BLACKPOOL AND THE FYLDE COLLEGE
FIRE TRAINING GROUND
VENTURE ROAD
FLEETWOOD
FY7 8RS

INITIAL SITE INVESTIGATION REVIEW

REVISION S1

Prepared for

BLACKPOOL & THE FYLDE COLLEGE

MAY 2015

PROJECT 6748

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Issue Rev	Details of Revision	Prepared by	Checked by	Date	Position
S1	Draft Report for comment	Lynda Moran		28/5/15	Technician

1.0 THE SITE

The site is located on the Burn Hall Industrial Estate at Venture Road in Fleetwood, Lancashire. The industrial estate is accessed from Fleetwood Road via Venture Road. The nearest post code is FY7 8RS and the NGR co-ordinates for the centre of the site are 333370, 444560. Site area is around 0.68 hectares.

The northern boundary of the site is formed by Venture Road. The precise location of the western boundary is uncertain but crosses land leading to Enterprise Way and is currently marked with temporary fencing. The southern and western boundaries are formed by unnamed access roads on the industrial estate.

2.0 DEVELOPMENT

The existing buildings at the site comprise a modular building in the north west of the site containing offices, changing rooms, showers and ancillary facilities. Also present located in this area of the site are a watertank, LPG tank and compound, pump house, plant room, 2-storey storage container office and workshop block and fire bays.

New structures will include a boat, mock helipad, mock oil rig head and small facility buildings.

3.0 GROUND INVESTIGATION STATUS

Sub Surface Northwest Ltd has undertaken previous intrusive site investigations at the site. This report should therefore be read in conjunction with the following reports which detail the results of the previous site investigations:

- Ground Investigation at Fire Training Ground, Burn Naze Industrial Estate, ref 5606A, dated October 2012 - targeted to the north western section of the site.
- Ground Investigation at Fire Training Ground, Burn Naze Industrial Estate, ref 5606C, dated May 2013 - targeted to the north western section of the site.
- Ground Investigation at Fire Training Ground, Burn Naze Industrial Estate, ref 5712B, dated May 2013 - targeted to the western section of the site.

The recent site investigation focussed on the south east and western sections of the site and included monitoring and sampling from previous boreholes across the site. Sub Surface Northwest Ltd issued their initial interpretative report, ref. 6007, in May 2015.

The interim report records the site works and results of contamination and geotechnical testing and gas and groundwater monitoring from an intrusive investigation that was undertaken in March 2015. The report also includes references to the findings from the earlier site investigations. A final report will be issued on completion of the gas monitoring.

4.0 SITE INVESTIGATION

The purpose of the site investigation was to obtain an indication of ground conditions, to assess the general pattern of strata beneath the site, establish load bearing characteristics and provide guidance on a suitable founding technique for the proposed development. A contamination assessment and gas monitoring were undertaken to assess the need for further sampling and analysis and determine necessary precautions and remedial measures

The works comprised the following:

- 3 no. cable percussive boreholes taken to 15.45m bgl and 1 no. borehole taken to 5.45m bgl.
- 4 no. mini boreholes taken to 4.45m bgl and 1 no. mini borehole to 0.70m bgl.
- Geo-technical laboratory testing
- Chemical contamination testing analysis
- Installation of standpipes followed by groundwater and ground gas monitoring in both new and existing boreholes (readings have been taken from 17 no. boreholes in total, including 9 no. boreholes from previous site investigations and 8 no. boreholes from this site investigation).

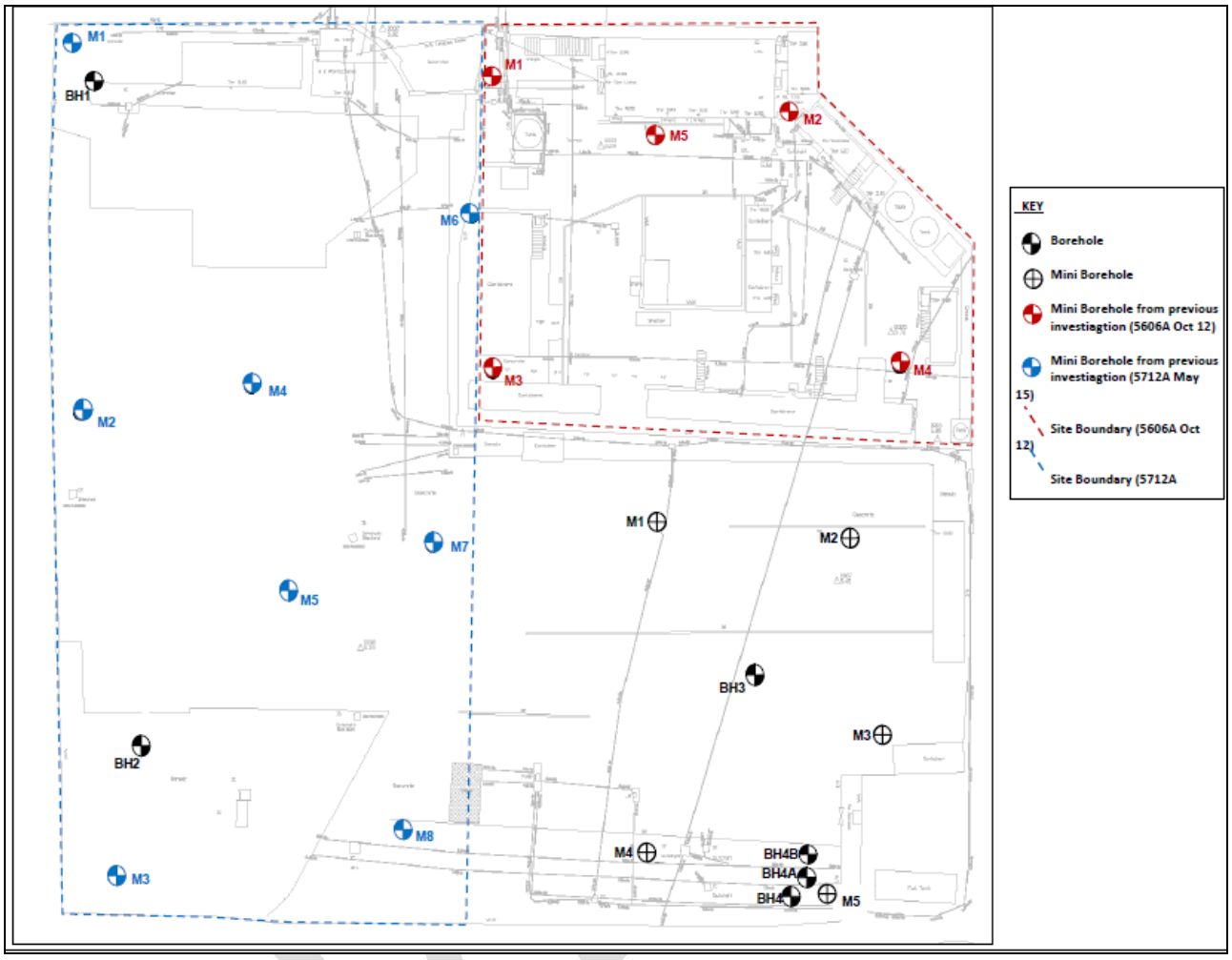

Figure 1: Locations of boreholes

INITIAL FINDINGS

The borehole and trial pit logs indicate the general succession of strata to be Made Ground over cohesive natural drift deposits. Bedrock was not encountered.

In the boreholes, Made Ground was encountered from ground level to depths of between 0.50 -1.80 bgl. This generally comprised brown gravelly sandy clay in BH1, M1 and M2 and slightly clayey sandy gravel BH2, BH3, BH4B, M3 and M4. Ashy material was recorded in BH4B and cobbles of stone, brick and concrete in BH1, BH3, M1, M3 and M5. This included gravel sized fragments of concrete, stone, brick, clinker and burnt shale.

A concrete surface slab was recorded at 0.20m bgl in the south eastern part of the site.

Drift deposits were of very soft to soft very low to low strength cohesive deposits generally comprising grey and brown silty clays and clayey silts. Exceptionally in BH2, the silty clays were underlain at 1.20m by firm grey and orangish brown clay. In BH1, M1, M2 and M4 the soft cohesive strata were underlain by very loose to loose grey very silty fine sands and sandy silts.

Stiff high strength locally medium strength dark brown slighty gravelly slightly sandy silty clays were encountered between 2.60 to 5.50m bgl in all holes except M3 where soft clayey silt was underlain at 2.70m by medium dense brown very silty sand.

BH1 recorded medium dense to dense brown gravelly sand below 9.30m bgl with a layer of stiff dark brown clay between 11.0m to 12.0m.

BH2 recorded medium dense brown very silty sand between 4.60 to 6.80m, overlying firm medium strength becoming stiff high strength locally very high strength dark brown clay with medium dense brown sand at 15.0m.

BH3 recorded dense brown sand interbedded within stiff dark brown clay between 10.10m and 11.30m. Interbedded stiff high strength dark brown clayey silts were identified between 12.00m and 13.50m and below 15m bgl.

5.0 GROUNDWATER

Groundwater entries were noted at 0.80m and 9.50m in BH1, at 5.50m in BH2 and 10.10m in BH3. Monitoring of groundwater in the standpipes recorded groundwater at depths between 0.40-1.50m.

6.0 FOUNDATION SOLUTION

In view of the inherent variability in consistency and compaction of the Made Ground, any shallow foundations should be founded in the underlying natural cohesive or granular strata using reinforced concrete bases/ pads and where appropriate strip footings in localised areas. Safe bearing pressure values of 60kN/m2 for strip footings and 70kN/m2 for pad bases should not be exceeded for the recommended foundation depths of 0.90m below finished ground level in natural cohesive strata or 0.10m below the base of the Made Ground if the natural strata are deeper. The area around BH1 and BH2 is considered unsuitable for shallow foundations due to its low strength.

Vibroflotation techniques are not considered viable for the site but a piled foundation solution is recommended.

A reinforced concrete suspended floor slab with intermediate support is recommended to avoid differential settlement.

Concrete specification should be DS-3 AC-4 in line with British Research Establishment (BRE) recommendations.

7.0 CONTAMINATION

Soils - Sixteen samples of selected soils from the investigation were analysed to confirm the levels of contamination. An Asbestos screen was undertaken.

Levels of contaminants were compared to CLEA Soil Guidance Values (SGVs), LQM and CIEH Suitable for Use Levels (S4ULs), CL:AIRE Generic Assessment Criteria (GACs) and DEFRA Category 4 Screening Levels (C4SLs) guideline values for a standard commercial/ industrial land use.

No elevated levels of contaminants were identified. No Asbestos was identified.

Leachate - Eight samples of Made Ground were tested to assess the leachability of on-site material. Levels were compared to the UK Drinking Water Standards (UK DWS) and EA Environmental Quality Standards (EA EQS). Elevated levels of Lead, aromatic TPH (>C16-C21 and C21-C35) and PAH were identified in material from BH1.

Groundwater – Seventeen samples of groundwater were analysed and levels were compared to the UK Drinking Water Standards (UK DWS) and EA Environmental Quality Standards (EA EQS). Elevated levels of Arsenic, Chromium (total), Selenium, TPH,

Benzene, mp-xylene and o-xylene and Nitrobenzene were detected with the majority of exceedences being located in BH4B and M8 (excepting Selenium). Elevated Chromium levels were identified in M1, M2, M3 and M4 and elevated levels of Selenium were identified in M1 and M2.

Boreholes M1, M2, M3 and M4 were excavated for report ref. 5606A (October 2012).

Borehole M8 was excavated for report 5712A (May 2013).

An earlier site investigation identified free phase petroleum hydrocarbons (TPH bands C10-21) above the water table in M8 which was potentially from a spillage of fuel from a nearby tank but no TPH concentrations were detected in the ground water (report ref. 5712A). However, this investigation has identified high concentrations of TPH dissolved in the groundwater at M8. High levels of TPH (band C10-C12) dissolved in ground water from BH4B appear to emanate from a different source. No TPH contamination was encountered in M4 which indicates that no common plume of contamination was identified emanating from M8 and BH4B.

Sub Surface recommends an extended period of groundwater sampling and analysis is undertaken to assess the extent of the contamination. The installation of additional monitoring wells in adjacent areas would assist in delineating the extent of any free phase product or dissolved phase plumes, particularly in the south and east where no monitoring points are present. Monitoring of Arsenic, Chromium and Copper should be included as elevated levels of these dissolved substances were identified at M8 and elevated levels of dissolved Chromium were recorded at M1, M2, M3 and M4 (these monitoring points were installed as part of a previous investigation - ref 5606A). A detailed quantitative risk assessment will be required to determine the most appropriate remediation measures and targets.

Although no Asbestos was identified in the recent investigation fibres were previously identified in M1 and M3 (ref 5712A).

Remediation measures will be required.

<u>Remediation Measures</u>

The issues of contaminated groundwater and free product should be addressed within a detailed quantitative risk assessment to determine appropriate remediation methods.

Information on contamination should be provided as part of the H&S information to the Contractor. Contact with onsite soils should be minimised. Appropriate PPE and safe working procedures should be used by site operatives, as appropriate.

Earthworks and stockpiled materials should be damped down to prevent the generation of dust in dry weather.

Contaminated materials should be retained onsite when possible. Excess materials should be classified and securely sheeted on lorries before being removed to an appropriate licensed waste facility.

Hardcover over affected areas together with a minimum 450mm blanket of imported clean topsoil placed in soft landscaped areas to protect end users of the development is recommended.

8.0 GROUND GASES

Five of the six gas monitoring visits have been undertaken to date.

Methane levels of 0.0 to 45.2% by volume were recorded.

Carbon dioxide levels of 0.0 to 9.8% by volume were recorded.

Oxygen levels were recorded between 0.3 to 20.4% by volume.

Gas flow rates up to 4.9 l/h were recorded.

It should be noted that elevated levels of carbon dioxide together with depleted levels of oxygen could pose a potential risk of asphyxiation.

The characteristic gas situation was assessed based on the recorded readings to date as CS3: moderate hazard potential. Gas protection measures in line with Table 2 of BS 8485:2007 will need to be incorporated during development. Based on Table 2, the remediation measures will attain a minimum score of 2.

Remediation Measures

Appropriate remediation measures include the following:

- passive sub floor ventilation, which can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc. of good performance (score 1)

AND

- reinforced concrete cast in situ suspended slab with minimal service penetrations and water bars around slab penetrations and at joints (score 1.5)

AND

- proprietary gas resistant membrane to reasonable levels of workmanship in line with current good practice under independent inspection - CQA (score 1)

Vent pipes can be incorporated into the development in road, hardstanding or car park areas to enable ground gases to escape to the atmosphere.

Gases can accumulate in manholes, inspection pits and void spaces beneath the site. These should be checked for air quality prior to entry.

This section of the report will be updated on completion of the gas monitoring