GeoDyne

Geotechnical &
Environmental
Consultants

Surrey Street
Glossop

# Remediation Method Statement (RMS)
# For
# Westleigh Partnerships Ltd

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## Contents



## Appendices



| **Project No: 34169** | | | **Date: 12th May 2015** | |
|---|---|---|---|---|
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# 1.0 INTRODUCTION

## 1.1 Introduction

GeoDyne Ltd has been appointed by the Client, Westleigh Partnerships Ltd, to produce a Remediation Method Statement (RMS) for the former Ferro Alloys site, Surrey Street, Glossop. A site location plan is provided in Appendix I (Figure No. 34169/RMS1).

The RMS has been prepared taking due consideration of the following reports previously prepared by RPS and GeoDyne:-

- RPS *'Ferro Alloys, Surrey Street, Glossop, Phase I Contamination Assessment'*, May 2007, Ref. RCM4721-006 R Final.
- RPS *'Ferro Alloys, Surrey Street, Glossop, Phase II Contamination Assessment'*, October 2007, Ref RCM4721-008 R Final.
- RPS *'Ferro Alloys, Surrey Street, Glossop, Controlled Waters Risk Assessment'*, July 2008, Ref. RCEI5071-001 R Final.
- RPS *'Ferro Alloys, Surrey Street, Glossop, Remediation Options Appraisal'*, November 2008, Ref. RCEI5071-040 R Final.
- RPS '*Ferro Alloys, Surrey Street, Glossop, Human Health Risk Assessment'*, January 2008, Ref. RCM4721-031 R Final.
- GeoDyne '*Former Ferro Alloys Site, Surrey Street, Glossop, Preliminary Contamination Appraisal'*, 6th January 2015, Ref. 34169.
- GeoDyne '*Former Ferro Alloys Site, Surrey Street, Glossop, Supplementary Geo-Environmental Ground Investigation'*, 10th April 2015, Ref. 34169.

This RMS should be read in conjunction with, and does not replace a detailed review of, the foregoing reports.

Since the completion of the above RPS and GeoDyne Preliminary Contamination Appraisal reports the proposed development site has been expanded to cover an additional area to the west of the Ferro Alloys site. The additional area covers the footprint of a depot which is operated on behalf of the Local Authority and was included in our 10th April 2015 reporting. Within this report 'the site' pertains to the combined depot and the former Ferro Alloys site collectively.

## 1.2 Project Understanding

We understand that the site will be redeveloped for a residential end-use including soft landscaped and private garden areas.

The following RMS has been produced based on the foregoing understanding.

## 1.3 Limitations

The conclusions and recommendations made in this report are limited to those that can be made based on the findings of the investigations undertaken at the site. Where comments are made based on information obtained from third parties, GeoDyne Limited assumes that all third party information is true and correct. No independent action has been undertaken to validate the findings of third parties unless specifically stated.

The RMS has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of its issue.

GeoDyne Limited has prepared this report in accordance with our standard Conditions & Limitations provided in Appendix IV. This report may not be used or relied upon by any unauthorised third party without the explicit written agreement of GeoDyne Limited.

### 1.4 Confidentiality

Elements of the risk assessments detailed herein remain the intellectual property and trade secret of GeoDyne Limited. The information contained within this report must not be disclosed or divulged to any commercial Consultant or other third party without the prior written agreement of GeoDyne Limited.

## 2.0 SITE SUMMARY

The following section provides a brief summary of the sites including their history and environmental setting.

### 2.1 Site Description

Ferro Alloys

The former Ferro Alloys buildings have been demolished to ground level with a concrete slab remaining in situ across the majority of the site. The north west of the site was surfaced with overgrowth and the southwest of the site was surfaced with rubble and slag.

Several large stockpiles of demolition rubble (including slag and locally asbestos containing cement) were encountered across the site (predominantly in the north and south of the site). Various other items such as rubber, empty plastic chemical drums, plastic and foam were located across the site. Suspected asbestos containing materials were also observed locally on the surface of the site.

The site was observed to slope gently to the south with the levels locally retained. The land located to the south of the site (a car park adjoining a Wickes) was observed to be approximately 2m lower than the site and marked by a retaining wall. The depot to the west of the site was observed to be approximately 1.5m higher than the Ferro Alloys site. Land to the north of the site was observed to be approximately level with the site. No access was available to view the land to the east of the site, as this generally comprised gardens to residential dwellings.

Suspected Japanese Knotweed was identified at the western boundary of the site in two locations.

Depot

The depot was observed to comprise an open parcel of land situated to the west of the Ferro Alloys site. A driveway, located off Surrey Street, extended south into the site to open area which was operated by a contractor, on behalf of the Local Authority, as a depot which stored and distributed new 'wheelie bins' and recycling bins. The site was predominantly surfaced with macadam and locally gravel hardcore. The site was generally level. A 1.0m to 1.5m retaining wall was present between the Depot and the Ferro Alloys site (lower on the Ferro Alloys side).

### 2.2 Site History

Ferro Alloys Site

The RPS Desk Study confirmed the Ferro Alloys site is indicated to have been occupied by a metal smelting works for the past approximate 140 years. *'Initially the site operated as an iron foundary (from 1860 onwards) and from 1934 as a manufacturer of a range of ferroalloys including ferro-molebdenum, ferro-vanadium, ferro-chrome and ferro-tungsten'*.

It is understood from an internet search (ref. www.geograph.org.uk/photo/1125754) that *'a new molybdenum furnace was installed in the 1970s to convert Molybdenum Concentrates (molybdenum in its naturally occurring form of $MoS^2$) to the oxide (primarily the trioxide) form…The new roaster was capable of processing much more molybdenum than the previous plant and as a result produce much more sulphur dioxide than the small (approx 120 ft) brick chimney which serviced it could possibly disperse and…in 1977 the company was allowed to erect a 300 ft chimney (Glossop Chimney)'*.

The RPS Phase I Desk Study indicates *'Historical maps suggest that the area of land to the west of the site currently occupied by the football pitch has been used for the deposit of materials, possibly ash and slag from the adjacent iron works'*.

Depot

The available information indicates that the depot was open ground until a refuse heap, likely to pertain to waste materials from the adjacent Iron Foundry (later to become the Ferro Alloys site), encroached onto the northern area of the site (the evidence for which is supported by the GeoDyne ground investigation findings). By the 1960s / 1970s the historical mapping indicates that the site had been developed as a Corporation Depot. During the site walkover the supervisor for the depot indicated that he was not aware of any underground or above ground fuel storage tanks on the depot site.

## 2.3 Environmental Setting

A full description of the sites environmental setting has been provided in the previous reports although the salient issues are summarised in Table 1 below.

| TABLE 1 – SUMMARY OF GEO-ENVIRONMENTAL SETTING | |
|---|---|
| Geology | The site is indicated to be underlain by Made Ground to depths ranging between 0.25m and 5.40m begl.<br><br>The Made Ground is indicated to be underlain by Glacial Till which comprised grey brown soft, soft to firm or firm variably silty / sandy / gravelly CLAY with significant horizons / bands (up to 3.00m thickness) of sandy SILT / silty gravelly SAND. The Glacial Till was encountered up to a maximum depth of 20.00m begl (full depth unproven).<br><br>The site and the surrounding area are indicated on the geological mapping to be underlain by the Marsden Formation of Marsdenian age (part of the Millstone Grit Group). This strata was not encountered during the site works. |
| Hydrogeology | The site is not indicated to be located within a Source Protection Zone (SPZ). The Marsden Formation was indicated to be designated as a 'Minor Aquifer' (subsequently reclassified by the Environment Agency as a Secondary A Aquifer).<br><br>No water abstractions are indicated within a 500m radius of the boundary of the site (up hydraulic gradient).<br><br>The groundwater flow direction is anticipated to be in a general southerly direction.<br><br>Water was frequently encountering in the Made Ground during the advancement of a number of the exploratory holes as a slight seepage at variable depths. However, a moderate ingress of water was encountered within three exploratory holes advanced in the southeast corner of the site. These exploratory holes were advanced in or adjacent to a shallow (<1.50m begl) infilled basement type structure. Perched water in the shallow window sample boreholes installations ranged between 0.41m begl and dry (no water encountered).<br><br>Water, anticipated to be representative of the deeper water unit in the Glacial Till, was encountered at depths ranging between 2.29m (CP4) and 7.36m (CP9) during the monitoring visits undertaken. However, typically the water depths varied between approximately 3.50m and 5.50m begl.<br><br>During the groundwater sampling visit no water was purged from the shallow boreholes due to the absence of significant water recharge. Furthermore, it was only generally possible to purge two well volumes (as opposed to the industry standard three) from the deeper boreholes due to the slow water recharge. |
| Hydrology | The Wren Nest Mill Race is indicated to be present 70m south of the site. |

## 2.4 Contamination Summary

Human Health

The following is reproduced from the GeoDyne Ltd Supplementary Geo-Environmental Report:

*'Metals and locally TPH and PAHs have been encountered in the shallow Made Ground (predominantly) and locally the Natural Strata at the site in concentrations in excess of their respective Tier 1 SACs for human health (residential end use). Elevated concentrations of metals have also been detected locally in the shallow perched water present within the Made Ground.*

*Asbestos fibres were detected in samples of the granular matrix of the stockpiles analysed (maximum 0.028%) and pieces of asbestos cement were proven to be present within the stockpiles. Further suspected asbestos containing materials (ACMs) were also noted locally on the surface of the site during our walkover.*

*Consequently, both the Made Ground and locally the Natural Strata may represent a potential risk to human health with regard to the redevelopment of the site for a residential end use'.*

Controlled Waters

The following is reproduced from the GeoDyne Ltd Supplementary Geo-Environmental Report:

*'Elevated concentrations of a number of metals have been detected in soils (including stockpiled material) and groundwater at the site. The most notably elevated concentrations in soil and groundwater were associated with Molybdenum. Molybdenum was also noted to be significantly elevated in soil leachate predominantly in the south of the site. The elevated concentrations of Molybdenum are likely to be associated with the ash, clinker, slag and foundry sand component of the Made Ground which are widespread across the site. Elevated concentrations of Molybdenum have also been detected in the Nest Mill Race Downstream of the site. There is also evidence to suggest that the high levels of Molybdenum in the southeast of the site in the soil, soil leachate and water may be associated with improper disposal of liquid waste generated during the operation of the Ferro Alloys site (high concentrations of Molybdenum were detected in the significant volumes of shallow perched water in the Made Ground in / within the vicinity of a shallow infilled basement type structure in the southeast of the site).*

*The exceedances of Molybdenum may represent a potential contaminant risk to the Wren Nest Mill Race (i.e. Controlled Waters). The remaining determinands are considered unlikely to represent a significant risk to the Nest Mill Race and are therefore not deemed to be Contaminants of Concern (CoCs) in order to simplify the objectives of the remediation. The information available indicates that it is possible that the Molybdenum contamination detected on the Ferro Alloys site is contributing the net loading of Molybdenum detected in samples collected from the Wren Nest Mill Race. The depot in the west of the site does not appear to be significantly impacted in the soil or groundwater (a relatively slight Molybdenum groundwater exceedance was detected in CP107 only).*

*Possible mechanisms for contaminant migration to the Nest Mill Race could include either a preferential pathway from a former drain / pipe extending from the south of the site (possible outfalls were noted on the bank of the Nest Mill Race during the site visit) or alternatively through permeable lenses / horizons in the Glacial Till. In addition, it is probable that the waste products (i.e. ash, slag and clinker) from the former metal works, which are likely to have been historically deposited on the land to the west of the site, are also contributing to the metal loading of the Wren Nest Mill Race'.*

## 2.5 Regulatory Consultation

The Environment Agency has recently reviewed the previous GeoDyne Supplementary Geo-Environmental Ground Investigation dated 10th April 2015. Their response is detailed in their letter dated 20th April 2015 provided in Appendix III.

## 3.0 REMEDIATION STRATEGY – PROTECTION OF HUMAN HEALTH

### 3.1 Human Health

Due to the potential risk to human health represented by elevated concentrations of contamination, remediation works will be necessary at the site to mitigate the potential risk to the health of future end users of the site.

### 3.2 Depth of Capping Required

In order to provide a break layer between the contaminated soils and future end users of the site a 1.0m remedial capping layer should be placed within proposed private garden areas, reducing to 0.50m within any proposed Public Open Space (POS) areas (inclusive of a minimum 0.15m hard to dig / capillary break layer in both scenarios). However, after the successful completion of the remediation works it may be possible to reduce the capping layer where the contamination scenario encountered is not considered sufficient to warrant a 1.0m thickness of capping. The depth of the capping required is subject to approval from the Local Authority.

The remedial capping thicknesses considered appropriate are detailed below in Table 2.

TABLE 2 – REMEDIAL CAPPING THICKNESS

| End Use | Capillary Break / Hard Dig Layer | Subsoil (m) | Topsoil (m) | Total (m) |
|---|---|---|---|---|
| Gardens | 0.15 | 0.70 | 0.15 | 1.00 |
| Soft Landscaped Area | 0.15 | 0.20 | 0.15 | 0.50 |

Note – From a contamination perspective subsoil may be replaced with topsoil or a capillary break / hard to dig layer, such that a robust capping is provided. However, a landscape architect should be consulted to ensure that the capping materials placed will provide a suitable growing medium for the proposed planting regime. The design of a suitable depth of growing medium is the responsibility of the landscape architect/Westleigh Partnerships.

The thickness of the topsoil/growing medium may require increasing from the above minimum levels in order to provide a suitable growing medium for the proposed planting regime.

We would additionally note that care should be taken with respect to the provision of the remedial capping in consideration of adjacent ground levels. It may be necessary to locally reduce existing levels in order to incorporate the remedial capping. The (off site) removal of soils can be expensive, is not typically environmentally sustainable, and should be minimised wherever possible.

### 3.3 Chemical Testing & Suitability of Remedial Capping Materials

<u>Imported Topsoil and Subsoil</u>

No topsoil is present at the site. Consequently, it will be necessary to import topsoil for use in garden and soft landscaped areas.

All topsoil imported to site should be tested at source for the determinands listed below (as a minimum) and any other determinands, as appropriate for the source site, to ensure that it is suitably clean (prior to importation) in accordance with CLEA/generic guidance.

We would initially propose to obtain 3No. samples per source site / stockpile or one sample per 250m$^3$ (whichever is the greater) and calculate the 95$^{th}$ %ile Upper Confidence Level (UCL) Mean Value of the Topsoil samples, which would then be compared to the appropriate SAC to determine whether the soil is 'clean' and suitable for use at the site.

Should the UCL Mean Value of the Topsoil samples be in excess of the SAC, further samples may be obtained to enlarge the dataset prior to reassessment and a final decision being reached. Alternatively, the Client may elect to reject the donor site as appropriate and select an alternative donor site.

Imported topsoil should ideally conform to BS3882: 2015 *'Specification for topsoil and requirements for use',* with respect to the presence of foreign objects and ideally nutrient levels etc. The results of the chemical analysis on the soils proposed for importation should be forwarded by the Consultant to the Local Authority for approval (prior to importation).

Materials imported to site should be screened against the Human Health SAC's detailed in Table 3 below.

| TABLE 3 – SITE ACCEPTANCE CRITERIA (RESIDENTIAL END USE) | |
|---|---|
| Determinand | Human Health SAC (mg/kg) |
| *Metals* | |
| Arsenic | 37 S4UL |
| Cadmium | 11 S4UL |
| Chromium | 910 S4UL |
| Copper | 2400 S4UL |
| Lead | 200 C4SL |
| Mercury | 40 CLEA SGV |
| Nickel | 180 S4UL |
| Selenium | 250 S4UL |
| Zinc | 3700 S4UL |
| *PAH's* | 1% SOM |
| Naphthalene | 2.3 S4UL |
| Acenaphthylene | 170 S4UL |
| Acenaphthene | 210 S4UL |
| Fluorene | 170 S4UL |
| Phenanthrene | 95 S4UL |
| Anthracene | 2400 S4UL |
| Fluoranthene | 280 S4UL |
| Pyrene | 620 S4UL |
| Benzo(a)anthracene | 7.2 S4UL |
| Chrysene | 15 S4UL |
| Benzo(b)fluoranthene | 2.6 S4UL |
| Benzo(k)fluoranthene | 77 S4UL |
| Benzo(a)pyrene | 2.2 S4UL |
| Indeno(123-cd)pyrene | 27 S4UL |
| Dibenzo(ah)anthracene | 0.24 S4UL |
| Benzo(ghi)perylene | 320 S4UL |
| KEY<br>S4UL - Generic Screening Value after CIEH/LQM 2015 | |

## 3.4 Validation of Capping Thickness

An Engineer from GeoDyne Ltd will attend site to provide / undertake the following:

- Hand auger / or hand excavate in finished rear private / communal gardens & soft landscaped areas to check that an appropriate capping thickness has been placed.
- One hand auger / hand excavated hole will be advanced in the approximate centre of each rear garden of the residential properties to validate the thickness of the capping for the plot. Holes will be terminated on the top of the hard to dig layer.
- Communal gardens / soft landscaped areas will be validated at the discretion of the Geo-Environmental Engineer.

The front gardens of the proposed residential properties are relatively small in size. Paving slabs and the presence of domestic utilities further reduce the area where a full depth of capping can be proven. Consequently, it is considered unnecessary to validate front gardens in this instance.

### 3.5 Asbestos Containing Materials

Asbestos fibres were detected in a number of samples of the granular matrix of the stockpiles analysed (maximum 0.028%). Any Asbestos Containing Material (ACM) encountered during development works may require disposal off-site to a suitably licensed disposal facility, and should be undertaken by suitably qualified Contractors. Alternatively, soils containing asbestos fibres may remain in-situ beneath a suitable remedial cap, placed in accordance with a suitable site specific risk assessment and a Materials Management Plan (MMP).

The CIRIA C733 document *'Asbestos in soil and made ground: a guide to understanding and managing risks'* (2014) recommends that remediation measures undertaken in sites affected by asbestos should be undertaken to a CAR (Control of Asbestos Regulations 2012) compliant risk assessment in order to protect site staff and members of the public.

The remediation of sites affected by Asbestos may involve licensable work, notified non-licensable work or simply non-licensable work. The CAR risk assessment for the site should be site specific and must cover all aspects of remediation involving ACMs.

The main risk associated with ACMs is the release of airborne fibres resulting from excavation, earth movements and primarily vehicle movements around the site (particularly during dry weather), the severity of which will depend upon the amounts and types of Asbestos present (Chrysotile and Amosite have been identified at relatively low concentrations). Good site awareness, site management, Asbestos-specific mitigation measures and training will reduce worker exposure to airborne dust and fibres. In order to avoid subsequent civil liabilities, mitigation measures need to prevent exposure of neighbouring residents and public to levels, which may be deemed significant in the future.

The CAR risk assessment in conjunction with the Client Health and Safety procedures will define the mitigation measures required at the site. Mitigation measures to avoid the spread of Asbestos fibres may include some or all of the following:

- Damping down of surfaces and stockpiles of demolition/crushed materials.
- Management of stockpiles and soil movements.
- Hand picking of visible ACM materials from the site surface and stockpiles.
- Segregated areas
- Potentially wheel washes, road wetting and road cleaning (as appropriate).

Monitoring around the sites perimeter for airborne Asbestos dust particles would ensure and confirm good site management of the Asbestos risk and further protect site workers and members of the public.

### 3.6 Gas Protection Measures

In accordance with Table 14.1 of NHBC Guidance the site was classified as '*Red*' by virtue of the maximum methane concentration of 41%v/v and the GSV of 2.09l/h for methane by RPS in their previous Phase II Report. The NHBC indicates for a Red categorised site that *'standard residential housing is not normally acceptable without further Ground Gas Risk Assessment and/or possible remedial mitigation measures to reduce/remove the source of the ground gases'*. However, the elevated concentrations of methane were only detected in a single borehole (WS04) during the six monitoring visits undertaken.

GeoDyne recommended that a further programme of ground gas monitoring was undertaken across the site and surrounding WS04 to confirm that the elevated concentrations of methane were a 'hot-spot' and not present pervasively across the wider site area. The further programme of ground gas monitoring undertaken by GeoDyne (6No. visits) indicates that carbon dioxide was present up to 9.0%v/v and methane was present up to 1.5%v/v with no recordable levels of gas flow within the 10No. ground gas monitoring boreholes. This ground gas regime is significantly less than that identified by RPS and is consistent with an Amber I categorisation.

Notwithstanding the above, in accordance with the CIRIA NHBC Red classification, '…*remedial mitigation measures to reduce/remove the source of the ground gases'* should be implemented to mitigate the production of methane in the area of WS04 (as detected by RPS). It is likely that the source of the methane detected at WS04 is the *'frequent wood and leaves'* recorded in the vicinity of this location (including WS102 and WS104) between 2.00m and 3.20m begl. **The remedial measures should comprise the verified removal of the extent of the vegetative matter in this area (WS04, WS102 and WS104). NHBC Amber II gas protection measures should subsequently be installed in all residential dwellings to mitigate the residual risk of ground gas.**

The following gas precautions should be adopted for the proposed development assuming that residential properties will have a suspended floor slab (e.g. beam and block):

- Provision of a gas resistant membrane with all joints and penetrations heat sealed, and extended across the cavity. A suitable, certificated, ground gas resistant membrane from a suitable manufacturer/supplier should be adopted at the site. The membrane should have suitable tensile strength and puncture resistance, may include an aluminium core (as appropriate) and be of a sufficient thickness to allow any welding to take place without damaging the membrane.
- Ventilated sub-floor void (minimum one complete volume change per 24 hours). Ventilated sub-floor void designed to provide a minimum of one complete volume change per 24 hours. This is typically achieved by the provision of periscopic air-brick ventilation on two sides of each dwelling. The recommended minimum area of ventilation for a sub-floor void is 1500mm$^2$ per metre run of wall or 500mm$^2$ per square metre of floor area, whichever gives the greater area of opening.
- Gas protection measures should be installed as prescribed in BRE Report 414.
- Membranes should be fitted by a specialist contractor and should be fully certified in accordance with Appendix E of NHBC *'Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present*'.
- Services should be designed such that they enter the building above the membrane. However, where services are required to penetrate the membrane they should be suitably sealed to the membrane, for example with a propriety 'top hat and collar' type assembly.
- **Third party inspection and certification of the membranes will be required (see below).**

Validation Protocol - Gas Membrane

The validation protocol applicable to the gas membrane to be undertaken by GeoDyne Limited may be summarised as follows:-

- Review/assessment of manufacturers technical specification for the proposed membrane to establish if membrane is suitable for the site and forward to the Local Authority for approval.
- After completion of the installation process undertake a visual assessment of the 'as-built' arrangement to assess the following.

    1. Continuity of the installed gas barrier around service penetrations and corner details.
    2. Assess if membrane has been suitably sealed (i.e. corner details and service penetrations and where extended across cavity walls) for example the presence of adhered cross-link butyl gas tape or extrusion welding.
    3. Detailed inspection/visual assessment of sealing arrangement beneath lapped areas (presence of adhered cross-link butyl gas tape/extrusion welding).
- A photographic record of selected representative details will be taken for inclusion within the validation report(s).

Validation report(s) relating to the membrane installation may be undertaken on a rolling basis (i.e. as each Block/series of plots is completed).

### 3.7 Japanese Knotweed

Suspected Japanese Knotweed has been observed in several locations at the Ferro Alloys western boundary. The presence of Japanese Knotweed should be confirmed by a specialist and a Knotweed Management Plan (KMP) for its eradication should be implemented.

## 4.0 REMEDIATION STRATEGY - PROTECTION OF CONTROLLED WATERS

### 4.1 Introduction

Remediation works are required at the site to mitigate the risk represented to the Wren Nest Mill Race (i.e. Controlled Waters) from the concentrations of Molybdenum in both the soils and the water (perched in the Made Ground and Glacial Till).

The remediation necessary comprises a combination of the following:

#### 4.1.1 Molybdenum in Soil

A reduction in the potential for Molybdenum to leach from the soils in the Made Ground (e.g. soil stabilisation) predominantly in the southern and southeastern area of the site is required (see attached Figure 34169/RMS2 in Appendix II). The area identified as requiring remediation is based on the most notable exceedances of Molybdenum soil leachate and incorporates the southeastern section of the site where shallow water in the Made Ground containing high concentrations of Molybdenum was detected in the vicinity of an infilled basement type structure (anecdotally indicated to have been subject to tipping of dissolved Molybdenum wastes).

The soil remediation works could be undertaken concurrently with the removal of sub-structures (relic foundations, bases, pits etc. where encountered) associated with the former metal works.

The targets for the remediation should comprise the Tier 3 Porewater (leachate) targets derived by RPS in their Controlled Waters DQRA (see Section 4.1.7 below).

The Environment Agency has confirmed that their preferred approach is for laboratory tests or field trials to prove the viability of a remediation contractors chosen methodology prior to the commencement of works on site (where appropriate).

The stockpiles of granular material (including the demolition type materials located in the northeastern corner of the site) may require removal to a licensed waste management facility or treatment (as appropriate with due consideration to the potential presence of asbestos containing materials). However, further testing and assessment will be undertaken on these materials to confirm their contamination status prior to commissioning remedial works.

Consideration should be given to the possibility that treatment of the soil may effect a geochemical change which could liberate other heavy metals which are currently immobile.

#### 4.1.2 Molybdenum in Perched Water in the Made Ground

Remediation of Molybdenum present in the perched water in the Made Ground (where present) should be undertaken to mitigate the risk to Controlled Waters. The perched water in the Made Ground was generally only encountered as a slight seepage or was absent from exploratory holes. However, a significantly higher influx of water was noted in several locations in the southeast corner of the site (within / in the vicinity of a shallow (<1.50m begl) infilled basement. Perched water in the Made Ground was not encountered in the depot located in the west of the site.

The remediation of the groundwater may include either its removal from site to a licensed waste disposal facility or treatment to reduce levels to the Tier 3 Groundwater targets derived by RPS in their Controlled Waters DQRA.

The perched groundwater in the Made Ground should be treated where it is encountered across the site. However, it is anticipated that the area requiring the most significant treatment will be located in the southeast of the site where moderate influx's of water and wet Made Ground were encountered.

A trench should be excavated along the length of the southern boundary of the site to verify the absence / remove any drain / culverts / pipework (with appropriate permissions) which could be acting as a preferential pathway for contaminant migration to the Wren Nest Mill Race.

### 4.1.3 Molybdenum in the Perched Water in the Natural Strata (Glacial Till)

Remediation of Molybdenum present in the perched water in the more permeable lenses / horizons of the shallow (<4.00m begl) Natural Strata (Glacial Till) should be undertaken to mitigate the risk to Controlled Waters. The remediation of the water may include either its removal from site to a licensed waste disposal facility or treatment to the levels specified in the Tier 3 Groundwater targets derived by RPS in their Controlled Waters Detailed Quantitative Risk Assessment (DQRA) (see Section 4.1.7 below). Other technologies may also be employed where appropriate. These technologies may vary the area requiring treatment (as necessary).

The groundwater in the depot and the adjoining area in vicinity of CP102 appeared to be generally uncontaminated (a relatively slight Molybdenum groundwater exceedance was detected in CP107 only). Therefore, groundwater remediation is considered unnecessary in this area. Furthermore, remedial action is also not considered necessary in the northeastern area of the site in the vicinity of CP110 due to the general absence of water bearing strata (no water strikes were recorded during the advancement of the borehole in this area) in the Glacial Till. The groundwater in the Glacial Till in the remaining area of the site (i.e. the sites southern and southeastern area) will require remedial action (see attached Figure 34169/RMS3 in Appendix II providing the approximate extent of the area requiring remediation).

The groundwater strikes in the Glacial Till were noted to be generally relatively shallow (approximately 2.8m to 3.7m begl). A deeper strike was encountered in CP109 although it is considered likely that the water in this permeable lense is not in continuity with the Wren Nest Mill Race as it was noted to be confined (a 6.20m head rise was observed over 20 minutes after a water strike at 16.60m begl during the advancement of the borehole). Therefore, the treatment of the water in the Glacial Till will be undertaken to a maximum depth of 4.00m begl where required. However, it may be necessary for some treatments to locally extend to depths greater than 4.00m begl to ensure sufficient depth of water is treated. In areas where water is not encountered in the upper 4.00m begl, remediation works will not be required for water in the Glacial Till.

It was only generally possible to purge two well volumes (as opposed to the industry standard three) due to the insufficient water recharge in the monitoring wells during the groundwater sampling visit. Consequently, the volume of water in the more permeable lenses in the Glacial Till (generally Silt / Sand) and their hydraulic connectivity may be limited. Therefore, the success of undertaking remediation of the groundwater in the presumed generally non-continuous perched lenses in the Glacial Till may be limited by its technical feasibility.

### 4.1.4 General

Historical deposition of waste materials (e.g. ash, clinker, slag and foundry sand) from the metal works is likely to have occurred on the land to the west of the site (as evidenced by the 1:10,000 geological mapping and the ground conditions in the depot). These materials may contain elevated concentrations of metals which could be contributing to the metal loading in the Wren Nest Mill Race. Consequently, the timeframes for improvement to be realised and the likely total reduction in Molybdenum concentrations observed in the stream after the completion of remediation works at the site are unknown. Notwithstanding the above, the levels or metals in the soil and groundwater on the site are considered a significant risk to Controlled Waters and a programme of remediation works is required to provide environmental betterment (where possible) as part of the redevelopment of the site.

Consideration should be given to the phasing of remediation works to ensure that remediated soil / water (whether vertically or laterally) is not cross contaminated by untreated soils / water.

### 4.1.5 Surface Water Monitoring in the Wren Nest Mill Race

The Environment Agency has requested that monitoring is undertaken on the Wren Nest Mill Race during remediation works to establish if a decrease in the levels of pollution are realised. The monitoring should be undertaken at approximate monthly intervals commencing prior to the start of the remediation works. In practice this may mean sampling before, during and after the works have been completed (i.e. 3No. visits testing for both Cadmium and Molybdenum). However, given the uncertainty with a potential migration pathway from the site towards the Mill Race, the concentrations of contaminants in the Mill Race shall not be considered as a validation criteria verifying of the success of the remediation work undertaken at the site (i.e. dependent on the active pathway it may be a number of years before any betterment is realised in the watercourse).

Furthermore, it may be difficult to accurately quantify the levels of Cadmium in the Mill Race due to interference with the laboratory analysis between metals where elevated concentrations of Molybdenum are present. Notwithstanding the above, monitoring of the watercourse may yield some confirmation that the remediation works undertaken have provided betterment with regard to the risk to Controlled Waters.

### 4.1.6 Cadmium

Concentrations of Cadmium in water (present within both the Made Ground and Glacial Till respectively) were detected in excess of the Level 3 Groundwater Remedial Target values at locations in the south and east of the site during the RPS investigation works. However, during the GeoDyne works, Cadmium was not detected in elevated concentrations in the soil, leachate or groundwater in the Made Ground or deeper Glacial Till (albeit locally with a raised limit of detection (<0.08 to <1.5µg/l) due to a residual interference between Cadmium and Molybdenum). Consequently, due to the recent absence of significant concentrations of Cadmium in soils, leachate and groundwater during the GeoDyne phase of investigation works (where interference with Molybdenum was mitigated) and difficulties with analysing Cadmium to the Porewater / Groundwater Remedial Target levels identified in the RPS DQRA, Cadmium is not considered a significant contaminant of concern with regard to Controlled Waters. However, it is anticipated that remedial works which mitigate the Molybdenum risk to Controlled waters will also provide betterment with regard to concentrations / mobility of Cadmium at the site. Therefore, the concentrations of Cadmium in the Wren Nest Mill Race will also be monitored during the remediation works to asses if betterment has occurred (see above).

### 4.1.7 Remedial Targets for Controlled Waters (Remediation Clean Up Criteria)

RPS undertook the production of a Controlled Waters Detailed Quantitative Risk Assessment (DQRA) for the site. The report derived targets for the protection of the Wren Nest Mill Race for Molybdenum for pore water (leachate) and groundwater. It is recommended that the targets summarised in Table are adopted as clean up criteria for the Molybdenum remediation.

TABLE 4 RPS REMEDIAL TARGETS FOR WREN NEST MILL RACE (POC 70m)

| Determinand | RPS Water Quality Standard at POC (mg/l) | Porewater Remedial Target (mg/l) | Groundwater Remedial Target (mg/l) |
|---|---|---|---|
| Molybdenum | 0.07 | 3.44 | 0.213 |

### 4.1.8 Regulatory Approval

It will be the responsibility of the successful preferred contractor to secure regulatory approval of their proposed Controlled Waters remediation strategy for the site (provided that it is consistent with the requirements and aspirations of the overarching RMS).

## 5.0 GENERAL REMEDIATION ISSUES

### 5.1 Off Site Disposal

Waste Acceptance Criteria (WAC) tests have been undertaken at the site to provide information for waste classification purposes should it be necessary to dispose of soil material to landfill. The results of the WAC tests together with the associated logs, plans and other chemical testing results should be provided to receiving landfill operator for assessment as required.

### 5.2 Unforeseen Circumstances

Due to the historical legacy of the site there is the potential for further areas of contaminated soils to be present that have not been identified during the site investigation works (e.g. underground storage tanks or where leakage / spillage or waste disposal has taken place).

Should any areas of potentially contaminated soil be encountered during site construction works we would recommend consultation with GeoDyne Ltd to ensure that our recommendations continue to apply. To mitigate against this risk, we anticipate that full time consultant observation of remediation works will be required.

Any potentially contaminated soils should be left in-situ and subjected to further assessment, to potentially include further chemical testing and risk assessment.

The following procedure should be adhered to if any areas of previously unidentified suspected contamination are encountered during the development of the site:

i. Suspected contaminated material will remain in-situ.
ii. GeoDyne Ltd to be notified, and will inform the Environmental Health Officer (EHO) at the Local Planning Authority and the Environment Agency Officer.
iii. GeoDyne Ltd will undertake a visual assessment of the possible contamination, followed by appropriate sampling/testing.
iv. If necessary, contamination will then be treated or removed from site and the EHO / Environment Agency informed accordingly. All necessary remediation works should be validated by testing in accordance with an approved strategy.

### 5.3 Pre-Start Meeting

Prior to commencement of remediation works a pre-start meeting should be held for the site. The aim of the meeting is to ensure that works commence in an appropriate manner and all parties understand their roles and responsibilities. The pre-start meeting should be attended by the following parties:

- GeoDyne Ltd.
- Representative of Westleigh Partnerships Limited.
- Representative of remediation contractor.
- Representative of the Local Authority (optional).
- Representative of the Environment Agency (optional).

### 5.4 Construction Workers

It is recommended that construction personnel involved with direct contact with the soils at the site use appropriate PPE / RPE equipment (i.e. boots, gloves and overalls) together with hygiene facilities in accordance with general health and safety guidelines.

**Appropriate consideration (by a suitably qualified professional) should be given to health and safety procedures for personnel working in asbestos contaminated soils.**

A copy of this report should be included in the site health and safety file, and site workers should be made fully aware of the sites setting.

### 5.5 Utilities

Prior to redevelopment of the site, we would recommend that a copy of this report is supplied to utility companies, and that their recommendations relating to appropriate supply pipes are adhered to. Barrier water supply pipes in double width clean service trenches are likely to be required across a significant proportion of the site, subject to the completion of an appropriate assessment (i.e. WRAS).

### 5.6 Statutory Consultation

**Written approval of this document should be obtained prior to commencement of development to avoid subsequent abortive works.**

### 5.7 Licences, Registrations, Permits, Exemptions

The Contractor/Developer is responsible for, and must ensure that, all necessary licenses, permits, registrations and approvals are in place prior to commencing with the earthworks at the site. These will include any Mobile Treatment Licenses (MTLs), Site Waste Management Plans (SWMPs), Materials Management Plans (MMPs) and/or Waste Management Licenses/Exemptions as necessary to enable the completion of the proposed works.

An MMP is likely to be required to facilitate the reuse of the stockpiles of granular material (where environmentally and geotechnical permissible), to enable remediation and movement / replacement of materials on site.

### 5.8 Site Managers Diary

It will be the responsibility of the Site Manager to keep a site diary to record the progress of the remediation works. This should include, but not be limited to:

- Photographic and written records of remediation works, with specific attention paid to unforeseen circumstances.
- Records of any remedial measures that cannot be dug up/sampled and validated at a later date.
- Records of all movements of waste materials.

### 5.9 Validation Reporting

Following completion of remediation works, it will be necessary to produce a completion report(s) (i.e. remediation validation report(s) for each respective phase of remediation), to

demonstrate compliance with this RMS. Remediation reports may be produced on a rolling basis to enable validation of plots or blocks of plots as appropriate.

It is likely that a series of reports will be required. These will be necessary to validate the contamination removal works, validate installed membranes and validate remedial capping in gardens. In summary therefore the following stages of reporting are required:

- Validation reporting related to soil and groundwater remediation.
- Validation reporting related to membrane inspection.
- Validation reporting related to selection of appropriate topsoil / subsoil and inspection of remedial capping.

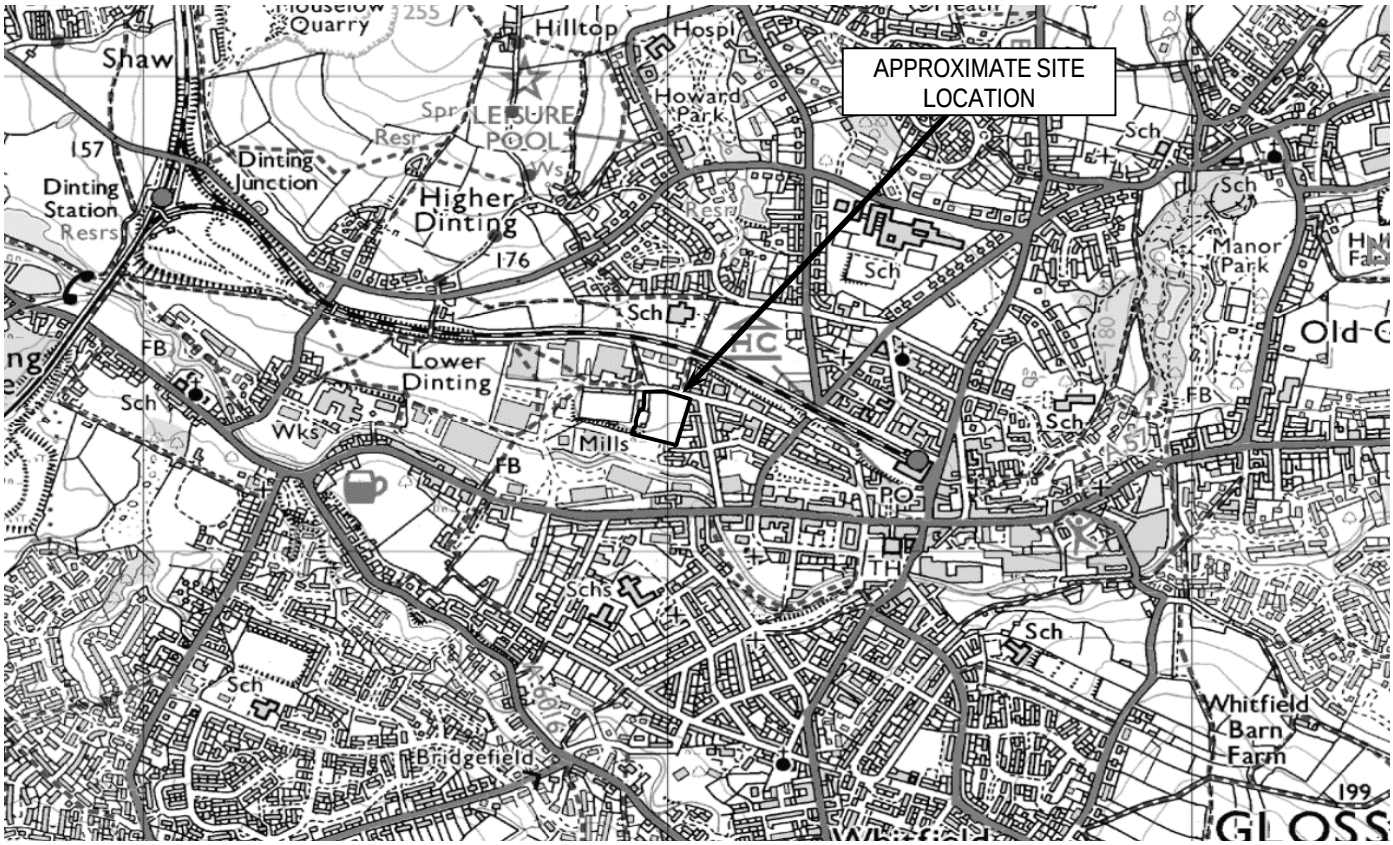
## 6.0 CONCLUSION

This report has been prepared to address the requirements of the key regulatory stakeholders.

The RMS may require slight amendment following selection of the preferred remediation contractor (to incorporate their experience of similar sites and proprietary techniques).

**APPENDIX I**

**Site Location Plan**






| | | | |
|---|---|---|---|
| Project No. | 34169 | Drawn | GJS |
| Client | Westleigh Partnerships Ltd | Checked | *JPH* |
| Project | Surrey Street<br>Glossop | Approved | *JPH* |
| | | Scale | NTS |
| | | Date Drawn | 05/05/2015 |
| Title | Site Location Plan | Rev. | |
| | | Figure No. | 34169/RMS1 |

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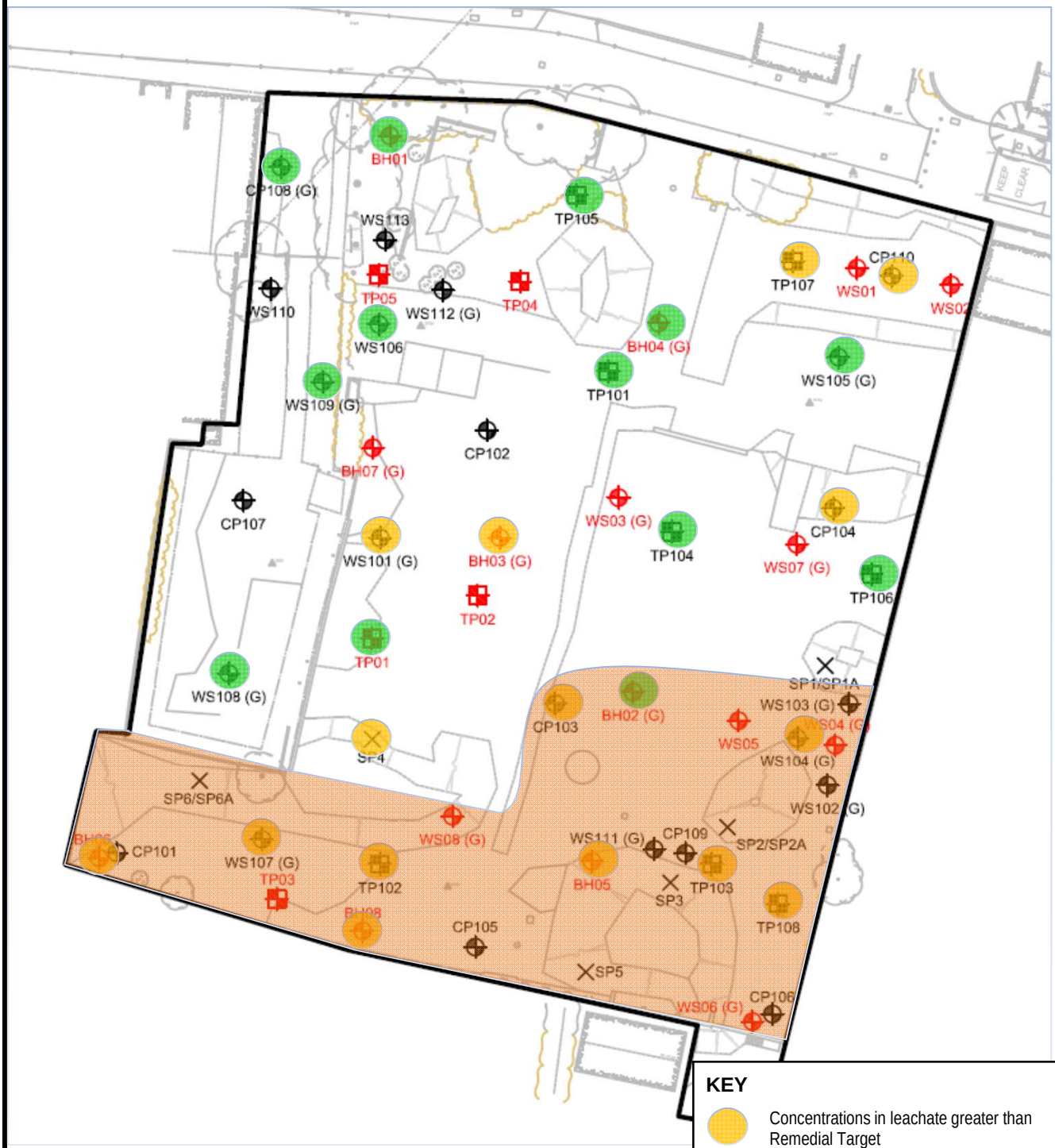
# APPENDIX II

## Plans Indicating the Approximate Location of the Areas Requiring Soil & Groundwater Remediation




**KEY**

- Concentrations in leachate greater than Remedial Target
- Concentrations in leachate less than Remedial Target
- Approximate area requiring Molybdenum soil remediation to reduce leachability

Extract from Survey Solutions Topographical Survey (Ref. 14519cv-01) dated 24/07/14

| | | | |
|---|---|---|---|
| Project No. | 34169 | Drawn | GJS |
| Client | Westleigh Partnerships Ltd | Checked | *JPH* |
| Project | Surrey Street<br>Glossop | Approved | *JPH* |
| | | Scale | NTS |
| | | Date Drawn | 05/05/2015 |
| Title | Plan Indicating Approximate Area Requiring Molybdenum Soil Remediation (based on leachable soil concentrations) | Rev. | |
| | | Figure No. | 34169/RMS2 |

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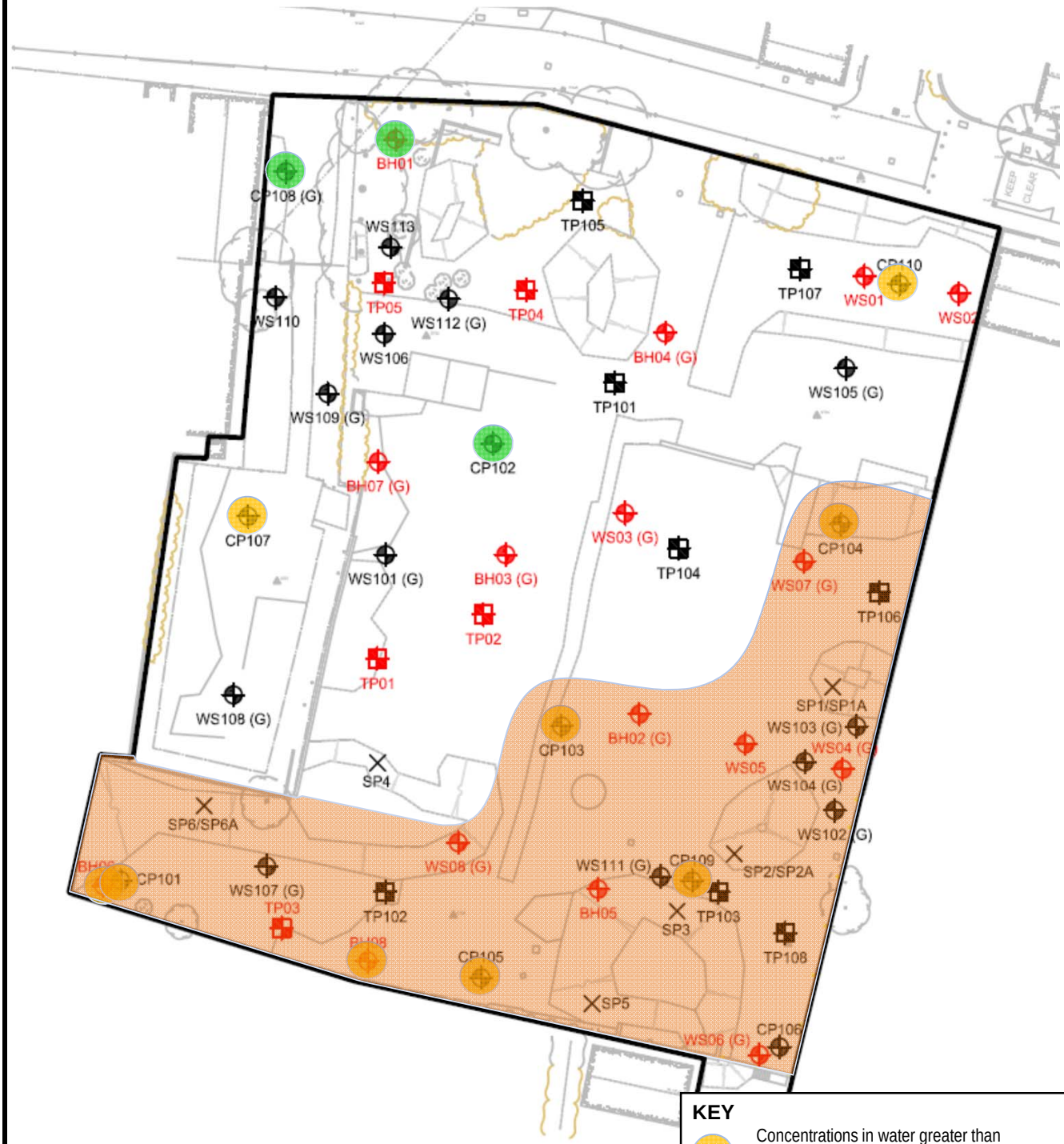


**KEY**

Concentrations in water greater than Remedial Target (response zone in the Glacial Till)

Concentrations in water less than Remedial Target (response zone in the Glacial Till)

Approximate area requiring Molybdenum groundwater remediation in the shallow Glacial Till (<4.00m begl)

Extract from Survey Solutions Topographical Survey (Ref. 14519cv-01) dated 24/07/14

| | | | |
|---|---|---|---|
| Project No. | 34169 | Drawn | GJS |
| Client | Westleigh Partnerships Ltd | Checked | *JPH* |
| Project | Surrey Street<br>Glossop | Approved | *JPH* |
| | | Scale | NTS |
| | | Date Drawn | 05/05/2015 |
| Title | Plan Indicating Approximate Area Requiring Molybdenum Groundwater Remediation in the in the Shallow Glacial Till (<4.00m begl) | Rev. | |
| | | Figure No. | 34169/RMS3 |

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**APPENDIX III**

**Environment Agency Correspondence**

**Our ref:** HP0001/003
**Your ref:** 34169 Phase2 Report

**Date:** 20th April 2015

Mr. Gareth Smith
Geo Dyne Environmental Consultants
The Granary, Church Lane
Thrumpton
Nottingham
NG11 0AX

Dear Gareth.

**SUPPLEMENTARY GEO-ENVIRONMENTAL GROUND INVESTIGATION REPORT ON FORMER FERRO ALLOYS SITE, GLOSSOP – FOR WESTLEIGH PARTNERSHIP LTD.**

I have reviewed your report entitled 'Supplementary Geo-Environmental Ground Investigation on Surrey Street Glossop.' Dated 10th April 2015 and would offer the following comments.

I noted that in the Phase 1 desk study that RPS stated that 'Historical maps suggest that the football pitches to the west of this site had been used for the deposit of materials, and then suggest that these might be ash, and slag from the adjacent iron works.' There is currently no supporting information in respect of the origins of the fill materials nor what they consist of. Is there any way that it might be possible to qualify this, as it is assumed that the main site itself would be the only source of pollution.

Tables 4, 5 and 6 indicate that the pollution from the Made Ground, Natural Ground and the Stock Piles are all derived from the previous use of the site, and that Lead, Molybdenum, Mercury and Vanadium with various PAH's constitute contaminant sources on the site.

Tables 7 and 8 indicate the leachable contaminants from the overlying soils and made ground, to be Chromium, Cadmium, Lead, Mercury, Molybdenum, Vanadium and Zinc. I note that there is difficulty in assessing the ICP-MS results due to the false positives caused by the high concentrations of Molybdenum within the samples.

Section 5.7 of your report shows the contamination within the undifferentiated groundwater, with significant exceedances of Molybdenum, Chromium, and Cadmium, and minor exceedances of Copper, Mercury, Nickel, Selenium, Vandium and Zinc. By comparison with the surface water analysis in the Wrens Nest Mill Race, it is shown that Molybdenum is having a significant impact on the surface waters, with Cadmium and Zinc having less impact.

Cont/d..

**Environment Agency, Lutra House**
Dodd Way, Walton Summit
Bamber Bridge, Preston
PR5 8BX

With the information received from the ex-employee who used to work on the site, there is evidence to suggest that by liberating the contaminants in acid and that disposing of the chimney wastes to ground in this way has had a significant impact upon the groundwater quality beneath the site, even to the present day. Residual heavy metal contamination has been enhanced by the acidizing during disposal, which has also had an impact on the pathway for the dispersion of the wastes to ground. With contaminants appearing in the Wrens Nest Mill Race, it is apparent that either an enhanced natural pathway has been generated due to the acidization, and/or there are residual physical pathways still present following demolition on the site.

**Controlled Water DQRA**

**Cadmium**

I note your comment with regards to cadmium, and the impact of high molybdenum on the ICP-MS measurements. Your conclusion is that cadmium should not be regarded as a contaminant of concern due to the fact that they have not been detected in this recent round of investigation. Cadmium is however present above EQS in the Wrens Nest Mill Race, and as such its source is most probably from the development site, and for this reason there will need to be some consideration of Cadmium as a pollutant. I would not accept that it should be dismissed without further consideration.

**Chromium**

From a controlled waters viewpoint I would agree that as Chromium was not detected in the Wrens Nest Mill Race that the only consideration for this contaminant is in relation to Human Health. If there is however a geochemical adjustment in the remediation scheme for shallow groundwaters on the site it should be born in mind that further liberation of chromium could occur, and this will need to be further assessed in the methodology for remediation.

**Copper**

The second round of investigation by GeoDyne did not detect elevated concentrations of copper in the groundwater within the natural strata. Again copper is not present in the made ground at values in excess of the target soils concentration, and again I would agree can be discounted in relation to surface water contamination.

**Molybdenum**

As noted in your report Molybdenum is detected well in excess of target concentrations in made ground, soils leaching values, and groundwater. The distribution of these excesses is all over the site, with specific concentration at the southern boundary to the site. It is noted that the presence of clinker and slag also increases to the south of the site. The highest concentrations being from the south east of the site. The highest values have been associated with the influx of water from confined basements, and interestingly this is located roughly where the acidized disposal might have taken place. Elevated concentrations are also noted in the deeper perched waters within the glacial clays. (See later comments)

**Vanadium & Mercury**

I note your comment in respect of Vanadium and Mercury, and I would agree that they are unlikely to represent a significant risk to controlled waters.

Cont/d..

**Zinc**

From a controlled waters viewpoint I would agree that as Zinc was not detected in the Wrens Nest Mill Race that the only consideration for this contaminant is in relation to Human Health. If there is however a geochemical adjustment in the remediation scheme for shallow groundwaters on the site it should be born in mind that further liberation of chromium could occur, and this will need to be further assessed in the methodology for remediation.

I would agree that Molybdenum (and Cadmium) are migrating to the Wrens Nest Mill Race, and as such are polluting this controlled water. The mechanism for this migration will require some further consideration. The potential for a man made drain to be acting as a pathway is possible, as is the potential for the pipe bedding around the pipe to be creating a pathway. The acidization (described by the ex-employee) when discharged to ground where foundation areas of concrete exist would erode the matrix of the foundations etc. The majority of the mass of contamination in the made ground is either foundry sand and/or clinker and slag and would suggest that an alternative route may have been generated by the liquid waste librating heavy metals, and etching a path below ground in the preferred direction of the groundwater flow towards the Mill Race. This will be difficult to establish.

**Conceptual Site Model**

The distribution of ash slag and clinker within the made ground and its impact upon groundwaters within the made ground via leaching, and also into the immediately underlying clays and silts would appear to have a direct relationship. I do however have concerns that there is a discrepancy when compared with the deeper confined aquifer within the CP109. This confined sand body has produced results that are comparable with the near-surface water contamination. This either shows that the deeper aquifer has been impacted, or that the drilling of the borehole has created a pathway to the waterbody and is cross contaminating it. The previous investigation by RPS designed BH06 so that the near surface water body and the deeper waterbody were sampled at the same time and again showed evidence of high Molybdenum – probably cross contaminaton.

CP 109 is shown to have a deeper confined waterbody in the sands at about 16.6 – 17.2 metres which when sampled are contaminated despite having 7 metres of overlying stiff brown clay.

At the near surface the construction of the original iron foundry, and its subsequent expansion with the redistribution of slag etc has generated a multi levelled cross section over the site which has in some cases a poorly seeping water body with high Molybdenum concentrations. The original slag would probably not have been derived from case hardening, and the time at which this was used in the history on the site might indicate what ratio of ash slag etc is likely to contain Molybdenum. Does the tip to the west contain molybdenum wastes or just normal foundry wastes? The excess/waste molybdenum being derived from the reheating of the castings during the dipping process to create case hardening, leaving residues in the foundry ashes used to heat the castings.

An understanding of how long molybdenum based case hardening had been undertaken on the site might be useful in defining if the major impact is from the leaching of slag or from the disposal of chimney dusts and acid. There is also the fact that if disposal methods as described were being used that direct disposal of molybdenum to ground could also have occurred, in which case the relative merits of slag versus acidized chimney dust is diminished.

Cont/d..

This understanding of the history on the site has an impact upon which might be the most suitable means of remediation, for this site. In consideration of the perched groundwaters in made ground there would be a need to stabilise and/or remove the made ground before remediating or removing the groundwater. Remediation of deeper groundwaters within the shallow glacial tills would also be dependent upon removing the source of leaching prior to removal of the groundwater. This issue is then clouded by the (apparent) contamination in a confined aquifer at 17 m in CP109.

Solidification of the molybdenum etc contaminated made ground and soils would act to prevent further leaching. This would have to be demonstrated in lab and field tests prior to commencing, and a full method statement of how this might be undertaken should be supplied. The layout of the site and the methods of stabilising may pose specific problems on this site. I would agree that removal of all foundations and relict building would be required before remediation of the contaminated soils. Following removal of the hard cover the site should not be left uncapped through long periods of rainfall.

If the stabilisation could be proven to prevent infiltration and leaching of molybdenum then some method of removal of the contaminated groundwaters could be considered, as described. Consideration should be given to the design of the cover to the stabilised ground, as penetration by services would not be acceptable. Again a suitable method statement would be required. I consider that a better understanding of the groundwater regime on the site would assist in defining the quantity of waters to be removed.

I would expect that during this time of remediation that surface water monitoring should be undertaken to establish if the remediation on the site is decreasing the pollution within the Mill Race. Monthly intervals for a set series of determinants would be sufficient. I would agree that it is necessary to establish if a priority pathway for groundwater migration exists to the south of the development site.

If you have any further questions, please do not hesitate to contact this office.

Yours faithfully,

Stuart McDonald B.Sc. F.G.S. Practising Geologist

Tel no 01772 714056 stuart.mcdoanld@environment-agency.gov.uk

c.c.
Mathew Rhodes
Pollution Control Officer
High Peak Borough Council
Town Hall
Buxton
Derbyshire
SK17 6EL

GeoDyne

# APPENDIX IV

## Conditions & Limitations

# Conditions & Limitations

**Phase I Desk Studies**

1. Works undertaken to provide the basis of the Phase I Desk Study report comprise a review of information available from a number of sources/parties (potentially also including the Client) together with a walk over of the site (where applicable and included within the quotation). The opinions given in the Phase I Desk Study are based on the information available from third parties/sources that has been obtained within the available timeframe. GeoDyne Limited assumes all third party information to be true and correct and therefore cannot accept liability for the accuracy of such information supplied.

2. Should additional information become available that may affect the comments and opinions made within the Phase I Desk Study, GeoDyne Limited reserves the right to review such information and make modifications to comments/opinions as appropriate.

3. It should be borne in mind that a Phase I Desk Study collates available information to generate a conceptual model of the site. The actual geotechnical and environmental considerations can only be fully quantified by intrusive investigation works to confirm the accuracy of the conceptual site model.

**Phase II Intrusive Investigations**

1. Our quotation assumes that access to the site will be arranged by others at no cost to ourselves.

2. We have assumed that free access is available throughout to the entire site and that works can be undertaken during a single mobilisation. Where restricted access is encountered, or where additional unscheduled mobilisations are required, additional costs may be incurred to the client.

3. We have assumed that all available information relating to buried services will be supplied by the Client at no cost to ourselves. No responsibility will be accepted for damage to underground services that have not been brought to our prior attention by the Client.

4. All excavations/boreholes will be backfilled with compacted arisings upon completion, with any excess arisings left proud of ground levels. Excess arisings will not be removed from the site unless specifically requested by the Client. Where we are requested to remove excess arisings, all associated costs will be passed to the Client.

5. We will attempt to leave the site in a clean and tidy state, however, it must be understood that some disturbance of the site is unavoidable during intrusive works.

6. Exploratory holes are positioned approximately on site by GeoDyne Limited. Should the client require precise locations of all exploratory points, additional fees will be incurred. It must be borne in mind that backfilled trial pits can create ‘soft spots’, therefore, should the Client wish to designate ‘no dig’ zones, for example under the footprint of proposed structures, these must be brought to our attention prior to commencement of works.

7. Groundwater observations relate to conditions encountered at the time of investigation. It must be understood that groundwater levels may vary as a result of recent climatic conditions or seasonal variation.

8. Trial pits and boreholes examine only a small proportion of the total site area. No liability can be accepted for conditions not revealed in exploratory holes, particularly between positions. All extrapolations of available data are given in good faith.

**Payment**

1 Payment terms are strictly 28 days from the invoice date.

2 Prior to commencement of works, we require receipt of formal written instruction from the party accepting full financial responsibility for the work. In the absence of such an instruction, we would expect the instructing Consulting Engineers/Architects to accept full financial responsibility for the works.

3 Receipt of instruction to commence work shall be taken as acceptance and compliance of the foregoing conditions.

**Liability**

1. GeoDyne Limited offer £5,000,000.00 Professional Indemnity Insurance (in aggregate over the year). This shall be the limit of our liability for works undertaken. No individual liability shall be implied to, or accepted by, any employee for works undertaken for and on the behalf of GeoDyne Limited.