In order to reduce the risk to site workers during redevelopment, appropriate safety measures should be adopted on site.

Workers should avoid contact with the soils by the use of protective boots, overalls and gloves, and should wash before eating, drinking and using the toilet.

To prevent the inhalation of contaminants by site workers and the wind-blown transfer of contaminants off site, the generation of dust should be avoided; this can be achieved by spraying the materials with water if necessary. Measures should be taken to ensure that contaminated materials are not accidentally transferred off site, for example on vehicle tyres.

Reference should be made to CIRIA Report No.132 'A Guide for Safe Working on Contaminated Sites' (1996), and Health and Safety Guidance Document, Protection of Workers and the General Public during the Development of Contaminated Land' (1991).

6.2.3. Soil Contamination and Flora

Concentrations of the phytotoxic contaminants, zinc, copper and nickel have been compared to the threshold values presented in Table 1 of British Standard BS3882: 'Specification for Topsoil and Requirements for Use' (2007), in order that this risk to flora may be assessed. It should be appreciated that this specification is only applicable to topsoil materials which are being placed. Topsoil which is to remain in-situ is not required to comply with the specifications of BS3882.

The screening values for phytotoxic contaminants are pH dependent and the following values have been adopted on the basis of a pH less than 6.

- Threshold Value for Zinc – 200 mg/kg
- Threshold Value for Copper – 100 mg/kg
- Threshold Value for Nickel – 60 mg/kg

One sample of soil (TP4 at 0.3m bgl) presented elevated concentrations of zinc when compared to the above screening values and thus this material is not considered appropriate for re-use as topsoil. Some imported topsoil may therefore be required to be used for landscaping purposes.

6.2.4. Soil Contamination and Controlled Waters

Significantly elevated concentrations of contaminants were not recorded in the soil samples analysed and thus there is not considered to be a significant risk of leaching or migration of contaminants into the identified Controlled Water receptors at the site (underlying Secondary A Aquifer).

On this basis, remedial measures are not considered to be necessary.

6.2.5. Summary

On the basis of the above it is considered that the site may be redeveloped for its intended end use as a school Sports Hall without the need for further investigation or remediation.

6.3. Waste

Reference should be made to the EU Waste Framework Directive, Revised Directive 2008/98/EC and 'The definition of Waste: Development Industry Code of Practice (CoP) Version 2' published by CL:AIRE (2011) to establish whether soils generated from on-site works are classified as waste.

An amount of waste will likely be generated from foundation excavation works. There may be limited opportunities for re-use of materials on site, subject to compliance with the CoP.

There is, however, likely to be some waste to be disposed of off-site. Waste removed from the site, for disposal, must be classified according to the analytical methods and criteria recommended by the Landfill (England and Wales) (Amendment) Regulations 2004 and 2005. The regulations set new acceptance criteria for wastes to be disposed of at landfill sites with effect from 16th July 2005.

Full and detailed records should be kept of all waste soils removed from site for future reference purposes.

6.4. General

As with any sampling exercise, the sampling process is representative and it is possible that areas of contamination may be found during the redevelopment of the site. Excavations on site should be supervised and any areas of suspected contamination should be assessed by a competent professional and subject to further analysis is necessary.

7. Geotechnical Assessment

We have assumed that the proposed development will be in keeping with the existing structure and be of a steel framed construction including a mezzanine floor level (for the proposed viewing gallery). Exact details of building loads were not available at the time of writing this report, however, the schemes structural engineers anticipate that loads of 300-350kN will be applicable.

The recommendations provided within this section are based upon the above information and our understanding of the proposed scheme as detailed in Section 4, together with the proposed development plans included in Appendix A.

7.1. Structural Foundations

The prevailing cohesive soils are susceptible to volume change due to the influence of trees, as discussed in Section 5.3. Numerous mature trees exist

in close proximity to the proposed structure some of which are proposed to be removed as part of the development scheme. However, the clay layer is not greater than 2.3m in thickness, based on the ground investigation data, and is underlain by water bearing granular deposits. Foundations will therefore need to allow for this.

7.2. Shallow Foundations

Pad foundations bearing on a firm clay at 1.5m bgl should be feasible for the proposed development provided that the bearing pressure is limited to 130kN/m^2. This is based on undrained shear strength measurements and soil descriptions.

Based on the NHBC standards (2017) it may be necessary to deepen foundations in the vicinity of existing/proposed trees. However, this will require the founding level to be taken closer to the water table, which was encountered in several trial pits at depths between 1.5m bgl and 2.7m bgl. Furthermore, groundwater ingress caused pit instability. The GEA investigation, which was carried out in August 2009, did not encounter groundwater, which suggests that the water table in this area is affected by seasonal variation.

The total drained settlements of a 1.5m x 1.5m square pad foundation bearing at 1.5m bgl is estimated to be less than 25mm. This settlement was calculated based on assumed modulus of elasticity values for the clay and Sand and Gravel Deposit and elastic theory. Where individual pad foundations are supported on granular deposits and cohesive deposits, we estimate that differential movements between pad foundations will be in the order of 20mm. The proposed structure should be designed to accommodate these potential differential movements.

The formation should be inspected by a competent engineer prior to concreting, and if very soft or loose pockets are encountered, these should be excavated until a firm to stiff or medium dense to dense deposit, suitable for bearing, is encountered. These should then be backfilled with well-compacted granular fill placed in layers.

Where foundations exceed a depth of 1.5m due to the influence of trees, anti-heave precautions should be adopted.

Foundations should be excavated beyond the depth of any significant roots encountered in the excavations. Reference should be made to NHBC standards when considering any new areas of planting.

Shallow and perched groundwater may be encountered in the Sand and Gravel Deposit deposits and should be considered at all times. Suitable groundwater control measures may be required to mitigate groundwater ingress, particularly if foundations are taken to depths deeper than 1.5m bgl.

7.3. Ground Floor Construction

Fully suspended ground floor slabs are recommended for adoption within the extensions to the sports hall and should incorporate a sub floor void appropriate to high volume change potential soils.

7.4. Groundworks

The stability of any made ground or disturbed ground must not be relied upon in unsupported excavations.

Safe working conditions must be provided at all times where operatives are required to work in excavations.

Heavy plant and stockpiles of materials should not be permitted close to the edges of open excavations.

Based on observations made during fieldwork, groundwater ingress from the Sand and Gravel Deposit could be encountered in excavations for structures or services and the requirement for groundwater control measures should be considered.

Further reference should be made to CIRIA Report No. 97, 'Trenching Practice' (1997).

7.5. Concrete Grade

Water soluble sulphate content and pH value determinations were carried out by both the geotechnical and environmental laboratories on a total of nine samples. Total sulphur content determinations were carried out on six of these nine samples.

Sulphate content determinations undertaken by the geotechnical laboratory are presented in terms of mg/l SO_3 and have been multiplied by a factor of 1.2 to determine content as mg/l SO_4.

Values of water soluble sulphate ranged from <10 mg/l SO_4 to 110 mg/l SO_4, pH values ranged from 3.5 to 6.5 and the percentage of total sulphur (TS %) ranged from 0.03% to 0.16%. The range of total potential sulphate (TPS %) was then calculated to be 0.09% to 0.48% based on a relationship of TPS % = 3.0 x TS %.

In accordance with the methodology presented in BRE Special Digest 1, third editions 'Concrete in Aggressive Ground' (2005). A characteristic value for water soluble sulphate of 85 mg/l SO_4 has also been adopted, together with a pH value of 3.5 and a characteristic value of 0.36% for total potential sulphate.

In accordance with BRE Special Digest 1 'Concrete in Aggressive Ground', (2005), on the basis of the above results and an assumption of mobile groundwater, a Design Sulphate class of DS-2 is recommended for shallow buried concrete. An aggressive chemical environment for concrete (ACEC) classification of AC-3z should be adopted.

7.6. External Works

7.6.1. Drainage

As discussed in Section 5.1.2, an infiltration test was attempted in TP2A in accordance with BRE Digest 365, 'Soakaway Design' (2007). An infiltration rate could not be calculated due to the test being affected by gradual groundwater ingress.

Given the relatively shallow depth of groundwater at the site and predominantly cohesive nature of the shallower soils, the adoption of infiltration drainage is not considered suitable for the site and alternative methods of surface water disposal should be considered.

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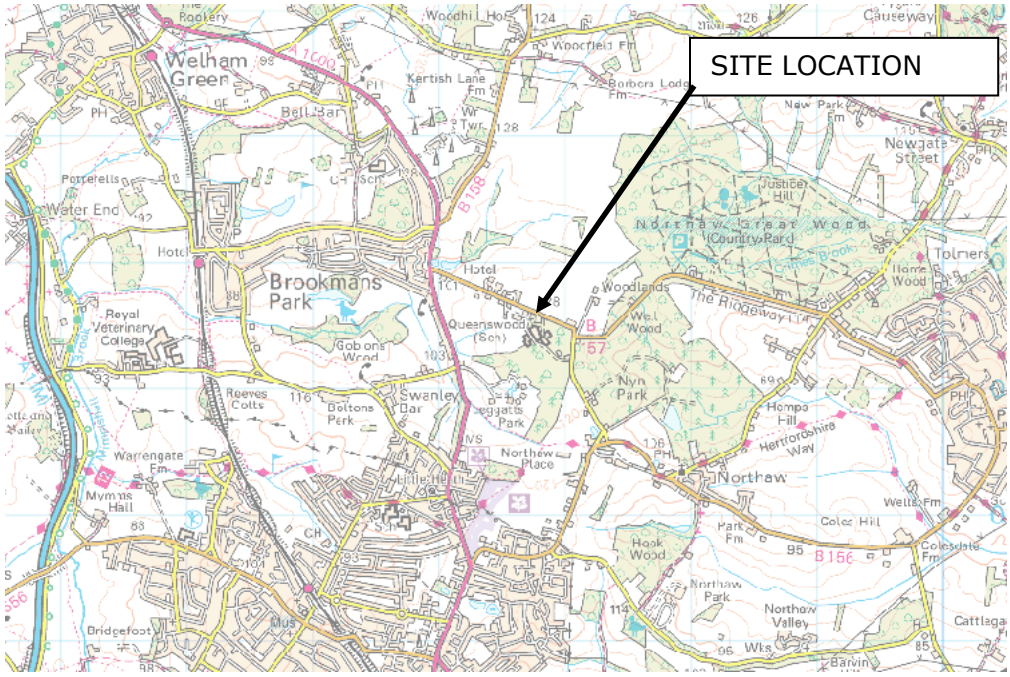
Appendix A

Figures & Drawings



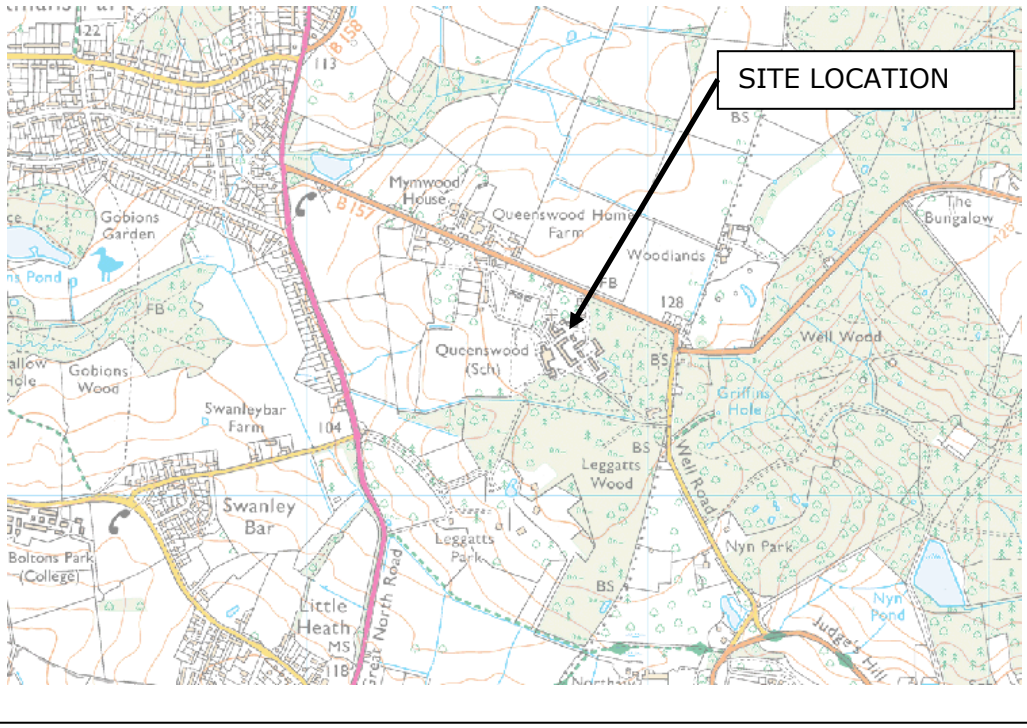


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FIGURE 1

SITE LOCATION PLAN

SCALE: N.T.S.

JOB NO: 47875