TEMPLE MEMORIAL PARK, SOUTH SHIELDS

Phase II – Ground Investigation Report

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Document History

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EXECUTIVE SUMMARY

Site Address	**Temple Memorial Park, John Reid Road, South Shields, NE34 8QN**
Site Description	The development area is roughly rectangular shaped encompassing an area of 18.13 Ha. Currently the entire site comprises of recreational land with paths/walkways and several sports pitches. The site is predominantly grassed and flat with several undulations of rough vegetated ground.
Site History	The site remained undeveloped however has had many different land uses including landfills until approximately 1994 when the site returned to recreational land. The site is generally surrounded by roads, residential properties and the remaining sections of Temple Memorial Park.
Previous Reports	One report has been completed to date. This was compiled by James Christopher Consulting and was entitled: • ***TEMPLE MEMORIAL PARK, SOUTH SHIELDS PHASE I – DESK TOP STUDY (Document Ref: JCC17-051 (E) 01, dated August 2017)***
Proposed End Use	It is understood that the site will be levelled and a new rugby/cricket club constructed with associated areas of soft landscaping and car parking.
Site Investigation	The investigation works undertaken by JCC involved: • 5 (no.) window sample boreholes (WS01 - 05) with ground gas installations • 20 (no.) machine excavated trial pits (TP01 - 20) • In-situ testing (SPT's and hand shear vanes) • Geoenvironmental and geotechnical sampling and laboratory soil testing
Ground Conditions	Made ground was encountered in all exploratory hole locations at depths from 0.30 - >3.30mbgl. The made ground consisted of clay/silt with variable volumes of sand and gravel. In some areas, the made ground graded into a gravel with variable volumes of secondary constituents. Anthropogenic debris was encountered in all exploratory hole locations including plastic fragments, glass bottles, metal wiring, plastic bags, brick, concrete, timber and paper. Natural ground consisted of firm clay/silt with secondary constituents of sand and gravel. The cohesive deposits became stiffer with depth and in some exploratory hole locations graded into hard clay/weak mudstone (recovered as gravel) suggesting proximity to rockhead.
Groundwater	No groundwater was encountered within any of the window sample boreholes whilst drilling. A perched water table was encountered in-between the made ground and the natural cohesive deposits.
Contamination	Asbestos presence was confirmed within topsoil type Made Ground in TP01 at 0.50m. Based on data assessment this elevated level is thought to be a data outlier. The results of the laboratory chemical screenings have identified no elevations in any of the metals, PAH's or TPH's tested for in comparison to the 'trigger levels' set for sites for intended commercial end use. However, due to the presence of anthropogenic debris within the made ground across the site, a level of risk for dermal contact during the construction phase has to be adopted.
Geotechnical	Particle size distribution tests were carried out on six samples of natural deposits and one sample of made ground from TP19. The results of the tests on natural samples indicate the presence of sand, gravel and cohesive (CLAY/SILT) deposits with varying volumes of secondary constituents. Five Atterberg Limit Determination tests were carried out on samples of cohesive material to classify the fine grained soils. The results were compared to the Casagrande Chart published in BS5930 and showed the samples to be clay of intermediate to very high plasticity.
Plant Phytotoxicity	There are elevated levels of phytotoxic contaminants (copper and zinc) within the made ground.
Sulphate Class	The site can be given a Design Sulphate Class of DS-2. Assuming mobile groundwater on site, the Aggressive Chemical Environment for Concrete (ACEC) is AC-2; buried concrete should be designed accordingly.

1 BACKGROUND

1.1 INTRODUCTION

As requested by Tolent Construction Ltd., James Christopher Consulting (JCC) was commissioned to carry out a geo-environmental investigation at a site of a public recreational park in South Shields. The investigation was required to obtain geoenvironmental and geotechnical information for a proposed sports club development including areas of hard standing and soft landscaping.

1.2 SCOPE

The scope of the investigation was specified by JCC and comprised 5 no. window sample boreholes and 20 no. machine excavated trial pits. Representative samples were collected for geochemical and geotechnical laboratory testing. The investigation was performed to the general requirements of BS 5930, BS EN 1997-2 (2007), BS EN ISO 22475-1 (2006) and other relevant related standards. The exploratory hole locations can be seen on the Exploratory Hole Location Plan, a copy of which can be seen in Appendix A. The fieldwork took place on the 21st to the 23rd August 2017.

Table 1 - Details of Site Investigation

Client:	Tolent Construction Ltd.
Project Type:	A new rugby/cricket clubhouse is proposed with associated areas of soft landscaping and car parking.
Site Location Plans:	See Appendix A
Layout Plan (Existing):	See Appendix A
Ground Investigation Works:	5 no. window sample boreholes (WS01 to 05) for representative geotechnical sampling, laboratory testing, in-situ testing (SPT's) and ground gas apparatus installation. 20 no. machine excavated trial pits (TP01-TP20) for representative geoenvironmental and geotechnical sampling, laboratory testing and in-situ sampling.
Laboratory Testing:	Geochemical Testing – Generic Suite including metals, inorganics, petroleum hydrocarbons, PAH's and asbestos presence. WAC testing was also commissioned. Geotechnical Testing – Atterberg classification and Particle Size Distribution testing.
Reporting:	Factual and Interpretative

This report contains information limited to the area of the site as indicated on the Existing Site Plan (Appendix A) and the areas that were accessible during the fieldwork. The record sheets (Appendix B) show strata depths recorded from current ground levels. This report presents the factual records of the fieldwork and laboratory testing.

1.3 LIMITATIONS

1.3.1 GENERAL

This Report has been prepared by James Christopher Consulting ('JCC') with all reasonable skill and care, within the terms and conditions of the contract between JCC and the Client ("Contract") and within the limitations of the resources devoted to it by agreement with the Client. Any reliance upon the Report is subject to the Contract terms and conditions.

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This Report shall not be used for engineering or contractual purposes unless signed above by the author, checker and the approver for and on behalf of JCC and unless the Report status is 'Final'.

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Whilst every effort has been made to ensure the accuracy of the data supplied and any analysis interpretation derived from it, the possibility exists of variations in the ground and groundwater conditions around and between the exploratory positions. No liability can be accepted for any such variations in these conditions. Furthermore, any recommendations are specific to the development as detailed in this Report and no liability will be accepted should they be used for the design of alternative schemes without prior consultant with JCC.

2 SITE SETTING

2.1 LOCATION AND DESCRIPTION

Temple Memorial Park is located between John Reid Road and Nevinson Avenue which borders King George Road, South Shields; see Site Location Plan (Appendix A). Temple Memorial Park lies approximately 2.5 miles south of South Shields Centre and 7.3 miles east of Gateshead centre. The site is at National Grid reference 436769, 563402.

The development area is roughly rectangular shaped encompassing an area of 18.13 Ha. Currently the entire site comprises of recreational land with paths/walkways and several sports pitches. The site is predominantly grassed and flat with several undulations of rough vegetated ground.

2.1.1 PUBLISHED GEOLOGY

The BGS Geology of Britain Viewer (2014) indicates that the site lies within an area of the Pelaw Clay Member. The solid geological deposits below the development site are recorded as the Pennine Middle Coal Measures; comprising mudstone, siltstone and sandstone.

2.1.2 PREVIOUS INVESTIGATIONS

One report has been completed to date. This was compiled by James Christopher Consulting and was entitled:

- ***TEMPLE MEMORIAL PARK, SOUTH SHIELDS PHASE I – DESK TOP STUDY (Document Ref: JCC17-051 (E) 01, dated August 2017)***

The findings of the Phase 1 Desk Study were as follows:

- The desk study has shown that the site is likely to have some moderate geotechnical risks associated with it.
- A risk rating of moderate is determined appropriate for this development with respect to ground contamination. Made ground is anticipated so the risk assessment must take the potential of made ground exposure into account. Historically, the site has remained undeveloped however has had many different land uses including landfills until approximately 1994 when the site returned to recreational land.
- A risk rating of moderate is determined appropriate for this development with respect to ground gas generation. Ground gas associated with potential sources such as; onsite made ground, nearby areas of infilling, landfill and the historical mining activity surrounding the site.

- A risk rating of low is considered appropriate for this site with respect to potential risks to controlled waters.

It was recommended that trial pits/boreholes are excavated/sunk respectively to confirm strata variability, groundwater regime and the extent and condition of made ground deposits. Representative samples should be taken for geotechnical and geochemical testing. The ground gas regime on site shall be classified with a ground gas monitoring campaign following the intrusive investigation.

3 FIELDWORK

The fieldwork was carried out in general accordance with BS 5930:2015, BS EN 1997-2 (2007) and BS EN ISO 22475-1 (2006).

The exploratory hole locations were selected by JCC. The locations were set out from local features.

The exploratory hole locations are shown on the Site Plan in Appendix A.

3.1 EXPLORATORY HOLES

Five window sample boreholes were sunk; all located toward the proposed clubhouse area to the central south site area. They were numbered WS01 - 05 and were each sunk to a maximum depth of 4.45m. Geotechnical samples were retrieved at varying depths. All window sample boreholes were excavated to inform ground conditions and to retrieve geotechnical samples. On completion, four boreholes were installed with gas monitoring apparatus (WS01, 02, 04 and 05).

Twenty trial pits were machine excavated by a JCB 3CX using a 2ft toothed bucket. They were numbered TP01 -20 and depths varied from 1.20m to 3.60m. Geochemical and geotechnical samples were taken at varying depths. On completion, the trial pits were backfilled with arisings. Please refer to Appendix E for photographs.

The exploratory hole logs are presented in Appendix B. These provide information including the equipment and methods used, samples taken, tests carried out, water observations and descriptions of the strata encountered. The logging of soil is in accordance with BS EN ISO 14688-1+A1 (2013) for soils as amplified by BS 5930:2015.

On completion of the fieldwork, geoenvironmental and geotechnical samples were transported to the Gateshead office of JCC with those required for testing being transferred to 'Dets' laboratory in Consett, Co Durham.

3.2 IN-SITU TESTING

3.2.1 SPT'S

A total of 19 (no.) in-situ standard penetration tests (SPT's) were carried out at varying depths down-hole in each exploratory window sample location. The results of the SPT's undertaken within the made ground and natural ground are shown by the graph and summarised in Table 3.1 (overleaf) and provided within the borehole logs in Appendix B.

An average N value of 5 (undrained shear strength value of 25kPa) was derived for the made ground deposits at 1.00mbgl. This corresponds to a soft clay/silt or very loose gravel classification. An average N value of 21 (undrained shear strength value of 105kPa) was derived for the natural cohesive deposits underlying the made ground. This corresponds to a firm clay classification.

Generally, within all boreholes, the SPT N value shows an increasing progressive trend with depth below ground level (see graph overleaf). One N value at 3m below ground level is 50 which is the highest N value throughout all of the boreholes, and will most likely be due to an obstruction i.e. a cobble or boulder within the borehole.

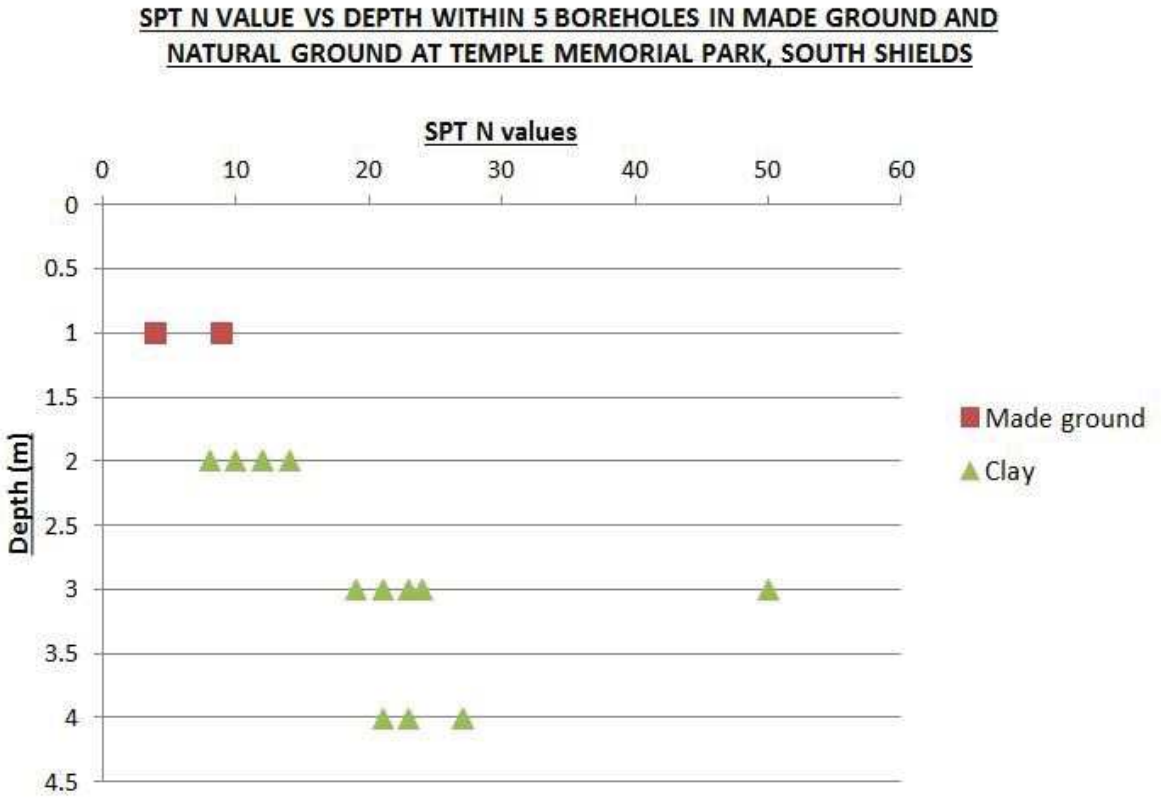

Table 3.1 - SPT Results

Strata	Depth below GL (m)	No of tests	SPT N Range	SPT N Average
Made Ground	0 – 1.60	5	4 - 9	**5**
Natural Ground (clay)	1.10 – 4.45	14	8 - 50	**21**

3.2.2 Hand Shear Vane Results

Nineteen residual hand shear vane tests were carried out on large pieces of clay already excavated within the natural cohesive deposits within the trial pits at depths varying between 1.50 – 3.10mbgl. The tests indicated overall average undrained shear strength of the in-situ clay to be 115kN/m²; a result which correlates to a firm clay material classification.

The average undrained shear strength of the in-situ clay from 1.50 – 2.50mbgl is 110kN/m² and from 2.50 – 3.10mbgl is 128kN/m². These results illustrate the same trend in undrained shear strength (increasing with depth) as the SPT results (Section 3.2.1).

3.2.3 Percolation Testing

Two boreholes were drilled to a depth of 2.00m next to WS03 and WS04 on the 22nd August 2017. The boreholes were cased to 1.50m; meaning the response zone was located within the natural clay deposits. The boreholes were then filled with water. Both water levels were checked through the day. The water level barely dropped in either borehole. Therefore, for surface water soakaways, the natural ground is considered unlikely to offer conditions conducive for soakaways.

4 LABORATORY TESTING

4.1 GEOENVIRONMENTAL TESTING

Geoenvironmental laboratory testing was scheduled by JCC on the soil samples recovered during the fieldwork. The testing was carried out by Derwentside Environmental Testing Services (Dets) located in Consett, Co Durham. This laboratory is UKAS accredited. The results are presented in Appendix C. Representative Samples were screened for the following determinands:

- Generic contamination testing: Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Zinc, Selenium, Mercury, Water Soluble Boron, pH, Total Cyanide, Total Sulphate, Monohydric Phenols, Sulphide, TPH (banded) and PAH (speciated).
- Asbestos presence.

Seven representative soil samples of the ground recovered were sent to 'dets' laboratory for contamination screening to be carried out. The results have been assessed using guidelines introduced by DEFRA in 2002 and 2009 and by the joint Land Quality Management Ltd (LQM) and Chartered Institute of Environmental Health (CIEH), 2015. The LQM/CIEH Suitable for Use Levels (S4ULs) are intended for use in assessing the potential risks posed to Human Health by contaminants in soil and as transparently-derived and cautious 'trigger values' above which further assessment of the risks or remedial action may be needed. With regards to the assessment of the site, which is proposed to be redeveloped for commercial use, the most appropriate SGV and LQM/CIEH Generic Assessment Criteria (GAC) values have been utilised.

The soil samples were screened using a generic contamination suite including metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Se, Hg, water soluble boron), TPH (banded) and PAH (speciated). A summary of the results are shown in Table 4.1 and also contained within Appendix C.

The results of the laboratory chemical screening have identified no elevations in the contaminants tested for within the generic contamination suite for sites with a proposed commercial end use.

Table 4.1 - Summary of the results of generic contamination suite including metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Se, Hg, water soluble boron), TPH (banded) and PAH (speciated).

Determinand	Maximum conc. (mg/kg)	Minimum conc. (mg/kg)	No of samples tested	GACs (mg/kg)	No of samples exceeding GACs
METALS					
Arsenic	70	15	7	640	0
Boron (water soluble)	5.7	3.6	7	240000	0
Cadmium	1.7	0.1	7	190	0
Chromium	41	21	7	8600	0
Copper	2500	86	7	68000	0
Lead	620	76	7	2300	0
Mercury	1.6	0.14	7	1100	0
Nickel	100	40	7	980	0
Selenium	1.2	0.6	7	12000	0
Zinc	2300	99	7	730000	0
PAH COMPOUNDS					
Naphthalene	1.1	<0.1	7	190	0
Acenaphthylene	<0.1	<0.1	7	83000	0

Determinand	Maximum conc. (mg/kg)	Minimum conc. (mg/kg)	No of samples tested	GACs (mg/kg)	No of samples exceeding GACs
Acenaphthene	0.5	<0.1	7	84000	0
Fluorene	1.8	<0.1	7	63000	0
Phenanthrene	11	<0.1	7	22000	0
Anthracene	2.2	<0.1	7	520000	0
Fluoranthene	8.6	<0.1	7	23000	0
Pyrene	7.9	<0.1	7	54000	0
Benzo(a)anthracene	4.1	<0.1	7	170	0
Chrysene	4.6	<0.1	7	350	0
Benzo(b)fluoranthene	3.7	<0.1	7	44	0
Benzo(k)fluoranthene	1.7	<0.1	7	1200	0
Benzo(a)pyrene	4.0	<0.1	7	35	0
Indeno(1,2,3-c,d)pyrene	2.6	<0.1	7	500	0
Dibenzo(a,h)anthracene	1.3	<0.1	7	3.5	0
Benzo(g,h,i)perylene	2.7	<0.1	7	3900	0
TPH COMPOUNDS					
EPH (C10-C12)	33	<10	7	28000	0
EPH (C12-C16)	120	<10	7	37000	0
EPH (C16-C21)	460	18	7	28000	0
EPH (C21-C36)	3400	130	7	28000	0
EPH (C36-C40)	220	17	7	28000	0

Seven representative soil samples were tested in order to determine their pH and soluble sulphate (SO_4) levels. The results are shown in Table 4.2 and also contained within Appendix C.

Table 4.2 pH and SO4 levels

Location	Depth (m)	pH	Sulphate as SO_4 (Total %)	Design SO_4 class	ACEC Class	Description of soil
TP01	0.50	7.8	0.11	DS-1	AC-1	Topsoil
TP02	1.40	7.3	0.29	DS-2	AC-2	Made Ground
TP06	1.00	7.6	0.21	DS-1	AC-1	Made Ground
TP11	0.50	7.6	0.65	DS-2	AC-2	Made Ground
TP14	1.50	7.7	0.21	DS-1	AC-1	Made Ground
TP17	2.00	7.4	0.25	DS-2	AC-2	Made Ground
TP20	3.00	7.3	0.60	DS-2	AC-2	Made Ground

The pH values obtained range from 7.3 to 7.8 in the excavated material. Based on the pH and SO_4 results obtained for the samples of ground, in accordance with BRE Special Digest 1:2005 (3rd Edition), the site can be given a Design Sulphate Class of **DS-2**. Assuming mobile groundwater on site, the Aggressive Chemical Environment for Concrete (ACEC) is **AC-2**; buried concrete should be designed accordingly.

Seven representative samples of the material recovered were screened for the presence of asbestos in order to determine whether any unidentified asbestos was present within the material. The results are shown in Table 4.3.

Table 4-1 Presence of asbestos results. ***NAD*** = No asbestos detected.

Location	Depth (m)	Result	Comment
TP01	0.50	*Chrysotile*	Small bundles of Chrysotile present
TP02	1.40	*NAD*	None
TP06	1.00	*NAD*	None
TP11	0.50	*NAD*	None
TP14	1.50	*NAD*	None
TP17	2.00	*NAD*	None
TP20	3.00	*NAD*	None

4.2 GEOTECHNICAL TESTING

Geotechnical laboratory testing was scheduled by JCC on the soil samples recovered during the fieldwork. The testing was carried out by 'PSL' (Professional Soils Laboratory), Doncaster. This laboratory is UKAS accredited. The results are presented in Appendix D.

Particle size distribution tests were carried out on six samples of natural deposits and one sample of made ground from TP19. The results of the tests on natural samples indicate the presence of sand, gravel and cohesive (CLAY/SILT) deposits with varying volumes of secondary constituents. The made ground result indicated the presence of predominantly sand with varying volumes of gravel, silt and clay.

Five Atterberg Limit Determination tests were carried out on samples of cohesive material to classify the fine grained soils. The results were compared to the Casagrande Chart published in BS5930 and showed the samples to be clay of intermediate to very high plasticity. The Plasticity Indices range from 16 to 48 with moisture contents generally recorded below the corresponding plastic limits. The cohesive material can be assessed as having a low to high shrinkage potential in relation to NHBC Guidance Chapter 4.2.

5 GROUND CONDITIONS

5.1 STRATUM

Made ground was encountered in all exploratory hole locations at depths from 0.30 - >3.30mbgl. The made ground consisted of clay/silt with variable volumes of sand and gravel. In some areas, the made ground graded into a gravel with variable volumes of secondary constituents. Gravel included sandstone, mudstone and brick. Anthropogenic debris was encountered in all exploratory hole locations including plastic fragments, glass bottles, metal wiring, plastic bags, timber and paper.

TP05, 06 and 09 were all terminated within made ground at depths of 1.30m, 1.70m and 1.20mbgl respectively. TP05 and TP06 (to the north of the site area) were terminated due to pit instability within the made ground deposits and due to high inflow of water causing instability to exacerbate. Concrete slabs were encountered within TP09 at 1.70mbgl therefore further excavation was not possible.

Natural deposits were not encountered within TP11, TP19 and TP20 at terminated depths of 3.20m, 3.10m and 3.30m respectively. These trial pits were located on grassed mounds to the north and west of the site area. The composition of the made ground within TP19 was predominantly sand; which differed to the clay/gravel made ground of the remaining site area.

Within TP08, TP10 and WS04, an organic rich clay layer of approx. 0.10m thick was encountered immediately under the made ground and overlying the natural cohesive deposits. This organic rich layer could possibly be the original topsoil in the area but was not encountered within any other exploratory hole location on the site.

Natural cohesive ground of silt/clay was encountered within all locations, with the exception of the exploratory holes outlined above. Natural ground was encountered at deeper depths within TP12, TP14, TP15, TP16, TP17 and TP18 which are located to the east of the site area – suggesting natural ground slopes to the east; opposing current site levels (refer to Appendix B for site cross sections). Natural ground was encountered at 2.10m, 2.40m, 2.00m, 1.90m, 2.90m and 2.30m respectively within these trial pits. Natural ground was encountered within all other exploratory hole locations from 1.10m – 1.70mbgl.

No groundwater was encountered within any of the window sample boreholes whilst drilling. A perched water table was encountered in-between the made ground and the natural cohesive deposits. This is to be expected due to the higher likely permeability of the made ground strata and lower permeability of the underlying natural deposits. The water table level will be established during the groundwater monitoring rounds.

5.2 GAS MONITORING

4 (no.) boreholes were installed with gas monitoring apparatus. Gas monitoring commenced on the 30th August 2017 and will continue over a 1 month period. The full results will be submitted once the monitoring is completed.

5.3 PLANT PHYTOTOXICITY

To assess the potential risks to plants in areas of soft landscaping, the results of the soil screening have also been assessed with respect to plant phytotoxicity. Phytotoxic contaminants include copper nickel and zinc. Table 5.1 summarises the results. There are elevated levels of copper and zinc within the made ground as indicated.

Table 5-1 Assessment of soil screening in respect to plant phytotoxicity.

Determinand	**Soil ph range**	**Max conc. (mg/kg)**	**Min conc. (mg/kg)**	**Assessment value as outlined within BS3882:2007(dependent upon soil ph range) (mg/kg)**		
				ph <6.0	ph 6.0-7.0	ph >7.0
Copper	7.3 – 7.8	**2500**	86	<200	<200	<300
Nickel		100	40	<100	<135	<200
Zinc		**2300**	99	<60	<75	<110

6 MODIFIED CONCEPTUAL SITE MODEL

The preliminary conceptual site model developed from the desk study information has been revised in light of the ground investigation and the chemical analysis results presented above. The revised conceptual model has been developed for the proposed future land use (commercial). This summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors.

In summary, the revised CSM has identified the following potential pollutant linkages which could result in an unacceptable risk to the proposed end-use, denoted as a moderate or higher risk on the CSM:

- Inhalation of Asbestos within one localised area of made ground on site; posing a low/moderate risk to human health
- Dermal contact of anthropogenic debris to site construction workers and site end users, posing a moderate risk to human health

7 DISCUSSION/ RECOMMENDATIONS

7.1 CONTAMINATION ASSESSMENT

The revised conceptual site model confirms pollutant linkages exist for both site construction workers and site end users.

Asbestos presence was confirmed within topsoil type Made Ground in TP01 at 0.50m. Based on data assessment this elevated level is thought to be a data outlier. The results of the laboratory chemical screenings have identified no elevations in any of the metals, PAH's or TPH's tested for in comparison to the 'trigger levels' set for sites for intended commercial end use. However, due to the presence of anthropogenic debris within the made ground across the site, a level of risk for dermal contact during the construction phase has to be adopted.

Contamination may pose a short-term (acute) or long-term (chronic) risk to workers during site construction. The potential risks must be specifically assessed as part of the health and safety evaluation for the works to be performed in accordance with prevailing legislation. Site practices must conform to the specific legislative requirements and follow appropriate guidance (e.g., HSE, 1991; CIRIA, 1996).

A remediation strategy report should be a produced and it is recommended that discussions with the regulatory authorities prior to commencement of remediation are sought.

7.2 GEOTECHNICAL ASSESSMENT

It is understood that the proposed development is to comprise the construction of a clubhouse with associated private sports pitches, soft landscaping and parking areas. In view of the nature of the proposed development, structural loads are expected to be relatively light. If this is not the case, then the following comments may require amendment.

The investigation has identified variable composition made ground across the entire site to depths of between 0.30m and more than 3.30m (though generally was found to be 1.50m thick). The Made Ground is noted to increase in thickness within the eastern part of the site.

The Made Ground stratum is in turn is underlain by predominantly firm to stiff, occasionally very stiff clay of the Pelaw Clay Member across the site.

The Pelaw Clay Member stratum is not present within the grassed mounds on the site to the north (TP11 and TP20) and to the north west of the site (TP19).

Based on the information derived from this ground investigation, the made ground identified on site is considered unsuitable as a bearing stratum using conventional shallow spread foundations due to the potential for excessive total and differential settlements.

It is considered that structural loads could be adequately supported upon traditional shallow spread foundations such as a strip, bearing upon the Pelaw Clay Member which is identified as a firm to very stiff gravelly, sandy clay/silt. The depth to this stratum within the area of the proposed clubhouse is approx. 1.30mbgl (TP01, TP03 and WS03).

7.3 DISPOSAL OF MATERIALS

It is considered that the made ground soils be classified as **non-hazardous** for the purpose of off-site disposal. However, it would be more appropriate to classify the waste materials once they have been generated. In order to provide a preliminary assessment of disposal costs, the results of the WAC testing carried out (Appendix C) should be made available to the waste carriers and receivers.

7.4 SULPHATE ATTACK ON BURIED CONCRETE

The results of the chemical analysis on the made ground indicate a BRE Special Digest 1:2005 Design Sulphate Class DS-2 with an ACEC classification AC-2. Buried concrete should be designed accordingly.

7.5 MINING AND QUARRYING

Based on published geological information and the Coal Authority mining report, it is considered that there is a negligible risk of surface subsidence arising as a result of the collapse of shallow abandoned coal mine workings.

No quarrying/mining activities are known to have taken place on site. However, there have been 9 different mineral extraction sites within 1 km of the site; of which all are ceased. These include collieries, air shafts and unspecified mining features.

7.6 GENERAL COMMENTS

For future site works, adequate lateral trench support will be required for excavations (especially within the unstable made ground strata) in order to prevent trench wall collapse or over excavations, as well as to create a safe working environment below a depth of 1.20m. Additionally, any excavations on this site should remain open for as short a period as possible since some of these materials may be susceptible to deterioration if left open to the natural elements for any significant period of time. Reference to CIRIA 97 'Trenching Practice' would be beneficial to establish a suitable means of support or battering of excavation sides during construction.

8 REFERENCES

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