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By post and email

1st August 2016

Ref. C7074/6418/PB/PH

Dear Mark,

C7074 – Former Siemens Factory, Hebburn – Preliminary Phase 1 (Desk Study) Review

1.0 Introduction

Sirius Geotechnical and Environmental Ltd (Sirius) was instructed by Miller Homes North East Ltd to carry out a Phase 1 (Desk Study) review at the former Siemens Factory Hebburn. It is understood that consideration is being given to the development of the site for a low rise residential end use comprising 334 units, inclusive of private gardens, estate roads and associated infrastructure. For the purpose of this report we have assumed that housing will not exceed three storeys.

A site location plan and proposed development layout are appended as Drawing No C7074/01 and Pod Urban Design Ltd Drawing No. 544-MIL-SD-10.01 (Rev. G), respectively.

As part of this investigation, information from the following sources has been reviewed: Landmark Information Group (LIG) Envirocheck report, the Coal Authority (CA), and the British Geological Survey (BGS).

Where this review refers to the potential presence of invasive plants (such as Japanese Knotweed) or asbestos-containing materials, such observations are for information only and should be verified by a suitably qualified expert.

The comments and opinions presented in this report are based on the findings of the desk study. There may be other conditions prevailing on the site which have not been revealed by this investigation and which have not been taken into account by this report.

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The objectives of this appraisal were to:

- Establish the historical development of the site and surrounding area from a review of available historical Ordnance Survey (OS) maps.
- Establish the environmental setting of the site.
- Determine whether historical activities could give rise to significant ground contamination.
- Evaluate whether past mining or other extractive industries could have an influence on the site.
- Determine the potential risk to the development from hazardous ground gas sources, including radon.
- Provide, where possible, provisional recommendations for foundations, and measures to deal with potential contamination; and,
- Provide recommendations for intrusive works required to confirm the ground conditions below the site and the contamination status of the shallow soils, and from this, foundation solutions and measures to deal with any contamination.

2.0 Site Details and Description

Table 1 Current Site Overview

Location:	The site is located between South Drive and Victoria Road West in Hebburn, Gateshead, Tyne and Wear. The site lies approximately 5km to the east of Newcastle upon Tyne city centre.
National Grid Reference:	NZ 30400, 63500 (approximate site centre).
Topography and Features:	The majority of the site is occupied by concrete hardstanding, with soft areas in the east, south and southeast areas of the site. All buildings and above-ground structures have been cleared, although a number of stockpiles of processed demolition rubble are present. Infilled subsurface structures, drainage culverts and markings indicate where structures were historically present. Railway and crane tracks remain in the northeast and southeast of the site. A short asphalt road crosses the centre of the site in an east-west direction. Two large densely vegetated mounds are present in the southeast of the site (to approximately 51m AOD). A grassed bund is present adjacent to the northern boundary of the site, approximately 0.9m in height. A shallow open excavation is present adjacent to the northern boundary of the site near to Parkside (believed to relate to the remediation of a former stand of Japanese Knotweed). Dark oil staining was noted on the concrete hardstanding in the northwest and central southern areas of the site. Suspected fragments of asbestos containing materials (ACMs) were noted in some of the stockpiles of processed demolition rubble. Several existing manholes are present across the site, indicating the presence of services. A number of lengths of stripped cable are present on the site surface. Site levels fall gradually from south to north (from approximately 45 to 42 mAOD). The site is bordered by mature trees and hedgerows to the northeast, east, west and south.
Approximate Site Area:	10ha.

Adjacent Land Uses:	The neighbouring land uses comprise the following: • South Drive and Parkside, and residential dwellings and sports ground to the north; • Victoria Road West (A185) to the east, beyond which are residential dwellings; • Railway line (Tyne and Wear Metro) to the west, beyond which is public open space; and, • Industrial estate to the south.
Current Land Use:	Vacant relic industrial land.
Invasive Plant Species:	Suspected Japanese Knotweed has been identified within an area of soft landscaping in the central north area of the site.

The main site features are shown on Drawing No. C7074/02 presented in Appendix A to this report.

3.0 Environmental Setting

General

Published environmental, geological and historical data relating to the site has been reviewed. A summary of relevant information is provided below.

Historical Development

A summary of the site history from historical Ordnance Survey maps dated between 1857 and 2016 is presented below. It is not the intention of this report to describe in detail all of the changes that have occurred on or adjacent to the site, only those pertinent to the proposed development.

The earliest historical plans show the site to be open fields, with Whinny Lane crossing the site from northwest to southeast. The 1898/9 plan shows two possible ponds in the east of the site, a pond in the southeast, a small rectangular building in the east, and two small buildings in the south (one of which is labelled on the 1957 plan as Whinny Cottage). Rises are indicated on the 1921 plan near to the small rectangular building in the east.

The first industrial development is shown on the 1951 plan in the northern area of the site, expanding during the 1960s and 1970s to include railway sidings and a works in the southwest, and tanks, a travelling crane, and a reservoir in the north. The site is labelled on the 1957 plan as an Electrical Appliance Works, and on later plans as a Works.

The historical plans show the surrounding area to be initially open fields, with the railway line constructed along the western boundary by 1898. Hebburn was expanding southwards towards the site in the mid 20th century, with a works and sports ground developed to the north, and residential dwellings to the east (Hartleyburn Estate). By the 1980s the works to the north had been cleared and later redeveloped with residential dwellings, and the industrial estate developed to the south.

Published Geological Information

A summary of the available published geological information is presented in Table 2.

Table 2 Geological Summary

Sources of Information:	BGS 1:10,000 scale geological plan (Sheet NZ 36 SW). BGS Sheet Memoir 20 (England and Wales), Geology of the district around Newcastle upon Tyne, Gateshead and Consett (dated 1988). Coal Mining Authority Reports (ref. 510012016960014, dated 8th July 2016).
Made Ground:	No made ground is shown beneath the site. Two spoil heaps are shown in the south east area of the site.
Drift Geology:	The site is shown to be underlain by superficial glacial deposits noted as Upper (or Pelaw) Clay, described as a red-brown silty clay with some stones.
Solid Geology:	The site is shown to overlie Carboniferous Middle Coal Measures strata, comprising interbedded sequences of mudstone, siltstone, sandstone and coal. The Top Hebburn Fell (THF) coal seam is conjectured to subcrop northwest to southeast across the centre of the site, dipping to the southeast. This seam is recorded to be thin. The Bottom Hebburn Fell (BHF) coal seam is conjectured to subcrop west to east across the northern area of the site, dipping to the south. This seam is recorded to be between 1.07 and 1.63m thickness, and present in two or three leaves.
Faults:	A fault is shown trending northwest to southeast just off the southwestern boundary of the site and downthrown to the southwest.

A Coal Authority report obtained by Sirius discloses the following information:

> *"The property is in a surface area that could be affected by underground mining in 4 seams of coal at 210m to 400m depth, and last worked in 1947. Any movement in the ground due to coal mining activity should have stopped. In addition, the property is in an area where the CA believe that there is coal at or close to the surface. This coal may have been worked at some time in the past. The potential presence of coal workings at or close to the surface should be considered prior to any site works or future development activity."*
> *"The property is not within a surface area that could be affected by present underground mining."*
> *"The property is not in an area where the CA has plans to grant a licence to remove coal using underground methods."*
> *"The property is not in an area likely to be affected from any planned future underground coal mining. However, reserves of coal exist in the local area which could be worked at some time in the future."*

Furthermore, the CA states "there are no known mine entries within, or within 20 metres of, the boundary of the property."

Hydrology and Hydrogeology

Table 3 Surface Water Features

	Presence / Location	Comments
EA GQA Classified Watercourses (within 500m)	None recorded	
Unclassified Watercourses (within 250m)	None known	
Licensed Surface Water Abstractions (within 1000m)	None recorded	
Surface Water Features (Canals, Pond, Lakes, etc.) (within 250m)	46m to the southwest. Backfilled ponds may be present on the site	Culverted watercourse
Flood Risk Status	The site does not lie within an indicative flood plain	

Table 4 Groundwater Occurrence and Abstractions

	Presence/Location	Comments
Licensed Abstractions (within 1000m)	None recorded	
Private Wells (within 1000m)	None recorded	
Source Protection Zones (within 500m)	None recorded	
Known Springs (within 500m)	None recorded	

Table 5 Groundwater Vulnerability Status

	Environment Agency Classification
Bedrock Aquifer Designations	Middle Coal Measures is classified as a Secondary 'A' Aquifer
Superficial Aquifer Designations	The Upper (or Pelaw) Clay is classified as Unproductive Strata
Groundwater Vulnerability	Recorded as soils of high leaching potential

Landfilling and Waste Management

Table 6 Waste Management Activities

	Presence/Location	Comments
Local Authority Landfills (within 1500m)	Three: closest is Pelaw Quarry, 552m south of the site	
Other Recorded Landfills (within 1500m)	Nine historical landfills: closest refers to Hebburn Quayside, 127m northwest of the site	Hebburn Quayside listed to accept industrial and household waste.

Other Active Licensed Waste Management Facilities (within 500m)	None recorded	
Evidence of Landfilling On or Within 250m of the Site	Spoil heaps listed on BGS sheet Backfilled ponds may be present on the site	
Walkover Evidence of Fly-Tipping on the Site	None	
Ground Gas Risk Assessment Required	Yes	Suspected backfilled ponds and Coal Measures strata beneath the site both have the potential to produce hazardous ground gas.

Radon Risk

To determine whether the site is at risk from radon gas, the BRE Report 211: "Radon: Guidance on the protective measures for new dwellings", dated 2007, has been previously referenced. This document shows the site to be in an area in which no radon protective measures are required.

Other

An inactive contemporary trade directory entry for the site itself lists Trench (UK) Ltd to be a manufacturer of transformers.

No other potentially contaminative activities or environmental constraints are present within 250m of the site, with the exception of a former petrol filling station 220m to the south. No Control of Major Accident Hazards (COMAH) facilities are present within 1km of the site.

4.0 Preliminary Conceptual Site Model

As part of the Preliminary Geoenvironmental Appraisal, Sirius developed a combined preliminary conceptual site model and conceptual exposure model (PCSM) for the proposed future end use (residential with gardens). This summarises the understanding of surface and sub-surface features, potential contaminant sources, transport pathways and receptors in order to assess potential pollutant linkages.

A qualitative risk assessment has also been made of the likelihood of any complete pollutant linkage and its potential significance.

The preliminary conceptual model for the site is presented in schematic form as Drawing No. C7074/03 in Appendix A to this report.

In summary, the preliminary CSM has identified the following potential pollutant linkages which could present an unacceptable risk to the proposed end-use, denoted as low to moderate or higher likelihood of pollutant linkages on the CSM:

- Direct and indirect ingestion, inhalation and dermal contact with polychlorinated biphenyls (PCBs), oil and hydrocarbons, metals, acids and alkalis, and asbestos from historical electrical manufacturing works on the site;
- Leaching of above contaminants to controlled waters (Secondary 'A' Aquifers);
- Direct and indirect ingestion of possible asbestos fibres within processed demolition rubble both reused and stockpiled on the site; and,
- Generation of hazardous ground gases (from possible backfilled ponds and underlying Coal Measures strata) and accumulation of such gases in enclosed spaces resulting in potential asphyxiation/explosive risks.

5.0 Conclusions and Recommendations

General

This Phase 1 (Desk Study) review has been performed for land at the former Siemens Factory Hebburn. It is understood that consideration is being given to the development of the site for a low rise residential end use comprising 334 units, inclusive of private gardens, estate roads and associated infrastructure. A proposed development layout is appended to this review.

Coal Mining Risk Assessment

On the basis of information provided by the CA and inspection of available geological plans and memoirs, it is considered that the risk of shallow unrecorded coal workings within the Top Hebburn Fell and Bottom Hebburn Fell coal seams affecting surface stability cannot be discounted.

To investigate the potential risk from unrecorded shallow coal workings, rotary probing is recommended to confirm the absence / presence of coal within an influencing distance of the surface and to determine any potential risk from shallow workings.

If mine workings are proven within influencing distance of the surface, they will require to be consolidated through rotary drilling and pressure grouting, in accordance with CIRIA Special Publication 32 "Construction over abandoned mine workings", or excavated prior to development.

Although no recorded mineshafts are noted by the Coal Authority as being located within, or within 20 metres of, the site, the possibility of encountered unrecorded mine entries (including bell pits/crop workings) within the site cannot be discounted. It is therefore recommended that excavations be examined for evidence of mine entries / bell pitting / crop workings. If a mine entry / bell pit / crop workings is/are suspected, then works should cease and the advice sought of a suitably qualified consultant.

Inspection of historical OS maps has not revealed any evidence of quarrying or opencast workings beneath the site. However, the possibility of encountering unrecorded quarries/opencast workings cannot be discounted. It is recommended that all excavations be examined for evidence of such features. If evidence of an infilled quarry /opencast workings is suspected works should cease and the advice sought of a suitably qualified consultant.

Geotechnical

Foundations

The site is underlain by a combination of tarmac hardstanding, concrete floor slabs and areas of made ground of unknown thickness / composition together with spoil heaps in the south east of the site.

Made ground is recorded to be underlain by Upper (or Pelaw) Clay over Carboniferous Middle Coal Measures Strata which is in turn underlain by. The Top Hebburn Fell and Bottom Hebburn Fell coal seams are conjectured to subcrop within the central and northern parts of the site respectively, generally dipping to, and underlying, the south east and south of the site.

Dependent upon the extents of proven made ground and potential remedial earthworks, it is considered that a range of foundation solutions including shallow spread, trench fill and piled foundations may be appropriate to support loads typically associated with traditional low rise housing. At this stage it is considered that reinforced strips with ground improvement via the installation of vibro stone columns may present an alternative to piled foundations.

Overall the nature and depth of foundations will be dependent on loadings, development levels and the detailed site geology, including:

- Location and thickness of made ground or reworked soils.
- Presence/absence of workable coal within influencing distance of the surface.
- Location and extent of any relict foundations and other buried structures.
- Bearing capacity of the natural strata.
- Groundwater levels.

A ground investigation is required to confirm ground conditions, the potential presence of underground coal workings and foundation requirements.

If mine entries and / or shallow mine workings are proven within influencing distance of the surface, these will need to be treated (see above); additionally, foundations may need to be designed to accommodate risk posed by residual movement. Foundation design will depend upon the depth to treated workings.

Given the historical development of the site, buried obstructions (i.e. former floor slabs/relict foundations) should be anticipated.

Floor Slabs

At this stage, it would be considered prudent to make allowance for suspended floor slabs in all proposed units.

Contamination

Risk Evaluation for the Proposed Land Use (Residential with gardens)

The preliminary conceptual site model indicates that pollutant linkages are possible to a variety of receptors. Potential heavy metals, acids and alkalis hydrocarbons, asbestos fibres and PCBs may pose potential risks to human health (construction workers, adjacent land users and site end-users) and controlled waters (Secondary A Aquifer).

Risks related to these potential linkages are currently given qualitative assessments of moderate. However, the precise nature of the risks should be investigated further through site investigation and laboratory analysis.

A Phase II (intrusive) geoenvironmental/contamination investigation should be undertaken to confirm the presence or otherwise of contaminants sources and quantify the risks to identified receptors.

Hazardous Ground Gases

A risk from hazardous gas sources, including mine gas and possible on site backfilled ponds exists. To confirm the situation regarding hazardous gases on site, from potential on and off-site sources, a hazardous gas investigation would be required to determine the need or otherwise for gas protection measures in future buildings.

According to the BRE, radon protective measures are not required for the site.

Invasive Plants

Suspected stands of Japanese Knotweed have been identified on site. It is recommended that this should be confirmed by a qualified ecologist together with specialist advice for appropriate treatment/removal, where necessary. The treatment/removal of any invasive species should take place in advance of the proposed construction works. In addition, appropriate site practises should be adopted to prevent the further spread of these species during site walkovers / site investigation / preparatory works.

Services

Given the potential for coal at, or close to, the ground surface at the site, calorific values may be elevated within shallow soils, and as such appropriate protection of services with the potential to generate heat may be necessary. In addition, given the historical development of the site, the potential for barrier pipe in potable water services may be required. This should be investigated further through site investigation.

6.0 Further Investigation

The following ground investigation works are recommended to allow foundation design and determination of any potential contamination constraints, and, abnormal costs, in relation to the proposed development:

- Rotary probing to investigate for the presence/absence of workable coal within influencing distance of the surface (and its thickness/collapse status) together with the installation of gas/groundwater monitoring wells (including obtaining Coal Authority License for the works).
- Cable percussion boreholes primarily positioned within the stockpile materials on site to determine the nature of the materials at the base of the stockpiles and confirm the nature of the underlying ground. Standard Penetration Tests (SPTs) to be undertaken within boreholes in order to provide geotechnical data for the underlying soils.

- Window sample drilling and installation of gas/groundwater monitoring wells to confirm the nature of the underlying ground.
- Trial pitting/trenching with a tracked 360° excavator and breaker, to provide a general coverage of trial pits across the site and to investigate the nature of stockpiled materials, concrete slabs and the potential for buried obstructions. This should include for the breaking and lifting of concrete floor slabs / hardstandings in places.
- Chemical and geotechnical laboratory testing to adequately categorise the shallow soils/groundwater.
- A minimum of six gas and groundwater monitoring visits over a three month period. Groundwater and surface water samples should be obtained on the inaugural visit.
- Survey of co-ordinates and elevations of all exploratory holes
- Reporting.

Intrusive ground investigation works should be carried out by a suitably qualified geoenvironmental consultant.

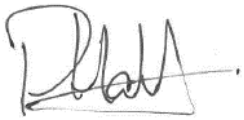
An invasive plant survey should be undertaken by an appropriately qualified specialist.

Regulatory Approvals

The conclusions and recommendations presented above are considered reasonable based on the findings of the Phase 1 (Desk Study) Review. However, these cannot be guaranteed to gain regulatory approval and, therefore, the report should be passed to the appropriate regulatory authorities and/ or other organisations for their comment and approval prior to undertaking any works on site.

It is hoped that the report is adequate for your present needs. However, should you require any further information please do not hesitate to call.

Yours sincerely

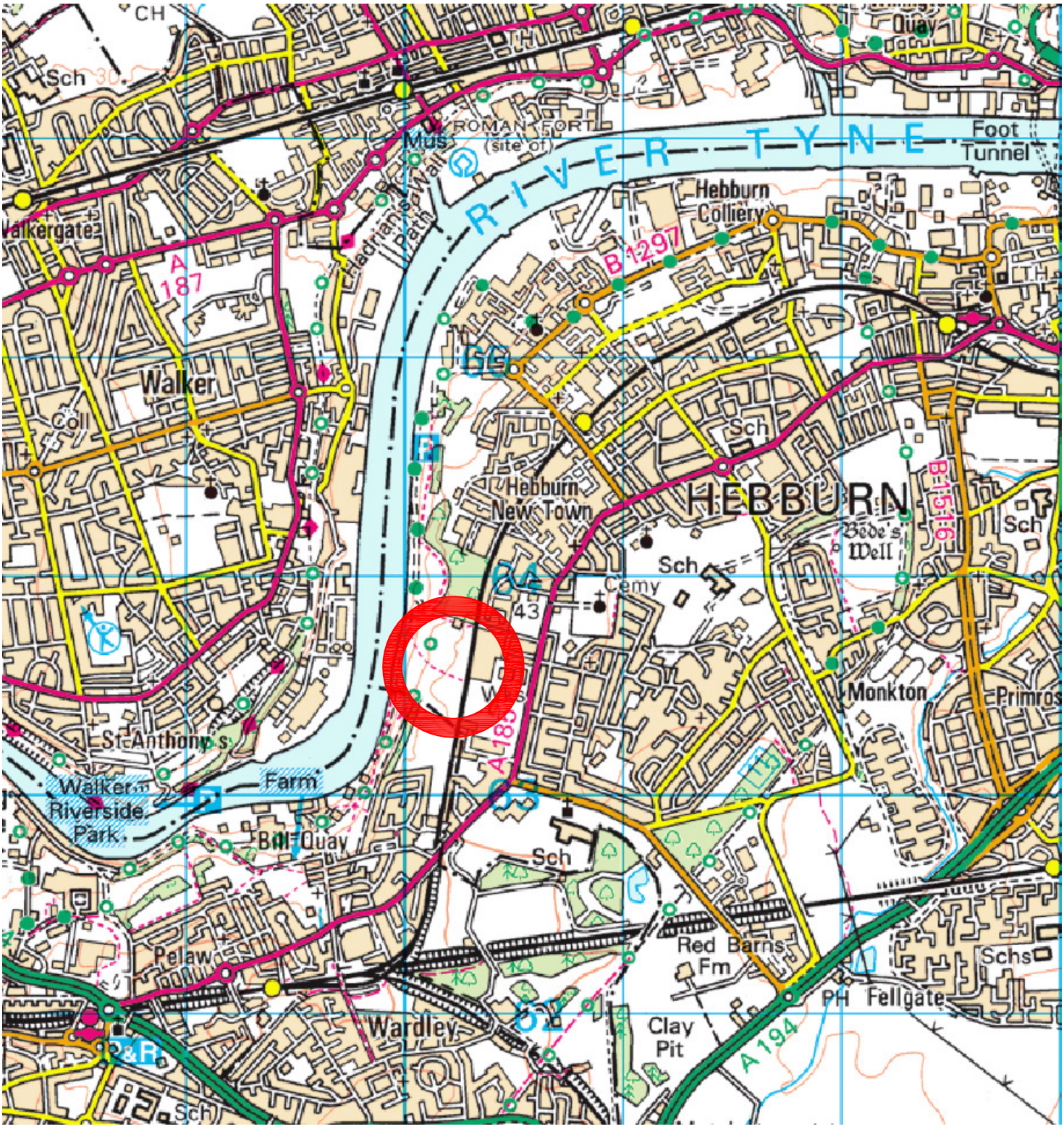


Peter Hall
Principal Engineer

For and on behalf of
Sirius Geotechnical and Environmental Ltd

Enc.

Drawing C7074/01 Site Location Plan
Drawing C7074/02 Site Features Plan
Drawing C7074/03 Preliminary Conceptual Site Model
Drawing 544-MIL-SD-10.01 (Rev. G), Masterplan as Proposed (Pod Urban Design Ltd)



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NOTES

Site Location

REVISION	
0	For information
A	>>
B	>>
C	>>
D	>>

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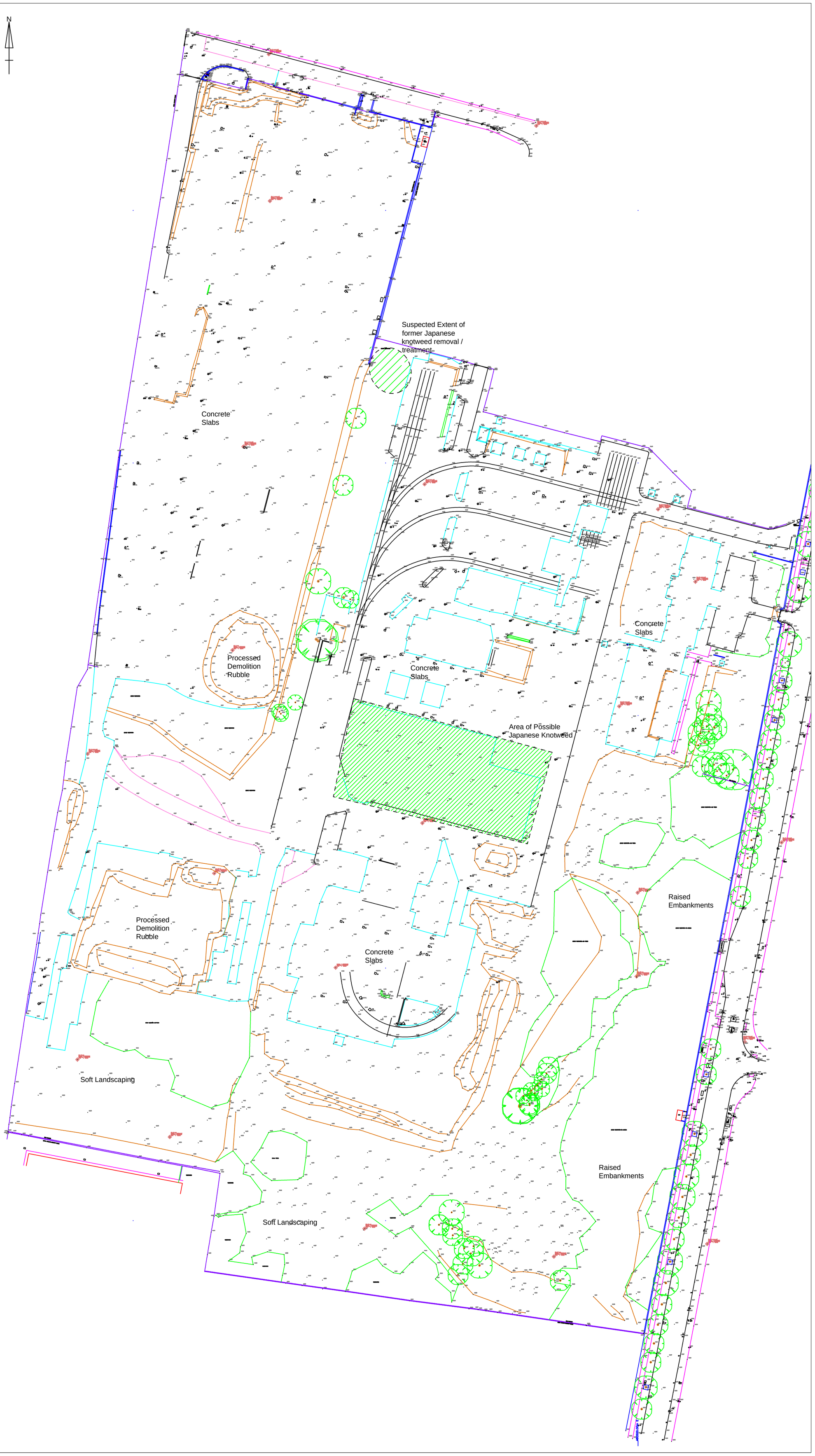
CLIENT	DRAWING NO.	REVISION NO.
Miller Homes (North East) Ltd	C7074/01	0
SITE: Former Siemens Factory, Hebburn	DRAWN BY: DT	APPROVED BY: PB
DRAWING TITLE: Site Location Plan	DATE: Aug 2016	SCALE: 1:25,000 — A4



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CLIENT

Miller Homes (North East) Ltd

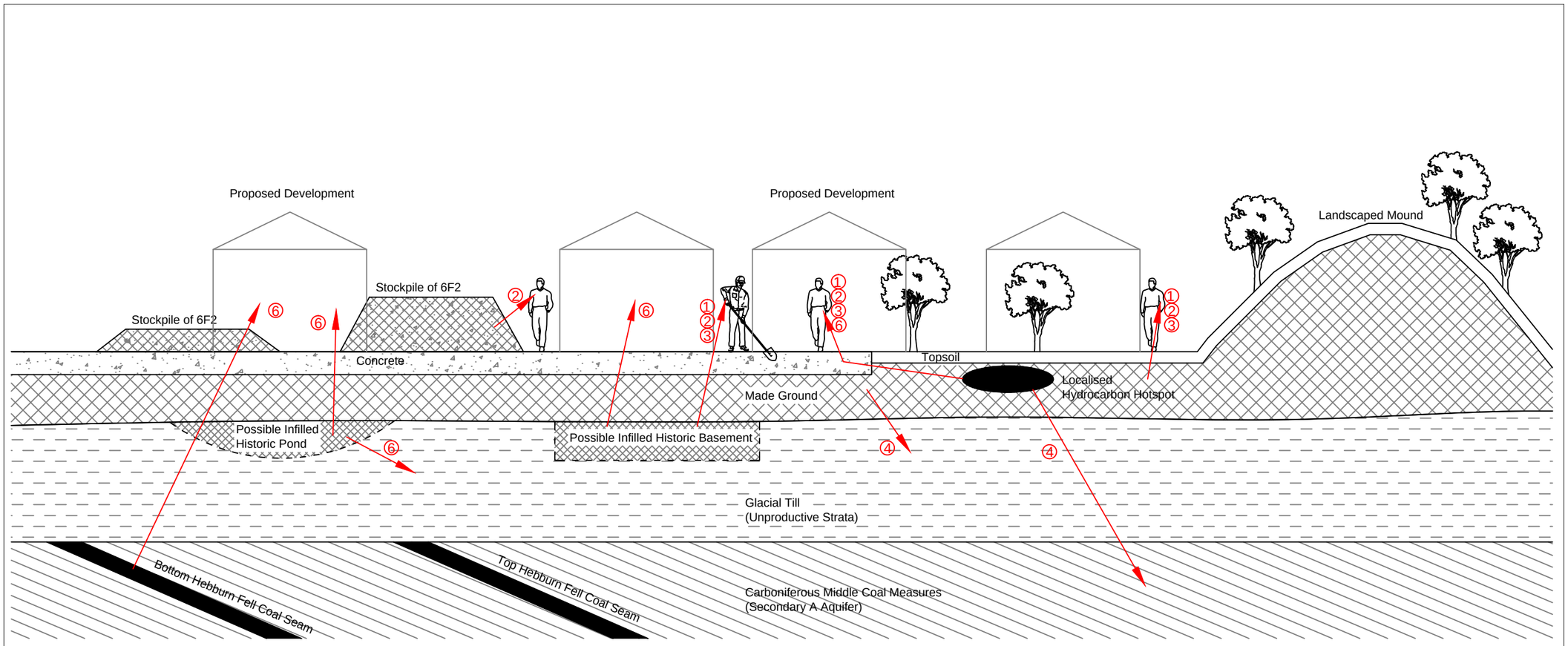
SITE

Former Siemens Factory, Hebburn

DRAWING TITLE

Site Features Plan

DRAWING NO.	REVISION NO.
C7074/02	0
DRAWN BY: DT	APPROVED BY: PB
DATE: Aug 2016	SCALE: 1:1000
PAPER SIZE: A2	



Contamination Sources	Contamination Pathways	Potential receptors	Likelihood of significant pollutant linkage
Metals, oils, hydrocarbons, acids and alkalis, PCBs and asbestos fibres within made ground soils	① Direct and indirect ingestion ② Inhalation of contaminated particles/dust ③ Dermal contact	Site end users	Moderate
		Construction/Maintenance workers	Moderate - high
	④ Leaching of contaminants	Controlled waters	Low
Asbestos fibres within processed demolition rubble	② Inhalation of contaminated particles/dust	Site end users	Low
		Construction/Maintenance workers	Moderate - high
Hazardous ground gases from on-site Coal Measures strata	⑥ Migration and accumulation of gases in indoor air	Site end users	Low - moderate

NOTES

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CLIENT

Miller Homes (North East) Ltd

SITE

Former Siemens Factory, Hebburn

DRAWING TITLE

Preliminary Conceptual Site Model

DRAWING NO.	REVISION NO.
C7074/03	0
DRAWN BY: DT	APPROVED BY: PB
DATE: Aug 2016	SCALE: NTS
PAPER SIZE: A3	

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REV	BY	DATE	NOTE
G	MC	29/07/16	Planning Issue

N

Ecological Corridor

Affordable Housetype

Ward Bdy

PARKSIDE

1.5

0 25 50 75 100 125m

SCHEDULE OF ACCOMMODATION – LAND OF VICTORIA ROAD WEST, HEBBURN 29/07/16

House Type	House Type	Description	No	Parking	Storeys	Bspace	sq.ft	Total
AFFORDABLE								
	HT2	2 BED SEMI/TERRACED HOUSE	**67**	PS	2	3	837	56079
	HT3	3 BED SEMI/TERRACED HOUSE	**17**	PS	2	3	985	16745
2 BEDROOM								
	APARTMENT	2 BED APPARTMENT	**18**	PS	3	3	623	11214
203	YARE	2 BED TERRACED HOUSE	**11**	PS	2	3	657	7227
3 BEDROOM								
305	TOLKIEN	3 BED TERRACED HOUSE	**16**	PS	2.5	5	892	14272
306	TWEED	3 BED DET HOUSE	**8**	IG	2	5	892	7136
309	ORWELL	3 BED DET HOUSE	**8**	IG	2	5	967	7736
310	KIPLING	3 BED DET HOUSE	**10**	SG	2	5	1027	10270
312	HARDWICKE	3 BED TERRACED HOUSE	**22**	PS	2.5	5	1000	22000
327	LARKIN	3 BED DET HOUSE	**10**	IG	2	5	980	9800
4 BEDROOM								
404	ESK	4 BED SEMI DET HOUSE	**31**	SG	2	6	1105	34255
410	TRAVERS	4 BED DET HOUSE	**17**	IG	2	6	1265	21505
411	BUCHAN	4 BED DET HOUSE	**7**	SG	2	6	1264	8848
416	STEVENSON	4 BED DET HOUSE	**6**	DG	2	7	1408	8448
415	MITFORD	4 BED DET HOUSE	**12**	SG	2	7	1388	16656
439	TRESSLE	4 BED DET HOUSE	**43**	IG	2	7	1349	58007
5 BEDROOM								
501	BUTTERMERE	5 BED DET HOUSE	**13**	IDG	2	8	1509	19617
503	JURA	5 BED DET HOUSE	**18**	IDG	2	9	1679	30222
TOTAL			**334**					**360037**
GROSS SITE AREA ACRES			**10.24**	**ha**			**ac**	**25.30**
PUBLIC OPEN SPACE			**1.03**	**ha**			**ac**	**2.55**
NETT SITE AREA ACRES			**9.21**	**ha**			**ac**	**22.76**
COVERAGE SQ.FT/ACRE								**15818.85**

pod

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PROJECT:
Land off Victoria Road West, Hebburn, South Tyneside

DRAWING TITLE:
Masterplan as Proposed

CLIENT:	STATUS:			
Miller Homes	Planning			
SCALE:	SHEET SIZE:	DATE:	DWN BY:	CHECKED BY:
1:500	A0	06:16	MC	CVB
PROJECT NO:	DRAWING NO:	REVISION:		
544-MIL	SD-10.01	G		