



**HINCKLEY SCHOOL
BUTT LANE, HINCKLEY**

**SPORTS PITCH SOIL AND DRAINAGE ASSESSMENT
FOR
REINSTATEMENT WORKS**

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Document No:	SPL0001-MAC-XX-XX-T-L-0005
MAC Ref No:	P01
Status:	S3
Reason for Issue	For Information

Version	Issue Status	Originated	Checked	Authorised	Date
P01	For Information	MC	RR		16/02/2024

Contents

1.0 INTRODUCTION	5
2.0 METHODOLOGY AND REFERENCES	6
3.0 EXISTING AND PROPOSED SITE.....	7
3.1 Location	7
3.2 Existing Use(s)	7
3.3 Previous Use(s)	7
3.4 Site Investigation Report	8
3.5 Topography	8
3.6 Site Geology	8
3.7 Soil Maps	8
3.8 Existing Site Drainage	8
4.0 SUMMARY OF SITE FIELDWORK AND LABORATORY ANALYSIS	10
4.1 Sampling Locations	10
4.2 Topsoil Descriptions	10
4.3 Grass Cover.....	14
4.4 Soil Depth.....	15
4.5 Schedule of Laboratory Analysis	15
4.6 Results of Laboratory Analysis	15
5.0 CONSIDERATIONS FOR SPORTS PITCH REINSTATEMENT.....	17
5.1 General Considerations and Selecting the Right Pitch Design	17
5.2 Subsoil and Primary Drainage System.....	18
5.3 Topsoil Quality	18
5.4 Topsoil Modifications.....	18
5.5 Grass Seeding & Fertiliser Applications.....	19
5.6 Pitch Maintenance & Management	19
5.7 Mowing	20
6.0 CONSTRUCTION OPERATIONS AND PROGRAMMING.....	21
6.1 Soil Structure & Degradation	21
6.2 Soil Handling	21
6.3 Programming.....	21
6.4 Sports Pitch Reinstatement – Topsoil Stripping and Stockpiling.....	22
6.5 Sports Pitch Reinstatement – Formation Preparation.....	22
6.6 Sports Pitch Reinstatement – Topsoil Respreding	22
6.7 Sports Pitch Reinstatement – Sand Amelioration.....	23
7.0 SUMMARY OF FINDINGS AND RECOMMENDATIONS.....	24
APPENDIX 1 – SITE PLANS	26

APPENDIX 2 – GROUND INVESTIGATION REPORT	27
APPENDIX 3 – LABORATORY ANALYSIS RESULTS	28
APPENDIX 4 – SITE PHOTOS.....	29

1.0 INTRODUCTION

MAC Consulting was commissioned by REDS10 to provide a survey and report into the soils and drainage of the existing sports field at Hinckley School, Butt Lane, Hinckley. The report is to address the following pre-commencement planning condition:

Prior to the commencement of any development on the site a detailed survey shall be submitted to the local planning authority for their approval in writing of the area of ground to be occupied by the temporary accommodation/car parking as shown on Drw No: SPL001-MAC-XX-XX-D-L-0015 (Sports Pitch Grass Reinstatement Plan).

This survey shall include a full investigation into the extent of any field drains present within this land as part of the playing field. These field drains shall be mapped and recorded as part of this work and shall include details of how these field drains would be reinstated. The approved details shall then be completed in full on the site within three months of the removal of the modular unit, temporary car park and associated infrastructure in this area.

2.0 METHODOLOGY AND REFERENCES

The following reference text and current industry guidance has been used in the production of this report:

- a) BS3882: 2015 British Standard for Topsoil
- b) BS8601:2013 British Standard for Subsoil
- c) Natural Turf for Sport – Sport England 2011
- d) Grass Pitch Performance Quality Standard – Football Association 2011
- e) Code of Practice for the Design, Construction and Improvement of Natural Turf – SAPCA 2010
- f) School Playing Fields Planning and Design Guidance – Sportscotland 2007
- g) Natural Turf Datasheet 103 – Sportscotland 2015
- h) Natural Turf Pitch Guidelines – World Rugby 2015
- i) Winter Games Pitches – STRI 1994
- j) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites – DEFRA 2009

MAC Consulting is a member of the following professional bodies:

- The Sport and Play Construction Association
- The Landscape Institute
- Grounds Management Association
- British Society of Soil Science

3.0 EXISTING AND PROPOSED SITE

3.1 Location

The site is an area of amenity grassland located in the north-west of the Hinckley Academy School Site, just west of the main vehicle entrance off Butt Lane (see red dashed outline in Figure 1 below). The site is to be used for temporary accommodation whilst an existing teaching block is demolished and rebuilt in the north east corner of the site.



Figure 1: Hinckley School

3.2 Existing Use(s)

The site is a school and the area to be used for the proposed temporary accommodation is used as a playing field with football goals.

3.3 Previous Use(s)

Historically the site has been used as a playing field. Prior to that a review of historic maps from National Library has shown the land was in agricultural use. There is evidence of old structures having been located within the area of the playing field with unnaturally regular shaped areas of discoloration evident in aerial images.

3.4 Site Investigation Report

B030162 V1 Ground Investigation Report has been reviewed in the production of this report. Three inspection pits IP03, IP04 and IP05 were excavated in the area of the proposed temporary accommodation on the upper sports pitch:

Below the surface Topsoil within the area of the proposed temporary classrooms, soils showed obvious signs of disturbance between a depth of 0.18 and 0.26m bgl in IP05. Below this depth, natural soils are tentatively assumed, however this assumption is based only on the absence of anthropogenic materials.

The Made Ground was variable in composition and comprised dark grey to black slightly ashy slightly sandy gravel of quartzite, sandstone and coal with rare metal.

The Oadby Member was encountered in IP05 at 0.26m bgl and although similar soils were encountered in IP04 and IP05 at similar depths, rare brick fragments have also been identified indicating possible disturbance within the depths investigated at these positions.

The unit was relatively uniform in composition and soils encountered were similar to those encountered in the proposed development areas (and consisted of soft to firm orangish to reddish brown slightly gravelly sandy clay). The gravel component comprised subangular to subrounded fine to medium flint and quartzite (with rare brick fragments noted in IP04 and IP03).

3.5 Topography

The site lies between approximately 134.60m AOD at the north end sloping down to 130.60m OD at the south end. The land falls uniformly from north to south and the fall is equivalent to a slope of 1 in 25. This is steeper than would generally be recommended by Sport England for a natural grass pitch (generally between 1:80 – 1:100 along the line of play).

3.6 Site Geology

The superficial deposits across the site are mapped as Oadby Member by the BGS which are laid down as lenses of sand and gravel, clay and silt. Clay, brown to grey, and silty clay, with chalk and flint fragments

Bedrock is mapped as belonging to the Mercia Mudstone Group. Dominantly red, less commonly green-grey, mudstones and subordinate siltstones with thick halite-bearing units in some basinal areas. Thin beds of gypsum/anhydrite are widespread; thin sandstones are also present. Mid Triassic (Anisian) to latest Triassic (Rhaetian).

3.7 Soil Maps

The soilscapes dataset published by Cranfield University describes the soils of the Hinckley site as “Slightly acid loamy and clayey soils with impeded drainage”.

3.8 Existing Site Drainage

No known drainage is thought to exist within the amenity grass area to be used for the proposed temporary accommodation. Aerial imagery suggests a herringbone system of old field drains is present in the playing field area to the west of the development site but there is no evidence of drains within the development site itself.

Given the 1:25 gradient along the longitudinal axis of the playing field it is likely that the area relies on the natural fall and permeability of the site soils to disperse surface water.



Figure 2: Aerial Image during drought conditions showing discoloured angled lines at the surface as evidence of herringbone field drainage to playing fields. The area of temporary accommodation exhibits no evidence of any existing field drains from records, anecdotal or aerial imagery.

4.0 SUMMARY OF SITE FIELDWORK AND LABORATORY ANALYSIS

4.1 Sampling Locations



Figure 3: Sampling locations

11 hand pits were excavated across the playing field area in the locations shown in figure 5 above at depths between 0.20 and 0.65m. The purpose of the trial pits was to examine the upper layers of the soil profile and establish the presence of any underlying drainage.

4.2 Topsoil Descriptions



TP1 – 100mm Greyish Brown Sandy Clay Loam Topsoil; Compact overlying Red Ash, Flint, Coal with occasional glass fragments (previously disturbed ground). Trial pit dry, no worm activity. No evidence of drainage; End of Pit.



TP2 – 300mm Greyish Brown Sandy Loam Topsoil; Worm Activity; Frequent Stones 30-40mm; Shallow Rooting to 150mm; 300-500mm Silty Clay Loam Subsoil; Trial Pit Dry; No evidence of drainage; End of pit.



TP3 – 200mm Greyish Brown Sandy Loam Topsoil; Compact overlying Red Ash, Flint, Coal with occasional glass fragments (previously disturbed ground). Trial pit dry, worm activity. No evidence of drainage; End of pit



TP4 – 320mm Greyish Brown Sandy Clay Loam Topsoil; Compact; Frequent stones 30-50mm diameter; Worm activity; Dry; Brown Silty Clay Loam Subsoil 320-600mm; No evidence of drainage; End of pit



TP5 – 325mm Greyish Brown Sandy Loam Topsoil; Friable; Frequent stones 30mm diameter; Roots to 200mm; Worm activity; Dry; Silty Clay Loam Subsoil 320-550mm; No evidence of drainage; End of pit.



TP6 - 300mm Greyish Brown Sandy Clay Loam Topsoil; Friable; Frequent stones 30mm diameter; Roots to 200mm; Worm activity; Dry; Brown Silty Clay Loam Subsoil 300-500mm; No evidence of drainage; End of pit.



TP7 - 290mm Greyish Brown Sandy Clay Loam Topsoil; Compact; Tree Roots to 150mm; Frequent stones 30-40mm diameter; Worm activity; Dry; Brown Silty Clay Loam Subsoil 290-500mm; No evidence of drainage; End of pit.



TP8- 290mm Greyish Brown Sandy Clay Loam Topsoil; Compact; Frequent stones 30-40mm diameter; Worm activity; Dry; Brown Silty Clay Loam Subsoil 290-500mm; No evidence of drainage; End of pit.



TP9 – 150mm Brown Sandy Clay Loam Topsoil; Compact overlying Ash, Flint, Coal with occasional glass fragments (previously disturbed ground). Trial pit dry, worm activity. No evidence of drainage; End of pit



TP10 - 300mm Greyish Brown Sandy Clay Loam Topsoil; Compact; Occasional stones 25-50mm diameter; Worm activity; Dry; Brown Silty Clay Loam Subsoil 290-490mm; No evidence of drainage; End of pit.



TP11 - 300mm Greyish Brown Sandy Clay Loam Topsoil; Compact; Occasional stones 25-50mm diameter; Worm activity; Dry; Brown Silty Clay Loam Subsoil 290-500mm; No evidence of drainage; End of pit.

4.3 Grass Cover

The playing field area is predominantly comprised of annual meadow grass with frequent moss and broadleaved weeds throughout.



4.4 Soil Depth

The trial pit logs show a varying depth of topsoil between 150 and 325mm. We would estimate the average topsoil depth to be 290mm, but this may vary locally.

4.5 Schedule of Laboratory Analysis

The topsoil samples were aggregated into two samples of the site topsoil which were sent to the European Turfgrass Laboratories (ETL) and NRM laboratory for analysis against the British Standard for Topsoil (BS3882:2015). The samples were analysed as per the following schedule :

- particle size analysis (% sand, silt, clay)
- organic matter content;
- stone content (2-20mm, 20-50mm, >50mm);
- pH value;
- electrical conductivity values;
- exchangeable sodium percentage;
- major plant nutrients - N, P, K, Mg;
- C:N ratio.
- Phytotoxic contaminants
- Visible contaminants

4.6 Results of Laboratory Analysis

Particle Size Analysis

The topsoil samples from the site fell into the **SANDY LOAM** and **SANDY CLAY LOAM** textural classes and would be considered **MEDIUM TEXTURED** soils.

TOPSOIL SAMPLE	SAND (%)	SILT (%)	CLAY (%)	Textural Class
1	56	26	18	Sandy Loam
2	59	21	20	Sandy Clay Loam

In the context of soil handling, landscaping, sports pitch construction the topsoils should be treated as Sandy Loam texture. The samples all fall within the textural range suitable for a multipurpose soil as defined by BS3882:2015.

Organic Matter Content

The organic matter content of the topsoils is between 5.7% and 6.8% which is within the acceptable range in all samples.

Stone Content

BS3882: 2015 for multipurpose topsoil outlines that a conforming sample shall contain no stones over 50 mm in size, no more than 10% stones over 20 mm in size, and no more than 30% over 2 mm in size.

All samples are within the acceptable range.

pH and electrical conductivity

The topsoil samples were found to range between slightly acidic and slightly alkaline (pH 6.4 to 7.9). The pH conforms to the requirements of multipurpose topsoil specification.

The subsoil samples were found to be slightly acidic (pH 6.1 to 6.4). The pH conforms to the requirements of multipurpose topsoil specification.

Electrical conductivity is within the acceptable range indicating that soluble salts (salinity) were not at levels that would be considered harmful to plants.

Nutrient Status

The topsoil samples were all sufficiently supplied with total nitrogen.

The topsoil samples were deficient in extractable phosphorous and potassium.

Phytotoxic contaminants (Zinc, Copper, Nickel)

All samples are in the acceptable range.

Visible contaminants (plastics, sharps, etc)

Sharps and visual contaminants were not found in the topsoil samples.

Compliance

All of the topsoil's tested from site do not comply with the **MULTIPURPOSE GRADE** of the British Standard for Topsoil BS3882:2015. Fertiliser application would be required to address non-compliance due to deficiencies in phosphorous and potassium.

5.0 CONSIDERATIONS FOR SPORTS PITCH REINSTATEMENT

5.1 General Considerations and Selecting the Right Pitch Design

Good drainage is essential for winter games pitches in the UK. Experience shows that pitches with consistently dry turf can withstand a large amount of play and require less maintenance and renovation. The soil profile associated with the turf surface should be able to retain enough moisture to sustain grass growth but not be so moist as to adversely affect the quality of play.

The extent to which engineered solutions are required to achieve the above conditions are not only dependent on the natural drainage characteristics of the soils but also the type and amount of use intended for any given sports field. Factors to consider include:

- The frequency of use (e.g. hours per week)
- The pattern of use (e.g. daily, midweek training, weekend games)
- The performance standard (e.g. school, community, national, international etc)
- The age of players (e.g. youth, adult, mix)
- The level of supervision and management (e.g. is use of the pitch controlled or uncontrolled with casual use)
- The level of maintenance available (e.g. local authority team, dedicated groundsman etc).

Figure 6 shows the levels of use that can be achieved through different engineered drainage solutions and Sport England suggests typical expected use of a well-constructed and well maintained grass pitch can be in the range of 2-6hrs per week.

Pitch Type	Adult Weekly Use (hours)
• Undrained	< 2
• Pipe Drained	2-3
• Pipe Drained with Mole Drains	2-4
• Pipe Drained with Sand Grooves	3-6
• Pipe Drained with Slit Drains	3-6
• Pipe Drained with Topsoil and Drainage Layer	3-6
• Pipe Drained with Suspended Water Table	4-6

Figure 4: Summary of Pitch Type and Use (Source: Sport England).

The existing pitch area at Hinckley is undrained and therefore it is likely that it can sustain a minimum of 2hrs use per week based on drainage alone. However the significant fall of 1:25 across the pitch surface likely increases the drainage capability of the pitch surface to that similar of a drained pitch and we would therefore estimate that the pitch could sustain up to 4hrs use per week.

5.2 Subsoil and Primary Drainage System

The subsoils appear to present as silt, with clay content increasing with depth and as such will limit any reliance on natural drainage. It is likely that the disturbed soils have been left in a compacted state and the site subsoils will likely provide limited, if any, significant drainage capacity to the proposed sports pitches and landscaped areas.

There is no evidence of existing field drains within the pitch area at Hinckley.

5.3 Topsoil Quality

The prevailing undisturbed site topsoil is described as a slightly acidic, non-saline SANDY LOAM bordering on SANDY CLAY LOAM with a medium texture. The organic matter and fertility status, while low, are within acceptable limits and require treatments that would be considered routine maintenance to promote grass establishment.

This site topsoil is suited to sports pitch use with some amelioration to improve wear tolerance and surface water infiltration, especially if higher usage levels are envisaged for the school and local community.

The main limitation of the site soils which present as SANDY LOAM bordering on SANDY CLAY LOAM topsoil is the medium texture and proportion of finer particles that are susceptible to compaction and degradation under heavy use. The surface of any sports pitch constructed from such soils can also be easily smeared by foot traffic and sliding tackles which further reduces infiltration of water and gaseous exchange through the soil profile. Ultimately these conditions affect the function and usage capacity of the sports pitch.

The texture of the soils must be taken into account when programming any reinstatement works (including re-grading) or drainage. Ideally this should be carried out in conditions that are suitably dry and the soils are non-plastic in their consistency otherwise irrecoverable damage may be done to the soil structure. This therefore limits any soiling works to the summer months and may have significant impact on the overall site construction programme.

5.4 Topsoil Modifications

As the pitch area will only be partially affected by the temporary accommodation it will be important to reinstate the disturbed soils in a manner that allows a consistent and uniform pitch surface to be maintained. As such this limits the amount of modification to the affected soils that can be undertaken during construction.

To ensure consistency we would therefore recommend that following replacement of the site soils to the disturbed area that the following operations are carried out across the entire pitch area:

- Aeration - The area of the pitch reinstatement should be verti-drained using 19 mm solid tines set to penetrate at least 200 mm. The amount of heave should be as great as possible to prevent surface disruption. The site should be in a suitable condition to accept the level of tine penetration as above but not too soft that the equipment causes surface disruption from wheel marks. The verti-drain should be used to reduce hardness of the playing surface which should be between 35 g and 200 g when measured by the STRI method of test using a 0.5 kg Clegg Impact Hammer from a drop height of 0.55 m.
- Sand Topdressing - The entire pitch area should be top-dressed on 2 occasions during establishment with approved salt free medium fine sports turf sand ideally with a particle size distribution within the central recommended range of the STRI Grading Curve for soil modification and top-dressing of winter games pitches. Following the application, the top-dressing sand it should be thoroughly brushed into the grass surface and levelled using a lute which will help to work the top-dressing into the verti-drain tine holes. The dressings should be applied following aeration in dry weather and ground conditions in a uniform layer of no more than 10.0mm deep from suitable top-dressing equipment.
- Fertiliser Application – see section 5.5.

- Over-seeding - The area of reinstatement works shall be over seeded using a high quality sports turf seed mixture at the rate of 35 g/m².

It is absolutely critical that existing site soils are NOT handled in wet or plastic conditions.

5.5 Grass Seeding & Fertiliser Applications

The reinstated areas should be sown with a high quality sports turf seed mixture containing a high proportion of wear tolerant ryegrass. Seeding should be carried out in suitable weather conditions with a base fertiliser applied during the final seedbed preparation. Seeding should be carried out at a minimum of 50g/m².

Application	Composition	Rate
Pre-seeder Fertiliser Application to Amenity Grass to a depth of 100mm	8%N:12%P ₂ O ₅ :8%K ₂ O + 3%MgO Or similar approved	50g/m ²

Allowing sufficient time for the full establishment of the turf is vital for the quality of the playing surface. The period required will depend on the timing of seeding and the weather conditions as well as the intensity of maintenance during the initial grow-in period.

Following seeding the pitch surface can take at least 12 weeks to be sufficiently established. If maintenance is infrequent or lacking a pitch can take up to 20 weeks or more to establish for match play.

Mowing is a fundamental requirement for the development of a strong and robust turf. The timing and frequency of mowing can determine how quickly this can be achieved, again this is weather dependent. Turf which is still establishing has a higher nutrient requirement and requires frequent applications of fertiliser during the establishment period. It may be necessary to apply fungicide to deal with turf disease or selective herbicide to control weed growth. Top dressing, soil loosening or aeration work are also essential to healthy turf establishment.

5.6 Pitch Maintenance & Management

Regular maintenance is required to ensure a good quality playing surface throughout the year. This should be planned & implemented throughout the playing season to ensure the surface is in good condition for as much of the season as possible.

Regular mowing is fundamental to a healthy grass sward and throughout the growing season pitches may require to be cut as a minimum weekly. Pitches would commonly be cut at a height between 35 and 40mm with no more than one third of the leaf being removed in a single cut.

Regular & Bi-Annual Maintenance Tasks will likely include:

- Mowing
- Aeration
- Fertiliser
- Decompaction
- Brushing and Levelling
- Hand Forking/Divot Repairs

Seasonal & Annual Maintenance Tasks will likely include:

- Scarifying (thatch removal)
- Top-Dressing
- Fertiliser

- Over-Seeding
- Weed and Pest Control

If amenity grass is not maintained appropriately, gradual deterioration will begin to affect the quality of the grass surface. Soils with significant proportions of silt and clay are prone to smearing and compaction through repeated traffic and mowing operations. Aeration and sand dressing are critical to maintain the drainage properties of the site soils.

5.7 Mowing

It is envisaged that the following equipment be available to maintain the grass pitche area during establishment:

- Ride-on triple with 8-blade cylinders
- Pedestrian wheeled rotary mowers with collection bags/boxes.

The pitch shall be maintained at a suitable height for the duration of the grass establishment works.

Height of cut during establishment shall be no greater than 40mm to promote tillering and encourage knitting of the grass sward across any drain lines and secondary drainage (e.g. sand slits).

It is envisaged the first cut will be around 15-18 days after seeding (subject to weather conditions and sowing date). The following cuts shall be undertaken at intervals to optimise the establishment of the sward across the drain lines and sand slits.

The first 6 cuts shall be by rotary mower with the next 4 cuts shall be by cylinder mower with grass clippings collected and disposed of.

Fertiliser applications shall commence immediately after the first cut, allowance shall be made for two further granular applications.

6.0 CONSTRUCTION OPERATIONS AND PROGRAMMING

6.1 Soil Structure & Degradation

As mentioned throughout this report it is fundamental to the success of any planting or seeding that a well structured and uncompacted soil profile is provided. Adequate soil structure is a key element for healthy plant growth ensuring aeration and drainage throughout the profile.

The reinstatement works will inevitably require the site soils to be disturbed through excavations, transport, storage and respreading. During these operations the soils are at their most vulnerable to damage through compaction. Whilst some degradation is inevitable, the potential quality and ultimate suitability of the topsoil and subsoil for re-use will depend on how well its soil structure is preserved during the earthworks phase of the project.

Crucially, the site soils should not be handled and/or moved when wet. In wet conditions the larger (air containing) soil pores are destroyed and replaced with smaller (water retentive) pores. This restricts gaseous exchange with the atmosphere and causes the topsoil to become anaerobic (oxygen depleted). The reduction of pore spaces has a further obvious consequence to the soils drainage capabilities and such degradation greatly increases the risk of waterlogging and saturation.

Anaerobic and wet conditions are extremely detrimental to plants. Anaerobic bacteria produce ammonia and methane gases which are harmful to plants. Without oxygen plant roots are unable to take up water and nutrients. These conditions will ultimately result in significant remedial actions and increased maintenance burden being placed on landscaped areas around the site.

6.2 Soil Handling

Soils should only be handled when it is reasonably dry and non-plastic in consistency. If soils are stripped and stockpiled in dry conditions they can then be kept dry and in good condition until they are respread.

If the topsoil is stripped when it is wet it may be possible to repair the damage provided there is sufficient time and dry weather which can be unpredictable. If this does happen then the topsoil respreading **MUST** take place during the summer season to allow enough time for the soil to dry out effectively and be thoroughly cultivated before planting and seeding takes place in autumn (grass seeding).

6.3 Programming

The handling of the site topsoil must be seen as a constraint to the project programme given the nature of the SANDY LOAM topsoil having been mixed with underlying subsoil and the prevailing UK Climate. The most appropriate time to carry out the topsoiling works will be during summer months (May/June to September/October) and then only when the soils are dry.

If the project programme results in soils having to be excavated and stockpiled when wet and then backfilled/respread in colder winter or spring months will leave little opportunity to rectify any degradation suffered during the earthworks process. Planting and or seeding in these conditions is likely to result in significant remedial works and increased maintenance if not complete failure of both planting stock and grass establishment.

The planning and programme of the project earthworks therefore needs to be carefully considered at an early stage as the protection of the site soils is as critical as the plants themselves to the success of the pitch reinstatement works.

6.4 Sports Pitch Reinstatement – Topsoil Stripping and Stockpiling

The topsoil from the pitch area should be stripped and stockpiled in accordance with The Construction Code of Practice for the Sustainable Use of Soils on Construction Sites – DEFRA 2009.

Prior to removal, the grass area should be sprayed with a total non-residual herbicide at least one week prior to stripping. The herbicide should be applied according to manufacturer's recommendations and all current legislation and Health & Safety Regulations. On no account must the herbicide be allowed to drift or otherwise affect any areas beyond the designated working boundary. After a minimum of one week following spraying the topsoil should be cultivated using a power harrow, rotary cultivator or other suitable equipment to break up the existing vegetation. Great care should be taken to prevent subsoil being mixed with topsoil.

The topsoil should be handled at low moisture content and soil structure should be maintained by minimising soil compaction and using appropriate soil handling techniques. In certain situations, especially when poor weather is expected, it may be preferable not to cultivate all of the topsoil prior to removal. The cultivation process opens up the topsoil and makes it more susceptible to becoming saturated during periods of poor weather. In these situations it is advisable to strip off the surface vegetation and then removing the exposed topsoil to stockpile over a series of small areas at a time. Working in this manner will help to minimise the risk of the topsoil being wet when stockpiled, and this in turn will help to maintain topsoil condition and structure. The stockpile should be constructed so as to shed water and to minimise erosion, plus be sealed up as soon as possible to prevent the water ingress. Following stripping the maximum height of topsoil stockpile should where possible be kept to a minimum, although site restrictions may impact up on this. The stockpile height should also be in accordance with any Planning Consent conditions. When stockpiled for a prolonged period, topsoil will probably become anaerobic, and may produce gases such as hydrogen sulphide. However when removed from stockpile and exposed to air the topsoil will become aerobic relatively quickly.

6.5 Sports Pitch Reinstatement – Formation Preparation

Following removal of the temporary accommodation units the disturbed area should be prepared to the required levels and grades to reinstate the pitch surface seamlessly to the previous levels. Prior to the placement of topsoil, the entire formation should be proof-rolled. Any soft spots identified during proof rolling must be removed and replaced with suitable compacted fill material so that a firm formation is produced. Topsoil materials should not be used for fill works.

Following sub-soiling the formation should be consolidated and the surface made smooth to the gradients specified i.e. free from humps, ruts and depressions. The formation should be graded to a tolerance of ± 10 mm.

6.6 Sports Pitch Reinstatement – Topsoil Respreading

The stored topsoil shall be carefully tipped and spread across the disturbed area in accordance with The Construction Code of Practice for the Sustainable Use of Soils on Construction Sites – DEFRA 2009.

Following respreading of the stockpiled topsoil it should be lightly rolled or tracked in to give sufficient degree of consolidation and a resulting minimum firmed depth of 200mm. After cultivation of the topsoil and prior to the addition of sand the works area should be carefully graded, if possible with laser-controlled grading equipment, to as far as possible eliminate all dips, depressions and undulations.

However, grading should be carried out in such a manner that at no point that the resulting profile will have a sand ameliorated topsoil depth less than 150 mm. Ideally, the topsoil depth with surface sand amelioration should range from 200 mm to 250 mm as this will assist with drainage and moisture retention during drier

periods. Care must be taken to avoid over compaction and any cultivation required should be carried out in such a way that there is no possibility of the topsoil being contaminated with underlying subsoil.

6.7 Sports Pitch Reinstatement – Sand Amelioration

The recommended depth of amelioration sand for the pitch reinstatement is 30mm depth. Care should be taken not to over cultivate the topsoil when ameliorating the sand into the topsoil. This will result in a gradual change in soil texture with depth through the profile, changing from a more to less sandy textured soil with depth. The gradation in soil texture will help to promote a freer draining and more durable surface with the profile becoming more moisture retentive with increasing depth. The development of such a profile will help with drainage during the wetter winter months, and promote the retention of moisture and reduce surface hardness during the summer period. The sand should be spread carefully with specialist sand spreaders and delivery lorries should not be allowed on the area under any circumstances.

The sand should be lime and salt-free (less than 2000 $\mu\text{S}/\text{cm}$) and have a medium/fine particle size distribution within the central limits of the STRI grading curve. The sand should have a pH value in the range of 6.0 to 7.5. The sand should be cultivated into the near surface of the underlying topsoil using tractor mounted cultivating machinery with depth control.

6.8 Sports Pitch Reinstatement – Seedbed Preparation

Levelling and finishing of the surface should ideally be undertaken using an approved rotary stone rake or other equivalent equipment. The surface tolerances of the prepared seedbed should be ± 10 mm under a 3 metre straight edge. The surface should be adequately firmed but not over-compacted and should have a smooth, even surface free from ridges, ruts, hollows, humps or other undulations. The final preparation should be carried out using equipment fitted with low ground pressure tyres.

During the final seedbed preparation a further stone picking operation should be carried out and all stones or other debris with any dimension greater than 10 mm, should be collected and removed and the area stone buried. After the seedbed has been prepared and shortly before seeding is carried out an appropriate pre-seeding fertiliser should be applied uniformly with an approved spreader.

7.0 SUMMARY OF FINDINGS AND RECOMMENDATIONS

The topsoil's tested from site do not comply with the **MULTIPURPOSE GRADE** of the British Standard for Topsoil BS3882:2015. Fertiliser application would be required to address non-compliance of low potassium and phosphorous levels.

No existing site drainage is present within the area of the proposed temporary accommodation units or the wider sports pitch area. There is evidence of previously disturbed soils within the pitch area (trial pits 1, 3 and 9). Topsoil shall be removed, stockpiled and respread in accordance with the recommendations made in section 6.0 above.

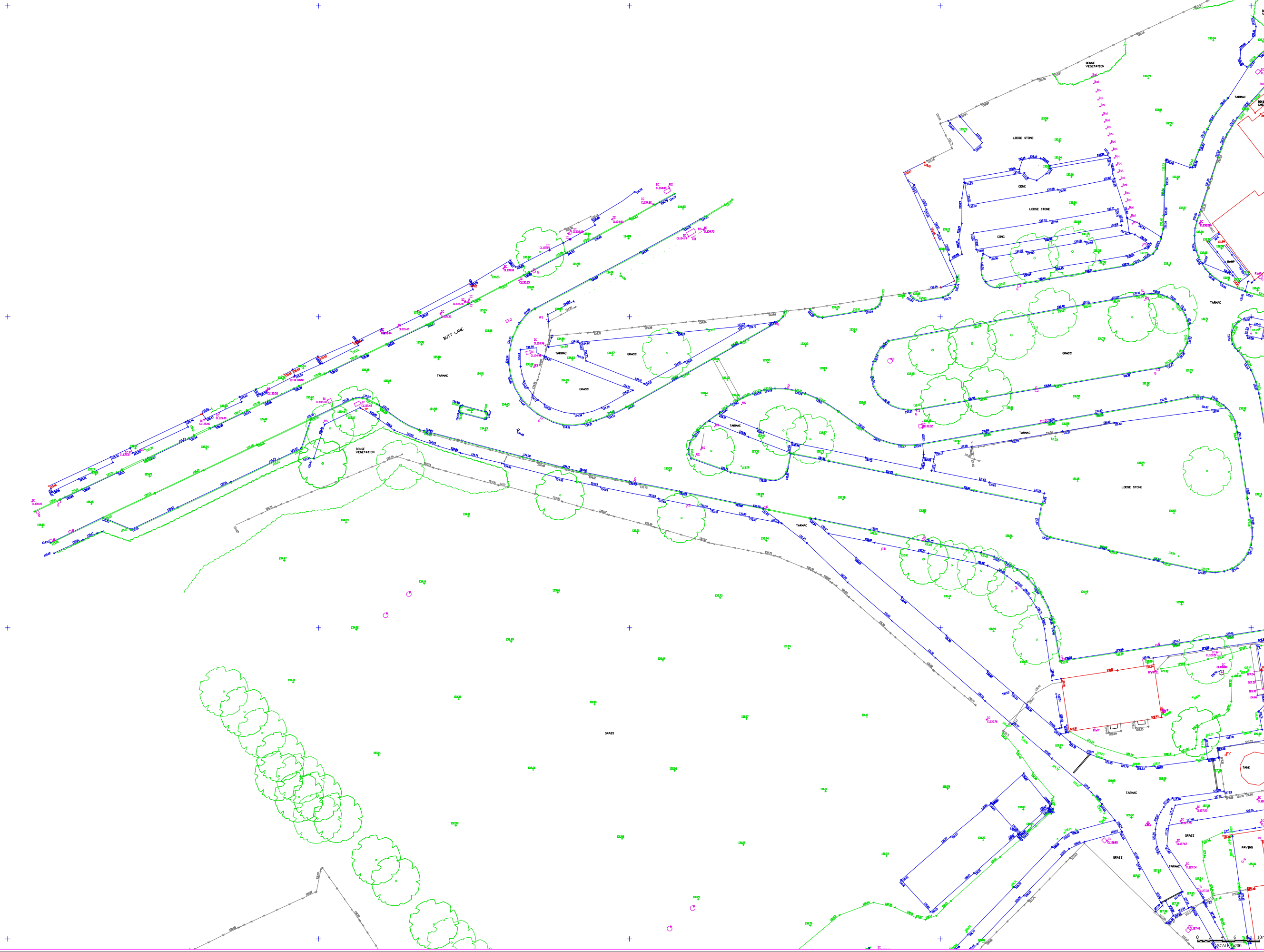
The following recommendations are made:

- **Programming must ensure as far as practically possible that the earthworks and soil operations associated to stockpiling of topsoil for the sports pitches is undertaken in dry and non-plastic conditions.**
- **Handling the prevailing site soils in wet conditions will risk failure of establishment, rendering the soils unsuitable for use, being rejected and imposing significant remedial and maintenance operations.**
- **It is absolutely critical that existing site soils are NOT handled in wet or plastic conditions.**
- NO existing drainage is evident in the pitch area.
- Site topsoil should be stripped, stockpiled and respread in accordance with section 6.0 of this report and generally in accordance with:
The Construction Code of Practice for the Sustainable Use of Soils on Construction Sites – DEFRA.
SAPCA Code of Practice for The Design, Construction and Improvement of Natural Turf.
- A programme of aeration, sand top-dressing, fertilizer and over-seeding shall be undertaken across the whole pitch area to ensure uniformity between disturbed and undisturbed areas.
- A pre-seeder fertilizer application should be incorporated into the seedbed for new grass.
- Further sand top dressing applications may be required throughout initial establishment and as part of the ongoing maintenance regime.
- A regular and intensive maintenance regime will be required.

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APPENDIX 1 – SITE PLANS

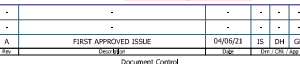


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LOCATION PLAN

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Project Name
Gleeds Schools - Hinckley Academy

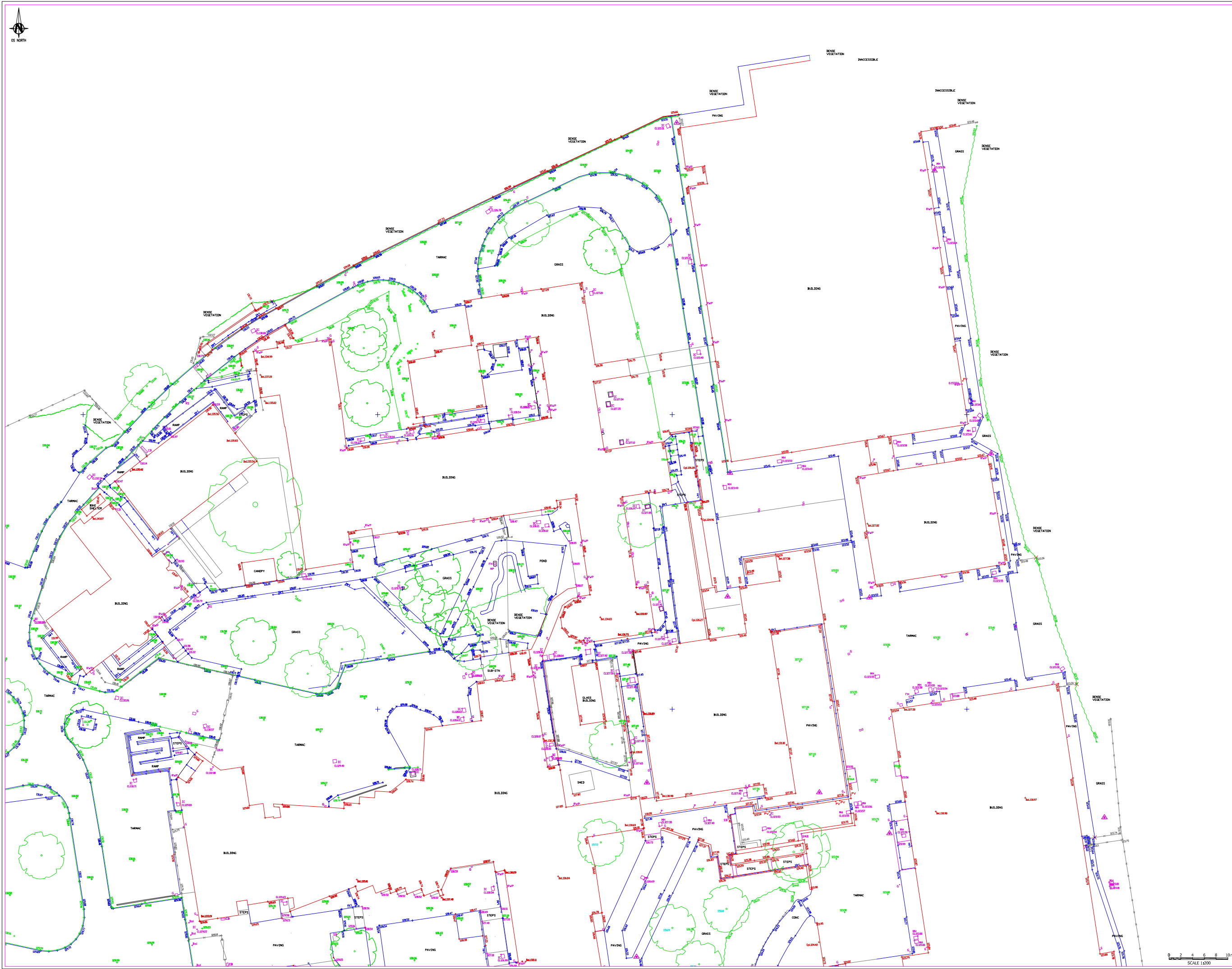
HINCKLEY ACADEMY
3D TOPOGRAPHICAL SURVEY
SHEET 1 OF 10

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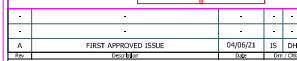


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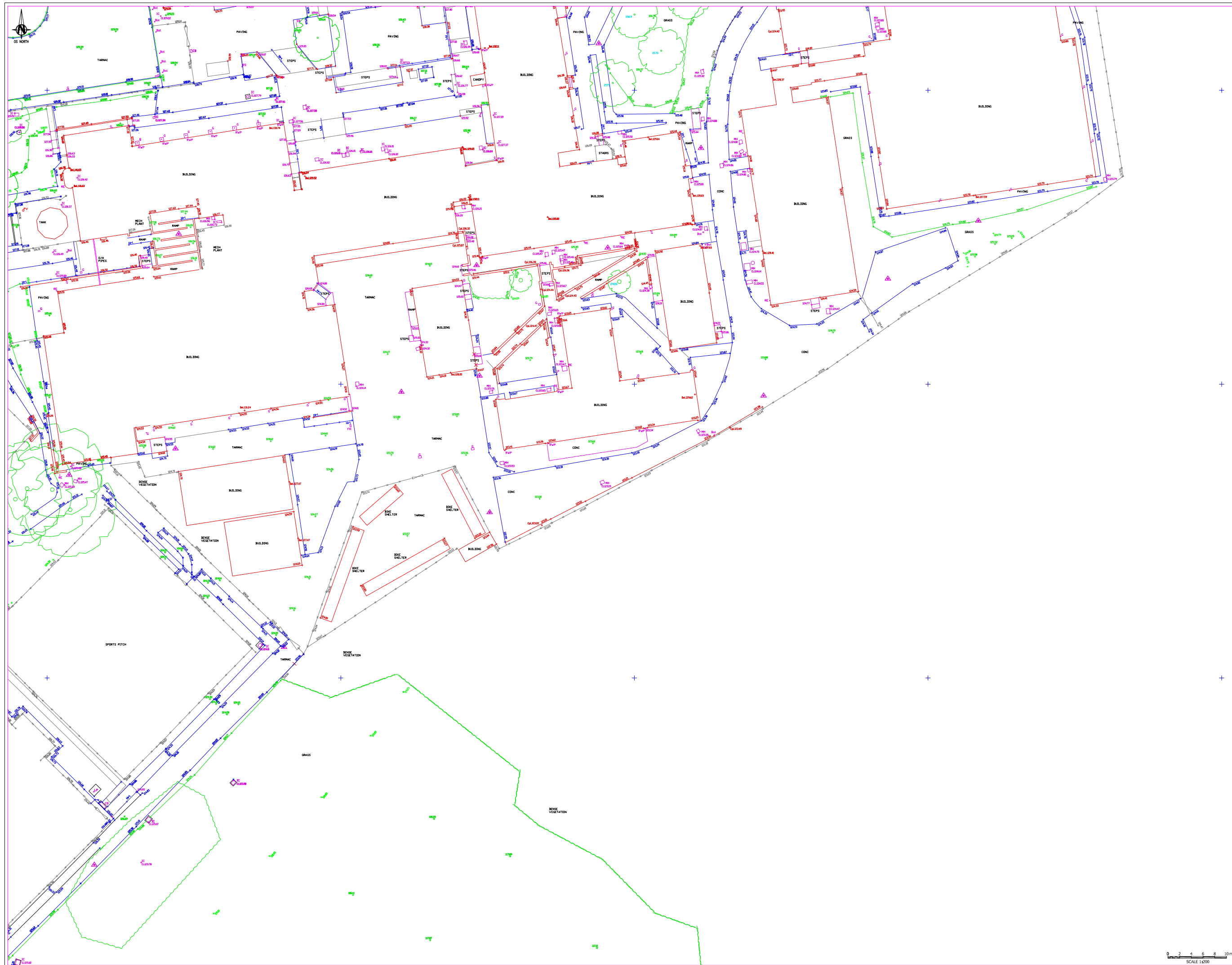
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HINCKLEY ACADEMY
3D TOPOGRAPHICAL SURVEY
SHEET 2 OF 10

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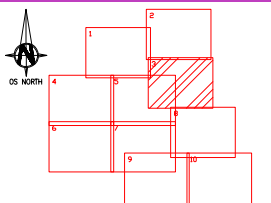
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HINCKLEY ACADEMY
3D TOPOGRAPHICAL SURVEY
SHEET 3 OF 10

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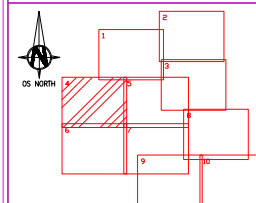
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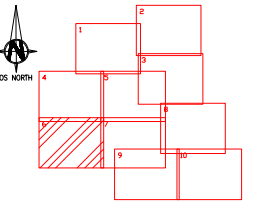
TOPO LEGEND

AB	AIR BRICK	LFB	LITERBODY
ABV	AIR VALVE	LP	LAMP POST
BB	BELUSH BEACON	MB	MOORING BOLLARD
BAL	BUILDING FISH	MF	MISCELLANEOUS FENCING
TBH	BUILDING FISH	MH	MANHOLE
BL	BUILDING FISH	MW	MANHOLE
BM	BENCH MARK	MP	MOORING PILE
BOL	BOLLARD	MS	MISCELLANEOUS FENCING
BRK	BRICK WALL	MT	MILE STONE
BS	BUS STOP	NS	NOTICE BOARD
BWF	BRAIDED WIRE FENCE	NP	NOTICE BOARD
CB	CONTROL BOX	NPA	NATIONAL PARKS AUTHORITY
CF	CORRUGATED IRON FENCE	OC	OVERGROUND CONDUIT
CL	CHAIN LINK FENCE	OCS	OVERHEAD GANTRY
CLF	CHAIN LINK FENCE	OSR	OPEN STEEL RAILINGS
CP	CONCRETE PAVEMENT	P	POST
CPT	CABLE PIT COVER	PB	PILAR BOX
CS	CABLE TV MANHOLE	PF	PARKING FENCE
CTV	CABLE TV MANHOLE	PI	PILAR BOX
CUL	CULVERT	PM	PARKING METER
DL	DECK LEVEL	PP	PARKING METER
DK	DECK LEVEL	PR	PARKING METER
DP	DOWNPIPE	PV	VERTICAL PIPE
DPC	DAMP PROOF COURSE	RE	REFLECTIVE POST
DR	DRAIN	RP	REFLECTIVE POST
DWB	DRAINAGE DRAIN	RS	ROAD SIGN
EA	ENVIRONMENT AGENCY	RTW	RETAINING WALL
EB	ELECTRICITY BOX	RP	REFLECTIVE POST
ECP	ELECTRIC CABLE FENCE	SC	STOP COOK
ECP	ELECTRIC CABLE FENCE	SP	STAND PIPE
EMH	ELECTRICITY MANHOLE	SK	SKAMMITY
EP	ELECTRICITY PILE	SL	SLOTTED LEVEL
ER	ELECTRICITY PILE	SM	SHEEP WIRE FENCE
ETL	ELECTRICITY PILE	SN	SHEEP WIRE FENCE
FB	FOOTBRIDGE	TC	TELECOM CABINET
FH	FIRE HYDRANT	TCB	TELECOM CABINET
FHM	FIRE HYDRANT MARKER	TD	TELECOM CABINET
FL	FLOOR LEVEL	TE	TELECOM CABINET
FP	FENCE POST	TL	TELECOM CABINET
FPM	FULL WATER MANHOLE	TL	TELECOM CABINET
G	GULLY	TL	TELECOM CABINET
GL	GROUND LIGHT	TL	TELECOM CABINET
GM	GAS MANHOLE	TL	TELECOM CABINET
GP	GATE POST	TL	TELECOM CABINET
GS	GAS VALVE	TL	TELECOM CABINET
HRL	HANDRAIL	TL	TELECOM CABINET
H	HANDRAIL	TL	TELECOM CABINET
I	INJECTION CHAMBER	TL	TELECOM CABINET
IL	INLET LEVEL	TL	TELECOM CABINET
IRF	IRON RAILING FENCE	TL	TELECOM CABINET
J	JUNCTION BOX	TL	TELECOM CABINET
K	KERN OUTLET	TL	TELECOM CABINET
L	LADDER	TL	TELECOM CABINET

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LOCATION PLAN

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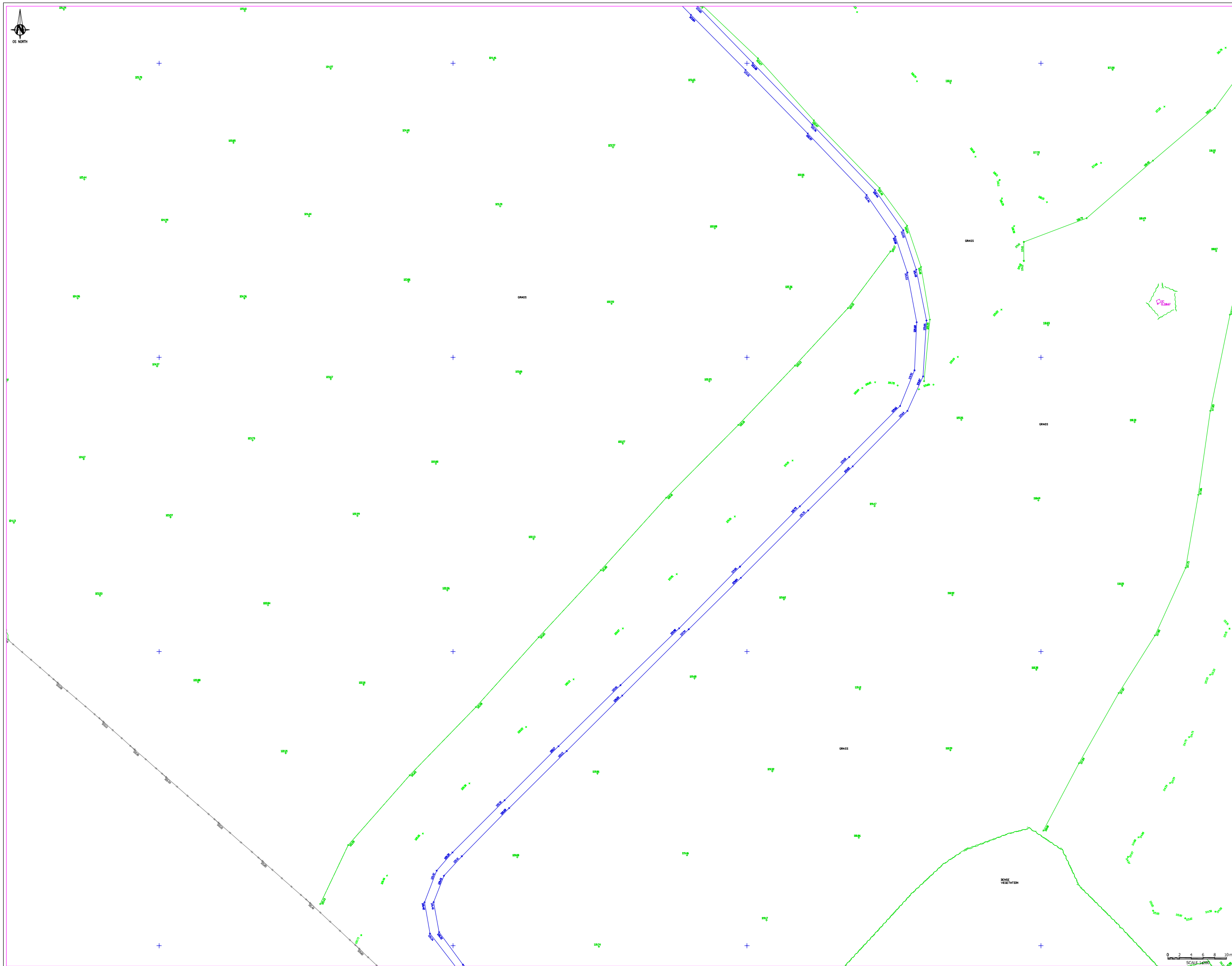
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Gleeds Schools - Hincley Academy

HINCLEY ACADEMY
3D TOPOGRAPHICAL SURVEY
SHEET 6 OF 10

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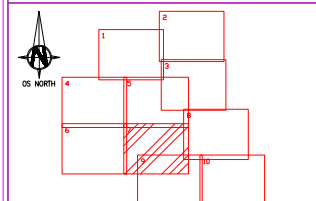
TOPO LEGEND

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3D TOPOGRAPHICAL SURVEY
SHEET 7 OF 10

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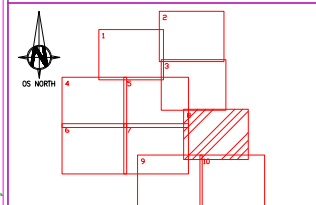
TOPO LEGEND

AB	AIR BRICK	UB	UTILITY
AD	AIR VALVE	UL	ULF
AE	ALUMINUM BRACKET	UM	MOISTURE BARRIER
BA	BUILDING HEDGE	UN	UNUSUAL
BB	BUILDING HEDGE	UP	MISCELLANEOUS FENCING
BC	BUILDING HEDGE	UR	UNDER
BD	BUILDING HEDGE	US	UNDER
BE	BUILDING HEDGE	UT	UNDER
BF	BUILDING HEDGE	UU	UNDER
BG	BUILDING BRICK	UV	UNDER
BH	BUILDING BRICK	UW	UNDER
BI	BUILDING BRICK	UX	UNDER
BJ	BUILDING BRICK	UY	UNDER
BK	BUILDING BRICK	UZ	UNDER
BL	BUILDING BRICK	VA	VALVE
BM	BUILDING BRICK	VB	VALVE
BN	BUILDING BRICK	VC	VALVE
BO	BUILDING BRICK	VD	VALVE
BP	BUILDING BRICK	VE	VALVE
BQ	BUILDING BRICK	VF	VALVE
BR	BUILDING BRICK	VG	VALVE
BS	BUILDING BRICK	VH	VALVE
BT	BUILDING BRICK	VI	VALVE
BU	BUILDING BRICK	VJ	VALVE
BV	BUILDING BRICK	VK	VALVE
BW	BUILDING BRICK	VL	VALVE
BX	BUILDING BRICK	VM	VALVE
BY	BUILDING BRICK	VN	VALVE
BZ	BUILDING BRICK	VO	VALVE
CA	CABLE	VP	VALVE
CB	CABLE	VQ	VALVE
CC	CABLE	VR	VALVE
CD	CABLE	VS	VALVE
CE	CABLE	VT	VALVE
CF	CABLE	VU	VALVE
CG	CABLE	VV	VALVE
CH	CABLE	VW	VALVE
CI	CABLE	VX	VALVE
CJ	CABLE	VY	VALVE
CK	CABLE	VZ	VALVE
CL	CABLE	WA	WALL
CM	CABLE	WB	WALL
CN	CABLE	WC	WALL
CO	CABLE	WD	WALL
CP	CABLE	WE	WALL
CQ	CABLE	WF	WALL
CR	CABLE	WG	WALL
CS	CABLE	WH	WALL
CT	CABLE	WI	WALL
CU	CABLE	WJ	WALL
CV	CABLE	WK	WALL
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DR	CABLE	YG	WALL
DS	CABLE	YH	WALL
DT	CABLE	YI	WALL
DU	CABLE	YJ	WALL
DV	CABLE	YK	WALL
DW	CABLE	YL	WALL
DX	CABLE	YM	WALL
DY	CABLE	YN	WALL
DZ	CABLE	YO	WALL
EA	CABLE	YP	WALL
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FV	CABLE	Z	

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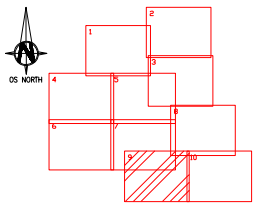
TOPO LEGEND

AB	ALB BROCK	LTB	LEEDING
AC	ALC VALVE	LUP	LAMP POST
AD	ALDR BRICK	MB	MCCORMACK BOLLARD
AE	ALD VALVE	MC	MCCORMACK FENCING
AF	ALD VALVE	MD	MEDICAL
AG	ALD VALVE	ME	MEASURING
AH	ALD VALVE	MF	MENDING
AI	ALD VALVE	MG	MENDING PILE
AJ	ALD VALVE	MI	MILK
AK	ALD VALVE	MS	MIS
AL	ALD VALVE	MT	MIS
AM	ALD VALVE	NU	NOTICE BOARD
AN	ALD VALVE	ST	STREET NAME PLATE
AO	ALD VALVE	NT	NATIONAL SERVICE
AP	ALD VALVE	OR	ORDERING CEMENT
AQ	ALD VALVE	OS	OVERSEEN
AR	ALD VALVE	OT	OTHER
AS	ALD VALVE	OW	OWNERS
AT	ALD VALVE	OX	OX
AV	ALD VALVE	PA	PAN
AW	ALD VALVE	PB	PILAR BOX
AX	ALD VALVE	PC	PILAR BOX
AY	ALD VALVE	PD	PILAR BOX
AZ	ALD VALVE	PE	PILAR BOX
BA	ALD VALVE	PF	PILAR BOX
BB	ALD VALVE	PG	PILAR BOX
BC	ALD VALVE	PH	PILAR BOX
BD	ALD VALVE	PI	PILAR BOX
BE	ALD VALVE	PJ	PILAR BOX
BF	ALD VALVE	PK	PILAR BOX
BG	ALD VALVE	PL	PILAR BOX
BH	ALD VALVE	PM	PILAR BOX
BI	ALD VALVE	PN	PILAR BOX
BJ	ALD VALVE	PO	PILAR BOX
BK	ALD VALVE	PP	PILAR BOX
BL	ALD VALVE	PQ	PILAR BOX
BM	ALD VALVE	PR	PILAR BOX
BN	ALD VALVE	PS	PILAR BOX
BO	ALD VALVE	PT	PILAR BOX
BP	ALD VALVE	PV	PILAR BOX
BQ	ALD VALVE	PW	PILAR BOX
BR	ALD VALVE	PX	PILAR BOX
BS	ALD VALVE	PY	PILAR BOX
BT	ALD VALVE	PZ	PILAR BOX
BU	ALD VALVE	QA	PILAR BOX
BV	ALD VALVE	QB	PILAR BOX
BW	ALD VALVE	QC	PILAR BOX
BX	ALD VALVE	QD	PILAR BOX
BY	ALD VALVE	QE	PILAR BOX
BZ	ALD VALVE	QF	PILAR BOX
CA	ALD VALVE	QG	PILAR BOX
CB	ALD VALVE	QH	PILAR BOX
CC	ALD VALVE	QI	PILAR BOX
CD	ALD VALVE	QJ	PILAR BOX
CE	ALD VALVE	QK	PILAR BOX
CF	ALD VALVE	QL	PILAR BOX
CG	ALD VALVE	QM	PILAR BOX
CH	ALD VALVE	QN	PILAR BOX
CI	ALD VALVE	QO	PILAR BOX
CJ	ALD VALVE	QP	PILAR BOX
CK	ALD VALVE	QR	PILAR BOX
CL	ALD VALVE	QS	PILAR BOX
CM	ALD VALVE	QT	PILAR BOX
CN	ALD VALVE	QU	PILAR BOX
CO	ALD VALVE	QV	PILAR BOX
CP	ALD VALVE	QW	PILAR BOX
CQ	ALD VALVE	QX	PILAR BOX
CR	ALD VALVE	QY	PILAR BOX
CS	ALD VALVE	QZ	PILAR BOX
CT	ALD VALVE	RA	PILAR BOX
CU	ALD VALVE	RB	PILAR BOX
CV	ALD VALVE	RC	PILAR BOX
CW	ALD VALVE	RD	PILAR BOX
CX	ALD VALVE	RE	PILAR BOX
CY	ALD VALVE	RF	PILAR BOX
CZ	ALD VALVE	RG	PILAR BOX
DA	ALD VALVE	RH	PILAR BOX
DB	ALD VALVE	RI	PILAR BOX
DC	ALD VALVE	RJ	PILAR BOX
DD	ALD VALVE	RK	PILAR BOX
DE	ALD VALVE	RL	PILAR BOX
DF	ALD VALVE	RM	PILAR BOX
DG	ALD VALVE	RN	PILAR BOX
DH	ALD VALVE	RO	PILAR BOX
DI	ALD VALVE	RP	PILAR BOX
DJ	ALD VALVE	RQ	PILAR BOX
DK	ALD VALVE	RS	PILAR BOX
DL	ALD VALVE	RT	PILAR BOX
DM	ALD VALVE	RU	PILAR BOX
DN	ALD VALVE	RV	PILAR BOX
DO	ALD VALVE	RW	PILAR BOX
DP	ALD VALVE	RX	PILAR BOX
DQ	ALD VALVE	RY	PILAR BOX
DR	ALD VALVE	RZ	PILAR BOX
DS	ALD VALVE	SA	PILAR BOX
DT	ALD VALVE	SB	PILAR BOX
DU	ALD VALVE	SC	PILAR BOX
DV	ALD VALVE	SD	PILAR BOX
DW	ALD VALVE	SE	PILAR BOX
DX	ALD VALVE	SF	PILAR BOX
DY	ALD VALVE	SG	PILAR BOX
DZ	ALD VALVE	SH	PILAR BOX
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EB	ALD VALVE	SJ	PILAR BOX
EC	ALD VALVE	SK	PILAR BOX
ED	ALD VALVE	SL	PILAR BOX
EE	ALD VALVE	SM	PILAR BOX
EF	ALD VALVE	SN	PILAR BOX
EG	ALD VALVE	SO	PILAR BOX
EH	ALD VALVE	SP	PILAR BOX
EI	ALD VALVE	SQ	PILAR BOX
EJ	ALD VALVE	SR	PILAR BOX
EK	ALD VALVE	SS	PILAR BOX
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EM	ALD VALVE	SV	PILAR BOX
EN	ALD VALVE	SW	PILAR BOX
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FC	ALD VALVE	TJ	PILAR BOX
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FU	ALD VALVE	UB	PILAR BOX
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GI	ALD VALVE	UP	PILAR BOX
GO	ALD VALVE	UQ	PILAR BOX
GP	ALD VALVE	UR	PILAR BOX
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GG	ALD VALVE	ZX	PILAR BOX
GH	ALD VALVE	ZY	PILAR BOX
GI	ALD VALVE	ZZ	PILAR BOX

FINAL ISSUE

LOCATION PLAN

HATCHED AREA SHOWN IN THIS DRAWING - BOLD LINE DEFINES SURVEY EXTENT



*	*	*	*	*	*
*	*	*	*	*	*
A	FIRST APPROVED ISSUE	04/06/21	IS	DH	GP
Rev	Description	Issue	Date / C. No. / App.		

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GLEEDS

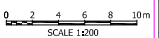
Project Name
Gleeds Schools - Hinckley Academy

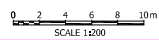
HINCKLEY ACADEMY
3D TOPOGRAPHICAL SURVEY
SHEET 9 OF 10

TTE Project Number	Drawn By	Date	Checked By	Date	Approved By	Date	Scale	AO	Sheet No
784-8060162	CP	24/08/21	GP	04/06/21	GP	27/08/21	1:200		S3
Proj/Project Number	Originator	Volume/Drawn	Level	Location	Type/Code	Role	Number		Revision
-	- TTE	- 00	- 01	- PL	- G	- 00001			A

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T.S.YM1





NOTES

1. UNLESS NOTED OTHERWISE, ALL DIMENSIONS ON THIS DRAWING ARE IN METRES.
2. ALL LEVELS ARE IN METRES AND RELATED TO NEWLYN DATUM, FROM GNSS POSITIONING, CONVERTED USING THE NATIONAL GRID GEOID MODEL OSGM15
3. LOCAL PLANE METRIC GRID RELATED TO ORDNANCE SURVEY GRID

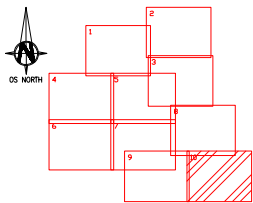
TOPO LEGEND

AA	AR BRICK	LFB	LAFETY
AB	BEHOLD BEACON	MB	MOORING BOLLARD
AC	BEHOLD	MBH	MISCELLANEOUS FENCING MATERIAL
AD	BUILDING DASH LEVEL	MBL	MISCELLANEOUS
AE	BENCH MARK	MBP	MOORING PILE
AF	BENCH MARK	MRF	MILL RAILING FENCE
AG	BENCH MARK	MS	ME STONE
AH	BENCH MARK	MSB	NOTICE BOARD
AI	BENCH MARK	MSH	STREET NAME PLATE
AJ	BAMBER MESH	MSL	MINERAL RESERVES AUTHORITY
AK	BAMBER MESH	MSM	MINERAL RESERVES AUTHORITY
AL	CORRODED RUST FENCE	MSO	MINERAL GARNET
AM	CORRODED RUST FENCE	MSR	MINERAL GARNET
AN	CORRODED RUST FENCE	MSV	MINERAL GARNET
AO	CORRODED RUST FENCE	MSW	MINERAL GARNET
AP	CORRODED RUST FENCE	MSX	MINERAL GARNET
AQ	CORRODED RUST FENCE	MSY	MINERAL GARNET
AR	CORRODED RUST FENCE	MSZ	MINERAL GARNET
AS	CORRODED RUST FENCE	MSA	MINERAL GARNET
AT	CORRODED RUST FENCE	MSB	MINERAL GARNET
AU	CORRODED RUST FENCE	MSC	MINERAL GARNET
AV	CORRODED RUST FENCE	MSD	MINERAL GARNET
AW	CORRODED RUST FENCE	MSE	MINERAL GARNET
AX	CORRODED RUST FENCE	MSF	MINERAL GARNET
AY	CORRODED RUST FENCE	MSG	MINERAL GARNET
AZ	CORRODED RUST FENCE	MSH	MINERAL GARNET
BA	CORRODED RUST FENCE	MSI	MINERAL GARNET
BB	CORRODED RUST FENCE	MSJ	MINERAL GARNET
BC	CORRODED RUST FENCE	MSK	MINERAL GARNET
BD	CORRODED RUST FENCE	MSL	MINERAL GARNET
BE	CORRODED RUST FENCE	MSM	MINERAL GARNET
BF	CORRODED RUST FENCE	MSN	MINERAL GARNET
BG	CORRODED RUST FENCE	MSO	MINERAL GARNET
BH	CORRODED RUST FENCE	MSR	MINERAL GARNET
BI	CORRODED RUST FENCE	MSV	MINERAL GARNET
BJ	CORRODED RUST FENCE	MSW	MINERAL GARNET
BK	CORRODED RUST FENCE	MSX	MINERAL GARNET
BL	CORRODED RUST FENCE	MSY	MINERAL GARNET
BM	CORRODED RUST FENCE	MSZ	MINERAL GARNET
BN	CORRODED RUST FENCE	MSA	MINERAL GARNET
BO	CORRODED RUST FENCE	MSB	MINERAL GARNET
BP	CORRODED RUST FENCE	MSC	MINERAL GARNET
BQ	CORRODED RUST FENCE	MSD	MINERAL GARNET
BR	CORRODED RUST FENCE	MSE	MINERAL GARNET
BS	CORRODED RUST FENCE	MSF	MINERAL GARNET
BT	CORRODED RUST FENCE	MSG	MINERAL GARNET
BU	CORRODED RUST FENCE	MSH	MINERAL GARNET
BV	CORRODED RUST FENCE	MSI	MINERAL GARNET
BW	CORRODED RUST FENCE	MSJ	MINERAL GARNET
BX	CORRODED RUST FENCE	MSK	MINERAL GARNET
BY	CORRODED RUST FENCE	MSL	MINERAL GARNET
BZ	CORRODED RUST FENCE	MSM	MINERAL GARNET
CA	CORRODED RUST FENCE	MSN	MINERAL GARNET
CB	CORRODED RUST FENCE	MSO	MINERAL GARNET
CC	CORRODED RUST FENCE	MSR	MINERAL GARNET
CD	CORRODED RUST FENCE	MSV	MINERAL GARNET
CE	CORRODED RUST FENCE	MSW	MINERAL GARNET
CF	CORRODED RUST FENCE	MSX	MINERAL GARNET
CG	CORRODED RUST FENCE	MSY	MINERAL GARNET
CH	CORRODED RUST FENCE	MSZ	MINERAL GARNET
CI	CORRODED RUST FENCE	MSA	MINERAL GARNET
CJ	CORRODED RUST FENCE	MSB	MINERAL GARNET
CK	CORRODED RUST FENCE	MSC	MINERAL GARNET
CL	CORRODED RUST FENCE	MSD	MINERAL GARNET
CM	CORRODED RUST FENCE	MSE	MINERAL GARNET
CN	CORRODED RUST FENCE	MSF	MINERAL GARNET
CO	CORRODED RUST FENCE	MSG	MINERAL GARNET
CP	CORRODED RUST FENCE	MSH	MINERAL GARNET
CQ	CORRODED RUST FENCE	MSI	MINERAL GARNET
CR	CORRODED RUST FENCE	MSJ	MINERAL GARNET
CS	CORRODED RUST FENCE	MSK	MINERAL GARNET
CT	CORRODED RUST FENCE	MSL	MINERAL GARNET
CU	CORRODED RUST FENCE	MSM	MINERAL GARNET
CV	CORRODED RUST FENCE	MSN	MINERAL GARNET
CW	CORRODED RUST FENCE	MSO	MINERAL GARNET
CX	CORRODED RUST FENCE	MSR	MINERAL GARNET
CY	CORRODED RUST FENCE	MSV	MINERAL GARNET
CZ	CORRODED RUST FENCE	MSW	MINERAL GARNET
DA	CORRODED RUST FENCE	MSX	MINERAL GARNET
DB	CORRODED RUST FENCE	MSY	MINERAL GARNET
DC	CORRODED RUST FENCE	MSZ	MINERAL GARNET
DD	CORRODED RUST FENCE	MSA	MINERAL GARNET
DE	CORRODED RUST FENCE	MSB	MINERAL GARNET
DF	CORRODED RUST FENCE	MSC	MINERAL GARNET
DG	CORRODED RUST FENCE	MSD	MINERAL GARNET
DH	CORRODED RUST FENCE	MSE	MINERAL GARNET
DI	CORRODED RUST FENCE	MSF	MINERAL GARNET
DJ	CORRODED RUST FENCE	MSG	MINERAL GARNET
DK	CORRODED RUST FENCE	MSH	MINERAL GARNET
DL	CORRODED RUST FENCE	MSI	MINERAL GARNET
DM	CORRODED RUST FENCE	MSJ	MINERAL GARNET
DN	CORRODED RUST FENCE	MSK	MINERAL GARNET
DO	CORRODED RUST FENCE	MSL	MINERAL GARNET
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DR	CORRODED RUST FENCE	MSO	MINERAL GARNET
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DV	CORRODED RUST FENCE	MSX	MINERAL GARNET
DV	CORRODED RUST FENCE	MSY	MINERAL GARNET
DW	CORRODED RUST FENCE	MSZ	MINERAL GARNET
DX	CORRODED RUST FENCE	MSA	MINERAL GARNET
DY	CORRODED RUST FENCE		

FINAL ISSUE

LOCATION PLAN

HATCHED AREA SHOWN IN THIS DRAWING - BOLD LINE DEFINES SURVEY EXTENT



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*	*	*	*	*
A	FIRST APPROVED ISSUE	04/06/21	IS	DH
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GLEEDS

Project Name
Gleeds Schools - Hinckley Academy

HINCKLEY ACADEMY
3D TOPOGRAPHICAL SURVEY
SHEET 10 OF 10

TTE Project Number	Drawn By	Date	Checked By	Date	Approved By	Date	Scale	AO	Sheet No.
784-8060162	CP	24/08/21	GP	04/06/21	GP	27/08/21	1:200		S3
Sheet Project Number	Originator	Volume/Sheet	Level	Location	Type/Code	Role	Number		Page No.
-	- TTE	- 00 - 01	- PL	- G	- 00001				A

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THE STUDY

APPENDIX 2 – GROUND INVESTIGATION REPORT

Hinckley Academy

Ground Investigation Report

B030162 V1

February 2022

Prepared on Behalf of Tetra Tech Limited. Registered in England number:
01959704

Document control

Document:	Ground Investigation Report
Project:	Hinckley Academy
Client:	Department for Education
Job Number:	B030162
File Origin:	\\Londondc02\100js\Projects\B0 Series\B030162 Hinckley\9. Reports and Specifications\GIR\B030162 Hinckley GIR 23.2.22 V1.docx

Revision:	V0	Status:	Draft
Date:	20 th December 2021		
Prepared by:	Checked By:	Approved By:	
Heshawa Abayatilaka	 Richard Tonge	 Cathy Cooke	
Description of revision:			
First issue			

Revision:	V1	Status:	Final
Date:	23 rd February 2022		
Prepared by:  Christopher Colwell		Checked by:  Richard Tonge	Approved By:  Cathy Cooke
Description of revision:			
Issue as final			

EXECUTIVE SUMMARY

Site Location and Description	The site is centred on National Grid Reference: 443929, 294487 and covers an area of approximately 11 Hectares on the eastern outskirts of Hinckley, south Leicestershire. At the time of the investigation the site comprised school buildings and landscaped areas constructed on levelled platforms.
Geology	Ground investigation confirmed the following geological sequence: Made Ground (predominantly fine soils which are likely derived from Oadby Member): 0.26-4.60 thick. Oadby Member (fine soils): up to 3.30m thick where present depth fully established. Woolston Sand and Gravel (coarse soils): to the full depth of the investigation (15.00m bgl).
Hydrogeology	The superficial deposits have been classified as an Undifferentiated Secondary A Aquifer .
Hydrology	A lined pond is located on site. Thurston Brook and Soar rivers are within 250m of the site.
UXO	Risk maps show the site to be at Low risk of UXO .
Ground Investigation	The ground investigation completed by Tetra Tech during November 2021 comprised the following: • 1No. cable percussive boreholes to a depth of 15m including recovery of undisturbed (UT100) samples and Standard Penetration Tests (SPTs) • 3No. window sample boreholes to a maximum depth of 5m bgl • 5No. hand excavated inspection pits • 4No. Dynamic cone penetrometer tests • 4No. Groundwater and gas monitoring wells • Soil geo-chemical and geotechnical testing, of samples recovered from site • 3No. return groundwater and ground gas monitoring visits
Geo-Environmental Risk Assessment	Based on the review of desk study information, subsequent ground investigation and a conceptual model of source, pathway and receptor linkages, the following risk levels established have been identified: • Groundworkers – Low/Moderate • Future School Site Users – Low/Moderate • Surface Water Features – Very Low • Secondary A Superficial Aquifer – Very Low No significant contamination has been recorded within the soils and groundwater on site (albeit limited testing completed). However, fragments of anthropogenic materials (concrete, brick, ceramic etc) in Made Ground may present a hazard if present in soft cover playing fields.
Ground Gas	The site has been assessed to be CS1 (Very Low Risk).
Geotechnical	Conventional shallow foundations (pad or strip) can be considered for relatively light structural loads associated with the temporary modular units. Piled foundations will be required to support permanent development in the vicinity of Block D.

CONTENTS

EXECUTIVE SUMMARY	3
CONTENTS.....	4
1.0 INTRODUCTION	7
1.1 Instruction.....	7
1.2 Objective.....	7
1.3 Proposed Development	7
1.4 report Conditions	7
2.0 SITE INFORMATION.....	9
2.1 Site Location and Description.....	9
2.2 Geology and Hydrogeology	9
2.2.1 Made Ground	10
2.2.2 Oadby Member	10
2.2.3 Wolston Sand and Gravels	10
2.2.4 Mercia Mudstone Group.....	10
2.2.5 Historic Boreholes	10
2.3 Services	11
3.0 GROUND INVESTIGATION	12
3.1 Summary of Scope.....	12
3.2 Summary of Ground Conditions Encountered	12
3.3 Made Ground.....	13
3.3.1 Proposed Demolition / Development area	13
3.3.2 Area of Proposed Temporary Classrooms.....	14
3.4 Oadby Member	14
3.4.1 Proposed Demolition / Development area	14
3.4.2 Area of Proposed Temporary Classrooms.....	14
3.5 wolston sand and gravel.....	14
3.6 Groundwater Strikes	15
3.7 Monitoring Installations	15
3.8 Insitu testing	15
3.8.1 Standard Penetration Tests (SPTs)	15
3.8.2 Dynamic Cone Penetrator (DCP) Testing.....	15

3.9 Monitoring and sampling	16
3.10 Geotechnical Laboratory Analysis	17
3.11 Environmental LABORATORY ANALYSIS	17
4.0 GROUND MODEL AND GEOTECHNICAL PARAMETERS	19
4.1 Summary Ground Model	19
4.1.1 Soil Units	19
4.1.2 Groundwater	19
4.2 Soil Properties	19
4.2.1 Classification	19
4.2.1.1 Made Ground (MG)	19
4.2.1.2 Oadby Member (ODT)	21
4.2.1.3 Wolston Sand and Gravel (WOL)	22
5.0 GEOTECHNICAL CONSIDERATIONS	23
5.1 introduction	23
5.2 foundations	23
5.2.1 Conventional Shallow Foundations	24
5.2.2 Piled Foundations	24
5.2.3 Floor Slabs	25
5.2.4 Temporary Works	25
5.2.5 Concrete	25
6.0 CONCEPTUAL SITE MODEL AND QUALITATIVE RISK ASSESSMENT	26
6.1 Introduction	26
6.2 Ground Contamination Tier 1 Screening Assessment	26
6.2.1 Human Health	26
6.2.1.1 Soils	26
6.2.1.2 Tier 1 – Soil Screening	27
6.2.1.3 Asbestos Screening	27
6.2.2 Groundwater	27
6.2.2.1 Leachate	28
6.2.2.2 Groundwater	28
7.0 GROUND GAS ASSESSMENT	29
7.1 Introduction	29
7.2 Potential Sources	29
7.3 Data Summary	29

7.4 Ground Gas Risk Assessment.....	29
8.0 CONCEPTUAL SITE MODEL.....	31
8.1 Introduction	31
8.2 Summary of Potential Ground Contamination Risk.....	31
8.2.1 Sources	31
8.2.2 Pathways.....	31
8.2.3 Receptors	31
8.3 Risk assessment	32
9.0 CONCLUSIONS	34
9.1 Contamination Risk Assessment Summary	34
9.2 Geotechnical Assessment Summary	34
9.3 Recommendations	34
APPENDICES	36
1 Report Conditions	36
2 Figures.....	37
3 Borehole Logs.....	38
4 Window Sample and inspection pit Logs.....	39
5 DCP Data	40
6 Groundwater & Ground gas & Monitoring Results.....	41
7 Laboratory Geotechnical Assessment Certificates	42
8 Laboratory Geoenvironmental Assessment Certificates	43
9 Qualitative Risk Assessment Matrix	44

1.0 INTRODUCTION

1.1 INSTRUCTION

Tetra Tech (Tt) were commissioned by Gleeds, on behalf of the Department for Education (D for E), to undertake a ground investigation at Hinckley Academy and John Cleveland Sixth Form Centre in Hinckley, Leicestershire.

1.2 OBJECTIVE

Following the Phase 1 Desktop Assessment^{ref 1}, the investigation was scoped by Tt to provide a more detailed understanding of risks associated with ground contamination and provide geotechnical recommendations for future development. This information will be provided to contractors to inform design and construction.

This report details the investigations undertaken and provides a factual record of the conditions encountered.

1.3 PROPOSED DEVELOPMENT

The development proposal being considered at the time of compilation of this report was confirmed in an email from Gleeds (12.11.21) and included the removal and landscaping of Blocks B and C in the north area of the site. Block D (the Technology Block) in the northeast will also be demolished and a new development is proposed in this area, the details of which were not confirmed / available at the time of writing. Temporary modular classrooms will be required during the construction phase and an area to the southwest of the main carpark has been identified to site these units.

Blocks F, G, I, L and M are scheduled for refurbishment. Blocks A, Q, R and W will remain untouched throughout the scheme. Block X is leased to another provider and will not form part of this scope of work.

The proposed development plans are provided in **Appendix 2**.

1.4 REPORT CONDITIONS

This report has been prepared for the client, Department for Education, in accordance with the terms and conditions of the contract. The report is prepared in line with the Invitation to Tender and the Tetra Tech tender submission and the agreed scope for the ground investigation for this specific site (dated 25th October 2021) and is subject to the report conditions included as **Appendix 1**.

The recommendations and opinions expressed within this report are based on the information provided and other sources of readily available information. Where reference has been made to

¹ B030162_Hinckley_DTS_V1_1, TetraTech (August 2021)

other reports or information provided by the client, or from other Third-party sources, such data has been reviewed in good faith and it has been assumed that their contents are correct. Tetra Tech is unable to guarantee any Third-Party Information. The ground conditions presented herein are representative of the conditions recorded at the time and in the positions of the investigation. Ground conditions may vary over time and in between investigation locations.

2.0 SITE INFORMATION

2.1 SITE LOCATION AND DESCRIPTION

The site is centered on National Grid Reference: 443929, 294487 and covers an area of approximately 11 Hectares on the eastern outskirts of Hinckley, south Leicestershire.

The school buildings occupy the northeast portion of the site and are arranged around hardstand access roads, walkways and landscaped areas which include broad-leaved mature trees, grass and hedgerows.

The buildings comprise the original single and two-story brick structures with pitched tiled roofs dating from c.1900 to 1960 (blocks A, B, I and K) and later (c.1990 to 2000) flat roof buildings, including the technology block D, which is of block construction.

The site lies across a southeast facing hillside, with levels stepped into the slope to accommodate the buildings. At its highest level, in the northwest extremity of the site, the playing fields reside at c. 135mAOD. Blocks B and C (scheduled for demolition / landscaping) are constructed into the slope falling from c.132 in the west to 127mAOD in the east, and this area is bounded by a steep bank down to the Block D level (Technology Block) at c.123.4mADO. A covered walkway connects an upper level on Block D with the ground floor of Block B. The lowest point in the southwest extremity of the site as at c.110mAOD.

Asphalt and AstroTurf sports pitches are situated to the southwest of the school buildings, beyond which, to the southwest and northwest are playing fields. The area identified to accommodate temporary units during the construction phase is in the northwest playing field immediately southwest of the main school carpark.

Structural defects, including water ingress and damp, noted in the project brief are attributed to flash flooding of the site.

2.2 GEOLOGY AND HYDROGEOLOGY

Information regarding the underlying geology anticipated from published British Geological Survey (BGS) maps and provided in the Phase 1 Assessment ^{ref 1} is summarised in Table 1.

Table 1 Summary of Anticipated Ground Conditions

Stratum	Thickness (m)	Aquifer Classification
Made Ground	0 to 3.00	Undifferentiated / Non-aquifer
Oadby Member	Up to 20m	Secondary Undifferentiated Aquifer
Wolston Sand and Gravel	Up to 20m	Secondary A Aquifer
Mercia Mudstone Group	more than 100m	Secondary B Aquifer

2.2.1 Made Ground

Various phases of development reside on generally level ground, and although not indicated on BGS mapping, it is anticipated that fill (likely comprising site won soils) would have been used to construct these platforms into the general southeast sloping topography. Therefore, based on the recorded site levels, the thickness of imported fill could potentially increase from <1m to c.5m from northwest to southeast across each platform.

2.2.2 Oadby Member

The BGS Lexicon of Named Rock Units ^{ref2} describes the Oadby Member, which is indicated across to the north and west of the site, as a grey, weathered brown, Diamicton comprising Cretaceous and Jurassic rock fragments with subordinate lenses of sand and gravel, clay and silt, and typically occurring as a brown to grey, and silty clay, with chalk and flint fragments.

2.2.3 Wolston Sand and Gravels

The south and eastern edges of the site is indicated to be underlain by the Wolston Sand and Gravels, which are also of glacial origin and are described as sand and gravel, locally with lenses of silt, clay or peat.

2.2.4 Mercia Mudstone Group

The bedrock geology is indicated to be of the Mercia Mudstone Group, described as red, commonly green-grey, mudstones and siltstones with thick halite-bearing units.

It is noted that based on BS5930 definitions, in terms of composition, the Mercia Mudstone Group can be highly variable and can be present as both soil or rock units of variable thickness depending on its detailed lithology and state of weathering. In some cases, localised weaker material (e. clay) can occur below stronger material (e.g sandstone), with associated geotechnical risks for substructures. Furthermore, the Mercia Mudstone Group contains evaporite minerals, mainly halite (sodium chloride) and gypsum (hydrous calcium sulfate). These lithologies can cause significant problems for construction due to dissolution (both naturally occurring and anthropogenically induced through brining). The Mercia Mudstone may contain aqueous solutions of sulfate and sulfuric acid in sufficient quantity for potential chemical attack on concrete.

2.2.5 Historic Boreholes

The BGS database holds records of borehole dating from 1957 which describe soils as 'Topsoil over firm to stiff reddish brown slightly sandy clay with little gravel, becoming stiff with depth' to depths of approximately 2m bgl (6ft). This description is comparable to the BGS lexicon description of the Oadby Member.

² <https://www.bgs.ac.uk/technologies/the-bgs-lexicon-of-named-rock-units/>

The nearest BH records extending beyond these shallow depths are SP49SW364^{ref 3} and SP49SW46^{ref 4} located approximately 320m west southwest of the site on ground currently residing at c.121m AOD. These records describe 18.5m of 'soft' and 'sandy marl' from ground level, above 4.3m of 'Very fine running sand' with alternating 'sandy clay' and 'marl' until 'rock marl' indicated at a depth of c.50m, which is possibly suggestive a locally deep Mercia Mudstone weathering profile

2.3 SERVICES

Services integral to the site including water, drainage, gas, electricity, and telecoms run below surface and are connecting to the mains statutory routes along Butts Lane to the north. The service routes within the site boundary were traced during a non-intrusive survey undertaken by others as indicated on the site layout plan (Figure ref: B030162-TTE-00-XX-DR-U-0001 (Ground Investigation Layout Plan) included in Appendix 2.

During the intrusive investigations, prior to breaking ground, exploratory hole locations were scanned using CAT and genny operating in both passive and active mode. Inspection pits were then excavated to a depth of 1.20m bgl. No uncharted services were encountered in these excavations.

³ http://scans.bgs.ac.uk/sobi_scans/boreholes/334578/images/14820719.html

⁴ http://scans.bgs.ac.uk/sobi_scans/boreholes/334260/images/10633607.html

3.0 GROUND INVESTIGATION

3.1 SUMMARY OF SCOPE

The scope of work originally proposed (Tt document ref: Hinckley - Proposed GI Scope 25.10.21 and Hinckley - Fee adjustment notice 11.11.21) was reduced due to the requirement for weekend working to limit disruption to school activities. The weekend work was further subject to statutory constraints on working hours relating to construction noise generation on sites at weekends. Furthermore, late notice revisions to the proposed developments resulted in revisions to the proposed layout of the proposed exploratory boreholes which could not be achieved due to practical constraints, including operational access tracks that could not be obstructed, and steep slopes impacting the safe mobilisation of cable percussive drilling.

The Tt intrusive investigations undertaken on 20th and 21st of November and 2nd December 2021 were therefore reduced from the originally planned scope of work, and in summary comprised the following.

- 5No. Hand excavated inspection pits (IP01 to IP05 inclusive) to 1m bgl
- 1No. Cable percussive boreholes with standard penetration testing (SPTs) (BH01) to a depth of 15m bgl
- 3No. Dynamic sample boreholes to depths ranging between 3 and 5m bgl
- 4No. TRRL Dynamic Cone Penetrometer tests to depths of c.1.40m bgl
- 4No. Dual purpose groundwater and gas monitoring installations
- Laboratory geo-environmental and geotechnical testing soil samples
- 3No. return monitoring visits to recover water samples and measure ground gas concentrations

Site investigation activities were undertaken in general accordance with BS5930:2015 'Code of Practice for Site Investigations' which incorporates BS-EN 1997-2:2007 and BS10175:2011 A1:2013.

Exploratory hole locations are indicated on the plan included in **Appendix 2**.

3.2 SUMMARY OF GROUND CONDITIONS ENCOUNTERED

The ground conditions encountered during the investigation compared well to the conditions anticipated from published information (Section 2.2) and in summary comprised the following deepening succession.

- Made Ground
- Oadby Member (locally present)
- Woolston Sand and Gravels

A summary of strata depths and thicknesses is provided in Tables 2 and 3. Detailed soil descriptions are provided on the Engineering Logs included in **Appendices 3 & 4**.

Table 2 Proposed Demolition / Development Area (around Block B and D) Summary of Strata Depths and Thicknesses

Location	Made Ground		Oadby Member		Woolston Sand and Gravel	
	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)
BH01	GL	1.30	1.30	3.30	4.60	>11.40
WS01	GL	4.60	NP	NP	4.60	>0.40
WS02	GL	>3.80	NE	NE	NE	NE
WS03	GL	>3.90	NE	NE	NE	NE
IP01	GL	>1.00	NE	NE	NE	NE
IP02	GL	>1.00	NE	NE	NE	NE

'>' Denotes the maximum thickness confirmed (base depth of the material not proved), NE – Not Encountered, NP – Not Present

Table 3 Proposed Temporary Classrooms Summary of Strata Depths and Thicknesses

Location	Made Ground		Oadby Member		Woolston Sand and Gravel	
	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)
IP03	GL	>1.00	NE	NE	NE	NE
IP04	GL	>1.00	NE	NE	NE	NE
IP05	GL	0.26	0.26	>0.74	NE	NE

'>' Denotes the maximum thickness confirmed (base depth of the material not proved), NE – Not Encountered

3.3 MADE GROUND

3.3.1 Proposed Demolition / Development area

IP01, IP02, WS01 and WS03 were located in soft landscaped areas and encountered a c.200mm thick layer of Topsoil at surface comprising grass / turf (where present) over dark brown slightly gravelly sandy silt. Gravel generally comprised flint with rare brick and concrete fragments and rootlets were also noted.

WS02 was commenced on hard standing and confirmed a 100mm thick layer of bitumen bound macadam (asphalt), whilst BH01 was drilled within a parking bay surfaced with mortared herringbone brick.

The full thickness of the Made Ground was not established in WS02, WS03, IP01, IP02 and IP03 where it persisted to the base of the exploratory holes at depths ranging between 1.00 and 3.90m bgl and confirmed the anticipated thicker layer of disturbed soils associated with historic earthworks (see Sections 2.1 and 2.2.1).

Where the full thickness was confirmed in BH01 and WS01, it extended to depths of between 0.20 to 4.60m bgl.

WS03 refused at a depth of 3.90m bgl.

Although slightly variable in composition, the Made Ground generally comprised fine soil (silt and clay) with lesser subordinate sand and gravel, and inclusions of ceramic tile, concrete, asphalt fragments near the surface, and rare fragments of brick noted throughout.

3.3.2 Area of Proposed Temporary Classrooms

Below the surface Topsoil within the area of the proposed temporary classrooms, soils showed obvious signs of disturbance between a depth of 0.18 and 0.26m bgl in IP05. Below this depth, natural soils are tentatively assumed, however this assumption is based only on the absence of anthropogenic materials.

The Made Ground was variable in composition and comprised dark grey to black slightly ashy slightly sandy gravel of quartzite, sandstone and coal with rare metal.

3.4 OADBY MEMBER

3.4.1 Proposed Demolition / Development area

The Oadby Member was encountered below the Made Ground in BH01 at a depth of 1.30m bgl where the full thickness of the unit was established (3.30m). This unit was locally absent at WS01 where the underlying Wolston Sand and Gravels were encountered below the Made Ground at 4.60. The Made Ground unit above the Woolston Sands and Gravels (between 2.20 and 4.60m bgl) at WS01 is noted to be of similar composition to the Oadby Member (reddish brown slightly gravelly silty CLAY), albeit with rare fragments of asphalt indicating disturbance.

The unit was relatively uniform in composition and described as soft to firm orangish to reddish brown slightly gravelly sandy clay.

3.4.2 Area of Proposed Temporary Classrooms

The Oadby Member was encountered in HP05 at 0.26m bgl and although similar soils were encountered in HP04 and HP05 at similar depths, rare brick fragments have also been identified indicating possible disturbance within the depths investigated at these positions.

The unit was relatively uniform in composition and soils encountered were similar to those encountered in the proposed development areas (and consisted of soft to firm orangish to reddish brown slightly gravelly sandy clay). The gravel component comprised subangular to subrounded fine to medium flint and quartzite (with rare brick fragments noted in IP04 and IP03).

3.5 WOLSTON SAND AND GRAVEL

The Wolston Sand and Gravel was encountered directly below the Made Ground (possibly disturbed Oadby Member) in WS01 and below the Oadby Member in BH01 at a depth of 4.60m bgl.

The full thickness of the unit was not established, and the unit persisted to the full depth of the investigation (15.00m bgl) in BH01.

The deposit was variable in composition and comprised a c.12.5m thick horizon of medium dense reddish brown silty fine to coarse sand, becoming gravelly between 8.70 and 10.40m bgl, and loose at 10.40m (possibly associated with the groundwater) overlying dense greyish brown sand with 40 to 120mm bands of stiff grey-brown clay which persisted to the base of BH01 (at 15.00m bgl).

3.6 GROUNDWATER STRIKES

During drilling, a groundwater strike occurred at 13.20 which then rose to a depth of 10.71m bgl after 20minutes in BH01.

3.7 MONITORING INSTALLATIONS

50mm internal diameter dual purpose land gas and groundwater monitoring standpipes were installed within BH01, WS01, WS02 and WS03. Installation details are provided on the engineering logs in Appendix 3 & 4 and response zone depths are summarised in Table 4.

Table 4 Summary of Borehole Installations

Location	Response Zone (m bgl)		Unit
	Top	Base	
BH01	1.00	14.50	Made Ground / Woolston Sand and Gravel
WS01	1.00	4.60	Made Ground
WS02	1.00	3.80	Made Ground
WS03	1.00	3.90	Oadby Member / Woolston Sand and Gravel

3.8 INSITU TESTING

3.8.1 Standard Penetration Tests (SPTs)

Standard Penetration Tests (SPTs) were undertaken at 1.00 to 1.50m intervals in BH01, WS01, WS02 and WS03. SPT N values are indicated on the engineering logs (Appendix 3 & 4).

3.8.2 Dynamic Cone Penetrator (DCP) Testing

Dynamic cone penetrator (DCP) testing was undertaken from ground level at 3No. locations adjacent to hand pits within the area of the proposed temporary classrooms as indicated on Figure B030162-TTE-00-XX-DR-U-0001 (Ground Investigation Layout Plan) ('DCP' ref locations). The tests were undertaken using a standard Transport and Roads Research Laboratory (TRRL) specification DCP probe to drive a 20mm diameter 60° cone using an 8kg weight dropped from a height of 575mm. The California Bearing Ratio (CBR) derived from these tests is presented in the tables

included in Appendix 5. CBR has been calculated for layers displaying discernible uniform rates of penetration (blows /10mm) using the TRRL standard relationship:

- $\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \cdot \text{Log}_{10}(\text{mm/blow})$ ^{ref 5}

3.9 MONITORING AND SAMPLING

3No return gas and groundwater monitoring visits have been carried out to date on 2.12.21 (Round 1), 8.12.21 (Round 2) and 8.2.22 (Round 3) to monitor and record the following parameters using a Photo Ionisation Detector (PID) and GA5000 Gas Analyser.

- Volatile Organic Hydrocarbons (VOCs)
- Methane CH₄ (% Volume)
- Carbon Dioxide CO₂ (% volume)
- Carbon Monoxide CO (% volume)
- Oxygen O₂ (% volume), CO (ppm)
- Hydrogen Sulfide H₂S (ppm)
- Atmospheric pressure (mB)
- Gas flow rates (liters/hr)

Groundwater levels recorded during monitoring are summarised in Table 5 and ground gas monitoring results are included as Appendix 6 and summarised in Table 6.

Table 5 Summary of Groundwater Monitoring

Location	R1: 2.12.21 (m bgl)		R2: 8.12.21 (m bgl)		R3: 8.2.22 (m bgl)	
	Water	Base	Water	Base	Water	Base
BH01	10.44	13.39	10.39	13.38	10.22	13.36
WS01	Dry	4.35	Dry	4.34	Dry	4.34
WS02	Dry	3.20	Dry	3.20	Dry	3.21
WS03	Dry	3.71	Dry	3.69	Dry	3.68

⁵ ORN8 A users manual for a program to analyse dynamic cone penetrometer data (TRL, 1990)

Table 6 Summary of Land Gas Monitoring

Round	Peak Readings (*denotes minimum)							
	VOC (ppm)	CH ₄ (%)	CO ₂ (%)	CO (%)	O ₂ (%)*	H ₂ S (ppm)	ATM Trend	Flow (ltrs/hr)
1	1.10	ND	3.50	ND	15.50	ND	Static	-0.026
2	0.40	0.10	3.10	1	16.40	ND	Rising	0.000
3	0.20	0.10	2.90	ND	15.6	ND	Static	-0.020

3.10 GEOTECHNICAL LABORATORY ANALYSIS

A programme of geotechnical testing was carried out on samples recovered from the exploratory holes. The testing was scheduled by Tetra Tech and undertaken by GEO Site & Testing Services Ltd who are UKAS accredited for a wide range of geotechnical tests. All testing was carried out in accordance with BS 1377:1990 ‘Methods of Tests for Soils for Civil Engineering Purposes’. Table 7 presents a summary of geotechnical testing undertaken. Laboratory certificates are detailed in **Appendix 7**.

Table 7 Summary of Laboratory Geotechnical Testing

Test	Standard	No. Tests
Moisture Content	BS 1377: Part 2 : Clause 3.2 : 1990	8
Atterberg Limits	BS EN ISO 17892-12:2018	7
Particle Size Distribution	BS EN ISO 17892-4:2016, cl. 5.2	10
PSD (Pipette Method)	BS EN ISO 17892-4:2016, cl. 5.4	8
Quick Undrained Single Stage 106mm dia	BS EN ISO 17892-7:2018	1
Geotechnical Chemistry - BRE SD1 Suite A	BRE SD1 2005, BS1377: Part 3: 1990	2
pH and SO ₄ of soil	BRE SD1 2005, BS1377: Part 3: 1990	2

3.11 ENVIRONMENTAL LABORATORY ANALYSIS

The assessment of the environmental chemistry of selected soil and water samples was scheduled by Tetra Tech and carried out by Element Laboratories (Element) as summarised in Table 8. Element are an approved supplier in accordance with the requirements of Tt quality system and are themselves UKAS and MCERTS accredited for a range of chemical analyses. Laboratory testing was carried out in accordance with BS 10175: 2011+A1:2013^{ref 6}.

⁶ BS 10175: 2011+A1:2013 Investigation of Potentially Contaminated Sites – Code of Practice

Laboratory test certificates with results are provided in **Appendix 8**.

Table 8 Summary of Laboratory Environmental Testing

Test	Determinants	No. Tests
Tt Soil Suite B	Asbestos Screen, FOC (Fraction of Organic Carbon), cyanide, heavy metals, PAH, TPH, BTEX	8
Tt Leachate Suite B	pH, SO ₄ , NH ₄ alkalinity as CaCO ₃ , heavy metals, total phenol, PAH, TPH.	2
Tt Water Suite B	pH, cyanide, heavy metals, PAH, TPH, BTEX	1

4.0 GROUND MODEL AND GEOTECHNICAL PARAMETERS

4.1 SUMMARY GROUND MODEL

4.1.1 Soil Units

The ground model presented in Table 9 has used information from the investigation to summarise the depth and thickness of the units encountered.

Table 9 Ground Model

Unit	Unit Ref	Characteristic Surface		Characteristic Thickness (m)
		mbgl	mAOD	
Made Ground	MG	GL	123	1 to 5*
Oadby Member	ODT	1 to 5	122	<3
Woolston Sand and Gravel	WOL	2 to 4.5	119	>12

*Made Ground thickness increasing from west to east across cut / fill platforms.

4.1.2 Groundwater

Groundwater levels within the limited investigation remained relatively stable at around 10.40m bgl (113m AOD) during the investigation and monitoring. Shallow wells (<5m deep) remained dry.

4.2 SOIL PROPERTIES

The ranges of the various soil properties measured via in situ and laboratory testing are summarised in the following sections. Where characteristic values are provided, these are reasonably conservative estimates of a measured or assessed property, usually based on the lower quartile or average value that may be used to represent the overall behaviour of the material.

Due to inherent variability of MG, which comprised of slightly gravelly silty clay with occasional fragments of brick and concrete, these soils are not considered readily characterisable and conservative parameters should be used. Allowances should also be made for the presence of hydraulically bound materials (e.g. asphalt and concrete) where present.

4.2.1 Classification

4.2.1.1 Made Ground (MG)

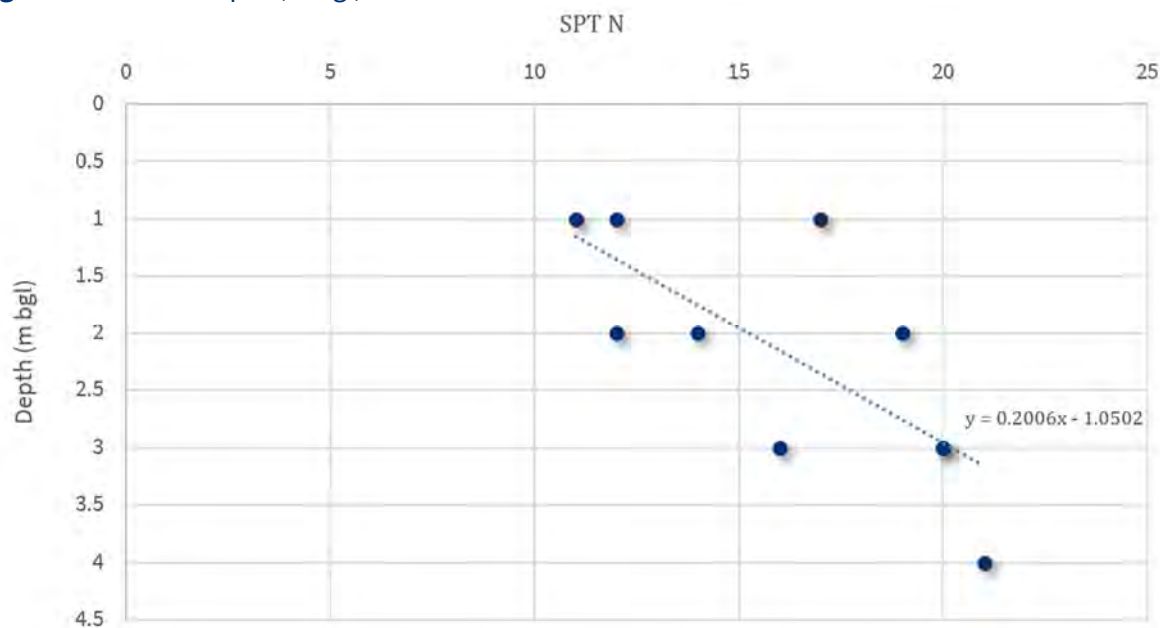
Particle Size Distribution (PSD) assessment undertaken on 3No. samples of MG confirmed predominantly fine soils with a similar size distribution to the likely parent materials (underlying Oadby Member) and compared well with the engineer's description of slightly sandy, slightly gravelly silty clay and clayey silt.

Atterberg limits derived from laboratory assessment of MG have confirmed moisture content in the range of 13 and 19%, a liquid limit in the range of 24 and 52%, a plastic limit in the range of 10 and 16%, and a plasticity index ranging between 14 and 42%.

Between 72 and 82% of the sample passed the 425µm sieve indicating a modified plasticity index (**I_p**) ranging between **11** and **34**, indicative of **low plasticity** fine soil of low to medium volume change potential^{ref 7}.

SPT N within MG generally ranged between 11 and 21 (a single outlier N of >50 recorded in WS03 at 4.00m bgl is possibly indicative of refusal in the underlying soils) and showed a gradual increase with depth (see Figure 1).

Figure 1 SPT N vs Depth (m bgl): Made Ground



Using the relationship proposed by Stroud and Butler^{ref 8}, where for SPT N <~25, the undrained shear strength (C_u) = SPT N x 4.5, the C_u ranges between **49 and 94 kPa** (where N = <50).

N shows an increase in depth equivalent to the gradient: Depth (m bgl) = 0.2N-1.05. Although SPT N demonstrates relative consistency, due to the evidence of disturbance and limited data available, unless further assessment is undertaken, it is recommended that these indicative strength parameters are used with caution, and a worse case (**N=11**) is considered characteristic throughout this unit.

TRRL DCP probes within the area of the proposed temporary classrooms confirmed variable CBR (%) ranging between 3 and 10% through the upper meter of MG. Owing to the inherent variability of the Made Ground a lower bound CBR of **3%** is considered conservative.

⁷ NHBC Standards 2011 Chapter 4, 4.2 Building near trees

⁸ Stroud and Butler, The Standard Penetration Test and the Engineering Properties of Glacial Materials, 1975 Conf. of the Midlands Geotechnical Society

Assessment of the geotechnical chemistry of 3No. samples of MG is summarised in Table 10.

Table 10 Summary of Chemical Analysis – Made Ground

Range (min – max)				
Acid Soluble Sulfate SO ₄ (% w/w)	Total Sulfur (% w/w)	pH	Water Soluble Sulfate SO ₄ as 2:1 extract (mg/l)	Corresponding DS & ACEC Class
0.04	0.02	8.5-8.6	41-72	DS1 AC-1

DS – Design Sulfate Class, ACEC – Aggressive Chemical Environment for Concrete

4.2.1.2 Oadby Member (ODT)

Due to limited presence (the ODT was only encountered in BH01 between depths of 1.30 and 3.30m bgl, and in IP05 from 0.27 to >1.00m bgl), limited assessment of the ODT has been undertaken. From the engineer's soil descriptions, it is tentatively concluded that the ODT is the parent material for much of the Made Ground on site, and therefore occurs as localised replacement fill which extends across the cut platform area covering the proposed development area (below blocks B and D), hence its subsequent classification as MG with which it is likely to share the general properties described in Section 4.2.1.1.

A PSD on a single sample of ODT confirmed the engineer's description of slightly gravelly very sandy, silty clay.

Atterberg limits derived from laboratory assessment of a single sample of ODT have confirmed moisture content of 14%, a liquid limit of 41%, a plastic limit of 12%, and a plasticity index of 29%. 95% of the sample passed the 425µm sieve indicating **I_p** of **27.55**, indicative of low plasticity fine soil of **low volume change** potential which is within the range determined for the MG.

SPT N of 19 and 25 at depth of 1.50 and 3.5m bgl suggest an increase in consistency with depth which plots above the MG trend line (see Figure 1) and are possibly indicative of higher consistencies owing to the soils undisturbed state. Laboratory quick undrained triaxial assessment of a single UT100 samples obtained from the ODT determined a **Cu (kPa)** of **123** which compares well with SPT N derived consistency of 112.5kPa^{ref 8} at 3.50m bgl.

A bulk and dry density of 198 and 1.71Mg/m³ was determined on a single sample of ODT from a depth of 2.50m bgl.

TRL DCP blow counts at deeper levels within TRL04 recorded an average stabilised CBR of c.5% through the ODT.

Assessment of the geotechnical chemistry of a single sample of ODT is summarised in Table 11 and again indicates similar properties to the MG.

Table 11 Summary of Chemical Analysis – Oadby Member

Acid Soluble Sulfate SO ₄ (% w/w)	Total Sulfur (% w/w)	pH	Water Soluble Sulfate SO ₄ as 2:1 extract (mg/l)	Corresponding DS & ACEC Class
-	-	8.6	41	DS1 AC-1

DS – Design Sulfate Class, ACEC – Aggressive Chemical Environment for Concrete

4.2.1.3 Wolston Sand and Gravel (WOL)

PSD assessments of samples obtained from the WOL at 4.60m bgl (WS01) and 6.00 and 9.00m bgl (BH01) indicate predominantly coarse soils and confirm the engineer's description of a silty fine to coarse sand horizon between 8.70 and 10.40m bgl. The engineers' observations of a horizon with greater fine soil component at deeper levels is also confirmed by PSD assessment on a sample at 14.50m bgl which determined 50% silt / clay and 50% sand components.

SPT N within WOL generally ranged between 23 and 35. Although a generalised increase in N with depth was discernible within the limited data available, a single outlier from this range of 6 was recorded at a depth of 10.50m bgl. This test coincided with a groundwater strike and is likely to be indicative of loosening of the soils associated with vadose conditions (see Figure 2).

Figure 2 SPT N vs Depth (m bgl): Wolston Sand and Gravel



5.0 GEOTECHNICAL CONSIDERATIONS

5.1 INTRODUCTION

The current development proposals (as of December 2021) are summarised in Section 1.3.

A new development is proposed in the current Block D (Technology Block) area, the details of which were not confirmed / available at the time of writing. This area is characterised by an area of Made Ground from surface which is likely to deepen from west to east overlying the predominantly fine soils of the Oadby Member, which in turn overlie the Woolston Sand and Gravel comprising predominantly coarse soils, with potentially loose coarse soils at the water table and clay / silt bands at deeper levels.

Geotechnical risks are presented by the assumed associated relatively high structural loads of the proposed block bearing upon the variable composition and thickness of the Made Ground, and Woolston Sand and Gravel at deeper levels.

Temporary modular classrooms will be required during the construction phase and an area to the southwest of the main carpark has been identified to site these units. Soils in this area were relatively uniform and the risks associated with the assumed temporary and relatively light loads of proposed structure are considered less significant, but residual risk remains.

The following sections present preliminary recommendations which are based on the limited data available from the constrained investigations. With consideration to the established geotechnical risks, once development proposals are finalised, it is recommended that further investigations are undertaken to inform efficient design, and further reduce these risks.

5.2 FOUNDATIONS

Due to the relatively variable near surface geotechnical conditions within the footprint of the proposed development, which potentially includes Made Ground to depths of up to 5m bgl, the use of conventional shallow foundations, e.g pads or strip, are unlikely to be a viable foundation solution for the new block due to the risk of unacceptable total or differential settlements, which could occur both in the short and long term, and therefore, it is therefore likely that piled foundations will need to be considered.

There is a lower risk of deeper Made Ground in the footprint of the proposed temporary classrooms. In this area and the soils show a relatively consistent composition. The proposed temporary modular units are also likely to be less sensitive to variable / differential settlements in the short term, much of which can be accommodated by design, e.g. via the use of large footprint or adjustable pad foundations, and therefore conventional shallow could be considered for relatively light structural loads of temporary modular units.

Shallow soils are noted to be of low to medium volume change potential and are susceptible to shrink and swell movements associated with seasonal moisture changes. Although these movements may not pose a significant risk to temporary buildings, in line with NHBC guidance ^{ref 7},

it is recommended that permanent structures would need to be constructed on foundations bearing at depths below the zones of influence of nearby trees.

Furthermore, both pile caps and the upper sections of piled foundations would need to be protected with compressible voids and sleeves to remove risks associated with volume change and the possible introduction of negative skin friction to pile shafts.

5.2.1 Conventional Shallow Foundations

The adoption of conventional spread foundations (e.g pad or strip foundations) is likely to be viable for light or broadly distributed loads such as the temporary classrooms.

Due to potential variability in composition and consistency of the near surface soils it is anticipated that these soils, if loaded, may give rise to unpredictable and unacceptable total and differential settlements. It is therefore recommended that foundations pass through the Made Ground and bear onto the underlying Oadby Member.

In consideration of allowable bearing pressures alone, calculations based on the Brinch Hansen method have estimated a net allowable bearing capacity (NBC) of the order of 70kPa. Loads of this order would limit settlement to less than 25mm and could be achieved for a 1x1m wide pads bearing at a depth of 1.0m bgl within the Oadby Member where it occurs at shallow levels, e.g within the area of the proposed temporary classrooms.

It is recommended that the local conditions are confirmed by a geotechnical engineer, and foundations extended to avoid low strength / variable soils where required.

5.2.2 Piled Foundations

Piled foundations will be required to support the permanent structures planned in the area of the existing technology block (Block D). A choice of pile type of various lengths and diameters can be designed to bear into the strata encountered beneath the site. However general site conditions, environs and proximity to adjacent extant structures and foundations are all influential in choice of piling system.

In consideration of the prevailing conditions and the anticipated scale of the scheme, where piles are required, Continuous Flight Auger (CFA) piles are likely to provide a practical and cost-effective solution due to limited generation of arisings and relatively quick installation. CFA piles also limit the risks to sensitive nearby substructures associated with vibration and percussion.

It is noted that certain practical constraints apply, for example when considering the incorporation of pile reinforcement or geothermal exchange systems, and pile emplacement in ground with potential obstructions. For these reasons it is recommended that a competent and experienced specialist piling contractor undertakes all piling works, adopting appropriate controls and that their advice should be sought at the earliest opportunity.

To provide an indicative assessment of pile capacities for the purposes of this illustrative exercise, variations in strata thickness have been averaged in a simplified model of ground conditions and characteristics as indicated in Table 9 whilst adopting worse case conditions (Made Ground of c. 5m thick). It is noted that the parameters applied are potentially conservative and have been

developed from the limited data available. The indicative capacities in Table 12 account for potentially weak soils at or near to the water table and include a widened buffer of 3m of potentially loose coarse soils around the vadose zone. Further efficiency / capacity may be achievable through a more detailed characterisation based on additional lateral coverage and deeper ground investigations to provide parameters for deeper piles.

Service capacities for a range of possible founding depths and pile dimensions have been calculated for CFA piles as outlined in Table 12.

Table 12 Summary CFA Preliminary Pile Capacity Assessment

Pile Embedment Length (m)	Pile Diameter (m)		
	0.30	0.60	1.20
	Approximate Service Capacity (kN)		
8	140	380	1170
10	190	510	1540
12	420	1300	4600

Parameters: α 0.30, β 0.30-0.56, N_c 8, N_q 2xSPT N, Groundwater 2.40m bgl. FOS: **1.5** shaft, **3.50** base.

5.2.3 Floor Slabs

Due to the presence of a variable thickness of Made Ground, which will be subject to variable longer-term settlement under relatively light loads, it is recommended that floor slabs are suspended.

5.2.4 Temporary Works

Shallow excavations remained stable during the investigation, however, owing to the variability of the shallow soils, there is potential for excavations to be unstable. It is therefore likely that temporary excavations will require battering back during excavation, and in line with good working practices, man entry into excavations greater than 1.2m deep, or working adjacent to unsupported soils, should only be carried out where temporary works and shoring are in place.

Shallow groundwater was not encountered during the investigation; however, there is some potential for minor perched water ingress, particularly after heavy precipitation and therefore allowances for the dewatering of excavations will need to be considered. It is recommended that dewatering is undertaken in accordance with the guidelines of CIRIA C515 Groundwater control – Design and Practice.

5.2.5 Concrete

It is recommended that concrete used for substructures complies with the design sulfate class of DS1 and ACEC class of AC-1 which assumes a mobile groundwater condition.

6.0 CONCEPTUAL SITE MODEL AND QUALITATIVE RISK ASSESSMENT

6.1 INTRODUCTION

Under the current UK environmental legislation (Environment Act 1995, Water Resources Act 1994, Environmental Protection Act 1990 (as amended), Health and Safety at Work Act 1994, Town and Country Planning Act 1990 and Building Regulations 1985), land is defined as contaminated if there is a significant ‘pollutant linkage’. This requires evidence of the presence of a contaminant “source”, a “pathway” through which contaminants could travel, and a “receptor” that could be harmed by the contaminant. In addition, the type of receptor and any harm must meet the descriptions of significant harm given in the statutory guidance. A site where a contaminant is causing, or is likely to cause, significant pollution of controlled waters also constitutes contaminated land.

This section of the report refines the Conceptual Site Model (CSM) developed during the Desk Based Assessment ^{ref 1}, which includes a qualitative assessment of environmental risks associated with each of the pollutant linkages identified.

The qualitative risk assessment is achieved by classifying the likely significance or severity of the risk and the probability of the risk actually occurring, to determine an overall risk for that particular pollutant linkage. The assessment has been undertaken with cognisance of:

- The nature, volume and extent of any identified contamination source;
- The potential pathways;
- Identified primary receptors; and
- Due regard to the current site status and potential future site redevelopment as a school.

6.2 GROUND CONTAMINATION TIER 1 SCREENING ASSESSMENT

The objective of the Tier 1 Screening Assessment presented herein is to identify the chemical constituents analysed which might potentially pose unacceptable levels of risk to sensitive on-site and off-site receptors. Measured concentrations in soil have been compared with various sets of Tier 1 Screening Values (TSVs). Where measured concentrations exceed these levels, this does not necessarily indicate a requirement for remediation; it can, however, be the trigger for the undertaking of a more detailed quantitative assessment in accordance with the current UK tiered risk assessment framework.

6.2.1 Human Health

6.2.1.1 Soils

In March 2014, DEFRA published the ‘C4SLs’ within the ‘Policy Companion Document: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination’

(SP1010). The purpose of the C4SLs is to identify a concentration in soil indicative of Category 4 status as defined by Part 2a Statutory Guidance on the definition of contaminated land. In September 2014, further clarification was published in a letter from Lord DeMauley to Local Authorities instructing them to use C4SLs in planning. Where available C4SLs have been used as the preferred choice of screening criteria.

For those constituents where no C4SL has been published, Tt have screened soil against Suitable for Use Levels (S4ULs).

For the purposes of this risk assessment, human health criteria for soils applicable to a school end use have been used in order to screen the site data. The TSVs applied are based on a 'residential without plant uptake' scenario and whilst this is conservative for the end use, it is considered protective of school pupils.

A number of TSVs are dependent on the Soil Organic Matter (SOM) content, and as such TSVs are typically calculated for a SOM of 1%, 2.5%, and 6%. An average SOM of 0.21% was calculated for samples taken. For this reason, GACs corresponding to a SOM of 1% have been used for the screening of the samples.

6.2.1.2 Tier 1 – Soil Screening

8No. soil samples obtained from the near surface materials on site were submitted for chemical laboratory analysis.

A single exceedance of the TSVs was recorded when using the screening criteria defined in S.6.2.1. Beryllium was recorded at a concentration of 3.1mg/kg with position IP05 at a depth of 0.20mbgl, compared to the TSV of 1.7mg/kg. All other analysed contaminants were recorded at concentrations below the corresponding TSVs within all soil samples.

It is considered that the exceedance of beryllium is relatively marginal and with the associated sample taken from Made Ground soils at a depth of 0.2mbgl, it is unlikely school end users would come into direct contact with these soils. It should also be noted that the analysed soils from that same position at a depth of 0.1mbgl did not show any exceedances above the TSV.

Full copies of laboratory certificates for all soil analyses are as well as the screened results are included as **Appendix 8**.

6.2.1.3 Asbestos Screening

8No. samples were analysed for the presence of asbestos comprising samples from a range of shallow depths. No Asbestos was identified in any of the samples.

6.2.2 Groundwater

The superficial geology is classified by the Environment Agency (EA) as a Secondary Undifferentiated Aquifer (Oadby Member) overlying a Secondary A Aquifer (Wolston Sand and

Gravel). There are no groundwater abstraction points within 500m of the site and the site is not located within a groundwater Source Protection Zone.

6.2.2.1 Leachate

2No. soil samples obtained from Made Ground soils were scheduled for leachate testing to assess the mobility of constituents from soil samples collected from the site. The results of this analysis have been compared with Tt's inhouse Freshwater TSV (the most conservative screening value from River Water Environmental Quality Standards (EQS), Drinking Water Standards (DWS) or Freshwater Lake TSVs). **No exceedances of the TSVs** were recorded, indicating limited potential for contaminants to leach from the soils.

6.2.2.2 Groundwater

The groundwater screening assessment has been undertaken is to identify the chemical constituents analysed which might potentially pose unacceptable levels of risk to the groundwater underlying the site. Measured concentrations from a single round of groundwater sampling have been compared with Tt's inhouse Freshwater TSV (the most conservative screening value from River Water Environmental Quality Standards (EQS), Drinking Water Standards (DWS) or Freshwater Lake TSVs). Where measured concentrations exceed these levels, this does not necessarily indicate a requirement for remediation; it can however, be the trigger for the undertaking of a more detailed quantitative assessment in accordance with the current UK tiered risk assessment framework.

A single groundwater sample was collected from BH01 (all other installations were dry) during the first round of water monitoring and scheduled for laboratory analysis for a suite of commonly elevated potential contaminants.

The results were screened using the adopted TSV (as defined above) and only the dissolved Zinc concentration (32µg/l) showed an exceedance of the respective screening value (10.9 µg/l). With the assumption that the concentration is 100% bioavailable, the Zinc concentration is slightly above typical ambient background concentrations of UK rivers which ranges between 1.2 and 7.1 µg/l.

7.0 GROUND GAS ASSESSMENT

7.1 INTRODUCTION

Three rounds of gas monitoring have been undertaken to date on the 2nd and 8th of December 2021, and 8th February 2022.

A full factual record of the monitoring visits is presented in Section 3.9 and **Appendix 6**.

7.2 POTENTIAL SOURCES

Based on the desk-based assessment ^{ref 1} and the findings of the site investigation, limited potential ground gas sources have been identified on the site and in the surrounding areas which include:

- Made Ground of variable thickness associated with creating level development platforms for the school buildings on the sloping site. Up to 3.9m thickness of Made Ground has been proven during these works.

7.3 DATA SUMMARY

Tables 5 and 6 summarise the ground gas concentrations and flows obtained during the two monitoring visits undertaken to date. Using the CIRIA C665 ^{ref 9} guidance on Ground Gas the greatest flow rate and greatest concentrations of ground gases are combined to reflect a worst-case scenario. The ranges of concentrations at each location do not necessarily correspond to the same monitoring date but represent the maximum readings across the monitoring programme to allow an assessment of the gas concentrations on a worst-case scenario basis. It is noted, however, that a worst-case scenario cannot be wholly achieved without falling atmospheric pressure during the monitoring period.

7.4 GROUND GAS RISK ASSESSMENT

A semi-quantitative land gas assessment has been undertaken using the guidance provided in BS8485 ^{ref 10} and CIRIA C665 ^{ref 9} which provides a framework for assessment of ground gas risk to buildings/structures with a range of foundation designs.

Using peak flow rates and gas concentrations recorded over both monitoring visits, a semi-quantitative, worst-case scenario GSV (ltr/gas/hr) derived from the peak concentration (% volume) x peak flow (ltr/hr) is summarised in Table 13.

⁹ CIRIA - C665 Assessing Risks posed by hazardous ground gases to buildings (2007)

¹⁰ BS 8485 (2015) Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings

Table 13 GSV Worst Case Scenario Summary

Gas	Peak Concentration (%)	Peak Flow (l/hr)	Maximum Gas Flow (l/hr)	GSV Worst Case Scenario
CO ₂	3.50	-0.026	0.00091	CS1 (Very Low Risk)
CH ₄	0.10	-0.026	0.000026	CS1 (Very Low Risk)

The resultant GSV calculations indicate the site is currently representative of Characteristic Situation 1, and therefore it is unlikely that special ground gas protection measures to new buildings will be required. If further monitoring indicates higher concentrations of ground gas or greater flows, consideration should be given to incorporating a gas membrane into new buildings.

8.0 CONCEPTUAL SITE MODEL

8.1 INTRODUCTION

A preliminary conceptual site model (CSM) and qualitative risk assessment was provided as part of the Tt desk-based assessment ^{ref 1}. Updates to the CSM and risk assessment of potential contamination linkages to receptors made based on the intrusive site investigation works and monitoring and laboratory assessment undertaken to date are discussed as follows.

8.2 SUMMARY OF POTENTIAL GROUND CONTAMINATION RISK

8.2.1 Sources

Based on a review of the available desk-based information ^{ref 1} and ground investigation data available to date, the following potential sources have been identified

- S1 – Made Ground associated with historical development / earthworks to create level development platforms. Some anthropogenic materials were noted within the Made Ground including ceramic tile, concrete and asphalt and brick fragments. These likely originate from former buildings that were historically present on site (farmstead and earlier school buildings).

8.2.2 Pathways

The primary pathways by which sensitive receptors may come into contact with ground contamination are considered to be the following:

- P1 – Direct dermal contact with and / or ingestion of contaminated soil;
- P2 – Atmospheric transport and inhalation of airborne dusts, vapours and fibres;
- P3 – Lateral and vertical migration of gases / vapours through the underlying strata;
- P4 – Leaching of potential onsite sources of contamination;
- P5 – Lateral and vertical migration of dissolved phase contamination in the Secondary Aquifers;
- P6 – Contaminant migration through preferential pathways (e.g. underground service ducts, drains, etc.);
- P7 – Surface water runoff;
- P8 – Direct contact with buildings / structures leading to chemical attack and damage;
- P9 – Accumulation of hazardous gas in buildings; and
- P10 – Leaching of potential offsite sources of contamination.

8.2.3 Receptors

The following are considered to be sensitive receptors:

- R1 - Groundworkers
- R2 - Future School Users
- R3 - Surface Water Features – on site pond, inland rivers, Thurlaston Brook and Soar River
- R4 - Secondary A Superficial Aquifers and Secondary B Bedrock Aquifer

8.3 RISK ASSESSMENT

A qualitative risk assessment has been undertaken using the matrix approach defined within CIRIA C552 ^{ref 11} as detailed in Table 14 which evaluates the pollutant linkages and the assigned risk rating and updates the preliminary CSM identified in the Tt desk based assessment ^{ref 1}. The CIRIA C552 risk categories and the assessment methodology are detailed in Appendix 9.

¹¹ Contaminated Land Risk Assessment, A Guide to Good Practice (Rudland et al., 2001).

Table 14 Updated CSM

Potential Source	Potential Pollutant	Potential Receptor	Potential Pathway to Receptor	Associated Hazard (Severity)	Likelihood of Occurrence	Risk
S1: Made Ground associated historic development and earthworks	No contaminants identified at concentrations that would be considered hazardous (with the exception of an isolated and limited instance of beryllium, although this is not considered to pose a significant risk) but occasional anthropogenic fragments of ceramic, brick and concrete were recorded	R1 Groundworkers	Direct contact/ingestion, atmospheric transport and inhalation, migration, and accumulation of hazardous gases/vapours. (P1, P2, P3, P9)	Human Health (Medium)	Low Likelihood Groundworks increase the chance of construction site workers encountering sub-surface soils impacted during earthworks. Limited evidence of contamination has been encountered. No asbestos fibres were recorded but anthropogenic materials were noted including brick and ceramic fragments which may present an injury hazard if found to be angular/sharp fragments Risks can be further reduced with the introduction of a Construction & Environmental Management Plan (CEMP) and adoption of appropriate PPE.	Low / Moderate
		R2 Future School Site Users			Low Likelihood Areas of soft landscaping in future developments will act as continuous pathways between underlying Made Ground and site users, however no significant contamination has been identified during the investigation. The anthropogenic materials identified, whilst not a mobile contamination sources, may be present as sharp/angular fragments that may be injurious if encountered near the surface in playing fields	Low / Moderate
		R3 Surface Water Features	Leaching of on-site contamination, lateral and vertical migration of contamination, migration through preferential pathways, surface runoff. (P4, P5, P6, P7)	Controlled Waters (Mild)	Unlikely Given the limited evidence of mobile contamination and the distance between the source and receptor, contamination of surface waters is highly unlikely.	Very Low
		R4 Secondary Superficial Aquifers	Leaching of on-site contamination, lateral and vertical migration of contamination, migration through preferential pathways. (P4, P5, P6)	Controlled Waters (Mild)	Unlikely Limited evidence of contamination and potential for leachate to impact groundwater.	Very Low

9.0 CONCLUSIONS

9.1 CONTAMINATION RISK ASSESSMENT SUMMARY

Based on the data collated during the ground investigation and the desk based review of the site in the Tetra Tech Phase 1 Report (Aug 2021), no contamination of any significance has been recorded within the ground on site. However, fragments of anthropogenic materials such as ceramics, brick, concrete etc. were noted within the Made Ground which may present a risk of injury if in shallow soils within playing fields. The groundwater table is deep (10.40m bgl) significantly reducing the risk of any contaminant linkages to the underlying Secondary A aquifer.

Ground gas has not been recorded in concentrations that are likely to present a significant risk at this site.

9.2 GEOTECHNICAL ASSESSMENT SUMMARY

The adoption of conventional spread foundations (e.g pad or strip foundations) is likely to be viable for light loads associated with the temporary modular classrooms. However, due to potential variability in composition and consistency of the near surface soils in the area of Block D, it is likely that Piled foundations will be required.

9.3 RECOMMENDATIONS

No significant sources of contamination have been identified on site and contamination of the shallow soils was not observed. However, for any areas of proposed playing fields (e.g. grass covered sports pitches), care will be required to make sure that fragments of former demolition rubble (concrete, brick etc) are not present near the surface which may cause injury to the users of these playing fields. In this instance, a cover of imported topsoil may be required to prevent any contact with the underlying Made Ground.

However, it is also acknowledged that variable conditions may be present in between investigation locations and on this basis, groundworkers undertaking construction works (foundations, site levelling, installing services etc) should be vigilant for any signs of contamination during their works and if such should be encountered, works halted whilst the advice of a contaminated land consultant is sought. Groundworkers should also use appropriate PPE and employ standard environmental management practices.

It is not considered that ground gas protection measures are required for new buildings based on the current data, however, further monitoring is recommended, particularly during falling atmospheric pressure, to confirm the ground gas regime.

The limited data available has resulted in a cautious approach to the geotechnical characterisation and ground model. Further efficiency in design and risk elimination could be achieved through additional investigations, particularly in the area around block D, where constraints prevented a standard triangulation of the deeper conditions of the site to inform pile design. This would be

achieved via the drilling of an additional 2No cable percussive boreholes to depths of between 15 to 20m bgl in areas targeted based on the emerging design and anticipated structural loads.

APPENDICES

1 REPORT CONDITIONS

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

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

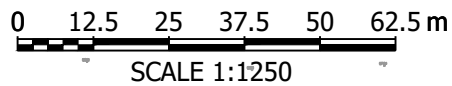
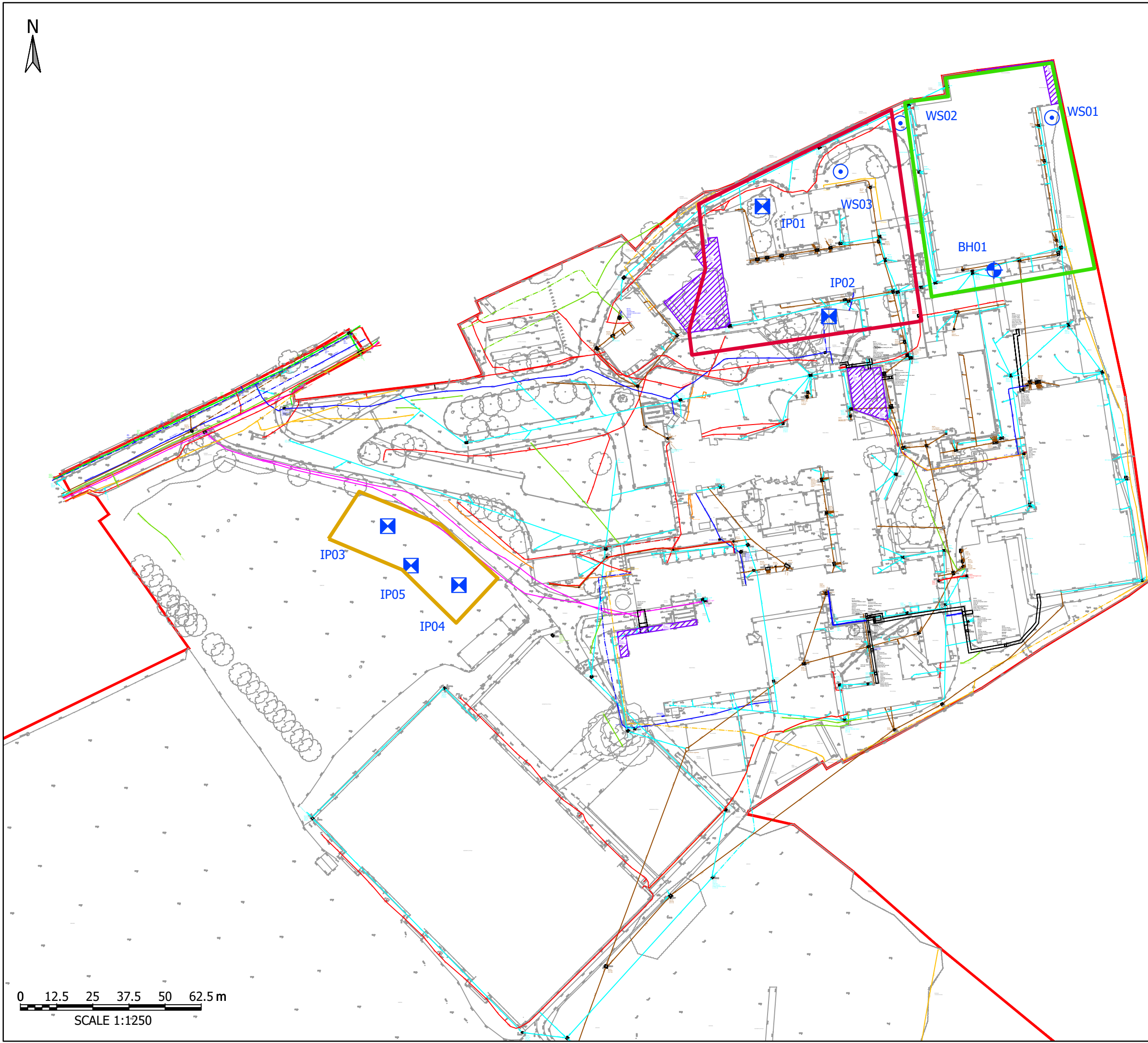
This report is based on a visual site inspection, reference to accessible referenced historical records, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. 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 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, perhaps in higher concentrations, elsewhere on the site 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 categorical assurances that they will be accepted by Authorities or Funds etc. without question as such bodies often have unpublished, 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 Tetra Tech. In time improved practices or amended legislation may necessitate a re-assessment.

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted.

The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by 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 further extensive research will be required before the effects can be better determined.

2 FIGURES



KEY

-  BOREHOLE
-  WINDOW SAMPLE
-  INSPECTION PIT
-  PROPOSED LOCATION OF MODULAR UNITS
-  DEMOLITION/LANDSCAPING
-  BLOCK D PROPOSED DEVELOPMENT

DRAFT ISSUE

Rev	Description	Date	PP	RT	CC
001	DRAFT ISSUE	20.12.2021	PP	RT	CC

Document Control

Issuing Office:
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www.tetrateteurope.com



Client:
GLEEDS ADVISORY LIMITED

Project Name:
HINCKLEY

Sheet Title:
GROUND INVESTIGATION LAYOUT PLAN

TTE Project Number	Drawn By	Date	Checked By	Date	Approved By	Date	Scale @ A3	Suitability
B030162	CM/PP	17.12.21	KT	20.12.21	CC	20.12.21	1:1,250	50
Client Project Number	Originator	Volume/System	Level/Location	Type/Code	Role	Number	Revision	
B030162	- TTE	- 00	- XX	- DR	- U	- 0001	D01	

3 BOREHOLE LOGS

Tt TETRA TECH Project: Hinckley Location: Hinckley Academy, LE10 1LE Client: Department for Education						Location Details						Status FINAL		Borehole Number BH01	
						Easting: 444079.00		Northing: 294592.00		Level: 123.46 mAOD					
						Logger:									

4 WINDOW SAMPLE AND INSPECTION PIT LOGS

Tt TETRA TECH	Project: Hinckley		Location Details				Status		Pit Number	
	Location: Hinckley Academy, LE10 1LE		Easting: 443999.00 Northing: 294614.00				FINAL		IP01	
Client: Department for Education			Level: 130.84mAOD Depth: 1.00m				Logger: Type: IP		Sheet 1 of 1	
Hole Information Pit Dimensions 0.30m 0.30m Orientation: ° Shoring: None Stability: Stable Plant: Hand Tools	Groundwater				Scale: 1:10					
	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: HA	Approved By: RT				
					Start Date: 20/11/2021	Finish Date: 20/11/2021				
Strata Description			Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
MADE GROUND: Grass over soft dark brown slightly gravelly sandy SILT with frequent rootlets and rare fragments of brick. Gravel is subangular to subrounded fine to medium flint. Sand is fine to coarse.				0.20	130.64			Depth (m)	Ref	Tests / Results
MADE GROUND: Soft brown slightly gravelly sandy SILT with occasional rootlets. Gravel is subangular to subrounded fine to medium flint. Sand is fine to coarse.								0.50	ES1	
EOH at 1.00m - Target depth				1.00	129.84					
Observations / Remarks								11th Floor, Angel Court, London EC2R 7HJ 020 7250 7500		
1. Location cleared with CAT and GPR scanning. 2. No groundwater encountered. 3. Backfilled with arisings								Project Number 784-B030162		