



EOS Inc Limited

J36 Rockingham Phase 2 and 3

Ground Treatment Specification – Development Platforms

322638 R03 (02)

SEPTEMBER 2020

DOCUMENT CONTROL SHEET

PROJECT NAME **J36 Rockingham Phase 2 and 3**

REPORT TITLE **Ground Treatment Specification – Development Platforms**

REPORT REFERENCE **322638-R03 (02)**

Version	Date	Prepared by:	Checked by:	Approved by:
00 Draft	13 May 2020	A Cox	G McGuicken	G McGuicken
01 Final	19 May 2020	A Cox	G McGuicken	G McGuicken
02 Final	08 September 2020	A Cox	G McGuicken	G McGuicken

CONTENTS

1	INTRODUCTION	1
1.1	General	1
1.2	Definition of Roles	1
1.3	Site History	1
1.4	Proposed development.....	2
2	SITE INFORMATION	3
2.1	Drawings	3
2.2	Site investigation information and reports	3
3	GROUND TREATMENT WORKS	5
3.1	Ground treatment required.....	5
3.2	Materials for use as Surcharge.....	6
3.3	Surcharge Heights	7
3.4	Outline Methodology.....	7
3.5	Programme.....	8
3.6	Alternative Schemes of Treatment	8
4	MATERIALS MANAGEMENT	10
5	PERFORMANCE REQUIREMENTS	11
6	MONITORING INFRASTRUCTURE AND TESTING REQUIREMENTS	12
6.1	Installations prior to Contractor Mobilisation (First Stage).....	12
6.2	Installations during the Contract (Stage 2).....	12
	Monitoring Infrastructure.....	12
6.3	Testing Requirements	14

FIGURES

Figure 1	Ground Treatment Areas including required Surcharge Construction
Figure 2a	Indicative Monitoring Infrastructure Locations - Phase 3
Figure 2b	Indicative Monitoring Infrastructure Locations - Phase 2

1 INTRODUCTION

1.1 General

The site includes Phase 2 and 3 of the J36 Rockingham development site, near Barnsley. It is currently proposed to develop the site with ten warehouse buildings with associated service yards, car parks and infrastructure.

The site is located within the former Rockingham opencast coal mine, situated approximately 1km north east of Junction 36 of the M1 motorway. The Phase 2 area lies to the south and Phase 3 to the north of the Dearne Valley Parkway (A6195).

This document (or any subsequent revision) provides detail on the ground treatment requirements for the development platforms as currently indicated on the latest masterplan. . This document will form part of the contract documents for the ground works, which will include a ground treatment specification for the Phase 2 and 3 development platforms (this document) a ground treatment specification for the adoptable roads and roundabout (produced by RSK) and an earthworks specification for the same area (by JPG) The ground works and subsequent building works will be managed by Joint Contracts Tribunal (JCT) contracts.

1.2 Definition of Roles

Harworth Group are the client for the ground treatment works.

The funder for the project will require agreement of the appointment documents with all parties prior to their appointment.

RPP – will be the Employer's Agent and Quantity Surveyor for the ground treatment works and building works.

RSK – are the geotechnical and environmental consultants and have been responsible for the assessment of the site ground conditions and the production of the performance requirements for the ground treatment works. They will also be responsible for supervising the earthworks and ground treatment works, carrying out independent testing and providing validation that all works are in compliance with the specifications and performance requirements following completion.

Contractor – is responsible for the ground treatment works which will include cut and fill operations, surcharge placement and clearance works to the final cut surface prior to handover of the site (as specified by JPG). The contractor will also be responsible for undertaking any validation testing required by the client, RSK or JPG. The contractor will be required to place the surcharge mounds detailed in this document. The client will be responsible for the settlement attributable to the surcharge mounds detailed within this document and the removal of these mounds only. For the avoidance of doubt the contractor is responsible for the performance of the development platforms and all other works.

JPG – are the civil and structural engineer appointed by the client to oversee the construction phase of the development which will follow-on from the Ground Treatment works. JPG have produced the earthworks specification and designed the development platforms with associated cut/fill plans.

Harris Partnership – Architect.

1.3 Site History

The site has a long history of both deep underground mining (from the Rockingham colliery) and more recent opencast coal mining (RJ Budge Rockingham opencast in the 1990's) with the most recent operations including backfilling and restoration in the late 1990's. The site has been assessed by RSK Environment Ltd (RSK) since 2013. The ground conditions underlying the wider site are complex, as they include areas of historic open cast mining (1960's), recent opencast mining (1990's), and unexcavated areas. Opencast backfill materials are present across the site, which overlie Coal Measures bedrock.

1.4 Proposed development

The site is proposed for development with ten commercial units; two in the Phase 3 area (Units 1 and 2) and nine in the Phase 2 area (Units 1 to 8). In addition, access roads will be required into both development areas.

At this stage it is expected that development will proceed in the Phase 2 area and then into the Phase 3 area however there is an opportunity to progress the work on both Phases 2 and 3 simultaneously if deemed viable by the Contractor. The anticipated sequence is as follows:

- Works for the access road off the existing roundabout will be carried out during the Phase 2 works
- Phase 2 Units 1 to 4
- Works for the access road and new roundabout will be carried out during the Phase 2/3 works
- Phase 3 Unit 1
- Phase 2 Unit 5
- Phase 3 Unit 2
- Phase 2 Unit 6
- Phase 2 Unit 7
- Phase 2 Unit 8

The surcharge mound for Units 1 to 4 will be left in situ and subsequently made available for re-use to surcharge other Phase 2 units; similarly, for Phase 3 on completion of the works a surcharge mound for Unit 1 will be left in situ for subsequent re-use.

For Phase 2 Units 5 – 8 and Phase 3 Unit 2 only earthworks to provide the development platform are included in the current package of work detailed within this document. For these latter plots ground treatment by surcharging is currently outside the scope of works for which this document is being prepared. Ground treatment beneath the roads and roundabout is within the Contractor scope of work and is detailed in a separate specification (RSK report reference 322638 R07).

2 SITE INFORMATION

This section lists all Site Information which is available.

2.1 Drawings

Harris Partnership Drawings

Title	Reference	Revision
Proposed Masterplan	12006-1-110	L

JPG Drawings

Title	Reference	Revision
Proposed Earthwork Levels	4652-2-JPG-SW-00-DR-C-1200-S4	P013
Cut Fill Analysis	4652-2-JPG-SW-00-DR-C-1201-S4	P014
Phase 3 Proposed Earthwork Levels	4652-2-JPG-SW-00-DR-C-1202-S4	P07
Phase 3 Cut Fill Analysis	4652-2-JPG-SW-00-DR-C-1203-S4	P07
Topsoil Strategy	4652-2-JPG-SW-00-DR-C-1212-S4	P03

Note: Please contact JPG for the latest revision of the above-referenced drawings. Where these differ to the revision referenced please seek confirmation from RSK of any required alterations.

RSK Drawings

Title	Reference	Revision
Ground Treatment Areas Including Required Surcharge Construction	Figure 1	C
Indicative Monitoring Infrastructure Locations – Phase 3	Figure 2a	01
Indicative Monitoring Infrastructure Locations – Phase 2	Figure 2b	01

2.2 Site investigation information and reports

RSK have completed site investigation work including borehole and trial pit investigation and monitoring of surface ground markers across both development Phases together with a large-scale loading test in the Phase 3 area.

Details of the site investigation work completed to date can be found in the latest versions of the reports referenced below:

- RSK Report Reference 321393 – R3 (01), dated April 2015: Geo-environmental Site Assessment: Rockingham 2 East.
- RSK Report Reference 321393 – R4 (01), dated April 2015: Geo-environmental Site Assessment: Rockingham 3.
- RSK Report Reference 321393 – R6 (01), dated April 2015: Geo-environmental Site Assessment: Rockingham 2 West.
- RSK Report Reference 322494-R1 (00), dated February 2019; Preliminary Risk Assessment and Coal Mining Risk Assessment: J36 Phase 2, Rockingham.
- RSK Report Reference 322638 R02 (01), dated May 2020; Phase 2 Geo-environmental and Geotechnical Site Investigation : J36 Phase 2, and Phase 3 Rockingham.

JPG have prepared the Earthworks Specification documents referenced below for the cut and fill earthworks element of the preparatory works. These provide details on the requirements for cut and fill earthworks to provide development platform areas.

- Site Specification – Earthworks, Phase 2 Rockingham Reference: 4652-JPG-XX-XX-SP-G-0401-S1-P02, May 2020.
- Site Specification – Earthworks, Phase 3 Rockingham Reference: 4652-JPG-XX-XX-SP-G-0402-S1-P02, May 2020.

This Ground Treatment Specification outlines the requirements for ground treatment works which are required for Phase 2 Units 1, 2, 3 and 4, Phase 2 roundabout treatment area and Phase 3 Unit 1 and access road to improve the current ground conditions to a standard capable of adequately supporting the proposed commercial development units.

3 GROUND TREATMENT WORKS

In the Table below the ground treatment requirements for the tender are summarised.

All areas	Cut and fill earthworks (in accordance with JPG specification and drawings)
Phase 2 Units 1-4 and Phase 3 Unit 1	Surcharge of development platforms (buildings, external and perimeter areas) as detailed on Figure 1
New roundabout and Phase 3 access	Detailed within RSK report reference 322638 R07

The ground treatment requirements are detailed in the following sections.

3.1 Ground treatment required

The outline design for the ground treatment works are set out below. The cut and fill earthworks are to be completed to the JPG specification and surcharge treatment shall be carried out in accordance with this specification.

In order to provide development platforms suitable for the proposed buildings, access roads, associated service yards and ancillary areas, cut and fill works are required as detailed in the JPG Earthworks Specification. Performance requirements for these works are detailed in the JPG specification and Section 5 of this document.

In conjunction with the cut and fill works, ground improvement works are also required to improve the engineering properties of the opencast backfill and in particular the near surface materials in order that the performance requirements for the remediated site can be met. It is anticipated that the placement of engineered fill, where required, will be completed before surcharge treatment works are undertaken.

The performance of the ground treatment works will be recorded by RSK using monitoring equipment installed in advance of the main site operations. Three stages of equipment installation will be required. The first of these will be carried out by RSK before the main Contractor mobilises to site and the position of these installations (magnetic extensometers installed in deep boreholes) will have to be protected and maintained by the Contractor to enable monitoring during and on completion of the earthworks and surcharge treatment. The second stage will follow vegetation removal and topsoil strip, when the Contractor will install the required monitoring infrastructure as detailed in Section 6. The third stage continues from the second after the completion of the cut and fill works to finalise installation of the monitoring equipment detailed in Section 6. The installation of monitoring infrastructure and all earthworks and ground treatment will be supervised by RSK.

After the initial stage of installation works (pre Contract), the following works will be carried out:

(a) Vegetation clearance

In accordance with JPG Earthworks Specification.

(b) Surface Strip

Strip of 'topsoil' and organic subsoil in accordance with JPG Earthworks Specification and Topsoil Strategy.

(c) Install monitoring infrastructure

The contractor will install monitoring infrastructure under instruction from RSK. The location and timing of works will vary across the site and will be dependent on the Contractors programme. Details are provided in Section 6 and an indicative layout (which will be subject to change and is dependent on the Contractors programme) is included in Figures 2a and 2b.

(d) Carry out Cut and Fill Works

In accordance with JPG Earthworks Specification and drawings.

(e) Surcharge Treatment

In areas where engineered fill has to be placed to achieve the development level, surcharge works can only take place once infill operations have achieved the required levels for each given treatment area. In areas where materials are to be cut, such materials will have already contributed to surcharging the underlying development platform and consequently the sequencing of operations need careful consideration to minimise double or multiple handling – e.g. in an area where 4m is to be cut but the surcharge height is to be 5m then placement of 1m of surcharge over the original levels should be considered.

Based on the current masterplan for the site produced by the Harris Partnership, there is a requirement for surcharge areas over each of the ten development units prior to construction however for this contract the Contractor is only required to place the surcharge mounds for Phase 2 Units 1,2,3 and Unit 4 and Phase 3 Unit 1 (see Figure 1)

The treatment to the Phase 3 access road and new roundabout treatment area is detailed separately in RSK report reference 322638 R07.

If the Contractor has chosen to delay cutting to the final earthworks levels in order to reduce the required surcharge height they would also be required to remove the surcharges to a location chosen by the client on completion of the treatment works such that the underlying material could be cut to level and the material used for fill elsewhere on the site. Outside of this scenario, removal or moving of the surcharge mounds to other areas of the site would constitute a variation and should be priced at that time if requested by RPP/the client.

Where buildings are closely spaced a single surcharge mound can be used for multiple units and this is required for Phase 2 Units 1 to 4 as detailed on Figure 1.

3.2 Materials for use as Surcharge

Materials to be used as surcharge treatment can include the 'topsoil' material stripped from the site as well as subsoil and the underlying opencast backfill materials (although at this stage it is expected that sufficient volumes of 'topsoil', subsoil and stripped material will be present for all the surcharge works). The opencast backfill materials can only be used if they are surplus to the earthworks requirements or if they are only used temporarily and are subsequently used as engineered fill to create the final development landform as detailed in the JPG Earthwork Specification and drawings, by completion of the contract.

If different materials are used, they should be segregated. This includes segregation of 'topsoil' and subsoil as well as opencast backfill in order to preserve the 'topsoil' for re-use. Where 'topsoil' is used within the same surcharge mound as other materials the 'topsoil' will need to remain accessible (e.g. at the top of the pile).

If soils become mixed then they are unlikely to be suitable for subsequent use in landscape areas or engineered fill and the Contractor may be required to remove the mixed material from site and replace it with chemically and geotechnically suitable fill/landscaping materials at the discretion of the client.

All materials to be used as surcharge will be tested by the Contractor to confirm the in-situ density in advance of construction at a rate of 1 test per 10,000m³.

It is proposed that each treatment area is surcharged in turn with Phase 2 Units 1 to 4 being treated in the first instance and forming the requirement of these works.

If the Contractor identifies an opportunity to treat a greater area of the site simultaneously, whilst still meeting the required deadlines, this should be presented to RSK/ RPP.

It is expected that the volume of materials from the Phase 2 surface scrape and 'topsoil' will be sufficient to surcharge Units 1 to 4 as a minimum and that the surface scrape, 'topsoil' and existing load test mound will be sufficient to surcharge Phase 3 Unit 1 as a minimum.

3.3 Surcharge Heights

A 3m surcharge height, above final earthworks levels for each given area, will be required over Phase 2 Units 1 to 4, increasing to 3.5m if organic rich 'topsoil'/subsoil or soils with a density of less than 1,500 kg/m³ are utilised.

A 5m height of surcharge, above final earthworks levels, will be required over all remaining Units and the new roundabout treatment area, increasing to 6m if organic rich 'topsoil'/subsoil or soils with a density of less than 1,500 kg/m³ are utilised.

If an accelerated programme was required consideration could be given to increasing the surcharge height to induce the required settlement in a shorter time.

All surcharge heights will be measured relative to the final earthworks levels, as defined on the latest revision of JPG's Proposed Earthwork Levels.

3.4 Outline Methodology

Following the vegetation removal and 'topsoil'/subsoil strip, the plan area where surcharge materials are to be placed will be subject to proof rolling following the specification defined in the JPG earthworks strategy. Any soft spots will be removed and replaced.

For areas where infill is required this would be completed in accordance with the JPG Earthwork Specification.

The Contractor will then install the required monitoring infrastructure and provide notice and access to RSK as detailed in Section 6 (NB installation will be required at different times across the site, subject to the Contractors programme, and some works can only take place once some areas are cut to final level).

After site clearance, enabling earthworks and initial installation works the following sequence will be completed, or an alternative as devised by the Contractor which has been agreed by RSK and RPP/ the client:

- 1 The first areas of the works (Phase 2 Units 1 to 4 and Phase 3 Unit 1,)will be set out by the Contractor to establish the area of placement (Figure 1) which indicates the top surface of the surcharge. The surcharge heights will be as detailed in the Surcharge Heights (Section 3.3) above. A 1:2 batter is proposed initially however the Contractor will need to review the stability of the material and determine an appropriate angle of repose. In determining side slopes consideration shall be given by the Contractor to potential slope stability issues, containing material and water run-off down side-slopes and, where relevant, proximity of services.
- 2 Arisings from areas of cut, including the existing load test mound (present in the Phase 3 area), soil removed with surface 'topsoil' scrape and any other agreed borrow pit areas (if used) will be brought to each area of surcharge placement in dumper trucks and appropriate plant will be used to level out and track over/compact the deposited materials and form the surcharge mounds.

- 3 The 'topsoil' and subsoil should be segregated from one another as well as being and segregated off from any opencast backfill materials (if they are being used for surcharge). It is suggested that in the Phase 2 area a significant volume of topsoil and surface scrape materials will be made available at an early stage, which could be used for the surcharge for Phase 2 Units 1 to 4 after completion of the cut and fill in this area. Similarly, on Phase 3 such materials and the existing load test mound can be used as surcharge Unit 1 after completion of the cut and fill.
- 4 As placement works progress a gently sloping ramp will be required at the edge of the surcharge area to allow access onto the top working surface by dumper trucks. This may require more regular tracking and compaction than the wider treatment area. The Contractor is required to consider an appropriate angle for the side slopes to maintain their stability and working practices should be continually reviewed to ensure the safety of all parties.
- 5 As construction of the surcharge treatment mounds progresses the Contractor will be responsible for ensuring the protection and integrity of all monitoring infrastructure (including both the previously installed magnetic extensometers and subsequent hydraulic profile loops). If any equipment is made inoperable by the works this would have to be replaced by the Contractor at his cost. If replacement was required works would have to locally cease until full reinstatement was completed and this could cause delays to the programme.
- 6 As placement works progress attention should be provided to side slopes to ensure safe working slopes which should be locally compacted by tracking plant or with the bucket of an excavator. Again, consideration should be given to the working practices employed to ensure safety of plant and operators.
- 7 Placement works should progress until the surcharge has achieved the required elevation above the proposed final development platform levels. At this stage the final surface should be compacted and sealed to minimise the potential for rainwater entry. The final mound as constructed should then be surveyed (as-built), and details provided to RSK in CAD format.
- 8 The surcharge mound will then remain in place until such time as the engineer (RSK) deems sufficient settlement to have been induced. At this stage it is considered likely that this will take approximately 3 months however dependant on the results of the settlement monitoring for each surcharge successful treatment may be achieved sooner or later.
- 9 Though not forming part of this contract, once treatment is deemed complete the surcharge mounds can be moved to the next area or progressively rolled across a treatment area, in order to achieve the required coverage. The above process would then be repeated until all Units have been treated.

3.5 Programme

The Contractor shall programme their works such that the surcharges over Phase 2 Units 1-4 and, Phase 3 Unit 1 are placed to allow sufficient treatment time ahead of construction.

3.6 Alternative Schemes of Treatment

The works set out in Sections 3.1 to 3.5 above have been designed to improve the ground conditions to a level suitable to support the proposed building development for Phase 2 Units 1 to 4 and Phase 3 Unit 1. This design is based on the results of a long-term loading test and detailed geotechnical settlement modelling of the proposed development platform.

It is possible that alternative schemes of treatment may be suitable for the prevailing ground conditions and in the case of the access road may be deemed more practical. If the Contractor considers other methods feasible, they can only be considered if their efficacy can be demonstrated by appropriate completion testing and they

are fully warranted by the Contractor. Alternatives may be considered if they are provided in addition to a compliant tender bid based upon the scope set out in this document and must be supported by an appropriate level of detail, together with an outline of time and cost savings and verification testing and warranty provision.

4 MATERIALS MANAGEMENT

All materials used for surcharge treatment and for cut and fill earthworks will be handled by the Contractor with due care in order to preserve their suitability for re-use on site. All movements of materials will have to follow the protocols set-out in a Materials Management Plan (MMP) which is currently under preparation and a template of which is included within the tender documents.

The MMP document will be written to allow re-use of suitable materials generated on site from the surface strip and cut operations to be used as engineered fill and as surcharge materials. It will require segregation of different material types, geotechnical and contamination testing by the contractor to demonstrate suitability of use (see Section 6) and will allow limited treatment of as dug materials to make them suitable for re-use. This may include crushing of oversized material and the option of conditioning of materials with lime or cement to reduce moisture content and/or improve handling characteristics.

In order to be reused the material will need to be chemically and geotechnically suitable for use on site. All environmental incidents must be reported to RSK (e.g. spills of hydraulic oil) and any resultant remedial requirements are the responsibility of the Contractor.

In order to remain geotechnically suitable the materials will need to be managed by the contractor to minimise water entry. Movement of materials in wet weather is not advised and all stockpiles and surcharge mounds should be sealed to prevent water ingress.

5 PERFORMANCE REQUIREMENTS

This section sets out the performance requirements for the finished surface on completion of the earthworks and after ground treatment only where this is indicated to be required.

(a) Performance requirements beneath building footprints

The performance requirements are to be achieved at a level 450mm below the finished earthworks level.

- Allowable Ground Bearing Pressure: 100kN/m² beneath building foundations.
- Anticipated weight of loaded building for settlement calculation purposes: Imposed Load up to 35kN/m². The imposed load will vary over time and across the footprint of the building depending on the amount of goods being stored within the building.
- CBR: A minimum CBR at top of formation level of 3% or 5% where granular fill is utilised (based on 600mm diameter plate tests).
- Maximum Residual Ground Movement: 25mm (to be reviewed following receipt of calculated ground movement from RSK).
- Maximum Differential Movement: 1 in 500.

(b) Performance requirements for external areas, car parks and roads

The performance requirements are to be achieved at the top of the formation level.

- CBR: A CBR at top of formation level of 3% or 5% where granular fill is utilised (based on 600mm diameter plate tests).
- Allowable Ground Bearing Pressure: 50kN/m².
- Anticipated weight for settlement calculation purposes: Transient load of 5kN/m². The imposed load will vary over time and across the hard-standing areas depending on the amount of goods being stored / vehicles in attendance.
- Maximum Residual Movement: 50mm (to be reviewed following receipt of calculated ground movement from RSK).
- Maximum Differential Movement: 1 in 200.

Note that in areas where engineered fill is to be placed in order to achieve the specified CBR, a near optimum moisture content will need to be achieved during compaction. In certain areas and dependant on how the materials have been handled there may be a requirement for a drying method (e.g. air drying or lime stabilisation) of the fill material to achieve near optimum moisture content.

In areas of cut inspection and proof rolling would be required in order to meet the performance requirements. At this stage any loose, soft or deleterious materials would need to be removed and replaced with suitable fill.

Any such actions to treat out of specification materials (i.e. drying or lime stabilisation, or material replacement) should be agreed by RSK/RPP prior to the works being carried out.

6 MONITORING INFRASTRUCTURE AND TESTING REQUIREMENTS

6.1 Installations prior to Contractor Mobilisation (First Stage)

Extensometer Boreholes

In advance of the Contractor mobilising to site RSK will install 3 no. earthwork monitoring boreholes across the site. The indicative locations for these boreholes are included on Figures 2a and 2b. These boreholes must be protected during the earthworks programme. Access must be maintained for RSK to conduct monitoring works and collaboration with RSK is required as engineered fill and/or surcharge is placed to extend the monitoring pipework as ground levels are raised.

The contractor should provide adequate protection to these boreholes such that their works will not damage the pipework. It is understood that disturbance of the ground surface adjacent to the boreholes will be unavoidable during the earthworks scheme however this will not impact the majority of the data points so long as the pipework is protected. RSK's suggestion for a practical method of protection is to install an additional 2m height of pipework above ground level such that the installations are visible to large plant. This extension should be marked with cones, hazard tape or flagged to further aid visibility. All operators should receive a briefing on the importance of protecting, and the locations of the extensometer boreholes before commencing work. If the Contractor wishes to adopt alternative or additional protective measures these should be agreed with RSK/Harworth Estates in advance,

As the earthworks progress and levels rise extensions to the pipework for these monitoring positions will be applied by RSK. The supervising engineer should be informed by the Contractor when ground levels are within 1m of the top of the pipes.

Once the earthworks and monitoring is complete the pipework will be grouted by RSK.

6.2 Installations during the Contract (Stage 2)

Monitoring Infrastructure

In order to allow confirmatory and performance monitoring of the ground settlement resultant from the surcharge treatment additional infrastructure will have to be installed and monitored. The Contractor will be required to install this infrastructure under RSK supervision and RSK will undertake the monitoring. The Contractor will allow safe access to RSK and any third-party staff to undertake monitoring and supervise installation, which may require the Contractor to cease working in particular areas during monitoring visits.

Settlement Monitoring Loops

The Contractor is required to provide plant and materials to install monitoring tubing in a number of shallow excavations and to subsequently protect monitoring infrastructure which is outlined below:

- Excavation of a series of trenches totalling approximately 1400m in length, 500mm deep and 300/450mm wide. Indicative locations are provided on Figures 2a and 2b. The trenches will be required at different times as the works progress dependant on the Contractor's programme. Access will be required to the end positions of each loop and these areas should be made (by the Contractor) free draining and safely accessible.
- The contractor will need to provide pipework (MDPE water pipe, 50mm ID, such as Wavin MDPE Pipe Blue 50mm x 100m or similar, any joints internally flush coupled) and a suitable pipe bedding material (e.g. building sand) to sufficiently bed and protect the pipe as the trench is backfilled also ensuring that excess surface water ingress is prevented. Each backfilled excavation will form a settlement monitoring loop.

RSK should be consulted before any of the above materials are purchased in order to confirm their suitability for the intended purpose.

Figure 2a and 2b differentiates the loops by colour based on the time of installation. Some can be installed in advance of filling operations and others can only be installed after some areas have been cut – NB these are indicative and final positions will be dependent on the Contractors programme. The Contractor will need to ensure plant and materials are available at the required time and must give RSK reasonable notice prior to dates of installation.

Permanent ground Markers (PGMs)

When building areas are brought to platform level, but in advance of surcharge treatment, the Contractor will install surface mounted ground anchor PGM's. These should be installed at a slightly reduced level in shallow hand dug pits and their precise elevation and co-ordinates recorded prior to covering with coloured sand (or similar to facilitate subsequent inspection and monitoring on removal of surcharge). The indicative number and positions of PGMs are presented in Figures 2a and 2b.

The PGMs need to be robust as they will have to withstand the construction process required to place and subsequently remove the surcharge before completion monitoring can be carried out. The design of the PGMs will have to be agreed with RSK. Previously we have used bespoke monitoring pins using 10 to 15mm diameter steel bar, protruding from and set-in concrete monoliths 200mm square and 300mm deep.

The Contractor will agree with RSK practical positions for the PGMs and the measures necessary to protect them during the early stages of surcharge placement (this may include for example the temporary placement of concrete sewer rings or similar, until surrounding levels are raised).

PGM's will also be required at either end of each settlement monitoring loop and must be similarly protected.

In addition, RSK will install PGM's at the ground surface in areas of cut once final levels are achieved. Once these PGM's are installed plant movements should cease in the vicinity of the PGM's. RSK will work with the Contractor in positioning these PGM's such that access is maintained to all remaining work areas though some restriction to haul routes should be expected. The Contractor would be responsible for making sure the PGM's are not damaged or disturbed as a result of their operations.

Groundwater inundation tests

At selected locations groundwater inundation tests will be required. These will be constructed by the Contractor but all equipment will be installed and monitored by RSK. Tests will be required at three locations, one in Phase 3 and two in Phase 2, some indicative locations are shown on Figures 2a and 2b.

At each test location the contractor will excavate a test pit of minimum dimensions 1m depth, 1m width and 6m length. This will then be backfilled with coarse gravel around three evenly spaced, vertically orientated, slotted standpipes (of 150mm diameter) NB all materials to be provided by the Contractor. RSK will then install monitoring pins, the position and spacing of which will be dependent on the test location. Once these are installed and levelled the Contractor will then carry out the water inundation stage (being mindful not to disturb any of the monitoring equipment). This will require a steady supply of potable water to be available to be brought to the test area (either by hose or tanker) and discharged into the test pit via the vertical standpipes. The volume of water required will be dependent on infiltration rate, but it is expected that continuous soakage will be required for a minimum of 2 working days. On completion of the soakage stage the Contractor will place temporary fencing around the test area and make sure that his subsequent site operations are conducted away from the test area. RSK will continue monitoring which will reduce in frequency but be required for up to 3 months.

It is possible that the three inundation tests will be carried out separately at different times or possibly concurrently. This would be dependent on the Contractors programme.

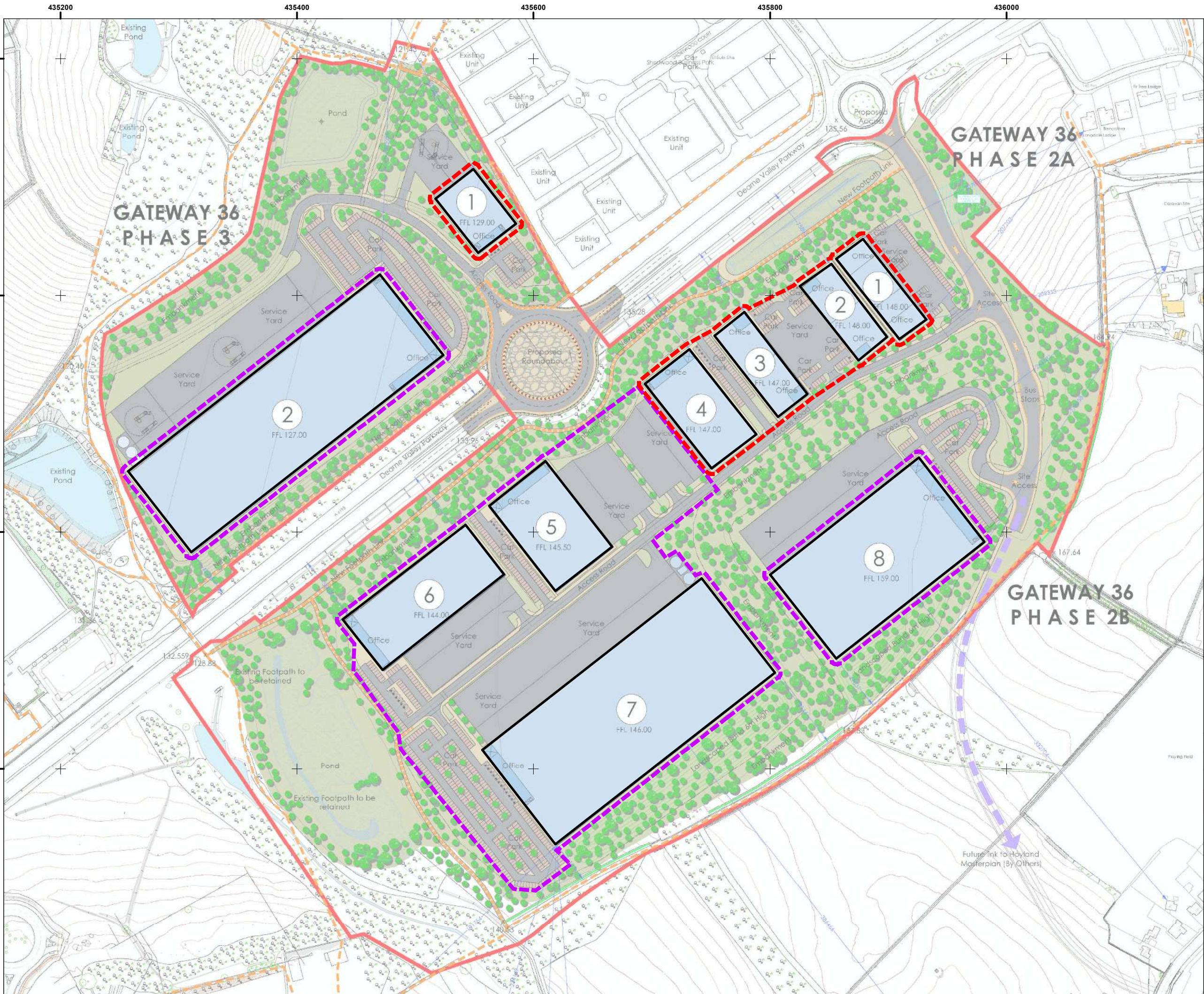
6.3 Testing Requirements

The Contractor will be required to carry out testing of materials to be used in the earthworks as outlined in the JPG Earthworks specification documents. Although not expected to be required, any materials to be brought onto the site to achieve final levels will have to be tested in advance to demonstrate their geotechnical suitability; their engineering material classification; and that they are chemically inert (and suitable for use). If any materials are to be taken off site the Contractor will be responsible for appropriate testing to ensure the materials can be accepted by the receiving off-site facility.

If any modification of on-site materials are required then additional testing would be necessary – the scope of such testing would be agreed with RSK in advance. This would include gradings for any materials subject to crushing and contamination testing (largely pH value but also total sulphate and dissolved metals) for lime or cement stabilised soils and monitoring of pH in any water courses or ponds.

The Materials Management Plan outlines a required testing frequency for those soils retained or placed in the landscaped areas of the development.

FIGURES



Legend:

- Proposed Building Footprints
- Top of surcharge treatment mound to be constructed prior to construction (outside the Contractors current scope of works). Area to achieve the heights specified in RSK report reference 322638 R03 (03) relative to post earthworks ground levels
- Top of surcharge treatment mound to be constructed by the Contractors within the current scope of works. Area to achieve the heights specified in RSK report reference 322638 R03 (03) relative to post earthworks ground levels

Notes:
Surcharge mounds are to be constructed in accordance with the requirements set out in RSK report reference 322638 R03 (03). This report details the required heights of surcharge for each of the treatment areas.

Top of surcharge extent to cover the whole building footprint.
Where required consider the use of concrete blocks, excavated boulders or other measures to create a stable and safe slope within the perimeter of the site.

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

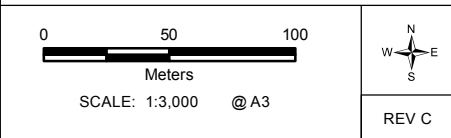


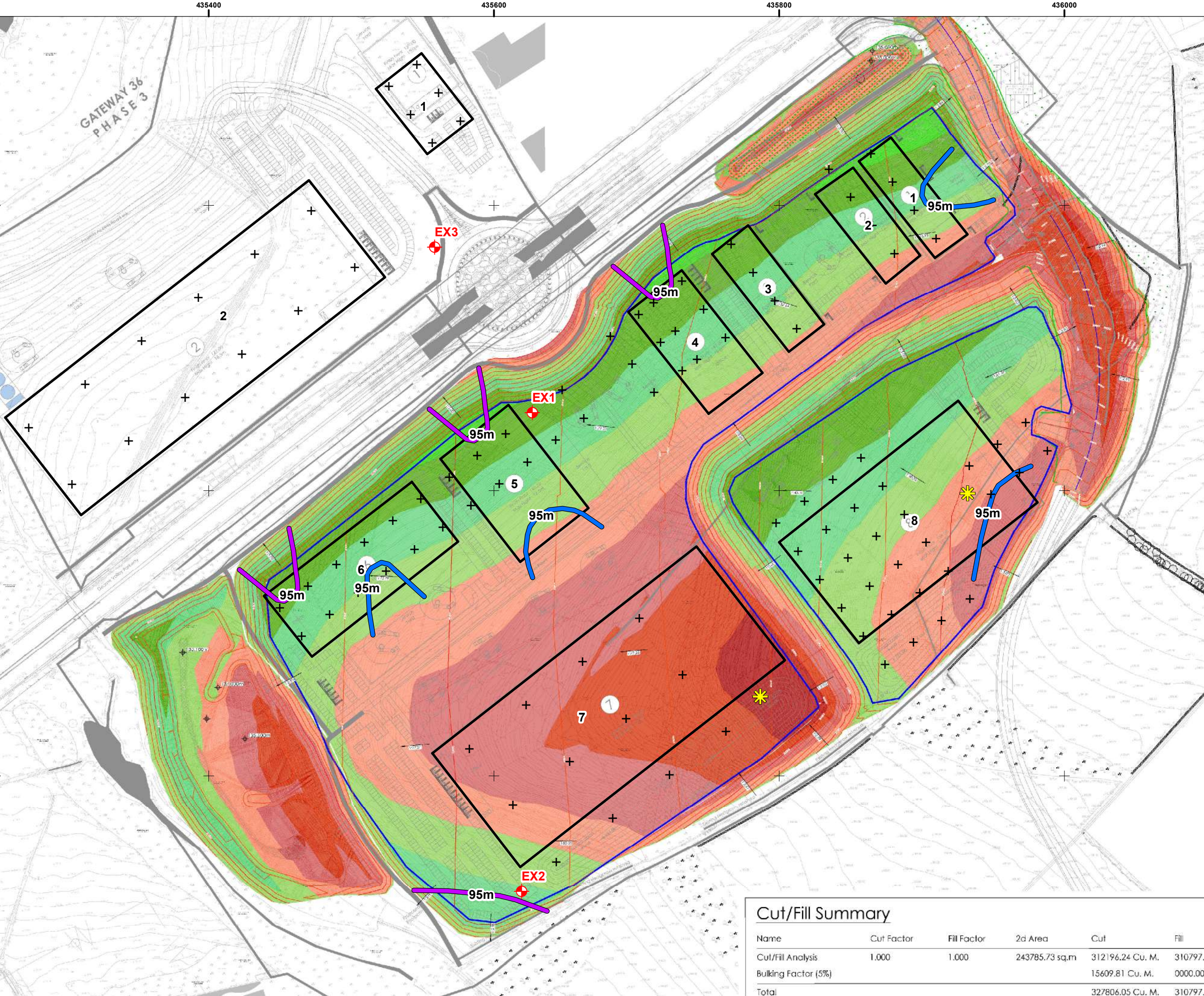
Rev	Date	Description	Drm	Chk	App
C	02/09/2020	Surcharge Updated	AJ	AC	AC
B	19/08/2020	Second Draft	DR	AC	AC

Rockingham Infrastructure



TITLE: 322638 R03 (03) - Figure 1:
Indicative Ground Treatment Areas
Including Required Surcharge
Construction





- Legend:**
- Possible Inundation Test Site
 - Permanent Ground Markers Installed at Final Level Beneath Surcharge
 - Extensometer Borehole Installations
 - Monitoring loop – constructed after completion of cut/fill but in advance of surcharging
 - Monitoring loop – constructed before overlying cut/fill
 - Building Footprints

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

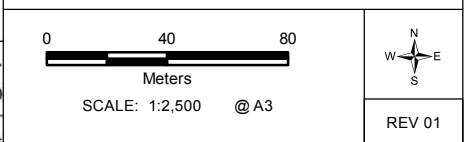


Rev	Date	Description	Drm	Chk	App
01	03/09/2020	Base Updated	AJ	AC	AC
00	13/05/2020	First Draft	DR	AC	AC

Rockingham Infrastructure



TITLE: 322638 R03 (03) - Figure 2b:
Indicative Monitoring Infrastructure
Locations



Cut/Fill Summary					
Name	Cut Factor	Fill Factor	2d Area	Cut	Fill
Cut/Fill Analysis	1.000	1.000	243785.73 sq.m	312196.24 Cu. M.	310797.00 Cu. M.
Bulking Factor (5%)				15609.81 Cu. M.	0000.00 Cu. M.
Total				327806.05 Cu. M.	310797.00 Cu. M.