

Remediation & Enabling Strategy and Implementation Plan

soilfix
GROUND RISK SOLUTIONS

C500.OAK-RESIP

Remediation & Enabling Works: Ford Road, Arundel, BN18 9EB

For Oakford Homes



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1. Introduction

1.1 Content and Purpose of Report

Soilfix Limited (Soilfix) has been appointed by Oakford Homes Limited (the 'client') to prepare a Remediation and Enabling Strategy and Implementation Plan (RESIP) for the former gasworks site off Ford Road, Arundel, BN18 9EB (the 'site') to render the site suitable for residential development.

Remediation works were completed on the site in 2021 by Celtic Technologies on behalf of National Grid Property Holdings to render the site suitable for a Commercial Open Storage land use.

Oakford Homes acquired the former gasworks from National Grid Property Holdings and propose to redevelop the site with two residential apartment blocks of 38 units, set at a raised level predominantly with open air parking or amenity space underneath. The development will include communal areas of soft landscape but no private gardens. The Arun District Council Planning Application reference for the proposed development is AB/88/19/PL.

Soilfix have been appointed by Oakford Homes to undertake further remediation and enabling works prior to the construction phase of the site's redevelopment. Soilfix's works are currently scheduled to commence site works in July 2022.

This document is intended to provide a statement of the remedial objectives for the site, the methods chosen to be applied including materials management, control measures, monitoring, and how validation will be completed to ensure that the objectives have been met.

This RESIP is based on and develops the RSK Further Site Investigation and Outline Remediation Strategy, ref. 29780—R02 (00), dated April 2022, which should be read in conjunction with this document.

This Soilfix RESIP as well as the RSK April 2022 report are considered to address Arun District Council pre-commencement planning Condition no. 11. Table 1 below outlines the requirements of Condition 11 along with where specific requirements are detailed in each report.

Table 1 - Condition no. 11 Requirements

Condition Requirement	Where Addressed
1. Preliminary Risk Assessment	RSK April 2022 report; Section 3 & 4 Soilfix RESIP; Section 2
2. Site Investigation	RSK April 2022 report; Section 6 & 7 and relevant appendices
3. Site Investigation interpretation, risk assessment, and Remedial Options Appraisal & Remediation Strategy	RSK April 2022 report; Section 8 RSK April 2022 report; Section 9.1 (Outline RS) Soilfix RESIP; Section 3 (ROA & RS), and Sections 5 & 6 (details of methodology)
4. Validation Plan	Soilfix RESIP; Section 8 & 9

Drawings showing the site and proposed remediation and enabling phase site setup are included in Appendix A.

1.2 Roles & Responsibilities

Key roles & responsibilities for the remediation project are set out in Table 2 below.

Table 2 - Roles & Responsibilities (Stakeholders)

Name of Party	Function / Interest
Oakford Homes	Landowner and Developer
Soilfix Limited (Soilfix)	Principal Contractor under CDM, Specialist Remediation & Enabling Contractor
RSK	Environmental Consultant providing 3rd party site investigation, risk assessment and validation services
Arun District Council (ADC)	Contaminated Land Officer / Local Planning Authority
Environment Agency (EA)	Controlled Waters / Waste Management Regulator
Southern Water	Statutory Water Authority

2. Site Characterisation

2.1 Site Location and Description

Site Address:	Former Gasworks, Ford Road, Arundel, BN18 9EB
National Grid Reference:	TQ 01277 06744
Remediation Site Area under this RIP:	Approx. 0.47 hectares

The site location is shown on Soilfix drawing C500_SITELOC included in Appendix A. Other drawings included in Appendix A show the site setting and site boundaries.

The site is currently derelict. The site surfacing is predominantly compacted aggregate, with an area of tarmac in the southeast corner. There is an electrical substation on the north-eastern boundary, which is the only above ground structure on site. The site is completely enclosed by chain-link fencing with barbed wire atop the concrete supports. Vegetation is sparse within the site's footprint and around the boundaries.

The site boundaries and immediate site surroundings are summarised below:

- **North-Western:** Footpath then Ford Road, with a cemetery directly opposite;
- **North-Eastern:** Public right of way track, then a ditch leading to the River Arun, with fields beyond this;
- **South-Western:** Residential properties and rear gardens;
- **South-Eastern:** Fields, with the River Arun approximately 50 metres from the site.

2.2 Geology, Hydrogeology, Hydrology

2.2.1 Geology

Below the made ground the site is superficially underlain by Raised Marine Deposits (mixtures of clay, silt, sand, and gravel, 0.7 to 6.3 metres in depth), the bedrock beneath this is the Spetisbury Chalk Member (chalk with flint seams, >3.8 to >7.6 metres with approximate 35 metre base).

2.2.2 Hydrogeology

According to the Environment Agency (EA) online mapping, the superficial Raised Marine Deposits are classified as a Secondary (A) Aquifer, and the Spetisbury Chalk Member is a Principal Aquifer. The lower

permeability of the alluvium impedes vertical migration of groundwater but increases horizontal migration and therefore potentially mobilised contaminants.

Being in proximity to the River Arun, groundwater is likely to be influenced by variations in the tide, with potential for saline intrusion too. Groundwater is present at an approximate depth of between 0-2 mAOD at high and low tide respectively. It is possible that perched water may be present within the shallow made ground too.

A recent Envirocheck report (2018) suggests that there are 10 licensed groundwater abstraction operations within a 2 kilometre radius. There is a single abstraction within 1 kilometre and a public water supply approximately 1096 metres northeast.

The site does not reside in a catchment area defined by the EA as a Source Protection Zone but is within a Nitrate Vulnerable Zone.

2.2.3 Hydrology

The nearest identified surface watercourse is an unnamed drainage ditch approximately 5m away from the south-eastern boundary of the site. This flows southeast and discharges into the River Arun which is located approximately 50 metres to the southeast of the site. The River Arun is a tidal river flowing in a southerly direction into the English Channel at Littlehampton on the south coast.

As part of the site's historic uses between the years 1971 and 1996, there existed a discharge consent to the north-eastern surface water drainage and consequently, the River Arun. Additionally, there was a pollution event to controlled waters of organic industrial waste recorded in 1995.

There are 4 surface water abstractions present within a 2 kilometre radius.

2.3 Ecology and Trees

There is no evidence of any ecological receptors on the site. No trees are present on the site. Trees are present outside the site, particularly along the access track off Ford Road.

2.4 Surrounding Sensitive Land Uses

Sensitive land uses (either SAC, SPA, Ramsar, or SSSIs) surrounding the site within a 1 km radius are shown on drawing C500_MTL01 in Appendix A. The only feature shown on the UK Governments Magic Map search is Arundel Park, on the South Downs, which is designated as an SSSI. As Arundel Park is approximately 600 m away from the site, no specific additional assessments are considered to be required.

Residential properties are located immediately to the northwest of the site which are considered the most sensitive receptor for the proposed remediation and enabling works.

Land uses surrounding the site are shown on drawing C500_MTL02 in Appendix A.

2.5 Site History

The site was operated as a gasworks from at least 1840, expanding in the west circa 1899, and in the south and southeast in circa 1937. Gasworks structures comprised of up to 4 no. gasholders, a retort house, including chimney/ tank, a boiler House, condensers, governor compound, liquor/ tar tanks, and associated offices and stores. It is understood that the gasworks continued operation until the mid-20th century.

2.6 Previous Investigations at the Site

Historic site investigations have been carried out on the site. The following reports relate to the investigations relevant to the recent remedial works carried out by Celtic Technologies Ltd (Celtic) in 2021 (detailed in Section below), and supplementary site investigation by RSK in 2022.

- Atkins; Ford Road, Arundel (Site No. 2551) Site Investigation Report, Report ref. 5104362/GTG.20100923/Arundel2011/R001v0, October 2011;
- Atkins; Detailed Quantitative Risk Assessment, Report Ref. 5104362/GTG.20100923/2012/R002v1, October 2012;
- Atkins; Site Information, Report Ref. 5156428/R001/V4, July 2019;
- Celtic; Supplementary Site Investigation, Factual Report, Ford Road, Arundel, Report ref. R1820/20/5043, December 2020;
- Celtic; Remediation Implementation and Validation Plan rev 2, Report ref: R1820/21/5045, March 2021;
- Celtic; Remediation Validation Report Rev 1, Ford Road, Arundel, Ref: R1820/21/5111, September 2021; and
- RSK; Further Site Investigation and Outline Remediation Strategy: Former Arundel Gas Works, Ford Road, Arundel, Ref: 29780 R02, April 2022.

2.7 Remediation Works Carried out by Celtic in 2021

Celtic carried out remediation works between June and August 2021 on behalf of National Grid Holdings. The primary objective of the remediation works was to render the site suitable for 'Commercial Open Storage' use.

In order to remediate the varying levels of contamination across the site, the site was divided into four areas on a site plan relating to historic usage, risk factors and anticipated conditions to be encountered (relevant Celtic drawings are included in Appendix A for reference). The site was further divided into nominal 10 m x 10 m grids to aid the tracking of material movements and recording of validation data. A summary of the works carried out in each area is provided below.

It must be noted that a groundwater detailed quantitative risk assessment (DQRA) was carried out by Celtic to assess the risk to the nearby River Arun located ~40m to the east. The DQRA concluded that there was no risk to the river and therefore there was no requirement for any specific remedial measures in relation to

controlled waters. However, it was decided that soils grossly impacted with petroleum hydrocarbons would be subject to soil stabilisation to reduce the ability for any contamination to leach and improve groundwater quality

Area 1 (1,200m²)

Area 1 in the south-eastern area of the site was excavated around a gasholder base, which was left in-situ. No obvious contamination was found below the base which sits on natural alluvium. A small fraction of black stained material was segregated for treatment. Obstructions were removed and remaining material screened, sampled, and validated for re-use prior to backfilling in the same area.

Area 2 (220m²)

A 5m wide strip along the south-western boundary was remediated against more stringent validation criteria due to nearby residential properties. The excavation of a 1.2m deep strip of made ground showed no visual or olfactory signs of contamination. The material was validated and reused as backfill in the same area.

Area 3 (1,000m²)

Area 3 included a shallow infilled gasholder base. Excavation around the base showed no observed contamination and with the base sitting on natural alluvium. A small fraction of black stained material was encountered on top of the slab which was segregated for treatment. The remaining shallow made ground soils were stripped, validated and reused as backfill in the same area.

Area 4 (1,300m²)

Area 4 is in the north-eastern area of the site where the main infrastructure for the historic gasworks was situated, and hence most impacted with hydrocarbon contamination. Grossly contaminated material was segregated for treatment. The area was excavated, obstructions removed only if an impediment to removing gross contamination (including cast iron former gas pipes), screened for non-treatable deleterious material and stockpiled prior to validation or treatment.

Contaminated materials from this area were subjected to stabilisation treatment in-situ (4% OPC, 8% PFA). Samples were retrieved of the treated material and tested for strength, durability and leachability. Locations of where grossly impacted material originated and its final placement after stabilisation were recorded in the Celtic Remediation Validation Report.

A summary of key points of Celtic's remediation works in 2021 are detailed below:

- Bases and faces of excavated areas were validated at a rate of 1 per 100m², or 1 per 20m² for grossly impacted material, and validated against remedial criteria;
- Reuse material was validated at a frequency of 1 sample per 100m³;
- Stabilised material was validated at a frequency of 1 sample per 250m³ and validated for strength, durability, and leachability against criteria;
- A 1m standoff area was adopted around the surface water drain running across the site;

- Small fragments of asbestos bonded cement were encountered and were collected and double bagged, approximately 10kg in total, by appropriately trained operatives, then removed offsite;
- No unexpected contamination was encountered;
- No NAPL or significant pumpable perched water was encountered, therefore no water was treated or disposed off-site during the works;
- Certain historic boreholes were decommissioned during the works. Boreholes remaining at the site following Celtic remediation works included BH201, BH202, BH104 and BH105; and
- Following remediation, all areas were backfilled with site won verified materials and covered with 300 mm of 'Type 1' granular capping layer (imported and verified against validation criteria), overlying an orange geotextile alert barrier.

A copy of the current constraints plan from the Celtic Validation Report is included in Appendix A.

2.8 Additional Site Investigation Works February 2022

RSK carried out further intrusive investigations in February 2022 to address data gaps, characterise the current conditions of the site, and identify potential environmental and geotechnical risks that would impact the proposed residential development along with an Outline Remediation Strategy. The scope of the RSK investigation is summarised as follows:

- Intrusive investigation across the site, particularly in the proposed building footprint, via 2 deep boreholes and 6 shallow window samples;
- Two groundwater monitoring wells BH101 and BH102, were installed in the deep boreholes to 10m and 12m;
- Laboratory soil chemical analysis and geotechnical testing;
- Ground gas/vapour and groundwater monitoring rounds were carried out as part of the investigation, including vapour samples submitted for laboratory analysis; and
- Tarmac tested for coal tar content.

2.9 Current Ground and Contamination Conditions

The current site conditions, as detailed in the 2021 Celtic Remediation Validation Report and the RSK February 2022 site investigation, can be summarised as follows:

- The ground surface comprises approximately 10% tarmac, with the remainder comprising of the Type 1 capping layer. Low level vegetation is also present, predominantly along the boundary of the site;
- Contaminated soils that were stabilised by Celtic in 2021 reside 0.8 – 1 mbegl in Celtic validation cells D-F (1-2), D5, E (4-5), in the north and central areas of the site. The stabilised

material was covered with a 0.5m layer of suitable for re-use made ground prior to the capping layer;

- Asbestos fibres are present within some of the made ground, with quantification analysis by Celtic in 2021 recording predominantly <0.001% (i.e. falling under the definition of 'trace' under CAR-SOIL 2016);
- Three concrete gasholder bases still remain on site in the western, southern and north-western corners of site, as well as a brick wall in the south-eastern corner of the site. Base thicknesses range between 150 – 300mm;
- A 300 mm diameter concrete surface water drain and two access chambers are present across the central area of the site;
- Remnant cast iron pipework is also present along the north-eastern and north-western boundaries;
- A live electrical sub-station (currently operated by SSE) is present on the north-eastern boundary with high voltage as well as low voltage cables exiting the sub-station below ground on its south-eastern side and crossing under the site access gate;
- A pot-ended low pressure (25 mm PE) gas pipe is also present below ground near the north-western site boundary. The gas pipe is not shown on any SGN plans and was not identified prior to Celtic's remediation works;
- Elevated dissolved phase concentrations of TPH in groundwater were recorded in RSK February 2022 well at WS201 located in the north-eastern corner of the site. Boreholes located down-gradient along the eastern boundary recorded no elevated concentrations of petroleum hydrocarbons above the analytical detection limit. The findings are consistent with those previously recorded by Celtic;
- Elevated concentrations of petroleum hydrocarbon vapours (including benzene) were recorded in the shallow wells installed by RSK during February 2022. The concentrations pose a risk to future residential users;
- Strong hydrocarbon odours are present in the some of the made ground soils, particularly in the northeast of the site; and
- In addition to the contaminated soils stabilised by Celtic in 2021, there is considered likely to be localised contamination hotspots in areas of the site not excavated by Celtic e.g. fill within gasholder bases, underlying gasholder bases etc.

2.10 Current Site Use Risk Assessment

RSKs April 2022 report did not identify any unacceptable risks to either human health or controlled waters in the sites current condition (as derelict open storage).

2.11 Future Site Use Risk Assessment

RSKs April 2022 report identified the following potentially unacceptable risks for the proposed future site condition as a residential redevelopment:

- Risk to future site users, water utility pipes, vegetation and building structure through direct contact with soils impacted with asbestos, polycyclic aromatic hydrocarbons (PAHs), and petroleum hydrocarbons;
- Risk to future site users via inhalation of hydrocarbon vapours (benzene being the risk driver); and
- Potential risk to controlled waters and future site users through piling by creation of vertical pathways (if not appropriately planned).

Further assessment and/or mitigation measures are therefore required to reduce the above risks to acceptable levels.

3. Remediation & Enabling Objectives, Strategy and Criteria

3.1 Remediation & Enabling Objectives

Based on the RSK risk assessment (April 2022), specific remedial objectives are summarised as follows:

- a) To mitigate any unacceptable risks to future site users, water supply pipes, vegetation and building structures from direct contact pathways with gasworks related contaminants in the made ground;
- b) To mitigate risk to future site users via inhalation pathways with hydrocarbon vapours, and avoid creating a risk to off-site residential properties from vapours; and
- c) To mitigate creation of any additional risk to controlled waters and future site users via new piled foundations;
- d) To avoid creating additional risk to controlled waters from mobile/leachate contaminants

Other objectives of Soilfix's proposed remediation and enabling works include;

- e) To enable the site ready for the follow-on groundworks and piling contractor for the initial part of the construction phase, including removal of buried obstructions which would otherwise impede foundation construction, and reprofiling the site to suit proposed construction levels. The existing gasholder bases will require breakout as part of this enabling;
- f) To minimise offsite disposal costs for waste soils generated during the construction phase (e.g. pile cap excavations, new utility trenches)
- g) To not cause any detrimental / nuisance environmental emissions to residents and members of the public surrounding the site;
- h) To have no detrimental impacts on environmental receptors surrounding the site, particularly the River Arun and its tributary drainage ditch;

The overall remedial objective is to complete works sufficiently to enable discharge of the relevant Arun District Council 'contaminated land' planning conditions, namely condition no. 13 (validation of remedial works). Full discharge of this condition will not be possible until later in the construction phase.

3.2 Remedial Options Appraisal

In order to provide a suitable development platform (objective e), the site requires comprehensive breakout/excavation, treatment and placement of suitable materials.

The contaminated soils stabilised by Celtic in 2021 were reused in the north and centre of the site which is within the proposed building / construction footprint. The stabilised soils are likely to classify as hazardous waste due to hydrocarbon content, which needs consideration for Objective (f). Excavation of the previously

stabilised soils would break the cementitious bonds, therefore reuse without re-stabilisation would potentially lead to an increased risk of contaminant leaching/mobility to controlled waters.

Offsite disposal of all contaminated soils is considered likely to be the only viable method to fully mitigate Objectives (a) and (b) to avoid the requirement for remedial measures to be incorporated into the proposed development (e.g. clean cover soil in landscaping areas, vapour protection in buildings etc). Offsite disposal of all made ground/contaminated soils is however not economically viable for the proposed development, or indeed a sustainable approach.

Soilfix have assessed the suitability of remedial treatment options which may be applicable for contaminated soils likely to be encountered during remedial and enabling excavations (including the Celtic 2021 stabilised materials). Stabilisation / solidification was the preferred method for treating contaminated soils adopted by Celtic in their 2021 works to render the site suitable for 'commercial open storage'. This approach acts to reduce contaminant mobility / leachability (Objective d), as well as improving soil geotechnical properties. There is no technical reason why soils previously stabilised cannot be excavated then placed in an alternative location on site and re-stabilised to rebind.

The extent of soft landscaping on the site is limited to two communal courtyards and some hedging / grassland around the periphery of the apartments (see landscape drawing presented in Appendix A). Therefore, it is considered that the use of a capping layer is the most appropriate remedial solution to ensure future site users do not come in direct contact with impacted soils, ensure a suitable growth medium for landscaping, and minimise the quantity of soils removed off-site.

In relation to the risk of hydrocarbon vapours, the relocation of the hydrocarbon impacted soils from directly beneath the proposed footprint of the building would reduce the risk to future site users but not eliminate it, therefore vapour protection measures will be required. The impacted soils should also be placed as to not increase the risk to the off-site residential properties.

3.3 Selected Remediation Strategy for Proposed Soilfix Works

The following Remediation Strategy has been selected to deliver the Remedial and Enabling Objectives in Section 3.1. The strategy is based on the Options Appraisal in Section 3.2 and also builds upon the Outline Remediation Strategy in the RSK April 2022 report.

- Site turnover and obstruction removal for construction enabling purposes;
- Reprocessing of excavated soils and aggregates to produce general fill and recycled aggregates, to reprofile the site for construction enabling purposes;
- Stabilisation/solidification (SS) of grossly contaminated soils (including those stabilised previously by Celtic in 2021), followed by reuse in an area of site where they will not be disturbed during the construction phase, and where they will be covered by external hardstanding in the proposed development (proposed car park area);
- Any untreatable materials encountered during remedial excavation, as well as surplus soils from the site reprofiling cut/fill works, to be removed offsite as waste;

- Soils with no visual/olfactory evidence of contamination can be reused as sub-capping general fill to reprofile the site ready for the construction phase of the sites redevelopment;
- Structural slabs and external hardstanding are proposed across the majority of the site (which will act as a pathway break between end users and residual made ground contaminants);
- Areas of proposed soft landscaping to have a clean cover soil layer (to act as a pathway break between end users and residual made ground contaminants);
- Vapour protection measures to be incorporated into the building/development design (to act as a pathway break between end users and residual made ground volatile contaminants);
- Protection of water supply pipes from organic contaminants via removal of made ground from proposed service trenches (source removal / management); and
- Production of a Foundations Works Risk Assessment to determine the most suitable piling method (to avoid creating an additional pathway between made ground contaminants and groundwater and/or end users).

3.4 Remedial Target Criteria

Details on the proposed criteria to determine the suitability of soils and aggregates to be retained / reused on site during Soilfix's proposed works are presented in Section 8.

4. Regulatory Requirements

4.1 Pre-Commencement Planning Condition

Prior to remediation and enabling works commencing on site, Soilfix's RESIP and the RSK April 2022 report will need to be submitted to Arun District Council and planning condition 11 of the planning approval Decision Notice AB/88/19/PL formally discharged.

4.2 MTL Deployment

All remedial treatment operations will be undertaken in accordance with Soilfix's multi-site Mobile Treatment Permit (EPR-RP3795FC) after deployment with the EA. All permitted activities will be overseen by Soilfix in-house Certificate of Technical Competence (CoTC) holders, with Technically Competent Manager (TCM) site attendance at a frequency to be agreed in the deployment.

4.3 Materials Management Plan

Reuse of soils onsite will be subject to regulation using a 'Materials Management Plan' (MMP) to be created in accordance with the CL:AIRE Definition of Waste Code of Practice (DoWCoP). The MMP will be reviewed by a CL:AIRE Qualified Person and a signed declaration submitted to CL:AIRE prior to re-use of materials on the site.

Version 2 of the CL:AIRE CoP requires validation that the works have been carried out in accordance with the MMP that has been submitted to CL:AIRE. This validation process also requires details of what types of materials, including actual volumes (as opposed to predicted volumes), were re-used and their locations on site.

4.4 Concrete Crushing

Concrete crushing works will be carried out by Soilfix on site as part of the enabling works (including concrete from breakout of the gasholder bases). Prior to mobilisation of a mobile crusher to site, checks will be carried out to ensure the correct permit (Mobile Crusher License), and notifications to the Local Authority are in place. Crushing will be carried out in compliance with the conditions of the mobile crusher permit, particularly mitigation of dust emissions.

4.5 Discharging Groundwater

Soilfix do not envisage the requirement for a temporary foul water discharge consent during the works due to the low amount of groundwater expected to be encountered. Should low volume dewatering activities be required Soilfix will remove pumped groundwater offsite by road tanker to a suitably permitted facility using a licensed carrier under Duty of Care.

5. Proposed Remediation & Enabling Works Methodology

5.1 Pre-Commencement Activities

Pre-start works for Soilfix's remediation and enabling phase will include:

- Submission and approval of all relevant regulatory permits as detailed in Section 4;
- Production of Temporary Works Designs as required for remedial excavations as well as for working platforms to be enabled ready for the construction phase;
- Risk Assessments and Method Statements will be produced and disseminated for all appropriate tasks and hazards;
- A Construction Phase Plan (CPP) will be produced by Soilfix as Principal Contractor under the CDM Regulations;
- A local residents letter drop will be carried out to inform of nature of works, duration, site contact for queries/complaints, and future progress updates if relevant; and
- Background environmental monitoring will be carried out.

5.2 Site Establishment

Site establishment will include:

- Securing the site boundary using existing and hired in fencing;
- Any remnant surface vegetation around the site boundaries will be carefully stripped and stockpiled – vegetation will be removed off-site as green waste;
- A site compound will be mobilised to include suitable welfare facilities, offices, parking, smoking area and waste skips;
- All site personnel and visitors will be inducted by the Soilfix Site Supervisor;
- Firefighting, spill kit and first aid provisions to be positioned in suitable locations across site and emergency muster point designated;
- Mobilisation of remediation equipment and plant required for the works;
- Protection of the existing storm drainage run and inlets to mitigate risks during the remediation works (to include a stand-off around the storm drain until the groundworks contractor completes diversion works);
- Protection of existing groundwater / ground gas monitoring wells;
- All fuel storage facilities will be bunded to 110% capacity;
- Demarcation of work areas. A combination of temporary safety fencing (Heras or temporary barriers) and signage will be established;

- Service plans and utility trace will be consulted and a service trace using a CAT scanner will be conducted;
- A buried utility and drainage survey will be carried out (including reference to Celtics Constraints Plan post their 2021 works), followed by hand excavation to expose services to confirm locations where required. Establish safety controls to protect workers and retained assets prior to works commencing;
- The electrical substation building will be securely fenced with warning signage displayed and a safe excavation standoff distance to this structure put in place;
- Dust suppression equipment will be established; and
- Environmental monitoring points will be setup around the site perimeter, including a period of baseline monitoring pre-start.

5.3 Over pumping of storm drain, and diversion works

A groundworks contractor instructed by the Client will be responsible for diverting the existing storm drain across the site. The 300mm diameter concrete surface water drain and two access chambers are present across the central area of the site, as shown on drawing MTL03 in Appendix A.

To facilitate the diversion Soilfix will provide over-pumping of the storm drain. Water shall be pumped into the sluice running parallel to the eastern boundary of the site until the diversion is completed.

5.4 Strip of Type 1 aggregate capping layer

As detailed in Section 3.3, previous remediation works left a 300mm protective cover layer of Type 1 granular aggregate (sourced from Torr quarry, Somerset), overlying an orange geotextile alert barrier. The imported material was tested in accordance with the Celtic Remedial Implementation Plan and was deemed suitable for use on site. Soilfix will carry out a controlled surface strip of the capping material (estimated 1,200 m³) and use a dumper on site to transfer this to stockpile. The material will remain in a stockpile which will be tracked under a materials management plan, until required for processing and re-use on site within the development platform (refer to later sections of this report).

5.5 Strip of Surface Tarmac in Southeast of Site

Approximately 10% of the site remains as an area of tarmac hardstanding (estimated volume of 36m³). This area will be lifted using an excavator under a watching brief for underlying unforeseen contamination.

RSK have tested the tarmac for coal tar content as part of their further site investigation works in 2022; no coal tar was identified within the material.

The tarmac once excavated will either be processed to produce a recycled aggregate for reuse in the development or removed from site by a licensed waste contractor.

5.6 Targeted Excavation & Segregation of Materials

Areas requiring targeted excavation include over-excavation of hydrocarbon contaminated hotspots below the primary cut formation, and excavation of previously stabilised fill as shown on the drawings presented in Appendix A.

These areas will be excavated under the supervision of the Remediation Engineer, with soils separated into grossly contaminated, moderately contaminated and lightly contaminated. This will be determined by visual and olfactory evidence of the material upon excavation, along with photo ionisation detector (PID) readings derived during the works.

Soils will be stripped back in layers to allow the identification of any unknown contamination which may be present and transported to the designated storage / processing area.

Excavation works to facilitate the removal of the gasholder bases and to reach the remediation formation level will require excavation to be completed in close proximity to the site boundaries. Temporary works design checks will be carried out prior to excavation near the site boundaries to avoid causing any slope stability or undermining adjacent infrastructure.

Transportation of excavated material across the site will be undertaken by a tipping dumper. Care will be taken not to overload the dumper to minimise the loss of load during transit across the site.

5.7 Mechanical Screening / Modular Processing

Suitable excavated made ground will be screened to remove any oversize hardcore & deleterious materials. Physical segregation treatment will be achieved primarily using either a riddling bucket attachment or a 3-way mechanical screener loaded by a 360 excavator. Separated fractions will comprise:

- **Oversize or bulk hardcore** segregated during excavation & screening works to be processed and crushed to a suitable grading for re-use onsite; and
- **General Deleterious Materials** such as plastic, wood, glass, metal etc will be segregated and removed offsite as waste to a permitted recycling facility.

5.8 Segregation / Handpicking of any Asbestos Containing Materials

Trained operatives will handpick any visible bound asbestos containing materials (ACM) fragments (expected to be limited to sporadic cement sheet), and place them directly into asbestos waste bags, which will then be double-bagged and transferred into a designated lockable asbestos skip. Picking will either be undertaken at the excavation face, or soils systematically spread and picked in batches. When handpicking is completed, the asbestos skip will be removed offsite as waste under duty of care. Safe working procedures for working with asbestos materials will be followed in accordance with current HSE guidance, including regular damping down and / or fine mist suppression during treatment activities. Reassurance airborne fibre monitoring will also be carried out.

5.9 Targeted Breakout of Subsurface Obstructions, including Gasholder Bases

Obstructions will be removed to a minimum depth of 200mm below proposed pile caps, ground beams and drainage infrastructure to facilitate construction. Any remnant obstructions that are impracticable to remove due to depth or fluctuating groundwater level will be recorded, and the Clients structural engineer notified the determine requirement to relocate proposed piled foundations.

Clean oversize concrete/brick from gasholder bases, foundations, brick walls and other buried obstructions will be removed on discovery and stockpiled for later processing.

Any remnant pipework containing tars / liquors will be carefully removed and allowed to drain into a contained excavation area or the contents pumped directly into an IBC.

Concrete gasholder bases will be removed using a 360° excavator and toothed bucket, with a hydraulic breaker attachment being used to assist in breaking the concrete into more manageable sections during removal. Foundations will be pulled in large sections (where feasible) rather than being broken out in-situ, in order to reduce noise / vibration emissions as low as reasonably practicable. These sections will be rotated / shaken by a 360° excavator equipped with a riddling bucket to enabling the removal of any adhered Made Ground, thus minimising the potential for cross contamination of soils with the concrete. Any such Made Ground will be returned to the underlying soil for subsequent processing.

Lifting of concrete slabs and any in-ground obstructions will be accompanied by a watching brief to check for asbestos containing materials (ACM's) which may be cemented to the underside of the slab, as well as checking for any other possible signs of contamination such as visible hydrocarbon staining. Contaminated sections will be kept separate from site won concrete regarded as "clean".

Large sections of concrete, visibly free of asbestos and Made Ground, will be further broken up into smaller pieces, using the hydraulic breaker, to aid the subsequent crushing process. During breaking, adequate dust suppression will be provided by the means of a jet wash and bowser unit to mitigate dust generation. All concrete suitable for crushing will be stockpiled on-site, in the proposed area where the crusher will be positioned.

5.10 Crushing / Processing to Produce Recycled Aggregates

Recovered Type 1 material from the existing cover layer will be transferred to a stockpile and remain available for re-use as fill. A portion of this material will be crushed and regraded as 'Type 3' material (also known as DOT Type 3), which will be subject to grading and classification, which will have a reduced fines content in comparison to the current Type 1 material, for reuse during the construction phase as pipe bedding,

Concrete from below ground obstructions and gasholder bases, and mixed aggregates (such as brickwork) segregated during breakout / screening operations deemed suitable for crushing will be processed on-site to a 6F2 grading. This material will then be utilised in the development platform for the follow-on contractor.

The crusher will be delivered to site using a low loader and will be unloaded in the designated unloading area. It will then be manoeuvred into place by a suitably trained operator. To minimise the impact of noise

and dust, the concrete crusher will be positioned away from the sites western boundary with the residential housing as far as practicable.

The crusher will be loaded using a 360° excavator, with a suitably sized bucket. The excavator operator will be instructed to avoid loading oversized material, scrap metal and any other material which may block or stall the machine. They will also be advised to not load the material from height to avoid increased dust generation.

Any dust generation during crushing will be suppressed by a sprayer bar fitted at all times during operation to the output belt of the crusher, and a mobile 'dust fighter' suppression unit deployed under dry conditions. Noise and dust monitoring will be completed at the designated monitoring points around the site boundary.

5.11 Groundwater / LNAPL Management

Based on the previous site investigation as well as Celtics 2021 remedial works, minimal groundwater is expected within the proposed excavation depths of Soilfix's works.

Any groundwater encountered will be managed via pumping and vacuum tanker collection and removal offsite as waste. Any LNAPL encountered will be contained using oil-absorbents, which will then be disposed offsite under duty of care.

5.12 Stabilisation/Solidification (SS) Treatment

Stabilisation/Solidification (SS) treatment is proposed to treat the grossly impacted hydrocarbon contaminated soils which will be segregated during primary / targeted excavation of the site.

SS treated soils will be required as part of the site cut/fill balancing to reprofile the site.

Re-treatment of the soils previously stabilized by Celtic in 2021 is expected to require only the addition of cement powder (i.e. dry mix) to rebind. Treatment of soils excavated from hotspots not treated by Celtic in 2021 will require wet slurry mix SS treatment applying in grout form.

During subsequent curing, residual contaminant concentrations would be bound into the stabilized soil, combined with a reduction in permeability to reduce residual leachability of the treated material.

5.13 Cut / Fill Site Reprofiling and Materials Management Earthworks

The site will be reprofiled by cut and fill operations to prepare it at levels suitable for the follow-on construction phase. Standard earthworks practices for fill classification, placement and compaction will be followed. A detailed breakdown on material volumes to be generated, processed and reused will be included in a separate Soilfix Materials Management Plan under the CLAIRE DoWCoP.

Cut fill works will include the reuse of SS treated soils in the west/central area of the site in the footprint of the proposed car parking area (no drainage is proposed in the car park design), where there will be no requirement to disturb the material during the construction phase. Drawing SF-001 in Appendix A shows the indicative location for the reuse of the SS treated soils.

The remedial works carried out by Celtic included a 5m cut-off strip along the western boundary which was assessed to a higher residential standard to ensure that there was no risk to off-site properties from the migration of vapours. The SS soils impacted with hydrocarbons will be placed beneath the proposed car park, located a minimum of 5m from the boundary (or residential properties). Therefore, a sufficient cut-off (as modelled by Celtic) will be maintained to ensure there is no risk to these off-site properties.

5.14 Working Platform (Pile Mat) Construction

Working platforms will be installed ready for the piling and ongoing construction phase. The platforms would be subject to a Temporary Works Design (TWD).

The provisional working platform design (subject to design check) is 600mm thickness. This comprises 450mm of suitable soil fill subjected to cement stabilisation using either an excavator mounted mixing wheel or tractor towed rotivation plant to improve its geotechnical characteristics (minimum 15% CBR). The cement stabilised fill will be capped with a 150mm protective running layer of site-won crushed aggregate material to the required 'top of pile mat' formation, to provide a suitable working surface for the piling rig and ongoing construction.

Tensar / geogrid will be included in the lower pile mat area, subject to validation in the Temporary Works Design, to reduce the pile mat thickness and/or depth of excavation required.

A ramp will also be constructed to facilitate access between the upper and lower areas of the site. The ramp would also be subject to a Temporary Works design as for the platforms. Loading tests will be undertaken to validate the design in accordance with the specification set out in the TWD.

Plate-loading tests would be carried out to validate the platform meets the criteria set out in the TWD

A schematic cross section drawing is included in Appendix A (SF-003) which summarizes the sites present and proposed profile.

5.15 Loading and Offsite Disposal of Surplus Soils

All surplus soils removed from site will be undertaken in line with duty of care, using a licensed haulier removing the material to a suitably licensed facility. Waste transfer notes will be obtained for every load of material removed from site and included in the completion report for the project. Suitable traffic management controls will be put in place to manage tipper lorry access, movement and egress at the site.

6. Remedial Measures During Construction Phase

The following measures will be completed after Soilfix's proposed remedial and enabling phase, during the construction phase by other contractors.

6.1 Clean Cover System in Proposed Soft Landscaping Areas

The risk of direct contact pathways from residual soil contaminants to future site users will be mitigated through the installation of a clean cover soil system in all proposed soft landscape areas.

The design of the clean cover system shall comprise a 150mm capillary / no dig layer comprising of crushed aggregate, overlain by a minimum 450mm of imported subsoil and topsoil. A visible marker layer (orange in colour) should also be placed at the base of the clean cover system to act as a visual warning for any future maintenance works. Validation of the clean cover system is further discussed in Section 9.

6.2 Vapour Protection to Proposed Buildings

Elevated concentrations of petroleum hydrocarbons have been recorded that pose a risk to future site users, therefore vapour protection measures will be installed to break the pathway between the impacted soils and future residential users. The following measures are proposed:

Table 3 – Vapour Protection Measures

Gas Protection Measure	Justification
The residential buildings will have 300mm ventilated subfloor void.	Passive protection that would dilute / disperse any vapours. The ventilation would also act as pressure relief if as the movement of vapours may be caused by hydraulic pumping of the underlying groundwater due to tidal variations.
A membrane suitable to mitigate the risk from hydrocarbon vapours shall be installed within the proposed residential properties.	The membrane shall act a barrier to prevent the ingress of vapours into the properties. The membrane shall be compliant with CIRIA C784' guidance on the use of plastic membranes as a VOC barrier'. The installation of the vapour membrane shall be overseen by an appropriately qualified NVQ qualified installer.
Service entries into the building shall be sealed.	All services entries into the building shall be sealed so that do not act as pathway for the migration of vapours.
Services leaving the site shall be sealed.	Services leaving the site should also be sealing using a bentonite plug to prevent the off-site migration of vapours.
Car parking	No measures specified given that the car park is open and any vapours would dilute and disperse in the atmosphere.

Further details on the design of the gas protection measures method of installation and verification will be set out in a separate report.

6.3 New Water Supply Pipe Specification

All new water infrastructure pipes should be specified in consultation with the regional water supply company, to be suitably protective against the identified contaminants. Confirmation is required of the agreed design.

6.4 Piling

A Foundations Works Risk Assessment is required prior to piling works commencing, to determine appropriate piling techniques with regard to avoiding the creation of additional potential contaminant pathways (for either vapours or mobile contaminants). This assessment is currently being produced by RSK and will be issued separately.

As part of mitigating this risk, placement (reuse) of contaminated soils treated by SS shall be in areas of proposed external hardstanding only (future car park area), to avoid piling through this material.

6.5 Monitoring Well Decommissioning

Any monitoring wells deemed redundant by the consultant RSK will be decommissioned in line with EA guidance to remove the direct pathway to groundwater.

The borehole will be backfilled to either mimic the natural ground conditions (low permeability backfill for high permeability zones for example) or by sealing the well completely using low permeability material (grout). Each well to be decommissioned will have a record sheet and include photographic evidence post and pre works.

7. Environmental Management

7.1 Supervision

The remediation and enabling works will be supervised by an experienced, Site Supervisor Safety Training Scheme (SSSTS)-accredited person. Soilfix propose to use site operatives who are highly experienced in the proposed treatment operations. All site staff will receive appropriate training with regard to potential contamination on site, the associated risks, control measures and the remediation methodology. A record of all attendees at induction training and toolbox talks will be kept in the site filing system.

The Waste Management Industry Training and Advisory Board (WAMITAB) Certificate for the principle Technically Competent Manager (TCM) proposed for this project is included in Appendix D.

A WAMITAB TCM will visit the site a minimum of 2 hours per week during set-up and initial treatment activities. The proposed Soilfix site manager and foreman for this project both have significant experience of the soil treatment techniques proposed (screening, stabilisation/solidification) and are able to work unsupervised after initial set-up and commissioning. All treatment works will be in accordance with the deployment of Soilfix's Mobile Treatment Licence with the Environment Agency.

RSK will attend site during the remediation works to undertake validation sampling and borehole monitoring, the results of which will be used as lines of evidence to demonstrate that the remediation objectives have been achieved. Validation methods and thresholds are discussed further in Section 8.

7.2 Existing Site Drainage

A 300 mm diameter concrete surface water drain runs through the site, draining vegetated land to the west of the site, and discharging to the unnamed drainage ditch to the east of the site. The ditch then discharges into the River Arun to the southeast of the site. Two access manholes are present across the central area of the site for this drain.

The drain will be diverted around the site's southern perimeter during the initial stage of Soilfix's remedial and enabling works by a specialist contractor, as described in Section 5. The drain will be protected by signage and fencing at all times to avoid damage or breach. A minimum 1m standoff distance will be maintained by all earthworks plant. Contaminated soils will not be stockpiled in proximity to the drain.

7.3 Containment & Quarantine

7.3.1 General Controls

Remedial reagents will be kept in approved supplier containers and stored in accordance with COSHH and away from incompatible materials.

Spill-kits and drip trays will be deployed at the locations of plant and equipment, and all fuel will be stored in a bunded tank with capacity of 110% of the storage volume.

7.3.2 Screening Treatment

Mechanical screening treatment of soils containing no mobile contaminants (i.e. only containing oversize concrete/brick, deleterious plastic/wood/glass materials, and bonded cement ACMs) does not present a risk of mobilising contamination via runoff to ground/groundwater. An impermeable bunded area for this treatment activity is therefore not required. Screening locations will be kept away from the site boundaries as far as practicable, and carefully managed in times of high winds to avoid windblown transport of any segregated light fractions offsite.

7.3.3 SS Treatment

Treatment of soils containing hydrocarbons may present a risk of mobilising contamination via runoff to ground/groundwater if uncontrolled. The proposed SS treatment involving addition of stabilisation binders will be carried out insitu within the excavation and/or placement area. An impermeable bunded area for this treatment activity is therefore not required. The addition / mixing of cement will utilise any free water in the soils as part of hydration reactions. SS treatment will be avoided during periods of heavy rain to prevent uncontrolled runoff.

7.3.4 Quarantine for Unexpected Contaminants

Should unexpected contaminated materials be encountered during remedial excavations then a Quarantine Area will be constructed for temporary storage as per the conditions of Soilfix's mobile plant permit (bundled impermeable area).

7.4 Remediation & Enabling Phase Conceptual Site Model

A remediation and enabling phase Conceptual Site Model assessment for Soilfix's proposed works is included in Appendix B.

7.5 Emissions Control and Monitoring

Four environmental monitoring points are proposed around the remediation area boundaries. A detailed Emissions Monitoring and Control Plan is included in Appendix C.

Environmental monitoring will be carried out by competent remediation personnel with a minimum of two years' experience. Environmental monitoring results will be audited and acted upon by personnel with a minimum of 8 years remediation experience.

7.6 Quantity Measurement, Quality Assurance and Record-keeping

Careful tracking of materials will be carried out throughout all stages of Soilfix's works to comply with Soilfix's Environmental Mobile Plant Permit as well as a Materials Management Plan under the DoWCoP which Soilfix will produce to regulate the reuse of treated soils. The Soilfix Remediation Engineer will record all details both in paper format on site and then backed up electronically. The Soilfix Remediation Engineer will maintain a stockpile register during the works to include full details of materials being treated, with tracking based on a validation grid system applied to the site plan. Details in the stockpile register, including material

origin, identity, volume, location, chemical analysis for validation, status, etc. will be audited on a regular basis by the Soilfix Project Manager and visiting Technically Competent Manager. Experienced and vigilant site operatives will monitor excavations and stockpiles to determine the nature and treatability of materials.

Preliminary, interim and final topographical survey visits will be carried out to ensure agreed levels are met and to volumise stockpiles.

7.7 Discovery Strategy for Unforeseen Contamination

Whilst the site investigations and 2021 remedial works previously undertaken on the site are considered to be thorough, it remains possible that unexpected soil or groundwater conditions may be encountered during Soilfix's proposed works. Should unexpected contamination conditions be encountered then the Discovery Strategy included in Appendix E will be followed, and Arun District Council will be notified as per Planning Condition no. 12 to agree a methodology to deal with the unexpected contamination.

7.8 Permit Breach Responses

If a condition of Soilfix's mobile plant permit is in danger of being breached (or has been breached) then activities in the affected works area will be immediately halted. All efforts will be diverted into remedial action. During this works stoppage controls will remain in place to prevent any further breaches. Any breach of a permit condition will be recorded and a verbal notification will be made to the EA and Environmental Health Officer (EHO) followed by a written report.

7.9 Waste Classification and Duty of Care

All waste disposal will be carried out fully in accordance with Section 34 of the Environmental Protection Act (Duty of Care), with all loads accompanied by a completed waste transfer or consignment note signed by the waste producer, waste carrier and waste receiver.

Soilfix will ensure that all waste carriers licences and receiving facility waste permits are current, valid and 'fit for purpose' for the particular waste classification.

8. Validation of Remediation and Enabling Phase Works

8.1 Controlled Waters Validation of SS-treated Contaminated Soils

8.1.1 Validation Criteria

Specific risk-based remedial targets for soils to verify their suitability for retention or reuse on the site in a commercial open storage scenario were derived by Celtic to be protective of controlled waters through a DQRA assessment. These criteria were set out in Celtics Remediation Implementation and Validation Plan dated March 2021. Soilfix propose to adopt the same leachate criteria as validation criteria for SS treated hydrocarbon contaminated soils during the proposed remedial and enabling phase. These criteria are presented in Table 4 below.

Table 4 Proposed Leachate Remedial Criteria in mg/l protective of controlled waters

Substance	Site Wide Porewater Criteria
TPH Aliphatics C8-C10	2,500 ⁽¹⁾
TPH Aliphatics C10-C12	4,300 ⁽¹⁾
TPH Aromatic C8-C10	2,000 ⁽¹⁾
TPH Aromatic C10-C12	2,000 ⁽¹⁾
TPH Aromatic C12-C16	2,000 ⁽¹⁾
TPH Aromatic C16-C21	2,000 ⁽¹⁾
TPH Aromatic C21-C35	2,400 ⁽¹⁾
TPH Aromatic C35-C44	2,400 ⁽¹⁾
Benzene	2,000 ⁽¹⁾
Phenols	1,600
Benzo[b]fluoranthene	6.9 ⁽¹⁾
Benzo[k]fluoranthene	7.4 ⁽¹⁾
Benzo[ghi]perylene	0.74 ⁽¹⁾
Benzo[a]pyrene	0.041 ⁽¹⁾
Fluoranthene	1.3 ⁽¹⁾
Indeno[123-cd]pyrene	0.45 ⁽¹⁾
Naphthalene	400 ⁽¹⁾
Anthracene	21 ⁽¹⁾
Easily Liberatable Cyanide	200

(1) above theoretical saturation limits

8.1.2 Validation Frequency and Methodology

The sampling frequency will comprise the following as a minimum:

- Samples of treated material will be taken during the in-situ SS mixing process at a rate of 1 per 250m³ and placed in cured moulds (UCS tubes) with air expelled, a lid placed over the exposed end and allowed to cure for 28 days at ambient temperature;

- Stabilised samples will be sent for tank leachate testing, to confirm that the residual leachability of the treated material is acceptable. A 3-point test will be carried out at time intervals of 7, 14 and 28 days.

Samples will be sent to a UKAS / MCERTS accredited laboratory, with appropriate sample consignment, transportation and chain of custody adhered to.

8.2 Human Health Validation of SS-treated Contaminated Soils

8.2.1 Validation Criteria

Hydrocarbon impacted soils that are excavated during the enabling works will be treated via soil stabilisation and placed beneath hard standing within the car park. Future site users will therefore not be able to come into direct contact with these soils. Vapour protection measures will be installed within the apartment to mitigate the risk of indoor inhalation of hydrocarbons. The only potential risk to site users is considered to be the inhalation of vapours outdoors. The risk is considered to be low as the car park is open and any vapours released into the air would be significantly diluted / dispersed. The primary risk drivers from vapours are considered to be the outdoor communal spaces.

It is proposed that the human health assessment criteria produced by Celtic for their 2021 works for off-site residential properties is adopted for Soilfix's works. These criteria considered the risk to residential uses from inhalation of vapours indoor and outdoor ~7m from the source area. The proposed communal soft landscaped area located in the northwest corner is approximately 8m from the proposed car park where the impacted SS treated material is to be placed, and so the Celtic criteria are considered suitably protective.

Only the criteria for benzene and aromatic hydrocarbon band C8 to C10 have been adopted as these were as the contaminants of concern identified during RSKs April 2022 vapour survey. The assessment criteria are;

- Benzene – 246 mg/kg (for outdoor air only); and
- Aromatic C8 to C10 – 34,000 mg/kg (for outdoor air only).

8.2.2 Validation Frequency and Methodology

The sampling frequency will comprise 1 sample per 250m³ of SS treated material.

Samples will be sent to a UKAS / MCERTS accredited laboratory, with appropriate sample consignment, transportation and chain of custody adhered to.

8.3 Validation of excavation base and walls in areas containing contamination

8.3.1 Validation Criteria

Following excavation of hydrocarbon impacted soils, the base of excavation in areas containing contaminated material will be tested to confirm the underlying soils meet the validation criteria set out in Section 8.1 and 8.2.

8.3.2 Validation Methods and Frequency

The sampling frequency will comprise the following as a minimum:

- A frequency of 1 composite sample per 100 m², generally equivalent to one sample per 10 m x 10 m grid;
- Boundary face of excavations at a frequency of 1 composite sample per 10 linear metres of excavation face;

Samples will be sent to a UKAS / MCERTS accredited laboratory, with appropriate sample consignment, transportation and chain of custody adhered to.

Leachate analysis on will be carried out using standard 10:1 eluate preparation methods.

In addition to the above, visual and olfactory observations will be utilised to aid validation during the works, with a photographic log of key stages kept and submitted with the Contractor's Completion Report.

8.4 Validation of General Site-won Soils reused as sub-capping fill

8.4.1 Validation Criteria

General site-won fill with no evidence of contamination (and not subjected to SS treatment) will be tested to confirm it meets the validation criteria set out in Section 8.1 and 8.2.

As this material will be reused in areas of the site where it will be partially excavated during the construction phase, additional validation criteria are proposed as follows for protection of construction workers:

- No visible ACMs;
- No deleterious material content (e.g. wood, plastic etc) above incidental levels.
- Soils will also be analysed for a typical made ground contaminant suite (heavy metals, pH, TPH, PAHs, asbestos) to provide the construction contractor with information on the expected waste classification of the soils.

Should any future contractor wish to remove any material from site, waste soil arisings will need to be classified in accordance with Environment Agency Guidance WM3.

8.4.2 Validation Methods and Frequency

The sampling frequency will comprise the following as a minimum:

- A frequency of 1 composite sample per 500 m³

Samples will be sent to a UKAS / MCERTS accredited laboratory, with appropriate sample consignment, transportation and chain of custody adhered to.

Leachate analysis will be carried out using standard 10:1 eluate preparation methods.

In addition to the above, visual and olfactory observations will be utilised to aid validation during the works, with a photographic log of key stages kept and submitted with the Contractor's Completion Report.

8.5 Validation of Site-won Aggregates

Site-won aggregates will be used by Soilfix as part of the development platform, pile mat and ramp. Soilfix will be reusing site-won aggregate in two ways: (1) recovery of the Type 1 capping layer from the previous remediation works, and (2) crushing of site won material from recovered concrete / bricks / tarmac from obstructions.

8.5.1 Validation Criteria

Proposed validation criteria for recycled aggregates are:

- Conformance with the relevant grading limits in the Highways Specification (whether 6F2, Type 3 etc);
- No visible ACMs; and
- No deleterious material content (e.g. wood, plastic etc) above incidental levels.

8.5.2 Validation Methods and Frequency

The sampling frequency will comprise the following as a minimum:

- A frequency of 1 composite sample per 500 m³

8.6 Earthworks / Geotechnical Validation

Geotechnical testing will be completed for the pile mat and ramp in accordance with the temporary works designers recommendations.

Testing is expected to comprise incremental plate load testing on the top of the constructed pile mat and ramp, to confirm a minimum of typically 10-15% CBR, as well as less than 10mm of total settlement at 1.5 times proposed pile rig loading.

In addition, general earthworks characterisation testing will be completed on the sub capping fill material which may include grading analysis, moisture content, and Optimum moisture content / Maximum Dry Density testing.

8.7 Groundwater Validation Monitoring

A recent groundwater monitoring round was carried out during the additional site investigation carried out in February 2022 by RSK. It is proposed to use this as a pre-remedial and enabling works baseline round. Further groundwater monitoring is proposed to demonstrate that site activities during the enabling, remediation and piling works do not detriment the underlying groundwater.

The following groundwater monitoring regime is proposed:

- Three designated monitoring wells to be protected throughout the works - one northern boundary and two southern boundary (down gradient) wells. The wells to be kept are BH101, BH104 and BH105 as shown on the plan contained in Appendix A.
- Low-flow sampling at each well location, with each sample analysed for a suite to include the contaminants of concern associated with the site (principally TPH); and
- Monitoring frequency proposed at one round during Soilfix's remedial and enabling works, and one round after these works have been completed (also to act as pre-piling baseline). Results to be compared to the baseline values already collected in February 2022.

Groundwater samples will be sent to a UKAS / MCERTS accredited laboratory using appropriate containers under a chain of custody.

8.8 Watching Brief

If any unexpected contamination is encountered during the course of the remediation works the following course of action should be adhered to (which is also summarised in Appendix E):

- The contractor shall immediately inform the Environmental Consultant who shall then carry out an inspection as soon as is reasonably practical;
- Following the inspection, the Environmental Consultant shall advise of any requirements for additional investigations or possible modifications to the remediation works; and
- The Regulatory Authorities shall be consulted if any substantially different conditions are encountered or modifications to the remedial works are required.

8.9 Soilfix Completion Report

A Contractors Completion Report will be compiled by Soilfix on completion of the remedial and enabling works phase. This report will include:

- Photographic record;
- 'As-built' Topographical Survey of completed site formation, with the locations of any remaining in-ground structures or piles recorded for construction purposes;
- Site layout drawing showing the locations of all stabilised materials as well as any recycled aggregates stockpiled on site for future use by the follow-on contractor;

- Waste duty of care information (carriers licence / disposal permits, Duty of Care Register and copies of all waste consignment notes);
- Copies of all QA / QC;
- Results of chemical / geotechnical analysis;
- Results of validation sampling;
- Confirmation the remedial objectives have been achieved; and
- Details of any deviations from the Remediation Strategy and appropriate mitigation measures taken.

8.10 RSK Validation

RSK will carry out periodic site visits during Soilfix's remedial and enabling works for validation / inspection purposes. RSK will produce a Validation Letter Report which will include Soilfix's Contractors Completion Report as an Appendix, with the RSK report then being submitted to Arun District Council Planning to partially discharge Condition 13 (with full discharge only possible after validation of the remedial measures to be implemented during the construction phase – refer to Section 9)

9. Validation during Construction Phase

9.1 Clean Cover System in Proposed Soft Landscaping Areas

RSK will undertake validation of clean cover layers installed during the construction phase.

This will comprise:

- Details on the proposed topsoil, subsoil and aggregates used for the clean cover system shall be provided to RSK prior to importation. These shall contain information on the source, volume of material to be imported and chemical test data to confirm suitability for use;
- Imported topsoil and subsoil shall be tested at a sampling frequency of 1 sample per 100m³ from a greenfield source or five samples per source whichever is greatest, and analysis results shall comply with RSK assessment criteria for a residential end use without plant up-take (as presented in Appendix F);
- The sampling frequency shall increase to 1 sample per 50m³ or a minimum of five samples (whichever is greatest) if the material is imported from a brownfield site. This will need to be carried out under a material management plan or suitable waste exemption;
- Imported aggregates for use in the no-dig layer shall comprise crushed concrete. The material shall be sampled and analysed for an asbestos screen; and
- A representative from RSK shall validate the thickness of the no-dig break layer and subsoil / topsoil layer installed in soft landscaped areas through periodic site visits.

9.2 Vapour Protection to Proposed Buildings

The installation of the vapour protection measures shall be verified in accordance with guidance CIRIA C735.

This will include:

- Inspection of the passive ventilation measures;
- Confirmation that services leaving the site boundary have been sealed via inspection / evidence provided by the groundworker;
- A suitability qualified person to verify the installation of the gas membrane.

Further details on the verification of the gas protection measures will be provided in a separate report to be produced at a later date.

9.3 New Water Supply Pipe Specification

The risk assessment identified a potential risk to water supply pipes from organic pollutants. The results of the site investigation should be forwarded on to the local water authority to confirm the pipe selection. Details on the agreed solution will be recorded along with evidence (as built drawings, photos, site inspection) that the pipes have been installed as the water authority's requirements.

9.4 Piling

A separate piling risk assessment is being prepared by RSK and will be available under separate cover and will outline any specific requirements.

Piling will be supervised to ensure the agreed method is being implemented correctly. RSK will obtain certification from the contractor installing the piles that these have been installed correctly as per the design. It is expected that RSK will complete an on-site inspection during and after the installation works, with any findings summarised in a written validation report.

9.5 Groundwater Monitoring

The scope of groundwater monitoring required during the construction phase will be determined following completion of the remediation works and the post-remediation groundwater monitoring round described in Section 8.7.

9.6 Waste Materials

All soils removed off-site shall be transported to an approved licensed waste management facility for treatment or final disposal. The contractor shall provide a full documentary record of this operation in accordance with the Duty of Care. This should include source/location from where the waste was excavated from, volume of waste, waste transfer notes and details of the receiving site. Copies of the landfill documents shall be provided to the Environmental Consultant for inclusion in the verification report.

9.7 Watching Brief

If any unexpected contamination is encountered during the course of the construction works the Discovery Strategy referenced in previous sections should be followed (also Appendix E), however this is not expected due to the nature of the prior remedial and enabling works to be carried out.

9.8 Construction Phase Validation Report

A validation report will be produced on completion of the construction phase remedial works by RSK and will be issued to Arun District Council for comment and to allow full discharge of Planning Condition no. 13. This document should include the following sections:

- Records of installation and inspection of vapour protection measures
- Records of installation and inspection of clean cover layers in soft landscaped areas;
- Records of installation and inspection of water supply pipes;
- Records of installation and inspection of piled foundations;
- Any construction phase groundwater monitoring analysis;
- Site photographs;
- Details of any waste disposal movements and waste transfer notes;

- The results of soil sampling and analysis; and
- Details of consultations with regulatory authorities.

10. Health & Safety Management

10.1 General

The remediation and enabling works will be carried out fully in accordance with the Construction Design Management (CDM) Regulations 2015, with Soilfix performing the role of Principal Contractor. A Construction Phase Plan (CPP) will be prepared for the remediation phase of works prior to Soilfix commencing on site and will detail all relevant health and safety information for the works.

All works will be carried out in accordance with relevant legislation and approved Codes of Practice (ACoP's). In particular, the Health and Safety Executive (HSE) Document '*Protection of workers and the general public during the development of contaminated land*' to prevent pollution and associated nuisance from remedial and associated works.

All personnel are adequately trained in the use of any PPE / RPE equipment supplied. All personnel operating plant will be required to hold a relevant in date CPCS card (or equivalent such as NPORS) in order to work on site. Soilfix operate a 100% CSCS Card policy, therefore all other operatives not holding a CPCS card will have a CSCS card appropriate to the tasks they are required to carry out.

The Soilfix Remediation Site Manager has the responsibility to ensure all works (including sub-contractors) are in a safe, managed and controlled manner at all times. All Site Managers are equipped with a full first aid kit and eye wash station which remains in the site office at all times upon mobilisation to site.

Soilfix believes that drug or alcohol misuse is unacceptable under any work-related circumstances. We have a zero-tolerance level to drugs and alcohol misuse in the workplace.

10.2 Risk Assessments & Method Statements

All works undertaken will be in accordance with site specific method statements (termed 'Task Plans') developed for the works which are accompanied by a suitable risk assessment.

The task plans will identify the hazards associated with the works and the suitable protective measures to be adopted during the task. Appropriate COSHH Assessments for chemicals or amendments to be utilised during the remediation process will also be held in the site file, and accompany the task plans, as appropriate.

All personnel on site will be required to review and sign on to the appropriate task plans associated with the works which they will be carrying out on site.

All works on site will be monitored by the Site Manager to ensure they are being carried out in accordance with the RAMS provided for the task.

10.3 Key Risks and Controls

Soilfix have overarching responsibility as Principal Contractor during the remediation works for ensuring provision to make sure the site is secure. The current site is bounded by chain-link fencing and secures the

site from unauthorised access, along with a padlocked gate at the main entrance. All Soilfix staff and sub-contracted labour will be briefed during the site induction on ensuring the site entrance is locked at all times when not in regular use. All staff are to be vigilant throughout daily activities and report anything that might compromise the site's security either externally or from within the site.

During high volumes of traffic movements, a gateman / banksman will be used at the main entrance to supervise movements on and off site where required.

The site is currently derelict with discrete areas of gravel and tarmac surfacing. There is a site entrance just off Ford Road which is a busy main road. To facilitate large heavy goods vehicle movements an additional set of access gates are located in the north-eastern corner.

To minimise disruption for local residents and traffic along Ford Road, a Traffic Management Plan (TMP) will be produced as part of Soilfix's Construction Phase Plan (CPP) and H&S file. The TMP will be regularly reviewed by the Site Manager to ensure the safety of site workers, road users and pedestrians.

A gateman and/or banksman will be used where required, to ensure disruption to traffic is kept to a minimum and to protect pedestrians who are walking along the pavements and public access roads surrounding the site. Daily checks of mud and debris on the roads will also be carried out and a road sweeper deployed/ wheel washing as required.

As detailed in the Environmental Management section, Soilfix shall be carrying out an environmental monitoring programme to ensure local residents, particular residential properties along the western boundary, are protected from noise, dust, odours and vapours. During a letter drop, contact details for the Site Manager will be detailed as a contact point for residents should they have any concerns.

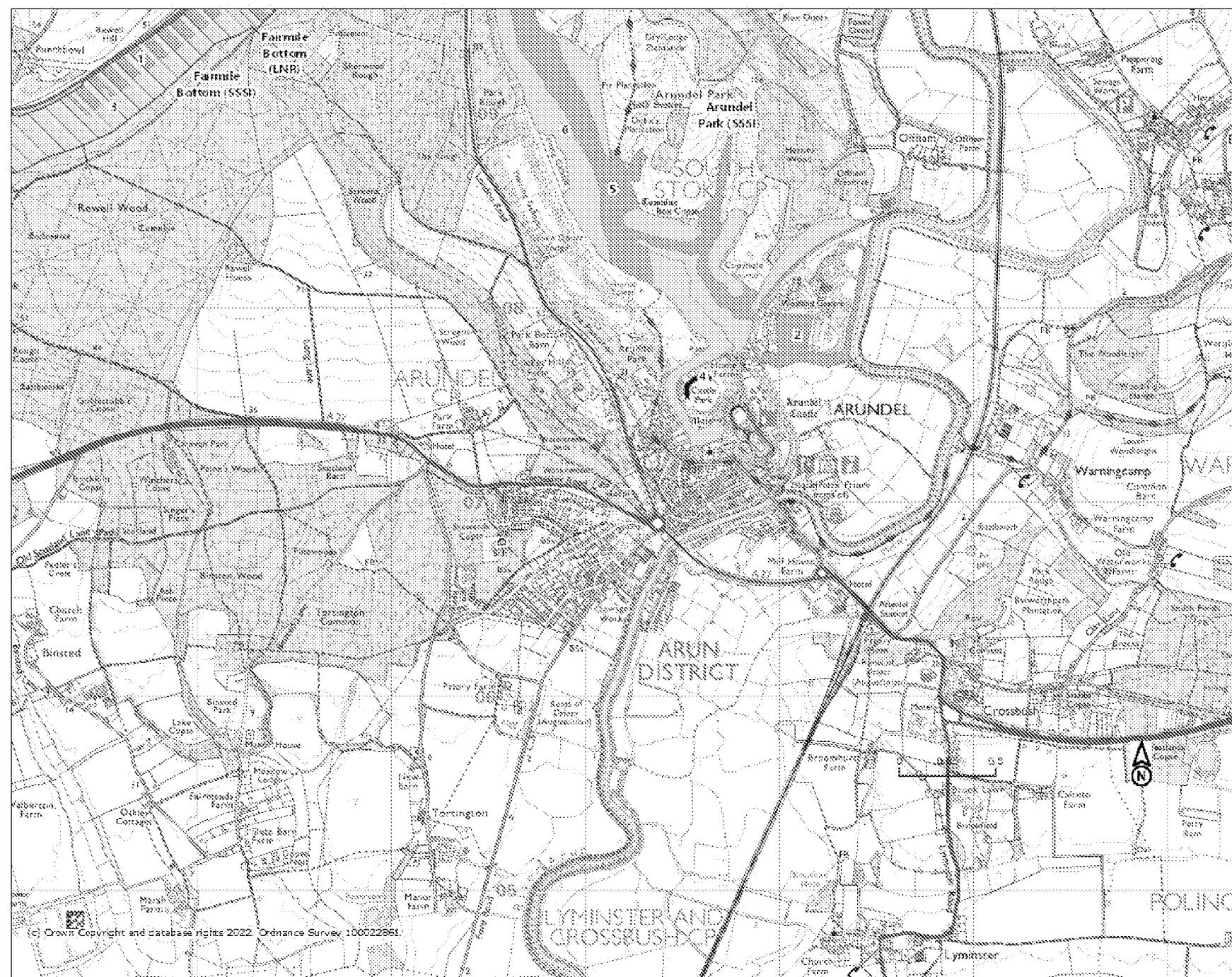
A live electrical sub-station (currently operated by SSE) is present on the north-eastern boundary with high voltage as well as low voltage cables exiting the sub-station below ground on its south-eastern side and crossing under the site access gate before turning and veering north and northwest along the verge of the current access track (towards Ford Road). Remnant cast iron pipework exiting the site is also present along the north-eastern and north-western boundaries and will be removed during the remediation works where encountered. A pot-ended low pressure (25 mm PE) gas pipe is also present below ground near the north-western site boundary. The gas pipe is not shown on any SGN plans and was not identified prior to the remediation works carried out by Celtic in 2021. No metallic strips were evident, and its presence was not identified during utilities surveying. The position of the pipe is approximately 10m in from the northeast site boundary gate and 1.2m in from the internal northwest boundary fence. Its depth is approximately 0.8 m below ground and is shown on the drawing MTL03 in Appendix A.

11. Appendices

Appendix A - Drawings

MAGIC

C500 Arundel



Legend

- Local Nature Reserves (England)
- National Nature Reserves (England)
- Ramsar Sites (England)
- Proposed Ramsar Sites (England)
- Sites of Special Scientific Interest Units (England)
 - Favourable Condition
 - Unfavourable Recovering
 - Unfavourable no change
 - Unfavourable Declining
 - Part Destroyed
 - Destroyed
 - Not Assessed
- Sites of Special Scientific Interest (England)
 - Special Areas of Conservation (England)
 - Possible Special Areas of Conservation (England)
 - Special Protection Areas (England)
 - Potential Special Protection Areas (England)
 - Biosphere Reserves (England)

Projection = OSGB36
xmin = 497200
ymin = 105000
xmax = 505200
ymax = 109100
Map produced by MAGIC on 1 April, 2022.
Copyright resides with the data suppliers and the map must not be reproduced without their permission. Some information in MAGIC is a snapshot of the information that is being maintained or continually updated by the originating organisation. Please refer to the metadata for details as information may be illustrative or representative, rather than definitive, at this stage.

Legend:

- Deployment Site Boundary

Contract: C500.OAK

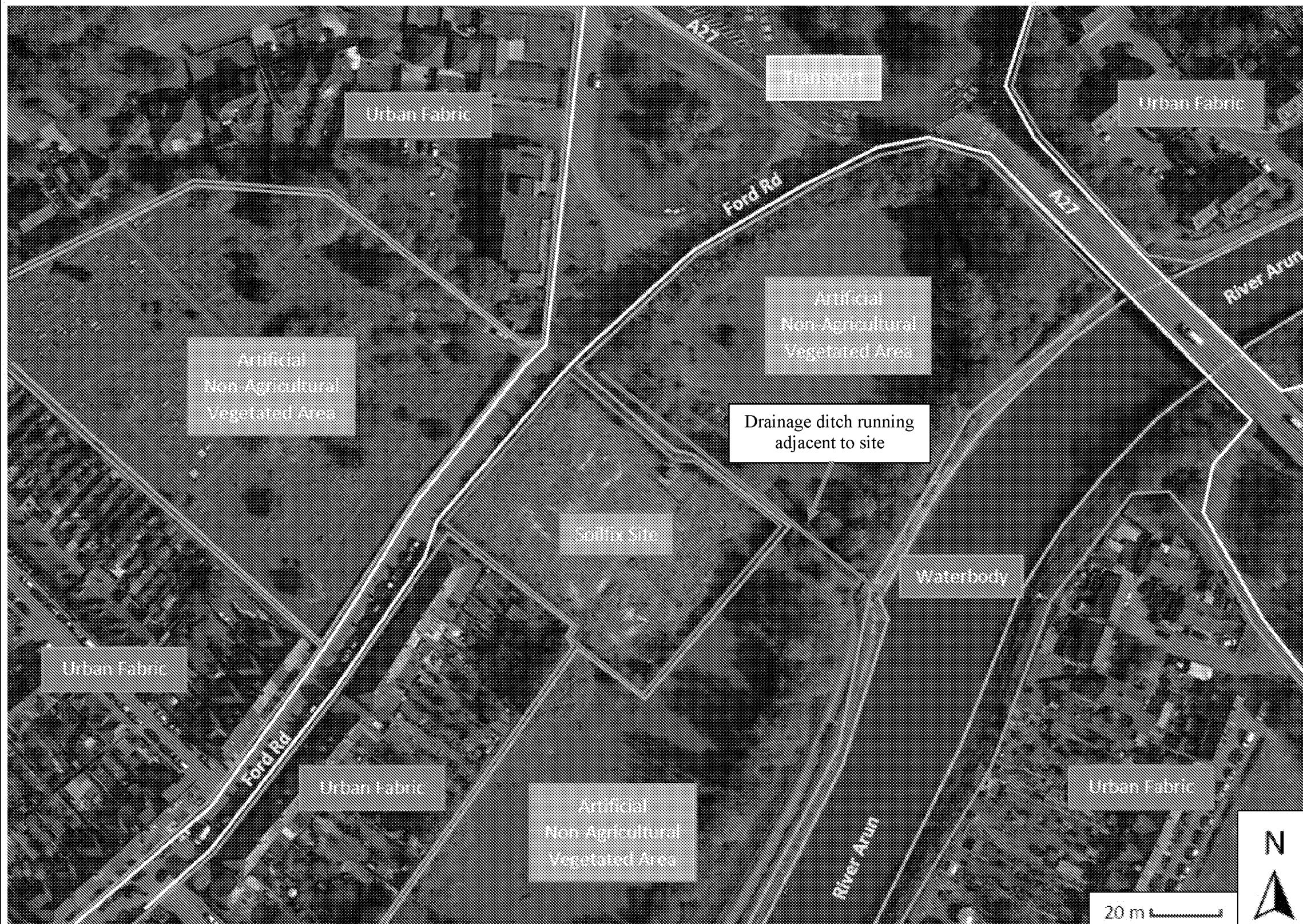
Client: Oakford Homes

Drawing Title:
Sensitive Sites within 1km

Drawing Number:
C500_MTL01

Drawing Date: 04/04/2022

soilfix
GROUND RISK SOLUTIONS



Contract: C500.OAK

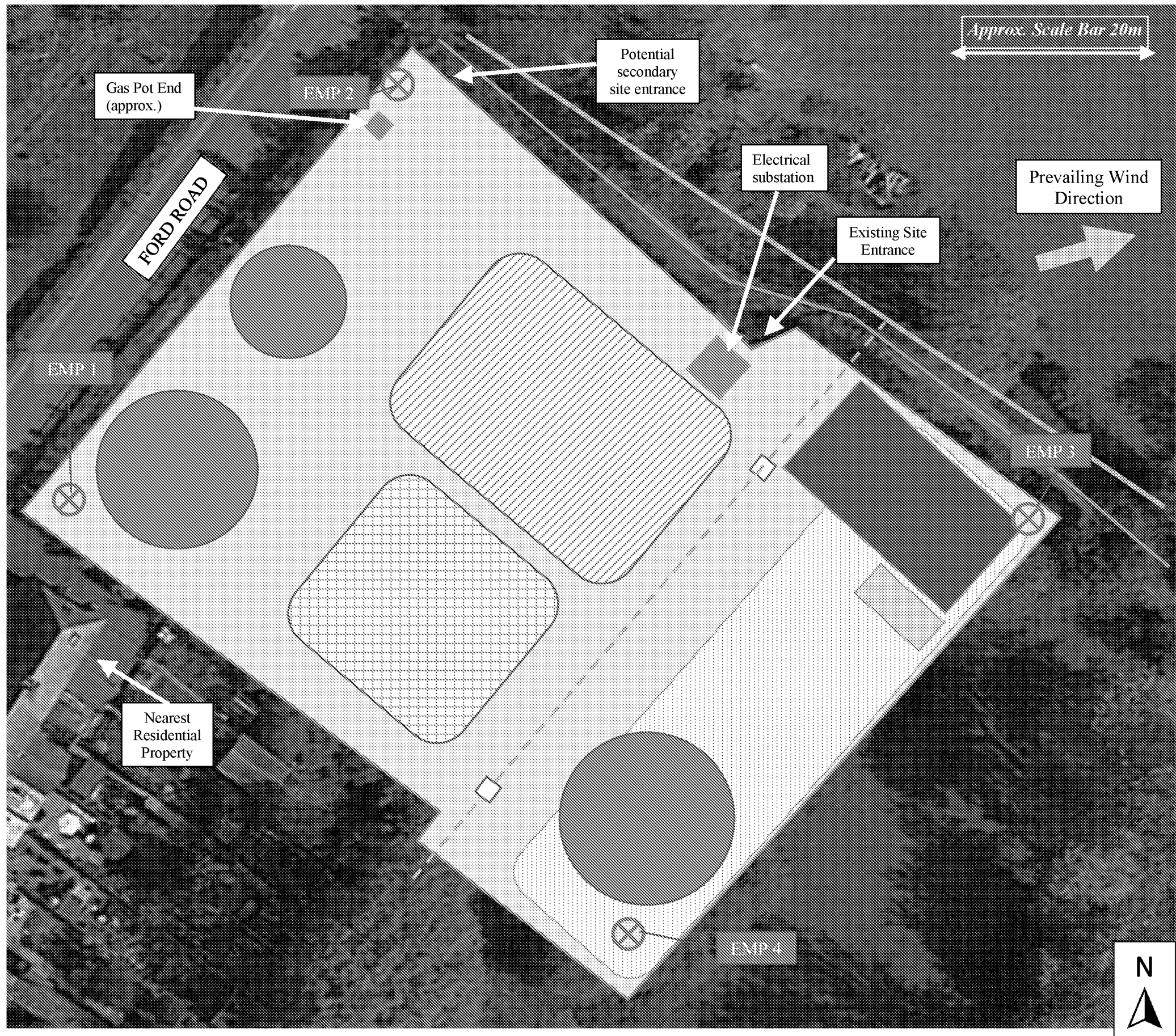
Client: Oakford Homes

Drawing Title:
Surrounding Land Uses

Drawing Number:
C500_MTL02

Drawing Date: 14/04/2022

soilfix
GROUND RISK SOLUTIONS



Legend:

- Site Boundary and fencing
- Drainage ditch – will be protected / monitored
- Public right of way to be maintained
- Proposed Environmental Monitoring Locations
- Proposed Quarantine Area (if required)
- Proposed primary area for soil treatment / processing
- Proposed re-use area of stabilised treated soils
- Approximate extents of tarmac to remove
- Gasholder tank bases to remove
- Welfare and parking area
- Existing storm drain (and manholes)

Contract: C500.OAK

Client: Oakford Homes

Drawing Title:
Proposed Remediation &
Enabling Phase Site Setup

Drawing Number:
C500_MTL03

Drawing Date: 14/04/2022





Notes



Remediation Site

Contract: C500.OAK

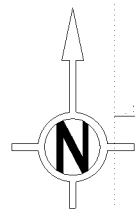
Client: Oakford Homes Ltd

Drawing Title:
Site Location

Drawing Number:
C500_SITELOC

Drawing Date: 12/04/2022





LEGEND

Approximate Site
Boundary


Indicative extent of
Stabilised treated
soils to be placed

E		
D		
C		
B		
A		
Rev.	Description	Date



+44 (0) 1268 502 272 (Essex)
+44 (0) 117 982 0025 (Bristol)
info@soilfix.co.uk
www.soilfix.co.uk

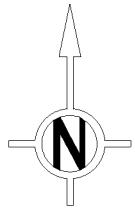
Site Address:

Ford Road, Arundel

Title: Indicative extent of stabilised treated soils to
be placed

Client:
Oakford Homes

Drawn: DS	Checked: PH	Appvd: PH	Rev: A
Contract: C500.OAK	Dwg No: SF-001	Scale: NTS	A3



LEGEND

Approximate Site Boundary

E		
D		
C		
B		
A	First Issue	14.04.2022
Rev.	Description	Date



+44 (0) 1268 502 272 (Essex)
+44 (0) 117 982 0025 (Bristol)
info@soilfix.co.uk
www.soilfix.co.uk

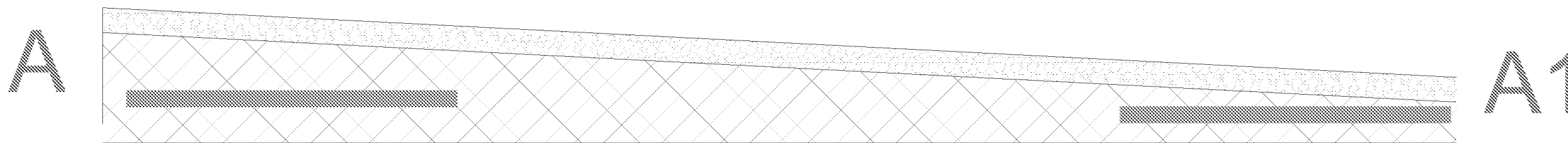
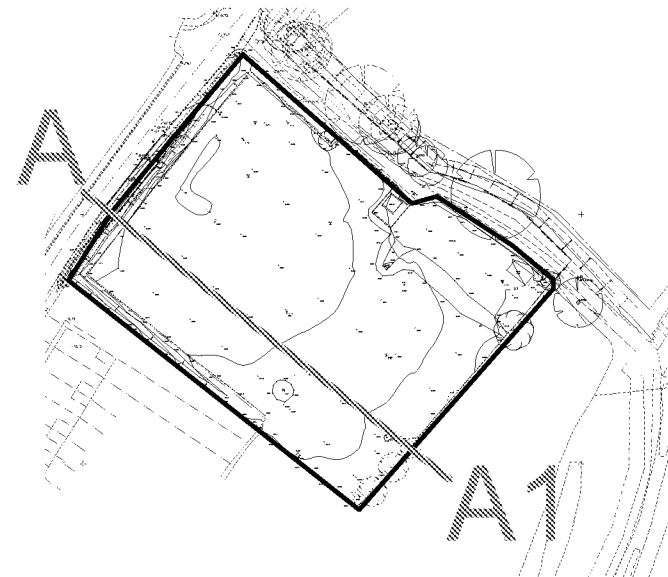
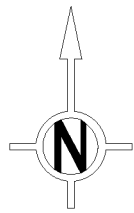
Site Address:

Ford Road, Arundel

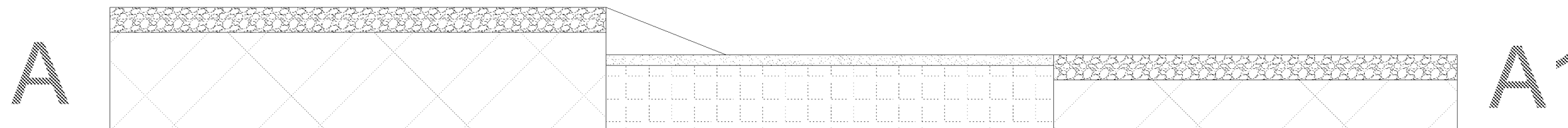
Title: Existing Site Layout

Client: Oakford Homes

Drawn: DS	Checked: PH	Appvd: PH	Rev: A
Contract: C500.OAK	Dwg No: SF-002	Scale: NTS	A3



Existing Site



Remediated Site

LEGEND

- A-----A1 Remediation Section Location
-  Crushed Aggregate capping layer
 -  Made ground / soils
 -  Gasholder tank bases
 -  Hybrid Pile mat
 -  Sub capping fill
 -  Stabilised fill
 -  150mm Crushed Aggregate Layer
 -  Transition Ramp

E		
D		
C		
B		
A	First Issue	14.04.2022
Rev.	Description	Date



+44 (0) 1268 502 272 (Essex)
+44 (0) 117 982 0025 (Bristol)
info@soilfix.co.uk
www.soilfix.co.uk

Site Address:

Ford Road, Arundel

Title:
Indicative remediation cross section

Client:
Oakford Homes

Drawn: DS	Checked: PH	Appvd: PH	Rev: A
Contract: C500.OAK	Dwg No: SF-003	Scale: NTS	A3