



RIDGE

SITE INVESTIGATION SCHEME

SANDY BROW LANE, KNOWSLEY

BALANCE POWER

August 2023

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1. INTRODUCTION

1.1. Brief

Ridge and Partners LLP (Ridge) was commissioned by Balance Power (the Client) to produce a Site Investigation Scheme for land at Sandy Brow Lane, Knowsley centred on 344459, 398401 (hereafter referred to as 'the site'). A site location plan is included as Figure 1. The development area is defined on Figure 2.

A number of other reports have been issued in relation to the site, which have been discussed in Section 4.

1.2. Proposals

Initial development plans comprise a track leading from Perimeter Road to the west which provides access to the main development in the eastern portion of the development area.

The main development area comprises a 132kV substation area, transformer, control room, storage room, and many battery enclosures with associated inverter and transformer.

Proposed development plans are included as Figure 2.

1.3. Planning Status

The proposed investigation is required to aid preliminary design.

1.4. Report Scope and Limitation

This report is based upon a review of readily available information. Information provided from sources is taken in good faith and Ridge cannot guarantee its accuracy.

The information contained in this report is intended for the use of **Balance Power** and Ridge can take no responsibility for the use of this information by any other party or for uses other than that described in this report.

2. SITE SETTING

2.1. Site Description

The site is centred on easting 344279 and northing 398453, broadly in Knowsley. The site is a rough rectangular shape with the longest axis east to west of 800m to 1,000m and approximately 350m to 400m north to south. The site has an area of approximately 32 hectares. A double vehicular gate and an adjacent pedestrian access point are present midway along the western site boundary along Perimeter Road. The double gate leads onto a single width gravel farm track which runs to the midpoint of the site before terminating.

The site generally comprises rough open grass land with densely vegetated field boundaries around the north, south and eastern perimeter. The western edge of the site which runs parallel to Perimeter Road is lightly vegetated. Barbed wire fencing is also noted within the vegetation along field boundaries. The east and south of the site are relatively flat however a large uneven mound is present in the central north of the site.

A number of mounds of concrete and brick rubble as well as numerous other grassed mounds and embankments were noted across the west of the site. A small area of Himalayan Balsam was noted in the south-eastern corner of the site. The east of the site was generally noted to be much flatter. The near surface grassed soils (Made Ground) across the majority of the site were noted to contain occasional plastics, glass, metals, fabrics, brick and concrete.

2no. monitoring wells with locked upright covers were noted in the centre of the site, one of which was located within the raised area.

The general elevation of farmland in the area is 45-50mAOD with a general fall towards the north-west. A topographic survey for the site has been produced. Site levels vary between 48-54mAOD although in the north-west portion, where waste was deposited, ground levels are up to 59mAOD. In general there is a relatively steep peripheral slope to the northern, eastern and southern boundaries and thereafter gradients are quite shallow. There is a 2m deep valley feature trending south to north across the north-western part of the site.

The site is surrounded by agricultural land to the north, south and east with an industrial estate located to the west across Perimeter Road. This large industrial estate comprises a variety of occupants from distribution warehouses to chemical manufacturers.

The closest properties to the site are summarised as follows –

- Industrial buildings some 90-150m to the west
- Top House Farm, approximately 310m to the north
- New Cut Farm, circa 670m south-east
- Sandy Brow 265m south

2.2. Site History

The earliest reviewed map from 1850 shows the entire site as farmland and woodland. Kirkby Moss Lane extended through the centre of the site orientated east to west and a second unnamed track through the centre of the site orientated north to south. The south-western portion of the site was part of Charley Wood and the remainder of the site was farmland sub-divided into a series of fields.

Kirkby Industrial Estate is first shown on the 1956 map, although it is understood that this area was developed during the war years for the manufacture of munitions. Two small 'marl pits' are shown to the north-east of the site.

Perimeter Road is first marked on the 1966 edition map. A small structure is shown in the central part of the site to the south-east of where the aforementioned tracks intersect. A series of drains are shown. A small pond is located on site close to the eastern boundary.

The Environment Agency reported that a portion of the site was operated as a landfill between 1965 and 1975 and included the filling of household and industrial wastes. More details are provided within subsequent sections of this report.

The 1990 map does not show any site features other than overhead cables, which were first shown on 1966 and 1978 maps.

KBC reports that 185,000m³ of topsoil, subsoil and builders waste was deposited on part of the site as an unauthorised operation circa 1989-1992. This material was never removed from the site.

The 2006 and 2013 maps show the site in its present day layout with a track extending from Perimeter Road to the centre of the site and area of enclosed woodland planting along the southern site boundary.

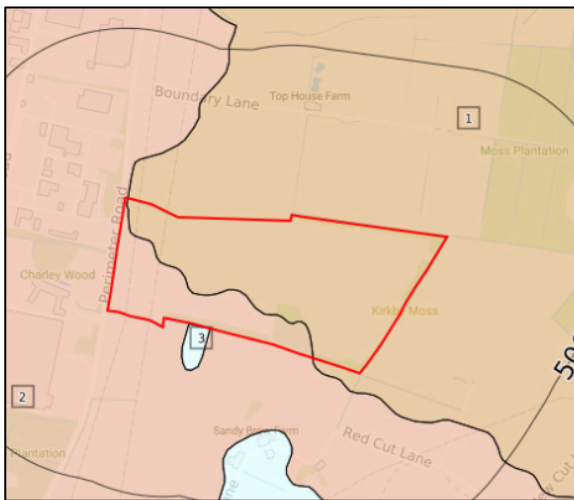
3. PHYSICAL SETTING

3.1. Geology and Hydrogeology

The following observations are taken from the British Geological Survey (BGS) GeoIndex (2023) and a Geo Insight Groundsure Report.

3.1.1. Superficial Deposits

Superficial deposits comprise the following, as shown on Extract 3.1. Peat [1] and Shirdley Hill Sand Formation [2]. Devensian Till [3] is adjacent south. All deposits are considered to be unproductive (aquifers).

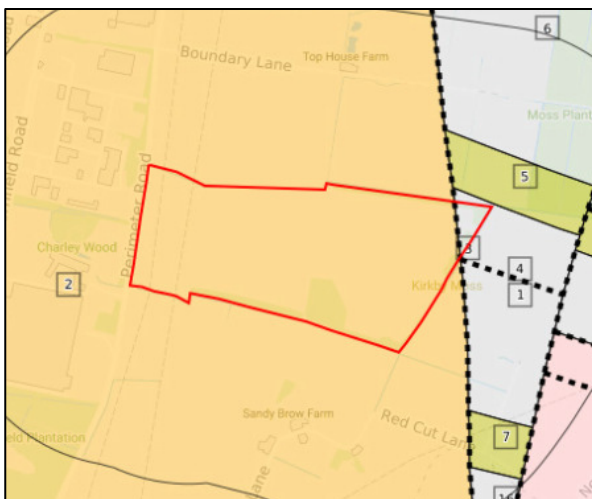


Extract 3.1: Superficial deposits

3.1.2. Bedrock Geology

Bedrock geology comprises the following, as shown on Extract 3.2. Chester Sandstone Formation [2] underlying the majority of the site and Pennine Lower Coal Measures [1].

Chester Sandstone Formation [2] is considered a Principal Aquifer while the [1] Pennine Lower Coal Measures [1] are categorized as a Secondary (A) aquifer.



Extract 3.2: Bedrock geology

A Principal aquifer is defined as layers of rock or drift deposits that have high intergranular and/ or fracture permeability meaning they usually have a high level of water storage. They may support water supply and/ or river base flow on a strategic scale.

A Secondary (A) aquifer is defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

3.1.3. Artificial Ground, Landslips and Faults

The entire site is classified as Made Ground owing to it's historical landfilling history.

An inferred fault [3] on Extract 3.2 above is situated on site. A fossil horizon/ marine band [4] is located adjacent east of the site.

3.1.4. Radon

Much of the site is classified as 'less than 1% of properties affected', but the extreme north-eastern corner is categorised as 'between 1% and 3% of properties affected'.

In consideration of the proposed end use of the site i.e. battery storage and absence of residential properties, this will not inhibit the development.

3.1.5. Ground Workings and Mining

The entire site is classified as a refuse heap, based on 1966 mapping. A pond has been identified in the extreme eastern portion of the site based on 1966 and 1976 mapping.

3.1.6. Natural Ground Subsidence

The BGS has provided the following on-site information as summarised in the table below.

PROCESS	RISK LEVEL	DETAILS
Compressible Deposits Majority of site	Very Low	Compressibility and uneven settlement problems are not likely to be significant on the site for most land uses.
Compressible Deposits North extreme of site	High	This is considered be associated with Peat potentially on site. Highly compressible strata. Significant constraint on land use depending on thickness.
Collapsible Deposits	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present.
Landslides	Very Low	Slope instability problems are unlikely to be present. No special actions required.
Running Sands	Very Low	Running sand conditions are unlikely. No identified constraints on land use due to running conditions unless water table rises rapidly.
Shrink Swell Clay	Negligible	Ground conditions predominantly non-plastic.
Ground Dissolution of Soluble Rocks	Negligible	Soluble rocks are either not thought to be present within the ground, or not prone to dissolution.

Table 3.1: Ground Subsidence Records

3.1.7. BGS Estimated Background Soil Chemistry

Estimated background concentrations on site are as follows: arsenic 25-35mg/kg; cadmium 1.8mg/kg; chromium 90-120mg/kg; nickel 15-30mg/kg, lead 100-200mg/kg.

3.2. Hydrology

3.2.1. Surface Water Features

The Groundsure Report has identified on-site drainage ditches which surround the site. Kirkby Brook, which flows west, is located on the southern boundary orientated east and west.

3.2.2. Flooding

The site is situated with Environment Agency Flood Zone 1 (negligible risk).

3.3. Controlled Waters

3.3.1. Abstraction Licenses

The closes active groundwater abstraction is 305m north-west for general cooling. There are no other active groundwater abstractions within 500m of the site.

There are no records of surface water abstractions within 500m of the site.

An active potable groundwater abstraction is recorded 643m west for drinking, cooking, sanitary and washing. There are no further potable abstractions within 1km of the site.

3.3.2. Source Protection Zones

The site is situated within a SPZ3, defined as the area around a water source within which all groundwater recharge is presumed to be discharged at the (water) source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge is >0.75 .

4. PREVIOUS REPORTS

Previous reports written in relation to the site are summarised below. Full reports should be read for completeness.

4.1. Site Investigation and Preliminary Risk Assessment (2014)

The Arley Consulting Company Limited (Arley) completed a Site Investigation and Preliminary Risk Assessment (Ref: 13673/1) in July 2014 for the wider site. Arley were commissioned by P Casey Enviro Limited (PCE) in relation to the proposed reclamation of the site, then known as Coopers Moss, Kirkby.

PCE's planning consultant was preparing an application for the reclamation and restoration of the site. Proposals were to re-grade illegally deposited wastes and to import further suitable soils to restore the site to beneficial agricultural use with shallow even gradients to promote passive site drainage through runoff.

The report contains the results of background searches, site inspection and investigations undertaken at the site by Arley and others.

4.1.1. Other Investigations

The Arley report summarises previous investigations carried out at the site.

In November 2013 PCE conducted a Trial Pit Investigation at the site which included the excavation of 18 trial pits using a mechanical excavator. 3 trial pits were excavated on the eastern low-lying section of the site and 15 were advanced on the western section. The trial pits were excavated to depths of between 0.90m and 4.10mbgl. Made Ground was encountered in all trial pits.

Eastern Field

Conditions comprised 0.50m thick brown sandy Clay with hardcore fines, shells and bricks overlying landfilled wastes. Waste comprised paper, wood, plastic, oil filters, oil, food waste, metal, hydraulic pipes and household waste. The engineer noted a strong smell of waste and oil.

At TP2 firm brown clay was encountered below the landfilled waste at 3.00m depth. The underlying natural soil was not identified at the other two trial pits which were abandoned in the waste at 3.30m and 3.00m depth. No groundwater or leachate was observed.

Area of Illegal Waste

The ground conditions in this area typically comprised sandy soils with occasional brick fragments and concrete or hardcore. Timber, metal and clay was also noted in some of the trial pits. A strong odour was recorded between 1.00m and 3.00m depth in TP10.

At TP13 and TP15 the soil and hardcore was underlined by landfilled waste including plastic, household waste, wood, rags, paper, metal, bottles, batteries and waste. Newspapers dated 1974 were observed in TP15. This stratum was similar to the waste encountered in the eastern field. The engineer noted a strong smell of waste associated with this stratum.

Landfilled waste was not identified at TP7 or TP12 – these trial pits were advanced to 3.80m depth.

None of the trial pits excavated in this area of the site identified natural soils beneath the waste.

Low lying area of Western Field

6 trial pits were excavated in the low-lying parts of the western field. Ground conditions comprised a layer of soil [clay or sand and topsoil] overlying landfilled waste. The soil layer varied in thickness from 0.50m to 2.30m.

The waste comprised a combination of paper, wood, plastic, metal, rags, bottles, household waste, disposable cups, pipes, oil, ash, burnt materials and tyres.

The engineer noted a strong smell of waste associated with the landfilled material. No groundwater or leachate was noted in the landfilled waste layer in this part of the site. None of the trial pits encountered natural soils.

Gas Monitoring

PCE carried out an initial gas survey of the site in September 2013, using a gas vent tube/ searcher bar. Gas concentrations were measured at 32 test locations all in the western part of the site. In summary gas concentrations measured were as follows:

- Methane 0 – 37.4%
- Carbon Dioxide 0.2 – 21.7%
- Oxygen 0.2 – 20.6%

It was noted that the Environment Agency does not generally accept searched bar spike testing as a precise investigation method and in any event the testing is limited to the western part of the site.

30 of the test locations were on the relatively low-lying part of the western half of the site. Test locations 31 and 32 were on the illegally deposited CDEW. Gas concentrations at these locations were very low, no methane was detected, and carbon dioxide concentrations measured were 0.2% and 1.6% and were thought to be in a typical background range.

Surface Water Sampling and Analysis

PCE collected surface water samples from the ditches around the site for chemical analysis. Four sample locations were taken from each corner of the site.

Samples were tested for a general suite of potential contaminants based on EA landfill monitoring guidance. Results showed that water quality in the ditches was highly variable.

Elevated concentrations of ammoniacal nitrogen were noted. It was considered likely that background concentrations in this agricultural setting are also elevated due to the use of fertilisers and other agricultural chemicals. All other results were below the corresponding freshwater EQS screening criteria.

Concentrations from some determinands were significantly higher in the sample from locations SW1 than the other locations in particular alkalinity, chromium, iron, manganese, nickel, potassium, sodium, ammoniacal nitrogen, total organic carbon and electrical conductivity.

4.1.2. Conclusions of PRA

It was recommended that further site investigation was required in order to quantify the potential environmental risks associated with the site and the proposed development works.

4.1.3. Site Investigation

Arley undertook a ground investigation at the site, the objectives of which were as follows:

- Determine the thickness and nature of the Made Ground and waste
- Determine the nature and thickness of the natural superficial soils between the waste and the underlying sandstone
- To install gas monitoring probes within the waste to facilitate gas and water monitoring
- To install groundwater monitoring boreholes in the Chester sandstone to facilitate groundwater monitoring within the principal aquifer

4.1.3.1. Conclusions

Investigations confirmed the landfilled waste did not contain significant quantities of potential biodegradable matter.

Landfill gas and leachate were found to be present within the local authority landfilled wastes. Gas concentrations were found to be high but flows suggested that there was no significant ongoing gas generation.

Arley considered that the potential for ground gas to impact off-site properties was low due to the distance to neighbouring farms and the industrial estate to the west.

Leachate was found to be present within the local authority waste, although it was identified as weak and therefore assessed to have a low polluting potential. Peat and boulder clay identified during the investigation was considered to have the potential to provide a natural barrier significantly reducing the potential for migration of contaminants from the waste to groundwater within the Chester Sandstone.

Groundwater and surface water quality appeared to be affected by some contamination which was thought to be from the local authority waste or off-site sources.

Arley considered that the proposed development (agricultural reclamation) did not represent a potential risk to the site or the general environment in terms of contamination. It was considered that the proposed site reclamation would reduce rainwater infiltration and thereby reduce the long-term risks associated with ongoing leachate generation.

4.1.3.2. Recommendations

On the basis of the risk assessment Arley did not consider any specific requirement to address existing or potential environmental issues at the site.

However, a series of recommendations were made:

- Local authority wastes should not be disturbed during development, the existing soil cover should be retained
- Environmental monitoring should continue until the site works commence. Ongoing monitoring should include gas and water level monitoring
- Further groundwater samples should be collected for analysis

- A programme of surface water sampling and monitoring should be implemented to confirm that the site restoration works do not have an adverse impact on surface water quality

4.2. Ridge Desk Top Study (2023)

4.2.1. Contamination

4.2.1.1. Potential Sources

Following site reconnaissance and a review of available records/ reports, the following contamination sources were considered to be potentially present:

- Waste Materials/ Made Ground associated with historical landfilling and illegal landfilling of the site. Waste included inert, industrial, liquid sludge, household and commercial.
- Landfill gas associated with waste materials.
- Contamination from adjacent industrial land uses within 100m of the site, inclusive of ROF Kirkby historically located circa 20m north-west.

4.2.1.2. Discussion

Initial development plans comprise a track from Perimeter Road to the west which provides access to the main development in the eastern portion. The main development area situated in the eastern portion comprises a 132kV substation area, transformer, control room, storage room, and many battery enclosures with associated inverter and transformer. Once the development area has been constructed, there is not expected to be regular use of the site by people, bar site visits for maintenance. It is anticipated that much of the development area will be surfaced with hardstanding, and therefore interaction with potentially contaminated shallow soils is unlikely. With the proposed structure in mind, foundations are expected to be traditional i.e. penetration into potentially contaminated soil will be restricted. This will reduce any disturbance of soils and mobilisation of contaminants.

Landfilled waste across the site represents the greatest contaminant risk. Additional construction, demolition and excavation waste (CDEW) was identified to the north of the development area from surface. CDEW comprised dark brown and black clayey gravelly Sand which included bricks and concrete fragments. This waste represents a risk to end users of the development, but the temporary external setting of users reduces the risk level significantly. The majority of the site contains a topsoil/ capping layer of circa 2.50m thickness. Below this, local authority waste of approximate thickness 4m, containing clay with concrete, bricks, clinker, ash and slag is present. This waste does not represent a significant risk to development end users due to its depths and capping layer above. Soil analysis has not been completed at the site, although leachate analysis was completed at three of the monitoring boreholes. Elevated concentrations of ammoniacal nitrogen were reported for each of the three samples tested. Concentrations of chromium, copper and zinc exceeded the lower EQS limit. Iron concentrations exceeded the EQS in each of the three samples tested. Some PAH species in the samples from BH4 and BH5 exceeded the corresponding EQS.

The site is underlain by a Principal Aquifer (Chester Sandstone) and is located within a SPZ3, although from investigation records peat and glacial Boulder Clay are present between the waste the underlying sandstone, and it is thought that these strata will provide a natural barrier significantly reducing the potential for migration of contaminants from the waste to the groundwater. According to previous investigations there were exceedances of the applicable screening criteria for ammoniacal nitrogen, chromium, copper, zinc and iron.

Some PAH species exceeded the EQS in BH4 and BH5. Surface water sampling results during previous investigations was highly variable. There were exceedances of the applicable screening criteria for ammoniacal nitrogen and metals.

Development users will work in a temporary and external setting thus reducing potential risks from ground gas significantly. According to previous investigations, landfill gases are present within the local authority landfilled wastes. The gas concentrations were high but low flows suggested that there is no significant ongoing gas generation. It was assessed that the potential for gas migration at concentrations and/ or flows which might affect neighbouring farms or the industrial estate to the west is low. Consideration should be given to gas mitigation for proposed structures on site. Further assessment of the ground gas regime will allow us to evaluate the requirement for gas mitigation.

4.2.1.3. Risk Assessment

SOURCE	PATHWAY	RECEPTOR	SEVERITY	LIKELIHOOD	RISK LEVEL
On-site waste materials/ Made Ground	Direct contact, ingestion and inhalation of impacted soils/ groundwater	Site end users	Minor	Low Likelihood	Very Low
		Construction and groundworkers	Minor	Likely	Low
	Vertical migration of contaminants through the underlying geology and/ or via overland flow	Principal and Secondary (A) Aquifer – bedrock	Medium	High Likelihood	High
		Surface water features	Minor	High Likelihood	Low/ Moderate
Landfill gas associated with waste materials	Migration of ground gas through the underlying geology	Site end users	Mild	Likely	Low/ Moderate
		Construction and groundworkers	Minor	Low Likelihood	Very Low
Off-site industrial land uses within 100m of the site	Direct contact, ingestion and inhalation of impacted soils/ groundwater	Site end users	Minor	Low Likelihood	Very Low
		Construction and groundworkers	Minor	Low Likelihood	Very Low

Table 4.1: Pollutant Linkage Assessment

At present, highest risk ratings relate to groundwater resources and surface water in relation to on-site waste (**High-Moderate**), and site end-user exposure to ground gas (**Moderate**).

In light of these risk ratings, further assessment is required to either refine the risk levels or produce a remediation/ mitigation plan to ensure the site is suitable for it's intended use.

4.2.2. Geotechnical

4.2.2.1. Expected Ground Conditions

Previous investigations have confirmed that strata at the site can be summarised as follows:

- Construction, demolition and excavation waste (CDEW) – north-west portion of site only
- Topsoil/ capping layer
- Local authority waste
- Peat
- Glacial Clay
- Chester Sandstone

We do not anticipate that constructing directly onto CDEW, topsoil/ capping layer, local authority waste or peat will be possible due to its inherently weak and heterogenous nature.

The environmental records search highlighted peat as highly compressible and acting as a significant constraint on land use.

4.2.2.2. Foundations

With reference to the expected geology and the proposed development, we suspect that upper soils will need to be stripped back to identify suitable stratum to bear weight or a layered and compacted sub-grade will need to be constructed.

Soil compaction will be necessary to increase the bearing capacity and stiffness of the soils or engineered layer. Compaction will increase the shear strength of soils by adding friction from the interlocking of particles. Future settlement of soils is reduced by increasing the stiffness and eliminating voids creating a densified soil. The removal of voids reduces the chance of the soil settling or shrinking or expanding and it decreases water seepage that would lead to deleterious shrinking and swelling soil properties.

Consideration should be given to the use of a piled foundation solution. The requirement for this can be assessed during additional ground investigation.

4.2.2.3. Drainage

On site drainage is likely to be highly variable and therefore we recommend soakage testing is undertaken to inform the Drainage Strategy.

Soakaway water should be prevented from percolating into the landfill. Storage of water above the old waste deposits represents a potential hazard with the likelihood of localised increase in infiltration.

4.2.2.4. Earthworks/ Site Levels

The general elevation of farmland in the area is 45-50mAOD with a general fall towards the north-west. Site levels vary between 48-54mAOD although in the north-west portion, where waste was deposited, ground levels are up to 59mAOD. In general there is a relatively steep peripheral slope to the northern, eastern and southern boundaries and thereafter gradients are quite shallow. There is a 2m deep valley feature trending south to north across the north-western part of the site.

Care should be taken when selecting the ground floor level of proposed structures to ensure that excessive earthworks are not required nor retaining situations created.

4.2.2.5. Other Considerations

The site contains a number of trees and bushes. Furthermore, mature trees are situated along boundaries. If soils are shrinkable, foundations may need to be deepened adjacent to existing or proposed trees.

5. PROPOSED SITE INVESTIGATION SCOPE

5.1. Objectives

The objectives of the Site Investigation are based on previous investigations conducted with the proposed development in mind.

An overall objective for Site Investigations of potentially contaminated sites, is: *to provide information on actual and potential contamination, to permit an assessment of environmental and physical risk and allow decisions to be made on the needs for and nature of any remedial work necessary* (Barry *et al*, 2001).

Furthermore, the Site Investigation will allow assessment of geotechnical facets of ground conditions below the site.

Therefore, the objectives of this Site Investigation are to:

- 1) Further refine the contamination risk assessment as detailed within the previously issued (2023) Ridge Desk Study Report. The Site Investigation will allow us to collect site-specific data to aid this process. It is considered that further investigatory work is required to refine assessed risk levels; and,
- 2) Allow assessment of geotechnical aspects of the development site.

Previous investigations advised local authority wastes should not be disturbed and where possible the existing cover soil should be retained – this should be taken into consideration during developmental phase.

5.2. Site Management and Preparation

Suitably experienced Ridge staff will supervise the intrusive investigation. Methods employed during the investigation will be carried out in general accordance with statutory guidance including BS5930:1999 *Code of Practice for Site Investigations* (Amendment 3: 2015) and BS10175:2011+A1:2013 *Investigation of Potentially Contaminated Sites: Code of Practice*.

5.2.1. Utility Clearance

Available utility plans will be consulted prior to finalising test locations and will be subject to a final pre-works site walkover.

Each test location will be scanned with a Cable Avoidance Tool (CAT) prior to breaking ground, and furthermore each intrusive position will be subject to a hand advanced inspection pit.

5.3. Rationale and Summary of Scope

The Site Investigation scope devised by Ridge, based on information and reports collated to date, will comprise the following:

- Assessment of geotechnical characteristics within the development area;
- Assessment of contamination characteristics inside and outside of the development area;
- A programme of groundwater and surface water sampling to allow assessment of improvement/deterioration of the water environment through the lifecycle of the development; and

- A programme of ground gas monitoring in newly installed monitoring wells to assess the ground gas regime in the specific development area. Existing wells across the wider site will be monitored where possible.

A site plan showing proposed test locations is presented as Figure 3.

5.4. Site Investigation

5.4.1. Geotechnical Assessment

Five windowless sample boreholes will be advanced with a tracked dynamic sampling rig to 5mbgl or refusal to allow the completion of *in situ* tests, logging of soils and collection of soil samples for geotechnical laboratory assessment. These boreholes will be advanced within the specific development area, targeting proposed structures. Standard Penetration Tests (SPTs) will be performed at 1m centres.

Nine trial pits will be advanced in the development area with a tracked mechanical excavator to 2-3mbgl to allow efficient assessment of geotechnical characteristics of soils. Advancing the trial pits will allow logging of soils and collection of soil samples.

Three of these trial pits will be used to conduct soakage testing in accordance with BRE 365 within the specific development area to allow assessment of the viability of traditional soakaways for the development. Testing will involve the squaring of the excavation sides and subsequent rapid filling of the pit with potable water. The subsequent fall in water will be monitored over a nominal period, with the aim to reach 75% and 25% effective depth/ water column.

Nine TRL DCP (Dynamic Cone Penetrometer) tests in areas proposed as road to allow CBR % conversion to aid roadway design.

Peat probing will be conducted across the development area specifically on a 20m grid, therefore approximately 60 probes will be completed. Peat probing will be conducted in accordance with appropriate guidance (Peatland Action 2017). At each intersection of the 20x20m grid the position will be recorded by noting the grid reference. The probe rods will be pushed into the ground – when resistance increases the depth will be marked and upon removal of the rods, the rod tip will be inspected for other soils to confirm full peat depth has been reached. Following completion of the peat survey, a contour map will be produced showing thickness of peat across the development area. This survey can be used to assess preferential areas for development.

5.4.2. Soil Contamination Assessment

The five aforementioned windowless sample boreholes advanced in the development area will also be used to collect soil samples for laboratory contamination testing. Visual and olfactory evidence of contamination will be logged. All five boreholes will be installed with 50mm diameter pipes at shallow levels to allow ground gas monitoring.

An additional three windowless sample boreholes will be advanced outside of the development area to allow soil logging and collection of samples for contamination laboratory analysis. The boreholes will be installed with 50mm diameter pipes to allow groundwater monitoring. An existing well (GM5) located close to the development site previously identified groundwater levels at 3.21-3.31mbgl. New groundwater monitoring wells will target the top of the water table.

Fourteen trial pits will be advanced inside and outside of the development area with a tracked mechanical excavator to 2-3mbgl to allow efficient assessment of contamination characteristics of soils. Advancing the trial pits will allow logging of soils and collection of soil samples.

5.4.3. Ground Gas Monitoring

Boreholes drilled in the development area will be installed with 50mm diameter pipes to allow ground gas monitoring. Monitoring wells will be installed with response zone above the groundwater table. Existing wells (GM4 and GM5) will also be monitored to provide reference against newly installed wells.

Ground gas monitoring will be conducted over at least 10 rounds spanning at least 3 months targeting falling/ low atmospheric pressure as much as possible.

Gas monitoring will be conducted in accordance with BS8576:2013 *Guidance on investigations for ground gas – permanent gases and volatile organic compounds*. Monitoring wells will be monitored for the presence of soil gases including methane, carbon dioxide, oxygen, carbon monoxide and hydrogen sulphide. In addition, gas flow rates, downhole pressure will also be measured using a GA5000 Geotech Gas Analyser. Monitoring will be conducted for at least three minutes, with readings taken at 30 second intervals.

5.4.4. Surface Water and Groundwater Sampling

Surface water samples (at 3 locations, shown on Figure 3) will be obtained from drainage ditches surrounding the development area on six occasions. Twice prior to development activities and twice during the development. This will allow assessment of the improvement/ deterioration of the surface water environment through the lifecycle of the development. It is acknowledged that water courses in the immediate vicinity of the site may be seasonal.

Groundwater samples will be collected from existing wells (GM4 and GM5) and three newly installed monitoring wells on six occasions. Three times prior to development and three times during development. Groundwater analysis will enable assessment of the impacts of any ground disturbance associated with the development.

5.5. Soil Logging

As previously mentioned, all intrusive locations will be logged, and visual or olfactory evidence of contamination will be noted in accordance with best practice.

5.6. Soil Sampling

Shallow soil samples will be collected to allow laboratory analysis and subsequent assessment of contamination and geotechnical risks associated with on-site soils. Details of proposed soil laboratory analysis is presented within Section 6.

Care is needed to avoid cross-contamination and chemical or biological reactions, which may affect analytical results. In line with BS5930:

- All sampling and digging equipment will be cleaned between each test location and sample point; and,
- Strict sample handling protocols will be implemented.

Further to this, selected samples will be placed in sealed glass jars or plastic tubs (dependent on the exact laboratory requirement and analysis to be undertaken) and stored in a temperature-controlled environment before transit.

All samples will be labelled with a unique reference number immediately after being removed from the excavation.

5.7. Site Visits and Site Diary

A site diary will be kept detailing any actions carried out by Ridge. The following information will be recorded where applicable:

- Weather conditions including atmospheric pressure
- State of ground surface
- Activities that could affect results

6. PROPOSED LABORATORY ANALYSIS AND INTERPRETATION

6.1. Soil Analysis

Soil samples collected during the trial pitting and windowless sample borehole drilling exercises will be submitted to a UKAS/ MCERTS accredited laboratory, Derwentside Environmental Testing Services (contamination/ environmental) and Geo Site and Testing Services Ltd (geotechnical).

6.1.1. Contamination

Following on from previous findings, contamination soil samples will be analysed for asbestos, heavy metals, Polycyclic Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPH) CWG, BTEX, tetrachloroethylene, trichloroethylene and volatile organic acids.

We will also classify soils for waste disposal, therefore two Waste Acceptance Criteria (WAC) tests will be undertaken.

6.1.2. Geotechnical

Geotechnical soil samples will be analysed for a geotechnical suite including pH, sulphate, moisture content, Atterberg limits and particle size distribution.

6.2. Interpretation of Soil Results

In the first instance, Ridge will undertake a screen of Generic Assessment Criteria. Site Specific Assessment Criteria may be utilised where necessary.

6.2.1. Generic Assessment Criteria

Ridge will undertake a screen of the soil laboratory results using generic assessment criteria. Generic assessment criteria (GAC) are conservative contaminant concentration values used for comparison purposes to assess the risk associated with contaminant concentrations found on site and are derived using non-site-specific information.

In order to assess the soil analyses results with regard to potential human health risks, Ridge has adopted published guidance criteria widely referred to by professionals within the industry, which include the following:

- Suitable 4 Use Levels (S4ULs) Generic Assessment Criteria (GAC) developed by the Chartered Institute of Environmental Health (CIEH) in partnership with Land Quality Management Ltd. (LQM); and,
- Category 4 Screening Levels (C4SL) for lead, produced by CL:AIRE (2014).

Based on the proposed future use of the site, comparisons will be made against the 'commercial' land use setting.

Results will be compared to the conservative 1.00% soil organic matter value unless otherwise stated.

6.3. Surface Water and Groundwater Analysis

Surface water and groundwater samples will be submitted for testing mirroring that of soil contamination analysis detailed above, and additionally ammoniacal nitrogen.

6.3.1. Interpretation of Results

In the absence of dedicated UK water standards, results will be screened against the conservative Water Framework Directive (WFD) 2015 Environmental Quality Standards (EQS), UK Drinking Water Standards (DWS) as taken from the Water Supply Regulations (2000), the New Dutch List (Dutch Target and Intervention Values, 2000) and the US EPA Drinking Water Standards (and Health Advisories) 2012.

7. REPORTING

7.1. Site Investigation Report

It should be acknowledged that where further investigation beyond what is set out in this scheme is required; this will be undertaken to clarify risks on site prior to completing the quantitative risk assessment.

Following site works and observations, receipt of logs and test results from the laboratory; all the information will be collated and evaluated in relation to ground conditions and presented in a Site Investigation Report.

The Report will detail works carried out and the test results of laboratory testing and monitoring. The report will include a (contamination) quantitative risk assessment which will discuss the degree and nature of any contamination identified and will include a revised contamination conceptual site model (based on the previously issued preliminary risk assessment).

The Report will also provide recommendations for foundations, earthworks, infiltration drainage, heave/shrinkage, specification of buried concrete, waste classification and any required remediation. Peat probe data will be analysed and interpreted.

The report will not include a standalone Remediation Method Statement. This may be required if remediation is necessary, based on the outcomes of the Site Investigation.

FIGURE 1 – SITE LOCATION PLAN



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THIS DRAWING DOES NOT DEFINE THE SCOPE OF SUPPLY
DO NOT SCALE FOR CONSTRUCTION PURPOSES

NOTES
(1) N/A

EQUIPMENT LIST
(1) N/A

PROJECT NUMBER
PR871 - L33 3AP - 001

PROJECT TITLE
SANDYBROW LANE

PROJECT ADDRESS
SANDYBROW LANE - L33 3AP

DATE
03/08/2023

PROJECT TYPE
ENERGY DEVELOPMENT

DRAWING TYPE
LOCATION PLAN

DESIGNER
C. VICK

CHECKED BY
R. MACINDOE

APPROVED BY
I. WILLIAMS

SCALE
1:2500

REVISION
REV A

PAPER SIZE
A1

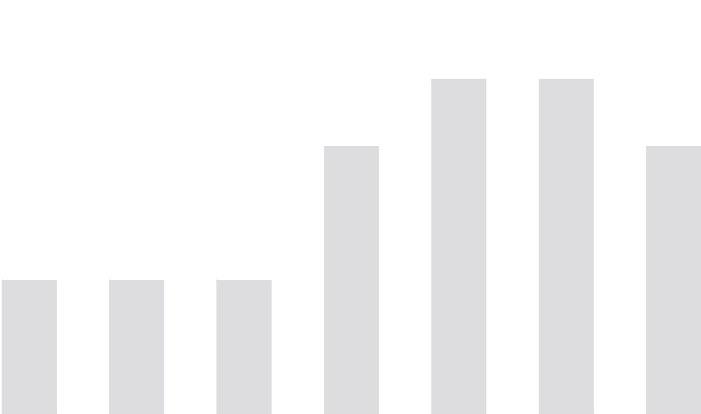
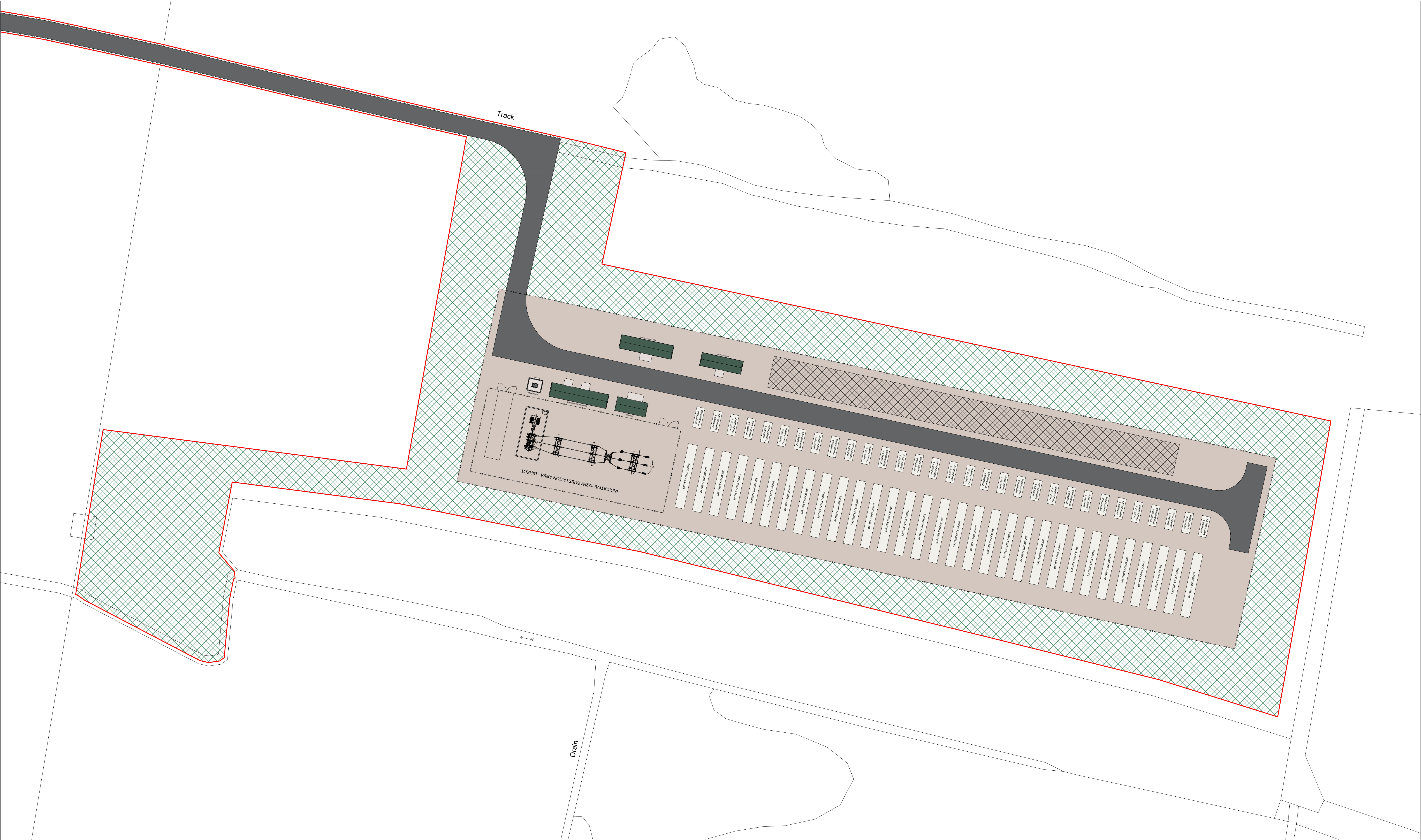


FIGURE 2 – DEVELOPMENT PLANS



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NOTES
(1) N/A

EQUIPMENT LIST
BATTERY CONTAINERS
INVERTER & TRANSFORMER MODULES
DNO ROOM
TRANSFORMER
PRIVATE SUBSTATION
WELFARE & CONTROL ROOM
STORAGE ROOM

PROJECT NUMBER
PR871 - L33 3AP - 101

PROJECT TITLE
SANDYBROW LANE

PROJECT ADDRESS
SANDYBROW LANE - L33 3AP

DATE
03/08/2023

PROJECT TYPE
ENERGY DEVELOPMENT

DRAWING TYPE
PROPOSED PLAN

DESIGNER
C. VICK

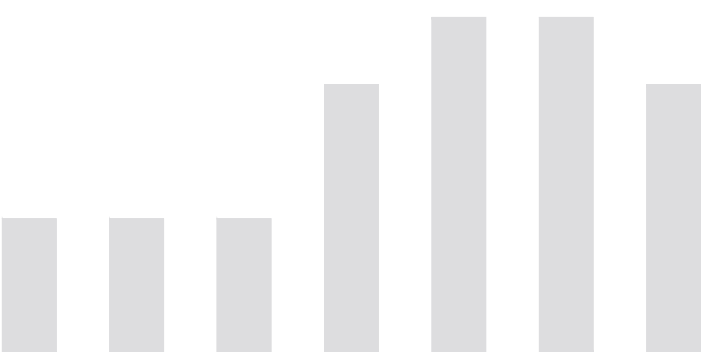
CHECKED BY
R. MACINDOE

APPROVED BY
I. WILLIAMS

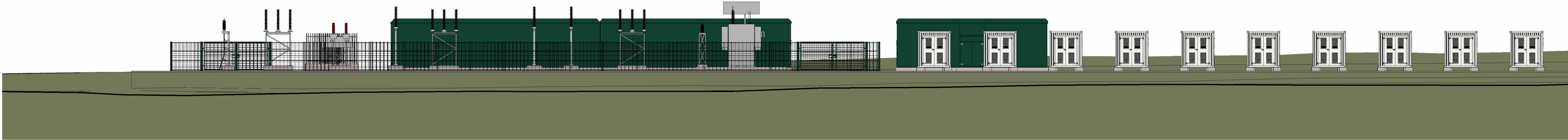
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REVISION
REV A

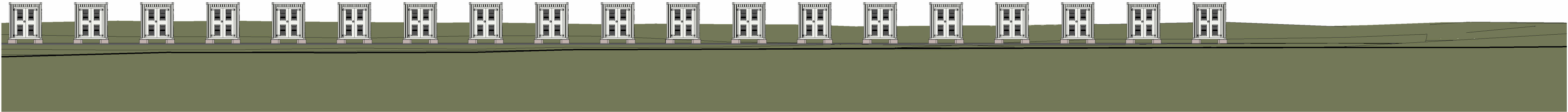
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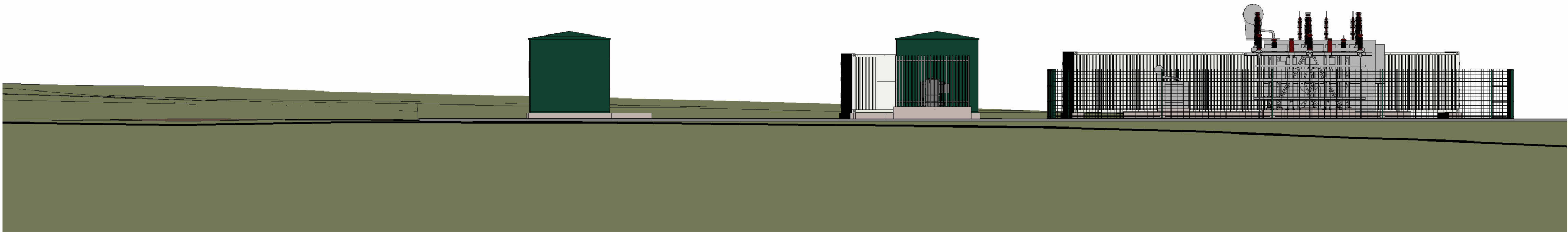
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PLANNING



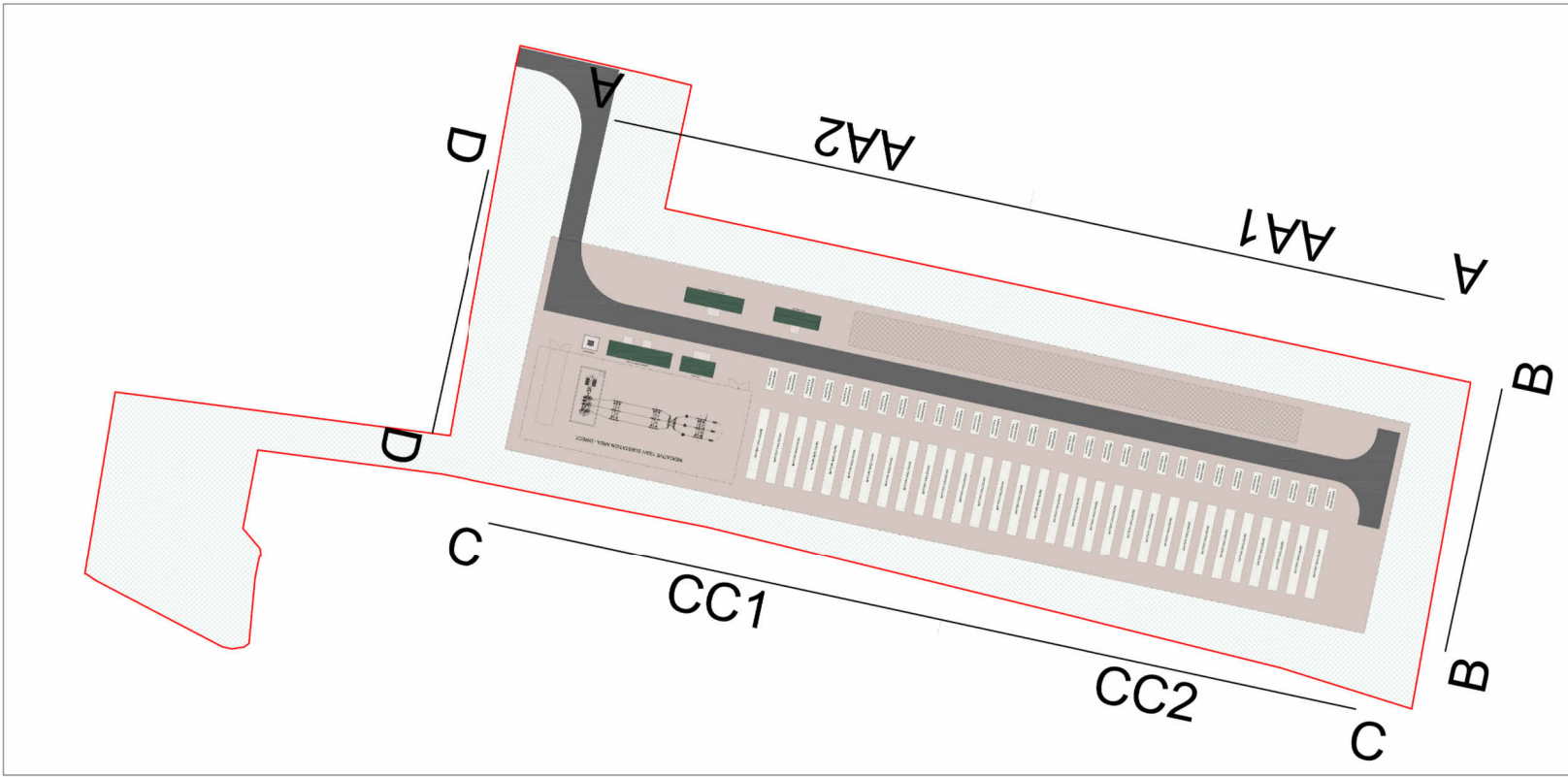
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CC2



DD



DRAWING PURPOSE
PLANNING

GENERAL

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THIS DRAWING DOES NOT DEFINE THE SCOPE OF SUPPLY

NOTES

ANCILLARY EQUIPMENT FOUNDATIONS STILL TO BE DECIDED

PROJECT NUMBER

PR871 - L33 3AP - 101

PROJECT TITLE

SANDYBROW LANE

PROJECT ADDRESS

SANDYBROW LANE - L33 3AP

PROJECT TYPE

ENERGY DEVELOPMENT

DRAWING TYPE

ELEVATIONS CC-DD

DATE

03/08/2023

REVISION

REV A

SCALE

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PAPER SIZE

A1

DESIGNER

C.VICK

CHECKED BY

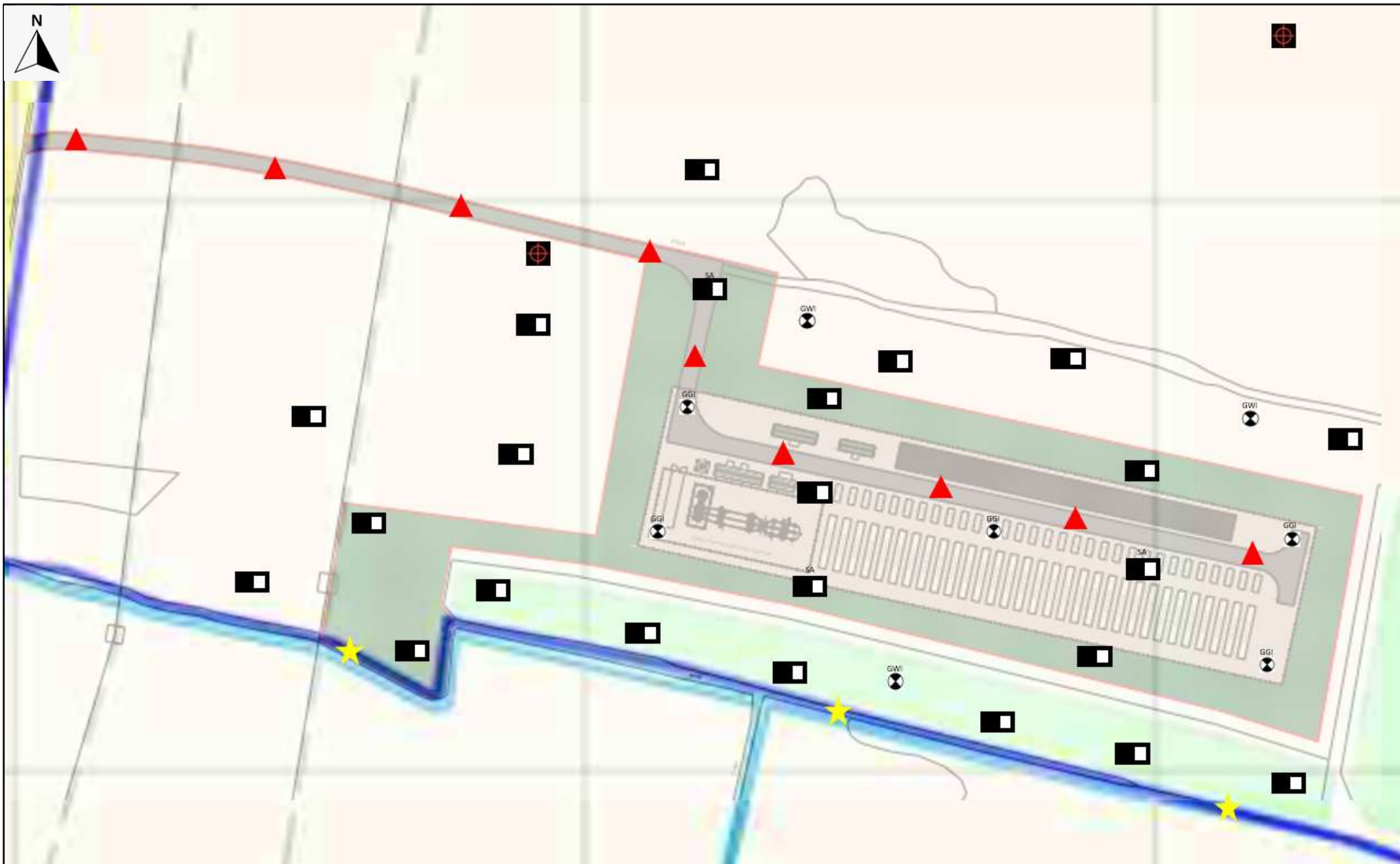
R.MACINDOE

APPROVED BY

I.WILLIAMS



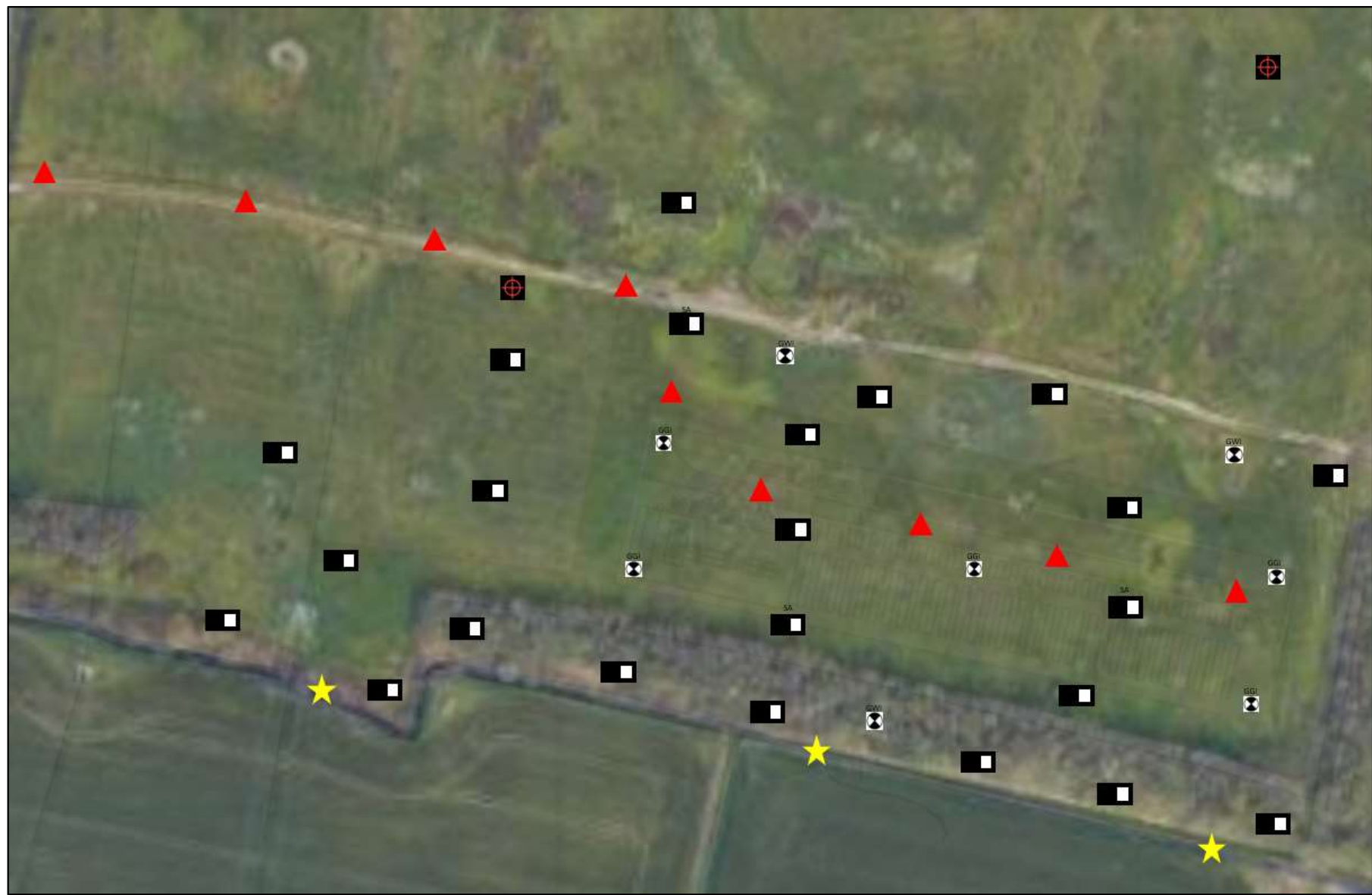
FIGURE 3 – PROPOSED TEST LOCATIONS



-  Windowless Sample Borehole
GGI - with Ground Gas Install
GWI - with Groundwater Install
-  Trial Pit
SA - with Soakage Test
-  TRL DCP Test
-  Existing Monitoring Well
-  Surface Water Sample

NOTE
Peat probes completed on 20x20m grid
60 probes completed across development area

Project:	Sandy Brow Lane			Title:	Proposed Test Locations – Development	
Job Number:	5022617	Client:	Balance Power	Ridge and Partners LLP TEL: 01962 834300 www.ridge.co.uk	1 Royal Court Kings Worthy Winchester SO23 7TW	
Drawing:	5022617-TLP	Revision:	-			
Drawn:	MS	Date:	August 2023			
Checked by:	RJH	Scale:	NTS			



 Windowless Sample Borehole
 GGI - with Ground Gas Install
 GWI - with Groundwater Install

 Trial Pit
 SA - with Soakage Test

 TRL DCP Test

 Existing Monitoring Well

 Surface Water Sample

NOTE
 Peat probes completed on 20x20m grid
 60 probes completed across development area

Project:	Sandy Brow Lane			Title:	Proposed Test Locations – Aerial View	
Job Number:	5022617	Client:	Balance Power	Ridge and Partners LLP TEL: 01962 834300 www.ridge.co.uk	1 Royal Court Kings Worthy Winchester SO23 7TW	
Drawing:	5022617-TLP	Revision:	-			
Drawn:	MS	Date:	August 2023			
Checked by:	RJH	Scale:	NTS			

APPENDIX 1 – REPORT CONDITIONS

This report is produced solely for the benefit of **Balance Power** and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report is based on a visual Site inspection, study of readily accessible referenced historical records, information supplied by those parties noted in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented in good faith without exhaustive clarification. Where ground contamination is suspected but no physical Site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to detailed activities related to the Site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, not revealed by this research cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by Authorities or Funds etc. without question, as such bodies may have unpublished, often more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Ridge and Partners LLP. In time improved practices or amended legislation may necessitate a re-assessment.

The report is necessarily limited to those aspects of land contamination specifically reported on and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents that may occur. The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous use and abuse of the Site and adjacent Sites. The report concentrates on the Site as defined in the report and provides an opinion on surrounding Sites. If migrating pollution or contamination (past or present) exists this can only practically be better assessed following extensive on and off Site intrusive investigations and monitoring.



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