



Vinci Building Ltd

Prestwich Multi-Storey Car Park

Options Appraisal and Remediation Strategy

Rev B

September 2024

Contaminated Land, Brownfield & Environmental Contracting



REPORT TITLE: Options Appraisal and Remediation Strategy

REPORT NUMBER: Rev B

CLIENT NAME: Vinci Building Ltd

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1.0 Introduction

1.1 Background

- 1.1.1 Vertase FLI Ltd (VertaseFLI) was employed by Vinci Building Ltd ('the Client') to prepare a remediation strategy for a car park located on Fairfax Road, Prestwich, M25 1BT ('the Site'), which forms part of a larger area of land intended for redevelopment for a mixed use in accordance with a hybrid planning application submitted to Bury Council (planning reference 70449). A site plan is shown in Drawing D4900_01 (Appendix A).
- 1.1.2 The Site is referred to as the "northern car park" in previous site investigation reports, which have been provided to VertaseFLI by the Client (see Section 1.3 for details about the reports). It is understood that the Site is intended to be redeveloped to construct a multi-storey car park.

1.2 Legal Context

- 1.2.1 Draft pre-commencement planning condition 47 associated with the planning application states that "*no development shall commence unless and until:*
- *A contaminated land Preliminary Risk Assessment report to assess the actual/potential contamination and/or ground gas/landfill gas risks at the site shall be submitted to, and approved in writing by, the Local Planning Authority;*
 - *Where actual/potential contamination and/or ground gas/landfill gas risks have been identified, detailed site investigation and suitable risk assessment shall be submitted to, and approved in writing by the Local Planning Authority;*
 - *Where remediation/protection measures is/are required, a detailed Remediation Strategy shall be submitted to, and approved in writing by, the Local Planning Authority."*
- 1.2.2 The reason cited for this pre-commencement planning condition by the Local Planning Authority is that the documentation submitted to Planning in support of the scheme "*does not provide full details of the actual contamination and subsequent remediation, which is required to*

secure the satisfactory development of the site in terms of human health, controlled waters, ground gas and the wider environment and pursuant to National Planning Policy Framework Section 15 - Conserving and enhancing the natural environment”.

1.3 Previous Investigations

1.3.1 Previous site investigation reports have been prepared by Geotechnical and Environmental Associates Ltd (GEA). These reports are listed below:

- GEA Ltd (2024). Ground Investigation Preliminary Findings at Prestwich North Car Park. July 2024.
- GEA Ltd (2024). Prestwich Village, Prestwich Manchester, Manchester, M25 1AY. Ground Investigation. The Prestwich Regeneration LLP. August 2024. J23254. Rev 0

1.3.2 In combination, these site investigation reports provide information (desk study, preliminary assessment of risk, intrusive site investigation information and a quantitative assessment of risk) relevant to the entire area of land intended for redevelopment, including the northern car park.

1.4 Document Purpose

1.4.1 The purpose of this document is to report the process and outcome of a remediation options appraisal and subsequent remediation strategy for the Site (i.e., the northern car park). This document completes the set of documentation required to discharge draft pre-commencement planning condition 47 for the Site. It is also intended to provide a record of how VertaseFLI shall verify implementation of the remediation works.

1.4.2 Preparation of the remediation options appraisal and remediation strategy has been undertaken in accordance with Land Contamination Risk Management (LCRM) guidance published by the Environment Agency.

2.0 Conceptual Site Model

2.1 Ground Conditions

- 2.1.1 The ground conditions beneath the Site comprise a moderate thickness of Made Ground underlain by alluvium. The alluvium is underlain by Hummocky Glacial Deposits. Beneath the superficial deposits, the Pennine Upper Coal Measures Formation is present. The Made Ground and superficial deposits are described in Table 2-1.
- 2.1.2 According to the GEA Ltd (2024) ground investigation report, the alluvium, hummocky glacial deposits and Pennine Upper Coal Measures Formation are classified by the Environment Agency as Secondary A Aquifers.

Table 2-1. Summary of ground conditions beneath the Site

Material	Description
Made Ground	Comprising tarmacadam underlain by subbase (comprising sandy silty gravel with fragments of brick, concrete, asphalt and sandstone) ranging in thickness from 3m in BH101 in the northern portion of the site to 1.1m in BH09 at the southern portion of the site. Obstructions comprising concrete substructures and brick footings (some of archaeological interest) are present in the Made Ground at various depths and locations Perched groundwater was present in the Made Ground at depths of 0.28m to 1m.
Alluvium	The alluvium includes some very soft dark grey and brown pseudo-fibrous peat over very soft grey slightly gravelly clay with rare pockets of brown peat to a maximum depth of 2.5m in BH02.
Hummocky Glacial Deposits	The hummocky glacial deposits were reported to be highly variable comprising interbedded granular and cohesive deposits, underlain by stiff cohesive deposits, underlain by dense and very dense granular deposits

Notes:

Summary of ground conditions is taken from GEA (2024). Prestwich Village, Prestwich Manchester, Manchester, M25 1AY. Ground Investigation. The Prestwich Regeneration LLP. August 2024. J23254. Rev 0

2.2 Contaminants

2.2.1 Contaminants identified to be present within the Made Ground and shallow groundwater beneath the Site are summarised in Table 2-2.

Table 2-2. Summary of contaminants identified in the Made Ground

Contaminant	Description
Asbestos	Detected in BH08A at 0.5m bgl in Made Ground (chrysotile fibre bundles at <0.001%)
Petroleum Hydrocarbons	Hydrocarbon odours were detected in the Made Ground at the north of the Site
Polycyclic Aromatic Hydrocarbons (PAHs)	Hydrocarbon odours were detected in the Made Ground and natural ground at the north of the Site (BH01). Elevated concentrations of total petroleum hydrocarbons (TPH), total PAHs, benzo(a)pyrene, benzo(b)fluoranthene, anthracene, fluoranthene and indeno(123-cd)pyrene were detected in groundwater from BH02
Sulphide	Detected at elevated levels in BH01
Notes: Summary of contamination identified is taken from GEA (2024). Prestwich Village, Prestwich Manchester, Manchester, M25 1AY. Ground Investigation. The Prestwich Regeneration LLP. August 2024. J23254. Rev 0	

2.3 Receptors

2.3.1 Potential receptors identified in previous site investigations by GEA Ltd include:

- Future users of the proposed multi-storey car park.
- Groundwater present in the underlying Secondary A aquifer.
- Buried services and building materials (concrete) in direct contact with contaminants in Made Ground.

2.4 Potential Pathways

2.4.1 Upon completion of the development, potential pathways for contaminants may include the inhalation of vapours by future site users and the downward migration of contaminants through the unsaturated zone into groundwater in the underlying Secondary A aquifer.

- 2.4.2 Pathways relating to ingestion and direct contact by future site users are unlikely due to the end use being a car park with a physical pathway break (i.e. hardstanding). However, direct contact of underground services and building materials (e.g. concrete) with contaminants is likely.

2.5 Contaminant Linkages

- 2.5.1 An assessment of the risk posed by chemical contaminants to the receptors was undertaken by GEA Ltd in their reported dated August 2024. The outcome of the assessment is summarised in Table 2-3.
- 2.5.2 The assessment did not identify any contaminant linkages posing unacceptable risks to current or future receptors in the context of the proposed development.

Table 2-3. Summary of GEA assessment of risk posed by contaminants

Receptor	Summary of GEA Assessment of Risk
Human health (future users or multi-story car park)	Elevated concentrations of PAHs present in Made Ground in the northern part of the Site (thought to be derived from coal tar) were present at concentrations exceeding generic assessment criteria for a commercial land use exposure scenario in some samples of Made Ground from the north of the Site. The commercial land use exposure scenario is very conservative for a car park.
Human health (construction workers)	Made Ground containing elevated concentrations of PAHs and some positive detections of asbestos fibres may pose risks to construction workers which should be managed via appropriate PPE and working in accordance with appropriate guidelines in relation to asbestos
Groundwater in Secondary A Aquifer	It was not considered likely that the redevelopment of the site would pose a risk to groundwater
Building materials (concrete)	Concentrations of soluble sulphates measured in the Made Ground were generally low except for some elevated concentrations in the northern part of the Site corresponding with an ACEC (Aggressive Chemical Environment for Concrete) class of AC-3 for mobile water conditions

Notes:

Summary of contamination risk assessment is taken from GEA (2024). Prestwich Village, Prestwich Manchester, Manchester, M25 1AY. Ground Investigation. The Prestwich Regeneration LLP. August 2024. J23254. Rev 0

2.6 Geotechnically Unsuitable Materials

- 2.6.1 Soft alluvial deposits are identified to be present in the investigation reports prepared by GEA Ltd beneath some areas of the Site. They are described as *“very soft dark grey and brown pseudo-fibrous peat over very soft grey slightly gravelly clay”* extending to a depth of approximately 2.5m.
- 2.6.2 While the proposed multi-story car park will have a piled foundation solution, some of these deposits (particularly the pseudo-fibrous peat) are likely to be geotechnically unsuitable beneath the working platform (piling mat) required to install the piles, due to their high settlement potential.

3.0 Remediation Options Appraisal

3.1 Remediation Objectives

3.1.1 The objectives underpinning the proposed remediation are as follows:

- Reduce Client's future liability for unacceptable risks posed by contamination present beneath the Site, which may have not been identified by the previous site investigations – either due to (i) the limited scope of the site investigation works; and / or (ii) the presence of obstructions and substructures encountered during the site investigation that may provide preferential pathways for the migration and / or accumulation of contaminants.
- Remove shallow obstructions and substructures to a depth that shall not obstruct piling, interfere with the construction or contribute to unacceptable magnitudes of differential settlement.
- Reduce settlement risks associated with geotechnically unsuitable materials present within the Alluvium beneath the Site.
- Complete the remediation works within a short timescale to enable the construction phase to commence as soon as possible.
- Minimise nuisance to local residents with regard to dust and noise.

3.2 Feasible Remediation Options

3.2.1 Potentially feasible remediation options are as follows:

- Site-wide excavation (turnover) of Made Ground to enable the identification, isolation and **disposal** of materials that are unsuitable for retention and re-use on Site – e.g., materials affected by unacceptable levels of contamination, obstructions and substructures, and geotechnically unsuitable materials (i.e., pseudo-fibrous peat). Quantities of materials disposed are replaced by imported materials that are not classified as a waste.
- Site-wide excavation (turnover) of Made Ground to enable the identification, isolation and **treatment** of materials that are currently unsuitable for retention and re-use on Site – e.g., materials affected by unacceptable levels of contamination,

obstructions and substructures, and geotechnically unsuitable materials (i.e., pseudo-fibrous peat). Treatment options include:

- Ex-situ bioremediation of hydrocarbon-contaminated soils / Made Ground (i.e., mass reduction of contaminants);
- Ex-situ chemical oxidation of hydrocarbon-contaminated soils / Made Ground (i.e., mass reduction of contaminants);
- Stabilisation and solidification of hydrocarbon-contaminated soils / Made Ground (i.e., immobilisation of contaminants);
- Stabilisation of geotechnically unsuitable materials (i.e., ground improvement).
- Ex-situ crushing of hard materials to produce a recycled aggregate for on-site re-use.

3.3 Evaluation of Remediation Options

- 3.3.1 A more detailed evaluation of the feasible remediation options identified in Section 3.2 is presented in Table 3-1. Each of the feasible remediation options have been scored on a scale of 1 to 5 to indicate their suitability (5) or lack of suitability (1) in relation to evaluation criterion (i.e., cost, duration, practicality and effectiveness). The scoring has been undertaken for each criterion having regard to the remediation objectives and the constraints associated with the size of the Site.
- 3.3.2 In considering 'practicality' as an evaluation criterion, this includes consideration of the impact of implementing the remediation option on the local residents with regard to nuisance. For example, where an option is very noisy to implement, the scoring for this criterion is relatively low.
- 3.3.3 It is evident from Table 3-1 that, in the context of the remediation objectives and site constraints, the excavation and off-site disposal of materials that are unsuitable for retention and re-use on Site and replacement with imported non-waste, is the highest scoring remediation option.
- 3.3.4 This option could be complemented by the crushing of site-won hard materials to form a recycled aggregate for retention on Site, assuming

the quantity of the site-won hard materials made the crushing activity economical, and the implementation of the crushing could be undertaken without causing nuisance (noise and dust) for local residents.

- 3.3.5 Treatment-based remediation options scored less highly due to their likely impact on the remediation programme (i.e., making the remediation programme longer) and the space constraints on site to implement them.

Table 3-1. Evaluation of feasible remediation options (5 = good suitability, 1 = poor suitability, with respect to the criterion – cost, duration, and practicality, effectiveness)

Remediation Option	Cost	Duration	Practicality	Effectiveness	Score	Comments
Off-site disposal of materials that are unsuitable for retention and re-use on Site and replacement with imported non-waste	3	4	5	5	17	Potentially costly to dispose, but relatively short duration, very practical and very effective
Treatment (via ex-situ bioremediation) of hydrocarbon-impacted soils / Made Ground to reduce contaminant mass and facilitate material re-use on Site	4	2	2	3	11	Less costly to implement, medium to long-duration (especially for heavy-end hydrocarbons), limited practicality due to space constraints, medium effectiveness
Treatment (via ex-situ chemical oxidation) of hydrocarbon-impacted soils / Made Ground to reduce contaminant mass and facilitate material re-use on Site	4	3	2	4	13	Less costly to implement, medium duration (due to difficulties mixing), limited practicality due to space and safety constraints, good effectiveness
Treatment (via stabilisation and solidification) of hydrocarbon-impacted soils / Made Ground to immobilise contaminants and facilitate material re-use on Site	4	3	2	4	13	Less costly to implement, medium duration (due to difficulties mixing), limited practicality due to space and safety constraints, good effectiveness
Stabilisation of geotechnically unsuitable materials (i.e., ground improvement)	2	3	2	3	10	Potentially costly due to high dosing requirement, medium duration, limited practicality due to space and safety constraints, medium effectiveness
On-site ex-situ crushing of hard materials to produce a recycled aggregate for on-site re-use	4	4	2	5	15	Less costly to implement, relatively short duration activity, limited practicality due to noise, available space and possible presence of asbestos containing materials, very effective

3.4 Final Remediation Strategy

3.4.1 The final remediation strategy recommended for the Site comprises the following:

- Site-wide turnover of Made Ground to separate grossly contaminated materials and substructures for off-site removal to an appropriate facility.
- Excavation of geotechnically unsuitable materials for off-site removal.
- Placement and compaction of all materials that are suitable for re-use, all materials that are imported onto Site, to an engineered specification. Verification of the strength and stiffness of the engineered materials (which form the subgrade to the working platform) shall be undertaken by plate load testing at the subgrade surface.
- Import of recycled aggregate (meeting the grading of a Class 6F5 as set out in the Specification for Highway Works Series 600) to replace removed quantities of materials and to construct a working platform / piling mat. Verification of the strength and stiffness of the working platform shall be undertaken by plate load testing at the surface.

3.4.2 If localised areas of visible gross contamination is identified in natural material at the base of Made Ground, the impacted material may also be excavated for disposal.

4.0 Implementation Plan

4.1 Excavation Control

- 4.1.1 Excavations shall be supervised by a suitably qualified VertaseFLI Environmental Engineer who shall inform the segregation of excavated materials via watching brief into materials likely to be suitable and unsuitable for re-use.
- 4.1.2 The Environmental Engineer shall also record the base of excavations, the locations of any obstructions / substructures that cannot be fully removed and obtain verification information (e.g., photographs and samples for laboratory chemical and physical analysis) for inclusion in the verification report.
- 4.1.3 A standoff from the site boundary shall be required (a minimum of 1m) coupled with a safe excavation slope angle (at least 1:1 subject to detailed consideration by a temporary works designer) to minimise the likelihood of disturbance or damage to boundary walls, fences and tree roots. Where materials requiring removal encroach into this zone, localised steepening of the excavation slope may be acceptable subject to design confirmation.

4.2 Control of Asbestos Regulations 2012

- 4.2.1 The Environmental Engineer supervising the excavations shall have asbestos awareness training and shall adhere to the requirements set out in an asbestos risk assessment and plan of works prepared by VertaseFLI in compliance with the Control of Asbestos Regulations (CAR) 2012.
- 4.2.2 Adherence to the plan of works shall prevent the uncontrolled release of asbestos fibres during the works and manage risks to site personnel posed by any asbestos containing materials present in the Made Ground.

4.3 Re-Use of Site-Won Materials

- 4.3.1 Re-use criteria for site-won materials are discussed further in Section 5.1 . Materials that are suitable for re-use on Site shall be managed in accordance with the CL:AIRE Definition of Waste Development Industry Code of Practice (DoWCoP) (via the re-use on the site of origin route).

- 4.3.2 This shall involve preparation of a materials management plan (MMP) for the tracking of excavated materials from origin through to deposition. The MMP shall undergo declaration to the Environment Agency by a Qualified Person (QP) acting in accordance with the CL:AIRE DoWCoP.

4.4 Waste Classification for Disposal

- 4.4.1 Materials that are designated as unsuitable for re-use on Site may be considered a waste and may require classification in accordance with WM3 Guidance. Waste classification testing shall inform the most appropriate disposal route for the material depending on whether it is hazardous or not.

4.5 Imported Materials

- 4.5.1 Imported recycled aggregate shall be purchased from a market supplier subject to the availability of evidence to demonstrate that the aggregate was produced in accordance with a quality protocol and is no longer waste. Evidence shall be retained for inclusion in the verification report.

4.6 Environmental Monitoring

- 4.6.1 Daily dust, odour and noise monitoring shall be undertaken at boundary locations around site immediately prior to (to establish baseline), and during, the implementation of the remediation strategy by a trained VertaseFLI Environmental Engineer. The monitoring records shall be retained on site and included within the verification report.

5.0 Verification Plan

5.1 Excavations

- 5.1.1 Excavations shall be surveyed and photographed. Excavation side and base verification samples shall be obtained for chemical analysis at a linear frequency of 1/25 linear m (excavation sides) and 1/625m² (excavation bases).

5.2 Site-Won Materials Intended for Re-Use

- 5.2.1 Six genotoxic PAHs were identified by GEA Ltd to be present in Made Ground at concentrations above the generic assessment criteria for a standard commercial land use exposure scenario. These are listed in Table 5-1.
- 5.2.2 The commercial land use exposure scenario is conservative for a multi-storey car park because it assumes that the critical receptor (a working female) is exposed to the contaminants during working hours for a duration of 49 years between the ages of 16 and 65, primarily via inhalation of vapours.
- 5.2.3 Re-use criteria for the six genotoxic PAHs in Made Ground are given in Table 5-1. These re-use criteria represent concentrations of the contaminants in soil below which an unacceptable risk to human health is unlikely.
- 5.2.4 Two type of re-use criteria are presented for the genotoxic PAHs in Table 5-1.
- Suitable for Use Levels (S4ULs) derived using the relative potency factor (RPF) approach by LQM/CIEH (2015).
 - Category 4 Screening Level (C4SL) derived for benzo(a)pyrene using the surrogate marker (SM) approach by Defra.
- 5.2.5 Where one or more genotoxic PAHs exceed their S4UL in a sample, assuming that the PAH profile is within an order to magnitude for that of the coal tar mixture used to derive the C4SL, then the C4SL for benzo(a)pyrene may be adopted as a surrogate marker for the genotoxic PAHs instead of the S4UL as a re-use criteria for site-won material.

- 5.2.6 Compliance with re-use criteria shall be verified at a testing frequency of 1 sampler per 500m³.

Table 5-1. Risk-based chemical re-use criteria for site-won materials

Contaminant	Re-Use Criteria (mg/kg)	Type
Benzo(a)anthracene	170	S4UL (RPF)
Chrysene	350	S4UL (RPF)
Benzo(b)fluoranthene	44	S4UL (RPF)
Dibenzo(ah)anthracene	3.5	S4UL (RPF)
Benzo(a)pyrene	35	S4UL (RPF)
Benzo(a)pyrene	77	C4SL (SM)
Indeno(123cd)pyrene	500	S4UL (RPF)

Notes:

S4UL (RPF) – Suitable 4 Use Level derived using Relative Potency Factor approach

C4SL (SM) – Category 4 Screening Level derived using Surrogate Marker approach to be adopted as re-use criteria for benzo(a)pyrene (as a surrogate for all genotoxic PAHs) if one or more exceed their individual S4UL

5.3 Exported Materials

- 5.3.1 Copies of duty of care waste transfer notes shall be retained on site and included in the verification report for all materials exported off-site as waste.

5.4 Imported Materials

- 5.4.1 Imported recycled aggregate shall be tested at source to confirm it complies with the grading requirements of a 6F5. Samples shall also be obtained upon arrival to site to confirm consistency with the source material. Samples shall be obtained at a frequency of 1 per week during import.

5.5 Verification Report

- 5.5.1 A verification report shall be prepared upon completion of the works for submission to the Local Planning Authority to address the relevant planning condition.

Appendix A

Drawings

Section Legend (Y Axis Exaggerated)

- Existing Ground Level
- Proposed Excavation
- Base of Made Ground
- Bottom of Piling Mat

Model Legend

- Top of Bank
- Bottom of Bank
- Prominent Contour
- Contour
- Section Line

FIRST ISSUE

21-08-2024

Rev.	Description	Revised By	Date
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DO NOT SCALE OFF THIS DRAWING

- Critical dimensions should be checked on site prior to works commencing.
- Dimensional conflicts should be brought to the company's attention as soon as they become apparent. Failure to do so could render the contractor liable for subsequent losses.
- Copyright in this drawing and any work executed from this drawing remains the property of VertaseFLI



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WR11 2SY

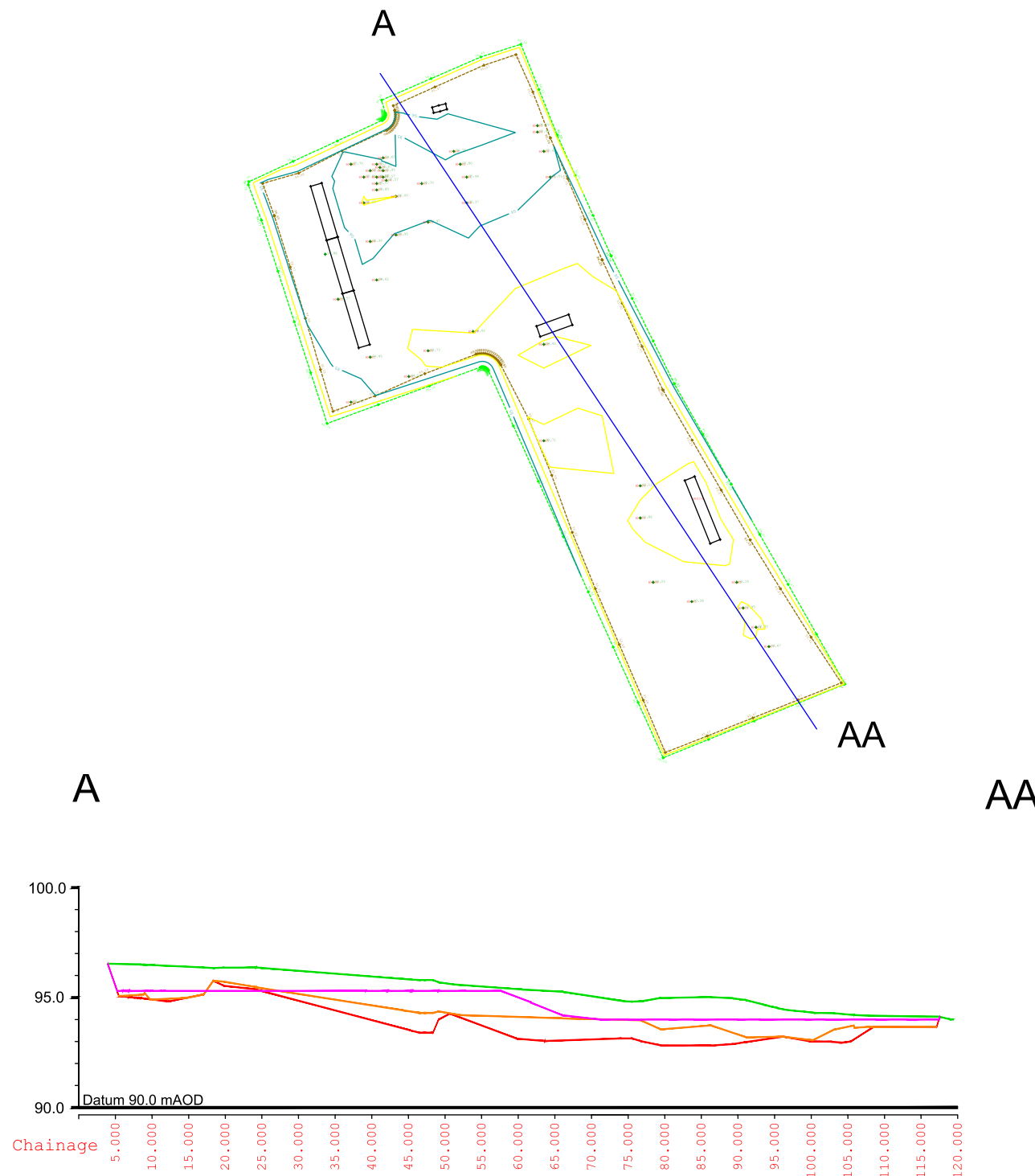
Rev:

Title: Proposed Excavation with Section

Client: Vinci

Drawn: TN Checked: MW Approved: DS

Dwg: D4900_01 Contract: 4900 Scale: NTS



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