

BAM Nuttall Ltd.

Victoria North HIF Infrastructure Works – Phase 1

Remediation Implementation and Verification Plan

Reference: VNIF-ARP-ZZ-YYY-RP-CG-0017

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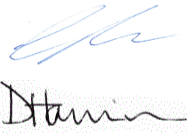
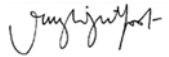
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Trade effluent discharge consent

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1. Introduction

1.1 Commission

Following ground investigation and interpretative reporting, BAM Nuttall Ltd commissioned a remediation strategy from LK Group Ltd [10] for the Victoria North Infrastructure and Enabling Works ‘phase 1’.

Arup has subsequently been commissioned by BAM Nuttall Ltd to produce a remediation implementation and verification plan (RIP) based on the LK remediation strategy, to discharge the relevant planning condition.

The phase 1 infrastructure works that this RIP relates to comprise earthworks and enabling works to create development platforms suitable for follow-on development, construction of a new road junction and a new retaining wall.

1.2 Planning context

Planning consent 133143/VO/2022 relates to Victoria North HIF Infrastructure and Enabling Works to prepare the site for future development.

The planning consent has been subject to a further Section 73 (S73) application (137079/JO/2023), to enable a number of relevant planning conditions to be discharged in discrete phases. The remediation works covered within this report relate to works associated with phase 1 infrastructure works only (**Figure 1**).

Condition 7 relates to ground contamination and this condition has been amended to allow for a phased discharge. The amended Condition 7a of the above planning consent addresses issues associated with ground contamination. The full text of condition 7a is as follows:

“Notwithstanding the Ground Investigation Interpretative Report, Victoria North Infrastructure Works, ARUP, Reference: VNIF-ARP-ZZ-YYY-RP-CG-0009, Dated: 31 January 2022 and Ground Investigation Interpretative Report, Victoria North Infrastructure Works, ARUP, Reference: VNIF-ARP-ZZ-YYY-RP-CG-0009, Dated 23 February 2022., (a) before the development hereby approved commences (excluding vegetation clearance and tree removal), the following information shall be submitted for approval in writing by the City Council, as Local Planning Authority:

- Submission of the further Site Investigation and Risk Assessment Reports
- Submission of a detailed Remediation Strategy
- Submission of a Remediation Implementation Plan and verification plan.

The development shall then be carried out in accordance with the approved details.”

The further “Site Investigation and Risk Assessment Reports” that condition 7a refers to have been submitted by Arup [8][9].

The remediation strategy that condition 7a refers to has been submitted by LK Group [10].

This remediation implementation and verification plan (RIP) completes the information necessary to address the requirements of condition 7a for the phase 1 infrastructure works. Vegetation clearance and tree removal is outside the scope of the relevant planning condition and is not considered further in this RIP.

Condition 7b of the relevant planning consent sets out requirements for demonstrating that the objectives of remediation work have been achieved. The full text of condition 7b is as follows:

“(b) When each phase of earthworks commences, the development shall be carried out in accordance with the previously agreed Remediation Strategy and a Completion/Verification Report for that phase shall be submitted to and approved in writing by the City Council as local planning authority prior to the first use of the development.

In the event that ground contamination, groundwater contamination and/or ground gas, not previously identified, are found to be present on the site at any time before the development is occupied, then development shall cease and/or the development shall not be occupied until, a report outlining what measures, if any, are required to remediate the land (the Revised Remediation Strategy) is submitted to and approved in writing by the City Council as local planning authority and the development shall be carried out in accordance with the Revised Remediation Strategy, which shall take precedence over any Remediation Strategy or earlier Revised Remediation Strategy.”

This document includes a verification plan detailing the information that must be collected during the works and subsequently presented in the verification report. It also includes a discovery strategy to address any contamination encountered during the works that has not previously been identified.

1.3 Purpose of Report

The purpose of this report is to provide the additional information required by condition 7a; namely a remediation implementation and verification plan (RIP) for the phase 1 infrastructure works. This RIP indicates how the LK remediation strategy will be implemented on site and identifies the verification data that will be collected to demonstrate that the requirements of the remediation strategy have been met.

1.4 Structure of this report

The structure of this RIP is as follows:

- Section 2 Summary of the remediation strategy.
- Section 3 The outline phase 1 scope.
- Section 4 Management and regulatory requirements.
- Section 5 Site clearance and preliminaries.
- Section 6 Earthworks.
- Section 7 Remediation.
- Section 8 Verification plan
- Section 9 Post-completion of phase 1.

1.5 Previous assessments

This RIP is based on a number of previous assessments and reports, as discussed below.

A preliminary ground investigation report (GIR) [2], which included a generic controlled waters risk assessment, was prepared using the results of 2019 and 2021 AEG ground investigations [3][4]. The report used desk study information and ground investigation data to review the site history, uses of the site that might have caused ground contamination, the environmental sensitivity of the site and the risks that contaminants of concern might present to the development and to controlled waters. The preliminary GIR provided the first stage of assessment of contamination as required by the planning process.

A third phase of ground investigation was subsequently completed in 2022 at the site by BAM, which was reported in a BAM factual report [5]. The results of this investigation were used to prepare an updated version of the GIR [1], together with a detailed controlled waters risk assessment [6].

A draft conceptual site model report was subsequently produced which focused on emerging water that had been encountered during site clearance in early 2022 [7]. The conceptual site model was the subject of detailed discussions with the Environment Agency and Manchester City Council Environmental Health Department and informed further ground investigations, focused on PFAS. The results of this further ground investigation together with a detailed quantitative assessment of risks from PFAS and other contaminants of concern, was presented in a PFAS human health risk assessment [9] and an updated detailed controlled waters quantitative risk assessment report produced by Arup [8], which was developed into a remediation strategy by LK Group [10].

1.6 Relevant legislation and guidance

This remediation implementation and verification plan (RIP) has been written in general compliance with relevant legislation and guidance including the following:

- Part IIA of the Environment Protection Act, 1990 [11].
- The Contaminated Land (England) (Amendment) Regulations 2012 [12].
- Contaminated Land Statutory Guidance (DEFRA, April 2012) [13].
- BS10175: 2011 +A2:2017, Investigation of Potentially Contaminated Sites - Code of Practice [14].
- British Standards, BS 5930:2015. Code of practice for ground investigations [15].
- Land Contamination: Risk Management (LCRM) [15].
- CIRIA C665 Assessing risks posed by hazardous ground gases to buildings [17].
- BRE SD1 Concrete in aggressive ground [18].
- Environment Agency Technical Guidance WM3 Guidance on the Classification and Assessment of Waste [19].
- The Water Environment (Water Framework Directive) Regulations [20].
- CL:AIRE TB 19 Managing Risks and Liabilities associated with Per- and Polyfluoroalkyl Substances [21].
- CL:AIRE, Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies [22].
- Environment Agency, Identify and classify waste containing persistent organic pollutants [23].

1.7 Relevant parties

The principal organisations involved with delivering the redevelopment of the site and their roles are summarised below:

- Manchester City Council (MCC) – Employer and promoter of the site.
- Far East Consortium International (FEC) – landowner and developer.
- BAM Nuttall Ltd (BAM)– Principal Contractor.
- BAM Nuttall Ltd (BAM)– Principal Designer.
- Ove Arup and Partners Ltd (Arup) – Design consultant to BAM.
- LK Group Ltd (LK) – Design consultants to BAM.
- Turner & Townsend Ltd (T&T) – Employer’s agent.
- Pell Frischman Ltd – Technical advisor and NEC site supervisor.

1.8 Early works

A number of preparatory activities have been undertaken on site ahead of the discharge of condition 7a. The scope of these works has been defined to avoid interaction with areas of identified contamination. As such, these early works activities have been limited to the following:

1. Breaking of the southern-most railway turntable.
2. Removal of the three southern-most lighting column bases.
3. Modification of the Honey Street retaining wall.
4. Removal of the retaining wall in the lower-lying section of Red Bank terrace.
5. Removal of fly-tipped material from the surface of the site.
6. Treatment of himalayan balsam.
7. Inspection of the steep slopes in earthworks area 4 (**Figure 3**) to enable future soil sampling.

Of the above, items 3 to 7 do not involve works with potentially contaminated soils and are not discussed further in this RIP. Items 1 and 2 have been undertaken in accordance with the RIP Section 5.4.

1.9 Use of report and limitations

This report was prepared by Arup on behalf of BAM Nuttall Ltd. It takes into account our client's particular instructions and requirements. This report was not intended for, and should not be relied on by, any third party and no responsibility is undertaken to any third party in relation to it.

All reasonable skill, care and diligence have been exercised within the timescale available and in accordance with the technical requirements of the brief. Notwithstanding the efforts made by the professional team in preparing the report, it is possible that other ground contamination or ground conditions as yet undetected, may exist and consequently reliance on this report must be limited accordingly.

2. Summary of Remediation Strategy

2.1 The Site

The extent of the phase 1 infrastructure works is shown outlined in blue on **Figure 1** and includes three main site zones:

- Red Bank plateau
- Red Bank terrace
- St. Catherine's Wood – note that St. Catherine's Wood extends outside the phase 1 infrastructure works.

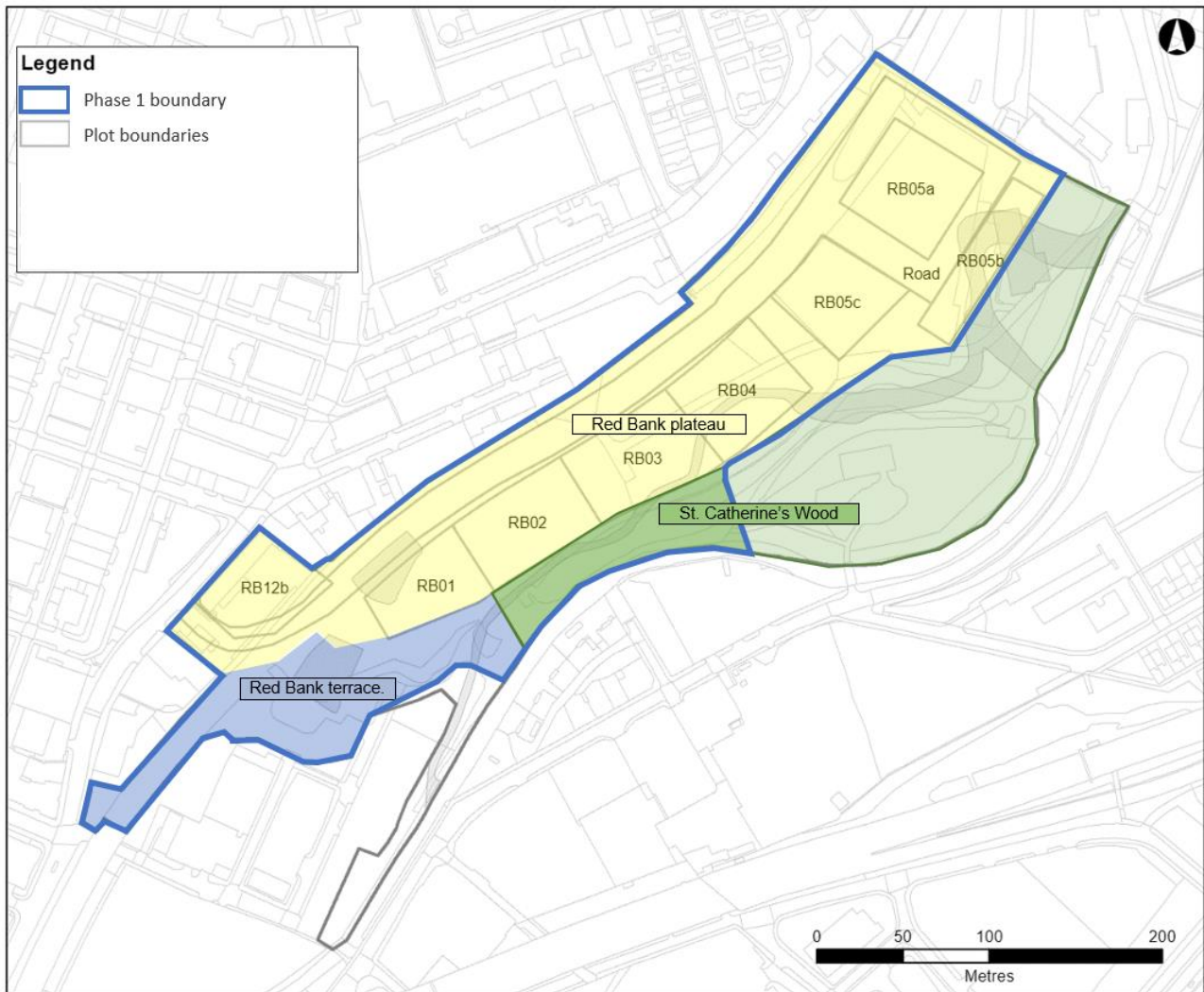


Figure 1: Victoria North site zones

2.2 Contaminant linkages

The phase 1 infrastructure works aim to deliver a remediated development platform suitable for the proposed residential and public open space end-use. The remediation works are intended to address the relevant contaminant linkages identified in the 2023 DQRA [8] and 2023 human health risk assessment [9] and will therefore, address potential statutory environmental risks associated with the site

The LK remediation strategy [10] has been informed by the findings of previous risk assessment reports [8][9], which identified a number of relevant contaminant linkages at the site. These linkages and the

associated mitigation measures are summarised below and the indicative extent of the relevant remediation areas are shown on **Figure 2**.

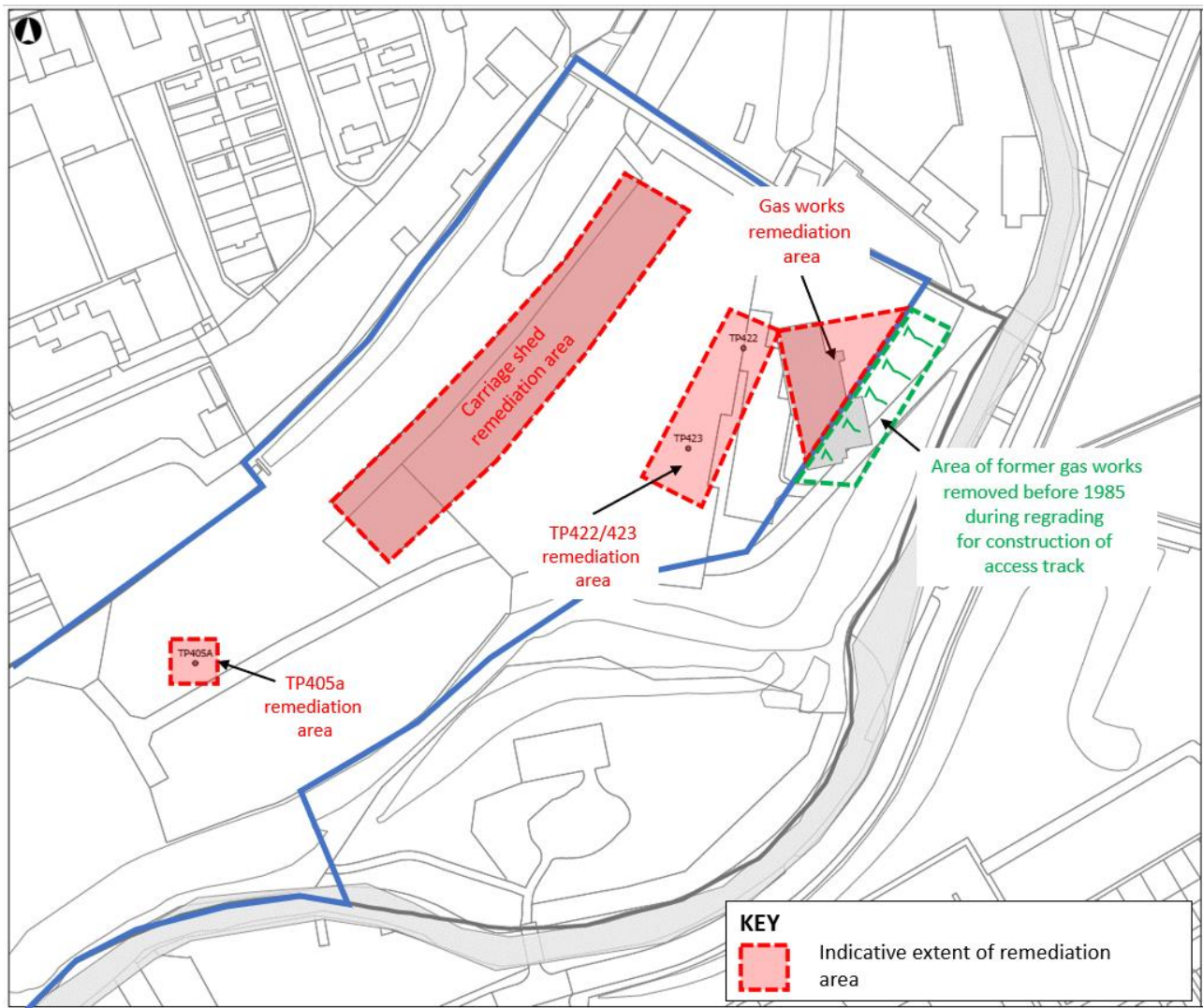


Figure 2: Indicative extent of remediation areas

2.2.1 Former gas works area

The gas works is located over the Collyhurst Sandstone principal aquifer. The contaminants of concern that have been identified in the gas works area include selected TPH fractions, PAH and ammoniacal nitrogen, which have all been detected in groundwater. The DQRA considered the contaminant source in the gas works area and derived remediation targets that are protective of groundwater.

2.2.2 TP422/TP423 PFAS outlier

An area of elevated PFAS concentrations has been identified in TP422 and to a lesser extent, in TP423, extending to a depth of c. 2.5m in TP422. The human health risk assessment [9] concluded that the soil tested from TP422 contains PFCAs marginally in excess of the human health criteria for residential developments. In addition, leachable concentrations of PFOA in excess of appropriate drinking water standards have been recorded in TP422, with elevated leachable concentrations of both PFOS and PFOA in in TP422 and TP423 [8]. Vertical and lateral migration pathways through the made ground and alluvial soils at the site may provide viable pathways for these sources of contamination. Remediation criteria have been developed for this outlier which are protective of both human health and the River Irk.

Although environmental risks associated with this outlier have been addressed, the lateral extent of the outlier is to be further delineated during the early stages of remediation works to further assess remediation quantities and associated costs (Section 5.2).

2.2.3 Former carriage shed area

A risk principally to controlled waters has been identified associated with the relic carriage shed sub-structure [8]. Sources of both hydrocarbons and PFAS have been identified associated with perched water within the carriage shed remains. In addition, potential hydrocarbon impact of the relic carriage shed masonry has been identified.

Lateral migration pathways through the made ground at the site may provide viable pathways for these sources of contamination and therefore the presence of elevated hydrocarbon and PFAS concentrations associated with perched water encountered within the carriage shed sub-structure present a potential risk to controlled waters.

2.2.4 TP405a

Although shallow and mid-depth samples from TP405a do not present a risk to human health or controlled waters, elevated leachable PFAS concentrations have been identified in a sample from 2m bgl in this exploratory hole excavated in earthworks area 3. Earthworks area 3 is to undergo in the order of 1.5m reduced-level excavation and although existing data indicates that contaminated soils will not be encountered during excavation, PFAS-impacted soils may be encountered at sub-formation level.

As a precaution, materials management will be adopted during the reduced-level excavation in the vicinity of TP405a. Excavated soils will be placed in segregated stockpiles pending the results of laboratory assessment, to identify any impacted soils that may be encountered. On reaching the sub-formation level, localised impact below the reduced-level excavation will be remediated.

It is proposed that the remediation targets generated for the TP422/TP423 outlier are proposed for use in the verification of TP405a.

2.2.5 Other contamination

Any further contamination identified during the phase 1 infrastructure works that is not identified above will be managed under a contamination discovery strategy (Section 4.13).

2.3 Remediation objectives

The overall objectives of the remediation are to remediate contamination sources that have been demonstrated as providing potential risks to human health and/or controlled waters, provide a site appropriate for the proposed development and thereby mitigate statutory liabilities. A number of residual remediation measures identified by the CSM will be undertaken by the subsequent developer (Section 9).

Works to address the relevant source-pathway-target linkages at the site will be undertaken in accordance with the LK Group remediation strategy [10]. The remediation works addressed in the remediation strategy can be summarised as follows:

- Vegetation clearance across development areas, including treatment of invasive species (Japanese knotweed, giant hog weed & Himalayan balsam). Vegetation clearance and tree removal is not considered further in this RIP.
- Removal of historic structures from the site (e.g. former building floor slabs, areas of former external hardstanding, lighting tower bases, turntable etc.)
- Remediate contaminated materials in the area of the former gas works.
- Remediate contaminated materials in the area of TP422/TP423.
- Remediate the former carriage shed area.
- Remediate contaminated material in TP405a at 2m.
- Complete earthworks across site (Drg. VNIF-ARP-00-YYY-DR-CE-0002).
- Hydro-seeding of all exposed made ground remaining on completion of the phase 1 works.

3. The Outline Phase 1 Scope

The proposed phase 1 infrastructure works include three key three elements that are relevant for this remediation implementation and verification plan: site clearance, earthworks and remediation.

3.1 Site clearance

The site clearance works tasks (Section 5) are to:

- Update the topographic survey of the site.
- Undertake further delineation of remediation areas (Section 5.2).
- Mark out areas on site requiring ecological protection/tree protection.
- Protection/decommissioning of existing borehole installations (Section 5.3).
- Removal of areas of existing surface hardstanding and near-surface structures (Section 5.4).

Material produced during the removal of surface hardstanding and near-surface structures will be managed under a material management plan (MMP) following the CL:AIRE code of Practice (DoWCoP) with the aim of re-using materials on site wherever possible and minimising offsite disposal (Section 4.11).

3.2 Earthworks

A number of specific earthworks activities are required as part of the phase 1 infrastructure works (**Figure 3**). These earthworks activities are not required to address the relevant contaminant linkages (Section 2.2) but are intended to adjust ground levels to suit the subsequent development of the site.

- Earthworks area 1 – re-grading the area of Red Bank terrace to facilitate the future provision of pedestrian footpaths and cycleways between Red Bank plateau and the lower lying areas to the south-west.
- Earthworks area 2 - construction of a highway embankment to allow access to the site off Red Bank.
- Earthworks area 3 - lowering of ground levels in plots RB02 and RB03 to 38.0mOD.
- Earthworks area 4 - reprofiling of the existing steep slopes between plots RB02 and RB03 and the River Irk.

In addition to these specific earthworks activities, general regrading works are required across the remainder of Red Bank plateau to achieve the proposed development levels.

All soils excavated as part of the general earthworks operations (earthworks areas 1 to 4) will be managed under a material management plan following the CL:AIRE code of practice (DoWCoP) with the aim of re-using materials on site where possible and minimising offsite disposal (Section 4.11). The suitability of materials for re-use in the remediation works will be assessed in accordance with the Victoria North HIF Infrastructure & Enabling Works, Specification for Highway Works – Civil Infrastructure (the specification) [24].

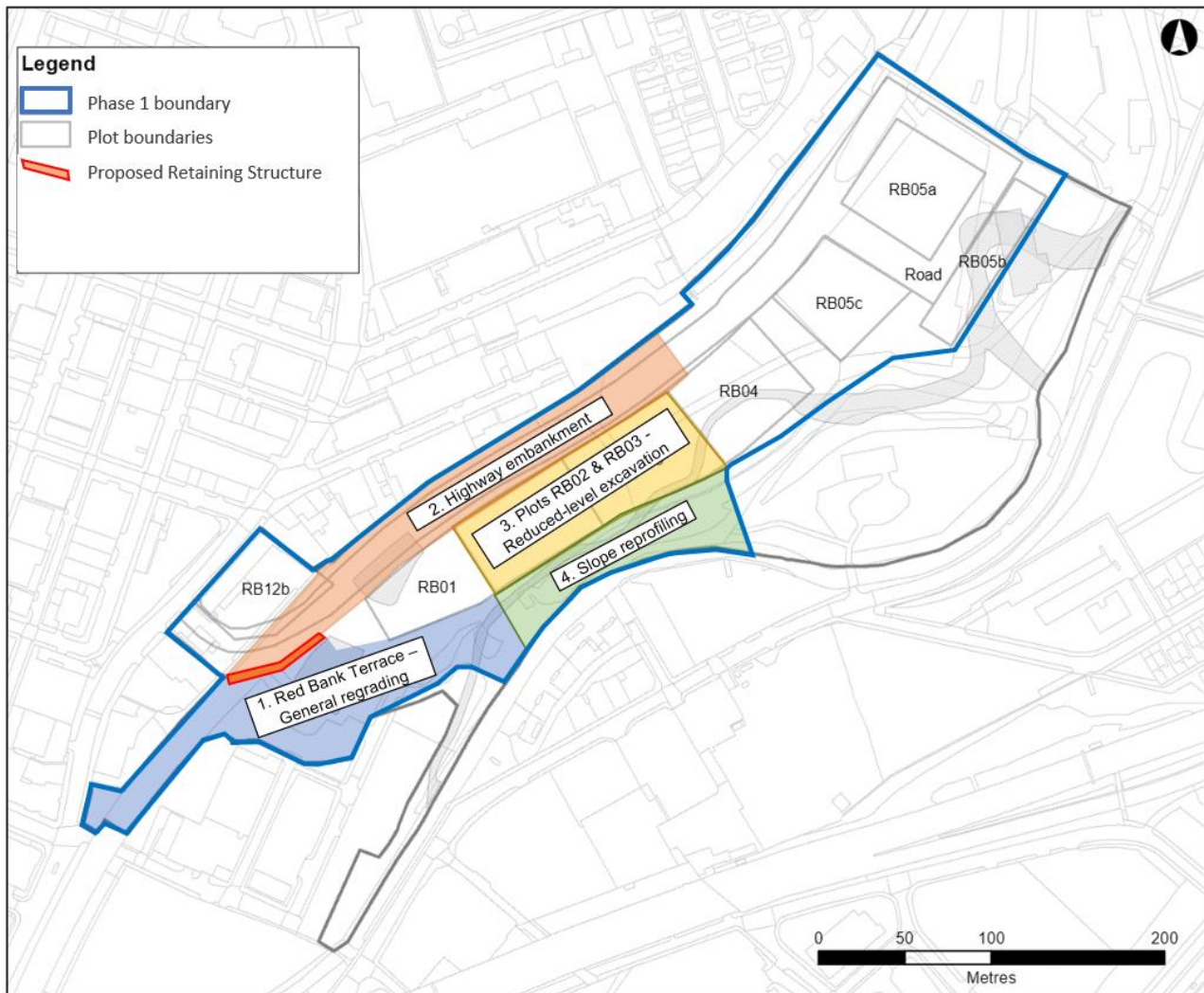


Figure 3: Summary of phase 1 earthworks areas.

3.3 Remediation

Remediation works to address the relevant contaminated linkages identified in Section 2.3 are described below. A cost-benefit assessment has identified that the most cost-effective remediation method for the site is excavation and removal [8]. The scope of the proposed remediation is:

- Excavation of the remediation areas identified on **Figure 2**.
- Re-use of suitable excavation arisings under a material management plan following the CL:AIRE code of Practice (DoWCoP - Section 4.11).
- Following verification of each of the remediation areas, reinstatement of the remediation excavations using, site won fill for re-use in accordance with the specification [24] and the requirements of DoWCoP.

Current earthworks balance calculations indicate that there will be no requirement to import fill. If during the remediation works, it is found necessary to import materials, appropriate records will be maintained during the works and provided in the verification report (Section 8).

4. Management and Regulatory Requirements

4.1 Project management

The phase 1 infrastructure works will be entirely carried out by BAM Nuttall Ltd (BAM). A project execution plan (PEP) has been prepared by BAM.[30] This PEP has been prepared in lieu of a construction environment management plan (CEMP). Specialist support services (e.g. in-situ and laboratory testing) will be subcontracted to specialist companies selected from BAM's approved supply chain.

BAM have appointed a project manager for the works. As detailed in the PEP, BAM will hold frequent project meetings with other members of the design team to ensure that the works are progressing in accordance with this remediation implementation and verification plan and that any deviations from the RIP that are required in response to unexpected site conditions, are identified and addressed promptly.

4.2 Sequence of works

As project managers, BAM have produced a programme of works [40] and will regularly monitor activities on site against this programme.

Subject to further delineation of remediation areas (Section 5.2), the anticipated sequence of activities is as follows:

1. Site clearance (Section 5).
2. Excavation in earthworks area 3 and regrading works in earthworks area 4 (**Figure 3**).
3. Concurrently with excavation and regrading in earthworks area 3 and 4, remediation of the gas works area by excavation and removal of impacted soils from site (**Figure 2**).
4. Verification of the gas works excavation, followed by reinstatement using suitable fill recovered from the earthworks area 3 and 4 excavations.
5. Concurrently with excavation and regrading in earthworks area 3 and 4, remediation of the TP422/TP423 outlier by excavation and removal of impacted soils from site.
6. Verification of the TP422/TP423 excavations, followed by reinstatement using suitable fill recovered from the earthworks area 3 and 4 excavations.
7. Localised dewatering and excavation in the former carriage shed area. Masonry recovered during the excavation together with selected soils, will be stockpiled for possible recovery and re-use.
8. Verification and reinstatement of the carriage shed excavations using suitable fill recovered from the site.
9. Subject to the findings of further delineation assessment (Section 5.2) and following completion of excavation in earthworks area 3 and 4, remediation of the PFAS contamination identified in TP405a at 2m below original ground level.
10. Verification and reinstatement of the TP405a excavations using suitable fill recovered from the site.
11. Undertaking required earthworks in earthworks areas 1 and 2.
12. Production of a remediation verification report (Section 8).

4.3 Contract

BAM have been appointed by Manchester City Council under an NEC 3 Option A contract.

4.4 Resources

BAM will provide and maintain adequate resources to complete the works within the agreed programme (as modified if necessary to reflect unexpected ground conditions that may be encountered during the works).

4.5 Health and safety and quality

Details of the proposed health and safety and quality management procedures that BAM will implement on site are provided in the project execution plan (PEP) [30].

Health and Safety will be managed in accordance with the current requirements of Construction, Design and Management (CDM) Regulations [25].

BAM operate a third-party accredited quality management system, in accordance with ISO 10005.

4.6 Asbestos management plan

During ground investigation asbestos was identified in 15 exploratory holes distributed across all areas of the site. Six samples found to contain asbestos were within the former gasworks area [1]. The asbestos identified was generally present as fibres, with both chrysotile and amosite identified. The possibility exists that asbestos may be present in soils between exploratory locations.

LK have produced an asbestos management plan which details the methods to be adopted on site for managing asbestos risk, including methods of dust prevention and suppression [31].

4.7 UXO risk management

The area surrounding the HIF Infrastructure site is known to have been a bombing target during the Second World War. During previous phases of ground investigation, specialist advice has been obtained to determine the risk from unexploded ordnance (UXO) at the site [41] and further specialist advice will be obtained for the HIF Infrastructure works by the contractor with appropriate measures incorporated into the health and safety risk assessment and methods statements adopted for the works.

4.8 Adjacent properties and boundary features

The proposed phase 1 infrastructure works will not have any potential impact on adjacent properties and therefore, no consultation with neighbouring landowners or associated approvals are considered necessary.

A number of features are present along the limits of the site, including a pedestrian viaduct along the north-eastern site boundary and a retaining wall along sections of the north-western site boundary. The impact of the proposed works on these existing features has been assessed and appropriate interventions have been put in place where necessary. No issues have been identified which will adversely impact existing boundary features.

4.9 Environmental protection

BAM's core delivery team on site have all undergone training under the Site Environmental Awareness Training Scheme (SEATS) and hold the relevant qualification [38]. As set out in the PEP, the HIF Infrastructure works will adopt a robust management structure which includes experienced environmental engineers who will have a thorough understanding of the specific environmental risks identified at the site.

BAM have produced the following management plans, technical notes and method statements required to support the remediation activities to be undertaken on site:

- A project execution plan (PEP)/construction environmental management plan (CEMP) [30], which includes:
 - A traffic management plan.
 - A spill response plan.
 - An environmental management plan.
 - A site waste management plan.

- A noise and vibration monitoring plan.
- An asbestos management plan [31].
- A transport routes plan [32].
- A bulk earthworks activity plan [33].
- A stockpile management plan [34].
- A plan for managing surface water run-off and safeguarding the River Irk [35].

4.10 Environmental permitting

BAM have a mobile plant permit (MPP) for crushing operations [36] and will obtain approval to deploy this plant at Victoria North and all other necessary permits required to undertake the HIF Infrastructure works.

The following have been addressed as part of the existing mobile plant permit:

- Air quality monitoring plan [37].

The relevant management plans will be supported by regular monitoring undertaken in accordance with Section 5.3, which will be modified as necessary if additional permits are required.

4.11 Materials management

The re-use of excavated materials on-site and the removal/disposal of surplus/unsuitable materials undertaken as part of the HIF Infrastructure works will be managed in accordance with the Remediation Strategy and specification [24].

The CL:AIRE definition of waste: code of practice (DoWCoP) [26] provides a voluntary framework by which suitable site won materials can be re-used without being considered unlawful deposit of waste. DoWCoP requires the preparation of a materials management plan (MMP) which specifies the materials that are proposed for use on site in accordance with a remediation strategy and/or remediation implementation and verification plan.

As required under DoWCoP, all materials that are excavated, treated, re-used and/or disposed of are to be tracked throughout the works and information maintained to provide a fully auditable record which demonstrates the ultimate fate of the material (Section 4.14).

A verification report will be required on completion of the works (Section 8) to demonstrate that materials were used in accordance with the MMP.

The MMP will be reviewed by a Qualified Person (QP). Once satisfied with the MMP, the QP will issue an online declaration via the CL:AIRE website. Only material re-use is covered by DoWCoP and therefore activities including site set-up, site clearance, service removal and removal of existing hardstanding can proceed before approval of the MMP. Earthworks will only start after QP declaration.

4.12 Temporary trade effluent discharge consent

BAM already hold a temporary trade effluent discharge consent for discharge to a combined sewer which crosses beneath the site. The details of the discharge consent are included in **Appendix A**. Currently the consent is being used for the discharge of the emerging water (Section 1.5). Prior to discharge, this water is treated to reduce dissolved methane concentrations. Elements of the temporary treatment plant will need to be relocated periodically to allow the HIF Infrastructure works to be completed and allowance for this has been included in its design.

Localised pumping will be required to remove perched water that has collected within the substructure of the carriage shed and gas works (Section 7). If relevant analysis indicates that pumped water meets the requirements of the discharge consent, disposal of pumped water to sewer is proposed. If pumped water quality exceeds the limits included in the existing consent, water will be collected and removed by road-going tanker to a suitably licensed facility for treatment/disposal.

It is not anticipated that significant shallow groundwater will be encountered during earthworks or remediation excavations. Current remediation proposals therefore, do not anticipate a need for dewatering of excavations and a groundwater abstraction licence is not required.

4.13 Discovery strategy

A BAM geoenvironmental engineer will be present on site during the HIF Infrastructure works to assess any unexpected contamination or ground conditions.

If unexpected contamination or ground conditions are encountered during the works, the suspect material will be left in-situ and works in the relevant part of the site will be suspended. If it is not possible to leave unexpected contaminated material in-situ, it will be wholly or partly transferred to a designated earthworks processing area (Section 6.4).

The resulting quarantined area and any associated material in the designated earthworks processing area will be managed in accordance with the following strategy:

- A suitably experienced geoenvironmental specialist will inspect the ground conditions (using a photo ionisation detector (PID) if appropriate) and direct a programme of investigation to determine the extent of the area of concern. It is likely that this will involve the recovery of suitable samples for laboratory analysis.
- If required the quarantined area and/or stockpiled material will be covered until associated risks are understood.
- The results of the geoenvironmental assessment together with laboratory analysis results will be used to determine relevant actions. It is likely that the material will be subject to one of the following outcomes:
 - Material is not significantly contaminated and can be considered for potential recovery and re-use subject to the requirements of the specification [24].
 - Material is significantly contaminated but can be considered for treatment on-site in order to meet the geotechnical and geoenvironmental requirements of the specification [24].
 - Material is significantly contaminated and is to be removed from site for treatment/disposal.

Where the nature of the contamination differs significantly from that already identified on site and addressed by this remediation implementation and verification plan, proposed actions will be agreed with the local authority contaminated land officer, Environment Agency and Project Manager, in accordance with the requirements of planning condition 7a (Section 0).

4.14 Waste disposal

Disposal of surplus and/or unsuitable materials will be undertaken in full accordance with current waste management regulations and guidance [19], to allow waste classification and to confirm the most appropriate disposal route. All necessary testing and waste characterisation/classification will be undertaken before removal from site.

All materials removed from site will be accompanied by appropriate Consignment Note/Duty of Care paperwork, copies of which will be maintained and made available for inspection by appropriate third parties on request and will be included in the verification report (Section 8).

4.15 Record keeping

Comprehensive daily records will be kept by BAM throughout the phase 1 infrastructure works. The results of all in-situ testing, sampling and laboratory analysis will be collated on site as the works progress. The testing records will be made available inspection by appropriate third parties on request.

The following records will be maintained as a minimum throughout works:

- Daily test and inspection records including daily notes, field tests and laboratory results.
- Drawings summarising earthworks and materials management operations, from which the fate of excavated materials can be determined.

- Plans showing the as-built location and depth of the remediation areas, together with verification sampling locations.
- Duty of care paperwork for all material removed from site whether surplus or unsuitable. This shall indicate the weight of material transferred in each load, the relevant analysis and material descriptions, the details of the relevant waste holders and the destination of the wastes.
- All in-situ test results.
- The results of all laboratory analysis.
- Plans showing areas from which perched water is pumped.
- Records of perched/pumped water samples collected and results of analysis.
- Records of the total volume of perched/pumped water discharged/removed from site.

On completion of the works, all records will be presented in a remediation verification report (Section 8), which demonstrates that the objectives of the works, as set out in the remediation strategy [10] and in this remediation implementation and verification plan have been met.

5. Site Clearance and Preliminaries

The required site clearance scope is outlined in Section 3.1.

5.1 Initial preparation

5.1.1 Site preparation tasks completed

A number of activities required to prepare the site for remediation and development have already been completed. These include:

- Asbestos survey and demolition of the former Creamline Dairies site.
- Asbestos surveys of the entire phase 1 area and removal of all identified asbestos containing material (ACM) in accordance with current legislation.
- Removal of flytipped material.
- Identification of routes of underground and/or overhead utilities and confirmation of their status (i.e. live or redundant). Disconnection and/or diversion of live underground and/or overhead utilities has been completed as necessary to enable earthworks, remediation and subsequent development activities to progress. Protection has also been provided to live utilities that remain within the site.

5.1.2 Welfare

A site compound has been established by BAM. This existing compound includes appropriate welfare facilities for the proposed works [30].

5.1.3 Security

BAM have already installed security fencing around the site perimeter to prevent unauthorised access.

5.1.4 Traffic management

All site access points are controlled by BAM. A traffic management plan has been prepared by BAM to control pedestrian, vehicle and plant movements within the site.

The traffic management plan is included in the project execution plan [30] and includes a works transport plan, identifies points of access for site deliveries with appropriate wheel washing/wheel cleaning facilities, identifies areas for vehicle and plant parking and provides protocols for plant refuelling and maintenance, all of which are located within the secure site perimeter. In addition, authorised routes for vehicle and pedestrian movement are indicated both in the traffic management plan and on site.

Plant refuelling and scheduled/routine vehicle maintenance will only be undertaken within the areas of the site designated for that purpose. These designated areas incorporate measures to protect against spills including hardstanding and emergency spill response equipment.

In cases of unscheduled plant breakdown on site, the spill response plan will be implemented as a contingency during repairs [30].

5.1.5 Areas of ecological protection

A Tree Replacement, Ecology and Biodiversity Net Gain Mitigation Strategy [42] was submitted as part of the relevant planning application for the phase 1 infrastructure works. A number of trees have been identified that require protection and these will be clearly identified on site. Issues associated with invasive species are outside the scope of this document and are addressed within the BAM invasive species management plan [43]. As necessary, BAM will establish protection zones for areas of existing habitat that are to be preserved, including trees.

5.2 Delineation of remediation areas

Further investigation will be undertaken to delineate the remediation areas as follows:

- A programme of trial pitting to further delineate the TP422/TP423 outlier and assist in determining disposal quantities and costs.
- As required by the Environment Agency, a programme of trial pitting to identify whether PFAS is present in the gas works area.

Preliminary trial pit locations for these delineation exercises are shown on **Figure 4**. These proposals are based on a 25m grid herringbone arrangement with additional targeted locations. Twelve trial pits in total are proposed, however the distribution of trial pits will be determined on site to reflect the ground conditions encountered as the delineation work progresses.

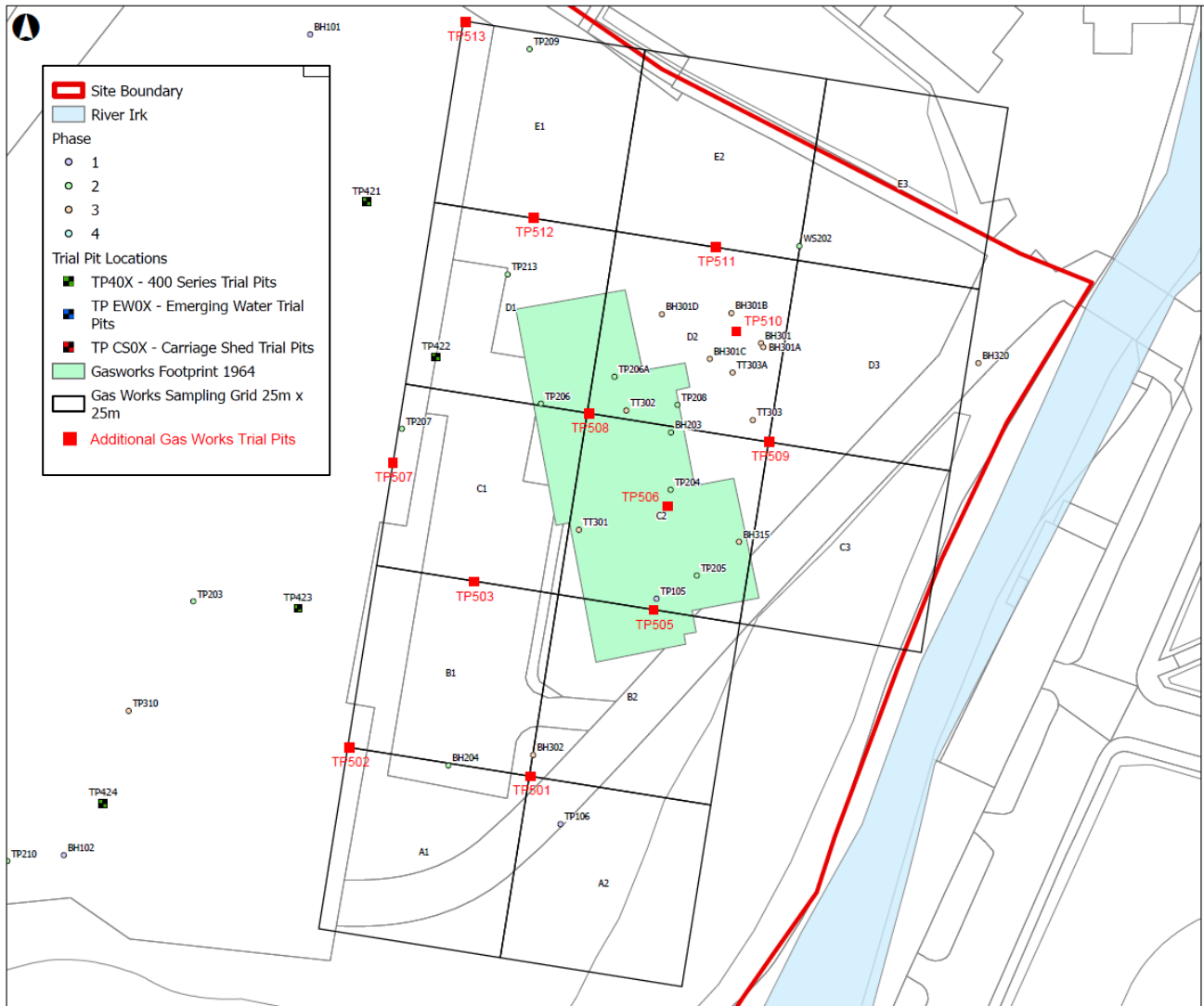


Figure 4: Proposed locations of additional trial pits for hotspot delineation

Further confirmatory investigation is also to be undertaken at the location of TP405a. This will comprise a single trial pit excavated adjacent to the recorded position of TP405a, with samples recovered from the same depths as previous in order to validate the findings of the earlier phase of laboratory PFAS analysis.

As-built records of the delineation exercise will be included in the verification report (Section 8).

To avoid cross-contamination and to maintain sample integrity, trial pitting will be undertaken in accordance with the PFAS sampling methodology that has been established for the site (**Appendix C**).

Trial pits will be excavated to target depths in the order of 2.5m, with actual depths limited by the ground conditions encountered. Soil samples will be recovered at depths of approximately 0.5m, 1.5m and 2.5m (subject to the ground conditions encountered) and samples of any perched or shallow groundwater encountered will be recovered for analysis. Analysis of soil and water samples will be for a standard PFAS suite (pre-ox only).

5.3 Environmental monitoring

5.3.1 Scope

Environmental monitoring (air quality, noise and vibration monitoring) will be undertaken during the phase 1 infrastructure works in accordance with the requirements of relevant management plans (Section 4.9) and as required by the relevant mobile plant permit requirements (Section 4.10). For the specific requirements please refer to the relevant documents (see ‘References’).

5.3.2 Protection of existing groundwater monitoring installations

A range of monitoring installations are present at the site from previous phases of ground investigation (Drg. VNIF-ARP-00-YYY-DR-CE-0008). Two borehole installations are required for ongoing monitoring and are to be protected during the HIF Infrastructure works:

- BH301 and BH302 (borehole inclinometers to monitor slope stability)

5.3.3 Decommissioning of groundwater monitoring installations

Except for the BH301 and BH302 (geotechnical instruments), all other existing groundwater/ground gas monitoring installations (identified on Drg. VNIF-ARP-00-YYY-DR-CE-0008), together with any unrecorded boreholes and/or borehole installations encountered during the works are to be decommissioned.

Decommissioning shall be undertaken to prevent contamination of aquifers underlying the site and shall be carried out in accordance with current EA guidelines [28].

5.4 Surface hardstanding and near-surface structures

Known areas of surface hardstandings and surface obstruction within the site will be removed to the underside of the surface feature. These include:

1. Floor slabs from former buildings.
2. Former car parking areas and other areas of external hardstanding.
3. Remaining former rail turntables.
4. Remaining lighting column bases.

A watching brief will be in place to identify any unexpected contamination exposed during these works (Section 4.13).

All masonry, concrete and other materials removed during these operations will be segregated for potential re-use in accordance with Section 6.4 and the specification [24]. All materials that fail to meet the requirements of the specification or surplus materials will be removed off-site to a suitable recovery/disposal facility.

5.5 Buried utilities

Live services and utilities have been disconnected where possible. All remaining live utilities are clearly marked on site for their protection.

Any unrecorded redundant drainage infrastructure or other utilities encountered during the works will be decommissioned.

If redundant utilities are to be removed, they will undergo a controlled programme of emptying and cleaning prior to removal to prevent the risk of spillage. All fluids produced shall be managed in accordance with Section 6.2.

6. Earthworks

The earthworks scope is outlined in Section 3.2

6.1 Earthworks design

In addition to the four areas of proposed earthworks identified on **Figure 3**, localised regrading operations will be required (VNIF-ARP-00-YYY-DR-CE-0002).

Excavated soils will be re-used under a material management plan following the CL:AIRE Definition of Waste code of practice with the aim of re-using materials on site and minimising offsite disposal (Section 4.11).

All earthworks are to be undertaken in accordance with the specification [24].

6.2 Groundwater management

Localised pumping will be required to remove perched water that has collected within the substructure of the carriage shed and gas works.

The made ground across the Red Bank plateau has been shown by ground investigation to be generally granular with isolated lenses of more cohesive fill deposits [1]. Generally therefore, it is not anticipated that shallow groundwater will be encountered during earthworks or remediation excavations. If groundwater is encountered during excavations, sump pumping will manage groundwater.

Groundwater from different sources (e.g. perched water from remediation excavations or any shallow groundwater encountered) will be stored separately and samples will be taken for analysis. Where analysis results indicate it to be acceptable, the relevant sources will be discharged to sewer in accordance with the existing temporary discharge consent issued by United Utilities (Section 4.12 – **Appendix A**).

If a specific source of groundwater does not meet the requirement of the temporary discharge consent, it will either be treated on site before discharge to sewer or will be removed from site by tanker for treatment/disposal.

6.3 Earthworks operations

All earthworks operations are to be undertaken in accordance with the specification [24] and this RIP. The areas of greatest excavation volume are earthworks area 3 and earthworks area 4 (**Figure 3**). In summary the earthworks comprise the following:

- Earthworks area 1 – re-grading the area of Red Bank terrace to facilitate the future provision of pedestrian footpaths and cycleways between Red Bank plateau and the lower lying areas to the south-west.
- Earthworks area 2 - construction of a highway embankment to allow access to the site off Red Bank.
- Earthworks area 3 - lowering of ground levels in plots RB02 and RB03 to 38.0mOD.
- Earthworks area 4 - reprofiling of the existing steep slopes between plots RB02 and RB03 and the River Irk.

As shown on Drg.VNIF-ARP-00-YYY-DR-CE-0002, additional minor regrading (local cut-to-fill operations) outside these areas is required to achieve proposed finished ground levels.

Filling operations are required in earthworks area 2 and filling will also be required to reinstate remediation excavations (Section 7).

6.4 Management of excavated materials

6.4.1 Stockpile management

A no-stockpile zone has been identified (Drg. VNIF-ARP-00-YYY-DR-CE-0011) to ensure that stockpiles are located a suitable distance from the River Irk. This zone will be clearly identified on site.

Except for contaminated material which is to be removed directly from site, excavated material will be managed by placing it to form a series of stable stockpiles which will be shaped and constructed so as to minimise rainfall infiltration. Stockpiled material will be segregated by type and source, with the source of each stockpile recorded.

The potential for nuisance associated with stockpiled material will be addressed by monitoring and if necessary, the adoption of suitable mitigation measures. As an additional measure to control dust and/or odour, stockpiles may also be provided with temporary cover.

To reflect the various scenarios that will occur during the remediation works, the following strategies are to be implemented for material management:

6.4.2 Material management strategy A

This strategy is relevant to contaminated material excavated from (see Section 7):

- Gas works area.
- TP422/TP423 area.
- TP405a at 2m.
- Any areas of contaminated soils identified on the basis of the discovery strategy (Section 4.13).

All material with visual or olfactory evidence of contamination and/or material confirmed as contaminated following further delineation (Section 5.2), will be excavated directly onto road-going transport prior to removal off site for treatment/disposal (Section 4.14). Disposal will be via a waste disposal route defined in advance with suitable waste carriers and the operators of the receiving waste management sites prior to the relevant remediation works commencing.

Although it is intended that contaminated material is removed directly from site, if direct removal is not possible for any reason during the HIF Infrastructure works phase 1, contaminated material will be temporarily stockpiled in the designated earthworks processing area provided under material management strategy B.

If unexpected contamination is identified or suspected and the suspect material cannot be left in-situ pending risk assessment (Section 4.13), this suspect material will also be transferred to the designated earthworks processing area prepared in accordance with material management strategy B.

6.4.3 Material management strategy B

This strategy is relevant to suspected contaminated material excavated from:

- The carriage shed area (see Section 7).

Material excavated from this area will be transferred to the designated earthworks processing area and will be segregated as follows:

- Material with visual or olfactory evidence of contamination.
- Saturated material that has been in contact with perched water within the carriage shed substructure.
- All other material.

Each segregated source will undergo appropriate testing to allow suitability for re-use to be determined in accordance with the requirements of the specification [24]. Suitability of material is to be determined on the basis of both geotechnical and geo-environmental criteria. Sampling frequencies to demonstrate suitability

for re-use as required by the specification, are summarised in Section 6.4.5. The geochemical requirements of the specification are summarised in Section 7.7.

Material that fails to meet the requirements for re-use that are set out in the specification will be removed from site for treatment/disposal (Section 4.14).

Material that meets the requirements for re-use will be retained on site and used in filling operations (Section 7.7).

All material excavated under materials management strategy B will be stockpiled in the designated earthworks processing area identified in the project execution plan [30]. This area will be provided with a temporary impermeable lining system and measures to contain potentially contaminated run-off from the stockpiled materials, prior to these liquids being collected and removed from site.

6.4.4 Material management strategy C

This strategy is relevant to all excavated material not addressed by material management strategy A or B. This strategy includes for hard material removed as part of the early works (**Section 1.8**).

Material excavated generally across the site (i.e. outside any of the identified remediation areas - **Figure 2**) will be segregated by area.

This material will be sampled and assessed for potential re-use as earthworks fill on site. This material will undergo appropriate validation testing to allow suitability for re-use to be determined in accordance with the requirements of the specification [24]. Suitability of material is to be determined on the basis of both geotechnical and geo-environmental criteria. Sampling frequencies to demonstrate suitability for re-use as required by the specification, are summarised in Section 6.4.5. The geochemical requirements of the specification are reproduced in Section 7.7.

Given that material excavated under materials management strategy C will be typical of the made ground present across the Red Bank plateau, it will not be necessary to stockpile excavated material in the designated earthworks processing area.

6.4.5 Sampling frequencies

The required geotechnical and geochemical sampling and testing frequencies for material proposed for re-use within the site are given in Appendix 1/5 of the specification [24] which is reproduced in **Appendix B**.

The specified geo-chemical sampling frequencies for site won material, as set out in specification are summarised as follows:

Objective	Sample/analysis frequency
Validation of general fill recovered for re-use within the site.	1 per 500m ³ . Minimum of 3.
Validation of capping fill recovered for re-use within the site.	1 per 500m ³ . Minimum of 3.
Validation of fill to structures recovered for re-use within the site.	1 per 500m ³ . Minimum of 3.

7. Remediation

Remediation scope is outlined in Section 3.3.

7.1 Supervision

Remediation areas (**Figure 2**) will be excavated under the supervision of an appropriate geoenvironmental engineer. The extent of hydrocarbon impacted soils will be determined based on visual/olfactory evidence on site and the use of a photo ionisation detector (PID).

Once the extent of excavation is considered by the geoenvironmental engineer to be sufficient to have removed the identified contamination, the limits of remediation will be verified in accordance with Section 7.6.

Material excavated during remediation activities will be managed in accordance with Section 6.4.

7.2 Remediation of former gas works

TPH, PAH and ammoniacal nitrogen impacted ground has been identified in the former gas works area (**Figure 2**).

Based on the findings of ground investigation [1], excavation should extend to a depth of at least 2.5m and should include removal of any in-ground relict structures. Excavation should extend until all impacted soils and relict structures have been removed however, the crest of adjacent slopes with existing mature trees to the south-east, may prevent full excavation and removal (see area in green on **Figure 2**). If these trees are to remain, excavation will cease at the crest of the slope/tree roots and representative samples taken of the remaining soils. The extent of remaining impacted soils will be confirmed by analysis and recorded for inclusion in the verification report (Section 8).

Except for areas of existing slopes and trees, once the extent of excavation is considered sufficient to have removed contamination, the limits of remediation will be verified in accordance with Section 7.6. All verification samples will undergo chemical testing in accordance with the requirements of the specification for the list of determinands identified in **Table 1**. The results of testing shall be compared with the verification requirements presented on **Table 1**.

Contaminant	Verification target (mg/kg)	Rationale for verification target
Ammoniacal nitrogen	4.5	RTM
Benzo(a)Pyrene	3.6	RTM
Fluoranthene	7	95%ile of Plateau made ground
Anthracene	1.8	95%ile of Plateau made ground
TPH – C8-C35	1000*#	Professional judgement
*Discovery strategy to be implemented to ensure no soil with visual or olfactory evidence of contamination is re-used		
# If exceedances of these values are noted, the risk-derived criteria for individual carbon bands detailed in this table shall be applied.		

Table 1: Soil verification targets for the gas works area

7.3 Remediation of TP422/TP423 outlier

Elevated PFAS have been identified in TP422 [8] [9]. Based on the findings of ground investigation [1], the provisional extent of the remediation area is shown on **Figure 2**, with excavation extending to a provisional depth of at least 2.5m. The full extent of the remediation area will however, be subject to further delineation works (Section 5.2).

Once the extent of excavation is considered sufficient to have removed contamination, the limits of remediation will be verified in accordance with Section 7.6. All verification samples will undergo chemical testing in accordance with the requirements of the specification for the list of determinands identified in **Table 2**. The results of testing shall be compared with the verification requirements presented on **Table 2**.

Contaminant	Verification target (mg/kg)	Rationale for verification target
PFPA	<2µg/kg	Requested by EA
PFHxA	<2µg/kg	Requested by EA
PFHpA	<2µg/kg	Requested by EA
6:2-FTS	<2µg/kg	Requested by EA
PFOA	<1µg/kg	Laboratory limit of detection and typical site concentration
PFHxS	<2µg/kg	Requested by EA
PFNA	<2µg/kg	Requested by EA
PFOS	<2µg/kg	Laboratory limit of detection and typical site concentration
PFDA	<2µg/kg	Requested by EA

Table 2: Soil verification targets for TP422/TP423 outlier and TP405a at 2m

7.4 Remediation of former carriage shed

Sources of both hydrocarbons and PFAS have been identified associated with perched water within the carriage shed remains (**Figure 2**). In addition, potential hydrocarbon impact of the relic carriage shed masonry has been identified. Controlled excavation will be undertaken to allow areas of perched water within the carriage shed to be identified and drained. Perched water will be removed and managed in accordance with Section 4.12.

The masonry remains of the carriage shed substructure will be selectively excavated. Any masonry identified by visual or olfactory assessment to be impacted with contaminants or masonry that is in contact with perched water should be segregated from other masonry arisings, prior to analysis for potential re-use. Once all masonry remains have been removed, any adjacent soils identified by visual or olfactory assessment to be impacted with contaminants will be excavated.

Once the extent of excavation is considered sufficient to have removed contamination, the limits of remediation will be verified in accordance with Section 7.6. All verification samples will undergo chemical testing in accordance with the requirements of the specification for the list of determinands identified in **Table 3**. The results of testing shall be compared with the validation requirements presented on **Table 3**.

Contaminant	Verification target (mg/kg)	Rationale for verification target
Benzo(a)Pyrene	3.6	RTM
Fluoranthene	7	95%ile of Plateau made ground
Anthracene	1.8	95%ile of Plateau made ground
TPH – C8-C35	1000*#	Professional judgment
PFOS	<2µg/kg	Laboratory limit of detection and typical site concentration
PFOA	<1µg/kg	Laboratory limit of detection and typical site concentration
PFPA	<2µg/kg	Requested by EA
PFHxA	<2µg/kg	Requested by EA

Contaminant	Verification target (mg/kg)	Rationale for verification target
PFHpA	<2µg/kg	Requested by EA
6:2-FTS	<2µg/kg	Requested by EA
PFHxS	<2µg/kg	Requested by EA
PFNA	<2µg/kg	Requested by EA
*Discovery strategy to be implemented to ensure no soil with visual or olfactory evidence of contamination is re-used # If exceedances of these values are noted, the risk-derived criteria for individual carbon bands detailed in this table shall be applied.		

Table 3: Soil verification targets for the carriage shed area

7.5 Remediation of TP405a

Sources of elevated PFAS were identified in TP405a at a depth of 2m. Shallow samples in this trial pit were not significantly impacted. The extent of the PFAS impact is to be further delineated (Section 5.2).

TP405a is in the north-eastern section of earthworks area 3 and the area is to undergo reduced-level excavation of between 1.5m and 2m. Subject to the findings of the further delineation that is proposed, existing ground investigation data indicates that the materials removed during the reduced-level excavation in the vicinity of TP405a are unlikely to be contaminated. As a precaution, excavation in the relevant parts of earthworks area 3 will be undertaken under the supervision of an appropriate geoenvironmental engineer and appropriate materials management measures will be adopted, with material stockpiled separately pending the results of analysis for PFAS.

Subject to the findings of the further delineation that is proposed, once sub-formation level is reached in the vicinity of TP405a, further localised remediation excavations will be undertaken below sub-formation level, to remove the PFAS impacted soils.

Once the extent of excavation is considered sufficient to have removed contamination, the limits of remediation will be verified in accordance with Section 7.6. All verification samples will undergo chemical testing in accordance with the requirements of the specification for the list of determinands identified in **Table 2**. The results of testing shall be compared with the verification requirements presented on **Table 2**.

7.6 Verification sampling of remediation excavations

On reaching the extent of each remediation excavation, validation samples will be undertaken from the sides and base of the excavation as follows:

- A 5 litre (minimum) composite sample will be collected by taking small sub-samples of the exposed made ground from across the entire base of the excavation. In excavations with dimensions less than 25m, a minimum of three subsamples will be taken. In larger excavations, a nominal 25m grid will be applied across the base of the excavation and a minimum of three subsamples taken from each whole or partial grid square. All composite samples shall be well mixed into a single base verification sample before being dispatched for analysis.
- 5 litre (minimum) composite samples will be collected from each wall of the excavation by taking small sub-samples of the exposed made ground. In excavations with dimensions less than 25m, a minimum of three subsamples will be taken. In larger excavations, a nominal 25m grid will be applied across each excavation wall and a minimum of three subsamples taken from each whole or partial grid square. A single composite sample shall be produced for each wall of the excavation by thorough mixing of the relevant subsamples before being dispatched for analysis.

To avoid cross-contamination and to maintain sample integrity, validation sampling will be undertaken in accordance with the PFAS sampling methodology that has been established for the site (**Appendix C**).

If the results of sampling and analysis identify any exceedances of the appropriate verification criteria, further localised excavation is to be undertaken and sampling and verification will be repeated. Alternatively, further detailed quantitative risk assessment will be undertaken on the reduced source term to determine whether residual risks to human health and controlled waters are acceptable.

7.7 Reinstatement of remediation excavations and re-use criteria

To address potential issues associated with instability of the excavations, all remediation excavations are to be backfilled as quickly as reasonably possible.

7.7.1 Red Bank plateau

Once successfully validated, remediation excavations will be reinstated with suitable engineered fill, placed and compacted in accordance with the specification [24]. The relevant re-use criteria set out in the specification are reproduced in **Table 4**.

Suitability of material is to be determined on the basis of both geotechnical and geo-environmental criteria.

Contaminant	Verification target (mg/kg unless stated)	Rationale for verification target
Nickel	27	RTM
Zinc	191	RTM
Benzo(a)Pyrene	3.6	NBC
Fluoranthene	7	95%ile of Plateau made ground
Anthracene	1.8	95%ile of Plateau made ground
TPH C8-C35	1000*#	Professional judgement, see note
PFOS	2µg/kg	Laboratory limit of detection and typical site concentration
PFOA	1µg/kg	Laboratory limit of detection and typical site concentration
PFPA	2µg/kg	Requested by EA
PFHxA	2µg/kg	Requested by EA
PFHpA	2µg/kg	Requested by EA
6:2-FTS	2µg/kg	Requested by EA
PFHxS	2µg/kg	Requested by EA
PFNA	2µg/kg	Requested by EA
*Discovery strategy to be implemented to ensure no soil with visual or olfactory evidence of contamination is re-used		
# If exceedances of these values are noted, the risk-derived criteria for individual carbon bands detailed in this table shall be applied.		

Table 4: Re-use criteria for site-won soils placed in Red Bank plateau.

7.7.2 Red Bank terrace

There will be no transfer of site-won fill from the phase 1 area to any other areas of the site.

Additionally, current earthworks volume projections indicate that the phase 1 infrastructure works can be completed without the need to move material from one site zone to another (**Figure 1**).

7.8 Reduced infiltration

In response to EA concerns regarding residual contamination across phase 1, measures will be implemented to reduce infiltration in the following relevant areas of the site:

- The gasworks
- TP422/423
- TP405a

On completion of the reinstatement of these remedial areas, the following additional measures will be taken in accordance with the requirements of Clause 602 part 16 of the specification [24], to promote run-off and reduce infiltration:

- The reinstated surface of the site in each remedial area will be laid to a distinct gradient ('fall') away from the River Irk, to promote runoff.
- In addition to standard compaction requirements, after being laid to a fall, the upper fill will be sealed in accordance with the specification, by receiving two passes of a smooth roller.

These additional measures will be extended for a distance of 10m in all directions, beyond the limits of each reinstated remedial excavation.

For the gas works area, if remedial excavations extend to the crest of the existing steep slopes overlooking the River Irk, it will not be possible to extend the reduced-permeability area in the direction of the existing slopes, however this extended treatment will be applied in all other directions.

Hydroseeding (Section 7.9) will also lead to a reduction in infiltration by promoting evapotranspiration.

7.9 Hydroseeding

On completion of the site clearance, earthworks and remediation, areas where made ground remains exposed at the surface of the site across phase 1 will be hydroseeded to provide a short-term barrier between residual contamination in made ground soils and unauthorised users of the site and will also reduce infiltration by promoting evapotranspiration (Drg. VNIF-ARP-00-YYY-DR-CE-0010).

8. Verification Plan

8.1 Scope of verification report

On completion of the HIF Infrastructure works, BAM will be responsible for producing a completion verification report for all the works discussed in this remediation implementation and verification plan. This verification report will include a description of final site conditions, to demonstrate that the site does not pose unacceptable risks to controlled waters, human health or other receptors in its post-remediation state.

The verification report will be submitted to the client, the local planning authority and the Environment Agency for approval. It is anticipated it will address both the verification requirements for the DoWCoP materials management plan and planning condition 7b (Section 1.2).

The verification report will document the source of materials recovered for re-use within the site, any processing or treatment undertaken to render them suitable for re-use and indicate the areas of re-use.

The verification report will identify any deviations from the remediation implementation and verification plan that were required on site during the works and any measures taken to address unexpected contamination.

8.2 Content of the verification report

The verification report will include the following:

- A description of the works.
- A comprehensive photographic record of the works.
- Locations of exploratory holes used to further delineate remediation areas.
- Locations of monitoring infrastructure.
 - Protected installations.
 - Decommissioned installations.
- As-built drawings, which demonstrate:
 - Areas of ecological protection.
 - Existing utilities.
 - Utility diversions.
 - Redundant utilities abandoned by grouting.
 - Obstructions not removed during the works.
 - Finished ground levels.
 - Areas of cut and fill.
 - Cut and fill isopachytes.
 - Extent and depth of remediation excavations.
 - Locations of in-situ geotechnical testing.
 - Locations of samples taken for laboratory geotechnical testing.
 - Locations of verification sampling.
 - Location of hydroseeded areas.
- Records of test results, including:
 - In-situ geotechnical tests.
 - Laboratory geotechnical tests.
 - Laboratory analysis results.
- A summary of the volumes of material excavated, processed and screened.
- A demonstration that excavated materials have been managed in accordance with the RIP.
- A demonstration that the number and type of samples undertaken during the works has been in accordance with the RIP.
- A demonstration that the testing and analysis undertaken during the works has been in accordance with requirements of both the RIP and the specification.
- Records of quantity and fill classes re-used and where each were placed.
- Comparison of geochemical verification testing with verification targets.

- Comparison of geotechnical testing with speciation requirements.
- Copies of any correspondence with regulators.
- A copy of the CL:AIRE MMP qualified persons' declaration.
- A copy of the MMP verification report.
- Records of unexpected contamination encountered and the results of investigation, assessment and remediation.
- Environmental monitoring data (e.g. asbestos fibre monitoring, noise, odour, etc.).
- Records of disposal of perched water and any groundwater including volumes and test results

A CDM Health and Safety File will also be produced by BAM on completion of the works. The verification report and an updated utility tracker will form part of that file.

9. Post-completion of Phase 1

9.1 Prior to follow-on development

Following the completion of the HIF Infrastructure works phase 1 and approval of the verification report, planning condition 7b will be discharged (Section 1.2).

Prior to follow-on development the site will remain securely fenced and risks to unauthorised users of the site from residual near-surface soil contamination will be addressed by the hydroseeded layer (Section 7.9).

9.2 Subsequent infrastructure and enabling works phases

Infrastructure works will be required in areas of the Victoria North site outside phase 1 (**Figure 3**). These will be required to discharge planning conditions (133143/VO/2022).

9.3 Developer obligations

This document addresses the remediation actions associated with phase 1 of the Victoria North HIF Infrastructure and Enabling Works only, as defined through the planning process. Phase 1 creates development platforms for follow-on development.

Separate planning applications will be required for follow-on development. Plot developers will need to undertake further remediation measures before the site can be occupied by end-users.

Based on the current end-state development proposals for the site (planning application ref: 136812/OO/2023) it is anticipated that these will include:

- Provision of suitable clean cover systems in all areas of soft landscaping within the developed site.
- A piling risk assessment to ensure foundation works do not present additional risks to controlled waters.
- A ground gas risk assessment to determine the level of risk in accordance with CIRIA C665 [29]. As reported in the GIR [1], ground investigation and monitoring has established CS2 conditions generally across the site (low risk) however, an isolated areas of CS3 conditions was identified. All new buildings will need to be provided with ground gas protection measures suitable for the level of ground gas risk that is ultimately determined appropriate for the development of the site.

References

- [1] Arup (2022) Ground Investigation Report VNIF-ARP-XX-XXX-RP-CG-0012, November 2023.
- [2] Arup (2022) Preliminary GIR Report VNIF-ARP-XX-XXX-RP-CG-0007, January 2022
- [3] AEG (2019) Northern Gateway Final Factual Report. Ref. NW1580, March 2019
- [4] AEG (2021) Northern Gateway Phase 2 Final Factual Report. Ref. NW1604, October 2021
- [5] BAM Ritchies (2022) Victoria North HIF Infrastructure & Enabling Works – Phase 3 GI. Ground Investigation Report – Factual Account. Project Reference: BAX.326R. October 2022
- [6] Arup (2022) Controlled Waters Detailed Quantitative Risk Assessment VNIF-ARP-ZZ-YYY-RP-CG-0011, November 2022.
- [7] Arup (2023) Conceptual Site Model and Ground Investigation Rationale VNIF-ARP-ZZ-YYY-RP-CG-0013 P02, March 2023.
- [8] Arup (2023) Controlled Waters Detailed Quantitative Risk Assessment VNIF-ARP-ZZ-YYY-RP-CG-1000, 21 August 2023.
- [9] Arup (2023) PFAS Human Health Risk Assessment VNIF-ARP-ZZ-YYY-RP-CG-0014, June 2023.
- [10] LK Group Ltd. (2023), Victorian North Infrastructure Work, Phase 1 Delivery (Pre-Development) Remediation Strategy, Ref LKC 22 1587, August 2023.
- [11] <https://www.legislation.gov.uk/ukpga/1990/43/part/IIA>, accessed 28 September 2023.
- [12] [https://www.legislation.gov.uk/uksi/2012/263/made#:~:text=The%20Contaminated%20Land%20\(England\)%20\(Amendment\)%20Regulations%202012,-Made&text=The%20Secretary%20of%20State%20makes,Protection%20Act%201990\(1\),](https://www.legislation.gov.uk/uksi/2012/263/made#:~:text=The%20Contaminated%20Land%20(England)%20(Amendment)%20Regulations%202012,-Made&text=The%20Secretary%20of%20State%20makes,Protection%20Act%201990(1),) accessed 28 September 2023.
- [13] <https://www.gov.uk/government/publications/contaminated-land-statutory-guidance> accessed 28 September 2023.
- [14] BS 10175 (2011+A2:2017) Investigation of potentially contaminated sites. Code of practice.
- [15] British Standards (2015), BS 5930. Code of practice for ground investigations
- [16] <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>, accessed 28 September 2023.
- [17] Construction Industry Research and Information Association (2007) Report C665 Assessing risks posed by hazardous ground gases to buildings.
- [18] BRE, 2005. Special Digest 1:2005, Concrete in aggressive ground. Third Edition.
- [19] Environment Agency, 2015. Technical Guidance WM3 Guidance on the Classification and Assessment of Waste. <https://www.gov.uk/government/publications/waste-classification-technical-guidance>, accessed 28 September 2023.
- [20] UKSI (2017) The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, <https://www.legislation.gov.uk/uksi/2017/407/contents/made>, accessed 28 September 2023.

- [21] CL:AIRE (2019) TB 19 “Managing Risks and Liabilities associated with Per- and Polyfluoroalkyl Substances (PFASs)”
- [22] CL:AIRE (2017). Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies. CL:AIRE, London
- [23] Environment Agency (2022) Identify and classify waste containing persistent organic pollutants (POPs) <https://www.gov.uk/guidance/identify-and-classify-waste-containing-persistent-organic-pollutants-pops>, accessed 28 September 2023.
- [24] Arup (2023) Victoria North HIF Infrastructure & Enabling Works, Specification for Highway Works – Civil Infrastructure, VNIF-ARP-ZZ-YYY-SP-C-001, November 2022.
- [25] HSE (2015) The Construction (Design and Management) Regulations 2015 <https://www.hse.gov.uk/construction/cdm/2015/index.htm>, accessed 28 September 2023.
- [26] CL:AIRE (2011) Definition of Waste: Code of Practice <https://www.claire.co.uk/projects-and-initiatives/dow-cop>, accessed 28 September 2023.
- [27] HSE (2012) Control of Asbestos Regulations.
- [28] Environment Agency (1996). “Decommissioning Redundant Boreholes and Wells”. National Groundwater and Contaminated Land Centre.
- [29] CIRIA C665, Assessing risks posed by hazardous ground gases to buildings, dated 2007.
- [30] BAM Nuttall Ltd. (2022) MT19:Project Execution Plan, VNIF-BNL-ZZ-YYY-MA-W-0001.
- [31] LK Group (2023) Victoria North Infrastructure Works, Asbestos Management Plan
- [32] BAM Nuttall Ltd. (2023). Works Transport Plan, VNIF-BNL-ZZ-YYY-FM-CG-0001
- [33] BAM Nuttall Ltd. (2023). Activity plan: Bulk earthworks
- [34] BAM Nuttall Ltd. (2023). Activity plan: Stockpile management plan
- [35] BAM Nuttall Ltd. (2023). Site Water Management Plan, VNIF-BNL-ZZ-YYY-RP-CD-0001.
- [36] Preston City Council (2022) Permit reference PCC110/2022.
- [37] SRL (2023) Air quality and dust management plan, ref 80823-SRL-RP-YQ-01-S2-P2.
- [38] https://www.csttraining.co.uk/seats/?utm_term=site%20environmental%20awareness%20training%20scheme&utm_source=adwords&utm_medium=ppc&utm_campaign=CITB+Seats+Course&hsa_cam=19484790934&hsa_grp=148801621670&hsa_mt=e&hsa_src=g&hsa_ad=643928909936&hsa_acc=3319471715&hsa_net=adwords&hsa_kw=site%20environmental%20awareness%20training%20scheme&hsa_tgt=kwd-313167198465&hsa_ver=3&gad_source=1&gclid=EAIaIQobChMIorK6u4nrgQMVA_DtCh1MsgejEAAYASAAEgJrr_D_BwE accessed 10 Oct 2023
- [39] Planit (2022) Landscape Specification, VNIF-PLA-ZZ-YYY-SP-L-0001, 8th December 2022.
- [40] BAM Nuttall Ltd. (2023). VNIF-BNL-ZZ-YYY-PR-WP-0134.
- [41] Zetica (2018) Northern Gateway, Manchester, UXO Desk Study and Risk Assessment, ref P8135-18-R1.
- [42] Avison Young (2022) Tree Replacement, Ecology and Biodiversity Net Gain Mitigation Strategy.

- [43] BAM Nuttall Ltd. (2023), Invasive Species Management Plan, VNIF-BNL-ZZ-YYY-MS-W-0003.

Appendix A
Trade effluent discharge consent

Temporary Agreement

Reference TWBAM05226323 – revised dates
WwTW Davyhulme



TEMPORARY WASTEWATER AGREEMENT BETWEEN

UNITED UTILITIES WATER LIMITED

And

BAM Nuttall Limited

This temporary Agreement is for 2 years or less

Start date **5th day of June of 2023**

Expiry date **4th day June of 2025**

Any discharge must only commence from the start date stated above and must terminate after the expiry date stated above. Any discharges undertaken outside the specified dates will be considered illegal. Any subsequent discharge will require a new application.

Temporary Agreement

Reference TWBAM05226323 – revised dates

WwTW Davyhulme

TEMPORARY AGREEMENT BETWEEN:

UNITED UTILITIES WATER LIMITED a company incorporated under the laws of England & Wales (company number 2366678) whose registered office is at Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Great Sankey, Warrington WA5 3LP ("**the Company**")

AND

BAM Nuttall Limited whose registered office is at **St James House, Knowl Road, Camberley, Surrey GU15 3XW** (" **the Applicant**")

(each a "Party" and together "the Parties")

WHEREAS:

The Company is the sewerage undertaker for the North West region of the United Kingdom appointed under the Water Industry Act 1991.

The Applicant is involved with the **construction / civil engineering projects** whose premise address is **Victoria North project, Collyhurst Road, Manchester M40 7RT**

The Applicant has applied to the Company for an agreement to discharge wastewater from the said premises into the sewers through details completed in your application form which was duly made on **28.09.22 (original application)**

The discharge of wastewater shall be in accordance with the said application form and would not be lawful without the permission of the Company.

The Parties are entering into this Agreement to set out the terms and conditions on which the Company agree to the discharge of wastewater by the Applicant from the said premises into its sewer.

Temporary Agreement

Reference TWBAM05226323 – revised dates

WwTW Davyhulme

NOW IT IS HEREBY AGREED as follows:

The Company HEREBY agree to the discharge of wastewater detailed in the application form submitted to the retailer **09.09.22** from the said premises into their sewers. This agreement shall be as if the discharge was trade effluent as defined in the Water Industry Act 1991 and shall be SUBJECT TO THE FOLLOWING CONDITIONS:

- | | |
|--|--|
| Nature of discharge | 1. Subject to the provisions of conditions below the nature or composition of the wastewater to be discharged under this agreement shall be solely as specified in the said Application form and shall consist solely of wastewater derived from

Contaminated groundwater |
| Sewer affected | 2. The sewer into which the wastewater may be discharged and the point of discharge is the public foul sewer situate at

Between MH 6601 And MH 6501 |
| Connections | 3. No connections shall be made to the said sewer without the prior approval of the Company and all such connections shall be constructed and maintained to the satisfaction of the Company at the expense of the Applicant. |
| Maximum volume of discharge | 4. The maximum amount of the wastewater discharged in any one day of twenty four hours shall not exceed 260 m³ without prior written consent of the company. |
| Maximum rate of discharge | 5. The highest rate at which the wastewater may be discharged shall not exceed 3 litre/sec |
| Matters to be eliminated prior to discharge to sewers | 6. The following matters shall be eliminated from the wastewater before it is discharged into the sewers of the Company:

a) petroleum spirit;

b) calcium carbide;

c) carbon disulphide;

d) except as provided in paragraph 7 hereof, the prescribed substances listed in Schedule 1 to The Trade Effluents (Prescribed Processes and |

Temporary Agreement

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Substances) Regulations 1989, as amended from time to time, insofar as they are in concentration greater than the background concentration (as defined in the said Regulations);

- e) where the wastewater derives from a prescribed process mentioned in Schedule 2 to the said Regulations, and except as provided in paragraph 7 hereof, asbestos (as defined in the said Regulations) and chloroform in a concentration greater than the background concentration (as defined in the said Regulations);
- f) organo-halogen compounds including pesticide residues and degreasing agents;
- g) any substances which either alone or in combination with each other or with any other matter lawfully present in the said sewers would be likely to;
 - i) cause a nuisance or produce flammable, harmful or toxic vapours either in the sewers or at the sewage works of the Company;
 - ii) injure the sewers or interfere with the free flow of their contents or affect prejudicially the treatment and disposal of their contents or have injurious effects on the sewage treatment works to which it is conveyed or upon any treatment plant there;
 - iii) be dangerous to or cause injury to any person working in the sewers or at the sewage treatment works;
 - iv) affect prejudicially any watercourse, estuary or coastal water into which the treated wastewater will eventually be discharged.

Matters to be limited prior to discharge to the sewer

- 7. The wastewater shall not contain
 - a) sulphides, hydrosulphides, polysulphides and substances producing hydrogen sulphide on acidification in excess of **1 mg/l**
 - b) cyanides and cyanogen compounds which produce hydrogen cyanide on acidification in excess of **1 mg/l**
 - c) sulphates as SO₄ in excess of **1000 mg/l**.

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WwTW Davyhulme

- d) Total suspended solids at pH 7.0 and dried at 110°C in excess of **400 mg/l**
- e) Settled chemical oxygen demand in excess of **1,000 mg/l**
- f) Toxic metals in excess of **10,000 ug/l** either individually or in total i.e. Antimony, Beryllium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Tin, Vanadium, Zinc;
- g) Separable grease and oil in excess of **100 mg/l**
- h) Chloroform and its compounds in excess of **100 ug/l**
- i) Arsenic and its compounds in excess of **50 ug/l**
- j) Methane in excess of **0.14 mg/l**
- k) Total Nitrogen (including ammonia) in excess of **250 mg/l**
- l) Iron and its compounds in excess of **100,000 ug/l**

Sampling and flow measurement

- 8. a) A flow metering device is to be installed at the discharge point and is to be maintained by the applicant to the satisfaction of the Company, or another means of assessing the volume of wastewater discharged is to be agreed in writing.
- b) (i) A sampling point is to be provided so as to enable an authorised member of the Company's staff safely to obtain a sample of effluent passing to sewer. Such authorised members of staff shall be given free and ready access to the sampling point at all times.
(ii) Representative samples of the wastewater may be obtained from **the settlement / methane removal treatment tank outfall point**
- c) The Trade Effluent department should be notified of all various discharges during the commissioning phase in order that adequate samples can be taken to monitor the discharge.

pH value

- 9. No wastewater shall be discharged having a pH of less than 6 or greater than 10.

Temperature

- 10. No wastewater shall be discharged which has a temperature higher than 43.3°C (110°F)

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WwTW Davyhulme

- | | | |
|-------------------------------|-----|---|
| Cessation of Discharge | 11. | In order to protect the sewer network and treatment processes it is essential that, should it be deemed necessary, the discharge to sewer will be terminated immediately on verbal instruction to your staff from the trade Effluent department. |
| Breach of Agreement | 12. | <p>If any wastewater is discharged to the sewer in excess or in breach of the conditions of this agreement</p> <p>a) The discharger shall notify the company on becoming aware of such a breach and shall immediately cease the discharge</p> <p>b) If the company detects such a breach they shall notify the discharger and if required by the company the discharger shall immediately cease the discharge.</p> |
| Disputes | 13. | <p>a) The Parties shall attempt to resolve all disputes and differences between themselves but if any dispute remains unresolved for more than 30 calendar days after it first arose it shall be referred to the Parties' Senior Management for resolution.</p> <p>b) If the parties are unable to reach a resolution between them or through senior management then any dispute arising out of or in connection with this agreement shall be determined by a single arbitrator to be agreed between the parties.</p> |

Signed _____ Date _____

Print Name _____

For and on behalf of **BAM Nuttall Limited**

Signed _____ Date _____

Print Name _____

For and on behalf of United Utilities Water Limited

Appendix B

Extract from specification appendix 1/5.

Extract of Appendix 1/5 of the specification [24], indication sampling and testing frequencies for earthworks materials proposed for re-use within the site.

Appendix 1/5 Testing to be carried out by the Contractor

Series 600 – Requirements for testing (see also “Series 600 - Requirements for testing - chemical testing on potentially aggressive fill materials” and “Series 600 – Requirements for testing - chemical testing on groundwater samples” below)					
Clause	Work, goods or material	Test	Frequency of testing (quantities are part thereof)	Test certificate	Comment
603, 616	Subgrade – granular and cohesive soils	Plate load test (600mm diameter plate)	50m grid across the sub-formation (excluding St. Catherine’s Wood and plots RB06, RB07 and RB08) and 30m centres along carriageway	Yes	See Appendix 6/7.2 Tests along carriageway to be off-set from the centreline on alternating sides.
	Subgrade – cohesive soils	Hand shear vane	50m grid across the sub-formation (excluding St. Catherine’s Wood and plots RB06, RB07 and RB08) and 30m centres along carriageway	Yes	See Appendix 6/7.2 Tests along carriageway to be off-set from the centreline on alternating sides.
601, 602, 603	Validation of remediation excavations in the former gas works area.	Chemical validation testing - see Appendix 6/14.1 for suite of determinands	See Appendix 6/3.13.1	Yes	See Appendix 6/14.1
601, 608, 612, 613, 631, 644	General fill	Classification, description, PSD, MC, compaction (2.5kg rammer).	1 per 500m ³ . Minimum of 2.	Yes	See Table 6/1 and 6/1A
	Site won Class 1A, 1B and 1C	Concrete aggressivity (Note 2)	1 per 500m ³ . Minimum of 2.	Yes	See Table 1/5B

Series 600 – Requirements for testing (see also “Series 600 - Requirements for testing - chemical testing on potentially aggressive fill materials” and “Series 600 – Requirements for testing - chemical testing on groundwater samples” below)

Clause	Work, goods or material	Test	Frequency of testing (quantities are part thereof)	Test certificate	Comment
		Plate load test (600mm diameter plate) or other method approved by the Engineer.	Plate load tests at 50m grid in plan and vertical intervals of 0.5m within the body of the fill.	Yes	See Table 6/1A
		Chemical validation testing (Note 3)	1 per 500m ³ . Minimum of 3.	Yes	See Appendix 6/14
601, 608, 612, 620, 631, 644	Landscaping and soil cover layer (subsoil) Site won Class 4	Classification, description, PSD, hand shear vane	1 per 500m ³ . Minimum of 2.	Yes	See Table 6/1 and 6/1A
		Concrete aggressivity (Note 2)	1 per 500m ³ . Minimum of 2.	Yes	See Table 1/5B
		Chemical validation testing (Note 3)	1 per 100m ³ . Minimum of 3.	Yes	See Appendix 6/14
601, 608, 612, 620, 631, 644	Landscaping and soil cover layer (subsoil) Imported Class 4	Classification, description, PSD, hand shear vane	1 per 500m ³ . Minimum of 2.	Yes	See table 6/1 and 6/1A
		Concrete aggressivity (Note 2)	1 per 500m ³ . Minimum of 2.	Yes	See Table 1/5B
		Chemical validation testing (Note 3)	One sample per 100m ³ for brownfield or unknown sources. One sample per 500m ³ for greenfield sources. A minimum of three samples per source.	Yes	See Appendix 6/14

Series 600 – Requirements for testing (see also “Series 600 - Requirements for testing - chemical testing on potentially aggressive fill materials” and “Series 600 – Requirements for testing - chemical testing on groundwater samples” below)					
Clause	Work, goods or material	Test	Frequency of testing (quantities are part thereof)	Test certificate	Comment
601, 618	Topsoil for landscaped areas	PSD	1 per 500m ³ A minimum of three samples per source.	Yes	See Appendix 6/8
	Site won Class 5A	Chemical validation testing (Note 3)	One sample per 100m ³ A minimum of three samples per source.		See Appendix 6/14B
601, 618	Topsoil for landscaped areas Imported Class 5B	No geotechnical testing required	-	Yes	See Appendix 6/8
		Chemical validation testing (Note 3)	1 per 100m ³ for brownfield or unknown sources. 1 per 500m ³ for greenfield sources. A minimum of three samples per source.		See Appendix 6/14B
601, 608, 612, 613, 631, 644	Capping Site won Class 6F2	Classification, description, PSD, MC, LA coefficient, compaction (vibrating rammer).	1 per 500m ³ . Minimum of 2	Yes	See table 6/1 and 6/1A
		Concrete aggressivity (Note 2)	1 per 500m ³ . Minimum of 2.	Yes	See Table 1/5B
		Plate load test (600mm diameter plate) or other method approved by the Engineer.	Plate load tests at 50m grid in plan and 30m centres along carriageway	Yes	See table 6/1A Tests along carriageway to be off-set from the centreline on alternating sides.

Series 600 – Requirements for testing (see also “Series 600 - Requirements for testing - chemical testing on potentially aggressive fill materials” and “Series 600 – Requirements for testing - chemical testing on groundwater samples” below)

Clause	Work, goods or material	Test	Frequency of testing (quantities are part thereof)	Test certificate	Comment
		Chemical validation testing (Note 3)	1 per 500m ³ . Minimum of 3.	Yes	See Appendix 6/14
601, 608, 612, 613, 631, 644	Capping Imported Class 6F5	Classification, description, PSD, MC, LA coefficient, compaction (vibrating rammer).	3 per source	Yes	See table 6/1 and 6/1A
		Concrete aggressivity (Note 2)	1 per 500m ³ . Minimum of 2.	Yes	See Table 1/5B
		Plate load test (600mm dia plate) or other method approved by the Engineer.	Plate load tests at 50m grid in plan and 30m centres along carriageway	Yes	See table 6/1A Tests along carriageway to be off-set from the centreline on alternating sides.
		Chemical validation testing (Note 3)	Not required if material recovered in accordance with the WRAP protocol (Note 2). One sample per 50m ³ for brownfield or unknown sources. One sample per 200m ³ for greenfield sources. A minimum of three samples per source.	Yes	See Appendix 6/14

Series 600 – Requirements for testing (see also “Series 600 - Requirements for testing - chemical testing on potentially aggressive fill materials” and “Series 600 – Requirements for testing - chemical testing on groundwater samples” below)

Clause	Work, goods or material	Test	Frequency of testing (quantities are part thereof)	Test certificate	Comment
601, 626	Gabion fill Class 6G Site won (crushed concrete)	Description, PSD, LA coefficient	1 per 500m ³ . Minimum of 3.	Yes	See table 6/1 and 6/1A
		Chemical validation testing (Note 3)	1 per 500m ³ . Minimum of 3.	Yes	See Appendix 6/14
601, 626	Gabion fill Class 6G Imported	Description, PSD, LA coefficient	2 per source	Yes	See table 6/1 and 6/1A
		Chemical validation testing (Note 3)	Not required if material recovered in accordance with the WRAP protocol (Note 2). Not required if quarried stone from a greenfield site. One sample per 50m ³ for brownfield or unknown sources. A minimum of three samples per source.	Yes	See Appendix 6/14
601, 610, 612	Fill to structures Class 6N,6P Site won	Classification, description, PSD, MC, LA coefficient, compaction (vibrating rammer), effective angle of internal friction and effective cohesion, permeability.	1 per 500m ³ . Minimum of 3.	Yes	See table 6/1 and 6/1A
		Concrete aggressivity (Note 2)	1 per 500m ³ . Minimum of 2.	Yes	See Table 1/5B

Series 600 – Requirements for testing (see also “Series 600 - Requirements for testing - chemical testing on potentially aggressive fill materials” and “Series 600 – Requirements for testing - chemical testing on groundwater samples” below)

Clause	Work, goods or material	Test	Frequency of testing (quantities are part thereof)	Test certificate	Comment
		Chemical validation testing (Note 3)	1 per 500m ³ . Minimum of 3.	Yes	See Appendix 6/14
601, 610, 612	Fill to structures Class 6N,6P Imported	Classification, description, PSD, MC, LA coefficient, compaction (vibrating rammer), effective angle of internal friction and effective cohesion, permeability.	2 per source	Yes	See table 6/1 and 6/1A
		Concrete aggressivity (Note 2)	1 per 500m ³ . Minimum of 2.	Yes	See Table 1/5B
		Chemical validation testing (Note 3)	Not required if material recovered in accordance with the WRAP protocol (Note 2). Not required if quarried stone from a greenfield site. One sample per 50m ³ for brownfield or unknown sources. A minimum of three samples per source.	Yes	See Appendix 6/14

Notes

- As detailed in Appendix 6/1.2.4, site won material proposed for re-use and imported materials will require testing to determine the potential risk to buried concrete in accordance with BRE Special Digest SD1.
- Concrete Aggressivity.** “Aggregates from Inert Waste: Quality Protocol” , Environment Agency and WRAP. Accessed from LIT 8709 c60600.pdf (publishing.service.gov.uk). See also “Series 600 - Requirements for testing - chemical testing on potentially aggressive fill materials” below, for recommended test methods.

Series 600 – Requirements for testing (see also “Series 600 - Requirements for testing - chemical testing on potentially aggressive fill materials” and “Series 600 – Requirements for testing - chemical testing on groundwater samples” below)					
Clause	Work, goods or material	Test	Frequency of testing (quantities are part thereof)	Test certificate	Comment
3.	Contamination testing. Soil samples recovered from remediation excavations, site won material proposed for re-use and imported recycled materials will require chemical validation testing for the suite of potential contaminants specified in Appendix 6/14. See also “Series 600 - Requirements for testing - chemical testing on potentially aggressive fill materials” and “Series 600 – Requirements for testing - chemical testing on groundwater samples” below for recommended test methods.				

Series 600 – Requirements for testing - chemical testing on potentially aggressive fill materials (see also “Series 600 – Requirements for testing” above, for relevant sampling and testing frequencies)		
Sample type	Determinand	Recommended test methods
Brownfield site (pyrite present)		
SOIL	pH in 2.5:1 soil/water extract	BR 279 Electrometric method
		BS 1377-3 Section 9 Electrometric method
	SO ₄ in 2:1 water/soil extract WS (g/l SO ₄)	BR 279 Procedures for gravimetric method, cation exchange or ion chromatography.
		BS 1377-3, Section 5 Gravimetric or ion exchange methods. (Values determined as g/l SO ₃ should be multiplied by 1.2.)
		TRL Report 447, Test 1 Sulfate extraction procedure as BS 1377-1, but ICP-AES used to determine sulfur in solution.
	Acid soluble sulfate AS (% SO ₄)	BR 279 Gravimetric method
		BS 1377-3, Section 5 Gravimetric methods. (Values determined as g/l SO ₃ should be multiplied by 1.2.)
		TRL Report 447, Test 2 Preparation and extraction of sulfate as BS 1377-3, ICP-AES used to determine sulfur in solution.
	Total sulfur TS (% S)	BR 279 Only Ignition in oxygen method recommended.
		TRL Report 447, Test 4A Microwave digestion method.
		TRL Report 447, Test 4B Ignition in oxygen method (e.g. with sulphur-carbon determinator).
	Soluble magnesium (g/l Mg)	BR 279 Atomic absorption spectrometry (AAS) method.
		Commercial test laboratory in-house procedure: Determination of magnesium in solution by ICP-AES.
	Nitrate (g/l NO ₃)	BR 279
		BR 279

Series 600 – Requirements for testing - chemical testing on potentially aggressive fill materials (see also “Series 600 – Requirements for testing” above, for relevant sampling and testing frequencies)

Sample type	Determinand	Recommended test methods
	Chloride (g/l Cl)	BS 1377-3 Section 7

Series 600 – Requirements for testing - chemical testing on groundwater samples (see also “Series 600 – Requirements for testing” above, for relevant sampling and testing frequencies)

Sample type	Determinand	Detection level
GROUNDWATER	pH value	0.1 pH units
	Hardness	2 mg/l
	Arsenic	1 µg/l
	Cadmium	0.5 µg/l
	Chromium	5 µg/l
	Copper	0.5 µg/l
	Lead	1 µg/l
	Mercury	0.1 µg/l
	Nickel	1 µg/l
	Selenium	1 µg/l
	Zinc	1 µg/l
	Antimony	1 µg/l
	Beryllium	1 µg/l
	Vanadium	1 µg/l
	Ammoniacal nitrogen	0.02 mg/l
	Chloride	1 mg/l
	Cyanide - total	10 µg /l
	Phenols - total	10 µg/l
	Dissolved organic carbon (DOC)	10 µg/l
	Calcium	10 µg/l
	Manganese	10 µg/l
	TPH CWG	10 µg/l
	BTEX	1 µg/l

Series 600 – Requirements for testing - chemical testing on groundwater samples (see also “Series 600 – Requirements for testing” above, for relevant sampling and testing frequencies)

Sample type	Determinand	Detection level
	16 USEPA Polyaromatic Hydrocarbons	0.01 µg/l
	Volatile Organic compounds	1 µg/l
	Semi-Volatile Organic compounds	1 µg/l
	Polychlorinated biphenyls	0.001 µg/l
	Total Petroleum Hydrocarbons	50 µg/l
	Diesel Range Organics	50 µg/l
	Petrol Range Organics	50 µg/l
	Mineral oils by IR	100 µg/l
	Cyanide - ferro and ferri-cyanide	30 µg/l
	Cyanide - free	30 µg/l
	Cyanide - thiocyanates	30 µg/l
	Chromium - hexavalent	10 µg/l
	Speciated phenols	0.5 µg/l
	BOD	2 mg O ₂ /l
	COD	10 mg O ₂ /l
	Triazine herbicides	0.1 µg/l
	Phenoxy Acid Herbicides	0.1 µg/l
	Carbamates & Uron Herbicides	0.1 µg/l
	Pyrethroid Insecticides	0.1 µg/l
	Organochlorine Pesticides	0.1 µg/l
	Organophosphorus Pesticides	0.1 µg/l
	Dibutyltin/ tributyltin/ tetrabutyltin/ triphenyltin	0.01 µg/l
	Iron	10 µg/l
	Magnesium	30 µg/l
	Sodium	10 µg/l
	Potassium	10 µg/l

Series 600 – Requirements for testing - chemical testing on groundwater samples (see also “Series 600 – Requirements for testing” above, for relevant sampling and testing frequencies)

Sample type	Determinand	Detection level
	Sulphates	2000 µg SO ₄ /l
	Sulphides	200 µg S/l
	Nitrate	0.3 mg/l
	Nitrite	0.01 mg/l
	Alkalinity	2 mg/l
	NAPL fractional and compositional hydrocarbon analysis	-
	NAPL density and viscosity	1 kg/m ³ and 0.5 mPa.s
	Cobalt	To be confirmed by contractor
	Thiocyanates	To be confirmed by contractor
	Aluminium	To be confirmed by contractor
	Tin	To be confirmed by contractor
	Titanium	To be confirmed by contractor
	Silver	To be confirmed by contractor

Appendix C
PFAS sampling methodology

PFAS sampling methodology

Investigation

Due to the presence of PFAS in the environment, and in particular equipment used in fieldwork, it is important to implement measures which limit the introduction of PFAS into samples. The Contractor shall implement the following measures.

- Decontamination of excavation equipment upon completion of each trial pit location (where possible do not use the same perishable items more than once i.e. sampling tubes, plastic sheeting etc);
- Washing of excavator bucket and other relevant plant with mains water between sampling.
- Soils that have been in contact with the excavator bucket are not to be sampled.
- Decontamination of sampling equipment with de-ionised water following collection of each sample.
- HDPE tubing/ equipment shall be used (Teflon™ tubing/ equipment shall not be used).
- PFAS-free cleaning products (Decon 90 shall not to be used).
- All sampling receptacles to be supplied by the testing laboratory.
- No sub sampling is permitted.
- HDPE or other laboratory-approved containers shall be used (ensure no Teflon™ liners are used).
- Non plastic field book, electronic data capture is preferred or a metal clipboard.
- Ball point pens/ pencils or fine sharpie markers to label samples (large permanent marker pens are not acceptable).
- New, powderless nitrile gloves/ cotton clothing shall be used for each new sample collected (soil and water). Water resistant or treated gloves/ clothing are not acceptable.
- Polyethylene bags shall be used as an alternative to standard plastic bags (bags may not be required for sampling).

To avoid contamination of water samples with PFAS, the Contractor shall use HDPE tubing or HDPE bailers (water sampling from open trial pits). Equipment that contacts water samples must not contain or be coated with Teflon® unless the Teflon® is internal to the equipment and does not contact the external environment.

Sample containers for PFAS analysis must be manufactured of polypropylene or HDPE. Glass containers with lined lids shall not be used for PFAS analysis. The Contractor is required to confirm sample containers with the selected analytical laboratory.

The Contractor shall confirm any specific requirements needed when sampling such as sample bottle material, field QC samples (field blank and replicates samples) and for guidance on PPE during sampling.

Field sampling equipment, including oil/water interface meters, trowels and other non-dedicated equipment used at the sampling location require cleaning between samples and between each trial pit.

Soil sampling

All samples collected from the trial pits shall be taken from the unsaturated zone (i.e. above the water table). To avoid cross contamination the Contractor shall take samples from 0.5m above the water table. Due to the potential presence of PFAS in the soils present at the site, particular equipment is to be used during the fieldworks. The sample containers for PFAS analysis must be manufactured of polypropylene or HDPE. Glass containers with lined lids shall not be used. The Contractor is required to confirm sample containers with the selected analytical laboratory. It is recommended that the Contractor confirms any specific requirements needed when sampling such as sample bottle material, field QC samples (field blank and replicates samples) and for guidance on PPE during sampling. The Contractor shall take all steps necessary to avoid cross contamination of sampling points. The Contractor shall take samples which are representative of each of the materials encountered. The outline soil sampling procedure is as follows, the method shall be agreed on site with the Investigation Supervisor:

- Excavate with clean decontaminated excavator bucket/tools and cease excavation upon encountering groundwater;
- No water is to be added to the pit during excavation;
- During excavation, soil shall be laid on a clean polyethylene sheeting in the sequence that the strata is excavated from the pit;
- Following completion of the pit, the supervising engineer shall apply a clean set of gloves and collect a sample into the laboratory approved sample container;
- The engineer shall then immediately remove the used gloves and store for disposal at a later time (i.e. a new set of clean gloves are to be worn for each sample recovery. Each set of gloves is to be used only once per sample to avoid cross contamination), furthermore, the plastic sheeting used shall be disposed of and not used again;
- Following the recovery of each sample, all hand digging tools shall be cleaned and dried prior to recovery of the next sample;
- Following the sampling and backfilling of the pit, all hand digging tools shall be cleaned and dried prior to commencing the next hole. The excavator bucket is to be cleaned prior to commencing the next hole.

The Contractor shall seek further guidance from the specialist chosen laboratory on mitigation of sample cross contamination and appropriate sample containers.

Water sampling

To be undertaken in trial pits if perched water is encountered.

The following sampling method shall be followed:

- Any visual or olfactory evidence of contamination or other descriptions relevant to the water quality shall be logged. Of particular interest is whether the water has any orange discoloration.
- Sample containers and sample volumes shall be discussed with the analytical laboratory prior to undertaking the works and the agreed sample volumes and sample methods shall be presented to the Investigation Supervisor prior to commencing works on site;
- Non-standard sampling measures (such as trip blanks) shall be discussed with the analytical laboratory and implemented when collecting the water samples;

- Any sampling equipment that will be used for sampling more than one location will require decontamination between each sampling that is recovered to avoid cross contamination;
- Samples collected on site shall be stored in the dark and protected at all times from temperatures below 2°C and above 4°C.
- Samples shall be sent to the laboratory at the end of the working day and laboratory analysis shall be completed within the required laboratory holding times which is likely to be between 24 to 48 hours.
- No sub sampling is permitted.

Drawings

Drawing VNIF-ARP-00-YYY-DR-CE-0002: Proposed HIF Lite Site Isopach

Drawing VNIF-ARP-00-YYY-DR-CE-0008: Existing Monitoring Boreholes

Drawing VNIF-ARP-00-YYY-DR-CE-0010: Extent of Temporary Site Weathering Layer

Drawing VNIF-ARP-00-YYY-DR-CE-0011: Stockpile Risk Zone



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 - boundaries between adjacent plots are indicative only and are subject to change as the FEC masterplan is developed.
 - Topographical Survey drawing PS-2158-TS by Paragon Surveys dated September 2021.
 - Landscape Architect masterplan drawing VNIF-PLA-ZZ-YYY-DR-L-1011 rev C01 dated 16/12/2022 by Planit.
 4. Drawing to be read in conjunction with the Victoria North HIF Infrastructure Works, Earthworks Specification, ref VNIF-ARP-ZZ-YYY-SP-CG-0004.
 5. Refer to Landscape Architect drawings for details of soft and hard landscaping in the development site.
 6. Plot boundaries are indicative based on FEC masterplan.
 7. Plot levels represent the proposed ground level for the interim state following HIF Enabling Works and do not represent building Finished Floor Levels.
 8. Invasive species present across the site. Refer to VNIF-BNL-ZZ-YYY-MS-W-0003 Invasive Species Management Plan to confirm location prior to undertaking earthworks.

Key

Red Line Boundary

Development Plot Boundaries

Proposed Cut

Proposed Fill

P01	26/11/21		RS	RG	RG	---
P02	17/12/21		RS	RS	RG	---
P03	02/03/22	Draft for Client Comment	OM	RS	RG	---
P04	28/06/22	Stage 4 Draft	ID	RS	LS	---
P05	21/03/23	HIF Lite Full Issue	AS	CR	RG	---
P06	31/05/23	HIF Lite Full Issue	AS	AL	CR	---
Rev	Date	Description	By	Chkd	Appd	Auth

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Project Title
Victoria North HIF Infrastructure & Enabling Works

Drawing Title
Proposed HIF Lite Site Isopach

Scale at A1 1:1000		Anup Job No 282022-00				
Role Civil - Earth works and Geotechnics						
Suitability S3 - Issued for Review and Comment						
Rev	By	Chkd	Appd			
P06	AS	AL	CR	--		
	Date 31/05/23	Date 31/05/23	Date 31/05/23	--		
Name VNIF - ARP- 00 - YYY- DR - CE - 0002						
Project	Originator	Volume	Location	Type	Role	Number

N

Exploration Hole	Depth (m bgl)	East	North	Elevation (m AOD)	Inclinometer?	Groundwater sampling?	Ground gas monitoring?	Groundwater level monitoring?
BH101	7.8	384796.682	399802.989	43.377			Y	Y
BH102	8.5	384763.18	399691.375	42.934		Y		Y
BH103	8.3	384689.014	399695.588	42.57		Y		Y
BH104	15	384607.46	399631.24	41.588			Y	Y
BH105	11.2	384463.735	399571.588	40.666		Y		Y
BH106	11.3	384459.989	399509.165	40.671				Y
BH112	4.3	384401.713	399486.259	32.249			Y	Y
BH201	9.3	384762.04	399820.851	43.4		Y	Y	Y
BH202	9	384723.888	399716.141	42.663		Y	Y	Y
BH203	24	384845.747	399748.863	41.891		Y		Y
BH204	16.5	384815.474	399703.59	43.276			Y	Y
BH205	10.8	384689.078	399735.153	42.578		Y	Y	Y
BH206	6.8	384729.233	399690.75	42.692			Y	Y
BH207	16.1	384654.246	399626.1	41.638			Y	Y
BH208	14.6	384562.98	399592.56	40.66			Y	Y
BH209	17	384548.843	399628.33	41.214			Y	Y
BH210	19.6	384479.67	399554.7	40.45		Y		Y
BH211A	11.6	384441.79	399513.96	40.44				Y
BH212	11.5	384487.32	399426.078	30.377		Y		Y
BH213	3.5	384475.449	399487.578	31.943			Y	Y
BH214A	5	384430.619	399360.713	30.033				Y
WS201B	1.65	384735.29	399787.2	43.55			Y	Y
WS207	5	384628.92	399674.79	41.91				Y
WS208	4.65	384566	399473	30.168				Y
BH301	15.08	384852.11	399762.18	41.87	Y			
BH302	14.08	384826.9	399705.6	42.76	Y			
BH303	12.7	384719.84	399660.22	42.3				Y
BH304	16.7	384618.46	399600.49	41.18			Y	Y
BH305	12.03	384525.98	399549.39	39.77			Y	Y
BH306	6.3	384520.14	399490.63	31.45		Y	Y	Y
BH307	5	384461.01	399430.12	30.61			Y	Y
BH309	11.5	384863.87	399641.32	30.5				Y
BH310	16	384838.09	399638.18	32.6		Y		Y
BH311	17.32	384411.7	399557.68	46.2			Y	Y
BH312	16.82	384382.83	399519.93	45.6				Y
BH313	12.4	384395.83	399507.84	39.81			Y	Y
BH314	12.45	384439.7	399502.02	43.11		Y	Y	Y
BH315	13.52	384852.04	399729.3	39.26		Y	Y	Y
BH320	6.7	384899.76	399761.36	34.26			Y	Y
BH321	6	384770.34	399639.02	34.2		Y	Y	Y
BH322	6	384715.2	399587.28	32.49		Y		Y
BH323	2.6	384658.4	399576.88	30.21				Y
BH324	15.3	384593.99	399584.6	41				Y
BH325	4.5	384446.11	399359.16	29.95				Y

Monitoring Borehole Co-ordinates Table

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4. Drawing to be read in conjunction with the Victoria North HIF Infrastructure Works, Earthworks Specification, ref VNIF-ARP-ZZ-YYY-SP-CG-0004.

- Key
- HIF Site Boundary

Plot Boundary

Provision of Utility and Drainage Infrastructure Only

BHxxx

Borehole - Inclinometers

BHxxx

Borehole - Groundwater sampling and ground gas monitoring

BHxxx

Borehole - Groundwater level monitoring

P01	20/06/22	Draft for Client Comment	AS	CR	LS	---
P02	02/09/22	WS4 Issue for BAM	AS	CR	LS	---
P03	21/03/23	HIF Life Full Issue	AS	CR	RG	---
Rev	Date	Description	By	Chkd	Appd	Auth

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Client



Project Title

Victoria North HIF Infrastructure & Enabling Works

Drawing Title

HIF Life
Existing Monitoring Boreholes

Scale at A1	1:1250	Arup Job No	282022-00			
Role	Civil - Earth works and Geotechnics					
Suitability	S3 - Issued for Review and Comment					
Rev	By	Chkd	Appd			
P03	AS	CR	RG	--		
	Date 09/03/23	Date 21/03/23	Date 21/03/23	--		
Name						
VNIF	- ARP-	00	- YYY-	DR - CE - 0008		
Project	Originator	Volume	Location	Type	Role	Number

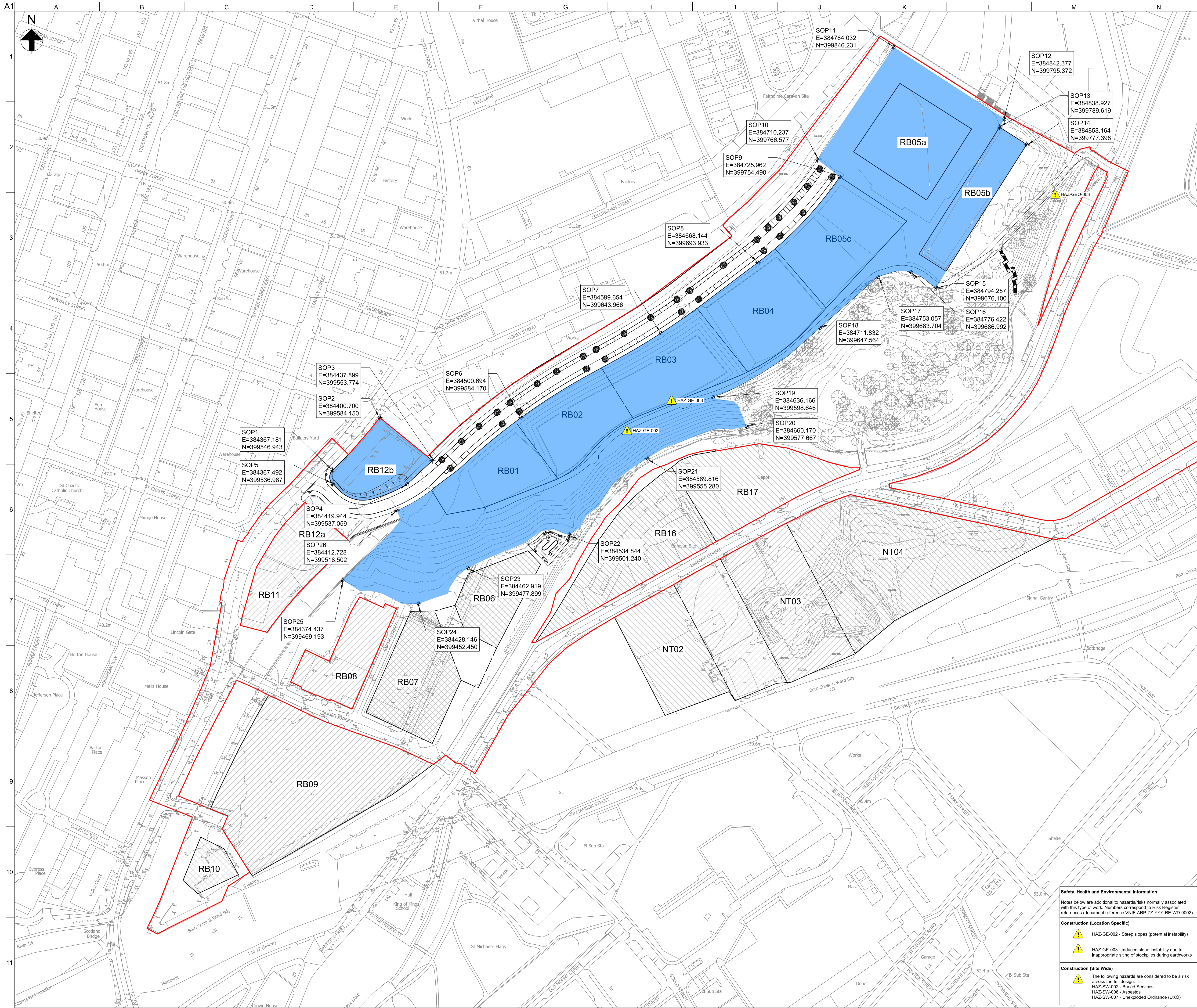
- Safety, Health and Environmental Information
- Notes below are additional to hazards/risks normally associated with this type of work. Numbers correspond to Risk Register references (document reference VNIF-ARP-ZZ-YYY-RE-WD-0002)
- Construction (Location Specific)
- HAZ-GE-001 - Excavations at the top and base of steep slopes.

HAZ-GE-002 - Steep slopes (potential instability)

HAZ-GE-003 - Induced slope instability due to inappropriate siting of stockpiles during earthworks

HAZ-SW-003 - Working adjacent to live water course

HAZ-SW-013 - Risk of water borne diseases such as Weil's disease
- Construction (Site Wide)
- The following hazards are considered to be a risk across the full design:
HAZ-SW-002 - Buried Services
HAZ-SW-006 - Asbestos
HAZ-SW-007 - Unexploded Ordnance (UXO)



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 - Drawing to be read in conjunction with the Victoria North HIF Infrastructure Works, Earthworks Specification, ref VNIF-ARP-ZZ-YYY-SP-CG-0004.

- Key**
- HIF Site Boundary
 - Plot Boundary
 - Extent of 100mm thick hydroseeded suitable fill layer, to be placed across all areas of made ground left exposed on completion of the VNHF works

Rev	Date	Description	By	Chkd	Appd	Auth
P01	20/06/22	Draft for Client Comment	AS	CR	LS	---
P02	02/09/22	WS4 Issue for BAM	AS	CR	LS	---
P03	21/03/23	HIF Lite Full Issue	AS	CR	RG	---

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Project Title
Victoria North HIF Infrastructure & Enabling Works

Drawing Title
**HIF Lite
Extent of Temporary Site Weathering Layer**

Scale at A1		1:1250		Anup Job No		282022-00	
Role		Civil - Earth works and Geotechnics					
Suitability		S3 - Issued for Review and Comment					
Rev	By	AS	Chkd	CR	Appd	RG	---
	P03	Date	09/03/23	Date	21/03/23	Date	21/03/23

Name							
VNIF - ARP- 00 - YYY- DR - CE - 0010							
Project	Originator	Volume	Location	Type	Role	Number	

Safety, Health and Environmental Information

Notes below are additional to hazards/risks normally associated with this type of work. Numbers correspond to Risk Register references (document reference VNIF-ARP-ZZ-YYY-RE-WD-0002)

Construction (Location Specific)

- HAZ-GE-002 - Steep slopes (potential instability)
- HAZ-GE-003 - Induced slope instability due to inappropriate siting of stockpiles during earthworks

Construction (Site Wide)

- The following hazards are considered to be a risk across the full design:
 - HAZ-SW-002 - Buried Services
 - HAZ-SW-006 - Asbestos
 - HAZ-SW-007 - Unexploded Ordnance (UXO)

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4. Drawing to be read in conjunction with the Victoria North HIF Infrastructure Works, Earthworks Specification, ref VNIF-ARP-ZZ-YYY-SP-CG-0004.

Key

- HIF Site Boundary
 Plot Boundary
 Extent of No Stockpile Zone
 Extent of No Build Zone
 Extent of No Stockpile Zone, defined as 15m from the upper crest of the REGRADED slope.

P01	20/06/22	Draft for Client Comment	AS	CR	LS	---	
P02	02/09/22	WS4 Issue for BAM	AS	CR	LS	---	
P03	21/03/23	HIF Lite Full Issue	AS	CR	RG	---	
Rev	Date	Description	By	Chkd	Appd	Auth	

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MANCHESTER
CITY COUNCIL



Project Title
Victoria North HIF Infrastructure & Enabling Works

Drawing Title
HIF Lite
Stockpile Risk Zone

Scale at A1	1:1250	Arup Job No	282022-00
-------------	--------	-------------	-----------

Role Civil - Earth works and Geotechnics

Rev P03	By AS	Chkd CR	Appd RG	---
	Date 09/03/23	Date 21/03/23	Date 21/03/23	---

Name

VNIF - ARP - 00 - YYY - DR - CE - 0011

Project | Originator | Volume | Location | Type | Role | Number

Safety, Health and Environmental Information

Notes below are additional to hazards/risks normally associated with this type of work. Numbers correspond to Risk Register references (document reference VNIF-ARP-ZZ-YYY-RE-WD-0002)

Construction (Location Specific)

- | | |
|---|--|
|  | HAZ-GE-001 - Excavations at the top and base of steep slopes. |
|  | HAZ-GE-002 - Steep slopes (potential instability) |
|  | HAZ-GE-003 - Induced slope instability due to inappropriate siting of stockpiles during earthworks |
|  | HAZ-SW-003 - Working adjacent to live water courses |
|  | HAZ-SW-013 - Risk of water borne diseases such as Weil's disease |

Construction (Site Wide)

 The following hazards are considered to be a risk across the full design:
HAZ-SW-002 - Buried Services
HAZ-SW-006 - Asbestos
HAZ-SW-007 - Unexploded Ordnance (UXO)