024 – 25th October 2024. Former Gasworks, Park Road, Worthing. Toureen, Ref: TCL1437_EN003_BH_A_L1, TCL1437_EN003_BH_B_L1, TCL1437_EN003_BH_C_L1, TCL1437_EN009_BH_D_L1, TCL1437_EN009_BH_E_L1, TCL1437_EN009_BH_F_L1, TCL1437_EN003_BH_G_L1, TCL1437_EN003_BH_H_L1, TCL1437_EN003_BH_I_L1.

⁴³ Verification Report. Land at Former Gas Works Site, Park Road, Worthing. Toureen, Report Ref: TCL1321-WOR-VFR-001.

APPENDIX 1

FIGURES AND DRAWINGS

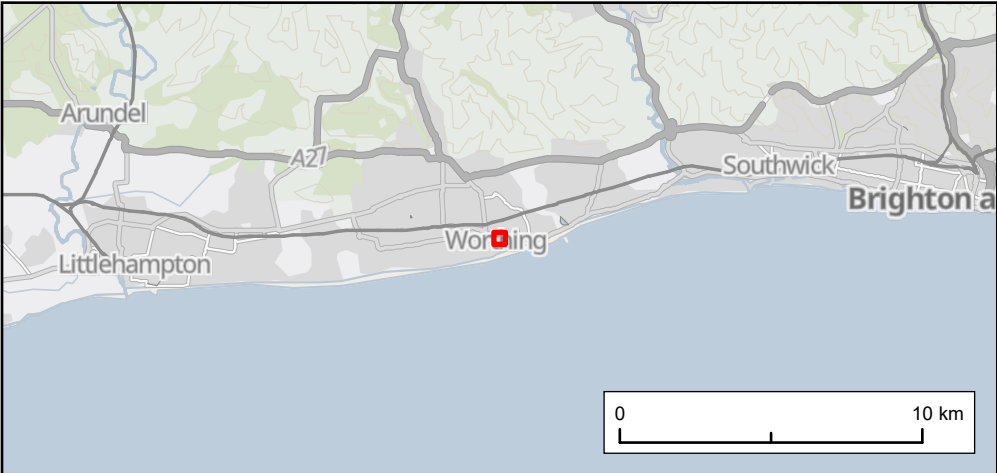
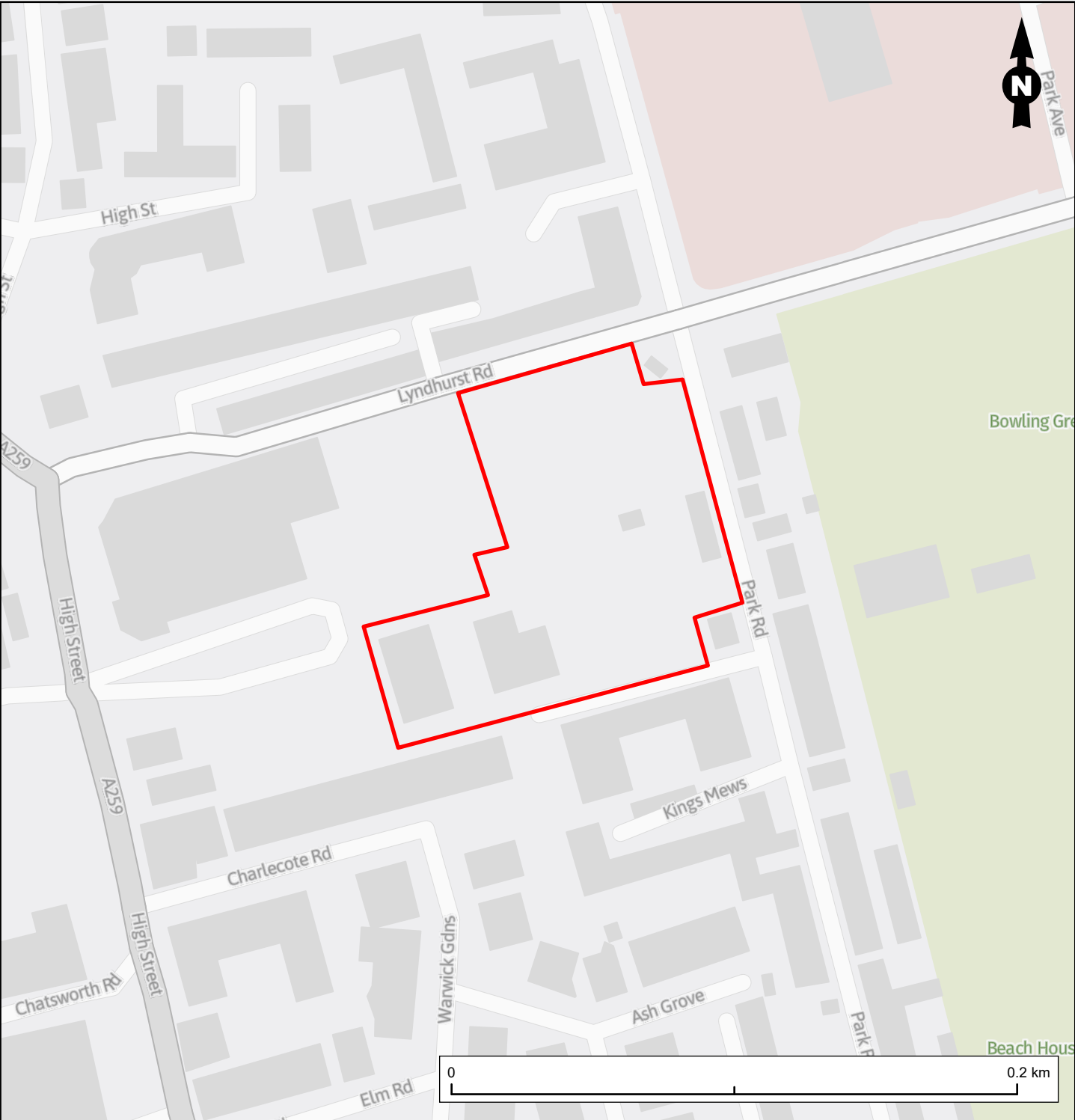


Figure Title Figure 1: Site Location	Project Name Former Gasworks, Park Road, Worthing	Date August 2024	
		Scale on Main Map 1:2,000	
Project Number 1620016977	Client Berkeley Homes (Southern) Ltd	Issue 1	Prepared By JB





Legend

Site Boundary

Figure Title

Site Boundary

Project Name

Former Gasworks, Worthing

Project Number

1620016977

Figure No.

2

Date

August 2024

Prepared By

AK

Scale

1:600 @A3

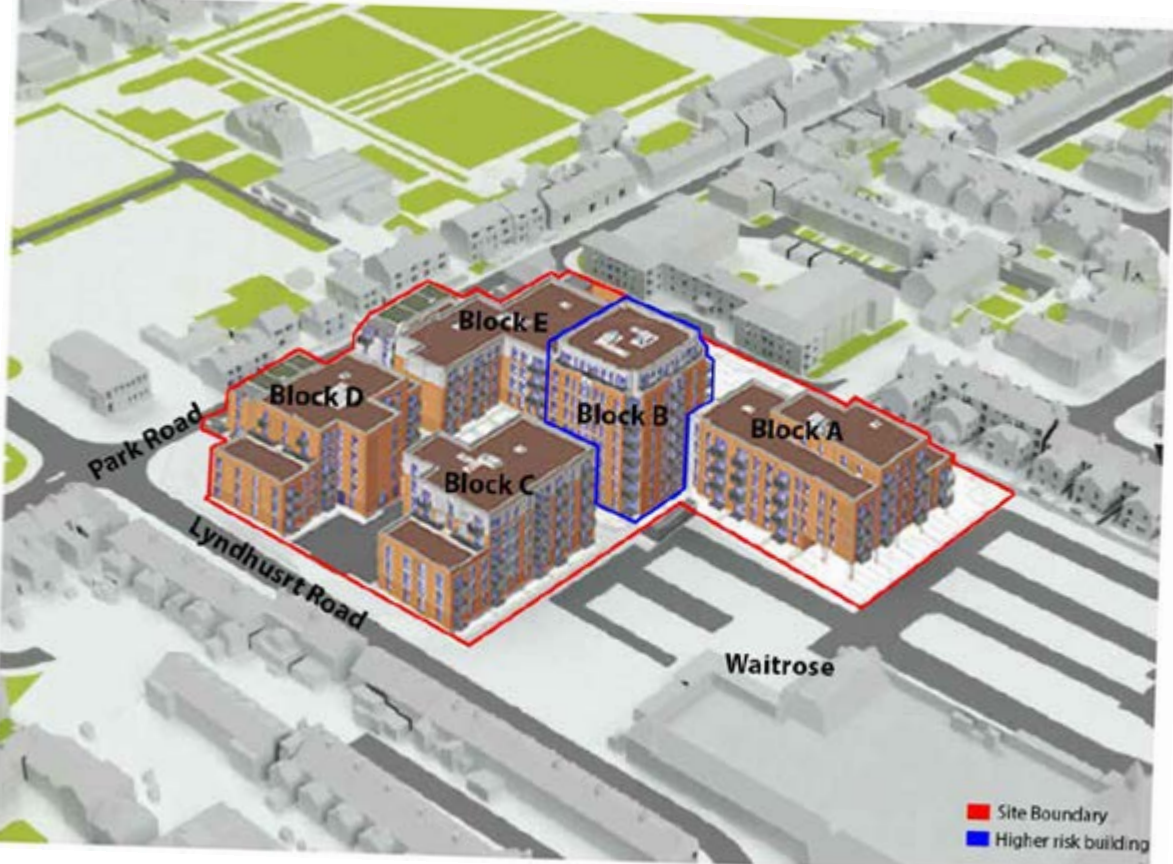
Issue

3

Client

Berkeley Homes (Southern) Ltd

RAMBOLL





Legend

- Borehole (no monitoring well installed)
- Borehole with Monitoring Well Installed
- Deep Borehole with Monitoring Well Installed
- Previously Installed Third-Party Well
- Window Sample with Gas Monitoring Well Installed
- Trial Pit
- Site Boundary

Figure Title	
Investigation Locations	
Project Name	
Former Gasworks, Worthing	
Project Number	Figure No.
1620016977	4
Date	Prepared By
August 2024	AK
Scale	Issue
1:600 @A3	3
Client	
Berkeley Homes (Southern) Ltd	





Legend

Borehole (no monitoring well installed)

Borehole with Monitoring Well Installed

Deep Borehole with Monitoring Well Installed

Previously Installed Third-Party Well

Window Sample with Gas Monitoring Well Installed

Trial Pit

Site Boundary

Hotspot Locations

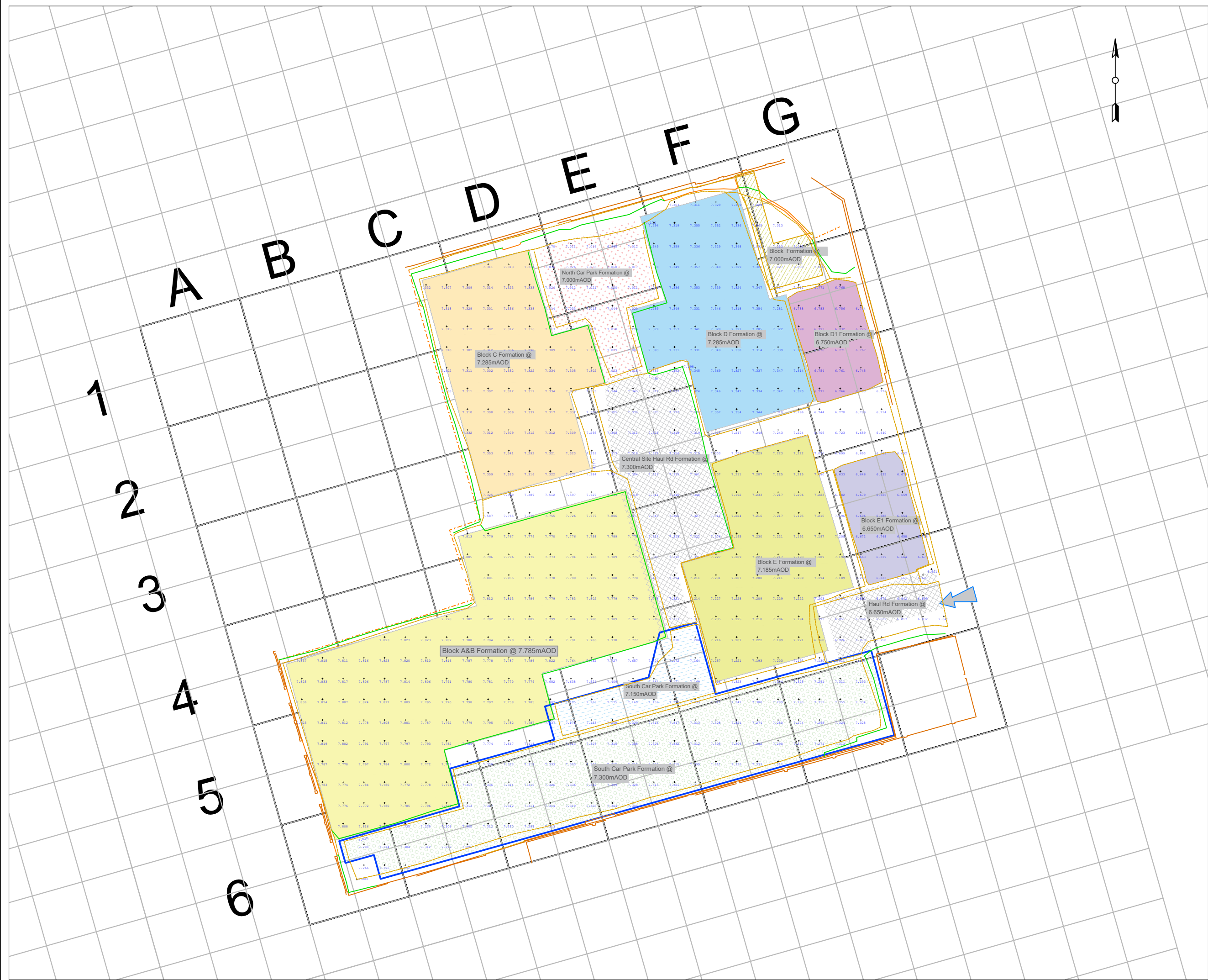
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Investigation Locations	
Project Name	
Former Gasworks, Worthing	
Project Number	Figure No.
1620016977	5
Date	Prepared By
August 2024	AK
Scale	Issue
1:600 @A3	5
Client	
Berkeley Homes (Southern) Ltd	



Legend

- Borehole (no monitoring well installed)
- Borehole with Monitoring Well Installed
- Deep Borehole with Monitoring Well Installed
- Previously Installed Third-Party Well
- Window Sample with Gas Monitoring Well Installed
- Trial Pit
- Site Boundary
- Retained Borehole (See Section 3 of Borehole Management Plan)

Figure Title	
Investigation Locations	
Project Name	
Former Gasworks, Worthing	
Project Number	Figure No.
1620016977	6
Date	Prepared By
August 2024	AK
Scale	Issue
1:600 @A3	3
Client	
Berkeley Homes (Southern) Ltd	
RAMBOLL	



General notes

- This drawing should be read in conjunction with all other relevant drawings and specifications.
- Do not scale from this drawing.
- All surveys are orientated to OSGB36(15).
- Dimensions and levels must be confirmed on site prior to starting works.
- All units are in metres unless stated otherwise.

Key			
	Bottom of bank		Water line
	Top of bank		Road
	Primary Contour (1m)		Secondary Contour (0.2m)
	Brick/Concrete		Gate
	Fence		Hedge
	Wall		Tree

Finished Ground Levels Survey Check.

Block Location & Formation Levels Discriptions

Site Boundary Wall/ Fence

Site Grid

Rev	Date	Description	Drawn	Chkd
A	08.08.24	INITIAL SITE SURVEY LEVELS	BH	DS
B	24.08.24	UPDATE SITE SURVEY	BH	DS
C	12.09.24	UPDATE SITE SURVEY	BH	DS
D	19.09.24	UPDATE SITE SURVEY	BH	DS
E	26.09.24	UPDATE SITE SURVEY	BH	DS
F	03.10.24	UPDATE SITE SURVEY	BH	DS
G	09.10.24	UPDATE SITE SURVEY	BH	DS
H	16.10.24	UPDATE SITE SURVEY	BH	DS
I	25.10.24	UPDATE SITE SURVEY	BH	DS
J	05.11.24	UPDATE SITE SURVEY	BH	DS

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Client
ST WILLIAM

Project
FORMER GASWORKS
PARK ROAD
WORTHING

Title
AS-BUILT HANDOVER LEVELS
CHECK SURVEY 7TH NOV 2024

Drawing no.
TCL1437_EN003_BH_J_L1

Issued 0711.24

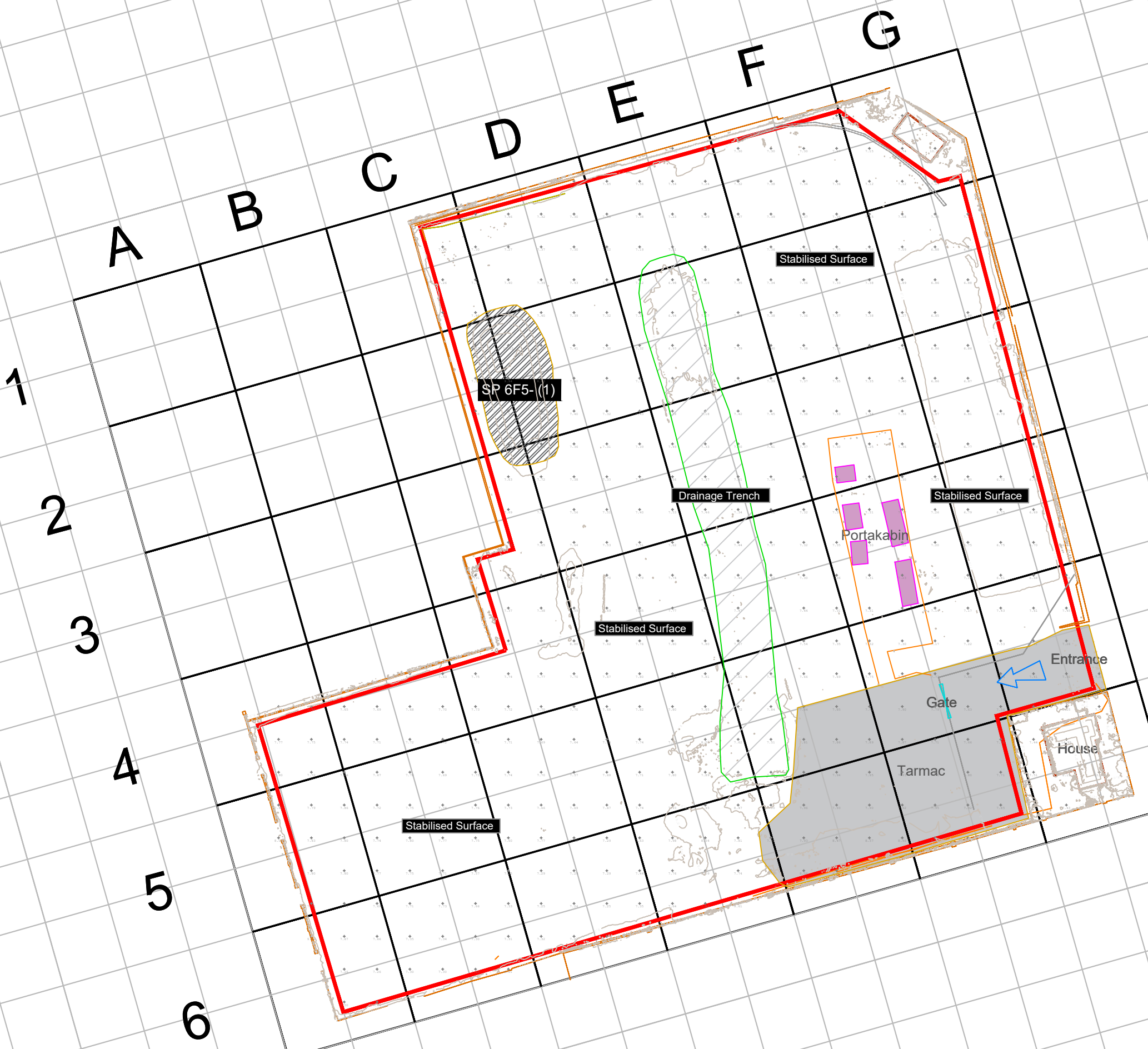
Scale NTS

Drawn BH

Checked RW

Project no.
TCL1437

Revision
J



General notes

- This drawing should be read in conjunction with all other relevant drawings and specifications.
- Do not scale from this drawing.
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- All units are in metres unless stated otherwise.

Key			
	Bottom of bank		Water line
	Top of bank		Road
	Primary Contour 1m		Secondary Contour 0.2m
	Building line		Gate
	Fence		Hedge
	Wall		Tree

— Surveyed Ground Levels

— Tarmac Area Remaining

— Stabilised Surface

— Drainage Run Excavation Location

— PRS Compound

STOCKPILE VOLUMES

— Stockpile 356m3

A	08.08.24	INITIAL SITE SURVEY LEVELS	BH	DS
B	24.08.24	UPDATE SITE SURVEY	BH	DS
C	12.09.24	UPDATE SITE SURVEY	BH	DS
D	19.09.24	UPDATE SITE SURVEY	BH	DS
E	26.09.24	UPDATE SITE SURVEY	BH	DS
F	03.10.24	UPDATE SITE SURVEY	BH	DS
G	09.10.24	UPDATE SITE SURVEY	BH	DS
H	16.10.24	UPDATE SITE SURVEY	BH	DS
I	25.10.24	UPDATE SITE SURVEY	BH	DS

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Client

ST WILLIAM

Project

FORMER GASWORKS
PARK ROAD
WORTHING

Title

SITE PROGRESS AND STOCKPILE
SURVEY 25th OCTOBER 2024

Drawing no.

TCL1437_EN003_BH_I_L1

Issued 25.10.24

Scale NTS

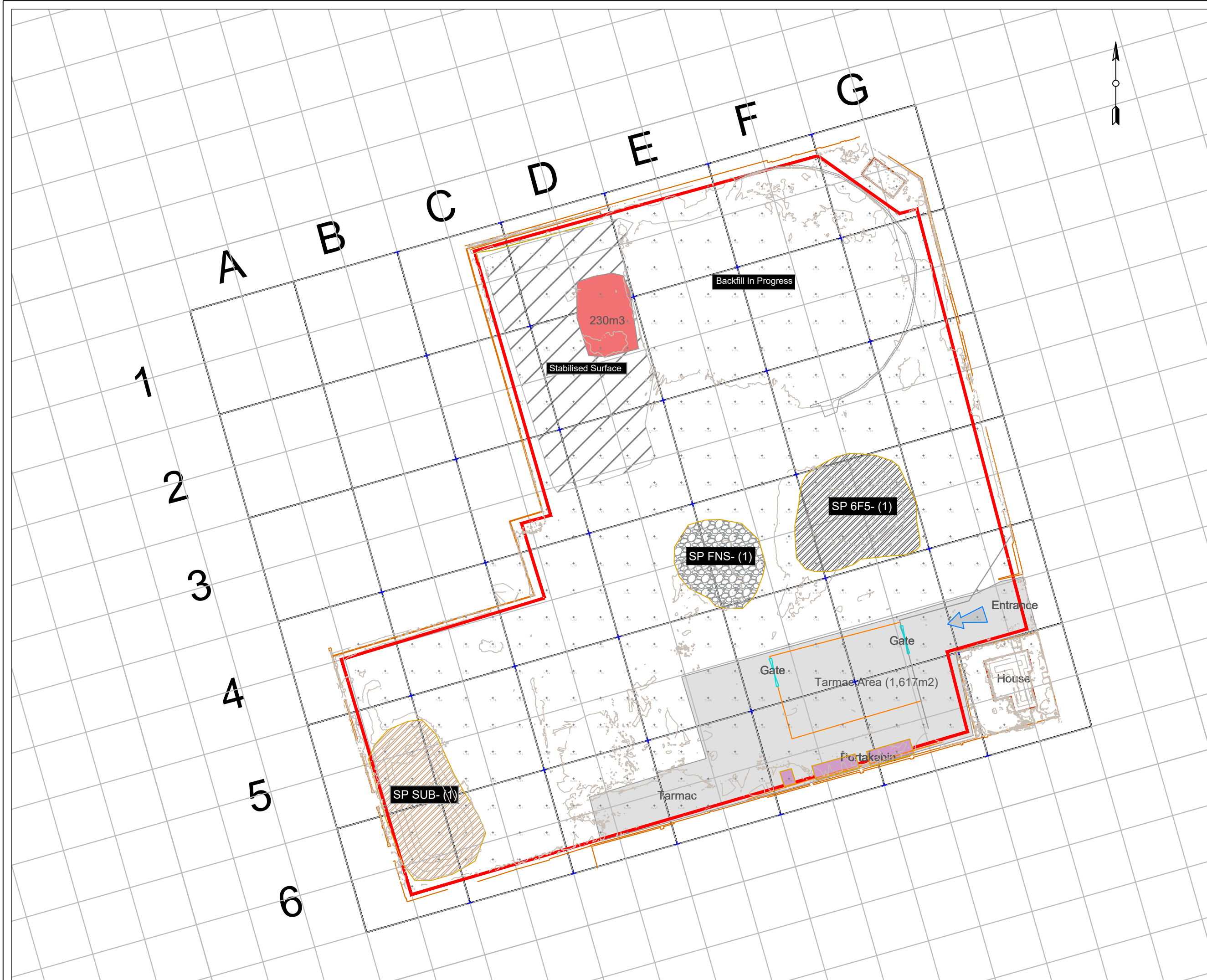
Drawn BH

Checked RW

Project no. TCL1437

Revision

I



General notes

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- Dimensions and levels must be confirmed on site prior to starting works.
- All units are in metres unless stated otherwise.

Key			
	Bottom of bank		Water line
	Top of bank		Road
	Primary Contour 1m		Secondary Contour 0.2m
	Building line		Gate
	Fence		Hedge
	Wall		Tree

— Surveyed Ground Levels

— Tarmac Area Remaining

— Contaminated Soil Stockpile Volume

STOCKPILE VOLUMES

SP 6F5- (1) — Stockpile 569m3

SP SUB- (1) — Stockpile Subsoil 749m3

SP FNS- (1) — Stockpile Concrete Fines 143m3

A	08.08.24	INITIAL SITE SURVEY LEVELS	BH	DS
B	24.08.24	UPDATE SITE SURVEY	BH	DS
C	12.09.24	UPDATE SITE SURVEY	BH	DS
D	19.09.24	UPDATE SITE SURVEY	BH	DS
E	26.09.24	UPDATE SITE SURVEY	BH	DS
F	03.10.24	UPDATE SITE SURVEY	BH	DS
G	09.10.24	UPDATE SITE SURVEY	BH	DS

Rev	Date	Description	Drawn	Chkd

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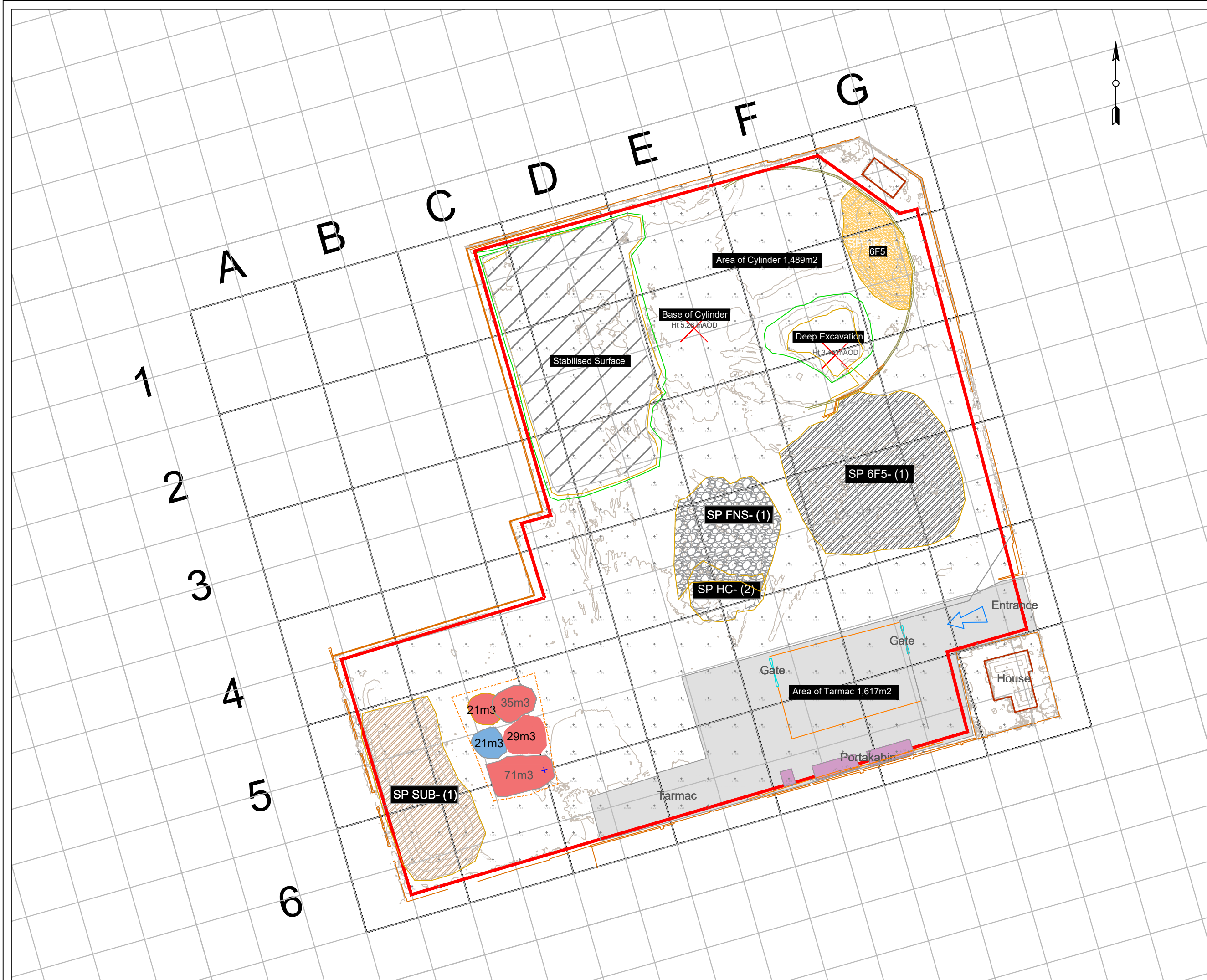
Client
ST WILLIAM

Project
FORMER GASWORKS
PARK ROAD
WORTHING

Title
SITE PROGRESS AND STOCKPILE
SURVEY 9th OCTOBER 2024

Drawing no.
TCL1437_EN003_BH_G_L1

Issued	09.10.24
Scale	NTS
Drawn	BH
Checked	RW
Project no.	TCL1437
Revision	G



General notes

- This drawing should be read in conjunction with all other relevant drawings and specifications.
- Do not scale from this drawing.
- All surveys are orientated to OSGB36(15).
- Dimensions and levels must be confirmed on site prior to starting works.
- All units are in metres unless stated otherwise.

Key			
	Bottom of bank		Water line
	Top of bank		Road
	Primary Contour 1m		Secondary Contour 0.2m
	Building line		Gate
	Fence		Hedge
	Wall		Tree

— Surveyed Ground Levels

— 6f5 in Cylinder

— Contaminated Soil Area Stockpiles Volumes

— Stabilised Surface

STOCKPILE VOLUMES

SP 6F5- (1) — 6F5 1,623m3

SP SUB- (1) — Stockpile Subsoil 954m3

SP HC- (1) — Stockpile Hardcore 112m3

SP FNS- (1) — Stockpile Concrete Fines 601m3

A	08.08.24	INITIAL SITE SURVEY LEVELS	BH	DS
B	24.08.24	UPDATE SITE SURVEY	BH	DS
C	12.09.24	UPDATE SITE SURVEY	BH	DS
D	19.09.24	UPDATE SITE SURVEY	BH	DS
E	26.09.24	UPDATE SITE SURVEY	BH	DS
F	03.10.24	UPDATE SITE SURVEY	BH	DS

Rev	Date	Description	Drawn	Chkd

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Client
ST WILLIAM

Project
FORMER GASWORKS
PARK ROAD
WORTHING

Title
SITE PROGRESS AND STOCKPILE
SURVEY 3rd OCTOBER 2024

Drawing no.
TCL1437_EN009_BH_F_L1

Issued 06.10.24

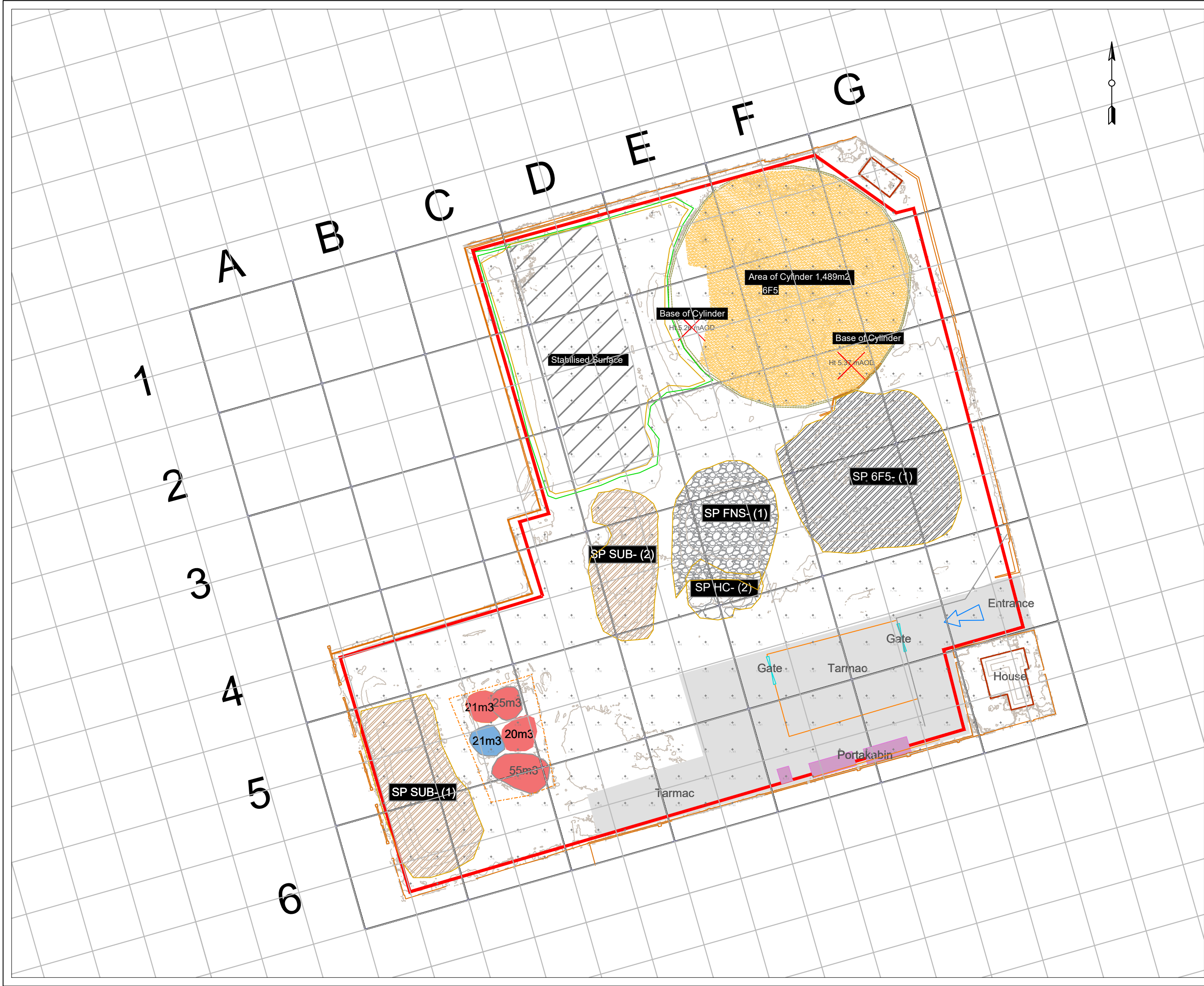
Scale NTS

Drawn BH

Checked RW

Project no.
TCL1437

Revision
F



General notes

- This drawing should be read in conjunction with all other relevant drawings and specifications.
- Do not scale from this drawing.
- All surveys are orientated to OSGB36(15).
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- All units are in metres unless stated otherwise.

Key			
	Bottom of bank		Water line
	Top of bank		Road
	Primary Contour 1m		Secondary Contour 0.2m
	Building line		Gate
	Fence		Hedge
	Wall		Tree

— Surveyed Ground Levels

— 6f5 in Cylinder

— Contaminated Soil Area Stockpiles Volumes

— Stabilisation in Progress

STOCKPILE VOLUMES

SP 6F5- (1) — 6F4 2,214m³

SP SUB- (1) — Stockpile Subsoil 954m³

SP SUB- (2) — Stockpile Subsoil 736m³

SP HC- (1) — Stockpile Hardcore 112m³

SP FNS- (1) — Stockpile Concrete Fines 1,085m³

A	08.08.24	INITIAL SITE SURVEY LEVELS	BH	DS
B	24.08.24	UPDATE SITE SURVEY	BH	DS
C	12.09.24	UPDATE SITE SURVEY	BH	DS
D	19.09.24	UPDATE SITE SURVEY	BH	DS
E	26.09.24	UPDATE SITE SURVEY	BH	DS

Rev	Date	Description	Drawn	Chkd

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Client

ST WILLIAM

Project

FORMER GASWORKS
PARK ROAD
WORTHING

Title

SITE PROGRESS AND STOCKPILE
SURVEY 26th SEPT 2024

Drawing no.

TCL1437_EN009_BH_E_L1

Issued 27.09.24

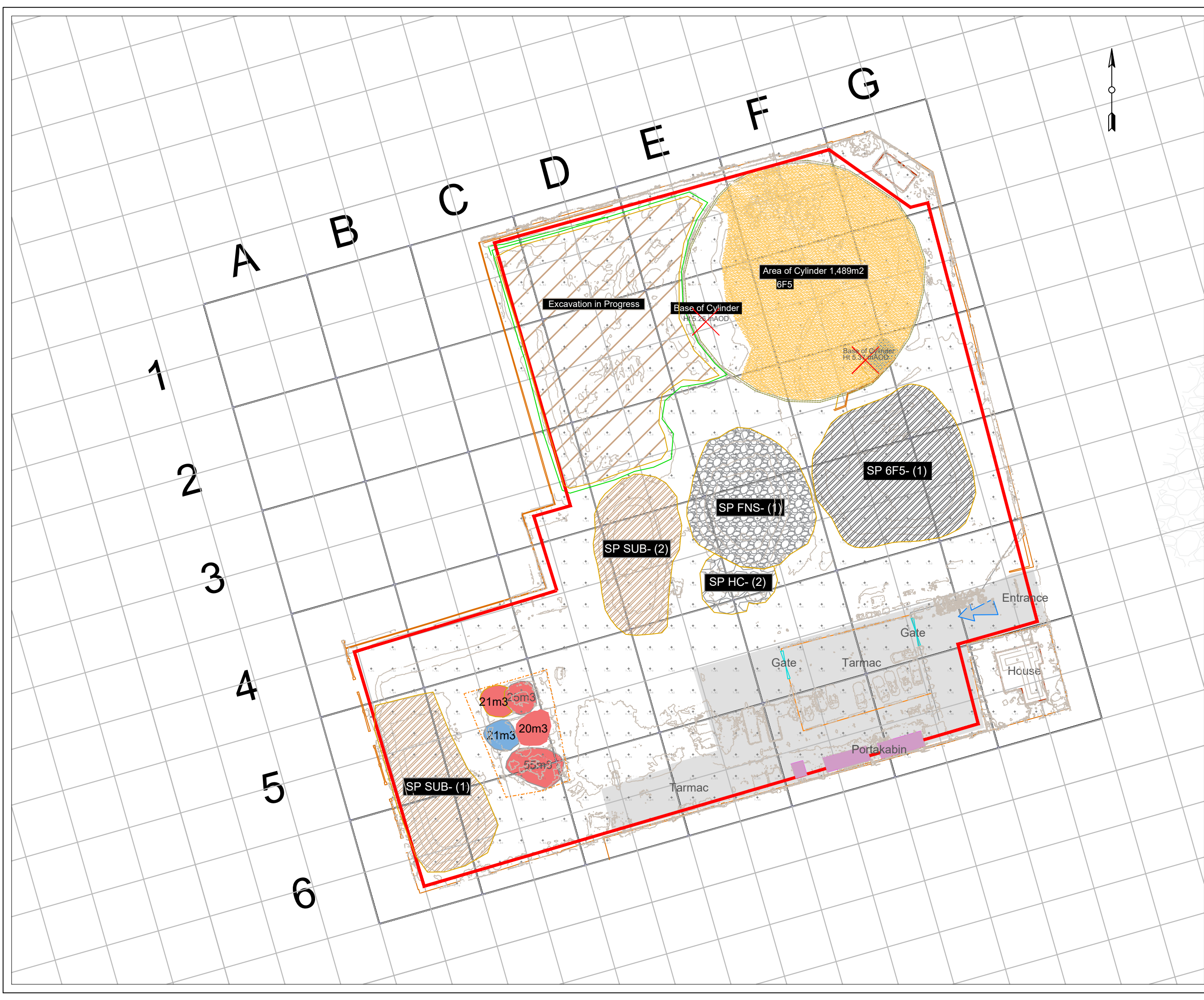
Scale NTS

Drawn BH

Checked RW

Project no.
TCL1437

Revision
E



- General notes
1. This drawing should be read in conjunction with all other relevant drawings and specifications.
 2. Do not scale from this drawing.
 3. All surveys are orientated to OSGB36(15).
 4. Dimensions and levels must be confirmed on site prior to starting works.
 5. All units are in metres unless stated otherwise.

Key			
	Bottom of bank		Water line
	Top of bank		Road
	Primary Contour (1m)		Secondary Contour (0.2m)
	Building line		Gate
	Fence		Hedge
	Wall		Tree

- Surveyed Ground Levels
- 6f5 in Cylinder
- Contaminated Soil Area
- Stockpiles Volumes
- Stabilisation in Progress

STOCKPILE VOLUMES

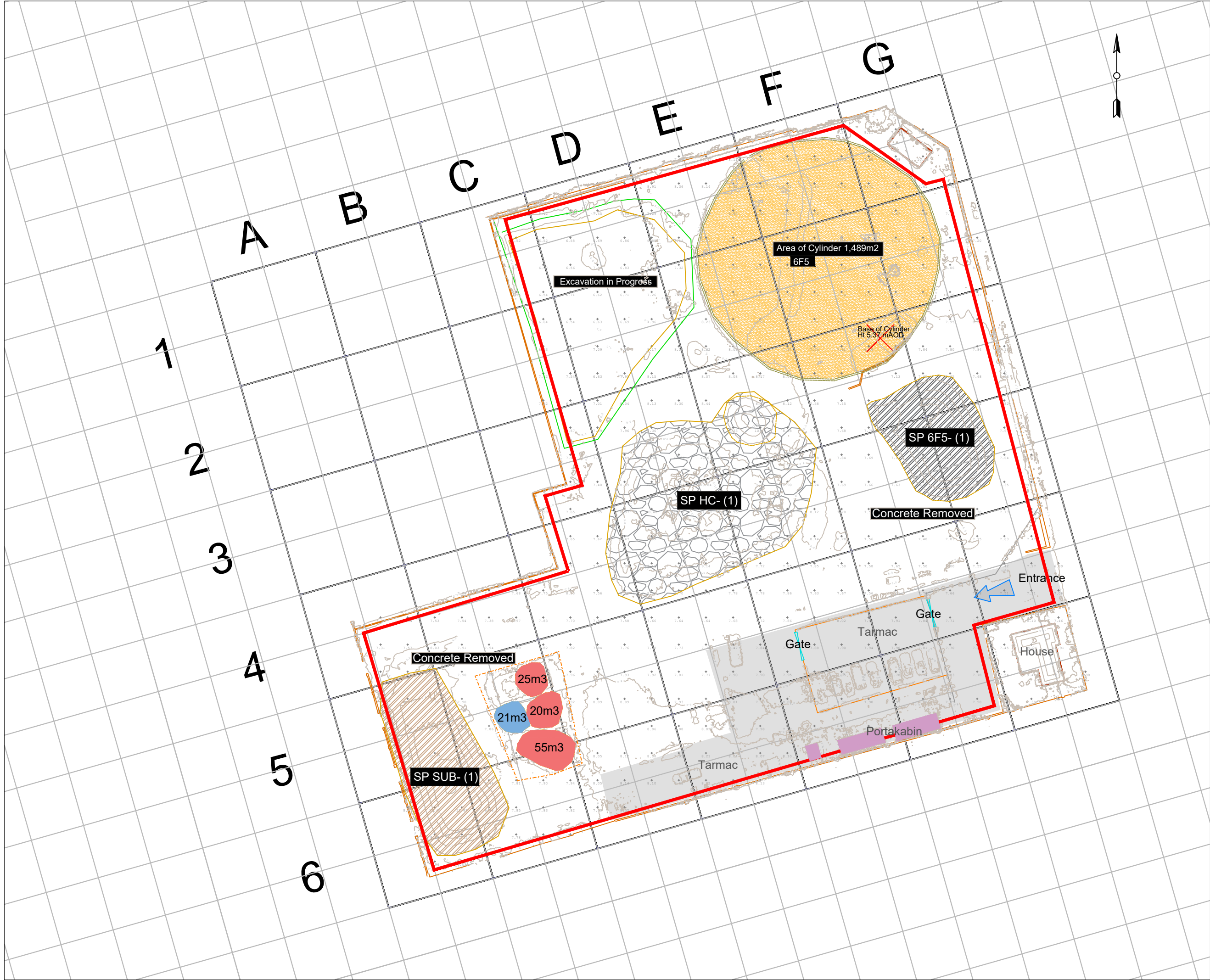
- SP 6F5- (1)** — 6F5 1,432m3
- SP SUB- (1)** — Stockpile Subsoil 687m3
- SP SUB- (2)** — Stockpile Subsoil 736m3
- SP HC- (1)** — Stockpile Hardcore 112m3
- SP FNS- (1)** — Stockpile Concrete Fines 1,085m3

Rev	Date	Description	Drawn	Chkd
A	08.08.24	INITIAL SITE SURVEY LEVELS	BH	DS
B	24.08.24	UPDATE SITE SURVEY	BH	DS
C	12.09.24	UPDATE SITE SURVEY	BH	DS
D	19.09.24	UPDATE SITE SURVEY	BH	DS



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Client		ST WILLIAM	
Project		FORMER GASWORKS PARK ROAD WORTHING	
Title		SITE PROGRESS AND STOCKPILE SURVEY 19th SEPT 2024	
Drawing no.		TCL1437_EN009_BH_D_L1	
Issued		21.09.24	
Scale		NTS	
Drawn		BH	
Checked		RW	
Project no.		TCL1437	
Revision		D	



General notes

1. This drawing should be read in conjunction with all other relevant drawings and specifications.
2. Do not scale from this drawing.
3. All surveys are orientated to OSGB36(15).
4. Dimensions and levels must be confirmed on site prior to starting works.
5. All units are in metres unless stated otherwise.

Key			
	Bottom of bank		Water line
	Top of bank		Road
	Primary Contour (1m)		Secondary Contour (0.2m)
	Building line		Gate
	Fence		Hedge
	Wall		Tree

— Surveyed Ground Levels

— Red Line Dig Extent

— Existing Tarmac

— 6f5 In Cylinder

— Concrete Removed

— Contaminated Soil Area Stockpiles Volumes

STOCKPILE VOLUMES

SP 6F5- (1)	— Stockpile 6F4	645m3
SP HC- (1)	— Stockpile Subsoil	1,772m3
SPSUB- (1)	— Stockpile Subsoil	614m3

Rev	Date	Description	Drawn	Chkd
A	08.08.24	INITIAL SITE SURVEY	BH	DS
B	24.08.24	UPDATE SITE SURVEY	BH	DS
C	12.09.24	UPDATE SITE SURVEY	BH	DS

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Client

ST WILLIAM

Project

FORMER GASWORKS
PARK ROAD
WORTHING

Title

SITE PROGRESS AND STOCKPILE
SURVEY 12th SEPT 2024

Drawing no.

TCL1437_EN003_BH_C_L1

Issued 13.09.24

Scale NTS

Drawn BH

Checked RW

Project no.
TCL1437

Revision
C