

Taylor Wimpey North West
Washington House,
Birchwood Park Avenue,
Birchwood,
Warrington,
WA3 6GR

Our Ref: 7565TWNW210121L

BY EMAIL

21 January 2021

For the Attention of Mr R. Allen

Dear Robert,

Re: Ground Assessments at “Lagoon Site”, Parc Brymbo, Wrexham.

Background

Coopers (Chester) Ltd, hereby referred to as Coopers, have been appointed to act as engineering consultants by Taylor Wimpey North West (TWNW) to undertake additional ground investigations on the above proposed development. The following assessments related to the risks associated with contaminated land and hazardous ground gases for submission and approval by Wrexham County Borough Council’s Contaminated Land Department under a formal planning application for the proposed development.

Please find enclosed a copy of the following:

- Coopers Drawing No. 7565/01 – Site Plan.
- Coopers Trial Pit Logs, referenced TP01 to TP21, excavated 2 December 2020.
- DETS Chemical Certificate of Analysis, referenced 20-24980-1, dated 22 December 2020.
- DETS Chemical Certificate of Analysis, referenced 21-00599, dated 18 January 2021.
- Statistical Calculation Tool Print Sheets.
- Coopers “Build Phase Remediation and Validation Strategy”, referenced 7565BPRS, dated 21 January 2021.

The enclosed report was provided to Coopers by TWNW in relation to previous investigations and assessments for the site:

- Wardell Armstrong “Ground Conditions Assessment”, referenced ST16882-001, dated November 2018.

Site Location and Context

The proposed development is located on open land to the north of Heritage Way, in the villages of Tanyfron and Brymbo, at National Grid Reference SJ297 525, post code LL11 5SQ, approximately 4km to the north west of Wrexham town centre (refer to Figure 1), and enclosed site location plan.



Figure 1: Site Location Plan. (NTS). Ordnance Survey Licence No. AL100005579.

The triangular shaped parcel of land is situated adjacent to residential housing to the south, west and north, with sports pitches to the east. At the time of Coopers walkover on 2 December 2020 the site consisted of 1 No. field with tree-lined embankments (refer to photograph 1) on the southern and western boundaries. The field consisted of scrubland with patches of no vegetation growth, with scattered self-seeded trees and strewn with scattered sandstone boulders left over from the remediation phase of the site. Access to the site was limited by secured palisade access gate on the northern site boundary (refer to photograph 2) and an open area between palisade fencing with walk-on access located on the southern site boundary; this was fenced off to limit trespassing. A small gap was observed in the far southern corner of the site through the palisade fencing, which was sufficient for foot access to the site. The site levels generally sloped toward the south, with the greatest change in elevation (12m) along the southern boundary where the site was sloping in downwards in a south, south-east direction. There was almost no elevation change along the northern boundary as a comparison.



Photograph 1: View of the site, with the tree-lined embankment in the background.



Photograph 2: View of the palisade gate along the north-eastern site boundary.

The eastern boundary which bordered the managed sports pitches was level with the off-site playing fields and consisted of a wood pole fence and medium sized trees. A suspected 'French drain' was also likely to be present parallel to this boundary, and clues to its possible existence were present in the form of a linear feature of angular cobbles running the length of this boundary alongside the fence (refer to photograph 3). In a number of places around the site, concrete pads with rusted metal bars protruding out of them had been left in place following on from settlement monitoring carried out during the remediation phase (refer to photograph 4).



Photograph 3: Suspected French drain.



Photograph 4: Concrete pad with metal bar protruding left over from settlement monitoring.

Based upon the site plan (Drawing No. 7565/01) which references utilities plans supplied by the developer, no live services were present on the site. The nearest services were in the carriageway of Heritage Way to the immediate south. The service plans notate a BT line crossing the site in the south-west of the field; however, this was not observed while on the site. A suspected drain was reported to run across the site in a north north-west, south south-east direction, connecting to a manhole located adjacent to the eastern site boundary, to the west of the off-site football shelter.

The northern site boundary was defined by a palisade fence & gate with reclaimed post-industrial land beyond consisting of wooded, terraced slopes, laced with walkways currently used for recreation (dog walking etc); these were not public rights of way. As mentioned previously, the

whole of the eastern boundary bordered the sports pitches and consisted of a wooden pole and wire fence with intermittent trees along its whole length. The southern site boundary consisted of two sections of palisade fence with a gap in the middle, secured with another wooden pole and wire fence and a bund to limit unauthorised trespass. Immediately beyond the southern site boundary existed Heritage Way and residential developments. An embankment gradually gained height to the north along the southern site boundary. The western site boundary continued this embankment from the west, and it gradually sloped to nothing along the boundary to the east. The embankment was very narrow on the top with a palisade fence acting as the boundary across the whole length of the western site boundary. Mature trees existed for the majority length of this boundary, with an earlier phase of residential housing present beyond this boundary.

Development Proposals

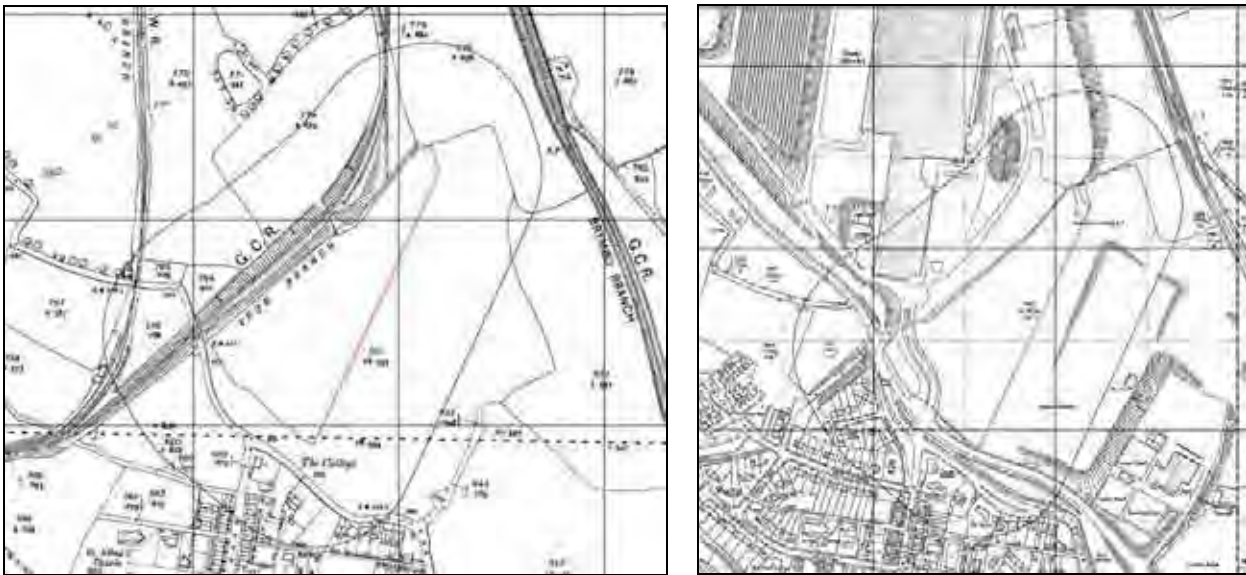
The proposed development by Taylor Wimpey North West is recorded on the enclosed MPSL Site Layout, referenced 20069/01, revision E, dated 13 January 2021, an extract of which is shown on Figure 2 (below). The 70 No. residential properties, consisting of a combination of traditional detached and semi-detached housing, with associated roads, parking, gardens and landscaping.



Figure 2: Extract of proposed development layout.

Site History

The site has consisted of open ground from 1879, with a mineral railway situated within a cutting along the north western site boundary recorded by 1900. The mineral railway connected Vron Colliery to the south of the site to Brymbo Steel and Iron Works to the north. The mineral railway was recorded as disused by 1962, following closure of Vron Colliery. By 1981 the mineral railway and cutting were no longer recorded with extensive earthworks to the north west at part of the extension of the steel works close to the site boundary (refer to Figures 3 and 4).



Figures 3 & 4: Showing historical Ordnance Survey map editions of 1912 (left) and 1990 (right) in relation to the approximate site boundary.

The steelworks was reported to have closed in 1990, followed by remediation works, at which time the site was formed as water storage for dust suppression, with numerous water lagoons shown on historical aerial photograph from circa 2006 (refer to Figure 5). Subsequent aerial photographs showed the lagoons to have been fills and remaining as open ground (refer to Figure 6).



Figure 5: Aerial photograph from circa 2006 with approximate site boundary. Image from Google Earth.



Figure 6: Aerial photograph from circa 2018 with approximate site boundary. Image from Google Earth.

Previous Investigations

The site was subject to monitoring, testing and assessments in 2007, with contaminated land aspects addressed by Smith Grant (SG) LLP and earthworks/settlement by Scott Wilson (SW) Ltd with the parcel of land referenced as “*Link Road Development Module*”. The completion report by both parties were reviewed and enclosed within the aforementioned Wardell Armstrong (WA) report (also enclosed).

The WA Report assessed the results from 19 No. shallow validation samples by SG in relation to current Tier 1 residential garden thresholds as part of the assessments for proposed development. The laboratory test results identified the elevated concentrations of chromium (III) in 1 No. sample, arsenic within 2 No. samples and 20 No. samples with elevated naphthalene. No asbestos fibres/fragments were found and no elevated concentrations of TPHs or dioxins were found. The WA report discussed the contaminants would not pose a significant risk to controlled waters due to the receptor sensitivity and the hydro-geological conditions.

The WA report outlined the previous assessments for chromium (III) had excavated this area as a hotspot, and the elevated arsenic had been assessed utilising 95th percentile upper confidence limit assessment as not requiring remediation. The changes in thresholds for naphthalene had not been previously considered as widely contaminated. The WA assessment identified that the exposure pathways for naphthalene would warrant placement of a 600mm inert cover within residential gardens and require inclusion of VOC mitigation measures for the proposed buildings.

Coopers Review and Ground Investigation Findings.

Coopers were requested by TWNW to review the Wardell Armstrong (WA) report in relation to the proposals for VOC vapour mitigation measures and cover systems to determine if further investigation works would be warranted. No investigation was undertaken by WA with assessments based solely on technical review of historical testing. The samples of the shallow infill were taken by Smith Grant in 2006, consisting of 19 No. samples, submitted to ALcontrol Geochem, the results of which were provided in test report No. 06/18815/02/01, dated 28 November 2006. The testing identified relatively higher concentrations of naphthalene from the PAH-16 suite analysis, with no other significant PAH's, which is relatively unusual, although can be found from volatile sources. A summary table of the results are included in Table 1 and 2, below.

Table 1: Summary Table of 2006 PAH analysis from post remediation shallow sampling by Smith Grant (samples FWT1-10)

	Tier 1 Threshold	Sample References									
		FWTA1	FWTA2	FWTA3	FWTA4	FWTA5	FWTA6	FWTA7	FWTA8	FWTA9	FWTA10
Naphthalene	2.3	3.676	2.820	4.075	2.764	3.355	2.284	3.532	3.175	2.043	3.891
Acenaphthylene	168	0.021	0.011	0.011	0.022	0.011	0.011	0.010	0.011	0.011	0.011
Acenaphthene	205	0.337	0.173	0.248	0.093	0.241	0.134	0.234	0.204	0.155	0.304
Fluorene	163	0.289	0.132	0.145	0.175	0.168	0.083	0.14	0.112	0.114	0.241
Phenanthrene	91.8	0.209	0.119	0.141	0.17	0.172	0.138	0.225	0.176	0.12	0.294
Anthracene	2260	0.027	0.01	0.01	0.01	0.01	0.01	0.018	0.01	0.01	0.02
Fluoranthene	257	<0.025	<0.025	<0.025	<0.025	0.041	0.029	0.072	0.039	0.050	<0.025
Pyrene	563	<0.022	<0.022	<0.022	<0.022	0.041	0.029	0.063	0.029	0.050	<0.022
Benz(a)anthracene	3.1	0.019	<0.012	<0.012	<0.012	0.031	0.030	0.046	0.04	0.03	<0.012
Chrysene	6	0.017	<0.01	<0.01	<0.01	0.031	0.02	0.055	0.03	0.02	<0.010
Benzo(b)fluoranthene	5.56	<0.016	<0.016	<0.016	<0.016	0.041	0.02	0.046	0.03	0.03	<0.016
Benzo(k)fluoranthene	8.5	0.033	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Benzo(a)pyrene	5	0.016	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Indeno(123cd)pyrene	3.18	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011
Dibenzo(ah)anthracene	0.76	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Benzo(ghi)perylene	10.7	0.016	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes to Table 1:

- All units are in mg/kg.
- Results in bold are above Tier 1 thresholds.

Table 2: Summary Table of 2006 PAH analysis from post remediation shallow sampling by Smith Grant (samples FWT11-19)

	Tier 1 Threshold	Sample References								
		FWTA11	FWTA12	FWTA13	FWTA14	FWTA15	FWTA16	FWTA17	FWTA18	FWTA19
Naphthalene	2.3	3.749	5.286	2.411	2.810	4.195	4.061	10.438	9.110	4.975
Acenaphthylene	168	0.011	0.022	<0.005	0.011	0.053	0.053	0.078	0.044	0.031
Acenaphthene	205	0.260	0.416	0.134	0.186	0.764	0.783	1.032	0.634	0.556
Fluorene	163	0.125	0.218	0.082	0.082	0.528	0.560	0.478	0.300	0.277
Phenanthrene	91.8	0.152	0.221	0.091	0.080	0.343	0.344	0.266	0.439	0.214
Anthracene	2260	0.01	0.01	0.01	<0.009	0.046	0.028	0.041	0.038	0.024
Fluoranthene	257	0.03	0.04	0.03	<0.025	0.03	0.057	0.04	0.117	0.027
Pyrene	563	0.03	0.04	0.03	<0.022	<0.022	0.042	0.043	0.077	0.022
Benz(a)anthracene	3.1	0.031	0.031	0.03	<0.012	0.024	0.049	0.036	0.086	0.028
Chrysene	6	0.031	0.031	0.02	<0.01	0.025	0.039	0.047	0.097	0.031
Benzo(b)fluoranthene	5.56	0.031	0.041	0.02	<0.016	0.022	0.079	0.042	0.079	0.017
Benzo(k)fluoranthene	8.5	<0.025	<0.025	<0.025	<0.025	0.028	0.06	0.04	0.045	0.039
Benzo(a)pyrene	5	<0.012	<0.012	<0.012	<0.012	0.017	0.067	0.024	0.057	0.017
Indeno(123cd)pyrene	3.18	<0.011	<0.011	<0.011	<0.011	<0.011	0.05	0.022	0.022	<0.011
Dibenzo(ah)anthracene	0.76	<0.008	<0.008	<0.008	<0.008	<0.008	0.017	<0.008	<0.008	<0.008
Benzo(ghi)perylene	10.7	<0.01	<0.01	<0.01	<0.01	0.021	0.074	0.036	0.082	0.039

Notes to Table 2:

- All units are in mg/kg.
- Results in bold are above Tier 1 thresholds.

The assessments by WA detailed the exposure pathways posed by naphthalene to impact human health were through contact in the growing medium of the gardens (dermal, hand to mouth/vegetable ingestion, secondary dusts) and indoor inhalation of vapours. The proposals detailed within the report were to include inert cover systems in gardens/landscaping and vapour mitigation measures for all plots in order to mitigate these risks.

Coopers proposed to undertake mechanical trial pits to depths of at least 1m in 20 No. positions across the site to obtain representative samples for chemical analysis to confirm the presence of naphthalene, identify the likely provenance and associated exposure risks, and propose finalised remediation/mitigation for the development. The samples were proposed for initial testing of speciated PAH compounds (PAH-16 suite) and speciated TPH by carbon ranges and aliphatic/aromatic ranges. The testing included both methods of PAH analysis (GC-Fid and GCMS) in order to disclose any variations in the methods of analysis. Subject to the test results further proposals were made to undertake a program of vapour monitoring across the site.

The enclosed trial pit logs identified the strata to consist of reworked sandstone and mudstone gravel and cobbles with occasional boulders, and rare inclusions of brick fragments and coal. The upper surface commonly contained a more weathered profile, recovered as a gravelly clay, indicative of softening from weather action and vegetation over the previous 13 years since placement.

Samples were obtained from 21 No. positions, with samples typically taken in the upper 0.5m, and lower 0.5m to allow for additional testing where needed. The shallow samples were taken in jars and vials in cool boxes, with overnight storage in fridges prior to sending to DETS for laboratory testing. The initial testing consisted of 20 No. samples, with results provided within the enclosed DETS laboratory test results, referenced 20-24980-1, dated 22 December 2020. These identified no detectable concentrations of naphthalene to the laboratories Limits of Detection (LOD) of 0.03mg/kg (by GCMS) and 0.1mg/kg (by GC-FID). The testing of the other 15 No. PAH compounds identified consistently low concentrations, at or close to the LOD. The TPH testing also identified no detectable concentrations to LOD indicating no PAH or TPH presence. A summary table of the previous and recent testing is shown in Table 3 (below) which indicates comparable results with the exception of naphthalene.

Table 3: Summary of previous and recent laboratory testing of PAH compounds.

	Tier 1 Threshold	Smith Grant - 2006			Coopers - 2020	
		Range	Mean	95 th Percentile	Range (GCMS)	Range (GC-FID)
Naphthalene	2.3	2.04-10.44	4.14	6.31	<0.03	<0.10
Acenaphthylene	168	<0.01-0.08	0.02	0.04	<0.03	<0.10
Acenaphthene	205	0.09-1.03	0.36	0.57	<0.03	<0.10
Fluorene	163	0.08-0.56	0.22	0.37	<0.03	<0.10
Phenanthrene	91.8	0.08-0.44	0.21	0.24	<0.03	<0.10
Anthracene	2260	<0.01-0.05	0.02	0.03	<0.03	<0.10
Fluoranthene	257	<0.03-0.12	0.04	0.06	<0.03-0.04	<0.10
Pyrene	563	<0.02-0.08	0.03	0.05	<0.03-0.04	<0.10
Benz(a)anthracene	3.1	<0.01-0.09	0.03	0.05	<0.03	<0.10
Chrysene	6.0	<0.01-0.10	0.03	0.05	<0.03	<0.10
Benzo(b)fluoranthene	5.56	<0.02-0.08	0.03	0.05	<0.03	<0.10
Benzo(k)fluoranthene	8.5	<0.03-0.06	0.03	0.04	<0.03	<0.10
Benzo(a)pyrene	5.0	<0.01-0.07	0.02	0.03	<0.03	<0.10
Indeno(123cd)pyrene	3.18	<0.01-0.05	0.01	0.02	<0.03	<0.10
Dibenzo(ah)anthracene	0.76	<0.01-0.02	0.01	0.01	<0.03	<0.10
Benzo(ghi)perylene	10.7	<0.01-0.08	0.02	0.04	<0.03	<0.10

Notes to Table 3:

- All units are in mg/kg.
- All laboratory results rounded to 2 decimal places for comparison.
- Mean/Statistical assessments utilised LOD for any values <LOD.

The recent results are clearly in variation to the previous findings, where enquiries were made to both laboratories to determine if any reasons for the variations may exist. ALS global (formerly ALcontrol Geochem) laboratory in Harwarden said that *"I've had it confirmed by our quality department, we do not hold records dating back that long. We hold them only for a period of 6 years unless otherwise requested, so we'd have no way of checking any data linked to the report via paperwork etc."* DETS stated *"The fact that the more recent testing by DETS using 2 completely different methods for the PAHs suggests that these results are reflective of the conditions in 2020. This would also be supported by the TPH CWG results which are showing very little in the aromatic splits."*

The material types had no odours, and as DETS have indicated multiple lines of testing have been utilised indicating there are no naphthalene risks for these materials. The testing from 2006 was unusual in identifying low PAHs other than naphthalene which is relatively unusual. The 2006 testing predated the laboratories automated reported, where on occasions inputs were entered incorrectly with the wrong units or decimal places, although given the time since the testing this would be hard to corroborate.

Given the absence of any detected concentrations of naphthalene Coopers determined that naphthalene vapour mitigation measures were not required, however further assessments would be required to determine the requirements for development to protect human health. Coopers discussed proposal for the development with Wrexham County Borough Council – Contaminated Land Officer (WCBC-CLO), with proposals for additional testing of metals to determine if other risks were present where an inert cover system would be required.

Coopers tested all 20 No. samples of the reworked sandstone/mudstone for the full CLEA suite metals, including pH, TOC and sulphates. A further 3 No. samples of topsoil from hand dug pits HDP1 to HDP3 within the existing embankment containing trees along the north western boundary were also tested for full CLEA suite metals, PAH-16, and asbestos, with the results provided within the enclosed DETS laboratory test results, referenced 20-24980-1, dated 22 December 2020.

The results are summarised in Table 2, below, showing all samples of the topsoil and 19 of the 20 samples were identified to be designated as within the chemical parameters are suitable for use within residential gardens growing medium. The sample from Coopers trial pit TP10 at 0.2m depth identified a elevated concentrations of lead (300mg/kg, above human health Tier 1 criteria of 200mg/kg), and zinc (1200mg/kg above phytotoxic thresholds of 300mg/kg). The results from these positions were significantly in variance to the other samples, indicating outliers relating to heterogeneity of the material, rather than results where statistical assessments would be applicable. Following further discussions with WCBC-CLO it was proposed to undertake further extracts to determine if the results were consistent in that location, representing a localised area of contaminants, or if this was representative of non-homogeneous variations that occur within a reworked soils that could be assessed a representative of the materials site wide.

Coopers contacted the laboratory to request further extracts and analysis of the sample, however there was insufficient sample volume to undertake further testing. The same strata was however sampled within trial pit TP10 at a depth of 0.8m, which was therefore commissioned for testing of 4 No. extracts of lead and zinc in addition to a nitric acid extract of the zinc (to determine relative uptake by plants for phytotoxic risks). The results of the further testing are provided in the enclosed DETS report No. 21-00599, dated 18 January 2021, identifying lead concentrations between

20mg/kg to 26mg/kg, zinc concentrations of 48mg/kg to 53mg/kg, and nitric acid soluble zinc of 36mg/kg.

The results of the further testing indicate this is not localised to a general area, and are more indicative of non-homogenous materials, where the results of the material as a whole would be applicable. The enclosed statistical analysis of the results indicates a 95th percentile for lead of 82mg/kg, and zinc of 311mg/kg, albeit without outliers due to heterogeneity. The assessments indicate the risks posed by the soils are very low when considering the materials will not be present at shallow depths within gardens, with proposals to import a minimum of 300mm of subsoil/topsoil for placement in the gardens to provide suitable planting medium. This would therefore designate the contaminated land requirements as comparable with other phases of the development on the former steelworks and the original assessments of the risks posed to the future residents.

Further details of the development phase requirements for testing and placement of imported soils are provided within the enclosed Coopers Build Phase Remediation and Validation Strategy, referenced 7565bprs, dated 21 January 2021.

Gas Mitigation Requirements

Given the absence of any identified naphthalene it is clear that protection measures for naphthalene vapour are not required. The original investigation by Smith Grant (SG) detailed that ground gas monitoring was undertaken across the wider redevelopment of the steel works, with identification of elevated concentrations of carbon dioxide within the areas of the former upper blast furnace, coke ovens, and wonder bank tip, inferred as indicative of the presence of biodegradable materials. No significant methane concentrations were identified.

None of the areas where elevated carbon dioxide was found during the gas monitoring were within or close to the site, however the original assessments recommended the use of precautionary gas mitigation measures across the site due to the absence of post remediation monitoring and risks posed by migration pathways from coal mining beneath the site. The proposals were therefore for inclusion of Characteristic Situation 2 (CS2) mitigation measures for all houses, and were designated for all areas of the site and previous adjacent developments. As detailed within the environmental data supplied within the WA report, the site is within an area where 3% to 5% of properties are estimated to be above the radon action level, where basic radon protection measures are required. The requirements for basic radon protection are largely comparable with those for CS2, although a higher specification of membranes are required for CS2.

The proposals are therefore to include Characteristic Situation 2 gas mitigation measures, in accordance with BS8485:2015+A1:2019 in accordance with the original proposals. The gas mitigation measure designs and verification proposals are provided in the enclosed Coopers Build Phase Remediation and Validation Strategy, referenced 7565bprs, dated 21 January 2021.

Conclusions

The site has been subject to additional investigation and assessments to confirm the ground conditions and requirements for development. These works confirm the previous assessments that human health risks associated with contaminated land are negligible, with the requirements for the development to import and verify a suitable minimum 300mm of topsoil/subsoil for planting on the existing strata.

Gas mitigation measures to the equivalent of Characteristic Situation 2 are required for all properties with associated verification. The design and verification requirements for the properties are included within the enclosed Coopers Build Phase Remediation and Validation Strategy.

Yours Sincerely

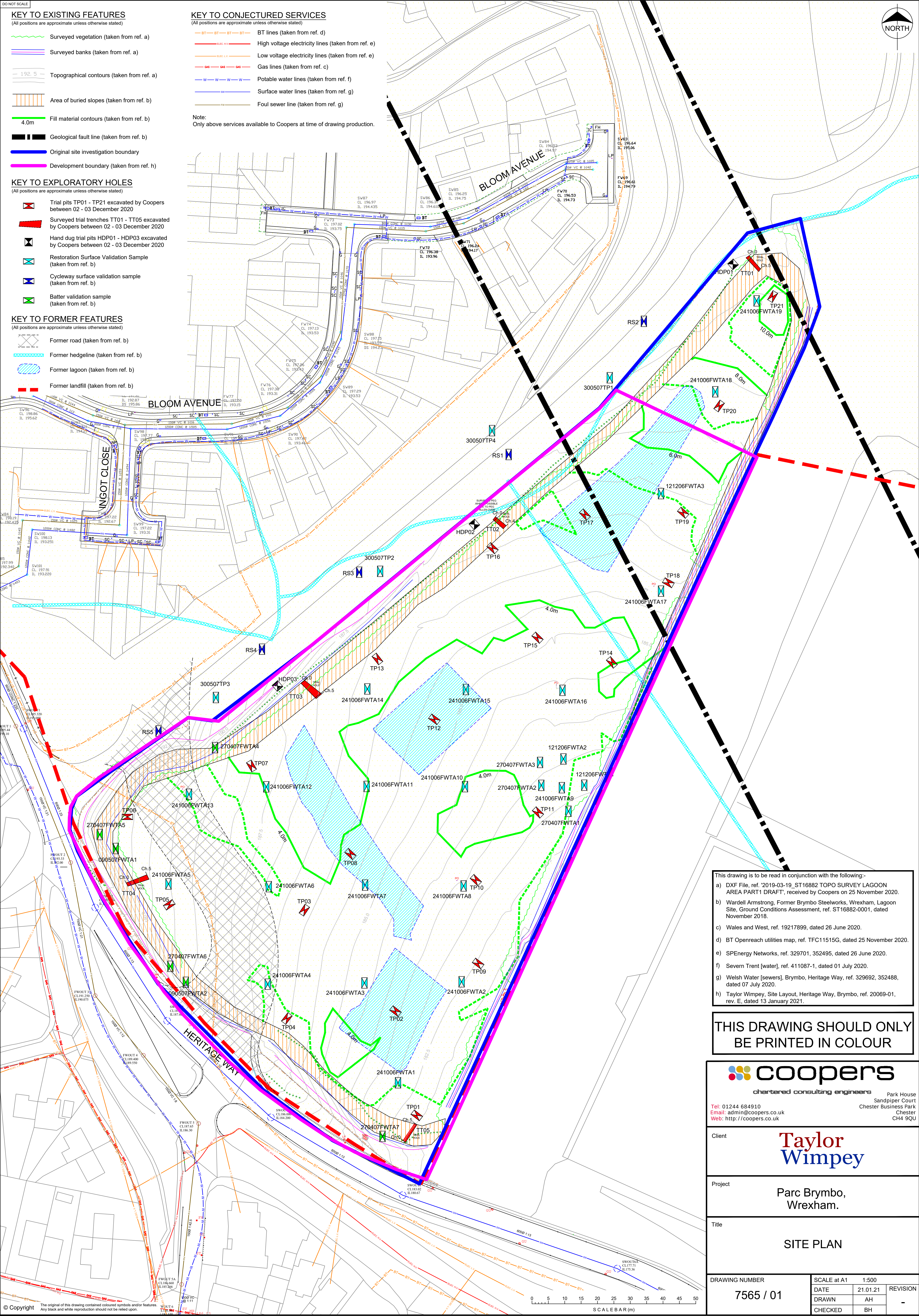


Ben Hill
BSc (Hons), CSci. MEnvSc, FGS
Senior Engineering Geologist

For COOPERS

ENCS:

- Coopers Drawing No. 7565/01 – Site Plan.
- Coopers Trial Pit Logs, referenced TP01 to TP21, excavated 2 December 2020.
- DETS Chemical Certificate of Analysis, referenced 20-24980-1, dated 22 December 2020.
- DETS Chemical Certificate of Analysis, referenced 21-00599, dated 18 January 2021.
- Statistical Calculation Tool Print Sheets.
- Coopers “*Build Phase Remediation and Validation Strategy*”, referenced 7565BPRS, dated 21 January 2021.
- Wardell Armstrong “*Ground Conditions Assessment*”, referenced ST16882-001, dated November 2018.



KEY TO EXISTING FEATURES

(All positions are approximate unless otherwise stated)

- Surveyed vegetation (taken from ref. a)
- Surveyed banks (taken from ref. a)
- Topographical contours (taken from ref. a)
- Area of buried slopes (taken from ref. b)
- Fill material contours (taken from ref. b)
- Geological fault line (taken from ref. b)
- Original site investigation boundary
- Development boundary (taken from ref. h)

KEY TO EXPLORATORY HOLES

(All positions are approximate unless otherwise stated)

- Trial pits TP01 - TP21 excavated by Coopers between 02 - 03 December 2020
- Surveyed trial trenches TT01 - TT05 excavated by Coopers between 02 - 03 December 2020
- Hand dug trial pits HDP01 - HDP03 excavated by Coopers between 02 - 03 December 2020
- Restoration Surface Validation Sample (taken from ref. b)
- Cycleway surface validation sample (taken from ref. b)
- Batter validation sample (taken from ref. b)

KEY TO FORMER FEATURES

(All positions are approximate unless otherwise stated)

- Former road (taken from ref. b)
- Former hedgeline (taken from ref. b)
- Former lagoon (taken from ref. b)
- Former landfill (taken from ref. b)

KEY TO CONJECTURED SERVICES

(All positions are approximate unless otherwise stated)

- BT lines (taken from ref. d)
- High voltage electricity lines (taken from ref. e)
- Low voltage electricity lines (taken from ref. e)
- Gas lines (taken from ref. c)
- Potable water lines (taken from ref. f)
- Surface water lines (taken from ref. g)
- Foul sewer line (taken from ref. g)

Note:
Only above services available to Coopers at time of drawing production.

- This drawing is to be read in conjunction with the following:-
- a) DXF File, ref. '2019-03-19_ST16882 TOPO SURVEY LAGOON AREA PART1 DRAFT', received by Coopers on 25 November 2020.
 - b) Wardell Armstrong, Former Brymbo Steelworks, Wrexham, Lagoon Site, Ground Conditions Assessment, ref. ST16882-0001, dated November 2018.
 - c) Wales and West, ref. 19217899, dated 26 June 2020.
 - d) BT Openreach utilities map, ref. TFC11515G, dated 25 November 2020.
 - e) SP Energy Networks, ref. 329701, 352495, dated 26 June 2020.
 - f) Severn Trent [water], ref. 411087-1, dated 01 July 2020.
 - g) Welsh Water [sewers], Brymbo, Heritage Way, ref. 329692, 352488, dated 07 July 2020.
 - h) Taylor Wimpey, Site Layout, Heritage Way, Brymbo, ref. 20069-01, rev. E, dated 13 January 2021.

**THIS DRAWING SHOULD ONLY
BE PRINTED IN COLOUR**

coopers
chartered consulting engineers

Tel: 01244 684910
Email: admin@coopers.co.uk
Web: http://coopers.co.uk

Park House
Sandpiper Court
Chester Business Park
Chester
CH4 9QU

Client	Taylor Wimpey		
Project	Parc Brymbo, Wrexham.		
Title	SITE PLAN		
DRAWING NUMBER	7565 / 01	SCALE at A1	1:500
DATE	21.01.21	REVISION	-
DRAWN	AH	CHECKED	BH

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP01			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.10m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.30	JV				(1.10) 1.10	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of various lithologies, predominantly sandstone, rare brick and concrete. *Assumed as medium dense to dense.			
						Complete at 1.10m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. Surface water seepage only during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP02			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.20m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.40	JV				(1.10)	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of various lithologies, predominantly sandstone, rare brick and coal. *Assumed as medium dense to dense.			
0.90	JV				1.10	Complete at 1.20m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. Surface water seepage only during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP03			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.30m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.30	JV				0.05	MADEGROUND. Grass over, brown, sandy, gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular, fine to coarse of sandstone.			
					(1.05)	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of predominantly sandstone, rare brick and coal. *Assumed as medium dense to dense.			
0.90	B		Seepage during excavation(1) at 1.20m.		1.10	Complete at 1.30m		∇1	
						Remarks Location CAT scanned prior to excavation. Spalling of larger material causing local instability, otherwise stable. Groundwater seepage at 1.20m during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25	Logged By ST	Checked By	

 coop ers chartered consulting engineers				Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk		Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP04	
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.10m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.30	JV				0.05	MADEGROUND. Grass over, brown, sandy, gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular, fine to coarse of sandstone.			
					(1.05)	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of predominantly sandstone, rare brick and coal. Sand is fine to coarse. *Assumed as medium dense to dense.			
0.80	B				1.10	Complete at 1.10m			
									
Remarks Location CAT scanned prior to excavation. Sides stable during excavation. Spalling only. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.									
Scale (approx) 1:25					Logged By ST			Checked By	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP05			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.10m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.30	JV				0.05	MADEGROUND. Grass over, brown, slightly sandy, gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular, fine to coarse of sandstone.			
					(1.05)	MADEGROUND. Brown, clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of predominantly sandstone, rare brick and coal. Low boulder content. *Assumed as medium dense to dense.			
0.90	B				1.10	Complete at 1.10m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. Spalling only. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE			Trial Pit Number TP06		
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.20m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.20	JV				0.10	MADEGROUND. Grass over, brown, slightly sandy, gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular, fine to coarse of sandstone.			
0.80	B				1.10	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of predominantly sandstone, rare brick coal and rare fused material. *Assumed as medium dense to dense.			
					1.20	Complete at 1.20m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. Spalling only. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP07			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.20m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.30	JV				0.05	MADEGROUND. Grass over, brown, slightly sandy, gravelly CLAY.			
					(0.75)	MADEGROUND. Grey, sandy, very clayey, angular to sub-angular, fine to coarse GRAVEL with a moderate cobble content. *Assumed as medium dense to dense.			
0.90	B				0.80	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLES. Sand is fine to coarse. Gravel is predominantly sandstone. *Assumed as medium dense to dense.			
					(0.40)				
					1.20	Complete at 1.20m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP08			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.10m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.40	JV				0.05	MADEGROUND. Grass over, brown, slightly sandy, gravelly CLAY.			
					(0.85)	MADEGROUND. Grey, sandy, very clayey, angular to sub-angular, fine to coarse GRAVEL with a moderate cobble content. Sand is fine to coarse. Gravel is predominantly sandstone. *Assumed as medium dense to dense.			
1.00	B		Seepage during excavation(1) at 1.00m.		0.90	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of various lithologies including sandstone, coal and brick. *Assumed as medium dense to dense.			∇1
					1.10	Complete at 1.10m			
					Remarks Location CAT scanned prior to excavation. Sides stable during excavation. Seepage at 1.00m during excavation. Sheen on surface. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.				
					Scale (approx) 1:25		Logged By ST		Checked By

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP09			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.20m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.30	JV				0.05	MADEGROUND. Grass over, brown, slightly sandy, gravelly CLAY.			
					(1.15)	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE. Sand is fine to coarse. Gravel is predominantly sandstone. *Assumed as medium dense to dense.			
0.90	B				1.20	Complete at 1.20m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. Seepage at 1.00m during excavation. Sheen on surface. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP10			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.10m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.20	JV				0.10	MADEGROUND. Grass over, brown, slightly sandy, gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular, fine to coarse of various lithologies including sandstone.			
0.80	B				1.00	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of predominantly sandstone with rare brick and coal. *Assumed as medium dense to dense.			
					1.10	Complete at 1.10m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. Spalling only. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP11			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.30m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.30	JV				(0.65)	MADEGROUND. Grass over, brown, sandy, slightly gravelly CLAY.			
0.90	B				0.65 (0.65)	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of sandstone. *Assumed as medium dense to dense.			
					1.30	Complete at 1.30m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP12			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.20m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.30	JV				0.05	MADEGROUND. Grass over, brown, sandy, slightly gravelly CLAY.			
					(1.15)	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE. Sand is fine to coarse. Gravel is predominantly sandstone with rare brick, ceramic, metal wire and coal. *Assumed as medium dense to dense.			
0.90	B				1.20	Complete at 1.20m			
					Remarks Location CAT scanned prior to excavation. Sides stable during excavation. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.				
					Scale (approx) 1:25		Logged By ST		Checked By

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP13			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.20m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.20	JV				0.05	MADEGROUND. Grass over, brown, sandy, slightly gravelly CLAY.			
0.80	B				(1.15)	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of various lithologies predominantly sandstone with rare coal. Low boulder content. *Assumed as medium dense to dense.			
					1.20	Complete at 1.20m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

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Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.40m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.30	JV				0.01	MADEGROUND. Grass over, brown, sandy, slightly gravelly CLAY.			
0.70	B				(1.39)	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of various lithologies predominantly sandstone with rare brick fragments, coal and cobbles of whole brick. *Assumed as medium dense to dense.			
					1.40	Complete at 1.40m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP15			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.40m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.10	JV				0.05	MADEGROUND. Grass over, brown, sandy, gravelly CLAY.			
0.80	B				(1.35)	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of various lithologies predominantly sandstone with rare brick, coal, slate and ceramic. Low boulder content of sandstone. *Assumed as medium dense to dense.			
					1.40	Complete at 1.40m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP16			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.30m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.20	JV				0.05	MADEGROUND. Grass over, brown, slightly sandy, gravelly CLAY.			
0.70	B				(1.25)	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of various lithologies including predominantly sandstone, rare brick and coal. *Assumed as medium dense to dense.			
					1.30	Complete at 1.30m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

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Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.50m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565			
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1			
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water		
0.20	JV				0.05	MADEGROUND. Grass over, brown, slightly sandy, gravelly CLAY.					
					(0.45)	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLE of sandstone. *Assumed as medium dense to dense.					
0.60	B				0.50	MADEGROUND. Stiff, grey, slightly sandy, gravelly, silty CLAY. Sand is fine to medium. Gravel is angular to sub-rounded, fine to coarse of various lithologies including sandstone. *Assumed as medium dense to dense.					
					(0.90)						
1.50	B				1.40 (0.10) 1.50	MADEGROUND. Brown, very sandy, angular to sub-angular, fine to coarse GRAVEL of sandstone. Low cobble content. *Assumed as medium dense to dense.					
						Complete at 1.50m					
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.					
						Scale (approx) 1:25		Logged By ST		Checked By	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE				Trial Pit Number TP18	
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions Location (Observed measurements)		Ground Level (mOD) Dates 02/12/2020		Client Taylor Wimpey North West		Job Number 7565	
						Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.10	JV				0.20	MADEGROUND. Grass over, brown, slightly sandy, gravelly CLAY.			
0.50	B				1.10	MADEGROUND. Grey, very clayey, sandy, angular to sub-rounded, fine to coarse GRAVEL of various lithologies, predominantly sandstone with rare coal. Moderate cobble content. *Assumed as medium dense to dense.			
					1.30	Complete at 1.30m			
Plan • • • • • • • • • •						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25	Logged By ST	Checked By	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP19			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.30m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.30	JV				0.05	MADEGROUND. Grass over, brown, slightly sandy, gravelly CLAY.			
					(1.25)	MADEGROUND. Brown, slightly clayey, very sandy, angular to sub-angular, fine to coarse GRAVEL of sandstone. Sand is fine to coarse. *Assumed as medium dense to dense.			
0.80	B				1.30	Complete at 1.30m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25	Logged By ST	Checked By	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP20			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 1.20m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.20	JV				0.10	MADEGROUND. Grass over, brown, slightly sandy, gravelly CLAY.			
0.80	B				1.10	MADEGROUND. Stiff, grey, slightly sandy, very gravelly CLAY with a low cobble content of sandstone. Sand is fine to coarse. Gravel is angular to sub-angular, fine to coarse of various lithologies, predominantly sandstone.			
					1.20	Complete at 1.20m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. No groundwater encountered during excavation. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	

 Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk				Site PARC BRYMBO, WREXHAM - LAGOON SITE		Trial Pit Number TP21			
Machine : 10 Tonne Tracked Excavator Method : Mechanical Excavation		Dimensions 1.50 x 0.60 x 0.90m		Ground Level (mOD)		Client Taylor Wimpey North West		Job Number 7565	
		Location (Observed measurements)		Dates 02/12/2020		Engineer Coopers (Chester) Ltd		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.20	JV				(0.40)	Stiff, grey, slightly sandy, silty, very gravelly CLAY. Sand is fine to medium. Gravel is sub-angular to sub-rounded, fine to coarse of sandstone.			
0.50	B				(0.50)	MADEGROUND. Brown, sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLES of sandstone. Sand is fine to coarse. *Assumed as medium dense to dense.			
					0.90	Complete at 0.90m			
						Remarks Location CAT scanned prior to excavation. Sides stable during excavation. No groundwater encountered during excavation. *Based upon trenchside stability characteristics. Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy. Trial pit backfilled with arisings upon completion.			
						Scale (approx) 1:25		Logged By ST	



Certificate of Analysis

Certificate Number 20-24980-1

Issued: 22-Dec-20

Client Coopers (Chester) Ltd
Park House
Sandpiper Court
Chester Business Park
Chester
CH4 9QU

Our Reference 20-24980-1

Client Reference 7565

Order No 8863-ST

Contract Title (7565) Parc Brymbo, Wrexham - Lagoon Site

Description 23 Soil samples.

Date Received 07-Dec-20

Date Started 07-Dec-20

Date Completed 22-Dec-20

Test Procedures Identified by prefix DETSn (details on request).

Notes **This report supersedes 20-24980, extra testing.**

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "A. Fenwick", written over a light blue circular stamp.

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Matrix Descriptions

Our Ref 20-24980-1

Client Ref 7565

Contract Title (7565) Parc Brymbo, Wrexham - Lagoon Site

Sample ID	Depth	Lab No	Completed	Matrix Description
TP01	0.3	1772725	14/12/2020	Dark brown gravelly, sandy CLAY
TP02	0.4	1772726	14/12/2020	Dark brown gravelly, very sandy CLAY
TP03	0.3	1772727	14/12/2020	Brown gravelly, sandy CLAY
TP04	0.3	1772728	14/12/2020	Brown gravelly, very sandy CLAY
TP05	0.3	1772729	14/12/2020	Brown gravelly, very sandy CLAY
TP06	0.2	1772730	14/12/2020	Dark brown gravelly, sandy CLAY
TP07	0.3	1772731	14/12/2020	Dark brown gravelly, very sandy CLAY
TP08	0.4	1772732	14/12/2020	Brown gravelly, sandy CLAY
TP09	0.3	1772733	14/12/2020	Dark brown gravelly, very sandy CLAY
TP10	0.2	1772734	14/12/2020	Dark brown gravelly, very sandy CLAY
TP11	0.3	1772735	14/12/2020	Dark brown gravelly, sandy CLAY
TP12	0.3	1772736	14/12/2020	Dark brown gravelly, sandy CLAY
TP13	0.2	1772737	14/12/2020	Dark brown gravelly, sandy CLAY
TP14	0.3	1772738	14/12/2020	Dark brown gravelly, sandy CLAY
TP16	0.2	1772739	14/12/2020	Dark brown gravelly, sandy CLAY
TP17	0.2	1772740	14/12/2020	Dark brown gravelly, sandy CLAY
TP18	0.1	1772741	14/12/2020	Dark brown gravelly, sandy CLAY
TP19	0.3	1772742	14/12/2020	Dark brown gravelly, sandy CLAY
TP20	0.2	1772743	14/12/2020	Dark brown gravelly, sandy CLAY
TP21	0.2	1772744	14/12/2020	Dark brown gravelly, sandy CLAY
HDP1	0.1	1772745	14/12/2020	Dark brown very sandy CLAY including much rootlets
HDP2	0.1	1772746	14/12/2020	Dark brown very sandy CLAY including much rootlets
HDP3	0.1	1772747	14/12/2020	Dark brown very sandy CLAY including much rootlets

Summary of Chemical Analysis

Soil Samples

Our Ref 20-24980-1

Client Ref 7565

Contract Title (7565) Parc Brymbo, Wrexham - Lagoon Site

Lab No	1772725	1772726	1772727	1772728	1772729	1772730
Sample ID	TP01	TP02	TP03	TP04	TP05	TP06
Depth	0.30	0.40	0.30	0.30	0.30	0.20
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	6.9	7.6	8.2	5.8	11	8.1
Beryllium	DETSC 2301#	0.2	mg/kg	0.7	0.8	1.4	1.0	1.0	1.1
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.3	0.4	< 0.2	< 0.2	< 0.2	0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.2	< 0.1	0.1	< 0.1	0.1
Chromium	DETSC 2301#	0.15	mg/kg	190	150	23	29	17	28
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	22	22	19	16	15	20
Lead	DETSC 2301#	0.3	mg/kg	28	32	9.2	9.9	9.2	15
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	23	31	32	28	28	32
Selenium	DETSC 2301#	0.5	mg/kg	0.7	2.4	< 0.5	< 0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	33	120	25	24	20	26
Zinc	DETSC 2301#	1	mg/kg	65	66	61	49	45	52
Inorganics									
pH	DETSC 2008#		pH	10.4	9.7	7.8	7.8	8.0	8.1
Cyanide, Total	DETSC 2130#	0.1	mg/kg	1.4	< 0.1	9.5	< 0.1	1.0	< 0.1
FOC	DETSC 2084#	0.001		0.007	0.010	0.003	0.003	0.003	0.005
Total Organic Carbon	DETSC 2084#	0.5	%	0.7	1.0	< 0.5	< 0.5	< 0.5	< 0.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	32	31	21	< 10	< 10	< 10
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.05	0.04	0.02	0.02	0.02	0.02
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03

Summary of Chemical Analysis

Soil Samples

Our Ref 20-24980-1

Client Ref 7565

Contract Title (7565) Parc Brymbo, Wrexham - Lagoon Site

Lab No	1772725	1772726	1772727	1772728	1772729	1772730
Sample ID	TP01	TP02	TP03	TP04	TP05	TP06
Depth	0.30	0.40	0.30	0.30	0.30	0.20
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 20-24980-1

Client Ref 7565

Contract Title (7565) Parc Brymbo, Wrexham - Lagoon Site

Lab No	1772731	1772732	1772733	1772734	1772735	1772736
Sample ID	TP07	TP08	TP09	TP10	TP11	TP12
Depth	0.30	0.40	0.30	0.20	0.30	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	5.1	6.4	6.4	9.1	7.5	7.5
Beryllium	DETSC 2301#	0.2	mg/kg	0.5	0.8	0.7	0.7	0.8	0.8
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2	< 0.2	0.2	0.2	< 0.2	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.1	0.2	0.2	7.7	0.2	0.4
Chromium	DETSC 2301#	0.15	mg/kg	23	22	18	86	60	21
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	15	19	20	57	23	20
Lead	DETSC 2301#	0.3	mg/kg	13	17	22	300	27	26
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	0.10	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	20	27	24	100	26	28
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	16	22	18	20	29	24
Zinc	DETSC 2301#	1	mg/kg	53	50	55	1200	55	88
Inorganics									
pH	DETSC 2008#		pH	8.2	8.0	8.1	8.3	8.7	8.0
Cyanide, Total	DETSC 2130#	0.1	mg/kg	1.2	< 0.1	1.9	< 0.1	0.3	< 0.1
FOC	DETSC 2084#	0.001		0.005	0.009	0.007	0.007	0.008	0.004
Total Organic Carbon	DETSC 2084#	0.5	%	< 0.5	0.9	0.7	0.7	0.8	< 0.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	27	17	16	24	17	26
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.02	0.02	0.02	0.02	0.03	0.03
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03

Summary of Chemical Analysis

Soil Samples

Our Ref 20-24980-1

Client Ref 7565

Contract Title (7565) Parc Brymbo, Wrexham - Lagoon Site

Lab No	1772731	1772732	1772733	1772734	1772735	1772736
Sample ID	TP07	TP08	TP09	TP10	TP11	TP12
Depth	0.30	0.40	0.30	0.20	0.30	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 20-24980-1

Client Ref 7565

Contract Title (7565) Parc Brymbo, Wrexham - Lagoon Site

Lab No	1772737	1772738	1772739	1772740	1772741	1772742
Sample ID	TP13	TP14	TP16	TP17	TP18	TP19
Depth	0.20	0.30	0.20	0.20	0.10	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	6.3	9.2	4.0	6.5	6.9	6.0
Beryllium	DETSC 2301#	0.2	mg/kg	0.8	0.9	0.6	0.8	0.7	0.7
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2	0.4	< 0.2	< 0.2	< 0.2	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.1	0.3	< 0.1	0.1	0.1	0.2
Chromium	DETSC 2301#	0.15	mg/kg	18	70	13	20	19	21
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	18	27	13	16	20	17
Lead	DETSC 2301#	0.3	mg/kg	13	39	5.2	13	15	16
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	26	31	21	29	28	25
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	19	29	14	18	19	18
Zinc	DETSC 2301#	1	mg/kg	50	85	37	41	47	39
Inorganics									
pH	DETSC 2008#		pH	7.9	8.6	7.9	7.9	8.1	8.1
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.7	< 0.1	0.4	< 0.1	< 0.1	< 0.1
FOC	DETSC 2084#	0.001		0.004	0.009	0.004	0.004	0.006	0.005
Total Organic Carbon	DETSC 2084#	0.5	%	< 0.5	0.9	< 0.5	< 0.5	0.6	0.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	19	28	16	23	16	22
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.02	0.03	0.02	0.02	0.02	0.02
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03

Summary of Chemical Analysis

Soil Samples

Our Ref 20-24980-1

Client Ref 7565

Contract Title (7565) Parc Brymbo, Wrexham - Lagoon Site

Lab No	1772737	1772738	1772739	1772740	1772741	1772742
Sample ID	TP13	TP14	TP16	TP17	TP18	TP19
Depth	0.20	0.30	0.20	0.20	0.10	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 20-24980-1

Client Ref 7565

Contract Title (7565) Parc Brymbo, Wrexham - Lagoon Site

Lab No	1772743	1772744	1772745	1772746	1772747
Sample ID	TP20	TP21	HDP1	HDP2	HDP3
Depth	0.20	0.20	0.10	0.10	0.10
Other ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units					
Metals								
Arsenic	DETSC 2301#	0.2	mg/kg	8.8	7.7	4.7	9.9	7.0
Beryllium	DETSC 2301#	0.2	mg/kg	0.7	0.8	0.3	0.6	0.4
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2	0.3	1.2	2.0	0.8
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.2	0.3	0.7	0.3
Chromium	DETSC 2301#	0.15	mg/kg	38	57	17	42	31
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	22	30	13	32	22
Lead	DETSC 2301#	0.3	mg/kg	24	22	46	95	71
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	0.10	0.06
Nickel	DETSC 2301#	1	mg/kg	26	31	8.8	23	15
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	0.8	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	22	25	14	29	23
Zinc	DETSC 2301#	1	mg/kg	42	72	120	160	75
Inorganics								
pH	DETSC 2008#		pH	8.2	8.9	6.2	7.4	6.8
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.2	< 0.1	0.3	0.3	0.2
FOC	DETSC 2084#	0.001		0.007	0.024	0.062	0.068	0.056
Total Organic Carbon	DETSC 2084#	0.5	%	0.7	2.4	6.2	6.8	5.6
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	39	47	17	30	34
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.04	0.06	0.06	0.08	0.06
Petroleum Hydrocarbons								
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10
PAHs								
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03

Summary of Chemical Analysis

Soil Samples

Our Ref 20-24980-1

Client Ref 7565

Contract Title (7565) Parc Brymbo, Wrexham - Lagoon Site

Lab No	1772743	1772744	1772745	1772746	1772747
Sample ID	TP20	TP21	HDP1	HDP2	HDP3
Depth	0.20	0.20	0.10	0.10	0.10
Other ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units					
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.04	0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.04	0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1			
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6			
Phenols								
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	0.7	0.6	0.6

Summary of Asbestos Analysis Soil Samples

Our Ref 20-24980-1

Client Ref 7565

Contract Title (7565) Parc Brymbo, Wrexham - Lagoon Site

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1772745	HDP1 0.10	SOIL	NAD	none	Darryl Fletcher
1772746	HDP2 0.10	SOIL	NAD	none	Darryl Fletcher
1772747	HDP3 0.10	SOIL	NAD	none	Darryl Fletcher

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 20-24980-1
 Client Ref 7565
 Contract (7565) Parc Brymbo, Wrexham - Lagoon Site

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1772725	TP01 0.30 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772726	TP02 0.40 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772727	TP03 0.30 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772728	TP04 0.30 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772729	TP05 0.30 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772730	TP06 0.20 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772731	TP07 0.30 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772732	TP08 0.40 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772733	TP09 0.30 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772734	TP10 0.20 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772735	TP11 0.30 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772736	TP12 0.30 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772737	TP13 0.20 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772738	TP14 0.30 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772739	TP16 0.20 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772740	TP17 0.20 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772741	TP18 0.10 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772742	TP19 0.30 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772743	TP20 0.20 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772744	TP21 0.20 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772745	HDP1 0.10 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772746	HDP2 0.10 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		
1772747	HDP3 0.10 SOIL	02/12/20	GJ 250ml x2, GJ 60ml		

Key: G-Glass J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETS 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETS 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETS 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETS 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETS 2076	Sulphate Aqueous Extract as SO ₄	mg/l	10	Air Dried	No	Yes	Yes
DETS 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETS 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETS 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETS 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETS 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETS 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETS 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETS 2321	Total Sulphate as SO ₄	%	0.01	Air Dried	No	Yes	Yes
DETS 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETS 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETS 2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETS 2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETS 2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETS 2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETS 2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETS 2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETS 2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETS 2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETS 2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETS 2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETS 2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETS 2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETS 2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETS 2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETS 2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETS 3072	Alk/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETS 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETS 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETS 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETS 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETS 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETS 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETS 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETS 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 062	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETS 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETS 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

End of Report



Certificate of Analysis

Certificate Number 21-00599

Issued: 18-Jan-21

Client Coopers (Chester) Ltd
Park House
Sandpiper Court
Chester Business Park
Chester
CH4 9QU

Our Reference 21-00599

Client Reference 7565

Order No 8888 - ST

Contract Title (7565) Parc Brymbo - Lagoon Site

Description 5 Soil samples.

Date Received 14-Jan-21

Date Started 14-Jan-21

Date Completed 18-Jan-21

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "A Fenwick", is written over a light blue horizontal line.

Adam Fenwick
Contracts Manager





Summary of Chemical Analysis Soil Samples

Our Ref 21-00599

Client Ref 7565

Contract Title (7565) Parc Brymbo - Lagoon Site

Lab No	1786263	1786264	1786265	1786266	1786267
Sample ID	TP10	TP10 Sub Sample 1	TP10 Sub Sample 2	TP10 Sub Sample 3	TP10 Sub Sample 4
Depth	0.80	0.80	0.80	0.80	0.80
Other ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/12/2020	02/12/2020	02/12/2020	02/12/2020	02/12/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units					
Metals								
Lead	DETSC 2301#	0.3	mg/kg		21	20	26	22
Zinc, Nitric Acid Soluble	DETSC 2308*	1	mg/kg	36				
Zinc	DETSC 2301#	1	mg/kg		49	48	53	51

Information in Support of the Analytical Results

Our Ref 21-00599
 Client Ref 7565
 Contract (7565) Parc Brymbo - Lagoon Site

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1786263	TP10 0.80 SOIL	02/12/20	PG		
1786264	TP10 Sub Sample 1 0.80 SOIL	02/12/20	PG		
1786265	TP10 Sub Sample 2 0.80 SOIL	02/12/20	PG		
1786266	TP10 Sub Sample 3 0.80 SOIL	02/12/20	PG		
1786267	TP10 Sub Sample 4 0.80 SOIL	02/12/20	PG		

Key: P-Plastic G-Bag

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

Client/client ref	TWNW	
Project ref	7565	
Site ref	Heritage Way, Brymbo	
Data description		
Contaminant(s)	Lead, Zinc	
Test scenario	Planning: is true mean lower than critical concentration ($\mu < C_c$)?	▼
Date	21 January 2021	
User details		

Statistics calculator (version 1)

Developed by:



On behalf of:



Input data

This spreadsheet has been produced based on the document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration (CIEH/CL:AIRE, 2008)'. Users of this spreadsheet should always refer to this guidance, the CIEH Statistics Calculator User Manual and to relevant guidance on UK legislation and policy, in order to understand how the procedure should be applied in an appropriate context.

Neither the CIEH nor ESI Ltd (ESI) promises that the spreadsheet will provide any particular facilities or functions. The user must ensure that the spreadsheet meets their needs and they remain solely responsible for the competent use of the spreadsheet. Users are entirely responsible for the consequences of any use of the spreadsheet, neither the CIEH nor ESI provides any warranty about the fitness for purpose or performance of any part of the spreadsheet. We do not promise that the media will always be free from defects, computer viruses, software locks or other similar code or that the operation of the spreadsheet will be uninterrupted or error free. The user should carry out all necessary virus checks prior to installing on their computing system.

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Client/client ref: TWWW
Project ref: 7565
Site ref: Heritage Way, Brymbo
Data description:
Contaminant(s): Lead, Zinc
Test scenario: Planning
Date: 21 January 2021
User details:

Lead	Zinc																
200	300																
Notes																	
Sample size, n	24	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sample mean, $\bar{x}$	31.0208333	102.208333	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Standard deviation, s	57.853007	234.185541															
Number of non-detects	0	0															
Set non-detect values to:	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit
Outliers?	Yes	Yes															
Distribution	Non-normal	Non-normal															
Statistical approach	Auto Chebychev	Auto Chebychev	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto
Test scenario:	Planning: is true mean lower than critical concentration ($\mu < C_c$)?																
t statistic, t_0 (or k_0)	-14.30911744	-4.137647918															
Upper confidence limit (on true mean concentration, μ)	82.4959236	310.576446															
Evidence level	100%	94%															
Base decision on:	evidence level	evidence level															
Result	$\mu < C_c$	$\mu \approx \geq C_c$															
Select dataset	☒ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y	☐ Y
Back to data	Go to outlier test	Go to normality test	Show individual summary														

Our ref: 7565bprs

Build Phase Remediation
and Validation Strategy
for “Lagoon Site”, Parc Brymbo,
Wrexham

For: Taylor Wimpey North West
Washington House,
Birchwood Park Avenue,
Birchwood,
Warrington,
WA3 6GR

21 January 2021

Build Phase Remediation and Validation Strategy for “Lagoon Site”,
Parc Brymbo, Wrexham

Document Verification

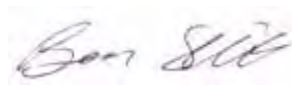
Project Title	Parc Brymbo, Wrexham
Project Number	7565
Document Title	Build Phase Remediation and Validation Strategy for “Lagoon Site”, Parc Brymbo, Wrexham
Document Number	7565bprs
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Prepared by



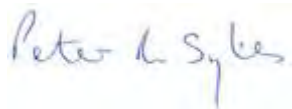
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Approved By:



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Document Revision

Report Reference	Date	Description	Prepared	Reviewed/Checked	Approved
7565bprs	21/01/2021	Build Phase Remediation Strategy	SLD	BWH	PRS

This report has been prepared for and on behalf of our clients, in accordance with the terms and conditions of the appointment agreement with Coopers. Other than where specifically allowed for in the said appointment agreement, any other party using this report for any purpose whatsoever does so at their own risk and any duty of care to that party is specifically excluded.

Build Phase Remediation and Validation Strategy for “*Lagoon Site*”,
Parc Brymbo, Wrexham

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Build Phase Remediation and Validation Strategy for “*Lagoon Site*”, Parc Brymbo, Wrexham

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Appendix

<u>Reference</u>	<u>Title</u>
Coopers Drawing No. 7565/BPRP.	Build Phase Remediation and Validation Plan.
Coopers Drawing No. 7565-LRH-GS2A-RF-02.	Typical Gas Precaution Detail –Stiff Raft.
Visqueen Product Specification Sheets.	Gas Barrier.
Coopers Drawing No. 2019-SD-GM-CU	Gas Membrane Corner Detail
Coopers Drawing No. 2019-SD-GM-DT	Door Threshold Detail
Coopers Drawing No. 2019-SD-GM-SE	Service Entry Detail
Coopers Drawing No. 2019-SD-GM-DSE	Dual Service Entry Detail

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1.0 Site Location and Proposed Development

- 1.1 The proposed development is located on open land to the north of Heritage Way, in the village of in the villages of Tanyfron and Brymbo, at National Grid Reference SJ297 525, post code LL11 5SQ, approximately 4km to the north west of Wrexham town centre (refer to Figure 1), and enclosed site location plan.



Figure 1: Site Location Plan. (NTS). Ordnance Survey Licence No. AL100005579.

- 1.2 The triangular shaped parcel of land is situated adjacent to residential housing to the south, west and north, with sports pitches to the east. At the time of Coopers walkover on 2 December 2020 the site consisted of 1 No. field with tree-lined embankments (refer to photograph 1) on the southern and western boundaries. The field consisted of scrubland with patches of no vegetation growth, with scattered self-seeded trees and strewn with scattered sandstone boulders left over from the remediation phase of the site.

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Photograph 1: View of the site, with the tree-lined embankment in the background.

- 1.3 The proposed development by Taylor Wimpey North consist of 70 No. residential properties, consisting of a combination of traditional detached and semi-detached housing, with associated roads, parking, gardens and landscaping (refer to Figure 2). A copy of the full development layout is recorded on the appended Coopers Drawing No. 7565/BPRP.



Figure 2: Extract of proposed development layout.

2.0 Summary of Site History

- 2.1 The site has consisted of open ground from 1879, with a mineral railway situated within a cutting along the north western site boundary recorded by 1900. The mineral railway connected Vron Colliery to the south of the site to Brymbo Steel and Iron Works to the north. The mineral railway was recorded as disused by 1962, following closure of Vron Colliery. By 1981 the mineral railway and cutting were no longer recorded with extensive earthworks to the north west at part of the extension of the steel works close to the site boundary (refer to Figures 3 and 4).

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Figures 3 & 4: Showing historical Ordnance Survey map editions of 1912 (left) and 1990 (right) in relation to the approximate site boundary.

- 2.2 The steelworks was reported to have closed in 1990, followed by remediation works, at which time the site was formed as water storage for dust suppression, with numerous water lagoons shown on historical aerial photograph from circa 2006 (refer to Figure 5). Subsequent aerial photographs showed the lagoons to have been fills and remaining as open ground (refer to Figure 6).



Figure 5: Aerial photograph from circa 2006 with approximate site boundary. Image from Google Earth.

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Figure 6: Aerial photograph from circa 2018 with approximate site boundary. Image from Google Earth.

3.0 Ground Investigations and Other Reports

- 3.1 The site was subject to monitoring, testing and assessments in 2007, with contaminated land aspects addressed by Smith Grant (SG) LLP and earthworks/settlement by Scott Wilson (SW) Ltd with the parcel of land referenced as “Link Road Development Module”. The completion report by both parties were reviewed and enclosed within Wardell Armstrong report “Ground Conditions Assessment”, referenced ST16882-001, dated November 2018.
- 3.2 The WA Report assessed the results from 19 No. shallow validation samples by SG in relation to current Tier 1 residential garden thresholds as part of the assessments for proposed development. The laboratory test results identified the elevated concentrations of chromium (III) in 1 No. sample, arsenic within 2 No. samples and 20 No. samples with elevated naphthalene. No asbestos fibres/fragments were found and no elevated concentrations of TPHs or dioxins were found. The WA report discussed the contaminants would not pose a significant risk to controlled waters due to the receptor sensitivity and the hydro-geological conditions.
- 3.4 Coopers undertook further investigation, testing and assessments of the ground conditions, the findings of which were provided within Coopers correspondence, referenced 7565TWNW210121L, dated 21 January 2021. The assessments determined the requirements for the development would be:
- Chemical testing of imported soils intended for use on site.
 - Gas mitigation measures to Characteristic Situation 2 (BS8485) for all properties.

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4.0 Summary of Gas Mitigation Measures and Verification

- 4.1 The previous assessments by Smith Grant (SG) identified that prior to remediation this parcel of the site was unaffected by hazardous ground. Due to the absence of post remediation gas monitoring and the potential risks of gas emissions from previous coal mining beneath the site, all properties should be constructed with Characteristic Situation 2 mitigation measures. The site is also designated as requiring basic radon protection measures, with the mitigation designs for CS2 superseding designs for basic radon (similar designs but higher specification of gas membrane).
- 4.2 The gas mitigation measures are incorporated into the floor slab construction with designs and risk classification dependent upon the type of floor slab. All plots are proposed for stiff raft foundations.
- 4.3 For any stiff raft foundation the gas mitigation design system follows BS8485:2015+A1:2019 and is required to justify the system is appropriate.
- 4.4 The requirements for gas protection designs, mitigation and associated verification are all interconnected as part of a holistic approach defined within CIRIA C735 and supported by BS8485 and NHBC Technical Extra 20. This approach and assessment is included within subsequent sections of this report.

5.0 Gas Mitigation Measures - Construction

- 5.1 All plots are to be constructed with integral floor slabs to stiff raft foundations, which would be required to follow the BS8485:2015+A1:2019 approach to gas mitigation design, for Characteristic Situation 2 (CS2) mitigation measures.
- 5.2 **Integral Floor Slab to Stiff Raft Foundations** - For residential houses on sites within a Characteristic Situation 2 risk site a score of 3.5 points is required in accordance with BS8485. The points achieved are based upon floor slab, passive venting beneath the floor slab and inclusions of gas membranes with associated verification. The points achieved for the preferred floor slab construction is demonstrated within Table 1 (below), which demonstrate a score of 3.5 points.

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Table 1: BS8485 Points Allocations Justification for Gas Mitigation Designs Applicable for Plots with Stiff Raft Foundations.

		Assigned scores	Gas Design Score	
			Design	Mitigation Score
Floor Slabs	Cast In Situ Suspended or Raft Foundations (standard *1)	1.5	●	1.5
	Cast In Situ Suspended or Raft Foundations (complex *1)	1.0		
	Cast In Situ Ground Bearing	0.5		
	Precast Suspended	0.0		
	Basement (grade 2 waterproofing *2)	2		
	Basement (grade 3 waterproofing*2)	2.5		
Venting (*3)	Very Good (*4)	2.5		
	Good (*4)	1.5		
	Pressure Release Vent Trench	0.5		
	No Venting	0.0	●	0.0
	Basements/Ground Floor Car Parks (*5)	4.0		
Gas Membranes	Proprietary Ground Gas Membrane with CIRIA C735 Compliant Verification (*6)	2.0	●	2.0
	Standard LDPE membranes for damp proofing without validation	0.0		
TOTAL POINTS ACHIEVED		-	3.5	

Notes to Table 1:

*1 For suspended cast in situ concrete slabs which are not designed with a well reinforced floor slab or includes additional or complex service entry penetrations (such as complex multiple service entries for apartments) a reduced score of 1.0 should be applied to the floor slab construction.

*2 Waterproofing grades to be compliant with BS8102 and must not include geo-synthetic clay liners.

*3 Active venting systems with pumps have not been included as these cannot be managed and controlled for standard housing.

*4 Venting scores are designed in accordance with Annex B of BS8485 (2015) which are based upon historical research by Partners in Technology. All types of floor slabs with passive venting of houses (only) have been designed by Coopers to achieve a very good score. Venting calculations can be provided upon request.

*5 The scores for ground floor/basement car parks will require the entire floor space to be occupied by the car park.

*6 CIRIA C735 verification process is a holistic method which requires the verification method to changes subject to multiple factors, as such increased verification may be required for higher risk sites, whilst still achieving the same score.

The gas membrane specifications for CS2 mitigation measures are to comply with the above BS8485:2015+A1:2019. Clause 7.2.4 details updated guidance on gas membranes, with Annex C including discussions on the aspects for consideration. Gas membranes compliant with BS8485 require a methane gas transmission rate of <40.0 ml/day/m²/atm. Manufacturers have advised that a 2000 gauge LDPE will not achieve these rates and an aluminium cored membrane would be needed. The membrane thickness to survive construction is designated as 2000 gauge (0.4mm) to be measured between the reinforcement scrims. Several manufacturers do not provide details on the membrane thickness measurements and this detail requires clarification. Note that the methane permeability rates still apply and therefore aluminium cored membranes will typically still be needed.

A typical construction detail for this floor slab type and gas membrane specifications are included in appended documents.

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6.0 Gas Mitigation Measures – Verification Approach

- 6.1 All plots requiring gas mitigation are to be verified as installed in accordance with the approved mitigation measure design details, although the level of verification changes with floor slab type due to the reliance on the gas membrane.

For plots with integral floor slabs to stiff raft foundations the gas membrane is the primary protection measure, and validation compliant with CIRIA C735 2014) “*Good Practice and Verification of Protection Systems for Buildings Against Hazardous Ground Gas.*” The proposals introduce a holistic approach to assessments of the gas risks, design, construction and verification as interconnected assessment of the site-specific gas risk assessment.

The CIRIA guidance provides 4 key criteria to determine the verification strategy as defined in Table 2.

Table 2 – Risk Based Approach to determine gas inspection program

Consideration	Assessment Criteria
Gas Regime	Risk based upon Characteristic Situation and levels of protection
Complexity of Designs	Based upon number of penetrations, building shape, steps in slab levels, etc.
Number of Plots/Buildings	The number of plots; where greater numbers are considered a high risk of variation and build duration.
Installation workforce	NVQ Level 2 qualification or general ground works contractor.

- 6.2 The site is a relatively low gas risk, with no hazardous ground gases identified during monitoring, although proposals for precaution gas mitigation measures due to the absence of post remediation/earthworks modelling and the potential risk of ground gas from deeper coal mine workings underlying the site. The gas risks would be generally considered a lower risk regime.
- 6.3 The floor slab construction for stiff raft construction includes significant amounts of linked horizontal and vertical reinforcement, with concrete thickness typically varying between 250mm and 600 thick (subject to designs) across the plots. These have a very low crack potential to allow ground gas to migrate into the enclosed spaces of the buildings. The gas membrane is placed above the raft foundation below the insulation and concrete screed, which insulation providing protection by separating the concrete screed from the gas membrane. The construction design is uniform across the site, with no proposals for basements, significant steps of floor slab levels or intricate designs for tanking/underbuild. The designs are therefore considered a lower risk regime.
- 6.4 The membrane requires suitably experienced contractors to install the membrane to manufacturers guidance, although given the gas risk do not require NVQ Level 2 installers (although is more reliant on verification to confirm the installation is adequate). The contractors installing the gas membranes have yet to be appointed but are likely to be a general ground works contractor without specialist qualifications. The installers are therefore considered a relatively higher risk.

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- 6.5 Given the gas regime and floor slab construction, it is considered that integrity testing is not required, unless significant defects or problems are being found during construction. With all plots to have gas mitigation measures it could be feasible to change inspection regime if consistent installers are used across the site. Coopers however recommend that all plots are to be independently verified given that the gas membranes are very difficult to retrospectively verify, previous problems with contractor’s photographs of verification being inadequate, advice on the independence of verifiers within Technical Extra 20 and CIRIA C735 and insurers requiring consultants to certify correct installations only where directly inspected. A summary of gas verification requirements are provided in Table 3.

Table 3 – Gas Verification Requirements by Construction Method

Construction Method (Note *1)	Consultants Inspection	Integrity Testing
Integral floor slab to stiff raft foundation, proprietary gas membrane.	All plots.	None

Notes to Table 3:

**1 – Changes to any proposed slab type, construction personnel and achievement of NVQ level 2 training must be reported to consultants for reassessment of the gas regime and inspection strategy.*

**2 – Consultants to undertake a defect test on initial plots to confirm the integrity testing is adequate to identify defects.*

- 6.6 Consultants undertaking inspections should be able to demonstrate experience and competence in the verification of gas membranes. Coopers have provided published guidance on verification of gas mitigation measures and are members of the British Verification Council for Ground Gas Protection Systems. The requirements for consultant’s inspections are included within Section 7.

7.0 Gas Mitigation Measures – Inspection Criteria

- 7.1 Based upon common problems and defects in installation it is recommended that the verification consultants (Coopers or others) hold a toolbox talk with the installation contractors and construction management prior to the first installation to reduce risks of incorrect installation and resultant failures.
- 7.2 CIRIA C735 provides a brief summary of the requirements for inspections and reporting, similar in detail to previous guidance (CIEH, LCC, etc). The aspects for verification and timing of inspection are subject to the specific slab designs. The plots with stiff raft foundations have no ventilation proposed, therefore no inspections are required prior to foundation construction. The primary risk of defects is with the gas membrane installation which are to be inspected for each plot.
- 7.3 The gas membranes should be inspected after completed installation, prior to obscuring by insulation to ensure that any defects or punctures are disclosed. The design should follow Coopers appended construction details. Any deviation to the construction detail that has not been approved by Coopers in advance will be deemed a failure and require construction to halt whilst further reviews are undertaken. For the gas verification the aspects that should be reviewed and considered are shown in Table 4, below.

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Table 4 – Gas Verification Inspection Criteria.

Criteria	Notes
1. Product Verification	Confirmation that suitable products have been installed to consist of photographs of product types (manufacturer/name), labels on packaging and delivery tickets. Gas Membrane <u>AND</u> tapes.
2. General Condition	The membrane is to be inspected to ensure there are no tears, punctures or rips. Take photographs of full plot status for each plot being inspected.
3. Membrane Subgrade	Commonly either insulation or sand blinding, check no gravel or other items with the potential to puncture when weight is applied.
4. Jointing/Welds	Checking the overlaps between membranes are correctly sealed, with correct tapes with sufficient overlaps or a good quality heat sealed weld if this method being utilised. Take photographs of at least one jointing section per plot being inspected to show sufficient overlap and use of tapes.
5. Creases/folds	Care must be taken to ensure that creases & folds within the membrane do not span over the jointing sections (bridging) as this provides an unacceptable gas pathway.
6. Service Entry Points	Verification of the presence of preformed tophats sealed to the pipe and membrane. If service entries are constructed using detailing strip or equivalent product then ensure adequate seal is achieved. Ensure installation is carried out in accordance with manufacturers guidance. Take photographs of all tophat installations. Refer to Coopers Drawing No. 2019-SD-GM-SE
7. Corner Sections	Not cut and folded where punctures are present but concealed with tapes. Either formed with Detailing Strip or preformed corner units. Refer to Coopers Drawing No. 2019-SD-GM-CU.
8. Reinforcement Spacers	Use of metal spacers/ties with potential to puncture the membrane would only be permitted with protection board.
9. Membrane Dirt/Debris	Whilst we appreciate the membranes are constructed on a real-world construction site, the membrane must be free of debris such as stones or mortar that would be liable to damage the membrane when weight is applied through subsequent construction. Whilst mud is inevitable on the membrane it must be kept to a minimal level to allow the membrane to be inspected and defects disclosed. If the membrane is not visible due to the amount of mud then it will be failed and need to be cleaned for reinspection.
10. Puncture Repairs	Punctures are relatively common and occasional damage with proper repair is not considered to be indicative of defective workmanship. All punctures require a patch that spans the damaged section by at least 150mm on each side.
11. Party Walls	The use of temporary blockwork for shuttering commonly involves placing the gas membrane above the blocks for the initial concrete pour. When this is removed we advocate placing the membrane back to run flat through the party wall to allow this to be sealed and inspected on the subsequent plot. Alternative approaches are available but the membrane must not be cut and patched after the second plot is cast (due to additional damage, difficult repairs, and lack of inspection at this stage). Also if robust details adopted the membrane will need to drop through the cavity.
12. Door Thresholds	Care is required in relation to gas membrane positions through the wall cavity to the external wall around the door thresholds, closing the cavity, and protection beneath any sills. The use of preformed cloaking units and/or detailing strip protection would be recommended. Refer to Coopers Drawing No. 2019-SD-GM-DT
13. Wall Cavity Inspection	Confirming that proprietary gas membrane or gas DPC spans the external walls. Check for rips across cavity. Check for jointing detail of gas resistant DPC or membrane across cavity to main membrane. Take photographs for all plots inspected.

- 7.4 A photographic record of the procedures for inspection are shown below, which are based upon our guidance provided to the CIEH. The product specifications for the gas membrane are provided in the appended documents.

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Raft Foundations:



Photograph 2 and 3: Check general condition of gas membranes with photographs showing the plot in context.



Photograph 4 and 5: Check top hat is sealed to membrane and pipework with tapes, and Jubilee clip, or detail strip installation.



Photograph 6 and 7: Check >150mm overlaps of membranes and proprietary tapes placed and sealed or heat welded jointing with photographs taken.

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Photographs 8 and 9: Formed corner sections correctly taped



Photographs 10 and 11: Confirm ancillary products utilised in the gas membrane installation.

8.0 Gas Mitigation Measure – Developer Requirements

- 8.1 After completion of the inspection of the gas mitigation measures the developer is required to demonstrate that the follow-on works do not compromise the integrity of the membrane. The significant areas of risk are gas membranes/DPCs spanning the external wall cavity which are liable to being damaged prior to placement of the cavity tray. We would advocate developers consider an approach to demonstrate the management of gas membranes integrities.

9.0 Imported Soil/Aggregate Validation Requirements

- 9.1 All soils/aggregates imported to site these should be subject to chemical testing after delivery to confirm the materials are inert and suitable for the intended end use. The frequency and testing suite should reflect the provenance and end use:

Topsoil and Subsoil:

- **Recycled/mixed/unverified source = 1 sample per 50m³** (minimum of 3 per source). Testing to include standard inorganics, PAHs (16), asbestos and speciated TPHs (CWG incl. BTEX), with potential for additional testing of VOCs, SVOCs and PCBs (subject to site of origin and material type)

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- **Greenfield source = 1 sample per 100m³** (minimum of 3 per source). Testing to include standard CLEA suite inorganics, PAHs (16), and asbestos.

Aggregates for use in gardens, beneath buildings or roads/driveways:

- **Quarried Stone = no chemical testing** with supply of delivery tickets.
- **Crushed brick and concrete = 1 sample per 1000m³** for asbestos identification.

- 9.2 The source testing of imported soils/aggregates should be approved prior to importation, including details of the site or origin. Where materials are classified as a waste at the producing site the importing of materials will require the associated waste exemptions or material management plans/registrations for this site. The developer should be cognisant of the powers introduced by the Finance Act, 2018, in which the HMRC can retrospectively recover landfill tax (with a 100% surcharge) from a developer who knowingly causes or permits illegal disposal of wastes on a site, without the appropriate permits/exemptions.
- 9.3 Due to the size of the site it is likely that materials can be stockpiled for testing prior to use. We would strongly recommend that materials are imported from a reputable source, with appropriate testing of the specific materials intended to be imported.
- 9.4 Following stockpiling of soils/aggregates the materials will require testing to confirm the suitability for reuse. Should contaminants be identified these will likely require removal from the site and replacement, unless directly agreed with regulators that the end use would not preclude the use of the material in specific areas.
- 9.5 Any soils that are to be used within either residential gardens or landscaped areas will require testing and photographic evidence of placement. This will then need to be submitted to the NHBC or Local Authority for review, either as plots individually or groups of plots.
- 9.6 The criteria for chemical testing of imported soils used in gardens are detailed in Table 5 (below).

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Table 5: Thresholds For Inert Material Within Gardens And Landscaping

Compound/Element		Human Health (Residential)	Phytotoxic		
			pH<6	pH6-7	pH>7
Inorganics	Arsenic	37	-	-	-
	Beryllium	51	-	-	-
	Boron	291	-	-	-
	Cadmium	26	-	-	-
	Copper	-	100	135	200
	Chromium (III)	3000	-	-	-
	Chromium (VI)	21	-	-	-
	Lead	200	-	-	-
	Mercury (methyl)	7.4	-	-	-
	Mercury (inorganic)	169	-	-	-
	Nickel	-	60	75	110
	Selenium	351	-	-	-
	Vanadium	79	-	-	-
	Zinc	-	200	200	300
PAHs	Acenaphthene	205	-	-	-
	Acenaphthylene	168	-	-	-
	Anthracene	2260	-	-	-
	Benzo(a)anthracene	3.1	-	-	-
	Benzo(a)pyrene	5.0	-	-	-
	Benzo(b)fluoranthene	5.56	-	-	-
	Benzo(ghi)perylene	10.7	-	-	-
	Benzo(k)fluoranthene	8.5	-	-	-
	Chrysene	6.0	-	-	-
	Dibenz(ah)anthracene	0.76	-	-	-
	Fluoranthene	257	-	-	-
	Fluorene	163	-	-	-
	Indeno(123-cd)pyrene	3.18	-	-	-
	Phenanthrene	91.8	-	-	-
	Pyrene	563	-	-	-
	Naphthalene	1.54	-	-	-
TPH – Aliphatic	5-6	30	-	-	-
	6-8	73	-	-	-
	8-10	19	-	-	-
	10-12	93 (48) ^{vap}	-	-	-
	12-16	740 (24) ^{sol}	-	-	-
	16-35	45,000 (8.48) ^{sol}	-	-	-
TPH - Aromatic	35-44	45,000 (8.48) ^{sol}	-	-	-
	8-10	27	-	-	-
	10-12	69	-	-	-
	12-16	140	-	-	-
	16-21	250	-	-	-
BTEX	21-35	890	-	-	-
	Benzene	0.2	-	-	-
	Toluene	119	-	-	-
	Ethylbenzene	62.5	-	-	-
	Xylene (based on p)	41.7	-	-	-
	Phenol	184	-	-	-
	Asbestos	None	-	-	-

Notes to Table 5:

Thresholds derived within CLEA 1.06 or DEFRA C4SL utilising the most conservative parameters for unknown nature of imported materials. This includes 1% Soil Organic Matter for organic compounds (inorganics unaffected), silty clay strata for metals, semi-metals and several PAH compounds and sandy loam for phenol and naphthalene.

Cyanide should not be present within significant quantities, and where encountered should be speciated to determine what form the cyanide is present in.

All imported material must be free of deleterious odour and should not include demolition/construction wastes within garden areas.

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10.0 Stockpile Management Practices

- 10.1 During the course of the development there will be areas of stockpiled soils intended for use within the proposed gardens. It is imperative that the stockpiles are well managed to avoid inadvertent mixing or depositing of surplus or deleterious materials that would compromise the continued use. We would recommend that the site management reviews the proposed positions for placement of stockpiles and places either fencing or warning signs to ensure compliance. Example photographs are below demonstrating good methods and practice.



Photograph 12: Example of good stockpile management with warning signs to demonstrate areas of inert topsoil.



Photograph 13: Example of good stockpile management with soils placed on geotextile with fences to prevent accidental cross-mixing.



Photograph 14: Example of good stockpile management with warning signs to demonstrate areas of inert topsoil.



Photograph 15: Example of good stockpile management with warning signs and fencing to prevent accidental cross-mixing.

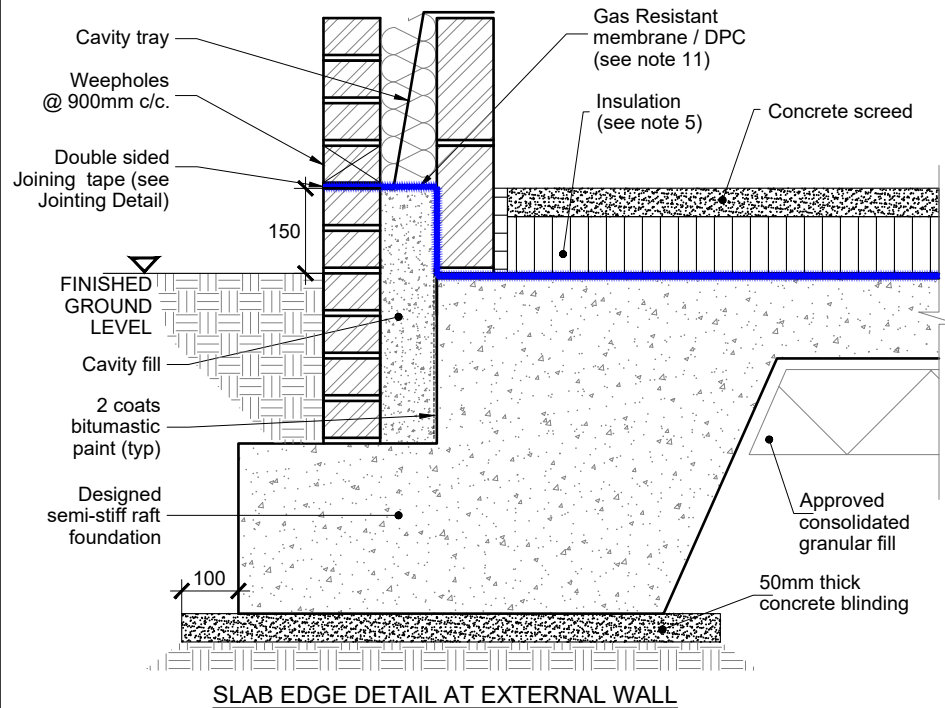
Build Phase Remediation and Validation Strategy for “*Lagoon Site*”,
Parc Brymbo, Wrexham**11.0 Conclusions**

- 11.1 The proposed development will require chemical testing of imported soils and construction of gas mitigation measures to ensure the future residents are not exposure to unacceptable levels of risks associated with contaminated land and hazardous ground gas.
- 11.2 The proposals within this report includes verification of the above referenced works which should be submitted to and approved by the local authority and NHBC prior to development.

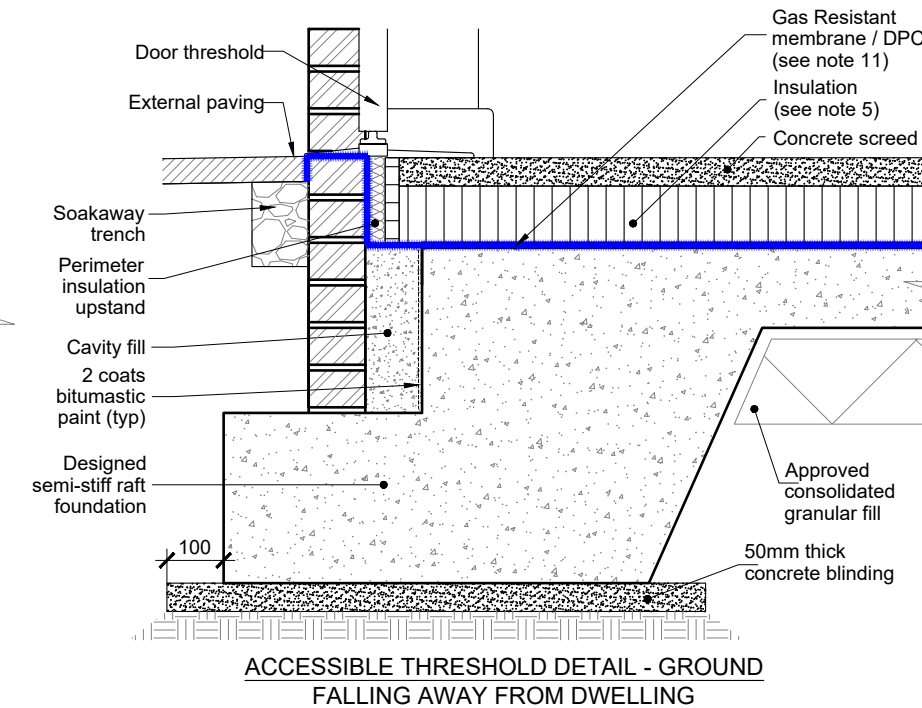
Documents appended:

- Coopers Drawing No. 7565/BPRP – Build Phase Remediation and Validation Plan.
- Coopers Drawing No. 7565-LRH-GS2A-RF-02 - Typical Gas Precaution Detail – Stiff Raft.
- Visqueen Product Specification Sheets - Gas Barrier.
- Coopers Drawing No. 2019-SD-GM-CU - Gas Membrane Corner Detail.
- Coopers Drawing No. 2019-SD-GM-DT - Door Threshold Detail.
- Coopers Drawing No. 2019-SD-GM-SE - Service Entry Detail.
- Coopers Drawing No. 2019-SD-GM-DSE - Dual Service Entry Detail.

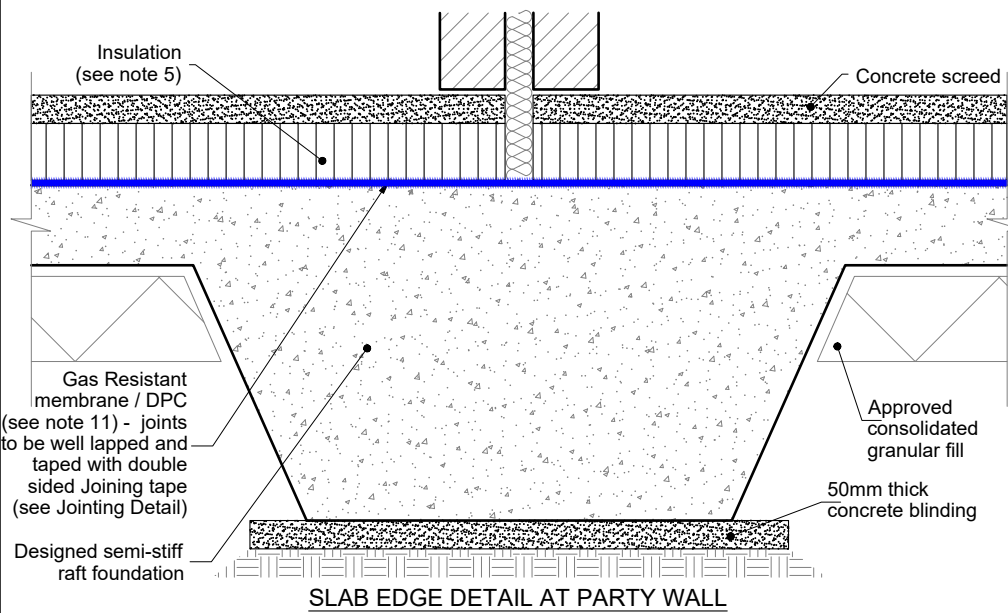
THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE RELEVANT HOUSE TYPE DRAWINGS, FOUNDATION PLAN & SCHEDULE AND THE SITE SPECIFIC GROUND GAS & SITE INVESTIGATION REPORTS



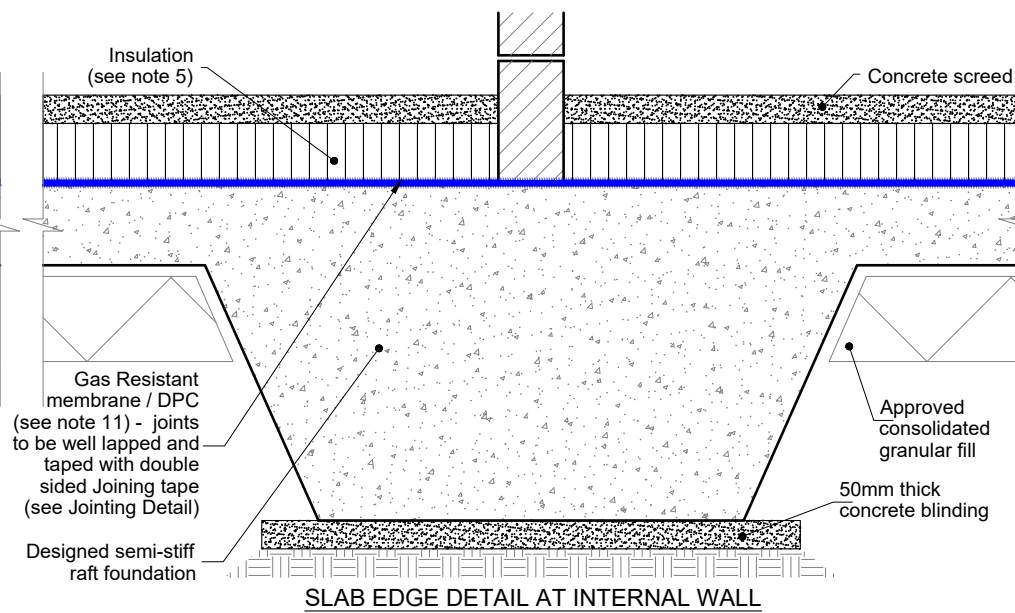
SLAB EDGE DETAIL AT EXTERNAL WALL



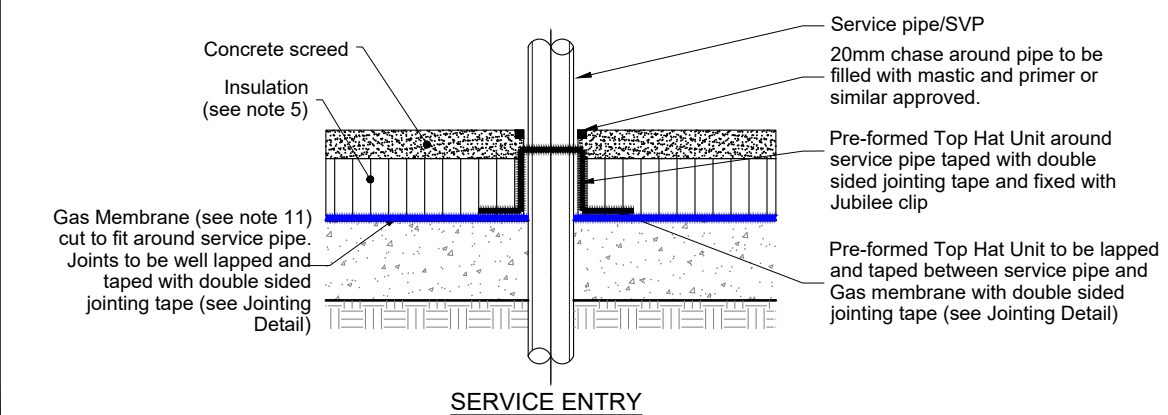
ACCESSIBLE THRESHOLD DETAIL - GROUND FALLING AWAY FROM DWELLING



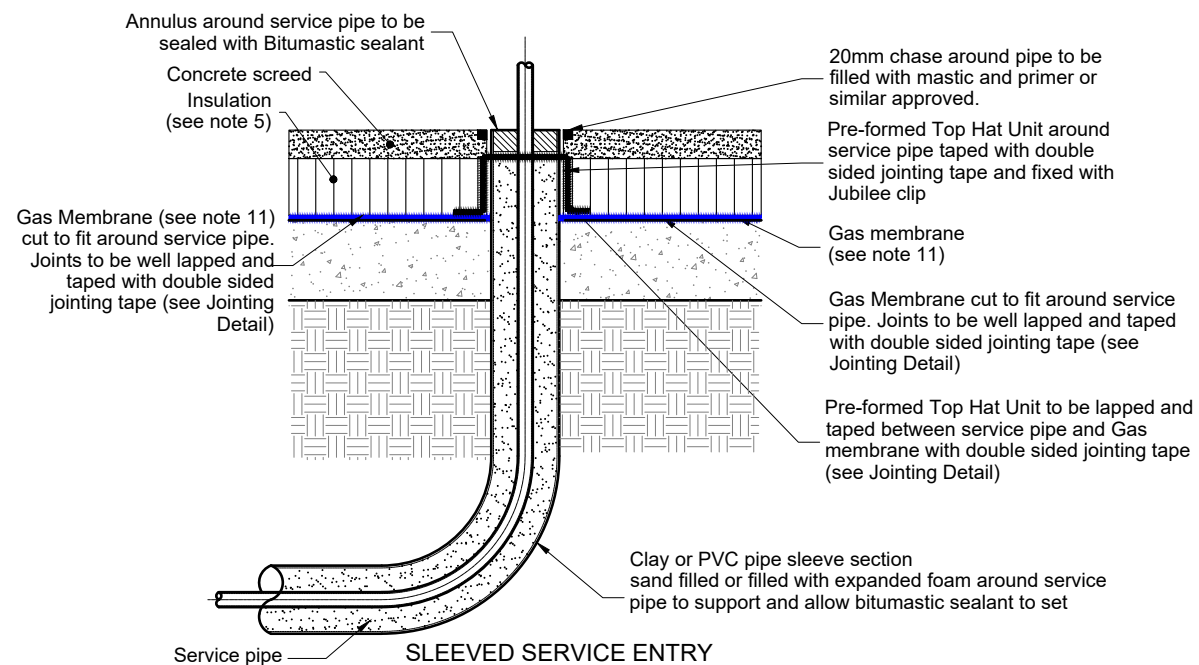
SLAB EDGE DETAIL AT PARTY WALL



SLAB EDGE DETAIL AT INTERNAL WALL



SERVICE ENTRY



SLEEVED SERVICE ENTRY

NOTES

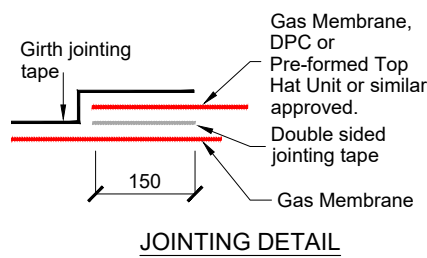
- Coopers take no responsibility for the inappropriate use of this detail on a development. The drawing is specifically designed in accordance with findings and recommendations of ground gas monitoring.
- Coopers drawing is in accordance with current guidance with respect to design of measures and specification of membranes for the adequate protection of dwellings from the ingress of harmful ground gases. The details contained on this drawing are generic and for guidance purposes only. Any proposed amendments to the detail due to variations on specific house types should be referred back to Coopers for review and approval prior to implementation on site.
- This drawing was prepared for the purpose stated. New products, improved practices and legislation may necessitate an alteration to this drawing in whole or in part after its submission. It is recommended that this drawing is referred to Coopers for reappraisal no later than one year from the date on this drawing. Continued use of this drawing beyond this date is at the Developers own risk.
- Refer to Foundation Drawing for suspended slab drawing for relevant house types.
- Refer to insulation details on specific house type slab drawings.
- For details of proposed foundations refer to Coopers Foundation Plan and house type specific foundation details.
- Characteristic Situation is defined in CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'. Suitability of mitigation measures in accordance with BS8485:2015+A1:2019.
- All gas membranes should be installed to the manufacturer's guidelines and recommendations. Special care must be taken to ensure that the gas membrane is not snagged, torn, punctured, stretched or in any way damaged during construction. All damaged areas of the gas membrane must be replaced or repaired to manufacturers recommendations.
- Joints between sheets of gas membrane should be well lapped (150mm min) and taped between sheets with a joining tape in accordance with the manufacturer's recommendations.
- All service entry points should be fitted with pre-formed gas resistant top hats. Tophats should be sealed to the pipe and gas membrane using joining tape and fixed to the pipe with a jubilee clip.
- The gas membrane should be a multi-layer, laminated, reinforced LDPE membrane with a central shield layer of aluminium foil. This membrane must have a low permeability to carbon dioxide and methane and also acts as a damp proof membrane as well as a barrier to radon gas. **The specification of the gas membrane should be submitted to Coopers for approval prior to use.**

 CDM HIGH RISK ASSESSMENT
FOR ALL RISKS REFER TO DESIGN RISK ASSESSMENT

INSTALLATION, INSPECTION AND TESTING

- A Ciria C735 compliant verification strategy is likely to be required, subject to approval by the Local Authority and NHBC.

FOR GUIDANCE PURPOSES ONLY



JOINTING DETAIL

REVISIONS

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Web: http://coopers.co.uk

CLIENT

Taylor Wimpey

PROJECT

Parc Brymbo, Wrexham.

TITLE

Typical Gas Precaution Detail to Semi-stiff Raft for Characteristic Situation 2 Including Service Entry Details

DRAWN BY	AH
DATE	21.01.21
SCALE(S)	NTS
DRAWING NUMBER	REVISION

7565/LRH/GS2A/RF/02 -

This typical detail is provided as a guide for construction. House type specific variations are required to account for slopes on garage floor slabs, stepped slab levels, full building level access, party wall temporary shuttering, corner unit construction, cloaking units around doors, piers, and other similar specific considerations. We would advocate the contractors hold pre-construction discussions with Coopers (and the verification consultants if another consultant) on the approaches and considerations for specific house type construction prior to commencing installation. Should variations be constructed without prior consent these will be deemed by Coopers as a defect and not suitable for construction or approval by us or third parties.



Visqueen Gas Barrier

Features and benefits

- BBA certified - third party accreditation
- Complies with BS 8485:2015 + A1:2019 - industry standard for methane and carbon dioxide protection
- Flexible - easy to detail and install on site
- Multi functional - also acts as a radon and damp proof membrane
- Dual jointing methods - lap joints can be taped or heat welded

Product description

Visqueen Gas Barrier is a multi-layer reinforced polyethylene gas barrier with a 20 micron aluminium foil. The barrier is coloured blue on the upper surface and silver on the reverse. The product is supplied in single wound rolls (not folded), 2m x 50m.

Approvals and standards

- Third party accreditation (BBA 13/5069)
- Conforms to the specification requirements of BS 8485:2015 + A1:2019
- Suitable for all Characteristic Gas Situation (CS) ground gas regimes
- Conforms to the specification requirements of NHBC Amber 1 and Amber 2 applications
- Conforms to the specification requirements of BR 211:2015
- CE Mark EN 13967:2017
- Quality Management System ISO 9001:2015
- Occupational Health and Safety System ISO 18001:2007
- Environmental Management System ISO 14001:2015

Usage

Visqueen Gas Barrier is suitable for use in all types of buildings to prevent the ingress of harmful levels of ground gases e.g.methane, carbon dioxide and radon.

The barrier can be positioned above or below a solid concrete ground floor slab or above a precast suspended segmental ground floor system, e.g. beam and block floor.

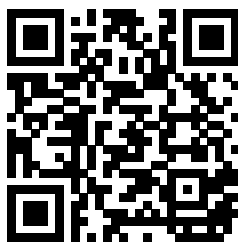
The barrier can also be used as a high performance radon membrane and/or damp proof membrane.

The product is not intended for use where there is a risk of hydrostatic pressure.

System components

- VisqueenPro Double Sided Jointing Tape, 50mm x 10m
- Visqueen Gas Resistant Foil Lap Tape, 75mm x 50m
- Visqueen Ultimate GR Lap Tape, 150mm x 10m
- Visqueen Ultimate Top Hat Units
- Visqueen Preformed Units
- VisqueenPro Detailing Strip, 300mm x 10m, 500mm x 10m
- Visqueen TreadGUARD 300, 2m x 75m
- Visqueen TreadGUARD 1500, 1m x 2m

Find your local stockist





Visqueen Gas Barrier

Storage and handling

Visqueen Gas Barrier should be stored horizontally, under cover in its original packaging.

Care should be taken when handling the product in line with current manual handling regulations.

Preparation

Visqueen Gas Barrier should be installed on a smooth continuous surface e.g. grouted beam and block floor, a compacted blinding layer e.g. 50mm thick sand blinding, or smooth concrete blinding. The substrate should be free from irregularities such as voids or protrusions.

The barrier can be cut with a sharp retractable safety knife or robust scissors.

Installation

Visqueen Gas Barrier should be loose laid on the substrate with the blue side up so as to avoid sunlight glare.

The barrier should be clean and dry at the time of jointing. It should be overlapped by at least 150mm, bonded with Visqueen Pro Double Sided Jointing Tape and sealed with Visqueen Foil Lap Tape. In demanding site conditions seal lap joints with Visqueen Ultimate GR Lap Tape.

Alternatively lap joints can be heat welded to achieve an effective seal. Welded lap joints can be less than 150mm provided the joint integrity is not compromised.

Airtight seals should be formed around all service entry points. Visqueen Preformed Top Hat Units should be used for sealing service entry pipes. The base of the top hat and the upstand should be bonded using Visqueen Pro Double Sided Jointing Tape and sealed with Visqueen Foil Lap Tape. The upstand should be secured with the supplied jubilee clip.

Forming an effective barrier to gases may give rise to complex three-dimensional detailing where, it is recommended Visqueen Preformed Units are used e.g. corners. Alternatively Visqueen Pro Detailing Strip can be used to seal awkward junctions.

If the barrier is punctured or perforated a patch of the same material should be lapped at least 150mm beyond the limits of the puncture and bonded with Visqueen Pro Double Sided Jointing Tape and sealed with Visqueen Foil Lap Tape. Alternatively a patch can be formed using Visqueen Pro Detailing Strip and lapped at least 150mm beyond the extents of the puncture.

The barrier should be covered by a protective layer as soon as possible after installation to prevent damage e.g. from following trades. Care should be taken to ensure that the membrane is not punctured, stretched or displaced when applying a screed or final floor covering. A minimum thickness of 50mm screed is recommended. When reinforced concrete is to be laid over the barrier the wire reinforcements and spacers must be prevented from puncturing the barrier. Where there is a high risk of potential damage, the barrier should be covered with Visqueen TreadGuard protection, screed, or other approved protection material before positioning the reinforcement.

Usable temperature range

It is recommended that Visqueen Gas Barrier and all associated system components should not be installed below 5°C.

Additional information

When used in accordance BS8485:2015 + A1:2019 a subfloor ventilation system or pressure relief maybe required Where hydrocarbon or VOC contamination is present use Visqueen Ultimate VOC or HC Blok gas protection systems To assist build sequencing, Visqueen GR DPC is available for gas protection through the wall constructions

For suspended beam and block floor detailing see GB-01

Visqueen Preformed Top Hat Units should be used at service pipe penetrations see GB-51

For internal and external corners Visqueen Ultimate Preformed Units should be used see PFU-553

To seal around steel columns use Visqueen Pro Detailing Strip see GB-52

For additional detailing information, contact Visqueen Technical Services +44 (0) 333 202 6800



Visqueen Gas Barrier

Property	Test method	Units	Compliance criteria	Result
Dimensions	EN 1848-2	m		2 x 50
Overall thickness including scrim mesh	EN 1849-2	mm		0.66
Effective thickness in between scrim mesh	EN 9863-1	mm		0.4
Mass	EN 1849-2	g/m ²	-0%/+5%	400
Tensile strength - MD	EN 12311	N	MLV	350
Tensile strength - CD	EN 12311	N	MLV	350
Tensile elongation - MD	EN 12311	%	MLV	20
Tensile elongation - CD	EN 12311	%	MLV	21
Joint strength	EN 12317-2	N	MLV	332
Watertightness 2kPa	EN 1928	-	Pass/Fail	Pass
Resistance to impact	EN 12691	mm	MLV	200
Dart impact	BS 2782	g	MDV	731
Low temperature flexibility	EN 495-5	°C	MDV	-40
Durability against ageing	EN 1296 and EN 1928	-	Pass/Fail	Pass
Durability chemical resistance	EN 1847	-	Pass/Fail	Pass
Resistance to tearing (nail shank) CD	EN 12310-1	N	MDV	358
Resistance to tearing (nail shank) MD	EN 12310-1	N	MDV	368
Resistance to static loading	EN 12730	kg	MLV	20
Water vapour transmission - resistance	EN 1931	MNs/g	MDV	7000
Water vapour transmission - permeability	EN 1931	g/m ² /d	MDV	0.03
Visible defects	EN 1850 -2	-	Pass/Fail	Pass
Reaction to fire	EN 13501-1	Class	MDV	F
BS 8485:2015 + A1:2019 testing requirements				
Mass	EN 1849-2	g/m ²	Average >370	400
Methane permeability	ISO 15105-1	mls/m ² /d/atm	Pass/Fail	<0.15
Puncture CBR	BS EN ISO 12236	N	MDV	1114
Impact resistance	EN 12691	mm	MDV	1000
Tensiles yield strength MD	ASTM D4885-01	kN/m	MDV	12.5
Tensiles yield strength CD	ASTM D4885-02	kN/m	MDV	7.3
Resistance to static loading	EN 12730	kg	>MLV	20
Yield elongation CD	ASTM D4885-04	%	MDV	19
Tear resistance - trouser method A - MD	BS ISO 34-1	kN/m	MDV	48.2
Tear resistance - trouser method A - CD	BS ISO 34-1	kN/m	MDV	44.8
Tear resistance - angle method B - MD	BS ISO 34-1	N	MDV	53.5
Tear resistance - angle method B - CD	BS ISO 34-1	N	MDV	60.6

Health and safety information

Refer to the Visqueen Gas Barrier material safety datasheet (MSDS).



Visqueen Gas Barrier

About Visqueen

The Visqueen name has long been recognised as one of the leading manufacturers of high quality advanced membrane technologies and design based solutions by specifiers, distributors, builders merchants and contractors throughout the UK and Europe.

For further guidance on the Visqueen services shown below, please refer to the relevant section of the Visqueen website (www.visqueen.com) or contact Visqueen Technical Services on +44 (0) 333 202 6800 or enquiries@visqueen.com

Complete Range, Complete Solution



Structural
Waterproofing



Gas
Protection



Damp Proof
Membrane



Tapes



Damp Proof
Course



Stormwater



Vapour
Control

Visqueen Technical Support

Visqueen combine an extensive product portfolio with industry leading levels of service and support which includes guidance over the phone, bespoke CAD drawings to help with complex detailing, electronic NBS specifications and access to a dedicated team of highly knowledgeable and experienced field based Technical Support Managers.

Visqueen Technical Support is available to all our customers including architects, specifiers, distributors, builders merchants, contractors and end users. All of our technical team have been awarded the industry recognised qualification Certificated Surveyor in Structural Waterproofing (CSSW).

Visqueen CPD Seminars

The Visqueen Continuing Professional Development (CPD) Seminars provide up-to-date information on changes within Building Regulations/Building Standards and nationally recognised industry guidance affecting damp proofing, water vapour control, hazardous ground gas protection and below ground structural waterproofing.

The one hour seminars have been produced for design specialists within the construction sector and are delivered by our team of Technical Support Managers.

Visqueen PI designs and special projects

From initial design to the completed project, Visqueen are with you every step of the way. Whether it be hazardous ground gas protection and/or below ground waterproofing protection employing barrier, structurally integral or drained systems, Visqueen can offer professional indemnity (PI) insurance for bespoke Visqueen design solutions.

Visqueen Technical Support Managers work with all stakeholders to provide cost effective Visqueen solutions offering complete peace of mind throughout the construction phase and beyond.

Visqueen Training Academy

Based at our manufacturing facility in Derbyshire, the Visqueen Training Academy is available to support Visqueen customers throughout the UK by providing a wide range of both theory and practical skills related training.

Courses include one day product awareness training for our distributors and builders merchants to help them in their day-to-day jobs, through to intensive three day courses giving detailed hands-on training in the practical skills required for safe and robust product installation.



Project

COOPERS STANDARD DETAILS
2019

Title

TYPICAL GAS MEMBRANE
CORNER DETAIL

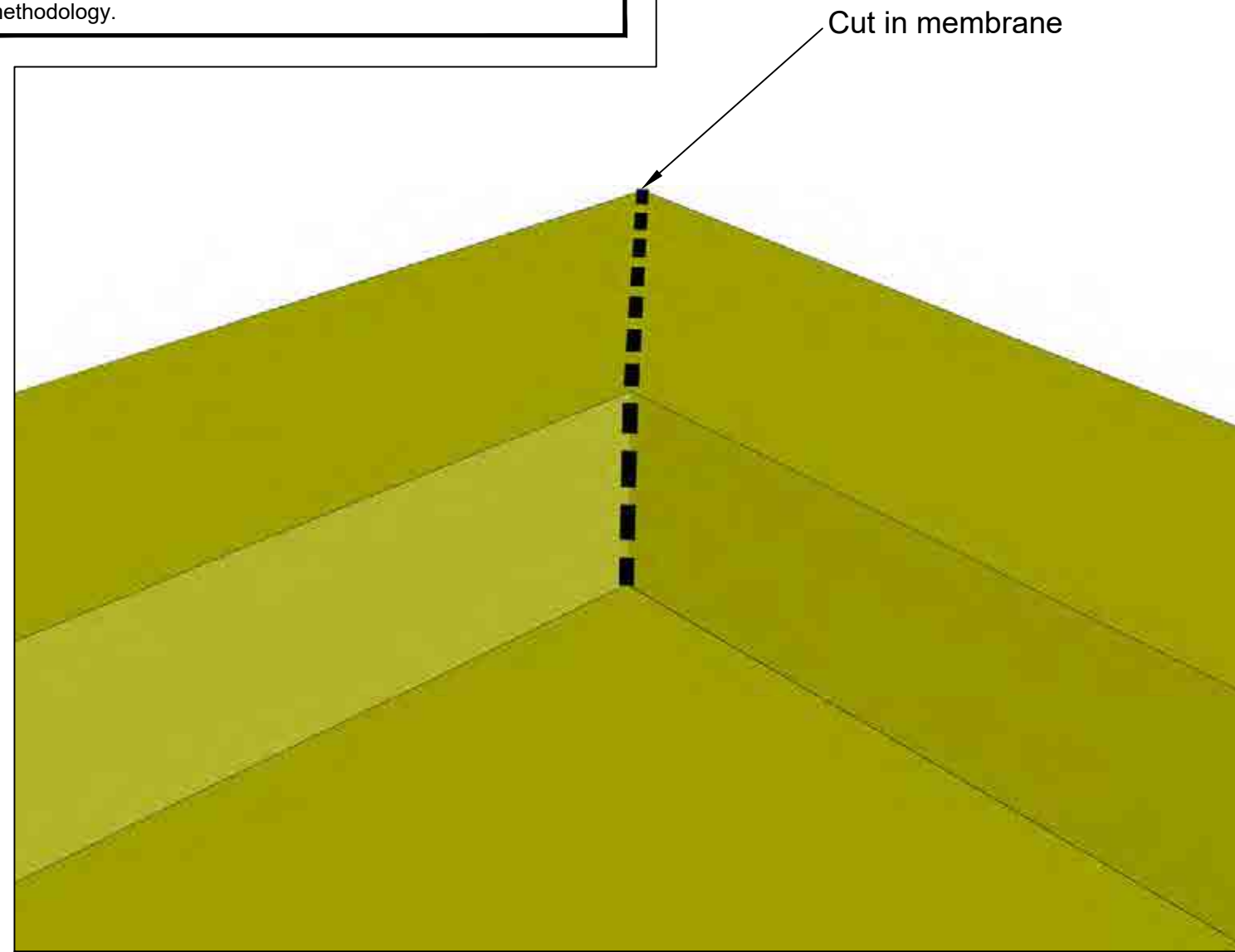
DRAWING NUMBER	SCALE at A2	NTS	REVISION
2019-SD-GM-CU	DATE	03.01.19	
	DRAWN	AH	-
	CHECKED	PRS	



TYPICAL EXAMPLE OF CORNER
CONSTRUCTION USING VISQUEEN
DETAILING STRIP

GENERAL NOTES

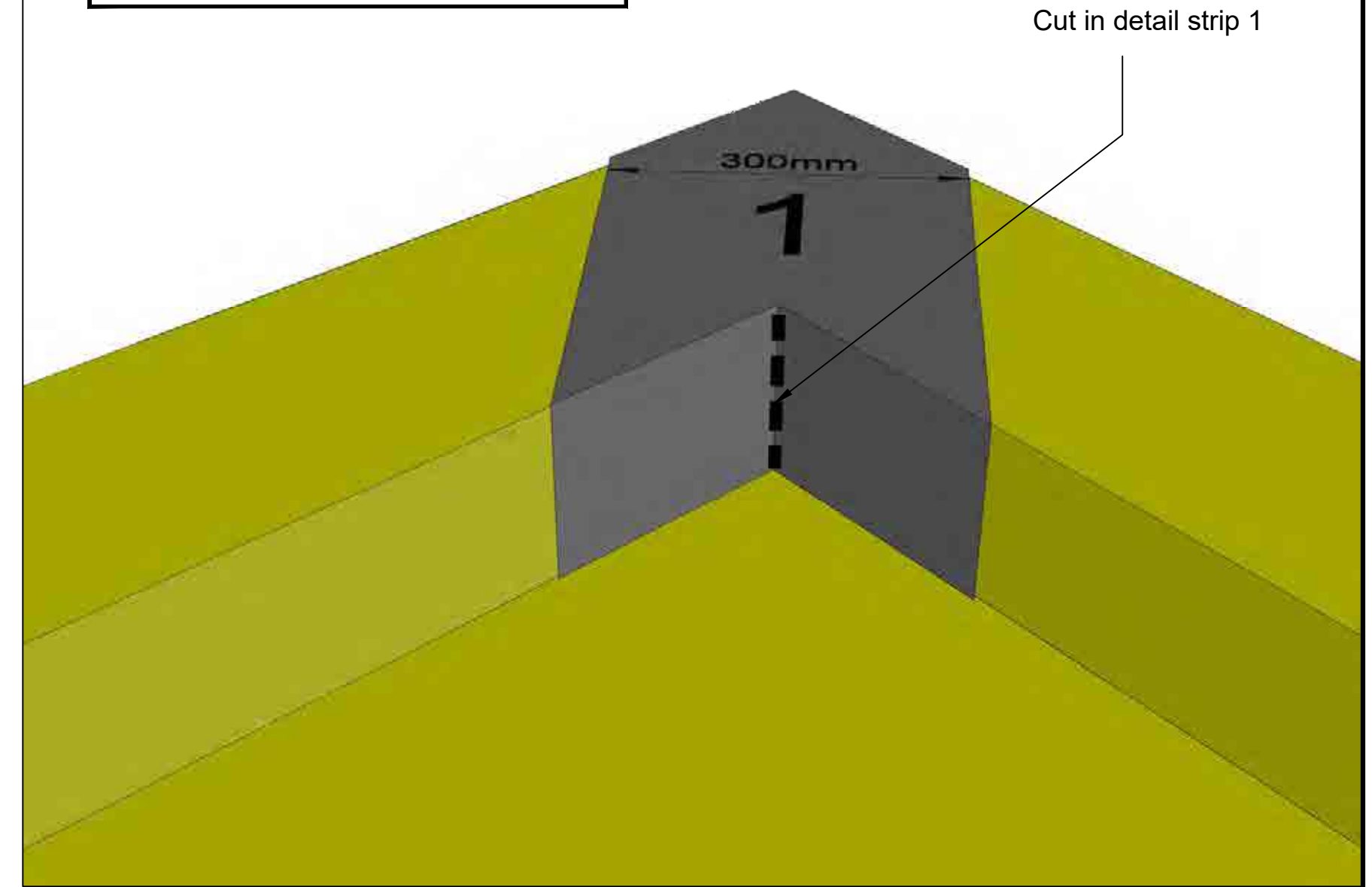
-The different colouring of detail strip presented on this drawing are for illustration purposes only.
-For any complex corners, please contact Coopers prior to undertaking the corner construction to discuss the best methodology.



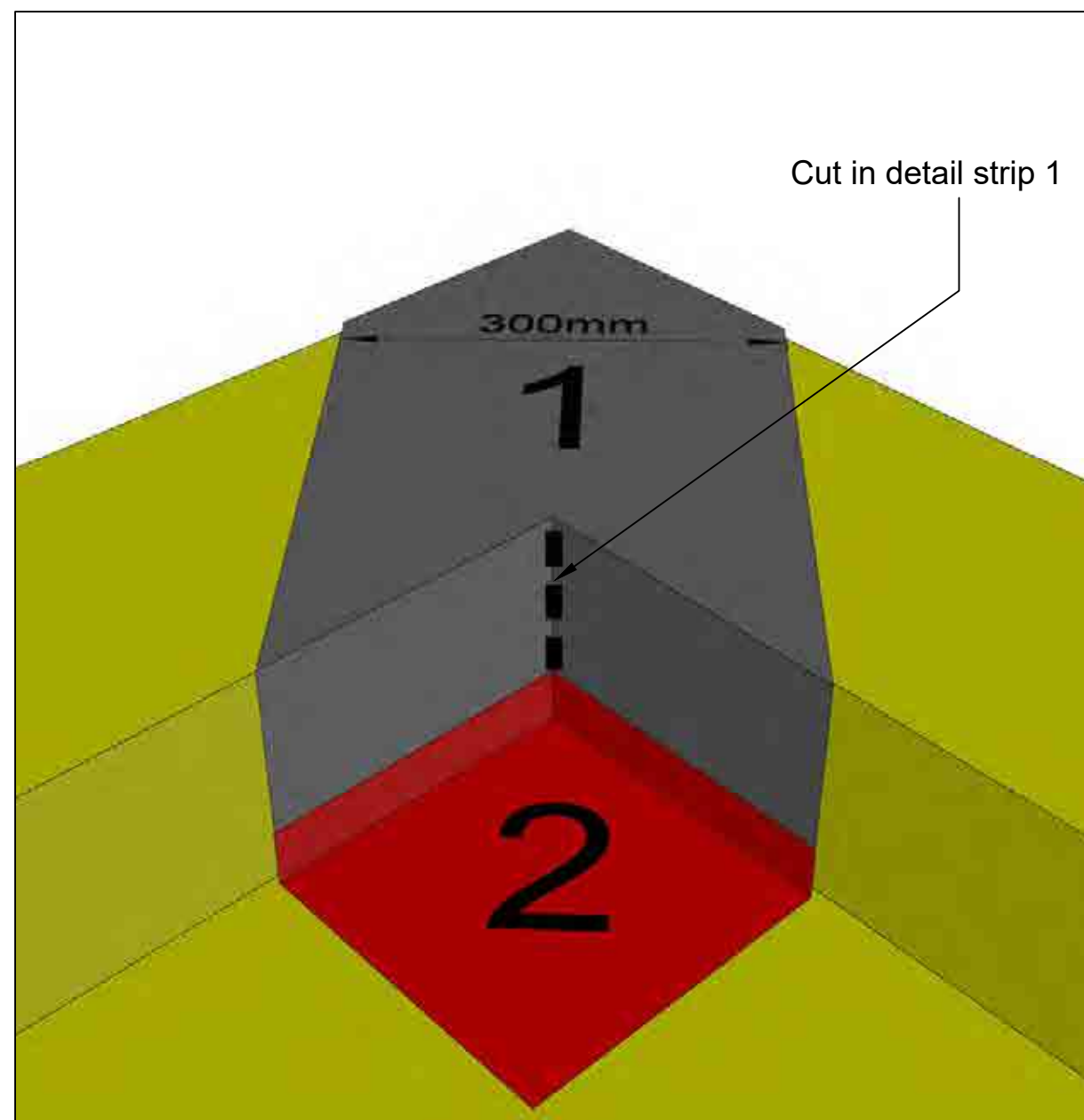
SHOWING GAS MEMBRANE CUT LOCATIONS IN PLOT CORNER
(NTS)

THIS DRAWING SHOULD ONLY
BE PRINTED IN COLOUR

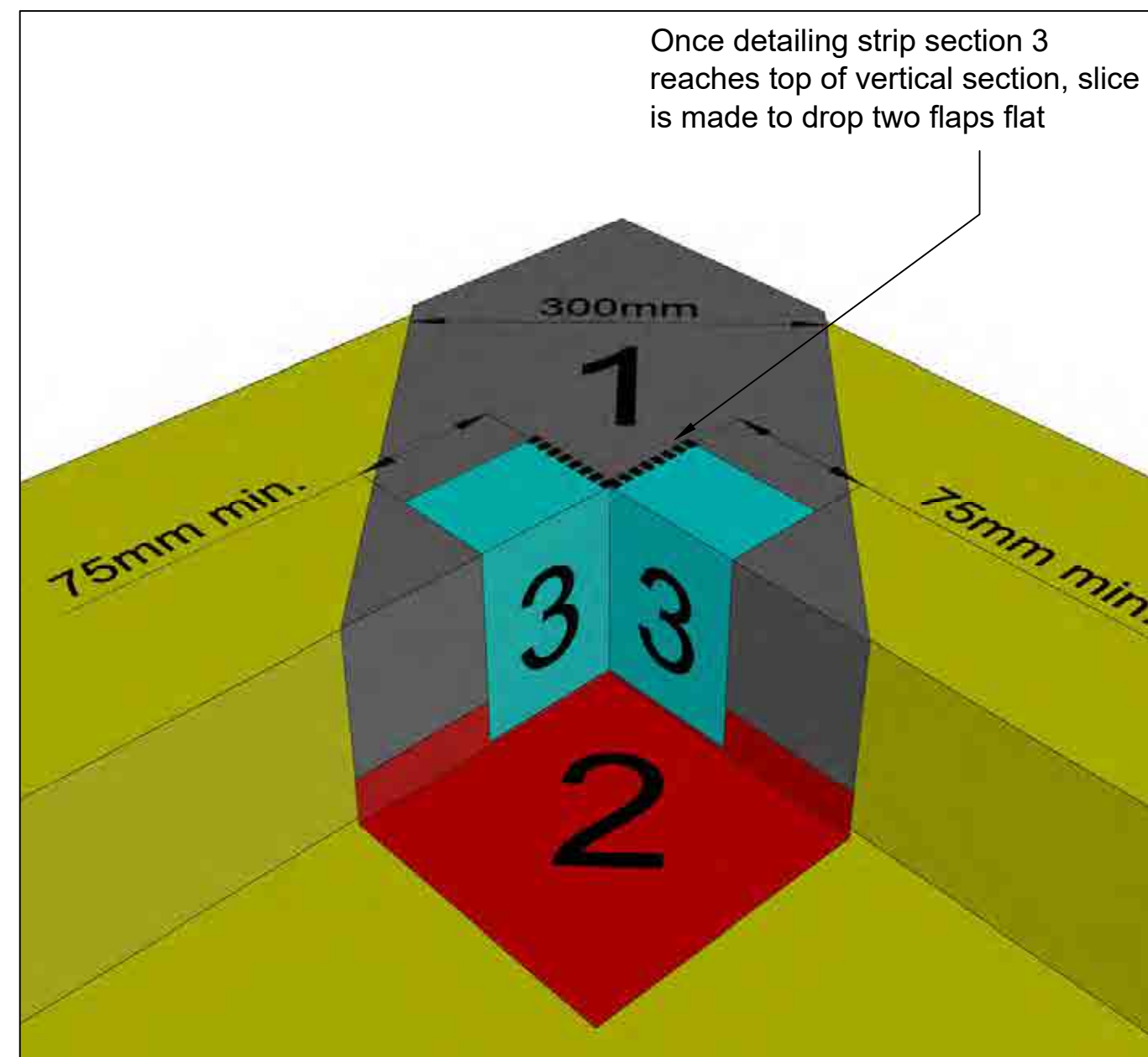
© Copyright The original of this drawing contained coloured symbols and/or features. Any black and white reproduction should not be relied upon. DO NOT SCALE



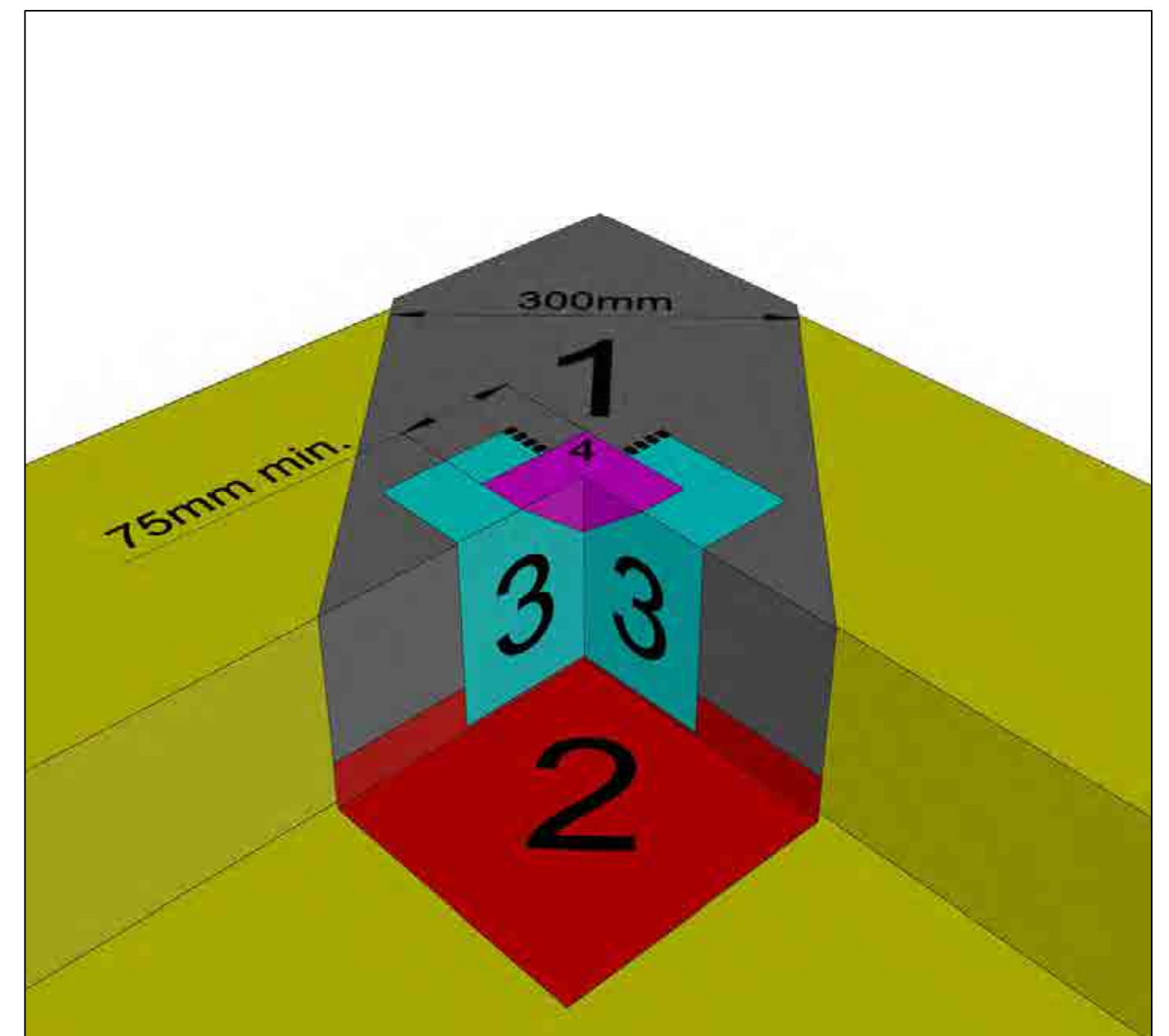
SHOWING FIRST DETAIL STRIP SECTION LAID
(NTS)



SHOWING DETAIL STRIP SECTION 2 LAID
(NTS)



SHOWING DETAIL STRIP SECTION 3 LAID
(NTS)



SHOWING DETAIL STRIP SECTION 4 LAID
(NTS)

Project

**COOPERS STANDARD DETAILS
2019**

Title

**TYPICAL GAS MEMBRANE
DOOR THRESHOLD DETAIL**

DRAWING NUMBER

2019-SD-GM-DT

SCALE at A2 NTS

DATE 03.01.19

DRAWN AH

CHECKED PRS

REVISION

A

A	06.08.19	Detail strip 7 added to plan.	AH	MO
Rev	Date	Revision	By	Appd.

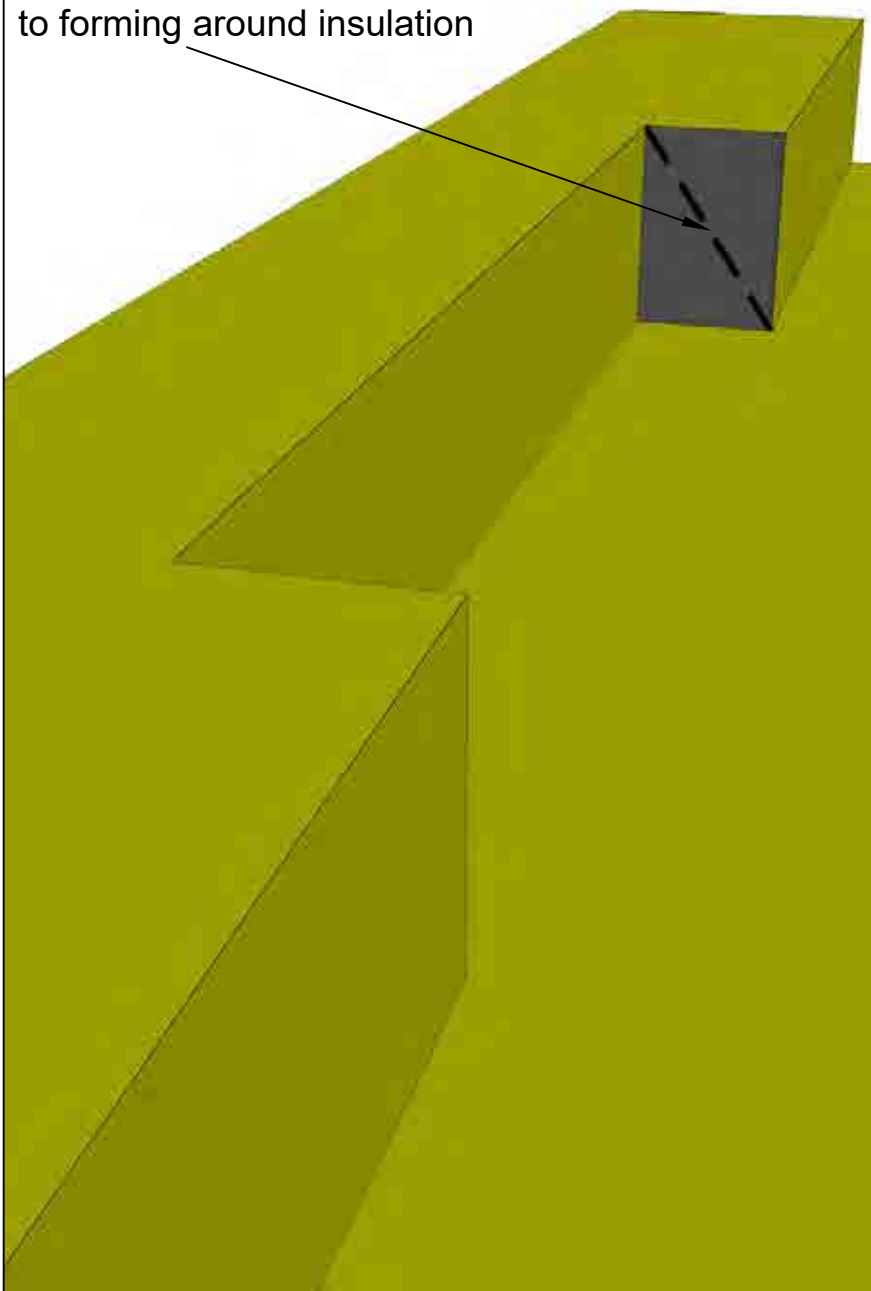


**TYPICAL EXAMPLE OF DOOR THRESHOLD
CONSTRUCTION USING VISQUEEN
DETAILING STRIP**

GENERAL NOTES

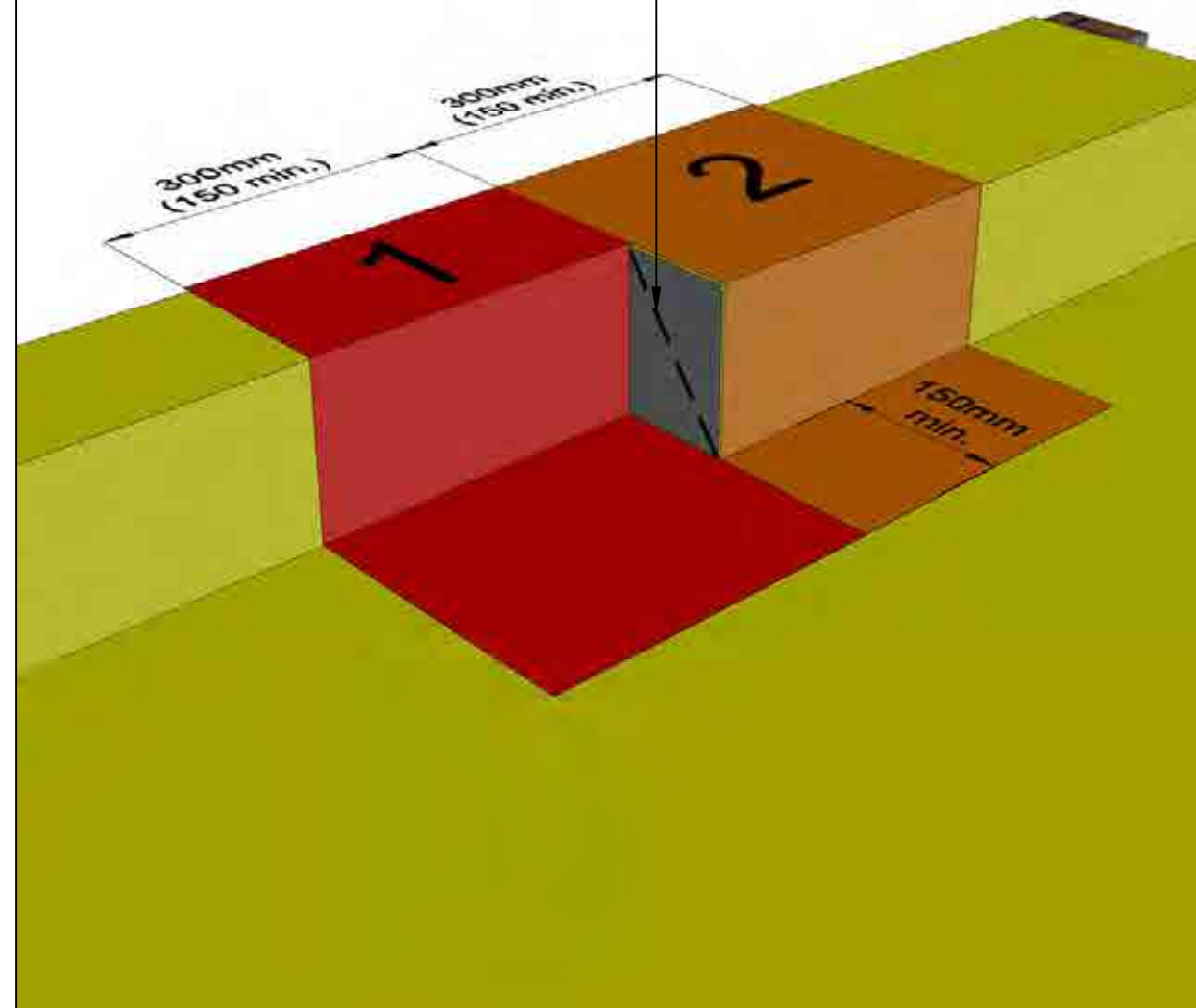
- The different colouring of detail strip presented on this drawing are for illustration purposes only.
- For any complex door threshold section, please contact Coopers prior to undertaking the construction to discuss the best methodology.

Cut in gas membrane prior to forming around insulation



**SHOWING CUT IN GAS MEMBRANE ON
DOOR THRESHOLD**
(NTS)

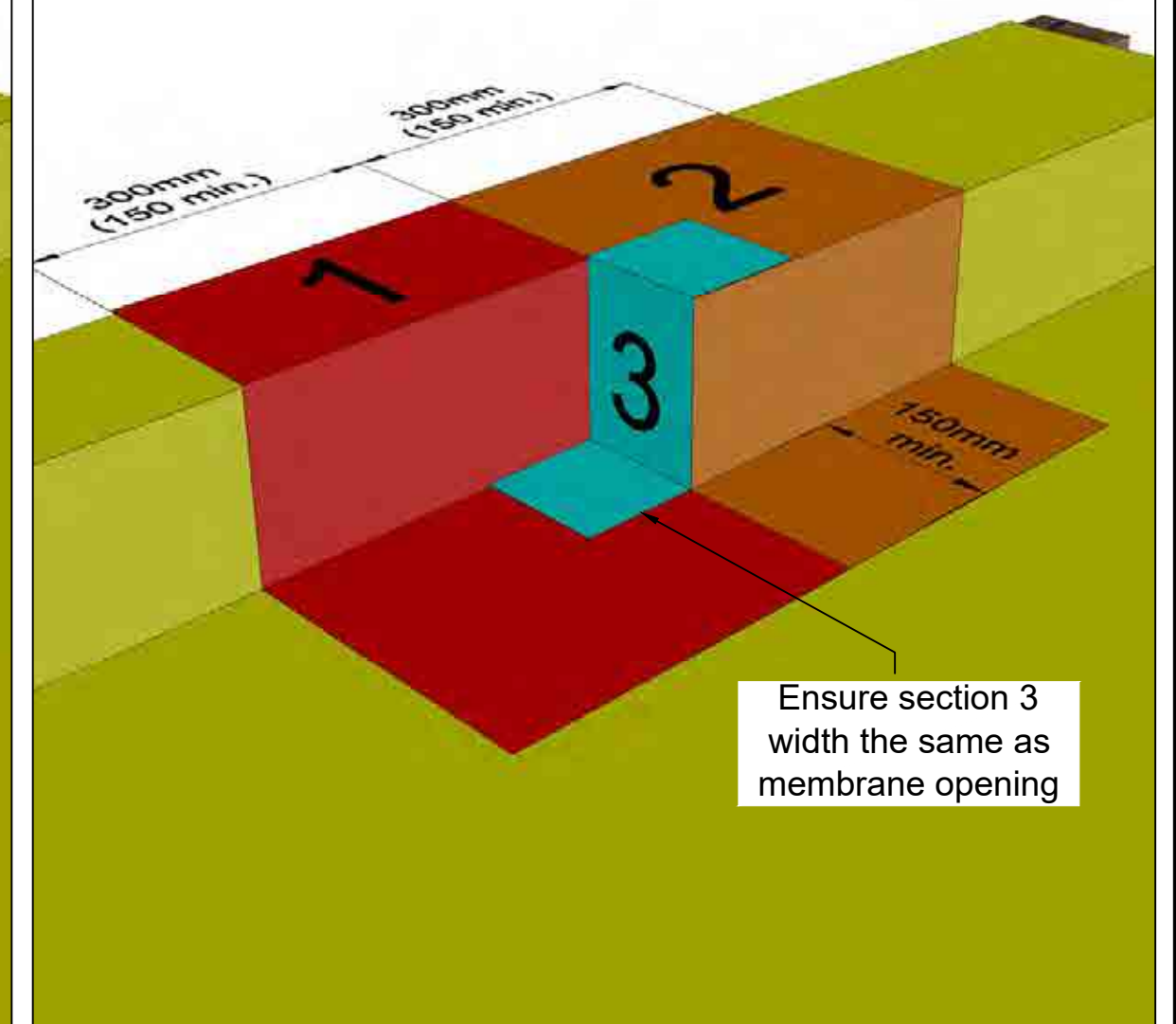
Cut in gas membrane prior to forming around insulation



SHOWING DETAIL STRIP 1 & 2 SECTIONS LAID
(NTS)

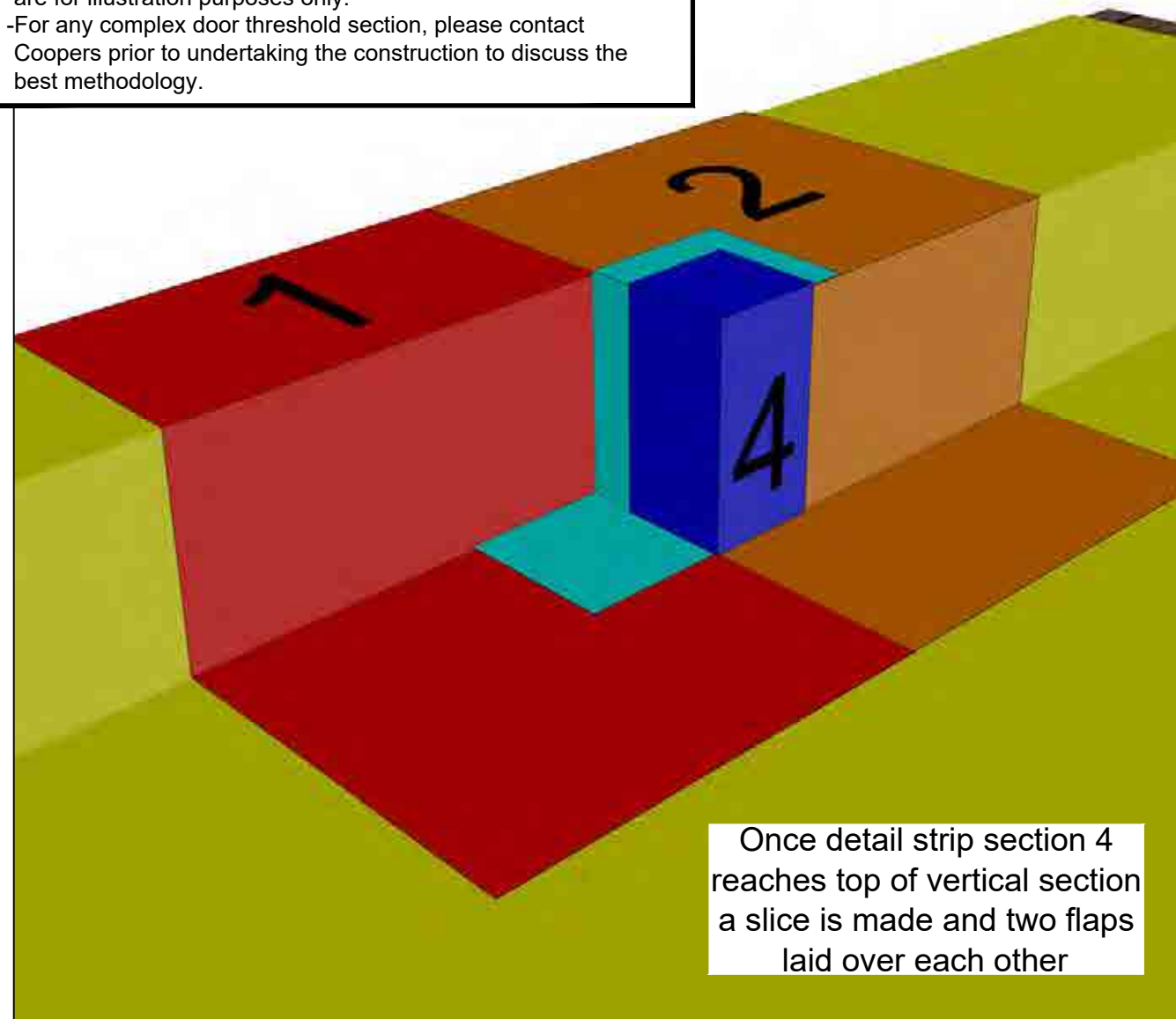
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**THIS DRAWING SHOULD ONLY BE
PRINTED IN COLOUR**



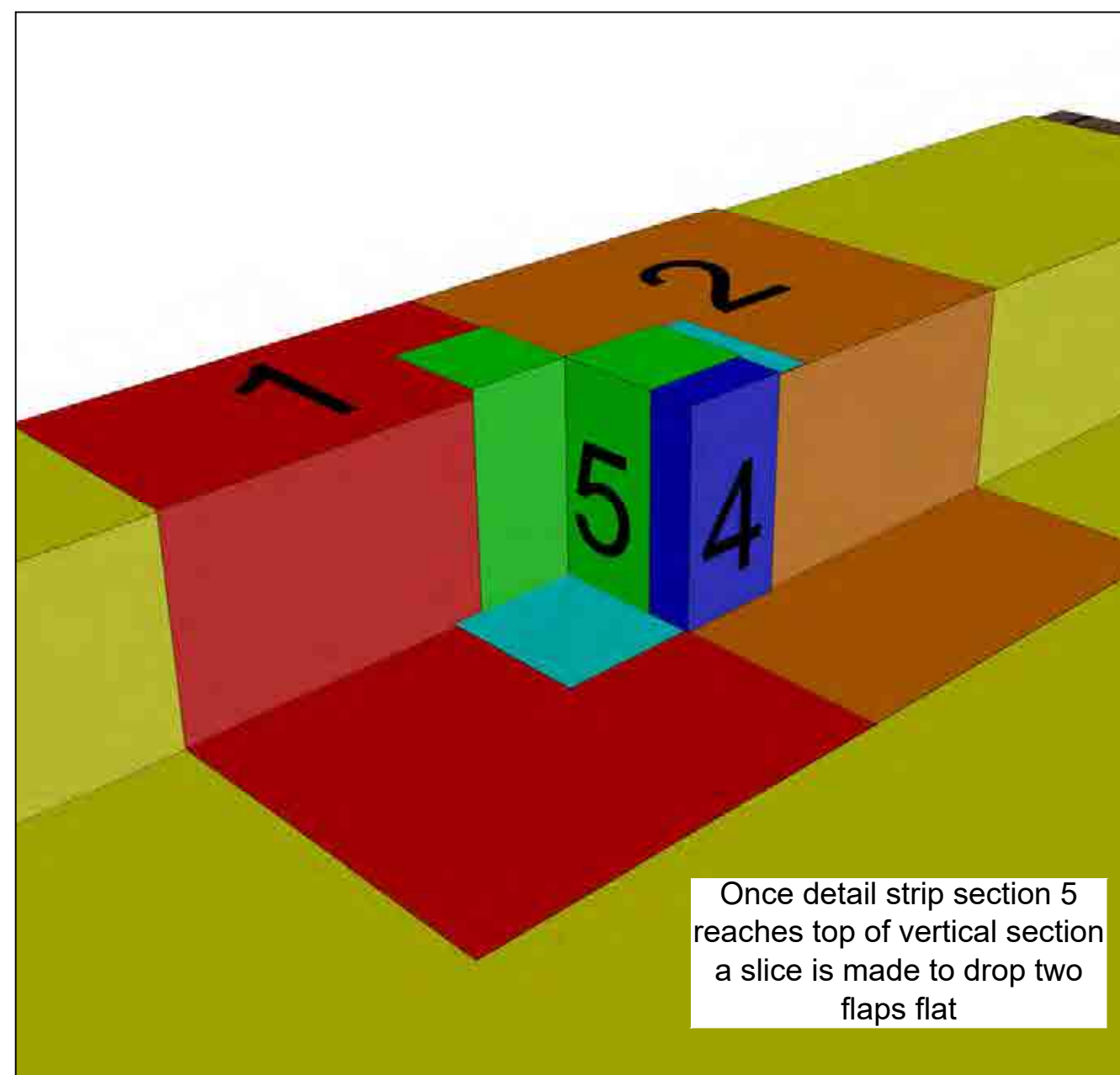
Ensure section 3 width the same as membrane opening

SHOWING DETAIL STRIP SECTION 3 LAID
(NTS)



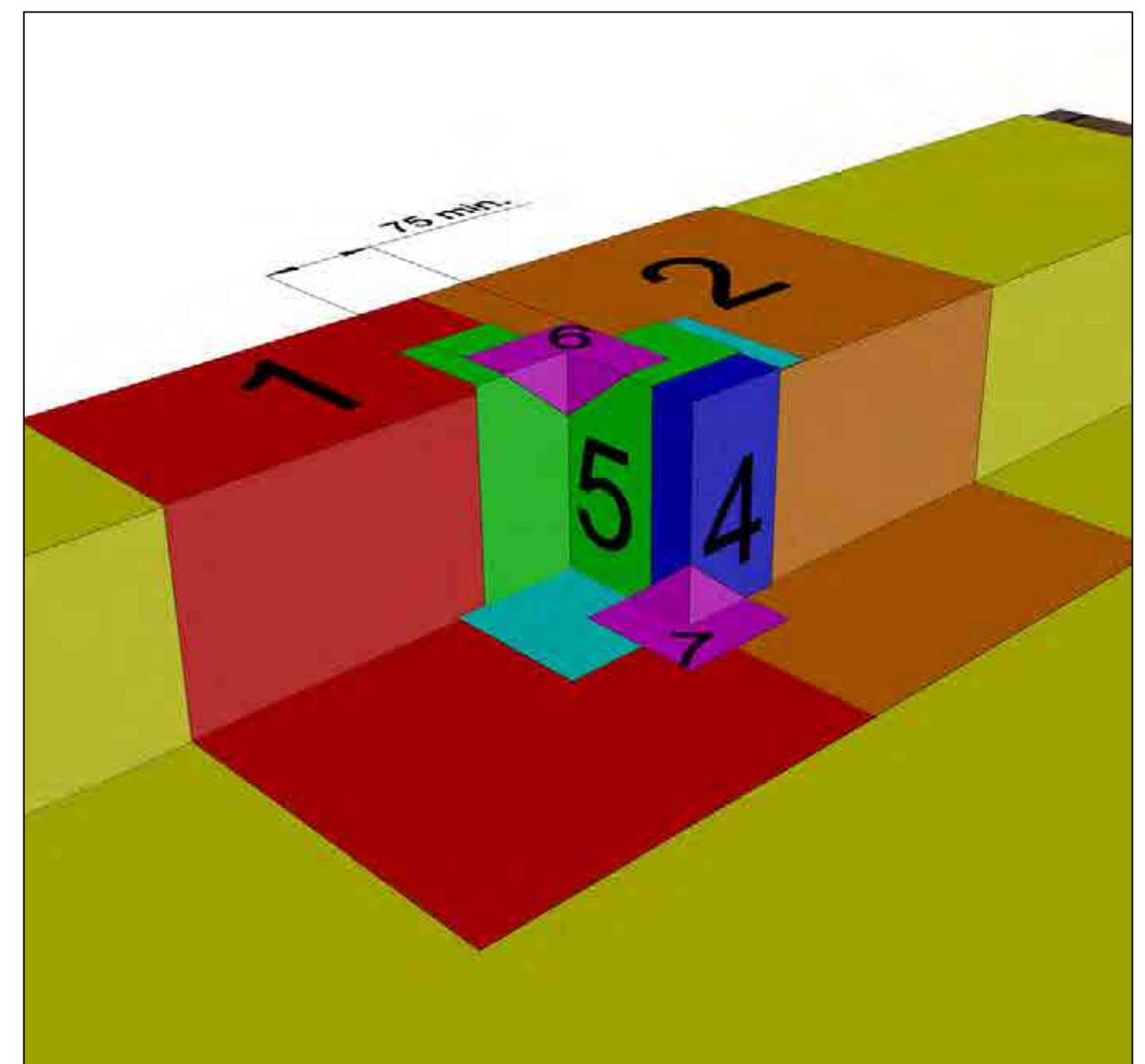
Once detail strip section 4 reaches top of vertical section a slice is made and two flaps laid over each other

SHOWING DETAIL STRIP SECTION 4 LAID
(NTS)



Once detail strip section 5 reaches top of vertical section a slice is made to drop two flaps flat

SHOWING DETAIL STRIP SECTION 5 LAID
(NTS)



SHOWING DETAIL STRIP SECTIONS 6 & 7 LAID
(NTS)

Project
**COOPERS STANDARD DETAILS
2019**

Title
**TYPICAL 100mm SERVICE ENTRY
POINT DETAIL**

DRAWING NUMBER	SCALE at A2		NTS	REVISION
	DATE	02.01.19		
	DRAWN	AH		
	CHECKED	PRS		
2019-SD-GM-SE				

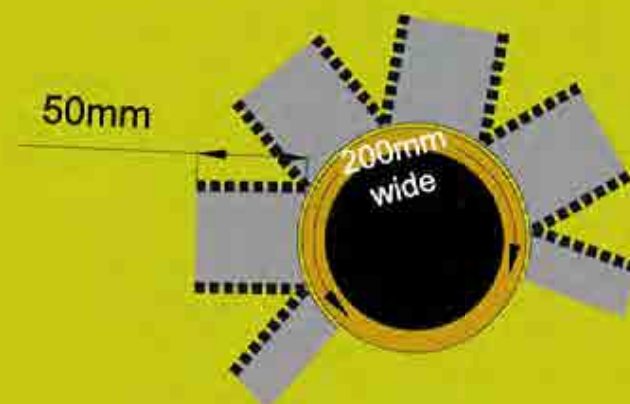


**TYPICAL EXAMPLE OF SERVICE ENTRY
POINT CONSTRUCTION USING VISQUEEN
DETAILING STRIP**

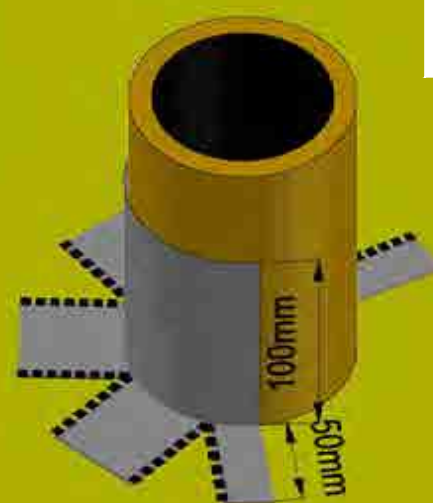
GENERAL NOTES

-For any complex service entry point details, please contact Coopers prior to undertaking the construction to discuss the best methodology.

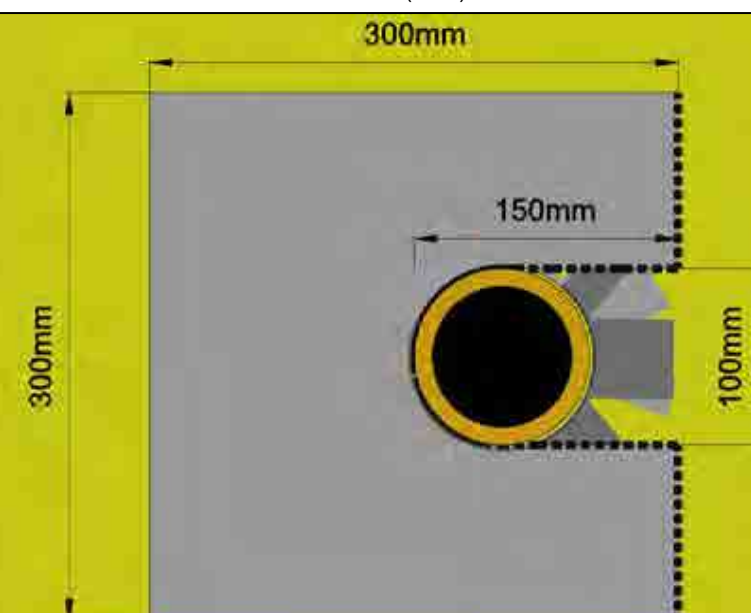
**THIS DRAWING SHOULD ONLY
BE PRINTED IN COLOUR**



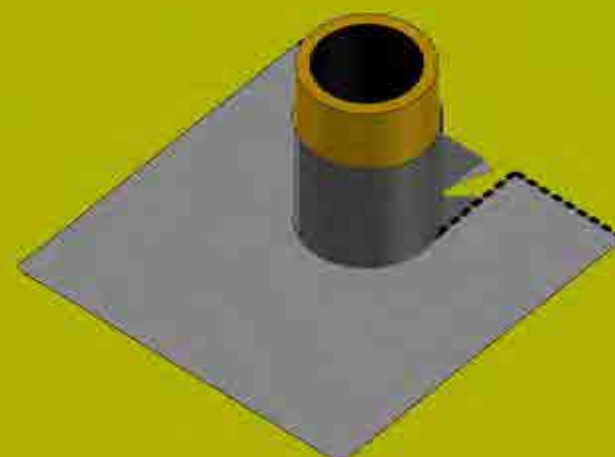
200mm wide and 150mm long detail strip section formed around service entry pipe with splices cut at service entry base to form 50mm long flaps



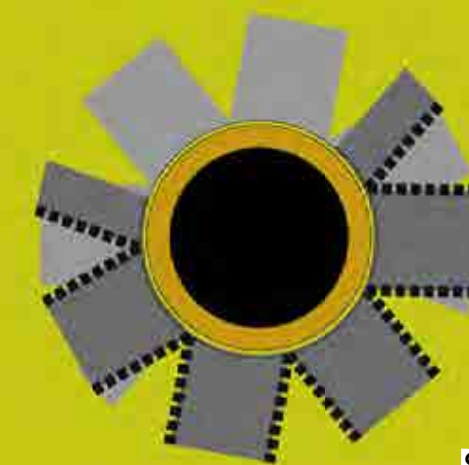
PLAN AND ELEVATION SHOWING DETAIL STRIP 1 SECTION LAID
(NTS)



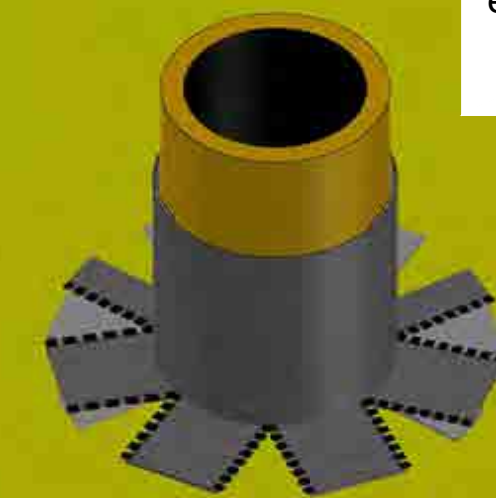
Detail strip section cut around pipe to sit flush against base of service entry



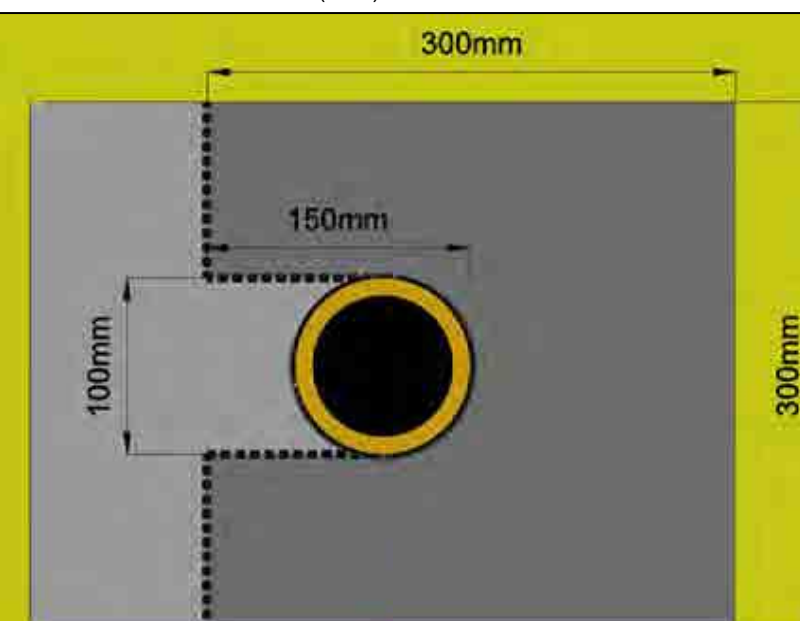
PLAN AND ELEVATION SHOWING DETAIL STRIP 3 SECTION LAID
(NTS)



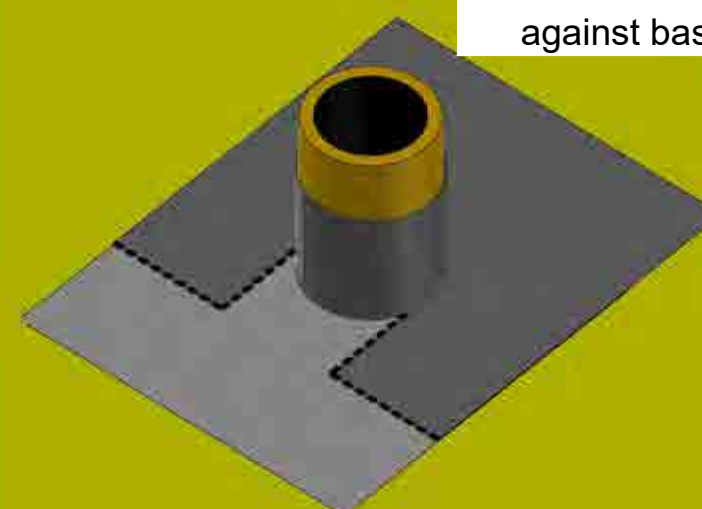
Second 200mm wide & 150mm long detail strip section formed around opposite side of service entry pipe with splices cut at service entry base to form 50mm long flaps



PLAN AND ELEVATION SHOWING DETAIL STRIP 2 SECTION LAID
(NTS)



Second detail strip section cut around pipe and placed on opposite side of service entry pipe to sit flush against base of service entry



PLAN AND ELEVATION SHOWING DETAIL STRIP 4 SECTION LAID
(NTS)

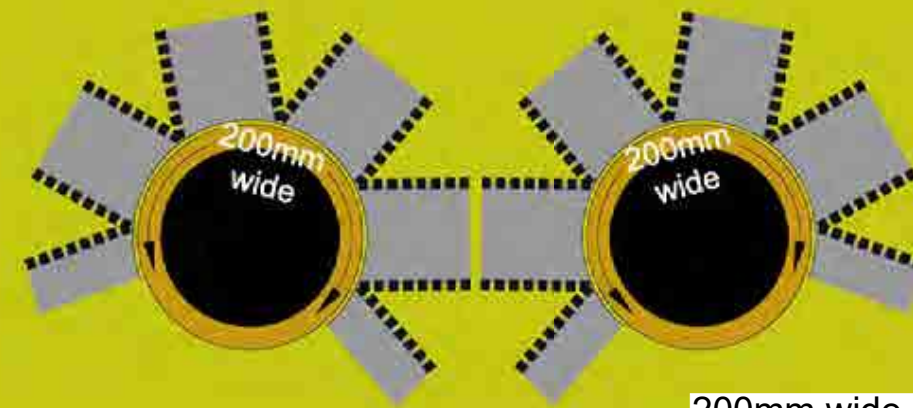
Project

**COOPERS STANDARD DETAILS
2019**

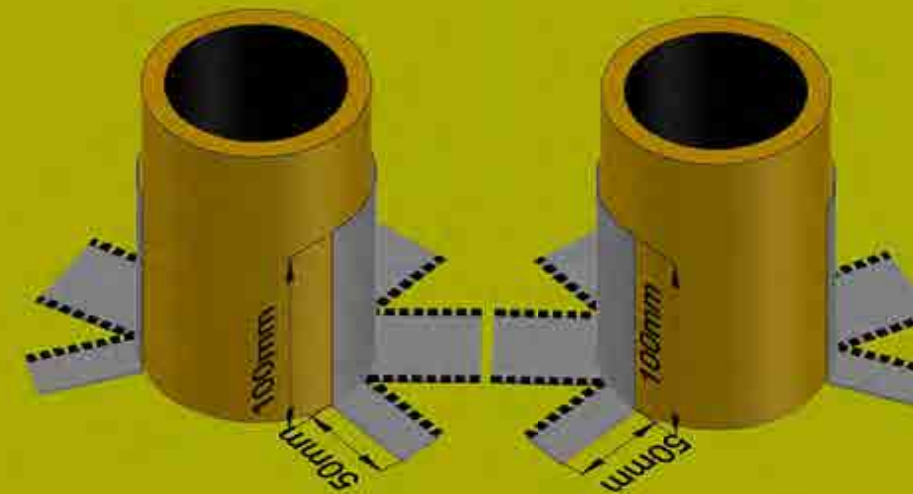
Title

**TYPICAL 100mm DUAL SERVICE
ENTRY POINT DETAIL**

DRAWING NUMBER	SCALE at A2		REVISION
	DATE	NTS	
	2019-SD-GM-DSE	03.01.19	
	DRAWN	AH	
	CHECKED	PRS	-



200mm wide and 150mm long
detail strip sections formed
around each service entry pipe
with splices cut at service entry
bases to form 50mm long flaps



PLAN AND ELEVATION SHOWING DETAIL STRIP SECTIONS 1 & 2 LAID
(NTS)

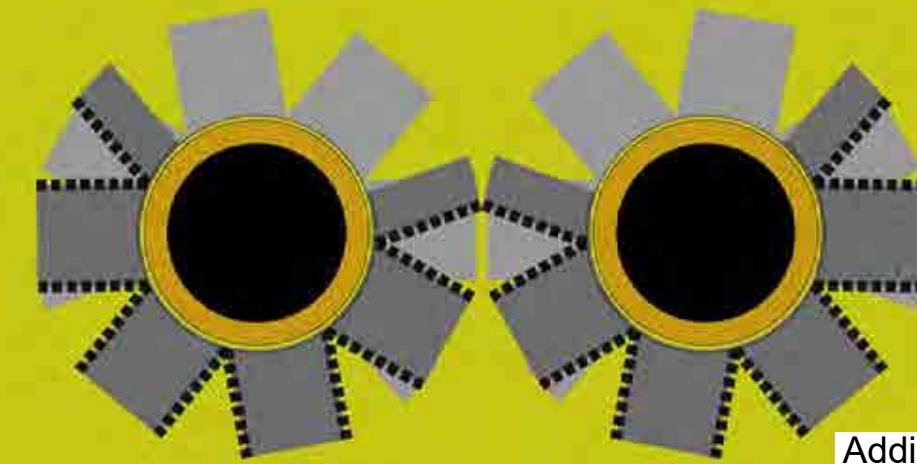


**TYPICAL EXAMPLE OF DUAL SERVICE
ENTRY POINT CONSTRUCTION USING
VISQUEEN DETAILING STRIP**

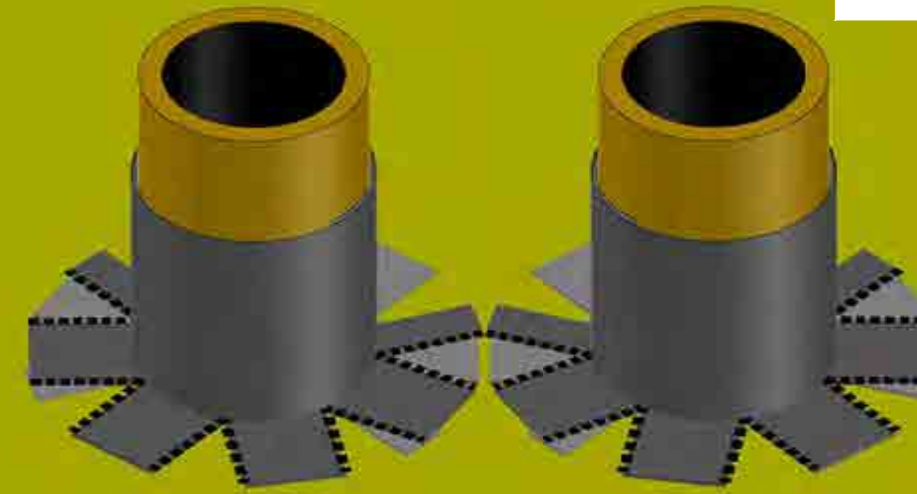
GENERAL NOTES

-For any complex service entry point details, please contact
Coopers prior to undertaking the construction to discuss the
best methodology.

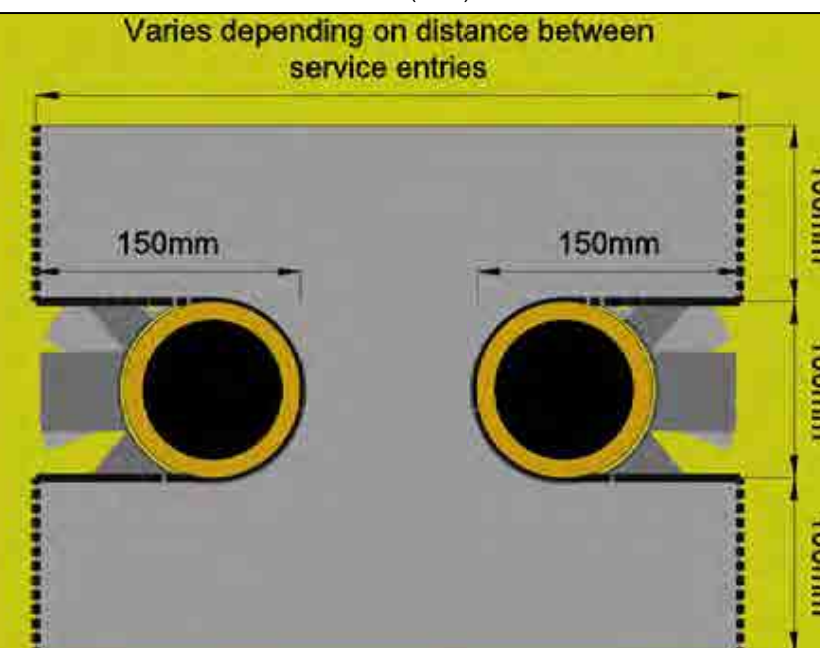
**THIS DRAWING SHOULD ONLY
BE PRINTED IN COLOUR**



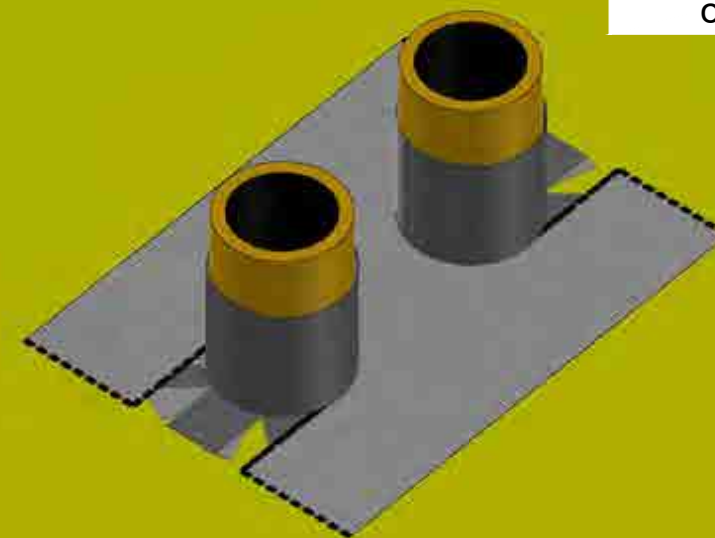
Additional 200mm wide & 150mm
long detail strip sections formed
around opposite side of each
service entry pipe with splices cut
at service entry bases to form
50mm long flaps



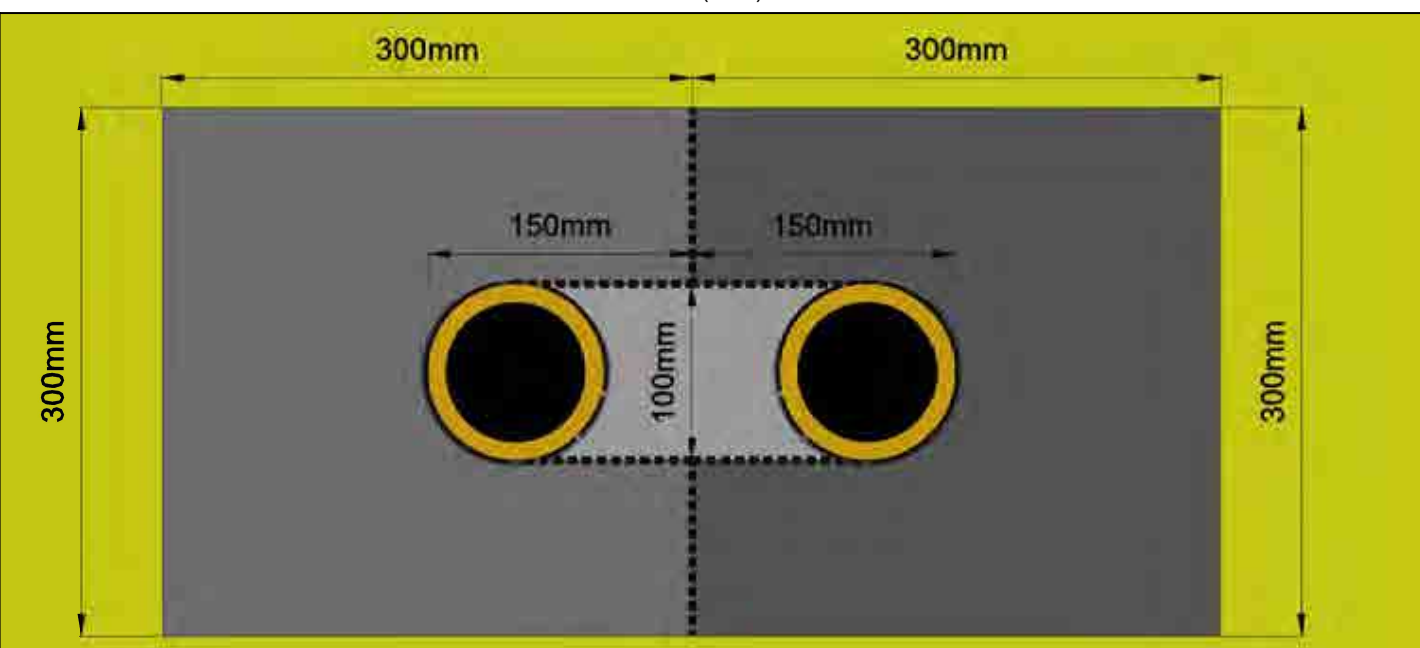
PLAN AND ELEVATION SHOWING DETAIL STRIP SECTIONS 3 & 4 LAID
(NTS)



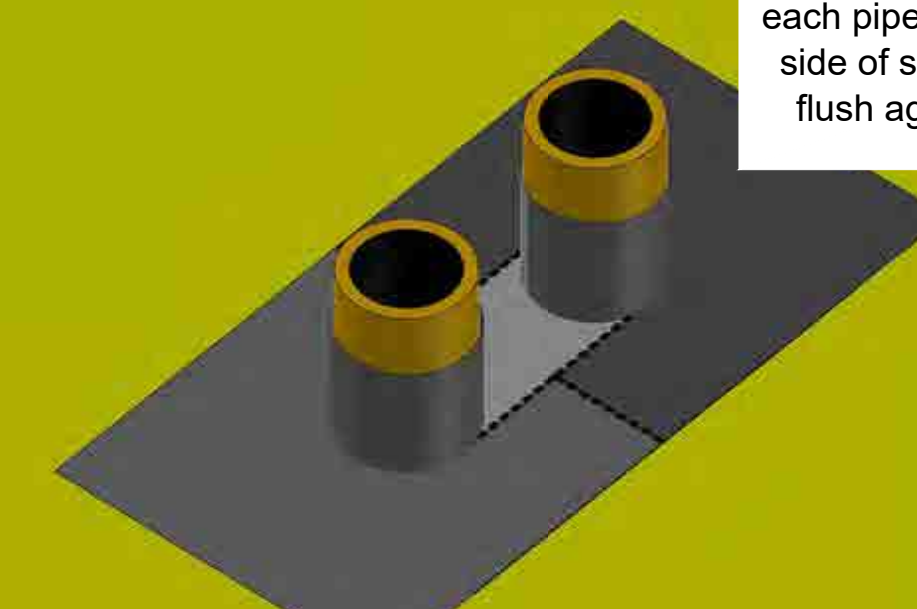
Detail strip section cut around
pipes to sit flush against bases
of service entry pipes



PLAN AND ELEVATION SHOWING DETAIL STRIP SECTION 5 LAID
(NTS)



2 x detail strip sections cut around
each pipe and placed on opposite
side of service entry pipes to sit
flush against bases of service
entries



PLAN AND ELEVATION SHOWING DETAIL STRIP SECTION 6 & 7 LAID
(NTS)



PARKHILL ESTATES AND BRYMBO DEVELOPMENTS LTD

**FORMER BRYMBO STEELWORKS, WREXHAM:
LAGOON SITE**

GROUND CONDITIONS ASSESSMENT

NOVEMBER 2018

Wardell Armstrong

Sir Henry Doulton House, Forge Lane, Etruria, Stoke-on-Trent, ST1 5BD, United Kingdom
Telephone: +44 (0)845 111 7777 Facsimile: +44 (0)845 111 8888 www.wardell-armstrong.com



DATE ISSUED: NOVEMBER 2018
JOB NUMBER: ST16882
REPORT NUMBER: 0001

PARKHILL ESTATES AND BRYMBO DEVELOPMENTS LTD**FORMER BRYMBO STEELWORKS, WREXHAM: LAGOON SITE****GROUND CONDITIONS ASSESSMENT****NOVEMBER 2018****PREPARED BY:**

J Sines Engineering Geologist

A handwritten signature in blue ink, appearing to read 'J Sines', written over a horizontal line.

APPROVED BY:

R Bates Technical Director

A handwritten signature in blue ink, appearing to read 'R Bates', written over a horizontal line.

This report has been prepared by Wardell Armstrong LLP with all reasonable skill, care and diligence, within the terms of the Contract with the Client. The report is confidential to the Client and Wardell Armstrong LLP accepts no responsibility of whatever nature to third parties to whom this report may be made known.

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ENERGY AND CLIMATE CHANGE
ENVIRONMENT AND SUSTAINABILITY
INFRASTRUCTURE AND UTILITIES
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MINING AND MINERAL PROCESSING
MINERAL ESTATES
WASTE RESOURCE MANAGEMENT

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APPENDICES

Appendix 1	Scott Wilson Ltd Link Road Development Module Completion Report
Appendix 2	Smith Grant LLP Link Road Development Module Contamination Certification Report
Appendix 3	Envirocheck Report
Appendix 4	The Coal Authority Consultants Report

DRAWINGS

Drawing No.	Title	Scale
ST16882-002	Site Location Plan	1:25,000
ST16882-003	Site Investigation - Scott Wilson	1:1,250
ST16882-004	Previous Site Investigation – Smith Grant	1:1,250
ST16882-005	Development Constraints	1:1,250

1 INTRODUCTION

- 1.1 This report has been prepared by Wardell Armstrong in accordance with the letter of instruction received from Parkhill Estates Limited (Ltd) and Brymbo Developments Ltd dated 11 July 2018 following a previous site walkover and following a meeting between Wardell Armstrong LLP and Parkhill Estate Ltd, dated 11 and 22 May 2018 respectively. This report is referred to as the Lagoon Site on the front cover as the site area incorporates land owned by Parkhill Estates Limited and Brymbo Developments Limited. However, the early technical aspects of the site are incorporated in the 2007 reports prepared by Scott Wilson and Smith Grant; at which time the site was referred to as the Link Road Development Module (LRDM). To avoid confusion, the site is referred to as the LRDM in this report.
- 1.2 The site, named the 'Link Road Development Module' (LRDM), formerly owned by Brymbo Steel and Iron Works, is located within the village of Brymbo, 5km northwest of Wrexham as shown on drawing ST16882-002. The LRDM is approximately c.2.65 hectares of unoccupied land. The LRDM was part of a large reclamation scheme that took place from 2003 to 2007 on land previously occupied by the Brymbo Steel and Iron Works. The main site was split into 11 smaller sites regarded as 'modules' for the following end uses; residential development, infrastructure, tourism and leisure. This report solely focuses on the Link Road Development Module (LRDM).
- 1.3 The site is bounded to the east by a sports recreational ground, to the west by a track and residential housing, to the south by Heritage Way and to the north by grassland and off road tracks.



Figure 1 – The red outline details the LRDM and nearby surroundings.

- 1.4 The site underwent reclamation works in 2006 and was completed in 2007. Two previously written reports have been provided by Parkhill Estates. The first report, dated November 2007, written by Scott Wilson Ltd (SW); the second report, dated July 2007, written by Smith Grant LLP (SGP). The factual data contained within these reports have been reviewed as part of this appraisal with the relevant information being reassessed in the context of current regulatory legislation for a residential end use. The Scott Wilson report is presented in Appendix 1 and the Smith Grant Report in Appendix 2.
- 1.5 The topography of the LRDM is generally flat, the plateau slopes gently southward from c.190m AOD in the west to c.182m AOD in the south. The southernmost edge of the LRDM slopes upward toward Heritage Way at c.190m AOD. The LRDM includes the south eastern batter of the adjoining cycle track and footpath which is raised above the plateau at c.192m AOD. Finally, towards the southeast the ground level drops and slopes towards the Brymbo sports and recreational ground.
- 1.6 Observations made during the site walkover on 11 May 2018, was that the site was relatively flat and covered in short grass. The site was bounded by vegetation around its perimeter. No signs of fly tipping or litter were observed.

Scope and Objectives

- 1.7 The purpose of this report is to identify and examine in broad terms readily available information relating to the following:
- to establish the historical, environmental, geological, hydrological and hydrogeological setting of the site and surrounding area;
 - to identify the potential risks posed by soil, groundwater and surface water contamination;
 - to identify potential geotechnical and development constraints associated with the site in relation to the future use of the site for residential development;
 - to provide recommendations for supplementary investigations within areas of the site where it is considered there is currently insufficient data; and,
 - to provide recommendations to mitigate identified ground conditions related to constraints to development.

- 1.8 In the preparation of this report, the following information has been used:
- 2007 Scott Wilson Link Road Development Module Completion Report;
 - 2007 Smith Grant Link Road Development Module Contamination Certification Report;
 - Envirocheck Report provided by the Landmark Information Group (LIG report);
 - 2004 Scott Wilson Mining Desk Study;
 - Coal Authority Consultant Coal Mining Report; and
 - British Geological Survey (BGS) online resources.
- 1.9 Wardell Armstrong LLP can accept no liability for the accuracy of information provided by others. Supervision and validation of the reclamation works was carried out by others and therefore the quality of workmanship and accuracy of the facts contained within the above reports is taken in good faith to be correct. In order to properly assess the current state of the ground conditions and to design the foundations etc for the proposed housing development, a further phase of investigation would be necessary.
- 1.10 The interpretation provided in this report is based on the extrapolation of ground conditions from individual site investigation locations, the potential for unforeseen ground conditions to be present between site investigation locations cannot be ruled out.

Proposed Site Use

- 1.11 The site has previously undergone reclamation and is currently unoccupied. It is understood that the proposed land use will be for residential development.

2 SITE HISTORY AND CURRENT SITE USE

Data Sources

- 2.1 The site history has been reviewed with reference to past editions of Country Series and Ordnance Survey mapping in conjunction with aerial photography, all of which have been supplied within the LIG report presented in Appendix 3. Reference has been made to the SW and SGP report and existing aerial photography from Google Earth.

Site History

2.2 Table 1 below identifies previous land uses. Following this, a summary of the history of the LRDM and its immediate vicinity over the period of 1871 to 2018 along with further information that may influence the future development of the site is provided.

Table 1 Summary of LRDM History		
Date	LRDM Land Use	Adjacent Land Use
1871-1879	The site is recorded as being situated within a series of farming fields with no buildings evident.	'Great Western Railway (GWR) tracks' is present 75m to 175m west. 'Iron works' is located 600m to the north with 6 coal mine shafts in an area labelled 'Cambrian Safety Fuse Works'. - A settlement called 'The College' is present c.30m to the south west. - A number of 'old shafts' are recorded in the vicinity of the LRDM, the closest being c.120m north east. - Broughton Colliery is located c.800m to the east and an area labelled 'old quarry' is recorded c.780m to the south south east. 'Vron Colliery' is located c.600m to c.1400m to the south west. - Safety fuse works is recorded c.250m from the LRDM.
1899-1911	The site remains to be situated within a series of farming fields, however an additional railway line passes the west perimeter of the site in close proximity. The area is now regarded as the 'Vron Branch'	- Football grounds are recorded c.70m to c.120m to the north west of LRDM. - Brymbo colliery is located c.1,000m to the north west. - All situated west from the LRDM, 'Brick Works' are seen at c.510m, a 'Clay Pit' and an 'Airshaft' are both recorded at roughly c.750m. - Minor housing developments are observed, including a 'school' and a 'church', directly to the south of LRDM. - Situated north east from the LRDM, 'NANT PIT' is observed at c.720m, also situated northeast is the 'black lane colliery' at c.1000m. - Situated c.750m east a minor quarry is observed covering ground less than c.100m. - Spring located c.410m south of LRDM. - All previous 'Mine Shafts' are now recorded as 'Old Shafts'.
1912-1915	No significant changes.	- The above mentioned housing development has expanded. - Smaller quarry addition to the west roughly c.300m away from LRDM's western edge.
1915-1938	No significant changes.	The 'Plas Power Colliery' is now regarded as disused.

Table 1 (continued) Summary of LRDM History		
Date	LRDM Land Use	Adjacent Land Use
1929-1954	No significant changes.	'Plas Power Colliery' is situated c.500m to the south south east. 'Phosphate works' is located c.550m north north west of the site. - What was once only recorded as the 'Vron colliery' is now recorded separately as 'Vron colliery', 'Brick works' and 'Coal works'
1955-1967	No significant changes.	At some time during this period the railway lines became disused and were dismantled, however the 'Steel works' (positioned c.100m west) still appears to have railways access.
1967-1987	A minor roadway has been constructed in the south west of the site. A helicopter landing pad is located in the north.	- A road is constructed directly south of the site. - A drain is positioned 60m north of the LRDM. - The sports ground positioned to the south east. - The site of the disused Plas Power Colliery is now recorded as a timber yard, detailing 2 disused mine shafts and a concrete block factory.
1987-1990	No significant changes	No significant changes
1991-2000	LRDM area is regarded as 'Sports Ground'	- Timber yard buildings still present yet they are not labelled, the ground surrounding this area, once a colliery, is now regarded as 'Southsea industrial estate' - Most of the previous mines, works and collieries with the exception of the large central steel works appear to be disused.
2000-2003	- Area regarded as 'Recreational Ground' - Surface water lagoon ponds are present on site	No alterations to note on mapping sheets available
2006	- Aerial photography shows two small buildings in the south west corner of the site beside Heritage Way. - Aerial photography shows the lagoons still present on site.	No significant changes.
2009-2013	Buildings no longer present	Residential development c.75m to the south west of the site.
Current	No significant changes.	No significant changes.

Current Site Use

2.3 The site is currently unoccupied awaiting development.

3 ENVIRONMENTAL SETTING

Geology

- 3.1 The assessment of the geology of the site is based on online resources and information based on previous reports in the area. This is summarised in Table 2 below:

TABLE 2 Summary of Relevant Geological Data	
Strata	Description
Made Ground	The Scott Wilson Report indicates the majority of the site is underlain by sandstone fill. The Smith Grant report indicates that colliery fill is present in the north west of the site.
Natural Superficial Deposits	No recorded data available within the site perimeters. The BGS online map shows the surrounding area to the south and east of the site are underlain by Glacial Till deposits. Superficial deposits are unlikely to be present as a result of the reclamation works.
Solid Strata	According to the BGS onshore available data, the site consists of the Cefn Rock Formation, a sandstone formation from within the Middle Coal Measures.
Geological Structure	According to the published geology, the 'Brymbo Fault' lies east and north-east to the site, trending north/north west to south/south east. The Coal Authority report suggests that two geological faults, trending north-west/south-east, is positioned in the north-west section of the LRDM. The Coal Authority suggested that these are two in-seam faults proven in the 'Main Coal Seam' as recorded on the 1914 Edition 6 inch Geological Denbighshire 28NW. The consultant's report suggests the Main Coal Seam is c.200m bgl beneath the site. These faults can be reviewed in Appendix 4.

Hydrogeology

- 3.2 Hydrogeological information has been obtained from a review of: Landmark Information Group Envirocheck report (LIG report); Smith Grant Link Road Development Module Contamination Certification Report; Groundwater Protection Policy and Groundwater Vulnerability maps published by the Environment Agency; Hydrogeological maps published by the British Geological Survey; and Guidance covered within the Environment Agency Groundwater Protection documents.
- 3.3 The underlying solid strata is classified as a Secondary A Aquifer.
- 3.4 SGP indicate that the closest borehole to the LRDM struck groundwater at an average depth of 11.4m bgl over a number of years. The closest available BGS borehole (reference SJ35SW483) c.548 south east of the site showed groundwater was struck at 5.90m within sand and gravel deposits.

- 3.5 There are no groundwater and surface water abstraction licenses within 1km of the site.
- 3.6 Groundwater within the area of Brymbo has previously been sampled by SGP and subsequently assessed. It was found to be of poor quality understood to be as a result of poor quality of groundwater within the Coal Measures and industrial land use.

Hydrology

- 3.7 The nearest surface water feature is c.189m to the south of the site behind a primary school in the form of a narrow stream or pond. The closest major water source to the site is Lodge Stream c.300m north east of the site.
- 3.8 There are no active water abstraction licences within 1km of the LRDM.
- 3.9 According to the LIG report, the site does not lie within a flood zone related to rivers or the sea. Although, small parts of the site in the south and east is shown to be at low risk of flooding during a 1 in 1,000 years flood event as a result of excess local rainfall.
- 3.10 According to the LIG report, the River Gwenfro has a river quality B assigned in 2000 c.749m south east of the site.

Coal Mining

- 3.11 The Coal Authority (CA) report (ref 51001895663001) that the site is within an area of previous underground coal mining activity between 1876 to 1913. It is reported that there are no probable unrecorded shallow workings and no mine entries within 100m of the LRDM. There is no recorded mine gas within 500m.
- 3.12 The CA has not received a damage notice for the LRDM or any property within 50m of the site boundary since 31st October 1994. There are no recorded coal mining licenses within 200m.
- 3.13 An open cast mine was present immediately north of the site in relation to the Brymbo Iron and Steel Works up until 1990. The reclamation of the former Brymbo steelworks commenced in circa 2003 and included the recovery of residual coal reserves by opencast operations. The excavation void was backfilled to an engineering

specification for the proposed built development. The full CA report for the LRDM area can be viewed as Appendix 4.

Statutory Sources

- 3.14 Information from various statutory sources has been summarised from the LIG report prepared specifically for this site.

Contaminated Land Register Entries and Notices

- 3.15 No contaminated land entries or notices are identified within 1km of the site.

Landfill / Waste

- 3.16 According to the LIG report, the site is underlain by an 'EA Historic Landfill and a 'Licensed Waste Management Facility (Landfill boundary)'. The LIG report shows the historic landfill to originate in 1899. As the site has recently undergone reclamation works, it is plausible to suggest that the landfill is no longer present beneath the LRDM. There are three additional Environment Agency historic recorded landfills within 1km of the site boundary. There are currently no BGS recorded landfill sites within 1km of the site. Details of the historic landfill sites are shown in Table 3 below.

TABLE 3 Recorded Historic Landfill Sites.	
Environment Agency Historical Landfill Sites	
Location	Details
Historic Landfill site: Licence Holder: Brymbo steel Works Ltd Grid Ref: 329737 352531 Distance from Site: 0m	Site Location: within perimeters of LRDM Provider Reference: EAHLD35604. Authority: Unknown. Site Category: Landfill. Waste Type: Deposited waste included industrial waste. First Input date: 30 th Dec 1899. Last Input date: not supplied. Licence Status: Unknown/ not supplied.
Historic Landfill site: Licence Holder: Mr P Dempsey Grid Ref: 329224 352165. Distance from Site: 500m SW	Site Location: Peniel House, Fron, Wrexham. Provider Reference: EAHLD35604. Authority: Unknown. Site Category: Landfill. Waste Type: Deposited waste included inert waste. First Input date: 31 th Dec 1980. Last Input date: 28 th Feb 1982. Licence Status: Unknown/ not supplied.

TABLE 3 Recorded Historic Landfill Sites.	
Historic Landfill site: Licence Holder: not supplied Grid Ref: 330184 353496. Distance from Site: 896m NE	Site Location: Byrmo, Byrn Malley Provider Reference: EAHLD14244. Authority: Unknown. Site Category: Landfill. Waste Type: Deposited waste included inert waste. First Input date: 31 th Dec 1890. Last Input date: 28 th Feb 1920. Licence Status: Unknown/ not supplied.
Historic Landfill site: Licence Holder: Brymbo steel Works Ltd Grid Ref: 329074 353278. Distance from Site: 948m NW	Site Location: Brymbo, Wrexham Provider Reference: EAHLD14760. Authority: Unknown. Site Category: Landfill. Waste Type: Deposited Waste included Industrial and Special Waste, and Liquid Sludge First Input date: 31/12/1940. Last Input date: 31/12/1985. Licence Status: Unknown/ not supplied.

- 3.17 There are four licensed waste management facilities within 500m of the site. According to the LIG report, the closest is 8m to the west of the site beside the cycle pathway. However, the site walkover confirmed that the licensed waste management facility is no longer present adjacent to the site.

Radon risk

- 3.18 The site is within an intermediate probability radon area, 3% to 5% of homes are estimated to be at or above the action level.
- 3.19 Therefore, basic radon protection measures are necessary in the construction of new dwellings or extensions.

Asbestos

- 3.20 The Smith Grant Contamination Certification Report indicates that there were no asbestos fibres detected prior and after the reclamation of the site. As the site remains undeveloped, it is unlikely that asbestos has since contaminated the area.

Environmental Issues

- 3.21 The Environment Agency data within the LIG report records 12 discharge consents within 1km of the site, one of which is within the site and 2 additional consents within

500m of the site. Table 4 provides information on the three consents within 500m of the site.

TABLE 4 Discharge Consents	
Consent	Details
Operator: Brymbo Developments Ltd Grid Ref: 329690 352430 Distance from Site: 0m	Location: Former Brymbo Steel Works Site, Brymbo, Wrexham. Discharge Reference: CG0371101 Date: 14 April 1997 Type: Trade and other matter discharge. Receiving Water: River Gwenfro
Operator: Pimbrook (Leicester) Ltd Grid Ref: 329896 352003 Distance from Site: 424m	Location: Southsea Plas Power Colliery Reclamation, Plas Power Colliery Reclamation. Discharge Reference: Cm0093001 Date: 19 July 1982 Type: Unspecified Receiving Water: River Gwenfro
Operator: Brymbo Developments Ltd Grid Ref: 330014 352581 Distance from Site: 403m	Location: Former Brymbo Steelworks Site, Brymbo, Wrexham, Wales. Discharge Reference CG0371001 Date: 14 April 1997 Type: Trade and other matter discharge. Receiving Water: River Gwenfro

- 3.22 The discharge consent that was assigned on site is the outlet from surface water treatment lagoons that were previously located on the site area, as part of the reclamation works environmental controls.

Environmental Pollutant Events

- 3.23 The Environment Agency data, via the LIG report, Appendix 3, recalls the following environmental pollutant events within the vicinity of the site, the nearest being at a distance of 294 metres. The findings are detailed below in Table 5.

Table 5 Pollutants within a 500m Radius of the LRDM	
Pollution incidents to controlled waters	
Details	Location
Property type: Council premises Location: n/a Authority: Environment Agency, Welsh Region Pollutant: mud/clay/soil Note: blocked sewer Incident date: 26 May 1992 Incident reference: 4379 Incident severity: cat 2 – significant incident	Grid reference: 329800 352100 Distance from LRDM: 294m S
Property type: water company sewage (storm overflow) Location: n/a Authority: Environment Agency, Welsh Region Pollutant: Light oil Note: weather Incident date: 25 May 1995 Incident reference: 24167 Incident severity: cat 3 – minor incident	Grid reference: 329900 352100 Distance from LRDM: 336m S
Property type: waste handling facilities Location: up stream of, Southsea church Authority: environment agency, welsh region Pollutant: farm land run-off Note: deliberate act Incident date: 16 May 1996 Incident reference: 28413 Incident severity: cat 3 – minor incident	Grid reference: 330001 352051 Distance from LRDM: 436m SE
Property type: n/a Location: Near Tyanfron, turning upstream of Gwyn hotel Authority: environment agency, welsh region Pollutant: farm land run-off Note: deliberate act Incident date: 25 May 1996 Incident reference: 28413 Incident severity: cat 3 – minor incident	Grid reference: 329900 352100 Distance from LRDM: 440m SE
Property type: n/a Location: 22 Pleasant view, Pentre Broughton, Wrexham Authority: environment agency, welsh region Pollutant: oils – petrol Note: river Gwenfro, direct introduction Incident date: 25 May 1995 Incident reference: 24167 Incident severity: cat 3 – minor incident	Grid reference: 330001 352001 Distance from LRDM: 475m SE

Underground Services

- 3.24 The site has been excavated and backfilled therefore it is unlikely that services are present beneath the site. However, future development within the LRDM should be approached with due regard for the location of possible underground services, water pipes and cables.

4 RECLAMATION OF THE LINK ROAD DEVELOPMENT MODULE

- 4.1 The reclamation work was undertaken by Brymbo Developments Ltd (BDL) on the LRDM between 2006 and 2007 as part of the reclamation of the former steel works site that began in 2003. The following information has been provided by SW and SGP within their reports.
- 4.2 Excavation works began in July 2006. The pre-reclamation baseline soil associated with the former surface water treatment lagoons was stripped off site. This involved reducing the level of the site by 3.5 to 4.5m to form a regular formation level. The formation level was formed within the weathered Cefn Rock (sandstone), where final excavation depths ranged between 3.06 in the south and 10.20m in the north. All the natural materials excavated were stockpiled and reused on the site as compacted layers.
- 4.3 Backfilling works began in August 2006, comprising Cefn Rock sandstone that was excavated within the LRDM and replaced to an engineering specification.
- 4.4 In the south west of the site are landscape batters which were treated with 0.50m of clean fill and topsoil. The north western boundary of the site, known as the 'tree line bank' was left undisturbed during the reclamation works.
- 4.5 Excavation gradients at the perimeters of the site were formed at gradients greater than 1:1. It is understood that this is steeper than allowed in the Earthworks Compaction Specification. It was stated that the slopes were formed to maximise the extent of fill and to maximise the area available for redevelopment. This is referred to further as a buried slope and is shown on drawing ST16882-005.

5 PREVIOUS SITE INVESTIGATION DATA

5.1 Numerous site investigations have previously been undertaken within the LRDM. Information related to these investigations have been provided by Parkhill Estates. The reports written by SGP and SW have been reviewed and are summarised below. The reports were both issued in 2007 and were prepared to support a residential end use. As environmental legislation has changed significantly since that time, the environmental conclusions of these reports need to be reviewed in light of the current housing development proposals. Therefore, the factual data contained within these reports have been reviewed as part of this current appraisal with the relevant information being reassessed for a residential end use within section 5 and 6 of this report. Earthwork validation results and geochemical results from the previous reports are presented in Appendices 1 and 2 respectively. The scope of the work undertaken within each phase of work is discussed below.

Smith Grant LLP Site Investigation 1995

- 5.2 SGP investigated the main steelworks site in 1995, the main aim of the investigation was to identify contamination levels across the site. The LRDM was not included within this investigation, apparently because a historical study had shown that the LRDM was not part of the industrial development envelope of the steelworks, however immediately north west (c.80m), Billet Mill was investigated via 12 trial pits.
- 5.3 Gas monitoring was undertaken in boreholes of unknown quantity for the concentrations of carbon dioxide, methane and oxygen. Boreholes were positioned in Wonder Bank, Works Tip, Blast Furnace Area and main steel works area.
- 5.4 No radiological hazards were encountered during a radiation survey.
- 5.5 Strata temperatures were measured during and post drilling. Results showed no indication of combustible materials.
- 5.6 A number of soil samples from contaminated wastes within the former Brymbo steelworks site were submitted for dioxin analysis. Detectable dioxins were recorded within samples from the Wonder Bank Tip, however were concluded to be at low enough levels to warrant no remedial measures.

Smith Grant LLP Site Investigation Pre-reclamation 2003-2006

- 5.7 SGP was appointed by BDL as an environmental consultant to advise on environmental aspects of the reclamation and redevelopment of the former Brymbo Steelworks site. SGP undertook a site investigation prior to the reclamation, to geochemically assess the soils potentially affected by the on-site surface water storage lagoons established by the steelworks.
- 5.8 SGP collected four composite topsoil samples from an area to the east of 'lagoon No 2' (see drawing R175-12 within Appendix 2) annually between 2003 and 2006. Additionally, twenty one soil samples were collected across the LRDM. In November 2005, a total of three samples were collected from the base of lagoon numbers 2 and 3 established by Brymbo Developments to assess any contamination associated with the sludges deposited during the use of the lagoons for surface water treatment. Lastly in 2006, fourteen samples were collected from hand dug pits in the area at depths between 0 and 0.50m bgl, after the surface water had drained from the lagoons.
- 5.9 SGP sampled groundwater encountered from other nearby reclamation sites to assess its quality. No depths are provided. The results showed that the groundwater was generally of poor quality due to the long industrial history of the site. Discussions were held at the time with The Environment Agency Wales (EAW), now known as Natural Resources Wales (NRW), who agreed that the groundwater is not considered a sensitive receptor and is not likely to be used for supply of potable water.

Smith Grant LLP Reclamation Works Inspections 2006

- 5.10 SGP inspected the backfilled material daily to ensure the material remained uncontaminated from other materials on site. Once backfilling had been completed, SGP undertook validation testing of the final fill layer, that was undertaken using a 30m grid spacing, 0.50m below finished floor level. Sampled areas also included the landscape batters in the south west that had 0.50m clean fill and topsoil emplaced, and the tree lined bank along the north west boundary as it remained undisturbed during the reclamation works.

- 5.11 In total 55 soil samples were collected and scheduled for geochemical testing, 23 of which from the intermediate fill materials, 25 from housing formation level, 2 from the batters and 5 from the tree lined bank. An additional 3 samples were taken from the topsoil stockpile stripped from the LRDM and 19 samples for leachate analysis.
- 5.12 Where available, the samples collected during the two site investigations were assessed based on CLEA SGVs for residential with plant uptakes end use. Where not published, reference was made to Inter Departmental Committee for the Redevelopment of Contaminated Land (CIRCL) guidelines for places where plants are to be grown and United Utilities Trigger and Action values. Seven samples underwent additional leachate analysis for a wide range of metals, cyanides and phenols. Results were compared to site specific leachate criteria that was agreed with the EAW following a P20 risk assessment undertaken by SGP. Results were also compared with UK EQS standards and UK Drinking Water Standards (UKDWS) 2000.
- 5.13 The full Contamination Certificate Report is presented in Appendix 2.

Scott Wilson Ltd Reclamation, Validation Testing and Monitoring 2006 to 2007

- 5.14 SW was appointed by BDL to provide geotechnical expertise in connection with the reclamation programme. The report issued by SW 'Reclamation of Brymbo Steelworks Link Road Development Module Completion Report' comprises of a brief desk study, summary of earthworks, validation testing and monitoring.
- 5.15 To validate the earthworks, SW undertook plate load testing and settlement monitoring as earthwork levels were achieved. Nine plate load tests were undertaken between 18 and 26 October 2006.
- 5.16 Twenty-two settlement pins were installed across the LRDM site. Monitoring took place between November 2006 and August 2007. SW had acknowledged within the report that this was 'a relatively short monitoring period' and therefore concluded that long term settlement predictions were less accurate. SW predicted a creep settlement of $8\text{mm} \pm 50\%$ over 25 years. Eleven years have now passed since the predictions.

- 5.17 The full reclamation Completion Report is presented in Appendix 1 and site investigation locations shown on Drawing No. ST16882-003.

6 GROUND CONDITIONS AND GEOTECHNICAL ASSESSMENT

Made Ground

- 6.1 The SW Completion Report indicates that 3.00 to 9.70m of compacted Coal Measures fill was placed across the site. This compacted backfill was encountered to the full depth of all locations during the SGP site investigation in 2007, although the majority of these were shallow trial pits. The thickest compacted backfill is located in the northern corner of the site.
- 6.2 Made ground was described to be reworked Coal Measures material, reworked from the Cefn Rock sandstone beneath the LRDM. The intermediate fill was described as 'clayey gravelly sands with gravel of sandstone, coal fragments and occasional crushed concrete'. The housing formation level surface comprised layers of compacted sand and sandstone fill previously excavated from the LRDM was generally described as a 'brown clayey granular material with sandstone and coal fragments'.
- 6.3 The undisturbed material within the Tree Lined Bank in the north west of the site was recorded as a 'gravelly sandy soil with gravel of shale, mudstone and sandstone with occasional pieces of slag'.

Natural Superficial Deposits

- 6.4 No superficial deposits were encountered within the LRDM during the site investigation and reclamation works.

Solid Geology

- 6.5 There are no data regarding the solid geology in any of the previous site investigations. Information from the desk study and previous desk studies confirm the presence of Cefn Rock sandstone. Depths to bedrock on the LRDM site are not specifically provided. Although the SW report does indicate that the original site levels had to be reduced by 3.5 to 4.5m to form a regular foundation level within the weathered Cefn Rock sandstone. Therefore, it is anticipated that depth to bedrock corresponds to the thickness of compacted backfill across the site.

Groundwater Observations

- 6.6 No groundwater was encountered within the LRDM during the site investigations or reclamation works.

pH and Sulphate

- 6.7 Based on the results of the Smith Grant 2007 post reclamation site investigation, assuming a mobile groundwater regime, a Design Sulphate Class of DS-2 and an ACEC class of AC2 is currently recommended.

Ground Gas

- 6.8 No gas monitoring has been conducted within the LRDM site boundary. No elevated ground gases were recorded in adjacent areas during the 1995 SGP site investigation. However, post reclamation monitoring in the northernmost development modules recorded a maximum concentration of 6.6%v/v for carbon dioxide and 1.7%v/v for methane with flow rates recorded below 0.07l/hr.

Foundations

- 6.9 During the earthworks validation carried out by SW, the plate load test results indicated a general CBR value of 2-3%, although the near surface materials may have, in part, deteriorated since the plate load tests were carried out c.10 years ago.
- 6.10 During the settlement monitoring in 2006 / 2007, 13 monitoring pins recorded less than 5mm of heave, eight pins recorded minimal settlement, less than 10mm and were located along the eastern edge of the area. In the northern corner of the site, one pin recorded a settlement value greater than 10mm (19.7mm in the area of thick made ground, up to 10m in thickness).
- 6.11 The relatively low settlement values indicate that reinforced shallow or trench fill strip foundations would be suitable for use on site, to minimise the effects of differential settlement, heave and longer-term creep settlement. Given the extent of fill on site, raft foundations may also be suitable.
- 6.12 The deeper compacted backfill in the north east of the site showed higher settlement in comparison to the remaining area of the site, and hence poses a high risk of

differential settlement. Therefore, raft foundations may need to be considered for residential development in that area.

- 6.13 Whilst on face value the information in the SW report indicates that the material has been placed in accordance with the engineering specification it would be prudent to carry out a further phase of site investigation to validate this.
- 6.14 The SW report indicated a buried slope around close to the perimeter of the site. Therefore, differential settlement is anticipated to be higher in these areas, thus built development should be avoided in these areas, which may be more suitable for less sensitive landscape/garden areas.

7 GEO-ENVIRONMENTAL ASSESSMENT

- 7.1 The UK legislative approach to the assessment of contaminated land is defined by the requirements of Part IIA of the Environmental Protection Act (EPA) 1990 and implemented by the Contaminated Land (England) Regulations 2006 (which consolidate the provisions of the Contaminated Land (England) Regulations 2000 and subsequent amendments).
- 7.2 This regime is designed to provide an effective statutory framework for the remediation of contaminated land and is based on a number of principles including the “suitable for use” approach and the assessment of contamination by a risk based approach.
- 7.3 Part IIA of the EPA (1990) defines contaminated land as land that is in such a condition that:
- significant harm is being caused or there is a significant possibility of such harm being caused; or
 - pollution of Controlled Waters is being or is likely to be caused.

- 7.4 The assessment of contamination risk is based on the source-pathway-receptor concept (referred to as a significant pollutant linkage). These terms are defined as follows:
- Source; a substance in, on, or under the land that is causing or has the potential to cause harm to people, property, or to cause pollution of controlled waters;
 - Pathway; a route or means by which a receptor could be, or is, exposed to or affected by a contaminant; and
 - Receptor; in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property or a water body.
- 7.5 The “pollutant linkage” describes the relationship between the source, the pathway and the receptor. Each component of the pollutant linkage has to be identified before land can formally be considered “contaminated”.
- 7.6 The above approach to contaminated land has been incorporated into the planning regime through the National Planning Policy Framework (NPPF), which ensures planning guidance compliments other relevant legislation. The key difference is that the planning regime looks at **future** potentially significant pollutant linkages and is thus sensitive to the proposed land use. The liability for investigating and remediating land through the planning process would usually lie with the developer. Land that has been developed in this way should subsequently be incapable of being declared as contaminated.
- 7.7 Current best practice in the assessment of contaminated land is to develop a conceptual site model (CSM) in which all of the potential sources, pathways and receptors, and the relationships between them, are described. The CSM is then refined as more information on the site (for instance, from site investigations) becomes available. Ultimately, this will result in either the dismissal of a pollutant linkage or the identification of a significant risk.
- 7.8 The results of the chemical testing from all available rounds of site investigation have been reassessed using the latest guidance values assuming residential land use with plant uptake. The Generic Assessment Criteria’s (GACs) used in this preliminary assessment is the Suitable for use levels (S4ULs) published by Land Quality Management and the Chartered Institute of Environmental Health. Assessment

criteria for organic contaminants vary dependent on the soil organic matter (SOM) in the material. A conservative assumption of 1% SOM has therefore been applied to all soils for the purposes of this initial assessment.

Risk to Human Health

- 7.9 The results of the soil testing undertaken on materials during the reclamation have been reviewed with regards to developing the entire site for residential dwellings. Soil contamination result of the pre-reclamation soils have not been included in this study as they are no longer present on site. The locations of the recorded soil contamination exceedance across the site is shown on drawing number ST16882-004

Metals and Inorganics

- 7.10 Previous comparison of the laboratory analysis had identified that screening values relating residential with plant uptake end use were exceeded for the following determinands:
- Chromium III in 9 locations;
 - Arsenic in 7 locations; and
 - Zinc in 3 locations.
- 7.11 However, when comparing the results to the most recent screening values, there is one exceedance of chromium III and two exceedances of lead. The chromium III exceedance was recorded within the intermediate fill material. The exceedances of lead were detected in the intermediate fill material and tree lined slope.
- 7.12 For chromium III, the primary exposure pathway is ingestion and dermal contact. Chromium III is the less toxic form of chromium, the more toxic form (being chromium hexavalent) was not detected.

Polycyclic Aromatic Hydrocarbon

- 7.13 Previous comparisons of the laboratory analysis had identified that screening values relating to residential with plant uptake end use, were exceeded for Naphthalene in one sample within the restoration surface. As generic CLEA SGVs were not provided during the time of the assessment, a Site Specific Assessment Criteria (SSAC) was assigned in reference to TOX reports. Statistical analysis showed that the 95th percent

upper confidence level (UCL) of the mean concentration was below the SSAC value and therefore was considered to not pose a significant risk.

- 7.14 However, the S4UL screening value has since been introduced, decreasing the screening value to 2.3mg/kg for residential end use and therefore when comparing the results to this screening value, there are 20 samples of naphthalene within the restoration surface material that show elevated levels of Naphthalene.
- 7.15 Statistical analysis was undertaken for the restoration material, the 95th percentile UCL value is above the S4UL criteria value, therefore poses a risk to human health.
- 7.16 The primary exposure pathway for Naphthalene is inhalation, which has a long term effect of vapour generation and therefore vapour risk may need to be considered. It is recommended that at least 600mm of clean cover is applied with a VOC membrane to break the pathway to future site users. This can be incorporated within the gas membrane normally provided to house foundations within former mining areas.

Total Petroleum Hydrocarbons

- 7.17 Previous and current comparisons of the laboratory analysis results had identified no exceedances, and therefore pose no risk to human health.

Asbestos

- 7.18 No samples were recorded to have traces of asbestos within the intermediate fill material. No testing for asbestos was undertaken within the restoration surface, batter topsoil and tree lined slope.

Dioxins

- 7.19 Only small traces of dioxins were detected within pre-reclamation baseline soils, all below the relevant assessment criteria.

Leachable Analysis

- 7.20 Post reclamation, leachate data indicated concentrations of chromium III (6 no exceedances), copper (8 no exceedances), lead (5 no exceedances), nickel (1 no exceedance) and zinc (6 no exceedances) above conservative water quality criteria.

Leachable phenol and benzo(a)pyrene are also recorded to be elevated compared to current published water quality criteria.

- 7.21 It is considered likely that the elevated levels of potentially leachable contaminants do not represent a significant risk to identified controlled water receptors given the nature of leachate tests to overestimate actual field conditions and the understanding of the hydrogeological conceptual site model. Additionally, it is understood that water quality in the area is generally poor due to the long industrial history in the area and that groundwater is not considered to be a sensitive receptor. Therefore, no further investigation and mitigation is considered necessary at this time.

Groundwater Analysis

- 7.22 No samples were taken of groundwater within the LRDM during the previous site investigations as groundwater was not encountered.
- 7.23 Full soil and water chemical results are presented within the SGP report in Appendix 2.

8 CONCEPTUAL SITE MODEL

- 8.1 The potential sources, pathways and receptors identified at the site are discussed below, followed by a Preliminary Conceptual Site Model (CSM).

Sources

- 8.2 Historical site maps show the site was primarily agricultural fields. The surrounding land was primarily collieries, with the land north of the site utilised as an iron and steel works since c.1750. Historical maps showed a rail line directly adjacent to the west of the site from 1871 to 1955 when it became disused. From historical map data and data from previous site investigation reports, the following contaminant sources are listed below:
- On site: The material used for the reclamation of the site is compacted sandstone fill from the excavation of Coal Measures (Cefn Rock). The chemical analysis included in the SGP report, identifies varying levels of heavy metals and PAH in the fill. This could either be natural background levels or indicate that

some made ground could have been mixed within it. This could be a potential source of contamination and gas;

- On site: Untreated made ground within the tree lined bank. This could be a potential source of contamination, such as heavy metals, PAH contamination and ground gas;
- Off site: Previous surrounding site uses such as iron and steel works and collieries may contain leachable heavy metals and PAHs;
- Off site: Nearby shallow coal and any untreated coal shafts may be a low potential source of ground gas.

Receptors

Human Health

8.3 The potential human receptors that may be affected by contamination are considered to be:

- Construction workers during the redevelopment of the site;
- Future inhabitants, mainly children between 3 to 16 years of age and the elderly aged 65+.

Controlled Waters

8.4 The majority of the site is underlain by a Secondary A Aquifer (Cefn Rock). The closest surface water feature is the 'Lodge Stream' c.300m north east of the site.

Property

8.5 Under the general definitions provided in Part IIA of the EPA (1990), future property at the site can be considered a relevant receptor for the purpose of contamination assessments.

Pathways

8.6 Whilst potential sources and receptors of contamination have been identified in relation to the site, in order for a potential contamination risk to be determined, it is necessary that a viable pathway exists for the contamination to reach a receptor.

Human Health

8.7 Potential pathways that may expose construction workers and future site users to soil contamination include dermal contact, accidental ingestion, and inhalation of dust and

gas/vapours. Additionally, any garden grown vegetables may absorb any soluble contaminants.

Contamination Leaching

- 8.8 No groundwater has been encountered on site in the previous site investigations and groundwater is anticipated to be at great depths within the Cefn Rock. Therefore, it is unlikely that any percolating surface water will come into contact with the groundwater.
- 8.9 The viability of these pathways is dependent upon the permeability of the underlying geology. The made ground deposits are predominantly granular and thus permeable, providing a potential pathway for infiltration and through flow. The surrounding area, notably to the south and east are underlain by Glacial Till superficial deposits that are generally low permeability deposits that may restrict throughflow to nearby surface water features. The faults noted beneath the site are considered to be at considerable depth and therefore should not provide an additional pathway.
- 8.10 A French drain is present along the east boundary of the site which may transport any potentially contaminated surface water.

Ground Gas Migration

- 8.11 No ground gas monitoring has been undertaken within the site during previous site investigations or subsequent to the reclamation operations. Low concentrations of carbon dioxide and methane were measured prior to the reclamation. After the reclamation, gas monitoring was undertaken to the north of the site in the area of the former Brymbo Steel and Iron Works; maximum carbon dioxide concentration was 6.6% and maximum methane was 1.7%. Flow rates were recorded below 0.07l/hr. As the reclamation fill is comprised of reworked Coal Measures, it is possible that natural occurring elevation of carbon dioxide may occur.
- 8.12 The likelihood of this occurring is particularly dependent upon the permeability of the near surface geology. Based on the available geological information, it is likely that the near surface deposits at the site are permeable made ground overlying Cefn Rock that is permeable sandstone. The faults noted beneath the site are considered to be at considerable depth and therefore should not provide an additional pathway.

Direct contact with between structures and contaminated soils/groundwater

- 8.13 As well as the risk posed by ground gas, property may incur damage through direct contact with contaminated soils/groundwater. The most common manifestation of this is sulphate attack on cement.

Preliminary Conceptual Site Model

- 8.14 The sources, pathways and receptors provided above have been assessed using Table 6 below, which is generally based on guidance within CIRIA C552 “*Contaminated Land Risk Assessment: A Guide to Good Practice*” (2001). The outcome of this assessment is summarised in Table 7, which presents a preliminary CSM based on current understanding of the site. In some cases, the risk category may be downgraded or upgraded based upon professional judgement with regard to the information currently available.

Table 6 Risk Assessment Matrix				
Receptor Sensitivity				
		Low	Medium	High
Contaminant Source (Potential Severity of Contamination)	Low	Low	Low to Moderate	Moderate
	Moderate	Low to Moderate	Moderate	Moderate to High
	High	Moderate	Moderate to High	High
Notes Where either contaminant source or receptor sensitivity is considered to be negligible, a classification of “very low” risk is used by default. The classification of “high”, “moderate” or “low” is made based on qualitative judgement. Discussion of the risk classification assigned in the CSM is provided below.				

- 8.15 The rationale for each of the risk assessment classifications within Table 7 is discussed below.

Table 7 Preliminary Conceptual Site Model			
Source	Pathway(s)	Receptor	Risk
Heavy metal and PAH contaminated re-engineered Coal Measures fill.	- leaching via surface run-off - Infiltration into any exposed soil - Ingestion of soil - Inhalation of vapour outdoors - Dermal contact with soil	Human health: - Construction workers - Future residents Controlled waters: - Secondary A aquifer - The Lodge Stream	Low to moderate
	Leaching of contaminants through permeable fill material	Human health: - Construction workers - Future residents Controlled water: - Secondary A aquifer - The Lodge Stream	Low
	Direct contact with sulphate/chloride soils/porewater	Structures: Foundations	Low
Heavy metal and PAH contaminated untreated Made Ground in the tree lined bank	- leaching via surface run-off - Infiltration into any exposed soil - Ingestion of soil - Inhalation of vapour outdoors - Dermal contact with soil	Human health: - Construction workers - Future residents Controlled waters: - Secondary A aquifer - The Lodge Stream	Low to moderate
	Leaching of contaminants through permeable fill material	Human health: - Construction workers - Future residents Controlled waters: - Secondary A aquifer - The Lodge Stream	Low
	Direct contact with sulphate/chloride soils/porewater	Structures: Foundations	Low
Subterranean gas from made ground deposits	Accumulation of ground gas in enclosed spaces following migration through superficial geology and made ground.	Human health: - Construction workers - Future residents Proposed Structures: - Basements	Moderate

Risk to Human Health (Future Residents) – Ingestion, Dermal Contact and Inhalation

8.16 In relation to potential risks to future residents from the re-engineered fill made ground/soil contamination, the receptor sensitivity is moderate. The contamination source is considered to be low (e.g. presence of heavy metals and hydrocarbon proven in previous site investigations). The combination of moderate receptor sensitivity and

low potential severity of contamination provides a preliminary qualitative risk classification to human health to low to moderate.

- 8.17 In relation to potential risks to construction workers from made ground contamination, it is generally assumed that construction workers will be exposed for relatively short periods, be made aware of any potential risks in advance, and will use the correct personal protective equipment for the tasks being undertaken. Therefore, although the receptor sensitivity (human health) is moderate and the potential contamination source is defined as 'low', the risk to construction workers is considered to be low (rather than the low to moderate classification that this combination of factors would result in).

Risk to Groundwater

- 8.18 The contaminant source criterion for risk to groundwater has been assessed as low. The receptor immediately underlying the site is a Secondary A aquifer which has a low sensitivity as groundwater is considered to be at considerable depth within the sandstone bedrock and is unlikely to be used as a source of potable water due to its poor quality. The combination of low receptor sensitivity and low severity of the contamination source provides a risk rating of low.

Risk to Surface Water

- 8.19 The nearest surface water feature, the Lodge Stream c.300m north east of the site, is considered to be a low sensitivity receptor, while the contaminant source is considered to be high, glacial till is present to the east and south of the site may restrict migration via through flow. The combination of low receptor sensitivity and low severity of the contamination source provides a low risk rating.

Ground Gas

- 8.20 The potential gas generating sources are considered to have moderate gas generation potential. The receptor sensitivity in respect of the proposed development is considered to be high which provides a risk rating moderate.

Risk to Proposed Structures

- 8.21 The receptor sensitivity of buried concrete to contact with aggressive soils and/or groundwater (e.g. high sulphate conditions resulting from made ground) is considered to be low and the potential severity of contamination (within any potential made ground beneath the site) is low. This results in a risk to proposed structures of low.

9 DISCUSSION AND CONSIDERATIONS

Introduction

- 9.1 The following considerations and development constraints have been identified by the desk study researches, walk-over surveys and historic ground investigations:

- Supplementary site investigation;
- Near surface soils and foundations;
- Faults;
- Influence of Trees;
- Soil contamination;
- Ground gas;
- Buried slopes; and
- Mine workings.

- 9.2 The above items are reviewed in regard to the development of the site, with outline recommendations presented in respect of remedial measures and further work.

Supplementary Site Investigation

- 9.3 The site has not undergone any intrusive site investigation for over ten years. It is recommended that an additional site investigation is undertaken within the LRDM in order to further assess the ground conditions, extent of contamination and to validate that the reclamation achieved the engineering specification; as well as providing the ground engineering information required for the design of the house foundations.

Near Surface Soils and Foundations

- 9.4 The site investigations have identified variable thickness of engineered Coal Measures fill between 3.00 to 9.50m covering the majority of the site, with the exception of the Tree Line Bank. The Coal Measures fill is directly underlain by the Cefn Rock sandstone (Coal Measures). The made ground generally comprises clayey granular fill with

sandstone, mudstone and coal fragments. The compacted fill is considered as suitable for a founding horizon taking into account the settlement results provided by SW. The thickness of fill contour lines are shown in Drawing No ST16882-005.

- 9.5 From reviewing the SW report it is anticipated that creep settlement will continue to occur over a 15 year period. However, the calculation carried out by SW have predicted it to be minimal.
- 9.6 Giving consideration to the completed reclamation works and subsequent validation testing, it would appear that the following foundations options could be utilised on site:
- Cage reinforced shallow strip or trench fill foundations, founded upon the re-engineered materials placed utilising an engineering specification;
 - Raft foundations could also be used upon the engineered fill in the northern area where higher differential settlement is anticipated.
- 9.7 The presence of granular soils within the made ground will mean that excavations may require temporary support. Where excavations require entry into the pits, consideration should be given to the need to provide trench support or to batter excavation sides to a safe angle. Although water was not encountered during the previous site investigations or the site reclamation operations, the need for de-watering of deep excavations cannot be discounted.
- 9.8 Based upon the results of the previous investigation chemical analysis and assuming a mobile groundwater regime, a Design Sulphate Class of DS-2 and as ACEC class of AC-2 is currently recommended.

Faults

- 9.9 The Coal Authority have suggested the presence of two faults beneath the site that are recorded as in-seam faults within the Main Coal Seam. The Main Coal Seam is recorded to be at least 200m below the site and therefore it is anticipated that this will have no effect on future development of the site.

Influence of Trees

- 9.10 Aerial photography and site visit observations shows the presence of trees along the eastern, southern and western perimeter of the site. In those locations, foundations may require deepening to take into account the potential influence of trees or houses could be located away from the site boundary.

Soil Contamination

- 9.11 Review of the past chemical results has shown heavy metal and PAH contamination within the compacted Coal Measures fill, and the undisturbed made ground in the north west of the site. Previous leachability analysis has shown leachable concentrations of heavy metals and PAHs which could have an affect on nearby surface water features. Soil contamination exceedances are indicated on ST16882-004. There is also the possibility of additional unrecorded contamination on site. From a human health point of view, in the absence of any recent sampling, it would be prudent to allow for a 'clean cover layer' to be placed in garden and landscaping areas. This layer will, most likely, comprise imported subsoil and topsoil and be c.600mm in thickness. Additionally, a VOC vapour membrane barrier is recommended due to recorded exceedances of Naphthalene that may pose a vapour risk. This can be incorporated within the gas membrane normally provided to house foundations within former mining areas.

Ground Gas

- 9.12 A review of past site investigations undertaken on site identifies that there are no data recorded within the site boundaries of the LRDM. However, post reclamation gas monitoring in the northern most development modules have shown elevated methane and carbon dioxide concentrations. In the absence of site specific monitoring, but based on the results of the desk study and historic off site monitoring, it is suggested that an assumption be made that residential dwellings will require passive gas precautions including a sub-floor ventilated void and carbon dioxide/methane/vapour barrier, typically implemented in a former mining area.

Buried Slopes

- 9.13 The SW report suggests that excavation gradients at the perimeters of the site were formed greater than 1:1 to maximise the extent of the development area. The buried slopes pose a risk of differential settlement and built development should be avoided

in these areas. In addition, whilst the engineered fill was placed over 10 years ago, there could be ongoing creep settlement taking place, particularly in the areas of thicker engineered fill. However, this is relatively shallow compacted fill with very small predictions of on-going settlement of $8\text{mm} \pm 50\%$. Despite this, it should be taken account of during the design of highways and services/drains that cross the buried slope areas.

Mine Workings

- 9.14 The Coal Authority Report states that there are no recorded mine workings present beneath the site. A Mining Desk Study Report was written by SW in April 2014, that made use of Coal Authority data, mine abandonment plans and previous site investigation boreholes across the entire reclamation site. The report suggested that the LRDM was not within influencing distance of any previously worked coal or ironstone and therefore there is no risk of mine related surface subsidence. However, the published Geological Maps and the BGS interactive map viewer shows the 'Upper Stinking' coal seam sub-cropping to the west/north-west of the site c.350m from the site. The published Geological Maps indicate the coal measures strata as dipping between 6° and 10° east/south-east. The 'Upper Stinking' coal seam is shown to outcrop c.350m west/north-west of the site. Cross sectional analysis has shown the seam to dip beneath the site, however at a depth to which mining related subsidence should have no effect.

10 CONCLUSIONS AND RECOMMENDATIONS

- 10.1 Desk study researches and several phases of ground investigation have been undertaken between 2003 and 2007 to determine the nature of the prevailing ground conditions and to validate the effectiveness of the reclamation of the LRDM.
- 10.2 Wardell Armstrong has assessed the factual data of those investigations, to evaluate the nature of the prevailing ground conditions and have identified ground related constraints to the development of the site.
- 10.3 A number of ground related considerations and development constraints have been identified including the following:
- Supplementary site investigation;

- Near surface soils and foundations;
- Faults;
- Influence of trees;
- Soil contamination;
- Controlled waters contamination;
- Ground gas;
- Buried slope; and
- Mine workings.

Recommendations

10.4 It is recommended that the additional site investigation comprises:

- Deeper intrusive investigations would be beneficial to validate the thickness of fill and to validate that the reclamation works has achieved the engineering specification.
- Insertion of boreholes with standpipes for ground gas monitoring to confirm the gas regime beneath the site, and to ensure the correct gas precautionary measures are put in place.
- Additional geochemical analysis across the site to evaluate the extent of PAH and heavy metal contamination and to ensure that there has been no further contamination and to update the conceptual site model and to ensure 600mm of clean cover remains suitable. Additional asbestos testing is required in the areas previously not screened for asbestos, the restoration surface, batter topsoil and tree lined slope.
- Acquire geotechnical samples to determine Atterberg limits for the potential influence of trees.

10.5 None of the aforementioned development constraints represent an insurmountable obstacle to development and applying the appropriate investigation or remediation options will enable the risks to be addressed to facilitate residential development; as well as providing the ground engineering information required for the design of the house foundations.

APPENDICES

APPENDIX 1

Scott Wilson Ltd Link Road Development Module Completion Report

Brymbo Developments Limited

Reclamation of Brymbo Steelworks

Link Road Development Module Completion Report

November 2007

Final

RECLAMATION OF BRYMBO STEELWORKS

LINK ROAD DEVELOPMENT MODULE COMPLETION REPORT

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SUMMARY

This document provides a statement describing the geotechnical condition and expected future geotechnical condition of the area of the reclaimed Brymbo Steelworks site known as the Link Road Development Module (LRDM).

The now completed reclamation works in the LRDM have entailed the forming of a development platform from Coal Measures fill over insitu Coal Measures strata. The work was undertaken during August 2006 to October 2006 and was followed by a 9 month period of movement monitoring.

It is concluded within this document that the area of the LRDM identified for built development is now suitable for housing development, provided that account is taken of the recommendations contained within this report. The report provides recommendations to be taken account of in the detailed design of the housing and associated infrastructure.

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- Figure 1 Reclamation of Brymbo Steelworks, LRDM Post-Reclamation Surface Settlement Monitoring (Natural Scale)
- Figure 2 Reclamation of Brymbo Steelworks, LRDM Post-Reclamation Surface Settlement Monitoring (*log* Scale)

DRAWINGS

- D101082/LRDM_COMP/001 Extract from Ordnance Survey Map, Landranger Sheet 117, (Chester and Wrexham, Ellesmere Port)
- D101082/LRDM_COMP/002 Finished Level, Fill Depth, Settlement Marker and Plate Load Test Locations
- D101082/LRDM_COMP/003 Indicative Distribution of Settlement / Heave
- D101082/LRDM_COMP/004 Cross Sections

1.0 INTRODUCTION

Scott Wilson Ltd (Scott Wilson) was appointed by Brymbo Developments Limited (BDL) to provide engineering consultancy services in connection with the reclamation of a former Steelworks site, at the village of Brymbo, near Wrexham. The main appointment associated with the reclamation works commenced in 2003, however, Scott Wilson has provided preliminary engineering advice as part of the project team for around ten years.

Scott Wilson's brief¹ included the requirement to assess when a pre-defined Development Module could be considered complete and at that point to issue a Completion Report. Such an area is typically considered complete when the predicted future settlement performance is such that it can be developed for the specified use within a predictable time scale after issue of the Completion Report, provided that the recommendations of the report are adhered to.

The Link Road Development Module (LRDM), to which this report pertains, is to be developed with housing and associated access roads. An area has been allocated for open space in the northern part of the site.

Filling works in the area of the LRDM began in August 2006, and controlled compaction operations were largely completed by October 2006. A Certification Report² relating to these filling works has been issued.

All unsuitable materials (including soft and softened materials that had resulted from the area's former use as surface water treatment lagoons) have been stripped from the site. This involved reducing the level of the area by, typically, 3.5 to 4.5 metres, to achieve a regular foundation level within weathered sandstone bedrock. The development platform was then formed from suitable material (comprising Cefn Rock sandstone) excavated from within the LRDM. A rubble-filled filter drain was also constructed along the eastern edge of the area, which connects into the historical surface water discharge point for the overall site.

Settlement monitoring of the completed earthworks commenced in November 2006 and continued until August 2007, with the final settlement readings being taken on 22nd August 2007.

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2.0 SITE LOCATION AND BACKGROUND

2.1 Site Location

The site is located at the former Steelworks in the village of Brymbo (Ordnance Grid reference SJ 297 535), 5 km northwest of Wrexham, in Wales. It is approximately 95 hectares in plan area and shown on the 1:50,000 Ordnance Survey Map, Landranger Sheet Number 117 (Chester and Wrexham, Ellesmere Port), an extract of which is provided on Drawing D101082/LRDM_COMP/001.

The site is bounded by Brake Road, Blast Road, Gwalia Road and Mount Hill to the north; New Road and Kent Road (B5101) to the east; and Brymbo Road and Tanyfron to the south and west.

The LRDM is located at the southern end of the main reclamation site. The boundaries and location of the LRDM are shown on the enclosed drawing D101082/LRDM_COMP/002.

Scott Wilson reports relating to the area of, and areas surrounding, the LRDM include:

- Compaction Certification and Completion Reports for the Southern Development Module^{3 & 4}
- Stability Assessment of As-Built Outer Slopes⁵
- Mining Desk Study⁶

2.2 Brief Site History

Although very few early records are available, it is understood that the site was developed as an iron works as early as 1750, with a number of coal and ironstone pits also being sunk at this time.

The earliest published historical map, dated 1872, indicates that the main iron & steel works buildings were originally located in the north western part of the whole site, whilst a number of railway lines and sidings extended across the central and southern part of the site. Several mounds of waste materials were also located across the southern area of the site.

The more recently published maps, dated 1967 and 1988, indicate that the steelworks had increased significantly in size, with several large buildings occupying much of the site area.

2.3 Geology and Mining

The existing ground conditions are those resulting from the modification of the site's topography and geology by previous uses and the completed reclamation activities.

Previous uses of the site are listed in Volume 1 of the BDL Regeneration Strategy⁷ and are shown on the historical Ordnance Survey maps included in Volume 2 of the BDL Regeneration Strategy⁸. A brief summary of this information is included in section 2.2, above.

The BDL planning application^{7 & 8} discussed the geology of the reclamation site. Superficial drift deposits are reported to be generally absent beneath the high ground to the west but thicken eastwards with a significant thickness recorded beneath the eastern part of the site. In the west, the drift may comprise only a few metres of boulder clay. Across the falling ground to the east, BDL reported that the thickness of boulder clay increases gradually as levels fall towards the bottom of the Brymbo valley.

BDL reported evidence of a complex sequence of minor buried glacial channels running north-south within the larger Brymbo valley.

The drift deposits are underlain by Carboniferous bedrock of Middle Coal Measures age. The strata comprise an inter-bedded sequence of mudstones, siltstones and sandstones with coal seams and associated seatearths. The strata generally dip to the east-south-east at angles of between 7° and 10°. The site is bisected by a large fault, known as the Brymbo Fault, which trends north/north west to south/south east. The strata are downthrown to the west by about 140 m.

The LRDM lies to the west of the fault and is underlain by the Bettisfield Formation (Productive Coal Measures) of the Middle Coal Measures. The approximate stratigraphic level is equivalent to Cefn Rock, which forms the founding level of the LRDM.

BDL required Scott Wilson¹ to undertake a desk study review of available information relating to old mine workings, shafts and adits as part of the commission. The results of the study were summarised in a report which outlines the potential hazards to future development posed by the abandoned mine workings⁶. The final version of this report was issued to BDL in July 2005. It concluded that extensive coal and ironstone working had taken place on the reclamation site. Workings had been carried out using both opencast and underground methods.

During the mining study, Scott Wilson reviewed documents and plans supplied by BDL and the Coal Authority, including:

- Geological Memoir for the Wrexham area⁹,
- Coal mining report prepared by The Coal Authority¹⁰,
- The Coal Authority mine abandonment record plans¹¹,
- Opencast and site investigation borehole records¹², and
- A draft schedule of abandoned shafts and adits prepared by Wardell Armstrong in 1996¹³.

The location of all known shafts and historical opencast areas and site investigation boreholes are shown on Drawing No. D101082/GS/11 enclosed in the Mining Desk Study⁶ and this report should be referred to for a detailed account of site geology and previous mining. This shows that no mineshafts are recorded beneath the LRDM area.

The Mining Desk Study⁶ details the recorded extent of abandoned mines, resulting from deep mining activity, and these are summarised on Drawing Number D101082/GS/25 of that report. The report concludes that the area occupied by the LRDM is not at risk from surface subsidence due to historic coal or ironstone workings. It should be noted that while the LRDM is not specifically mentioned as an area for future development within the Mining Desk Study it does lie within the area covered by the study.

3.0 SUMMARY OF EARTHWORKS

Filling works in the area of the LRDM began in August 2006, and controlled compaction operations were largely completed by October 2006. A Certification Report² relating to these filling works has been issued. The earthworks undertaken involved:

- Removal of unsuitable soil materials (including soft and softened materials that had resulted from the area's former use as surface water treatment lagoons) and made ground deposits (existing as remnants of the operations at the Steelworks). This involved reducing the level of the area by, typically, 3.5 to 4.5 metres, to achieve a regular foundation level within weathered sandstone bedrock.
- The construction of a rubble-filled filter drain along the eastern edge of the area, to ensure surface water runoff does not flow onto the adjacent sports pitches. The drain comprised a 700 mm deep trench containing a 150 mm diameter perforated plastic pipe surrounded by >50 mm diameter crushed concrete gravel wrapped in a separator geotextile. This drain connects into the historical surface water discharge point for the overall site.
- The placement and compaction of suitable material excavated from within the LRDM in order to achieve the required development platform level.

The works are described in more detail in the LRDM Compaction Certification Report.²

In accordance with the Specification for Compaction¹⁴, a number of compaction trials took place prior to the commencement of the compaction operations, the purpose of which was to assess the suitability of the Contractor's proposed method of working. The results of previous trials are reported in the Interim Compaction Report No. 1¹⁵.

The excavation gradients at the perimeters of the area were formed at gradients of greater than 1:1 at their steepest. This is steeper than allowed in the Earthworks Compaction Specification (which stipulates that slopes cut in rock should not be steeper than 1:1 and that the overall slope should be no steeper than 1V:1.5H).¹⁴ Steep slope sides were formed in order to maximise the extent of the fill of relatively uniform depth and hence provide the greatest degree of flexibility in terms of the area available for built development. It is understood that the housing development will be configured such that settlement insensitive garden areas will be located above the steepened excavation walls.

Drawing D101082/LRDM_COMP/002 indicates the thickness of fill placed and the final fill levels across the LRDM.

4.0 VALIDATION TESTING AND MONITORING

During filling, validation testing comprising nuclear density gauge testing and classification testing was conducted. Once bulk earthwork levels had been achieved, validation of the earthworks was carried out by means of plate load testing and settlement monitoring.

Details of the results of the insitu testing can be found in the Scott Wilson Compaction Certification Report². The results of this testing indicate that the compaction works complied with the Specification¹⁴.

4.1 Plate Load Testing

Once the required finished ground levels had been achieved, a series of 9 no. plate load tests were carried out across the LRDM between 18th and 26th October 2006. The locations of the plate load tests are shown on Drawing No. D101082/LRDM_COMP/002.

Scott Wilson site personnel conducted the testing in accordance with BS 1377. A maximum pressure of 240 kPa was applied in 5 roughly equal increments through a 600mm diameter plate.

The results of the plate load testing are summarised in Table 1 and indicate that the compaction works complied with the Specification¹⁴. Full details of the testing are contained in the Compaction Certification Report². The equivalent CBR values derived from these tests are generally calculated as being 3 % or greater, although one test (LA9) recorded an equivalent CBR value of 1 %. This test was undertaken outside of the area proposed for housing development in the outline planning permission document.

4.2 Settlement Monitoring

4.2.1 Introduction

In order to measure post-reclamation movements and assess the likely future ground movements within the LRDM, the results of monitoring of 22 no. settlement monitoring pins installed across the LRDM have been used. The pins are identified as SMP 1 to 22, and are located as shown on drawing no. D101082/LRDM_COMP/002.

Monitoring of the pins commenced in November 2006 and was continued until August 2007. A summary of the results of the monitoring, carried out using precise levelling techniques, is presented in Table 2 and on Figures 1 & 2.

It should be noted that this monitoring is only useful to assess the likely long-term (creep) settlement characteristics of the fill. The magnitude and likelihood of other modes of fill settlement, such as settlement due to future groundwater inundation and settlement induced by further imposed loading (such as building

loads), are not indicated by the results of this monitoring. Given that the permanent groundwater levels are recorded to be much deeper than the base of the fill and therefore unlikely to rise into the fill, this mode of settlement is anticipated to be insignificant. Some fill movements may result from the ingress of surface water, and in areas of shallow fill this may result in heave movements (due to wetting and swelling of the fill) rather than settlement.

4.2.2 Monitored Movements

The period of monitoring since completion of the earthworks has been 9 months for the majority of the settlement marker pins. This is a relatively short monitoring period, and consequently the prediction of long-term trends in ground movement made here may be less reliable than one based on a longer monitoring period. However, monitoring from elsewhere in the overall site has been underway for a greater period, which adds to the level of confidence in the Module specific monitoring.

The monitored movement of the pins, is summarised below:

- A total of thirteen pins have recorded small amounts (less than 5 mm) of heave. These markers form the majority of the points monitored and are located throughout the LRDM.
- Eight pins have recorded small amounts (less than 10 mm) of settlement. These markers are mainly located along the eastern edge of the area.
- One pin has recorded a larger amount (19.7 mm) of settlement. This marker (SMP22) is located at the northern corner of the area where the fill is deepest (locally up to 10 m). This area is outside the permitted outline planning permission for residential development and is understood to be intended for use as public open space.

4.2.3 Interpretation

(i) Behaviour of Fill

It is generally considered that, under conditions of constant stress (i.e. post-completion of the earthworks) with the exception of the period immediately following placement, there is a linear relationship between the long-term creep settlement of fill materials and log time. This relationship, referred to as the creep compression parameter (α), can be expressed by the equation:

$$\alpha = \frac{s}{\log t_2 - \log t_1}$$

Where, s = the settlement between time t_1 and t_2 ,
expressed as a percentage strain for the fill depth.

The prediction of the long-term settlement behaviour that follows is made with the observed general relationship between ground conditions (including fill depth variation) and the recorded settlement behaviour in mind. It should be noted that

the settlement predictions described below exclude movements likely to be generated by imposed loads.

It should be noted that in relatively shallow (i.e. typically 3 – 4 m or less) engineered fills, the long-term settlement of the fill that occurs through the rearrangement of individual particles (creep settlement) is likely to be very slight. Further, in the short-term these movements are likely to be masked by heave within the near-surface layers caused by some swelling of the fill upon infiltration by rainfall and by stress relief of individual particles.

Values of α have been calculated for all the settlement monitoring markers. The calculated values of α range from 0.06 % heave (SMP13) to 0.10 % settlement (SMP8).

Overall, it can be seen that the recorded movements within the LRDM are generally minimal, with correspondingly low α values, with only SMP22 (which is outside the area of proposed housing development) exhibiting more than 10 mm movement. It is noteworthy that this marker is underlain by the deepest fill in the LRDM, which suggests that some creep settlement is occurring here in the deeper fill layers.

A review of settlement data carried out by Scott Wilson as part of a 'State of the Art Review of the Compaction of Opencast Backfill', dated 1997, for British Coal Opencast Executive¹⁶, indicates that opencast sites which are restored with well compacted backfill for their full depth, typically display average α values in the range of 0.1 – 0.2%. In addition, the minimum and maximum α values calculated from individual monitoring points over well compacted backfill typically lie within +/- 50% of the average value; giving a range of 0.05 – 0.3 %.

The α values determined from the available monitoring data for the LRDM are at the lower end of the range of α values for compacted fill. This is to be expected given the short monitoring period and the observed heave across much of the site. It could be reasoned that, even where the fill is deepest (6-10 m) at the northern end of the LRDM, creep settlements within the fill are currently being offset by shallow heave. In the longer term, heave will cease and with this in mind, moderately conservative α values of $0.15\% \pm 50\%$ will therefore be adopted for predicting long-term movements.

(ii) Total Settlement Predictions

Assuming the average α value of 0.15%, the anticipated creep settlement has been estimated for the various depths of fill across the LRDM. It has been assumed that development may take place in the near future and that the majority of creep settlement will be completed by 25 years after the earthworks finished. The depth of fill across the LRDM is generally around 3 to 4 m, as indicated by Drawing No. D101082/LRDM_COMP/002. For this indicated range of fill depth, creep settlements after 25 years are estimated as generally being approximately $8 \text{ mm} \pm 50\%$. At the northern end of the LRDM, (the area

proposed for open space use) where filling extends to as much as 10 m depth, creep settlements after 25 years are estimated as being approximately 21 mm $\pm$ 50 %.

(iii) Differential Settlement Predictions

Across the area proposed for built development, there is little variation in fill depth. Taking the maximum variation in α of $\pm$ 50 %, minor variations in formation depth generate potential maximum differential settlements of 9 mm. Over 10 m horizontal distance, this is equivalent to a tilt of less than 1:1000. This is considered acceptable for typical low-rise construction.¹⁷ More severe differential settlements have been calculated for the area of proposed open space within which the formation level shelves down to a maximum depth of 10 m.

At the perimeter of the LRDM, the buried former walls of the excavation are present and formation levels slope steeply down from natural ground level. Differential settlements will be experienced in areas overlying these slopes.

At the north-western boundary of the area intended for built development, the largest differential settlements generated by the buried slopes (as shown on drawing no. D101082/LRDM_COMP/002) are predicted to be up to 16 mm over a 3 m horizontal distance (equivalent to a tilt of approximately 1:200). This would be unacceptable for typical low-rise construction, and structures should not be built within the zones of influence of these buried walls.

At the southern edge of the module, differential settlements of up to 13 mm over a 6 m horizontal distance (equivalent to a tilt of approximately 1:500) are predicted. It is understood that an access road is to be constructed across these buried slopes.

4.2.4 Implications

The majority of the LRDM, excluding the buried slopes and the area proposed for open space use as defined on drawing no. D101082/LRDM_COMP/002, is predicted to exhibit relatively minimal overall creep settlements and tolerable differential creep settlements in the future. It is therefore considered that built development may now proceed in this area.

Given that the foundations in the LRDM will be located on the recently placed fill, the buildings should include measures to reduce the effects of potential differential settlement and heave. These measures should consider both the initial foundation loading and longer-term creep. On sites of this nature, one such precaution involves the addition of steel reinforcement within building foundations such as strip footings. Where any development incorporates the building of an irregular shaped structure, consideration should be given to measures such as the inclusion of additional movement joints or articulation into the structure.

Differential settlements are likely to be high around the edges of the filled area where the formation profile is steep. These excavation walls were formed at relatively steep angles to maximise the area available for built development. Whilst built development could be considered in the longer term, these areas will currently be best occupied by gardens and other open space, as construction over such a steep buried slope is generally not recommended.

Access into the LRDM is anticipated to be from the south, meaning that the access road will cross a buried slope. The access road should therefore be appropriately designed to accommodate the predicted localised differential settlements of up to 13mm. All drainage and service connections should be designed to be flexible (to accommodate differential settlement) and the gradient of drainage runs should be sufficiently steep to maintain at least the required minimal fall as settlements occur.

5.0 CONCLUSIONS

The LRDM is formed of compacted Coal Measures fill and is underlain by natural ground comprising the Cefn Sandstone unit of the Middle Coal Measures. The fill is generally of approximately 4 m depth, with an area of deeper fill at the north of the site.

The bulk earthworks across the LRDM have been carried out by BDL, and Scott Wilson has supervised and validated these works as detailed in the Compaction Certification Report².

It is considered that the area of the LRDM proposed for built development, as defined within this report, is now suitable for development with lightweight structures. Creep settlements are predicted to be in the order of $8\text{mm} \pm 50\%$. Buried slopes are present at the perimeter of the area (as shown on drawing D101082/LRDM_COMP/002) and the overlying zone is unsuitable for built development, although it may be occupied by gardens. The module will be accessed by a road from the south. Where this crosses the former excavation walls, additional design precautions should be taken to ensure that the road and drainage can adequately accommodate the predicted differential movements of up to 13mm.

Foundations to be constructed on the recently placed fill should be designed to be sufficiently stiff so as to mitigate the possible effects of differential settlement. The actual foundation form will need to be assessed and designed by the structural engineer for the project, taking full account of the advice given herein. Furthermore, as is normal in such circumstances, it is recommended that all drainage and service connections are specified to be flexible and that the gradient of drainage runs is sufficiently steep to maintain at least the required minimal fall as settlements occur. Drainage should also be designed to avoid localised ingress of water into the fill and hence prevent the possibility of any local inundation settlements.

The LRDM is recorded to be underlain at depth by abandoned coal workings. Further details are provided in the LRDM Compaction Certification Report² and the Mining Desk Study Report¹⁴. It is considered that there is negligible risk of any ground movements resulting from the presence of these workings. There are no recorded shafts within the LRDM.

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TABLES

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Table 1: LRDM Plate Bearing Testing Results (Summary)

Test number	LA1	LA2	LA3	LA4	LA5	LA6	LA7	LA8	LA9
Date	26/10/06	18/10/06	19/10/06	20/10/06	20/10/06	23/10/06	24/10/06	24/10/06	26/10/06
Max. settlement (mm) at applied bearing pressure of 240 kN/m ²	19.98	10.74	5.70	7.56	12.36	11.46	3.15	11.67	20.82
Approx. settlement (mm) at applied bearing pressure of 80 kN/m ²	3.1	2.5	2.0	0.7	3.5	3.0	1.2	3.8	6.5
Equivalent CBR value (%) at 1.25 mm settlement	3	3	4	15	3	3	9	3	1

TABLE 2: LRDM Ground Movement Monitoring Results Post-reclamation

Monitoring Pin	Date	Age of Fill (days)	Monitored Ground Level (m AOD)	Monitored Ground Movement (mm)	Type of movement over period	Cumulative Ground Movement (mm)	Type of movement cumulative	Cumulative Settlement (mm)	Depth of fill (m)	Creep α -value based on monitoring information
SMP1	21/11/06	0	95.7269	0.000		0.000		0.000	3.000	-0.02%
	08/12/06	17	95.7263	-0.600	Settlement	-0.600	Settlement	0.600		
	10/01/07	50	95.7266	0.300	Heave	-0.300	Settlement	0.600		
	06/02/07	77	95.7274	0.800	Heave	0.500	Heave	0.600		
	04/04/07	134	95.7291	1.700	Heave	2.200	Heave	0.600		
	06/06/07	197	95.7279	-1.200	Settlement	1.000	Heave	1.800		
	22/08/07	274	95.7286	0.700	Heave	1.700	Heave	1.800		
SMP2	21/11/06	0	95.3108	0.000	No movement	0.000		0.000	3.300	0.05%
	08/12/06	17	95.3092	-1.600	Settlement	-1.600	Settlement	1.600		
	10/01/07	50	95.3080	-1.200	Settlement	-2.800	Settlement	2.800		
	06/02/07	77	95.3083	0.300	Heave	-2.500	Settlement	2.800		
	04/04/07	134	95.3101	1.800	Heave	-0.700	Settlement	2.800		
	06/06/07	197	95.3078	-2.300	Settlement	-3.000	Settlement	5.100		
	22/08/07	274	95.3065	-1.300	Settlement	-4.300	Settlement	6.400		
SMP3	21/11/06	0	97.4856	0.000	No movement	0.000		0.000	4.000	-0.05%
	08/12/06	17	97.4857	0.100	Heave	0.100	Heave	0.000		
	10/01/07	50	97.4864	0.700	Heave	0.800	Heave	0.000		
	06/02/07	77	97.4869	0.500	Heave	1.300	Heave	0.000		
	04/04/07	134	97.4893	2.400	Heave	3.700	Heave	0.000		
	06/06/07	197	97.4898	0.500	Heave	4.200	Heave	0.000		
	22/08/07	274	97.4902	0.400	Heave	4.600	Heave	0.000		

TABLE 2: LRDM Ground Movement Monitoring Results Post-reclamation

Monitoring Pin	Date	Age of Fill (days)	Monitored Ground Level (m AOD)	Monitored Ground Movement (mm)	Type of movement over period	Cumulative Ground Movement (mm)	Type of movement cumulative	Cumulative Settlement (mm)	Depth of fill (m)	Creep α -value based on monitoring information
SMP4	21/11/06	0	99.3935	0.000	No movement	0.000		0.000	3.000	-0.06%
	08/12/06	17	99.3944	0.900	Heave	0.900	Heave	0.000		
	10/01/07	50	99.3942	-0.200	Settlement	0.700	Heave	0.200		
	06/02/07	77	99.3944	0.200	Heave	0.900	Heave	0.200		
	04/04/07	134	99.3976	3.200	Heave	4.100	Heave	0.200		
	06/06/07	197	99.3976	0.000	No movement	4.100	Heave	0.200		
	22/08/07	274	99.3979	0.300	Heave	4.400	Heave	0.200		
SMP5	21/11/06	0	101.8143	0.000	No movement	0.000		0.000	3.300	0.07%
	08/12/06	17	101.8140	-0.300	Settlement	-0.300	Settlement	0.300		
	10/01/07	50	101.8124	-1.600	Settlement	-1.900	Settlement	1.900		
	06/02/07	77	101.8114	-1.000	Settlement	-2.900	Settlement	2.900		
	04/04/07	134	101.8122	0.800	Heave	-2.100	Settlement	2.900		
	06/06/07	197	101.8090	-3.200	Settlement	-5.300	Settlement	6.100		
	22/08/07	274	101.8087	-0.300	Settlement	-5.600	Settlement	6.400		
SMP6	21/11/06	0	99.6107	0.000	No movement	0.000		0.000	3.000	-0.03%
	08/12/06	17	99.6128	2.100	Heave	2.100	Heave	0.000		
	10/01/07	50	99.6128	0.000	No movement	2.100	Heave	0.000		
	06/02/07	77	99.6123	-0.500	Settlement	1.600	Heave	0.500		
	04/04/07	134	99.6149	2.600	Heave	4.200	Heave	0.500		
	06/06/07	197	99.6132	-1.700	Settlement	2.500	Heave	2.200		
	22/08/07	274	99.6131	-0.100	Settlement	2.400	Heave	2.300		

TABLE 2: LRDM Ground Movement Monitoring Results Post-reclamation

Monitoring Pin	Date	Age of Fill (days)	Monitored Ground Level (m AOD)	Monitored Ground Movement (mm)	Type of movement over period	Cumulative Ground Movement (mm)	Type of movement cumulative	Cumulative Settlement (mm)	Depth of fill (m)	Creep α -value based on monitoring information
SMP7	21/11/06	0	98.0633	0.000	No movement	0.000		0.000	4.000	-0.05%
	08/12/06	17	98.0644	1.100	Heave	1.100	Heave	0.000		
	10/01/07	50	98.0650	0.600	Heave	1.700	Heave	0.000		
	06/02/07	77	98.0650	0.000	No movement	1.700	Heave	0.000		
	04/04/07	134	98.0673	2.800	Heave	4.500	Heave	0.000		
	06/06/07	197	98.0669	-0.900	Settlement	3.600	Heave	0.900		
	22/08/07	274	98.0674	0.500	Heave	4.100	Heave	0.900		
SMP8	21/11/06	0	96.2000	0.000	No movement	0.000		0.000	3.700	0.10%
	08/12/06	17	96.1979	-2.100	Settlement	-2.100	Settlement	2.100		
	10/01/07	50	96.1961	-1.800	Settlement	-3.900	Settlement	3.900		
	06/02/07	77	96.1959	-0.200	Settlement	-4.100	Settlement	4.100		
	04/04/07	134	96.1967	0.800	Heave	-3.300	Settlement	4.100		
	06/06/07	197	96.1926	-4.100	Settlement	-7.400	Settlement	8.200		
	22/08/07	274	96.1912	-1.400	Settlement	-8.800	Settlement	9.600		
SMP9	21/11/06	0	95.9611	0.000	No movement	0.000		0.000	3.100	0.05%
	08/12/06	17	95.9586	-2.500	Settlement	-2.500	Settlement	2.500		
	10/01/07	50	95.9563	-2.300	Settlement	-4.800	Settlement	4.800		
	06/02/07	77	95.9557	-0.600	Settlement	-5.400	Settlement	5.400		
	04/04/07	134	95.9571	1.400	Heave	-4.000	Settlement	5.400		
	06/06/07	197	95.9582	1.100	Heave	-2.900	Settlement	5.400		
	22/08/07	274	95.9571	-1.100	Settlement	-4.000	Settlement	6.500		

TABLE 2: LRDM Ground Movement Monitoring Results Post-reclamation

Monitoring Pin	Date	Age of Fill (days)	Monitored Ground Level (m AOD)	Monitored Ground Movement (mm)	Type of movement over period	Cumulative Ground Movement (mm)	Type of movement cumulative	Cumulative Settlement (mm)	Depth of fill (m)	Creep α -value based on monitoring information
SMP10	21/11/06	0	97.2397	0.000	No movement	0.000		0.000	4.000	-0.04%
	08/12/06	17	97.2390	-0.700	Settlement	-0.700	Settlement	0.700		
	10/01/07	50	97.2390	0.000	No movement	0.000	Settlement	0.700		
	06/02/07	77	97.2394	0.400	Heave	-0.300	Settlement	0.700		
	04/04/07	134	97.2433	3.900	Heave	3.600	Heave	0.700		
	06/06/07	197	97.2433	0.000	No movement	3.600	Heave	0.700		
	22/08/07	274	97.2432	-0.100	Settlement	3.500	Heave	0.800		
SMP11	21/11/06	0	98.7408	0.000	No movement	0.000		0.000	4.000	-0.05%
	08/12/06	17	98.7424	1.600	Heave	1.600	Heave	0.000		
	10/01/07	50	98.7427	0.300	Heave	1.900	Heave	0.000		
	06/02/07	77	98.7426	-0.100	Settlement	1.800	Heave	0.100		
	04/04/07	134	98.7455	2.900	Heave	4.700	Heave	0.100		
	06/06/07	197	98.7456	0.100	Heave	4.800	Heave	0.100		
	22/08/07	274	98.7456	0.000	No movement	4.800	Heave	0.100		
SMP12	21/11/06	0	100.4587	0.000	No movement	0.000		0.000	4.000	-0.02%
	08/12/06	17	100.4608	2.100	Heave	2.100	Heave	0.000		
	10/01/07	50	100.4607	-0.100	Settlement	2.000	Heave	0.100		
	06/02/07	77	100.4603	-0.400	Settlement	1.600	Heave	0.500		
	04/04/07	134	100.4627	2.400	Heave	4.000	Heave	0.500		
	06/06/07	197	100.4613	-1.400	Settlement	2.600	Heave	1.900		
	22/08/07	274	100.4608	-0.500	Settlement	2.100	Heave	2.400		

TABLE 2: LRDM Ground Movement Monitoring Results Post-reclamation

Monitoring Pin	Date	Age of Fill (days)	Monitored Ground Level (m AOD)	Monitored Ground Movement (mm)	Type of movement over period	Cumulative Ground Movement (mm)	Type of movement cumulative	Cumulative Settlement (mm)	Depth of fill (m)	Creep α -value based on monitoring information
SMP13	21/11/06	0	101.7785	0.000	No movement	0.000		0.000	3.100	-0.05%
	08/12/06	17	101.7805	2.000	Heave	2.000	Heave	0.000		
	10/01/07	50	101.7807	0.200	Heave	2.200	Heave	0.000		
	06/02/07	77	101.7796	-1.100	Settlement	1.100	Heave	1.100		
	04/04/07	134	101.7829	3.300	Heave	4.400	Heave	1.100		
	06/06/07	197	101.7827	-0.200	Settlement	4.200	Heave	1.300		
	22/08/07	274	101.7826	-0.100	Settlement	4.100	Heave	1.400		
SMP14	21/11/06	0	99.0552	0.000	No movement	0.000		0.000	4.000	-0.03%
	08/12/06	17	99.0568	1.600	Heave	1.600	Heave	0.000		
	10/01/07	50	99.0568	0.000	No movement	1.600	Heave	0.000		
	06/02/07	77	99.0575	0.700	Heave	2.300	Heave	0.000		
	04/04/07	134	99.0601	2.600	Heave	4.900	Heave	0.000		
	06/06/07	197	99.0588	-1.300	Settlement	3.600	Heave	1.300		
	22/08/07	274	99.0581	-0.700	Settlement	2.900	Heave	2.000		
SMP15	21/11/06	0	97.8246	0.000	No movement	0.000		0.000	4.000	0.03%
	08/12/06	17	97.8331	8.500	Heave	8.500	Heave	0.000		
	10/01/07	50	97.8236	-9.500	Settlement	-1.000	Settlement	9.500		
	06/02/07	77	97.8238	0.200	Heave	-0.800	Settlement	9.500		
	04/04/07	134	97.8262	2.400	Heave	1.600	Heave	9.500		
	06/06/07	197	97.8227	-3.500	Settlement	-1.900	Settlement	13.000		
	22/08/07	274	97.8220	-0.700	Settlement	-2.600	Settlement	13.700		

TABLE 2: LRDM Ground Movement Monitoring Results Post-reclamation

Monitoring Pin	Date	Age of Fill (days)	Monitored Ground Level (m AOD)	Monitored Ground Movement (mm)	Type of movement over period	Cumulative Ground Movement (mm)	Type of movement cumulative	Cumulative Settlement (mm)	Depth of fill (m)	Creep α -value based on monitoring information
SMP16	21/11/06	0	97.0757	0.000	No movement	0.000		0.000	4.000	0.03%
	08/12/06	17	97.0742	-1.500	Settlement	-1.500	Settlement	1.500		
	10/01/07	50	97.0738	-0.400	Settlement	-1.900	Settlement	1.900		
	06/02/07	77	97.0736	-0.200	Settlement	-2.100	Settlement	2.100		
	04/04/07	134	97.0756	2.000	Heave	-0.100	Settlement	2.100		
	06/06/07	197	97.0738	-1.800	Settlement	-1.900	Settlement	3.900		
	22/08/07	274	97.0728	-1.000	Settlement	-2.900	Settlement	4.900		
SMP17	21/11/06	0	98.4899	0.000	No movement	0.000		0.000	4.000	-0.01%
	08/12/06	17	98.4884	-1.500	Settlement	-1.500	Settlement	1.500		
	10/01/07	50	98.4880	-0.400	Settlement	-1.900	Settlement	1.900		
	06/02/07	77	98.4888	0.800	Heave	-1.100	Settlement	1.900		
	04/04/07	134	98.4919	3.100	Heave	2.000	Heave	1.900		
	06/06/07	197	98.4918	-0.100	Settlement	1.900	Heave	2.000		
	22/08/07	274	98.4907	-1.100	Settlement	0.800	Heave	3.100		
SMP18	21/11/06	0	98.3161	0.000	No movement	0.000		0.000	4.100	-0.02%
	08/12/06	17	98.3171	1.000	Heave	1.000	Heave	0.000		
	10/01/07	50	98.3171	0.000	No movement	1.000	Heave	0.000		
	06/02/07	77	98.3178	0.700	Heave	1.700	Heave	0.000		
	04/04/07	134	98.3198	2.000	Heave	3.700	Heave	0.000		
	06/06/07	197	98.3190	-0.800	Settlement	2.900	Heave	0.800		
	22/08/07	274	98.3180	-1.000	Settlement	1.900	Heave	1.800		

TABLE 2: LRDM Ground Movement Monitoring Results Post-reclamation

Monitoring Pin	Date	Age of Fill (days)	Monitored Ground Level (m AOD)	Monitored Ground Movement (mm)	Type of movement over period	Cumulative Ground Movement (mm)	Type of movement cumulative	Cumulative Settlement (mm)	Depth of fill (m)	Creep α -value based on monitoring information
SMP19	21/11/06	0	98.8857	0.000	No movement	0.000		0.000	4.400	-0.03%
	08/12/06	17	98.8872	1.500	Heave	1.500	Heave	0.000		
	10/01/07	50	98.8876	0.400	Heave	1.900	Heave	0.000		
	06/02/07	77	98.8880	0.400	Heave	2.300	Heave	0.000		
	04/04/07	134	98.8905	2.500	Heave	4.800	Heave	0.000		
	06/06/07	197	98.8896	-0.900	Settlement	3.900	Heave	0.900		
	22/08/07	274	98.8889	-0.700	Settlement	3.200	Heave	1.600		
SMP20	21/11/06	0	99.6119	0.000	No movement	0.000		0.000	5.000	0.01%
	08/12/06	17	99.6105	-1.400	Settlement	-1.400	Settlement	1.400		
	10/01/07	50	99.6101	-0.400	Settlement	-1.800	Settlement	1.800		
	06/02/07	77	99.6110	0.900	Heave	-0.900	Settlement	1.800		
	04/04/07	134	99.6130	2.000	Heave	1.100	Heave	1.800		
	06/06/07	197	99.6120	-1.000	Settlement	0.100	Heave	2.800		
	22/08/07	274	99.6107	-1.300	Settlement	-1.200	Settlement	4.100		
SMP21	21/11/06	0	100.5308	0.000	No movement	0.000		0.000	7.300	0.01%
	08/12/06	17	100.5280	-2.800	Settlement	-2.800	Settlement	2.800		
	10/01/07	50	100.5264	-1.600	Settlement	-4.400	Settlement	4.400		
	06/02/07	77	100.5270	0.600	Heave	-3.800	Settlement	4.400		
	04/04/07	134	100.5321	5.100	Heave	1.300	Heave	4.400		
	06/06/07	197	100.5304	-1.700	Settlement	-0.400	Settlement	6.100		
	22/08/07	274	100.5288	-1.600	Settlement	-2.000	Settlement	7.700		

TABLE 2: LRDM Ground Movement Monitoring Results Post-reclamation

Monitoring Pin	Date	Age of Fill (days)	Monitored Ground Level (m AOD)	Monitored Ground Movement (mm)	Type of movement over period	Cumulative Ground Movement (mm)	Type of movement cumulative	Cumulative Settlement (mm)	Depth of fill (m)	Creep α -value based on monitoring information
SMP22	21/11/06	0	101.0767	0.000	No movement	0.000		0.000	9.700	0.08%
	08/12/06	17	101.0701	-6.600	Settlement	-6.600	Settlement	6.600		
	10/01/07	50	101.0591	-11.000	Settlement	-17.600	Settlement	17.600		
	06/02/07	77	101.0573	-1.800	Settlement	-19.400	Settlement	19.400		
	04/04/07	134	101.0593	2.000	Heave	-17.400	Settlement	19.400		
	06/06/07	197	101.0588	-0.500	Settlement	-17.900	Settlement	19.900		
	22/08/07	274	101.0570	-1.800	Settlement	-19.700	Settlement	21.700		

TABLE 3: LRDM Total and Differential Creep Settlement Predictions

$\pm$
50%

Area	Location	Thickness (m) CM	alpha CM	t1 (years)	t2 (years)	Typ sett (mm)	Min sett (mm)	Max sett (mm)	Typ differential settlement (mm)	Length of Slope (m)	Typ Tilt (1V:2H)	Max differential settlement (mm)	Length of Slope (m)	Max Tilt (1V:2H)
Main LRDM Area	Typical	3	0.15%	1	25	6	3	9	2	10	4769	9	10	1060
Main LRDM Area	Typical	4	0.15%	1	25	8	4	13	2	10	4769	9	10	1060
Northern area of LRDM	5 m contour	5	0.15%	1	25	10	5	16	2	12	5723	14	12	880
Northern area of LRDM	6 m contour	6	0.15%	1	25	13	6	19	2	12	5723	16	12	763
Northern area of LRDM	7 m contour	7	0.15%	1	25	15	7	22	2	12	5723	18	12	561
Northern area of LRDM	8 m contour	8	0.15%	1	25	17	8	25	2	10	4769	20	10	251
Northern area of LRDM	9 m contour	9	0.15%	1	25	19	9	28	2	5	2384	22	5	454
Northern area of LRDM	10 m contour	10	0.15%	1	25	21	10	31	2	10	4769	24	10	191
NW boundary slope of LRDM	Top of excavation	0	0.15%	1	25	0	0	0	10	3	206	16	3	477
NW boundary slope of LRDM	Top of excavation	5	0.15%	1	25	10	5	16	10	3	206	16	3	477
Southern boundary of LRDM	Top of excavation	10	0.15%	1	25	0	0	0	8	6	715	13	6	477
Southern boundary of LRDM	Top of excavation	4	0.15%	1	25	8	4	13	8	6	715	13	6	477

Figure 1 Reclamation of Brymbo Steelworks, LRDM
Post-reclamation Surface Settlement Monitoring (Natural Scale)

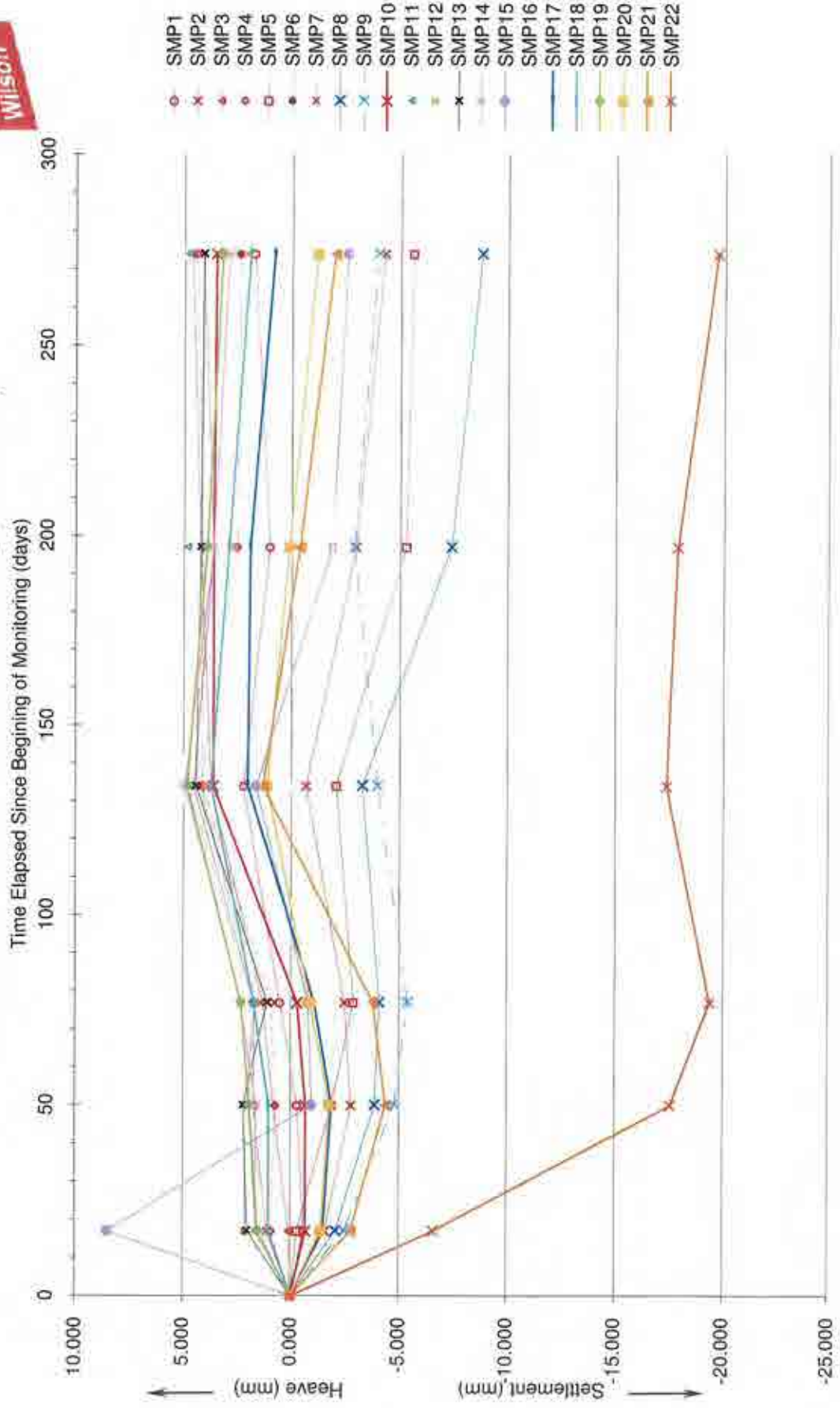
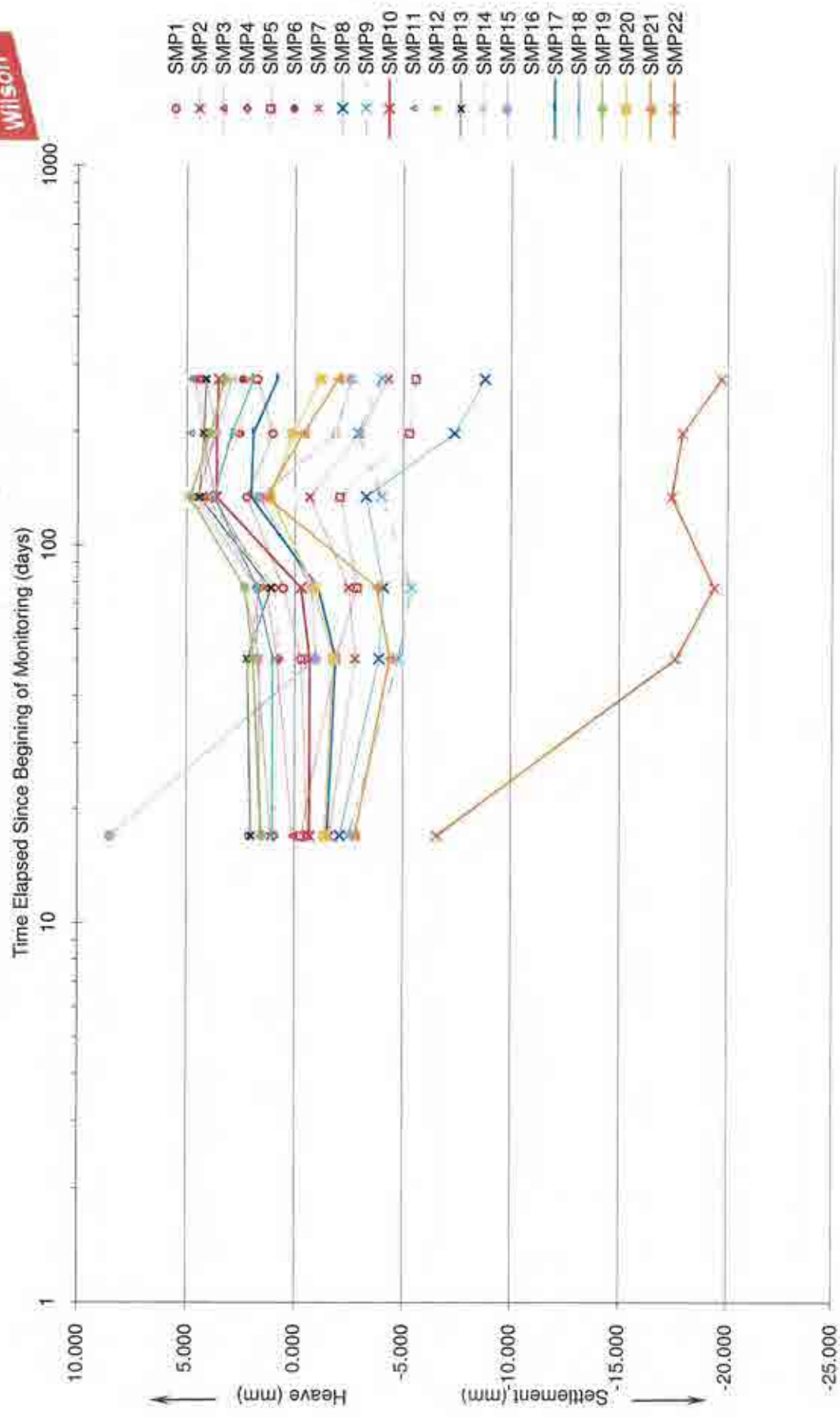




Figure 2 Reclamation of Brymbo Steel works, LRDM
Post-reclamation Surface Settlement Monitoring (log Scale)



DRAWINGS



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Drawing Title

**EXTRACT FROM
ORDNANCE SURVEY MAP
LANDRANGER SHEET 117
(CHESTER & WREXHAM, ELLESMERE PORT)**

D101082/LRDM_COMP/001

Scale at A4 : 1 : 50,000

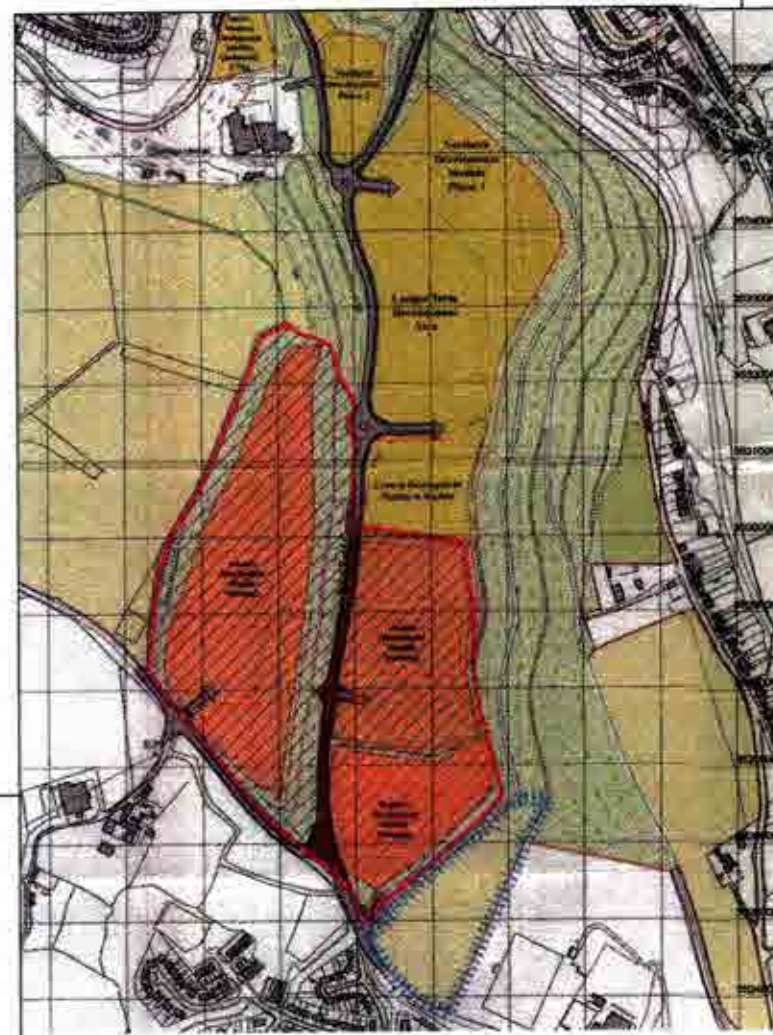
Drw GJC App SJH Rev

Chk MON Date April 07 Date



www.scottwilson.com

Plot Date :
AutoCAD File Name :



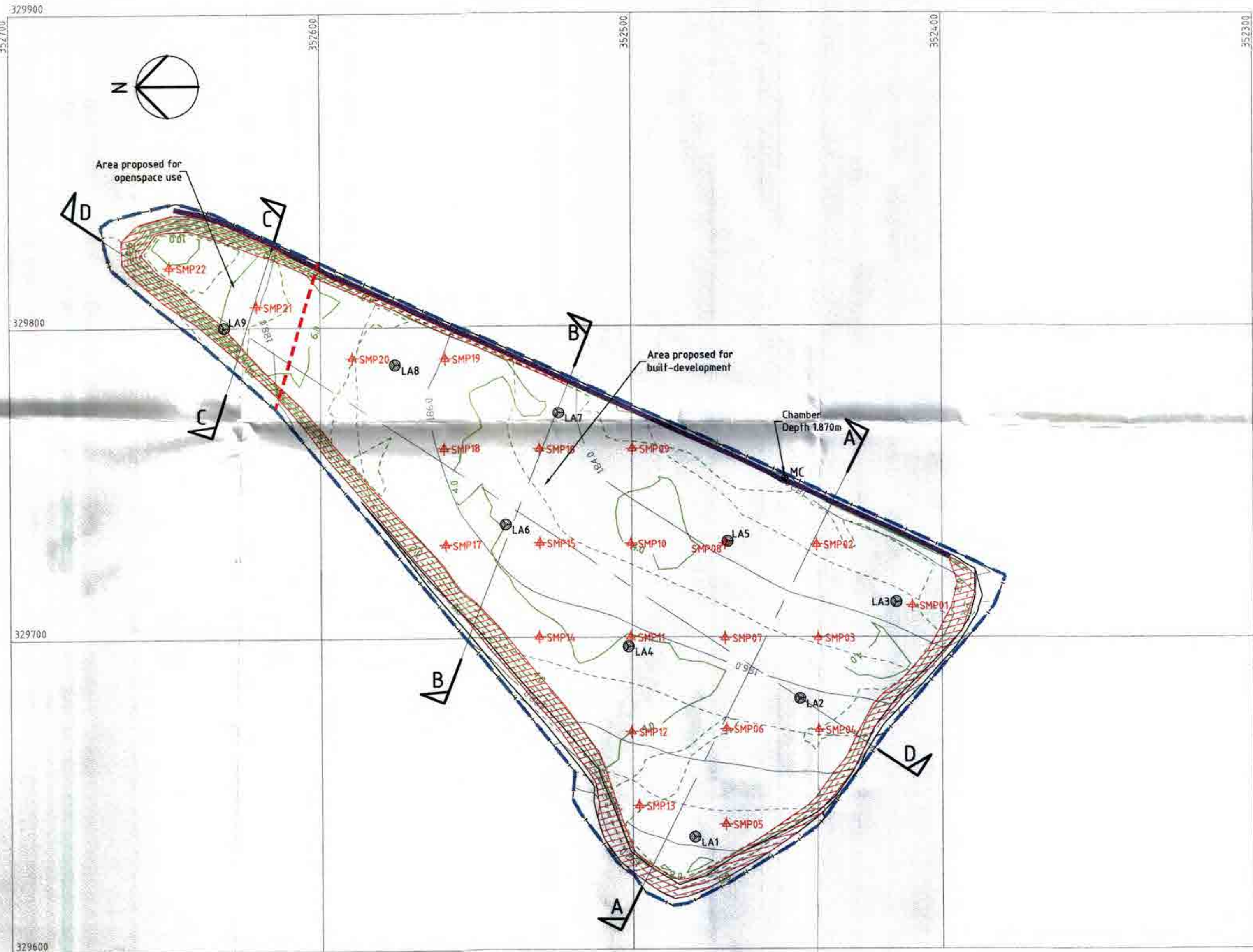
SITE PLAN
SCALE 1:10000

NOTES.

1. Module boundary details and survey information defining extent and thickness of controlled fill provided by Brymbo Developments Ltd.
2. Refer to drawing D101082/LRDM_COMP/04 for cross sections.

KEY

- Boundary of Link Road Development Module
- Northern boundary of proposed area of built development
- Finished level contours
- Fill depth contours
- Location of rubble filled filter drain
- Settlement Monitoring Pins
- Plate Load Test Location
- Area of buried slopes not suitable for buildings



Job Title

**RECLAMATION OF
BRYMBO
STEELWORKS**

Drawing Title

**LINK ROAD DEVELOPMENT MODULE
FINISHED LEVEL, FILL DEPTH, SETTLEMENT
MARKER AND PLATE LOAD TEST LOCATIONS**

Scale at A2
1:1000

Drawn
GJC

Stage 1 check
EB

Approved
SJH

Originated
CH_GEO

Date
Nov 20(17

THIS DRAWING MAY BE USED ONLY FOR
THE PURPOSE INTENDED AND ONLY
WRITTEN DIMENSIONS SHALL BE USED

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Drawing Number
D101082/LRDM_COMP/002 Rev

Revision Details	By	Date	Suffix
Drawing Status	Check		
FINAL			

Job Title	RECLAMATION OF BRYMBO STEELWORKS
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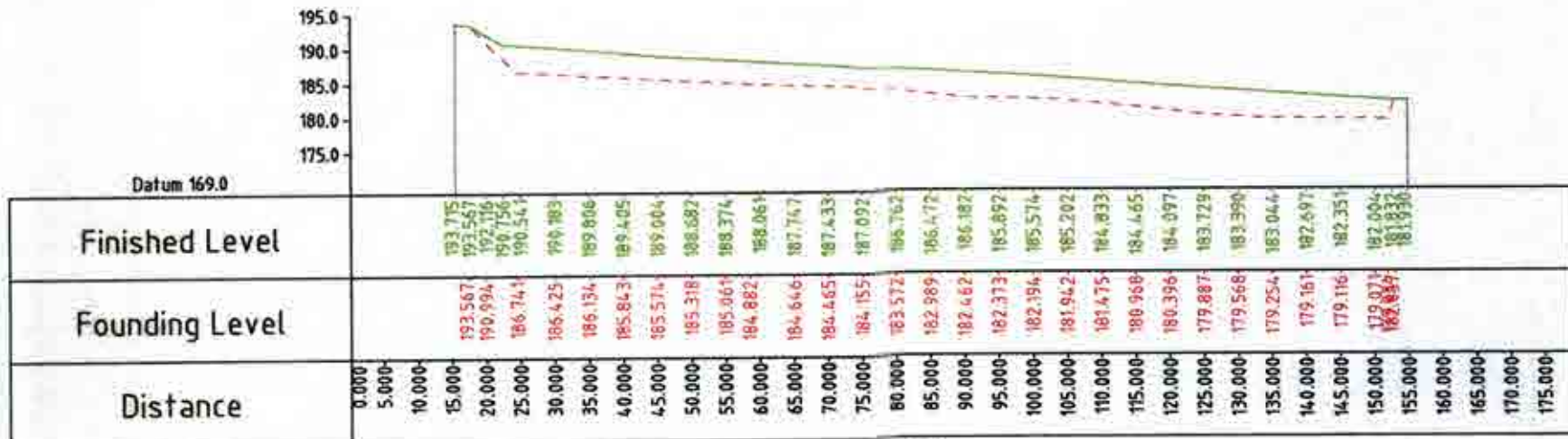
Drawing Title	LINK ROAD DEVELOPMENT MODULE CROSS SECTIONS
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Scale at A2 1:1000			
Drawn GJC	Approved SJH		
Stage 1 check EB	Stage 2 check	Originated CH_GEO	Date Nov 2007
THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED			

Scott Wilson Royal Court, Basil Close Chesterfield Derbyshire, S41 7SL Telephone (01246) 209221 Fax (01246) 209229 www.scottwilson.com		Drawing Number D101082/LRDM_COMP/004	Rev -
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NOTES

- Module boundary details and survey information defining extent and thickness of controlled fill provided by Brymbo Developments Ltd.
- For Cross Section locations see drawings D101082/LRDM_COMP/002 and 003.



APPENDIX 2

Smith Grant LLP Link Road Development Module Contamination Certification Report

*Contaminated Land
Air Quality
Environmental Audit*



Partnership No. OC 300776

**FORMER BRYMBO STEELWORKS
LINK ROAD DEVELOPMENT MODULE**

CONTAMINATION CERTIFICATION REPORT

For: Brymbo Developments Limited

July 2007

R175-R28/Final

DOCUMENT CONTROL SHEET

Report Title: Former Brymbo Steelworks
Link Road Development Module
Contamination Certification Report

Client: Brymbo Developments Ltd

Report Reference Number: R175-R28

Report Status: Final

Version: Version 0

Report Date: July 2007

for: Smith Grant LLP

	Name	Position	Signature	Date
Author	K.E.Hawkins BSc MSc AIEMA	Member		9.7.07
Checked	A F Smith BSc, PhD, MCIWM	Chariman		9/7/07

**FORMER BRYMBO STEELWORKS, LINK ROAD DEVELOPMENT MODULE
CONTAMINATION CERTIFICATION REPORT**

For: Brymbo Developments Limited
July 2007

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3. Environmental Setting
4. Site History and Development
5. Pre-Reclamation Site Investigation Findings
6. Environmental Risk Assessment
7. Reclamation Preparatory Works
8. Remedial Strategy
9. Validation Sampling and Testing
10. Completion Assessment
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1. Introduction

1.1. Brief

- 1.1.1. Smith Grant LLP (SGP) was appointed by Brymbo Developments Ltd (BDL) as Environmental Consultant to advise on the environmental aspects of the reclamation and redevelopment of the former Brymbo Steelworks, Brymbo, Wrexham (NGR: SJ297528).
- 1.1.2. The former steelworks site has been divided into a number of discrete development modules. This following report forms the Contamination Certification Report specifically for the Link Road Development Module (LRDM).

1.2. Background

- 1.2.1. Brymbo Steelworks closed in 1990 after some 200 years of iron and steel production. Following closure much of the structure and plant were cleared and the site remained largely derelict. The site was subsequently acquired from United Engineering Steels Ltd. (UES) by Brymbo Developments Limited (BDL), specifically to undertake the reclamation and redevelopment of the site.
- 1.2.2. Detail of the original reclamation scheme was submitted to Wrexham County Borough Council (WCBC) in December 1995 with Planning Approval being granted in November 1997 (ref: CB00016). This included an area of residential development.
- 1.2.3. The original approved scheme covered an approximate area of 95 ha and included the coal recovery of approximately 200,000 tonnes by opencast working. This scheme was not implemented as originally envisaged.
- 1.2.4. Following discussions between BDL and WCBC to find a scheme to ensure the redevelopment and regeneration of the site, a revised scheme was drawn up based largely on the original planning permission. The revised scheme resulted in:
 - Approximately 20 ha of the original 95 ha of BDL ownership to be redeveloped and remain in the ownership of BDL. The extent of the open

cast working and coal recovery was to be reduced to about 90,000 tonnes;

- The remaining land areas, largely unreclaimed or undevelopable, to be transferred into the ownership of WCBC who would be responsible for the redevelopment and regeneration works on these areas, supported by a Land Reclamation Grant (LRG) from the (then) Welsh Development Agency (WDA).

1.2.5. The revised scheme also featured a revised residential development zone covering the southern end of the former steelworks site.

1.2.6. It was subsequently agreed, in July 2004, that BDL would act as contractor for the LRG reclamation works with WCBC as managing agent on behalf of the WDA.

1.2.7. Reclamation works commenced on the main site in October 2003 following earlier demolition activities by WCBC in a number of areas. The overall reclamation scheme has evolved since the preparation of the revised scheme in 2001 in on-going consultation with all the relevant bodies (WCBC, Local Liaison Committee, Environment Agency Wales (EAW), WDA etc).

1.2.8. Although the LRDM lay within the original reclamation site application boundary, at the time there was no specified end-use for this area. A separate Planning Application has therefore been submitted regarding the development of the LRDM. The planning authority has Resolved to Permit (July 2006) subject to the finalisation of a Section 106 Agreement. The planning permission is expected to have a specific condition requiring the investigation, assessment and remediation of contamination within the development. The LRDM however has also been considered within the requirements and conditions of the main site planning permission.

1.2.9. The site has been divided into a number of distinct development areas, depending on the nature of the proposed redevelopment:

- Link Road Development Module (LRDM) – housing
- Southern Development Module (SDM) - housing
- Central Development Module (CDM) –housing

- Western Development Module (WDM) -housing
- Central Development Northern Module (CDNM) - school
- Spine Road - infrastructure
- Northern Development Module Phase I (NDM1) – industrial/commercial
- North Western Development Module (NWDM) – learning, information and resources centre
- Northern Development Module Phases 2 & 2A (NDM2/2A) – housing
- Longer Term Development Module (LTDM) – industrial/commercial
- Heritage Module – tourism/leisure

1.2.10. The overall reclamation strategy across the main site principally involves the:

- excavation and replacement of steelworks wastes to permit the classification and stabilisation of these materials;
- regrading of natural soils and made ground to form development plateaux and landscaped batters;
- stabilisation of the underlying ground affected by historical mining;
- segregation and controlled storage of unsuitable materials away from future development zones; and,
- provision of uncontaminated and physically suitable capping materials on development and landscaped areas.

1.2.11. A Contamination Certification Report is to be provided for each individual development module on completion of the reclamation activities. The following report deals specifically with the Link Road Development Module (LRDM). Reclamation activities commenced in this area in July 2006 and the area was completed to level by October 2006.

1.3. Roles and Responsibilities

1.3.1. Reclamation and redevelopment works have been undertaken by BDL. SGP has been retained as Environmental Consultant by BDL since 1995 and information and data obtained by SGP has been used in the design of the reclamation strategy for the overall site, both in relation to potential environmental impacts during the works and on completion.

1.3.2. The role of SGP during the reclamation of Brymbo Steelworks included the placement of a full-time chemist on site to observe and monitor activities and

collect samples as required and in accordance with environmental monitoring plans and agreements. Specific activities included:

- identification of the nature and extent of contamination across the site;
- provision of advice on appropriate reclamation and remediation measures across the site;
- deposition and airborne dust monitoring;
- controlled waters monitoring;
- noise monitoring;
- liaison and correspondence with the relevant regulatory authorities as necessary;
- additional sampling, analysis and monitoring as required across the site;
- production of Contamination Certification Reports for the individual reclamation modules for provision to the relevant parties.

1.3.3. Scott Wilson have been retained by BDL to advise on geotechnical issues such as slag expansivity, ground stability, locations and capping of coal shafts etc.

1.3.4. The Planning Authority and Environmental Health Authority (responsible for contaminated land regulation) is Wrexham County Borough Council. The EAW is responsible for waste regulation and environmental protection, particularly with respect to controlled waters.

1.4. Site Location and Boundaries

1.4.1. The former steelworks site is located at Brymbo, 4.5 km to the west of Wrexham. The main site occupies an elevated position on the west side of a north-south valley extending between The Lodge and Brymbo. The works was mostly constructed on a plateau formed from tipped slag and quarry overburden which projects out from the original valley side at an elevation of about 195 m AOD.

1.4.2. The main site occupies an area between the village of Brymbo to the north, the valley and villages of The Lodge and Broughton to the east, the village of Tanyfron to the south and Ty Cerryg, a former opencast coal site, to the west. The site boundaries are formed by Brake Road, Blast Road, Gwalia Road and Mount Hill to the north; New Road and Kent Road to the east; and Brymbo Link Road and Tanyfron to the south and west.

- 1.4.3. The LRDM is located in the southern tip of the former steelworks site forming a roughly triangular shaped development plateau bound by the SDM to the north west; the re-graded Eastern Slopes down to the north east; Brymbo Link Road and Tan-y-Fron to the south and Brymbo Sports and Social Club complex to the east and south east. The location of the LRDM in relation to the pre-reclamation and current site layout are shown in Drawings D001 and D002. The FWTa comprises an area of approximately 3.1ha of which 2.3ha is allocated for residential development and 0.2ha for informal open space. The remainder is formed by a footpath / cycleway and a tree lined batter along the north western strip (0.6ha).

2. Sources of Information

2.1. Document List

- 2.1.1. A large number of documents relevant to the environmental status and overall reclamation scheme of the main site have been produced by several parties since the closure of the works. A list of the key documents considered most relevant to this report is provided in Appendix C.
- 2.1.2. The principal source of information regarding the original status of the main site prior to reclamation works is the site investigation report prepared by SGP in 1995, 'Brymbo Steelworks Site Contamination Assessment, September 1995, ref: R31-R07' which describes the contamination status of the overall site.

3. Environmental Setting

3.1. Topography

- 3.1.1. The main LRDM plateau falls gently from 188m AOD in the west to 182m AOD in the south. The southern edge of the site rises to the Brymbo Link Road at 190m AOD. The site includes the northwestern batter and adjoining proposed cycle track / footpath which is raised above the plateau at 192m AOD. The northwestern boundary of the site is formed by the base of the batters of the SDM which then rise up to the SDM plateau at 196m AOD. To the southeast the ground drops down to the Brymbo Sports and Social Club.

3.2. Geology

- 3.2.1. The main site overlies Middle Coal Measures strata predominantly of

mudstones, with sequences of thin siltstones and sandstones, coal seams and seatearths. The coal seams and iron-rich sandstones have been extensively worked in the area. The strata dip generally to the east-southeast at between 1v : 6h and 1v : 8h.

3.2.2. The Brymbo Fault is mapped as running roughly NNW-SSE across the centre of the site, lying mainly to the east / northeast of the LRDM. The fault was seen in the opencast workings as a narrow well-defined break, and down throws the strata by about 140m to the west. On the west side of the fault the Cefn Sandstone outcrops whilst to the east are the typical sequences of Coal Measures strata.

3.2.3. Drift deposits of Boulder Clay may have originally overlain parts of the site, however, it is now generally thin or absent from the slopes. Prior to the reclamation the majority of the main site was underlain by variable depths of fill material created by the deposits of waste and slag to facilitate the expansion of the works over the years. The stratigraphy of the LRDM is described in detail later, however no deposits of slag were known to occur in the area of the LRDM prior to reclamation.

3.3. Hydrology

3.3.1. The area of the main site potentially falls into the catchment of two tributary systems: to the north is the Afon Cegidog (~2.6 km from the LRDM) which joins the Afon Alun at Cefn y Bedd and to the south is the Afon Gwenfro (~0.5km from the LRDM) that joins the Afon Clywedog in Wrexham. The Gwenfro is fed by the Lodge Stream, which runs down the valley along the eastern boundary of the main site. The stream forms the closest surface watercourse to the LRDM, lying about 300m to the north east.

3.3.2. The Gwenfro and Cegidog are classed by the EAW as having a GQA level of B (good) and A (very good) during the most recent sampling rounds (2003 – 2005). The Lodge Stream is unclassified under the GQA scheme.

3.3.3. Drainage on the main site is via direct run-off from the slopes, through man made drains and channels constructed during previous uses of the site or by infiltrating the ground and moving through a saturated zone beneath the site. It is considered likely that the majority of drainage on the main site moves via infiltration, however, the presence of compacted fills over the remediated

LRDM results in low permeability and therefore a French drain has been constructed on the eastern boundary to catch surface run-off and prevent water logging of the adjacent football field. This drain links into the historical surface water discharge point for the main site.

- 3.3.4. The area has been extensively mined in the past and the historic underground workings are likely to be linked along worked seams and via shafts of varying sizes, drains and adits to form a large interconnected system of multiple voids linked to the surface environment, possibly at significant distance from the site itself. Hence, it is possible that drainage from the site is directed by a series of former mine adits to the Afon Cegidog, Afon Alun or the Afon Gwenfro

3.4. Hydrogeology

- 3.4.1. The area of the former steelworks is underlain by a minor aquifer (the Coal Measures) of variable permeability as shown on the Environment Agency Groundwater Vulnerability Map (Sheet 16, West Cheshire). This formation can contain locally significant quantities of groundwater which may provide baseflow to local rivers. Groundwater within the overall site has been found within perched water tables in the fractured sandstone strata and old workings and in hollows above superficial boulder clay.
- 3.4.2. Generally the original fill on the main site is highly permeable and rapidly transmits precipitation water downwards to the base. Seepages have been noted at the base of the fill slopes above the Lodge.
- 3.4.3. Groundwater is likely to be present at depth within the bedrock below the LRDM. Drainage across the site is probably heavily influenced by former mineworkings and associated voids and jointing within the sandstones. Drainage pathways are unknown but could be to the north via old mine workings and mine drainage discharges to the Afon Cegidog in the Ffrith valley, to the east via old mineworkings to mine discharges to the Afon Alun near Cefn-y-Bedd, to the east down gradient through sandstone units to the natural springs in the Lodge area feeding the Lodge stream or to the south via the Tan-y-Fron Adit and discharging to the Afon Gwenfro. The height of groundwater across the main site generally decreases from an average of 203m AOD on the west side of the fault to 148m AOD on the east side of the Brymbo fault, roughly coinciding with the base of the Lodge Valley.

3.4.4. A number of boreholes have been installed across the main site over time which have permitted the measurement of groundwater depth. The closest to the LRDM for which depth monitoring records are available was referred to as BH101 (located to the immediate east of the former Billet Mill on the site of a former garage; now under the regraded Eastern Slopes). Measurements over a number of years have shown that the groundwater in this location was at an average depth of 11.4m (~180m AOD) below the top of the original boreholes.

3.4.5. The groundwater in the area is not currently abstracted locally and the site does not lie within a Source Protection Zone.

3.5. Neighbouring Development

3.5.1. The LRDM is located on the south eastern edge of the former steelworks site. To the immediate north west lies the SDM, which has been developed to residential properties, beyond which, across the Spine Road is the WDM which is also being developed as residential properties. Beyond the WDM lies the former Ty Cerryg opencast coal site which now comprises agricultural grazing land having been backfilled with the excavated Coal Measures overburden and landscaped in the 1970s.

3.5.2. To the north of the SDM lies the CDM, also undergoing development to residential properties, and the CDNMM which is to be allocated for a school. To the south of the LRDM, beyond the Brymbo Link Road, lies the village of Tan y Fron and to the east/south east lies the Brymbo Sports and Social Club complex. To the northeast lie the Eastern Slopes, the remediated former slag banks which have been re-graded to provide informal open space.

3.5.3. The former site reclamation 'void' lies to the north of the CDNMM. This area was excavated to enable extraction of coal and clean Coal Measures overburden material for use as fill material elsewhere on site. The void has now been backfilled with steelworks waste according to a classification agreed with WCBC and will ultimately be redeveloped for industrial / commercial use.

4. Site History and Development

4.1. Brymbo Steelworks

- 4.1.1. Information regarding the historical development of the site has been generated from a number of sources during the course of the development of the reclamation scheme including historical County Series and Ordnance Survey maps, discussions with former employees and review of undated former works plans. Historical maps showing the development of the southern area of the steelworks encompassing the LRDM are provided in Drawings D003 – D011.
- 4.1.2. Industry commenced at the site in the late 18th century with the establishment of an ironworks, and coal and ironstone mines. Progressive development of the ironworks and expansion into steel production over a period of about 200 years resulted in the present overall size of the site. Growth tended to be in an easterly and southerly direction from the original works which was centred upon the blast furnaces and colliery (now within the Heritage Module).
- 4.1.3. The principal buildings and development across the main site associated with the operation of an iron and steelworks included blast furnaces, mineral railways and sidings, colliery buildings, billet mill, opencast coal workings, coke ovens and by products plants (although smaller than associated with modern steelworks sites), water treatment plants, machine shops, waste tips etc.
- 4.1.4. The smelting of iron and refining of steel produced large volumes of slag wastes, much of which could not be re-used and was tipped alongside the sites of production. Other wastes were produced in substantial volumes and these included ash from coal fired boilers and reheating furnaces, retort bricks, moulding sands, flue dusts and soot and general works wastes. These were interspersed within the slags in the waste tips. After 1974, when waste tips required licensing, disposal took place in two locations: the Works Tip and the Wonder Bank.
- 4.1.5. Production on site ceased in 1990 and the full plant was decommissioned by December 1990.

4.2. Link Road Development Module

- 4.2.1. The earliest available historical maps show that in 1879 the area now occupied by the LRDM comprised open land. The only nearby development is shown as the Vron branch of the Great Western Railway 700m to the north west, running from the Vron Colliery to the south, to the Brymbo Iron Works to the north, and a group of buildings labelled 'The College' to the south.
- 4.2.2. By 1900 the site still remained undeveloped other than the Vron branch of the W.M & C.Q.R which ran along the north western boundary, partly encroaching within the site. The railway is shown as partly dismantled by 1964 with complete dismantlement having occurred by 1992. The main area of the LRDM is shown to have remained undeveloped through the 1900s until by 1987 when the main site access road encroached into the southwest corner (No 2 Gate Access). By 1992 a small helicopter landing pad is shown in the northern most corner. The Brymbo Link Road was constructed by 2000 forming the southern site boundary.
- 4.2.3. In 2003 a series of 4 settlement lagoons were constructed by BDL on the LRDM to provide a final water treatment area for the storm water run-off from the main site and to provide a source of water for dust suppression during the reclamation works (see drawing D012). In the event the majority of the water was used on site and was rarely released for discharge from the steelworks historical surface water discharge point. An access road was also created along the northwestern edge of the site, providing the principal access route onto the site during the bulk of the reclamation works.
- 4.2.4. Other than the presence of the railway line along the northwestern boundary, there are no indications of any historical industrial activities having occurred on the LRDM prior to the construction of the water treatment lagoons.

4.3. Surrounding Land

- 4.3.1. As noted above the LRDM is located on the southern edge of the former steelworks. Principal historical areas within the steelworks in proximity to the LRDM include:
- SDM – southern end of former Billet Mill and effluent treatment plant; now reclaimed and developed to residential; adjacent to north west;

- Eastern Slopes – includes the former Works Tip, predominantly slag waste; now re-graded and stabilised for informal open space; 300m to the east;
- CDM – former Billet Mill; now reclaimed and being developed for residential use; 80m to the NW;
- CDNM – former railway sidings; former southern end of opencast void; now backfilled with mudstone/sandstone engineered fill and to be developed to a school; 500m to north;
- WDM – former railway sidings and Slag Reduction Company; now reclaimed and being developed to residential; 250m to north west;
- LTDM – site reclamation 'void', area of coal and overburden excavation now backfilled and to be redeveloped to commercial/industrial use; 600m to the north.

4.3.2. Ty Cerryg, a former opencast coal site, lies to the north west beyond the WDM. The area was backfilled with excavated Coal Measures overburden and returned to agricultural use in the 1970s.

4.4. Contaminative uses

4.4.1. The principal source of contamination across the main site was metalliferous slags and other wastes used as general fills and hardcore or construction materials. Slag was tipped in large quantities across the site in close proximity to the works to form space for subsequent expansion. Other wastes associated with the iron and steel industry include large volumes of boiler ash, refractory bricks from flue and furnace linings, flue dusts and soot from ducts, air filters and chimneys, scale and sludges from cleaning baths and water treatment plants, acids, alkalis and waste oils. Unusable scrap, demolition rubble and general works wastes were also tipped at random within the main slag banks. The contamination characteristics of the steelworks was therefore varied but was dominated by the presence of alkaline, metal-rich slags.

4.4.2. Reference to historical maps did not indicate any historical industrial activities or tipping of slags to have occurred on the LRDM during the operation of the steelworks, other than the presence of the former railway line on the northwest edge. This may have been originally constructed on made ground.

- 4.4.3. The area was subsequently used for the collection and settlement of storm water run-off during the main site reclamation works in 2003 – 2006.
- 4.4.4. The LRDM was subject to routine inspection by SGP as part of the site wide water monitoring and management programme during 2003 – 2006 and the discharge was sampled when flowing. The discharge rarely flowed however as the majority of water was used for dust suppression on site. Elevated contaminants were generally not detected within the occasional discharge. It is however possible that some contaminated sediments collected at the base of the lagoons. In January 2005 some water containing oil from the plant yard was pumped to the N°3 lagoon for temporary storage prior to disposal off site. In addition in April 2005 water containing ochreous silt from the cleaning of a drainage channel was placed in N°3 lagoon for settlement prior to use for dust suppression. No other specific potential polluting incidents were recorded associated with the lagoon area.

5. Pre-Reclamation Investigation Findings

5.1. Description

- 5.1.1. The main steelworks site was investigated in 1995 by SGP, 'Brymbo Steelworks Site Contamination Assessment, September 1995, ref: R31-R07'. The investigation comprised identification of the general contamination levels across the site through the excavation of trial pits and collection of soil and water samples.
- 5.1.2. For ease of reference the main site was divided into 9 distinct zones relating to their physical or historical character. The area occupied by the LRDM however was not included within this investigation, the nearest zone to the LRDM being the Billet Mill zone, to the immediate northwest. The area of the Billet Mill was investigated through the excavation of 12 trial pits, of which only 1 (BM3) was located within close proximity to the LRDM.
- 5.1.3. The LRDM was subsequently utilised from 2003 – 2006 for the collection and settlement of surface water run-off from the site during the reclamation works.
- 5.1.4. A sample (BL2) was collected from topsoil (composite samples created from a number of locations) in an area to the east of Lagoon No 2 on an annual basis from 2003 – 2006 as part of the annual baseline sampling in

accordance with the Section 106 Deed between BDL and WCBC. A total of 4 samples were taken over this period, and submitted for analysis for metals, dioxins, furans and PAHs.

5.1.5. In November 2005 a total of 3 samples (221105FWTA1 – 3) were collected from the bases of lagoons nos 2 and 3 and the overflow channel to assess the presence of any contamination which may have been present in the sludges previously deposited in these locations.

5.1.6. Given the absence of extensive data on the LRDM, additional background data was obtained through the collection of a series of soil samples (280706FWTA1 – 14) in 2006 from hand dug pits in the area following drainage of the majority of water from the lagoons and prior to the commencement of the reclamation earthworks. Samples were collected from the exposed surfaces (0.0-0.5m) on the following basis:

- Lagoon Beds: collected over a 25m grid spacing from each exposed lagoon bed (total of 9 samples);
- Areas external to the lagoon beds: collected on a 50m grid spacing from surrounding surface material used as access roads around the lagoons (total of 8 samples).

5.1.7. The soil samples were submitted for comprehensive chemical analysis and a proportion were submitted for leachate testing. At the time of sampling Lagoon No 1 still contained water and the soft silts in Lagoon No 4 prevented safe access into the centre of the lagoon.

5.1.8. At this stage it was not possible to undertake any investigation or sampling of the southwestern or northwestern areas as these remained in use as the main site access gate and road. The north western strip was predominately undisturbed during the reclamation works and additional information obtained from this area following reclamation is discussed in Section 9. The south western area was excavated as part of the reclamation and the works observed by SGP, details are provided in Section 9.

5.1.9. The details of all the sample locations are provided in Drawing D012.

5.2. Physical

5.2.1. Prior to reclamation the majority of the site comprised the 4 settlement lagoons which drained to the historical discharge point in the southeastern

side of the site. BDL advised that during the excavation of the lagoons (to a maximum depth of 4m below the surrounding ground) the ground conditions were noted to comprise natural soils or possible re-worked Ty Cerryg overburden with no indications of steelworks slag, waste deposits or other deleterious materials.

- 5.2.2. Inspection of the settlement lagoons following draining confirmed the ground to comprise a clayey brown sand with sandstone pieces which was either natural or possibly re-worked overburden from Ty Cerryg. Some crushed hardcore of concrete and brick had been placed in a number of areas to provide roadway surfaces and access to the lagoons.
- 5.2.3. The samples collected from the bases of the lagoons in 2006 typically comprised clayey sand and sediments with occasional coal fragments and gravel. Sample logs are provided in Appendix E.
- 5.2.4. BDL advised that the main site access road along the northwestern edge was constructed through the stripping off of the original topsoil and placement of at least 0.2m crushed hardcore and a surface covering of concrete fines. The access road was routinely repaired through the placement of additional concrete fines during the on-going reclamation works.

5.3. Groundwater Conditions

- 5.3.1. No groundwater was observed entering the lagoons or any excavation faces in the LRDM during the reclamation works.

5.4. Soil Contamination

- 5.4.1. A total of 21 samples were collected from the LRDM prior to the onset of reclamation activities and subject to a variety of chemical analysis. A comprehensive summary of the chemical analytical data is included in Appendix F and is outlined below.
- 5.4.2. The results have initially been compared to the assessment criteria agreed with WCBC for use in the housing development areas within the main site to provide information on the level of contamination present. The criteria are based on the CLEA SGVs, where available, for the 'residential with plant uptake' standard landuse. Where SGVs have not been published reference is made to other criteria including the ICRL guidelines for places where plants are to be grown and United Utilities Trigger and Action values for

places where water mains are to be laid (discussed in detail in Section 9).

Table 1: Summary of Pre-reclamation Soil Chemical Analysis

Determinand	Number of Samples	Range	Assessment Criteria	No of exceedances
pH	17	6.85-8.43	<3 United Utilities	none
Asbestos screen	5	nfd	nfd	none
Arsenic	21	<1-27	20 CLEA SGV	7
Boron (water soluble)	17	<1-1	3 ICRL	none
Cadmium	21	<1-6	30 CLEA SGV	none
Chromium (total)	21	<1-1,325	130 CLEA SGV	3
Chromium VI	17	<0.3-<6.0	130 CLEA SGV	none
Mercury	21	<1	8 CLEA SGV	none
Nickel	21	10-41	75 CLEA SGV	none
Lead	21	<1-121	450 CLEA SGV	none
Copper	21	<1-37	130 ICRL	none
Zinc	21	27-723	300 ICRL	1
Selenium	17	<3	260 CLEA	none
Total sulphate	17	80-1,250	none	-
BRE 2:1 soluble sulphate	7	0.01-0.171	1.2 BRE SD1	none
Total cyanide	17	<1	none	-
Free cyanide	17	<1	none	-
Thiocyanate	17	<1	none	-
Total Phenols	17	<0.01-0.23	1 screening conc	none
TPH (C6-40)	14	<10-1,342	4,000 TPHCWG	none
EPH (C10-40)	3	69-200	4,000 TPHCWG	none
Total PAH	21	0.02-48	none	-
Naphthalene	21	<0.01-3.9	9.7 CLEA SSAC	none
Benzo(a)pyrene	21	<0.01-0.25	0.9 CLEA SSAC	none

All concentrations expressed as mg/kg unless stated otherwise

Nfd – no fibres detected; fd – fibres detected

5.4.3. The soils were uncontaminated apart from 7 marginal exceedances for arsenic, 2 exceedances for chromium and a single exceedance of zinc.

5.4.4. Seven samples contained marginally elevated arsenic (maximum recorded

concentration of 27 mg/kg compared to a SGV of 20 mg/kg). Statistical analysis of the data set shows the US95 to be below the SGV at 15 mg/kg and a 95% probability that the maximum value lies within the general sample population. The samples containing marginally elevated arsenic were collected from both the bases of the lagoons and areas external to the lagoons, suggesting that the arsenic arises from natural sources within the soils.

5.4.5. The highest concentration of chromium was substantially in exceedance of the SGV for chromium (at 1,325 mg/kg compared to a SGV of 130 mg/kg). However, the concentration of chromium VI was below the limit of detection indicating the chromium to be present as the less toxic form Cr (III). This sample comprised sand with some gravel with no indications of any slag or other materials. The next highest result of the soils contained chromium at a much lower concentration that was marginally elevated, at 176 mg/kg. No other samples collected of the sands from the former lagoons or sediments contained elevated levels of chromium (total) and chromium VI was not detected in any of the other samples,

5.4.6. In 2006 the baseline topsoil sample contained elevated chromium at 585 mg/kg (301006BL2). This sample was subsequently re-analysed as samples previously collected from this location (in 2003 – 2005) had recorded a maximum of 98 mg/kg. The revised concentration was 176 mg/kg.

5.4.7. No other determinands, including hydrocarbons, were detected at elevated concentrations, other than a single sample containing elevated zinc at 723 mg/kg. The three sediment samples collected from the bases of lagoons Nos 2 and 3 did not contain any elevated contaminants from the temporary containment of oily water.

5.5. Leachate Analysis

5.5.1. A proportion of the samples (1 in 4; total of 7 samples) were submitted for leachate analysis. Analysis was undertaken for a wide range of metals, total cyanides and phenols and the results are summarised below in Table 2 (full details provided in Appendix F). The results were compared to the site specific leachate criteria previously agreed with the EAW for a range of contaminants considered to be of most concern at the site following a P20 risk assessment undertaken by SGP.

- 5.5.2. With respect to other potential contaminants which may have been present, the results were also compared to other relevant guidelines including the UK EQS Standards and the Water Supply (Water Quality) Regulations 2000, commonly referred to as the UK Drinking Water standards (DWS), although these are not directly applicable to the site and location.

Table 2: Summary of Pre-Reclamation Soil / Leachate Chemical Analysis

Determinand	Range	Assessment Criteria	No of Exceedances
pH	7.19-8.34	>6, <9 EQS	none
Arsenic	<1	50 EQS	none
Boron	<10-44	2000 EQS	none
Cadmium	<0.4	400 P20	none
Chromium	<1-7	6950 P20	none
Hex Chromium	<0.03	none	-
Copper	<1-12	112 P20	none
Mercury	<0.05	1 P20	none
Nickel	<1	200 P20	none
Lead	<1-5	2340 P20	none
Selenium	<1	10 WHO DWS	none
Zinc	<3-43	3860 P20	none
Total Cyanide	<50	50 UK DWS	none
Free Cyanide	<50	50 UK DWS	none
Thiocyanate	<50	none	-
Sulphate (mg/l)	<3-53	400 BRE SD1	none
Total Phenols	<10	30 EQS	none
PAH 16 Total	<0.01-14.64	none	-
PAH DWS Specified	<0.01	none	none
Naphthalene	<0.01-11.92	10 EQS	1
Benzo(a)pyrene	<0.01	0.01 UK DWS	none

All concentrations expressed as µg/l unless stated otherwise

Notes:

- P20 – site specific assessment criteria generated by SGP through P20 risk assessment
- WHO DWS - World Health Organisation: Guidelines for Drinking Water, 1984
- UK DWS - Water Supply (Water Quality) Regulations 2000
- EQS - National Environmental Quality Standards as published by Environment Agency

- 5.5.3. None of the samples contained any leachable determinands in exceedance of the relevant assessment criteria other than a single elevated naphthalene concentration at 11.92 µg/l (compared to an EQS of 10 µg/l). This sample

did not contain substantial concentrations of naphthalene within the soils (concentration 0.4 mg/kg compared to an SSAC of 9.7 mg/kg for housing development). The sample was described as 'soft dark brown silty clay sediment' collected from the base of Lagoon No 4 with no indications of any hydrocarbon contamination. The leachable naphthalene is therefore likely to be of natural organic origin.

5.6. Groundwater Quality

- 5.6.1. Groundwater within the main site and surrounding area was sampled and assessed prior to the commencement of reclamation activities (Summary Review of Baseline Water Quality Prior to Commencement of Works, October 2003, SGP, Ref: R175-R13). The groundwater was found to be of generally poor quality, due both to the natural poor quality of groundwater within Coal Measures and arising from the long industrial history of the site. The EAW has agreed that the groundwater beneath and around the site is not considered a sensitive receptor in its own right and is not likely to be used as a supply of potable water in the foreseeable future. The groundwater is considered primarily as a pathway to other sensitive receptors.
- 5.6.2. Monitoring of the nearby surface watercourses and mine adit drainage prior to the onset of reclamation activities indicated that the metal contaminants on site within the slag banks were potentially impacting the Lodge Stream, for which levels of chromium and lead exceeded the EQS values on occasion. These exceedances were not being transferred to the Afon Gwenfro. Analysis of the mine adits indicated varying levels of pollution by coal mine drainage but no significant steel works leachate.

5.7. Ground Gas

- 5.7.1. Gas concentrations of methane, carbon dioxide and oxygen were measured in 1995 within the completed boreholes, none of which were placed within the LRDM. The boreholes were sited in a number of areas deemed to be potentially generating gases including the Wonder Bank, Works Tip, Blast Furnace area and main steelworks area. Significant concentrations of methane or carbon dioxide were not detected in the Billet Mill, Works Tip, Steel Works or lower Blast Furnace area and it was considered there was little evidence of ground gas generation in the main part of the site.

5.7.2. Elevated carbon dioxide concentrations were recorded in the boreholes in the Upper Blast Furnace area, on the site of the former coke ovens, and the Wonder Bank Tip with corresponding depleted oxygen levels, indicating the presence of biodegradable or combustible material, particularly within the Wonder Bank Tip.

5.7.3. Methane was only detected in one borehole across the site in 1995 and at 0.1% was not considered significant.

5.8. Radiation and Temperature

5.8.1. A survey was undertaken in 1995 to determine whether any of the materials within the site were emitting radiation significantly above the background levels for the area. When compared with the regional background variation there was no evidence to suggest that any of the materials present within the site posed significant radiological hazards.

5.8.2. Measurements were also taken in 1995 of the strata temperatures from within the boreholes during drilling and during the post-drilling gas survey to provide an indication of possible combustion in the fill materials. No indication of combustion was found and specific requirements were not required.

5.9. Dioxins

5.9.1. A number of soil samples collected in 1995 representing a range of contaminated wastes within the site were submitted for dioxin analysis. Detectable dioxins were limited to those samples that were found to be hazardous due to other toxic contaminants (i.e. materials from the Wonder Bank) and the levels detected did not warrant any specific or separate remedial measures to avoid dioxin exposure.

5.9.2. The three baseline samples collected from the main site on an annual basis between 2003 - 2006, including those from within the LRDM (sample BL2) have been submitted for dioxin analysis. Although traces of dioxins and furans have been detected in BL2 on each occasion (and in the samples from the other two locations) the levels are substantially below the assessment criteria referred to. No discernible significant increases have been noted between 2003 and 2006 during the site reclamation.

6. Environmental Risk Assessment

6.1. Site Conceptual Model

- 6.1.1. A conceptual model of the site was developed to provide a systematic risk assessment to develop an appropriate remedial strategy. This took into account the likely requirements of the site development, including technical, commercial, practical and sustainability issues. These objectives required the retention and reuse of all useful engineering materials within the site, whilst removing all unacceptable materials. Unacceptable materials included certain demolition wastes such as scrap metal, timber and degradable organic matter, and the associated fill where this is effectively inseparable. All existing materials or hard materials that can be crushed to provide suitable granular fills were to be retained for reuse as engineered fills within the site formation.
- 6.1.2. The conceptual model of the site following development is based on three elements: landuse (which introduces various receptors), fate and transport of contaminants, and contaminant toxicology (DEFRA / EA, CLR report 10).
- 6.1.3. *Landuse*
The LRDM is to provide residential development with an area of open space in the northern corner. The former access road along the northwestern boundary will form a cycleway to the Eastern Slopes. In this respect the key receptors or targets considered to be at risk are the health of future human users of the site, infrastructure, services, landscaping and construction workers. The principal landuse to be considered with respect to the main development plateau of the LRDM is therefore the standard 'residential with plant uptake' scenario used in CLEA.
- 6.1.4. As noted above the site setting is not considered particularly sensitive with respect to local groundwater. The aquifer does not provide a potable water resource. However the local aquifer does provide baseflow to surface watercourses, notably the Lodge Stream, and via mine drainage discharges, the Afon Cegidog and Afon Gwenfro. It has been previously agreed with the EAW that due to historical contamination and the effects of mineworking, the aquifer is primarily considered as a pathway between source zones and surface water receptors, rather than as a sensitive receptor in its own right.

6.1.5. *Contaminant toxicology*

Site investigations identified arsenic and chromium as the potential principal contaminants of concern within the sandy clays of the LRDM. The nature of the distribution of the levels of arsenic within the sands suggest these to be naturally occurring whereas the isolated elevated level of chromium indicated a possible hot-spot of contamination, probably arising from cross-contamination of the natural soils. Arsenic and chromium principally pose a risk to human health via ingestion and / or inhalation. An isolated elevated level of zinc was detected at a concentration that may pose a risk to plant growth.

6.1.6. *Fate and transport of contaminants*

Leaching tests of the materials confirmed that the metal contamination was relatively immobile.

6.2. Human Health / Built Development

6.2.1. Risks to human health from the proposed future residential use of the LRDM were expected to result primarily from direct ingestion or inhalation of any metal contaminated sediments by future users of the site or the construction workforce in the absence of reclamation. The proposed development is also likely to include some areas of landscaping and the potential existed for the plant uptake of certain contaminants.

6.2.2. The remediation strategy therefore provided for the excavation of all ground within the LRDM plateau to at least 3m below development formation level, the isolation of any residual steelworks materials encountered and off-site removal of any visual 'hot-spots' of chemically unacceptable material. Excavated sediments from the former lagoons were to be retained at depth with the area and covered with suitable materials re-placed and compacted. The area was to be provided with a 3m clean cover of re-worked natural ground from within the LRDM.

6.3. Controlled Waters Risk Assessment

6.3.1. The principal risk posed to the surrounding environment by the contaminated materials on the main site was the long term potential for mobile soil contamination (principally chromium) to leach into controlled waters, either via mine adit drainage or infiltration through and run-off from fill material on site into the Lodge Stream. A P20 risk assessment was undertaken by SGP

to derive leachate remedial targets to ensure protection of the potential receptors. The risk assessment and targets were agreed with the EAW prior to the on-set of reclamation activities on site.

7. Reclamation Preparatory Works

- 7.1. The only building requiring demolition within the LRDM was the original security cabin at the No 2 Gate. This was demolished in January 2005 at the completion of much of the main site reclamation works.
- 7.2. The lagoons were removed by excavating out and stockpiling all suitable material in the area to a predetermined level prior to its replacement in compacted layers. This operation was carried out in a south to north direction, with N°s 3 and 4 lagoons being removed first, and N°1 lagoon being removed last.

8. Remedial Strategy

8.1. Overall Works Specification

- 8.1.1. Reclamation works commenced on the main site in October 2003 following the earlier demolition activities. The overall scheme has evolved since the preparation of the revised scheme in 2001 in on-going consultation with all the relevant bodies (WCBC, Local Liaison Committee, EAW etc).
- 8.1.2. The overall reclamation strategy across the site is described in Section 1.2.10. This has effectively been achieved through:
 - excavation of a void within the Coal Measures strata to enable recovery and sale of residual coal, stabilize mine workings, and provide uncontaminated material for the capping of the whole site and a void for the disposal of the suitable industrial fills;
 - regrading of the eastern slopes composed of slag material to a stable slope profile;
 - remedial works to the Wonder Bank;
 - progressive replacement of the overburden materials to the proposed restoration levels;
 - progressive creation of development module plateau areas; and,
 - restoration including infrastructure planting and creation of Nature Conservation and Open Space areas.

- 8.1.3. The scheme has produced minimum cover layers of 3m clean fill in the housing development areas and along the Spine Road (5m where the Spine Road crosses the opencast area) and 0.5 m clean fill / soil cover on the opencast void and development plateau batters.
- 8.1.4. As required under Planning Condition 30, a scheme for identifying and handling contaminated materials was submitted to and approved by WCBC (ref: Smith Grant LLP, R175-R13/RevD/Final). This applies to those parts of the site where excavated steelworks wastes are placed as fills.
- 8.1.5. The scheme involved routine monitoring and testing of relocated wastes, and validation testing at a rate of one sample per 2,500m³. The overall scheme for excavation and replacement of steelworks wastes is based upon three material classifications, as agreed with WCBC, EAW and the former Welsh Development Agency (WDA):

W1 material shall be material excavated within the site that is suitable for use within the Reclamation Works by virtue of meeting the agreed leachability requirements and not having the properties of W2 or W3 materials listed below. The leachability requirements shall be met if the 95th percentile value of the leachability test results for the sampled material are equal to or less than the values determined by the site-specific risk assessment.

W2 material shall be excavated material that is unsuitable for inclusion in the Reclamation Works by reason of:

- (i) having greater than 1% by weight of timber, peat or other perishable organic matter per 50m³; or*
- (ii) having greater than 1% by weight of mineral oil or other liquid hydrocarbon per 50m³; or*
- (iii) being material susceptible to spontaneous combustion; or*
- (iv) being incapable of compaction by normal equipment and techniques.*

W3 material shall be excavated material having hazardous chemical or physical properties requiring special measures for its excavation, handling, storing, transportation, deposition and disposal.

- 8.1.6. The leachability criteria as agreed with the EAW are:

Cadmium	0.400 mg/l
Chromium	6.950 mg/l
Lead	2.340 mg/l
Zinc	3.860 mg/l
Copper	0.112 mg/l

Mercury	0.001 mg/l
Nickel	0.200 mg/l

8.1.7. The W1 material was largely steelworks slags, boiler ash, coal mining discards, brick and masonry rubble with a low pollution potential and was to be used as engineered fill within non-residential development areas. W2 and W3 materials were excavated for off-site recovery, treatment or disposal as necessary.

8.1.8. No slag has been imported to the southern housing development areas, and following investigation, slag has been removed from these areas prior to the placement of clean fills. W2 or W3 materials were not retained in any of the proposed housing zones during BDL reclamation works.

8.2. Supervision of Remedial Works

8.2.1. During the reclamation works the role of SGP was principally to advise BDL concerning contamination and pollution management within the site. Specific duties included:

- validation testing of fill material in accordance with the Condition 30 Method Statement and other agreements with WCBC;
- visual inspections of sides and bases of excavations on removal of slags and W2/W3 material from previously identified contaminated areas;
- sampling where appropriate for analysis;
- daily inspections of all earthworks; and,
- visual assessment of any suspect materials.

8.3. LRDM Principal Actions

8.3.1. BDL commenced excavation and replacement fill work in the LRDM in July 2006 and the area was completed to level by October 2006.

8.3.2. Work progressed in a south to north direction, with the site being reduced to a pre-determined level, which involved the removal of lagoons as the works progressed. Initially material was stockpiled in the area of lagoon N°1, prior to being backfilled in compacted layers. A total of 89,000m³ of material was excavated and replaced across the LRDM. The ground was excavated to depths of at least 3m below the final formation level, with final excavation depths ranging from 3.06m in the south to 10.20m in the north. No material

was encountered requiring removal off-site and other than the importation of crushed concrete for the French drain along the eastern boundary, no material was imported into the LRDM plateau from elsewhere on the main site.

- 8.3.3. Preparation in the site entrance way / access gate was undertaken once most of the site was level. Work in this area included removal of road surface and underlying road formation materials for use on other areas of the main reclamation site. Strata comprising clays, shales, sandstone and sand was present beneath the road surface. A small band of slag was also observed but this was not extensive. Suitable, excavated material was placed as fill in the development area. Visual inspection of the placed material confirmed the absence of slag or any other unsuitable material in the replaced fill.
- 8.3.4. The replacement material was inspected by SGP on a daily basis to ensure it remained free from contamination by steelworks or other waste materials (e.g. slag, timber) and a photographic record maintained. The replacement material was sampled on an approximate basis of 1 per 3,500m³.
- 8.3.5. A French drain has been placed along the eastern site boundary to intercept site run-off towards the Brymbo Sports and Social Club, with the water flowing into the historic surface water discharge point.
- 8.3.6. On completion of the infilling SGP undertook validation testing of the final layer of fill. The testing was undertaken on a 30m grid spacing at a depth of 0.5m below formation.
- 8.3.7. The LRDM also includes the landscape batters to the south west which has been provided with 0.5 m clean fill and topsoil. The topsoil has been sampled by SGP on a 50m grid.
- 8.3.8. The tree lined bank along the northwestern boundary has been undisturbed during the reclamation works. The undisturbed topsoil along this stretch has been sampled by SGP on an approximate 100m lineal grid.
- 8.3.9. The cycleway has been provided with at least 0.2m of crushed hardcore and covered with a layer of concrete fines. The surface has been sampled on an approximate 50m lineal grid. The eastern and western strips along the cycleway (part of the former access road) has been provided with at least 0.2m of topsoil (and is now extensively grassed). The topsoil was originally stripped from within the LRDM, stockpiled and sampled by SGP.

9. Validation Sampling and Testing

9.1 Soils – Assessment Criteria

- 9.1.1. Contamination is defined as the presence of substances in concentrations and forms that constitute a potential risk to the future use of the site, including residential housing, and the wider environment. To assist in the determination of risks to human health, DEFRA has published the CLEA model and generic soil guideline values (SGVs) for a number of common soil pollutants. CLEA SGVs are indicators for “intervention” either in the form of further detailed risk assessment and/or remediation.
- 9.1.2. Condition 42 of the planning consent for the main site works required surveys of the completed areas to be undertaken in accordance with ICRCL document 59/83. The Condition specifies that if the levels of contamination found by the survey exceed the threshold levels for action in ICRCL 59/83 then a programme of further action should be agreed in writing with the Local Planning Authority. The ICRCL 59/83 trigger values have been withdrawn since the issue of planning consent and it is now UK and Welsh Assembly Government policy to use the CLEA risk assessment methodology or equivalent methods to determine acceptable levels of contamination on land. SGP has agreed with WCBC an amended wording for Condition 42. The assessment of the completed zones is based on human health risk-based soil standards as agreed in advance with WCBC (see Appendix G). These comprise the DEFRA/EA published SGVs, and other site-specific assessment criteria (SSACs) derived using the CLEA model with toxicity data drawn from the DEFRA/EA TOX publications or other authoritative sources.
- 9.1.3. The results of the testing of the development plateau have been initially compared to the CLEA SGVs for ‘residential use with plant uptake’ where available. Where generic CLEA SGVs have not been provided, for those contaminants identified as present in the soil, then reference is made to the TOX reports to determine site specific assessment criteria (SSACs) or to use other generic standards which are determined on the basis of human health risks and environmental effects. Hydrocarbons are compared to the screening levels published by the Total Petroleum Hydrocarbons Criteria Working Group (TPHCWG) for a typical fuel oil. The screening level is calculated using the most toxic compound within each of 14 classes of compounds.

- 9.1.4. Hydrocarbons, PAHs and phenols are also compared to the action values set by United Utilities for the laying of water pipes which have recently been revised.
- 9.1.5. ICRL 59/83 trigger values for the phytotoxic elements copper, boron and zinc are based upon risks to sensitive plant species and remain valid. These values are used as generic assessment criteria.
- 9.1.6. The 95th percentile (US95) of the test results is compared with the generic assessment criteria in accordance with current guidance.
- 9.1.7. The batters and cycleway are to provide informal open space. There are currently no published SGVs for this landuse and hence, the results for the analysis of the batters have initially been compared to the nearest, but more conservative, landuse for which SGVs are available: 'residential without plant uptake' as agreed in advance with WCBC (see Appendix G). SSACs have been previously agreed with WCBC for chromium (III), nickel, naphthalene and benzo(a)pyrene for this specific end-use.
- 9.1.8. The complete results of the validation sampling are presented in Appendix F along with the results of the statistical analysis and comparison with the adopted soil standards. A summary is provided below in Table 3.

Table 3: Summary of Soil Analysis (Intermediate Fill and Housing Formation Level)

	Sample Location/range (mg/kg or indicated)	Housing formation level	Soil standard adopted and concentration (mg/kg or indicated)	Housing Exceedances
No. of samples	23	25	n/a	
pH	7.26-8.31	7.71 – 9.91	<3 United utilities action	none
Arsenic	<1-10	<3 – 11	20 CLEA SGV	none
Boron (Water Soluble)	<1-3	<1 – 4	none	-
Cadmium	<0.3 – 2	<0.3	pH 6=1; pH 7=2; pH 8 =8 CLEA SGV	none
Chromium (total)	<1 – 2214	14.5 – 431.7	130 CLEA SGV	3
Hex Chromium	<3 - <24	<0.3 - <12	130 CLEA SGV	none
Mercury	<1.2 – 2.1	<0.6	8 CLEA SGV	none
Nickel	8 – 98	21.3 – 36	50 CLEA SGV	none
Lead	11-237	10 – 114	450 CLEA SGV	none
Selenium	<3	<3	35 CLEA SGV	none
Copper	<1 – 46	8 - 78	130 ICRCL	none
Zinc	21.3-570	44.9 – 589.2	300 ICRCL	1
Total Sulphate	100-2,146	<100 – 994	none	none
Total Oxidisable Sulphur (%)	-0.15 – 0.06	0.01 – 0.82	0.3 % BRE SD1	1
Free Cyanide	<1	<1	None	-

	Sample Location/range (mg/kg or indicated)		Housing formation level	Soil standard adopted and concentration (mg/kg or indicated)	Housing Exceedances
	Intermediate Samples				
Total Cyanide	<1	<1		None	-
Thiocyanate	<1	<1		None	-
Total Phenols	<0.1 – 0.23	<0.15		10 United Utilities action	none
TPH ($C_6 - C_{40}$)	<10 – 581	-		5000 United Utilities action/4000 TPHCWG	-
EPH ($C_{10} - C_{40}$)	17 – 103	35 – 200		800 United Utilities action/4000 TPHCWG	none
Total 16 PAH ($\mu\text{g/kg}$)	25 – 4,819	856 – 12,663		200,000 United Utilities action/1,000,000 TPHCWG	none
Naphthalene ($\mu\text{g/kg}$)	<10 – 518	23 – 10,438		9700 CLEA SSAC	1
Benzo(a)pyrene ($\mu\text{g/kg}$)	<12 – 152	<12 – 67		900 CLEA SSAC	none

Notes:

US95: Upper Bound Value calculated with reference to CLR 7

CLEA SGV: Soil Guideline Values published by DEFRA/EA, 'Residential with plant uptake' scenario

CLEA SSAC: Site Specific Assessment Criteria generated using CLEA model

BRE SD1: BRE Special Digest 1

TPHCWG: Total Petroleum Hydrocarbon Criteria Working Group

ICRCL: Interdepartmental Committee on Redevelopment of Contaminated Land, 59/8

9.2. Housing Plateau - Soils

Intermediate Fill Material

- 9.2.1. 23 samples were taken of the fill material as it was being replaced in the area, on an approximate basis of 1 sample per 3,500m³ material, and submitted for the complete chemical analysis schedule. The material typically comprised clayey sand containing sandstone and small coal fragments with occasional crushed concrete. No slags or other deleterious materials were observed.
- 9.2.2. Chromium was present in exceedance of the SGV of 130 mg/kg in two samples at 2,214 and 447 mg/kg. The toxic form of chromium, hexavalent chromium, however was undetected in either sample indicating the chromium to be present in the less toxic form, Cr III. The samples were all collected from at least 1m below the formation surface.
- 9.2.3. All other determinands for which SGVs are established were below the relevant assessment criteria. A single sample contained zinc at a level in exceedance of the ICRL guideline limit. Total phenols, total and free cyanide were all undetected. EPH (C10-C40), naphthalene and benzo(a)pyrene were all below the relevant assessment criteria for potential risks to human health. EPH were present in exceedance of the United Utilities threshold value of 100 mg/kg in 4 samples although all were below the Action Value. PAHs however were below both the Trigger and Action Values.
- 9.2.4. 3 samples were submitted for 2:1 soluble sulphate extract. None contained extractable sulphate in excess of the 1.2 g/l threshold value in the BRE Special Digest 1. Since Carboniferous strata potentially contain pyritic material the oxidisable sulphate content of the intermediate fill (23 samples) was calculated in accordance with the methodology outlined in BRE SD1. The 0.3% threshold was not exceeded by any samples.

Housing Formation Level

- 9.2.5. The restoration surface comprised compacted sand and sandstone fill excavated from the LRDM and replaced in compacted layers. Nineteen samples were initially collected of the formation layer on an approximate grid spacing of 30m (241006FWTA1 – 19) and submitted for comprehensive

chemical analysis, of which two were from the northernmost section of the plateau which is to provide informal open space. Although this area effectively has a less sensitive landuse the results of the analysis have initially been considered within the overall data set for the formation surface across the LRDM. A twentieth sample was later collected on installation of settlement monitoring in the northern section of the housing area (121206FWTA3).

- 9.2.6. Low concentrations of metals were detected within the formation layer material with all determinands being below the CLEA SGVs where applicable other than a single sample containing marginally elevated chromium at 159.2 mg/kg (compared to the SGV 130 mg/kg). Hexavalent chromium was undetected in this sample. Statistical analysis identified the US95 to be below the SGV and a 95% probability that the elevated sample was an outlier. Two additional samples were therefore collected of the formation layer in the immediate vicinity to obtain further information (121206FWTA1 – 2). The two samples both contained elevated levels of chromium at 431 mg/kg and 206 mg/kg. Following discussion with BDL, the material in this area was subsequently excavated and replaced with material from the northern most section of the LRDM. The replacement material however similarly contained elevated chromium at 150 mg/kg and 340 mg/kg. Hexavalent chromium however was undetected in any sample. Statistical analysis identifies the US95 to be below the SGV. The samples all comprised clayey sand with sandstone with no evidence of any slags or other deleterious materials. This is discussed in greater detail in Section 10.
- 9.2.7. A single elevated result for zinc (at 590 mg/kg compared to 300 mg/kg) was recorded although the US95 was below the ICRCL guidelines.
- 9.2.8. All the samples were submitted for EPH (C10-C40) and speciated PAH analysis. Levels of EPH and total PAH were below the agreed site assessment criteria. A single sample contained naphthalene marginally in exceedance of the SSAC at 10,438 mg/kg compared to 9,700 mg/kg. Statistical analysis identified the US95 to be below the SSAC and a 95% probability that the elevated result is within the general sample population. Small coal fragments were noted as being present within the sample which may have given rise to the elevated level. Benzo(a)pyrene levels were significantly below the SSAC in all samples were detected.
- 9.2.9. EPH were in exceedance of the United Utilities Trigger value in 7 samples but were all below the Action value. Coal fragments were recorded to be

present in some samples which may have been the source of some of the organic contaminants detected. All samples contained PAH below the United Utilities Trigger Value.

- 9.2.10. Total sulphate concentrations are low in the range 100 – 994 mg/kg indicating that sulphate resistant concrete is not necessary. Since the strata used in the fill may contain pyritic material the Oxidisable Sulphide content of the formation level samples has been calculated in accordance with the methodology outlined in BRE SD1. The 0.3% threshold was exceeded in only 1 out of 25 samples and on this basis pyrite is not considered to be present in significant amounts in the ground. The results therefore do not indicate the requirement for sulphate resistant concrete within the development.

Batter Soils

- 9.2.11. Six soil samples were collected from the southern / southwestern batter.

Table 4: Summary of Soil Analysis (Batters)

Contaminant	Number of Samples	Range (mg/kg or stated)	Soil Quality Standard adopted and concentration (mg/kg or stated)	Exceedances
pH	6	7.15-8.09	<3 United Utilities	none
Arsenic	6	<3-6	20 CLEA	none
Boron	6	<3.5	none	none
Cadmium	6	0.4-0.6	30 CLEA	none
Chromium (total)	6	31-470	5000 SSAC	none
Hex Chromium	6	<0.3-<30	130 CLEA	none
Copper	6	21-41	130 ICRCL	none
Mercury	6	<0.6	15 CLEA	none
Nickel	6	16-32	150 SSAC	none
Lead	6	82-110	450 CLEA	none
Selenium	6	<3	260 CLEA	none
Zinc	6	88-170	300 ICRCL	none
Total Cyanide	6	<1	none	-
Free Cyanide	6	<1	none	-
Thiocyanate	6	<1	none	-
Total Sulphate	6	610-1,100	none	-
EPH (DRO)(C10-C40)	6	140-290	800 United Utilities/4000 TPHCWG	none/none
Total Phenols	6	<0.15	10 United Utilities	none
PAH 16 Total (µg/kg)	6	940-5,300	200,000 United Utilities/1,000,000 TPHCWG	none/none
Naphthalene (µg/kg)	6	32-200	10400 SSAC	none
Benzo(a)pyrene (µg/kg)	6	72-460	900 SSAC	none

Notes:

CLEA SGV: Soil Guideline Values published by DEFRA/EA, 'Residential without plant uptake' scenario

SSAC: Site Specific Assessment Criteria

BRE SD1: BRE Special Digest 1

TPHCWG: Total Petroleum Hydrocarbon Criteria Working Group

ICRCL: Interdepartmental Committee on Redevelopment of Contaminated Land, 59/83

- 9.2.12. No determinands were present in the topsoil batters in exceedance of the relevant assessment criteria.

9.3. Soils – Northwestern Strip

- 9.3.1. Following completion of the reclamation works in the LRDM in 2007 further information on the northwestern strip was obtained through the excavation of a series of trial pits (300507TP1 – TP4) and the collection of 3 soil samples for chemical analysis. Trial pit locations were restricted by the very compact nature of the cycleway and underlying access road hardcore and the presence of the slope dropping down to the main LRDM plateau. In addition a series of topsoil samples (240507Fwta1-5) were collected from the undisturbed tree lined batter and surface soil samples collected from the cycleway surface (300507RS1 – RS5). Analytical results are included in Appendix F. As the areas are outside the housing development zone but with close proximity, the results have been compared to the assessment criteria previously referred to for the housing batters, namely SGVs where established for 'residential without plant uptake' or other appropriate assessment criteria.

Northwestern Strip

- 9.3.2. A total of 4 trial pits were excavated along the northwestern strip to obtain greater detail on ground conditions in this area. Trial pit 300507TP4 on the western edge of the cycleway confirmed the presence of at least 0.5m topsoil overlying very compact crushed concrete hardcore to at least 1m. The hardcore was underlain by dense sandstone and stone fill. It was not possible to progress beyond this material.
- 9.3.3. Trial pit 300507TP1, on the northeastern edge of the cycleway, encountered 0.2m topsoil over a dark brown damp sandy clayey fill with brick and coal and occasional metal and wood fragments. The fill was proven to 2.30m where an orange clay was encountered (either natural ground or re-worked overburden).
- 9.3.4. The two trial pits on the southeastern edge of the cycleway encountered variable depths of topsoil (0.2 – 0.6m) over compact concrete hardcore underlain by dense sandstone fill through which it was not possible to progress beyond 1.7m.

- 9.3.5. Based on the information it is anticipated the area is predominantly underlain by depths of dense sandstone fill with some areas of more variable colliery spoil fill with some wood, plastic and metal fragments. The fill is typically overlain by topsoil of at least 0.2m depth.
- 9.3.6. Three soil samples were collected from the trial pits. Sample TP1.S1 was of the mixed clay fill at 1.2m depth. Samples TP2.S1 and TP3.S1 were of the compact sandstone and hardcore fill at 1.2m and 0.5m depth respectively. None of the samples contained any determinands at elevated levels other than a single marginally raised level of arsenic (at 23 mg/kg compared to an SGV of 20 mg/kg) in the clay fill in TP1.S1. The SGV is overly conservative for the particular landuse in this area, and the sample was collected from 1.2m depth, the fill material being provided with 0.2m of topsoil. On this basis the single exceedance is not considered to indicate a significant risk to human health.
- 9.3.7. The northwest strip has been provided with site-sourced topsoils that were stripped from within the LRDM at the start of reclamation works and stockpiled. SGP collected and submitted for analysis 3 soil samples from the stockpile in July 2006. None of the samples contained any determinands in excess of the assessment criteria.

Tree Lined Bank

- 9.3.8. A series of 5 samples were collected of the undisturbed topsoils along the tree lined bank. The samples typically comprised sandy soil with mudstone, shales and sandstones fragments with isolated slag pieces. None of the samples contained any determinands in exceedance of the assessment criteria.

Cycleway Surface

- 9.3.9. The cycleway surface material comprises crushed concrete fines which was derived on the main site. A total of 5 samples were collected of the concrete fines placed along the cycleway. The fines overlie at least 0.2m of crushed hardcore. None of the samples contained any determinands in excess of the assessment criteria.

9.4. Leachate Analysis

- 9.4.1. Leachate tests were carried out on a proportion of samples from the intermediate material, formation level and batters to determine the mobility of any residual contamination and enable an assessment to be undertaken of

the potential impact on controlled waters. Site specific leachate limits have previously been agreed with the EAW for a range of contaminants considered to be of most concern at the site following a P20 risk assessment undertaken by SGP.

- 9.4.2. To gain an understanding of the levels of any other potential contaminants that may be present the results have been initially compared to other available guidelines such as UK EQS Standards or Water Supply (Water Quality) Regulations 2000 (commonly referred to as the UK drinking water standards), although these may not be directly applicable to the site and location.

Table 5: Summary of Leachate Analysis (all locations)

Contaminant	Number of Samples	Range (µg/l or stated)	Water Quality Standard adopted and concentration (µg/l or stated)	Exceedances
pH	19	7.69 – 10.87	>6, <9 EQS	3
Arsenic	19	<1 – 3	50 EQS	none
Boron	19	<10 – 130	2000 EQS	none
Cadmium	19	<0.4	400 P20	none
Chromium	19	<1 – 57	6950 P20	none
Hex Chromium	19	<0.03 – <0.3	none	-
Copper	19	<1 – 12	112 P20*	none
Mercury	19	<0.05	1 P20*	none
Nickel	19	<1 – 11	200 P20*	none
Lead	19	<1 – 41	2340 P20	none
Selenium	19	<1 – 5	10 WHO DWS	none
Zinc	19	<3 – 44	3860 P20	none
Total Cyanide	19	<0.05	0.05 UK DWS	none
Free Cyanide	19	<0.05	0.05 UK DWS	none
Thiocyanate	19	<0.05	none	-
Sulphate (mg/l)	19	<3 – 22	400 BRE SD1	none
Total Phenols	19	<0.01 – 0.03	30 EQS	none
PAH 16 Total	19	<0.01-2.13	none	-
PAH DWS Specified	19	<0.01	0.1 UK DWS	none
Naphthalene	19	<0.01-1.76	10 EQS	none
Benzo(a)pyrene	19	<0.01	0.01 UK DWS	none

Notes:

- P20 – site specific assessment criteria generated by SGP through P20 risk assessment
- WHO DWS – World Health Organisation: Guidelines for Drinking Water, 1984
- UK DWS – Water Supply (Water Quality) Regulations 2000
- EQS – National Environmental Quality Standards as published by Environment Agency

*The site specific assessment criteria for copper, mercury and nickel were set by default at the EQS standards as these substances had not been recorded in any significant concentrations in the earthworks or receiving water courses prior to the onset of the reclamation works.

- 9.4.3. None of the determinands were present within the LRDM in a leachable form in excess of the agreed limits for specific contaminants within the former steelworks (chromium, lead, nickel and zinc) or other assessment criteria referred to.
- 9.4.4. The three samples collected of the crushed concrete hardcore and fines from the northwestern section were alkaline (typical of concrete crush) at levels above the EQS with all other determinands below the relevant assessment criteria.
- 9.4.5. All the leachate samples contained total sulphate below the 0.4 g/l threshold as provided in BRE Special Digest 1 and hence do not indicate the requirements for sulphate resistant concrete within the development.

10. Completion Assessment

10.1. Post Completion Monitoring

- 10.1.1. No post-completion monitoring has been undertaken on the LRDM although the area remained subject to regular inspection following completion to levels. A programme of daily, weekly and monthly controlled waters monitoring was implemented by SGP in agreement with the EAW at the onset of the remedial works across the main site. This included daily monitoring of the Lodge Stream and monthly monitoring of a series of mine adits to assess potential groundwater discharges from the site, along with monitoring of other locations as deemed necessary based on the works on site or visual observations. Sampling and analysis of the remaining boreholes on site has been undertaken on an annual basis since 2003 and was last undertaken during October 2006. From October 2003 to December 2006 reports were provided to EAW and WCBC on a monthly basis along with an annual summary.
- 10.1.2. The monitoring of the mine adits showed little or no evidence of steelworks derived leachate, other than an isolated occurrence of elevated chromium concentrations were noted at a number of near and distant mine drains in Autumn 2004. Levels subsequently returned to previous concentrations.

10.1.3. A comprehensive report has been produced (R175-R27 (final)) and provided to WCBC and EAW summarising all the results and observable trends obtained from October 2003 to December 2006. It is proposed to reduce the monitoring of the Lodge Stream and Reed Beds to monthly and to cease off-site mine adit monitoring from July 2007.

10.1.4. Following completion to level of the northern development modules (area beyond the CDNM) a series of gas monitoring boreholes (21) were installed across the area. The boreholes were installed to variable depths, with variable response zones depending on ground conditions, using either a window sampler or cable percussion techniques. Eight rounds of monitoring for methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulphide and VOCs were undertaken over a 4 month period (May – August 2006). Methane was detected in 3 locations (in the Apartment Area and NDM2A, in the far northern areas) and was present up to a maximum of 1.8%. Carbon dioxide was present in a number of locations up to a maximum of 6.6%, along with correspondingly depleted oxygen. Flow rates were negligible resulting in all gas limiting volumes being below 0.07 l/hr. Gas monitoring in this area has recommenced (June 2007) and is to be undertaken for a further 3 months.

10.2. Residual Environmental Risk Assessment

10.2.1. No residual steelworks waste is present within the housing development zone of the LRDM, the underlying material predominantly comprising reworked natural sand / sandstone ground. Although two samples of the intermediate fill contained elevated levels of chromium, these were both collected from at least 1m below the restoration surface level and do not pose a risk to human health. An isolated sample contained marginally elevated naphthalene. However, statistical analysis shown the 95th percentile to fall below the relevant assessment criteria and the isolated sample was not identified as a potential hot-spot.

10.2.2. Levels of chromium were detected in a number of samples in exceedance of the assessment criteria in the restoration surface material, although the 95th percentile was below the criteria. It should be noted however that the results are for total chromium, the more toxic form, hexavalent chromium (Cr(VI)), being undetected. The assessment criteria referred to is the published SGV for chromium (total) for a 'residential with plant uptake' standard landuse.

The SGV does not distinguish between Cr(III) and Cr(VI) and assumes all chromium present within the soils is present as Cr(VI), due to uncertainty of effects of sampling and analysis and inter-changeability between the oxidation states. The most prevalent natural form however is Cr (III) for which there are no published reports of adverse effects resulting from ingestion of Cr(III) and which is known to be of low oral toxicity (DEFRA / EA, Contaminants in Soil: Collation of Toxicological Data and Intakes Values for Humans. Chromium). The analytical laboratory has confirmed that their analytical technique for Cr(VI) is most likely to produce a conservative result (due to the use of an alkali extraction which will convert Cr(III) to Cr(VI)). On this basis, given the absence of any detectable Cr(VI) within the soil samples, the levels of chromium present do not pose a significant risk to human health.

- 10.2.3. The northwestern strip of the LRDM, forming the cycleway, and adjoining tree-lined bank, have been undisturbed during the reclamation works, and residual fill material is present within this area. Some fill comprising sandy clay with brick and coal and occasional metal and wood fragments is present in the northern area, the extent of which has not been confirmed. Ground along the central and southern section of the strip comprised a layer of crushed hardcore over very compact layers of shale and sandstone fill. The ground is provided with at least 0.2m of topsoil. This area is to remain undisturbed during the development and the residual materials do not pose a risk to future site users.
- 10.2.4. Fill materials and the underlying ground within the development zone are free from potential significant sources of gas. Although some fill material was noted in the northwestern corner of the LRDM, but outside the housing development area, containing some wood fragments, this is not likely to be substantial. Organic substances potentially posing a risk via vapour transport through the overlying fill material have not been detected in any of the samples. No significant ground gas or vapour risks are likely to arise, however, carbonaceous soils can naturally be associated with elevated carbon dioxide concentrations. These would not be expected to affect houses without basements, however, risk assessment will be appropriate prior to entry to confined spaces resulting from development of the LRDM. Post-completion gas monitoring within the northern development areas have recorded marginally elevated levels of methane and carbon dioxide in

isolated locations. Simple precautionary gas protection measures consistent with UK practice described in CIRIA Report C659 for 'Characteristic Situation 2' and NHBC Report No. 4 for 'Amber 1' (for low rise housing meeting the specified construction detailed) are therefore recommended (Table 28, page 144).

10.2.5. The residual soils and replacement fill materials within the LRDM do not contain significant leachable amounts of the contaminants previously agreed with the EAW to be of most concern in relation to the site, with the exception of an elevated naphthalene result. On-going monitoring of groundwater (via mine adit drainage) and the Lodge Stream by SGP has not identified any particular on-going concerns regarding the surrounding water quality. It is concluded that residual soils and fills within the LRDM do not pose a significant risk to controlled waters.

10.2.6. The steep tree lined slope on the northwestern edge of the housing zone has remained undisturbed during the reclamation. Analysis of the near-surface soils has not detected any significant risks to human health.

10.3. Development Requirements

10.3.1. EPH have been noted in the fill and restoration material within the housing development zone at levels above the United Utilities trigger levels for the laying of water pipes in a number of samples, although all are below the action levels. Since the fill material is natural reworked sand/sandstone it is likely that the EPH identified is due to the presence of low solubility compounds in coal fragments within the material rather than industrial contaminants that would pose a risk. On this basis there will be no physical or chemical constraints to the re-use of excavated soils below topsoil and no chemical constraints to the laying of water mains or other underground services. The statutory undertaker should be passed copies of the test results to determine any requirements for supply pipe protection measures.

10.3.2. The levels encountered did not indicate any requirements to protect water mains installed within the site against the permeation of other organic substances such as phenols.

10.3.3. The levels of 2:1 soil / water sulphate extract and leachable sulphate within the intermediate fill and restoration surface fill material did not indicate the

requirements for the use of sulphate resistance concrete (Design Sulphate Class 1). In addition, only 1 out of 58 samples of the intermediate fill and restoration surface layer contained oxidisable sulphate in excess of the 0.3% threshold detailed in BRE SD1, indicating the absence of any pyrite within the soils. On this basis the design sulphate class is DS-1 and the ACEC class as AC-1 according to Table 2 of BRE SD1.

- 10.3.4. The upper surface of fill should be treated as the formation level for the development and should not be regarded as topsoil. The developer is responsible for the importation of topsoil for gardens and landscaping and it is envisaged that at least 350 mm depth of topsoil will be utilized. It is anticipated that WCBC will require the developers to demonstrate the suitability of the topsoil.
- 10.3.5. Elevated levels of ground gases were not detected across the main site in the earlier 1995 site investigation. Potentially biodegradable material such as wood has been removed from the main development area of the LRDM during the fill excavation works, and it is not envisaged the residual materials will give rise to levels of ground gas of concern. However, confirmatory gas monitoring has not been undertaken on the southern area of the site as part of the reclamation works and given the location of the development area within a former coal mining area it is advised that the development utilizes precautionary gas protection measures (Characteristic Situation 2 / Amber 1) as outlined in CIRIA Report C659 and NHBC Report No 4 as appropriate.
- 10.3.6. Some residual fill materials are present within the northwestern strip of the LRDM which forms a cycleway. It is understood this area is to be undisturbed during the development and is provided with at least 200mm topsoil. However, if any services are to be laid along this section, or the materials exposed, measures must be taken to ensure that any arisings are stockpiled so they do not cross-contaminate clean fill on other, neighbouring areas by means of windblown dust, leachate run-off, etc and are disposed of accordingly. An assessment should be undertaken to determine any requirements for the protection of any such services.

10.4. Contingent Environmental Liabilities

- 10.4.1. It is considered that all reasonable measures have been taken to remedy environmental pollution within site, in accordance with the WCBC planning requirements and as agreed with statutory consultees (EAW etc.). Minimal residual contaminated soils are present within the LRDM following the excavation and filling works, although some residual fill is present within the northwestern strip which is to remain undisturbed. All filling has been closely supervised and monitored by SGP and Scott Wilson for environmental and geotechnical issues respectively.
- 10.4.2. SGP does not anticipate any part of the LRDM being registered as Part IIA Contaminated Land by WCBC. No objections to further development of the site from WCBC or EAW are anticipated by SGP on soil quality issues.
- 10.4.3. With regard to potential off-site pollution sources that may impact the LRDM it should be noted that the W1 fills contained within the main void, located to the north of the area beyond the CDN, are deemed stable and have a low pollution potential as agreed with EAW (primarily determined on the basis of leachability criteria).
- 10.4.4. A current Waste Management Licence (WML) is held by United Engineering Steels (UES) for the former Works Tip which covers land to the north of the LRDM. It is expected that the outcome of the reclamation works, in particular the regrading of the steep slag bank overlooking The Lodge, will be that the EAW can accept surrender of the site licence. The EAW must agree that the licence area does not present a significant potential pollution source in order to accept the licence surrender.
- 10.4.5. The potential for cross-boundary pollution to impact the LRDM housing area is very limited.
- 10.4.6. There is the potential for groundwater migration to occur below the site but this will be at substantial depth and will not be caused or affected by the LRDM. The groundwater quality has been monitored via boreholes, local watercourses and mine adits which potentially receive groundwater drainage from the site in accordance with a methodology agreed with the EAW. Monthly reports have been produced and submitted to WCBC and the EAW since the commencement of the reclamation works. No concerns have been

raised by WCBC or the EAW to date. Routine monitoring undertaken by SGP on a weekly and monthly basis has demonstrated that any groundwater pollution under the site does not significantly impact on nearby discharges to surface watercourses. Any groundwater pollution below site is likely to be historical in nature and is expected to improve as a result of the reclamation works as rainwater infiltration is expected to be reduced following the laying of tarmac roads and hard standing areas.

- 10.4.7. Due to the poor quality of the groundwater in the general area of the site (arising from the historical mining activity resulting in increased weathering of rocks bearing naturally occurring contaminants) and lack of any important local abstractions, the EAW accepts that the groundwater beneath and around the site is not considered a receptor in its own right. It is therefore considered unlikely that any future environmental impairment liability will arise from groundwater quality below the development modules.

10.5. Statutory/Regulatory Approvals

- 10.5.1. The investigations and reclamation strategy across the main site have all been agreed in on-going consultation with WCBC Planning and Environmental Protection Department and EAW since 1995.
- 10.5.2. Information has been (and is continuing to be) provided to the EAW and WCBC throughout the course of the overall reclamation works. Copies of principal correspondence between SGP and the Regulatory Authorities specifically regarding the reclamation works and validation testing in the LRDM or considered directly relevant are included in Appendix G.

11. **Conclusions and Recommendations**

- 11.1. SGP has inspected the remediation works carried out on the LRDM and is satisfied that these have substantially complied in all material respects with the strategy recommendations as approved by Wrexham County Borough Council, and that significant deposits of contaminated soils and deleterious materials are not present within the LRDM.
- 11.2. Validation testing of the remediation formation level to the LRDM has shown acceptable concentrations of substances and when combined with a minimum 350mm

depth of topsoil to be placed in housing gardens and landscaping areas, will provide a sufficient depth of suitable cover material to any residual contaminated fills.

- 11.3. The formation level is underlain by at least 3m of reworked natural sand and sandstone. The engineered fill is underlain by natural sandstone strata.
- 11.4. There are no significant off-site pollution risks associated with the residual materials and replacement fill.
- 11.5. As a precautionary measure it is recommended passive gas protection measures consistent with UK practice as per CIRIA report no. 149 Characteristic Situation 2 / NHBC Report No. 4 for 'Amber 1' (for low rise housing meeting the specified construction detailed) are installed within the development.
- 11.6. Analysis of the soils within the LRDM have not identified the requirements for sulphate resistant concrete within the development. In accordance with BRE SD1 the design sulphate class is DS-1 and the ACEC class is AC-1.
- 11.7. All test results should be provided to the relevant statutory undertakers to determine any requirements regarding supply pipe protection measures. Should any services be laid along the undisturbed northwestern strip (proposed cycleway) further testing and assessment may be necessary to determine any protection requirements.
- 11.8. SGP concludes that the appropriate and necessary remedial works have been completed and that the LRDM may be developed for residential development. It will be for the housebuilder to place topsoil cover of suitable quality to garden and landscape areas and to satisfy the planning authority with respect to this element of the site remediation.
- 11.9. Smith Grant LLP reserves the right to alter any of the foregoing information, recommendations or conclusions in the event of new information being provided and in the light of changes to legislation, guidelines and responses by the statutory and regulatory authorities.
- 11.10. Limitation
This report has been prepared by SGP for the use of Brymbo Developments Ltd and any other person to whom Smith Grant LLP gives a collateral warranty pursuant to its appointment by Brymbo Developments Ltd. Transfer of benefit of this report will be

permitted to one further assignee without the written permission of Smith Grant LLP. All reasonable skill, care and diligence has been exercised within the timescale and budget available, and in accordance with the technical requirements of the brief given by and developed with Brymbo Developments Ltd. Notwithstanding the efforts made by Smith Grant LLP in undertaking the assessment and preparing this report, it is possible that other ground conditions and contamination as yet undetected may exist. Reliance on the findings of this report must therefore be limited accordingly. Such reliance must be based on the whole report and not on extracts which may lead to incomplete or incorrect conclusions when taken out of context



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Project:

Link Road Development Module

Drawing:

Site Location
(Pre-Reclamation)

Drawn:

DFB

Checked:

KEH

Date:

09/07/07

Scale:

1:25,000 @ A4

Job No:

R175

Drg No:

001



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 Gwynedd LL55 2DL
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 Fax: 012578 824716
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 email: contact@smithgrant.co.uk

Project:
Former Bymbo Steelworks
Link Road Development Module

Drawing:
Sediment Development Areas
(Post-Reclamation)

Drawn: DFB	Checked: KBH
Date: 09/07/07	Scale: 1:5,000 @ A3
Job No: R175	Dwg No: 002

Base Plan Provided By
 Parkhill Estates Ltd

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Project:
Link Road Development Module

Drawing:
Historical Map 1879

Drawn:
DFB

Date:
20.05.07

Job No.:
R175

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KEH

Scale:
1:10,000 @ A4

Drg No.:
03



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Project:
Link Road Development Module

Drawing:
Historical Map 1900

Drawn:
DFB

Date:
20.05.07

Job No:
R175

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KEH

Scale:
1:10,000 @ A4

Drg No:
04



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Project:
Link Road Development Module

Drawing:
Historical Map 1915

Drawn:
DFB

Date:
20.05.07

Job No:
R175

Checked:
KEH

Scale:
1:10,000 @ A4

Drg No:
05



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Project:
Link Road Development Module

Drawing:
Historical Map 1938

Drawn:
DFB

Date:
20.05.07

Job No:
R175

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KEH

Scale:
1:10,000 @ A4

Drg No:
06



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Project:
Link Road Development Module

Drawing:
Historical Map 1964

Drawn:
DFB

Date:
20.05.07

Job No:
R175

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KEH

Scale:
1:10,000 @ A4

Drg No:
07



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Project:
Link Road Development Module

Drawing:
Historical Map 1976

Drawn:
DFB

Date:
20.05.07

Job No:
R175

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Scale:
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Drg No:
08



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Project:
Link Road Development Module

Drawing:
Historical Map 1987

Drawn:
DFB

Date:
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Job No:
R175

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Scale:
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Drg No:
09



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Project:
Link Road Development Module

Drawing:
Historical Map 1992

Drawn:
DFB

Date:
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Job No:
R175

Checked:
KEH

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1:10,000 @ A4

Drg No:
10



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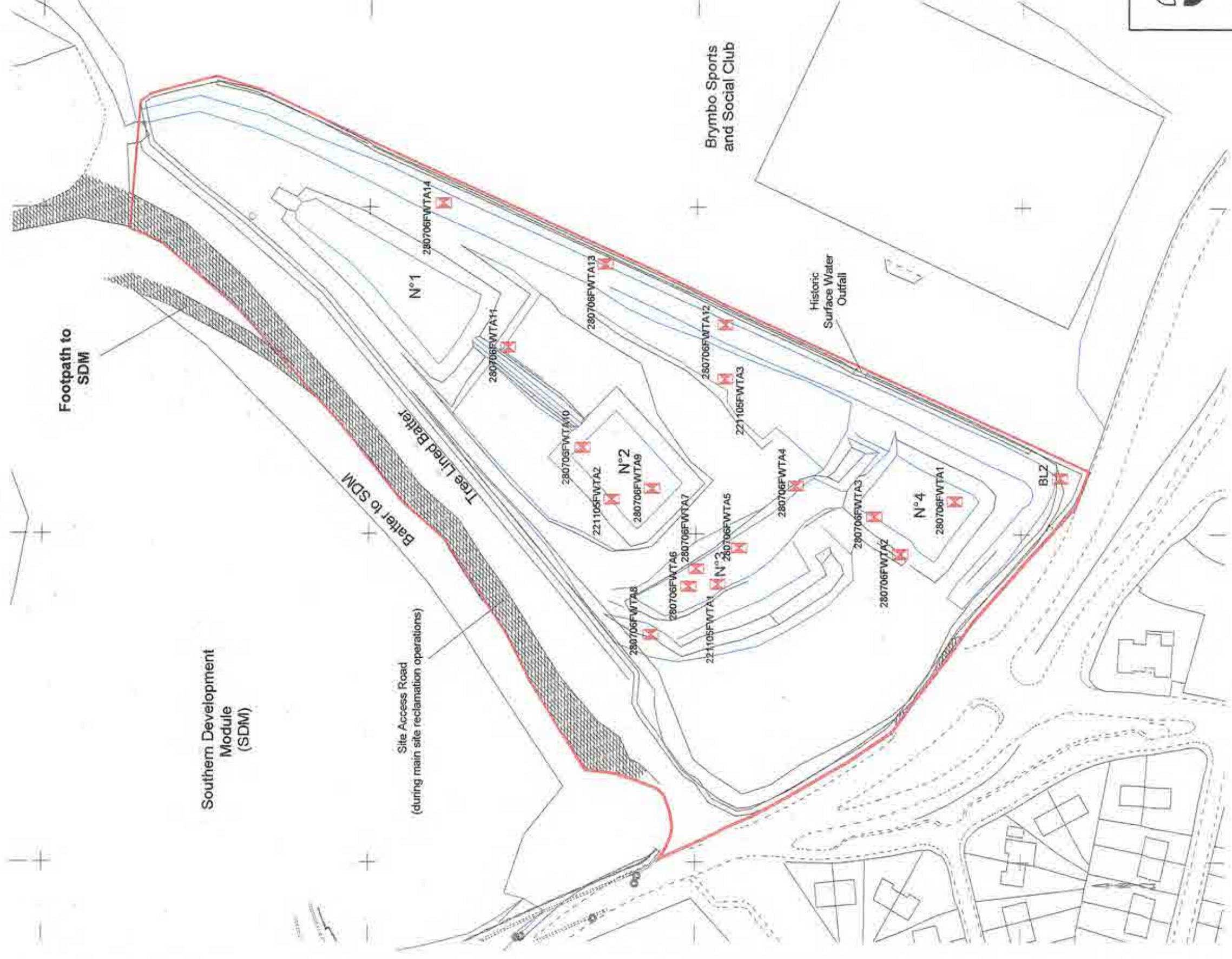
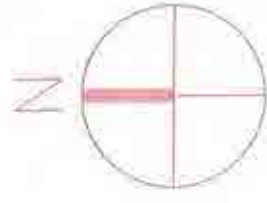
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Project:
Link Road Development Module

Drawing:
Historical Map 2000

Drawn: DFB	Checked: KEH
Date: 20.05.07	Scale: 1:10,000 @ A4
Job No: R175	Drg No: 11



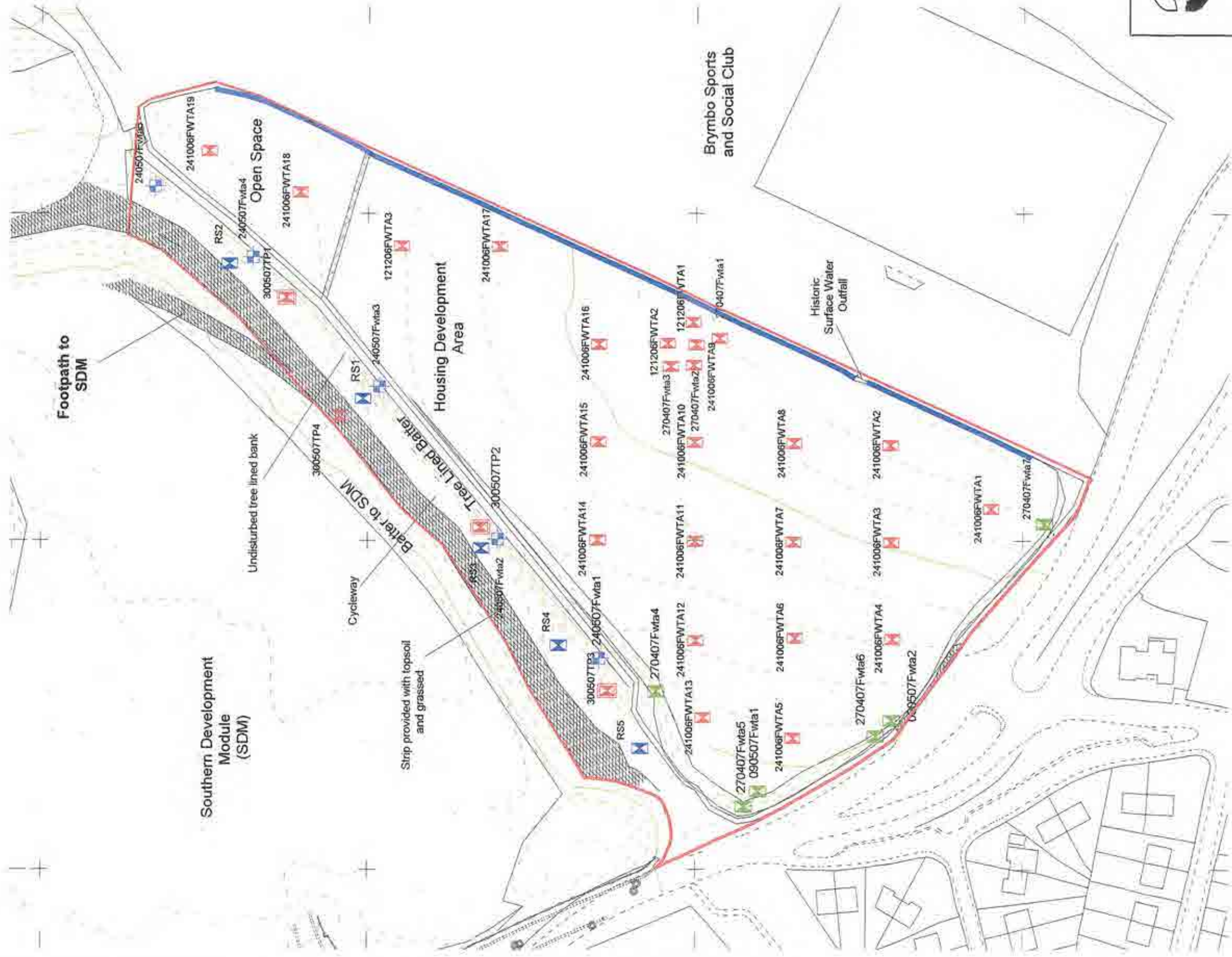
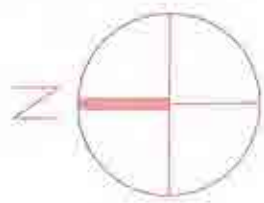
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Project:
Link Road Development Module

Drawing: Pre-Reclamation
Sample Locations

Drawn:	DFB	Checked:	KEH
Date:	09.07.07	Scale:	1:1250 @ A3
Job No:	R175	Dwg No:	12

Base plan provided
by Parkhill Estates Ltd



Restoration Surface Validation Sample



Cycleway Surface Validation Sample



Batter Validation Sample



Additional trial pits along NW strip

French drain

Topsoil samples from undisturbed tree lined bank



Base plan provided by Parkhill Estates Ltd



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Project:

Link Road Development Module

Drawing: Validation Sample Locations

Drawn:	DFB	Checked:	KEH
Date:	09.07.07	Scale:	1:1250 @ A3
Job No:	R175	Drg No:	13

Appendix A
Terms of Appointment

TERMS OF APPOINTMENT

Former Brymbo Steelworks, Brymbo, Wrexham

The services provided by Smith Grant LLP were undertaken in accordance with the ACE Agreement B(1) 2002, Memorandum of Agreement with amendments, between Brymbo Developments Ltd and Smith Grant LLP (dated 18 August 2004) and subsequent Deed of Variation (ref: NOT_L001\721224\2).

The agreement related to the provision of environmental services in relation to remediation works to form the Northern Area which includes the Link Road Development Module.

The Memorandum of Agreement and Deed of Variation may be reviewed on request.

Appendix B
Certificate of Completion

Certificate of Completion

Link Road Development Module, Former Brymbo Steelworks, Brymbo, Wrexham

Certificate of Completion

Smith Grant LLP certifies that having exercised reasonable skill, care and diligence in the performance of its duties that Brymbo Developments Ltd. has carried out remediation works to the above site in accordance with the SGP Remedial Strategy, having regard to the intended use of the site for residential purposes.

This certificate is not a guarantee save to the extent that Smith Grant LLP has failed to exercise reasonable skill, care and diligence as aforesaid and does not in any way increase Smith Grant LLP's liability beyond that agreed under the Terms of Appointment.

This certificate is for the benefit of Brymbo Developments Ltd and to any other person providing finance in connection with or taking a freehold interest in the whole site. Transfer of benefit of this certificate will be permitted to one further assignee without the written permission of Smith Grant LLP.

Signed (For Smith Grant LLP)



15.7.07

Appendix C
List of Relevant Documents

Brymbo Steelworks Site Development, References and Sources of Information.

Last updated: 22nd June 2007

Smith Grant LLP Reports

Main Site

1. Brymbo Steelworks Site Contamination Assessment for Brymbo Developments Ltd. September 1995. Vol. 1 & 2. Smith Grant Partnership. R31.R07.
2. Brymbo Steelworks Site Groundwater Risk Assessment for Licensed Relocation Zone for Brymbo Developments Ltd. November 1995. Smith Grant Partnership. R31-R08.
3. Brymbo Steelworks Reservoir Area. Sediment Analysis Report. October 1996. R31-R09/Final.
4. Method Statement for Identifying and Handling Contaminated Materials for Brymbo Developments Ltd and WCBC. November 2001. Smith Grant Partnership. R031-R13/Rev D/Final.
5. Reclamation of the Former Brymbo Steelworks, Soil Leachate Assessment for Brymbo Developments Ltd. March 2002. R175-R02/Final.
6. Methodology for the derivation of soil leachate remedial targets for fill material to be used in the development of the Brymbo Steelworks site. P20 Assessment. September 2002. R175-R12.
7. Summary of Hydrogeological Information on Brymbo Steelworks Site to be used in P20 Risk Assessment. September 2002 for Brymbo Developments Ltd. R175-R11.
8. Summary Review of Baseline Water Quality Prior to Commencement of Works, October 2003. R175-R13.
9. Brymbo Steelworks Reclamation. Water Quality Reports. October 2003 – December 2006. R175w1-w41 (produced monthly until December 2006)
10. Brymbo Steelworks Reclamation. Air Quality Reports. October 2003 – October 2005. R175aq1-aq25 (produced monthly)
11. Annual Review of Groundwater Quality, Brymbo Steelworks, November 2004. Ref: R175-R19
12. Southern Development Module, Contamination Certification Report, January 2005. Ref: R175-R16/Final.
13. Spine Road (Southern Section) Contamination Certification Report, July 2005, Ref: R175-R21/Final
14. Central Development Module, Contamination Certification Report, July 2005, Ref: R175-R20/Final
15. Western Development Module, Contamination Certification Report, February 2006, Ref: R175-R18/Final
16. Central Development Northern Module, Contamination Certification Report, June 2006, Ref: R175-R17/Final
17. Eastern Slopes, Contamination Certification Report, July 2006, R754-R09, Final
18. Wonder Bank, Contamination Certification Report, May 2007, Ref: R754-R07, Final
19. Annual Review of Water Quality, Brymbo Steelworks, October 2005 - December 2006; May 2007. Ref: R175-R27, Final
20. Northern Spine Road, Contamination Certification Report, June 2007, Ref: R175-R26/Final.

Former Coke Ovens Site

21. Land to West of Blast Road. Environmental Site Investigation, Risk Assessment and Remedial Strategy. September 2004. R175-R14/Final.
22. Former Brymbo Steelworks Coke Ovens Zone, Remediation Strategy for Brymbo Developments, September 2004. R175-R15/Rev 1.
23. Phase I (Source Reduction) Remedial Works of Coke Ovens Zone, Former Brymbo Steelworks Coke Ovens Zone for Brymbo Developments Ltd. Environmental Management Plan, July 2004 (DRAFT). R754-R01.
24. Former Brymbo Steelworks Coke Ovens Zone. Ground Gas Migration, Monitoring and Management. August 2004. R754-R02.
25. North Western Development Module, Contamination Certification Report, August 2005. Ref: R754-R05 (Final).
26. North Western Development Module, Groundwater Monitoring Update Review, December 2006. Ref: R754-R08, Rev1.
27. Land to West of Blast Road, Contamination Certification Report. 2006, R175-R22, in preparation.

Smith Grant LLP Correspondence

28. Letter to EAW, dated 28 October 2002, regarding P20 Assessment, Ref:R175-L12
29. Letter to EAW, dated 3 November 2003 regarding wording for W1/2/3 classification and leachability criteria, Ref: R175-L17
30. Letter to WCBC, dated 18 November 2003, regarding baseline soil monitoring locations and results. Ref: R175-L18
31. Response to EAW Comments in letter of 20th July 2004; Groundwater Considerations. R754-R04 (relates specifically to coke ovens site)
32. Letter to WCBC/EAW, dated 21st September 2004 regarding validation results for coke ovens area. Ref: R754-L04
33. Letter to WCBC, dated 21st September 2004 regarding WCBC comments on Coke Ovens Remedial Strategy. Ref: R754-L05.
34. Letter to WCBC, dated 21st September 2004 regarding proposed revised wording to Condition 42. Ref: R175-L46
35. Letter to WCBC, dated 26 April 2004 regarding Validation Testing Methodology for SDA, ref: R175-L36
36. Fax to WCBC, dated 2 August 2004, regarding validation testing of formation surface of WDA. Ref: R175-F22
37. Letter to WCBC, dated 8 October 2004 regarding proposed SSAC for housing development modules. Ref: R175-L48
38. Letter to EAW, dated 15 October 2004, regarding additional groundwater monitoring results for Coke Ovens area. Ref: R754-L06

39. Letter to WCBC, 25 October 2005 regarding Validation Testing Methodology for WDA, ref: R175-L51
40. Letter to EAW, dated 11 November 2004, regarding validation testing of the capping layer on Coke Ovens. Ref: R754-L07
41. Letter to EAW, dated 11 November 2004, regarding groundwater considerations of coke ovens. Ref: R754-L08
42. Letter to WCBC, dated 22 December 2004, regarding status of ground gas monitoring at the former coke ovens zone. Ref: R754-L05
43. Letter to WCBC, dated 10 January 2005, regarding results of annual baseline sampling. Ref: R175-L57
44. Letter to WCBC, dated 14 January 2005, regarding proposed site-specific assessment criteria for batters of housing development areas. Ref: R175-L60
45. Letter to WCBC, dated 8 February 2005, regarding proposed site-specific assessment criteria for batters of housing development areas. Ref: R175-L64
46. Letter to WCBC, dated 17th October, 2005, regarding borehole installation works and gas monitoring results available to date at the Wonder Bank. Ref: R754-L15
47. Letter to WCBC, dated 21st November 2005, providing additional information in relation to gas monitoring at the Wonder Bank
48. Letter to WCBC, dated 8th December 2005, providing results of latest annual baseline samples. Ref: R175-L88.
49. Letter to EAW, dated 16th December 2005, regarding latest groundwater monitoring results for the former coke ovens. Ref: R754-L19.
50. Letter to EAW, dated 26th July 2006, regarding status of monitoring in relation to former coke ovens. Ref: R754-L22.
51. e-mail / note to WCBC, dated 27 July 2006, regarding proposed pre-earthworks sampling in Fron Water Treatment Area. Ref: R175-N81.
52. Letter to WCBC, dated 21 December 2006, regarding annual baseline soil sampling. Ref: R175-L95.
53. e-mail to WCBC, dated 6 June 2007, regarding the earlier letter on the annual baseline results.

Wrexham County Borough Council (WCBC) Reports and Correspondence

54. Reclamation Works On The Site Of The Former Brymbo Steelworks. Results of Leach Tests On Slag Samples. Engineering Services, Wrexham County Borough Council, September 2002.
55. Reclamation Works On The Site Of The Former Brymbo Steelworks. Chemical Analysis of Steelworks Slag, Chemical Analysis of Groundwater. July 2002.
56. Reclamation Works On The Site Of The Former Brymbo Steelworks. Site Investigation on Wonder Bank and the Site of the Former Coke Ovens. Laboratory Analysis of Soil/Water samples. [undated –but logs are dated April 2003]
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72. Letter to BSES, dated 24 March 1999, regarding Notice of Determination for surrender of Work's Tip licence, Ref: WL293/TN (EAW refused to accept the application)
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75. Letter to SGP, dated 20 July 2004, regarding comments on Coke Ovens area Remedial Strategy. Ref: EM5/Brymbo/CokeOvens
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77. Letter to SGP, dated 6th January 2006, regarding the NWDM Contamination Certification Report.
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- 82. Brymbo Steelworks Coke Ovens: Remediation Strategy, March 2004. Ref: NE02133/D5/V3

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- 88. Wonder Bank: Capping and Remodelling Scheme (undated)
- 89. Letter from BDL to WCBC dated 7th December 2004 regarding works on Wonder Bank
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- 91. Letter from BDL to WCBC dated 6th January 2005 regarding fencing on the Wonder Bank
- 92. Extract from Planning Committee report regarding the lagoon area, dated 3 July 2006

Scott Wilson

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Other

99. Wrexham County Borough Council. Grant of Planning Permission. Dated 10th November 1997. Ref: BRY CB00016
100. Brymbo Developments Ltd and WCBC. Deed under Section 106 of the Town and Country Planning Act 1990 relating to land at Brymbo near Wrexham. Dated 10th November 1997. Ref: AW/AMG/PLG1/28
101. Reclamation and redevelopment of Brymbo Steelworks: A review of Available Data and Assessment of the Water Environment. December 1995. Steve Bennett
102. BGS Hydrogeological Map of Clwyd and the Cheshire Basin, 1:100,000
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Appendix D
SGP Photo Logs



Original security building at No 2 Gate access – demolished in 2005



Northwestern strip prior to creation of reclamation site access road (2003)



Stripping of topsoil to create reclamation site access road (2003)



Reclamation site access road along northwestern strip



Excavation of lagoon area (November 2003)



Excavation of lagoon area (November 2003)



Lagoons (November 2003)



Lagoons (November 2003)



On-going re-compaction of materials in LRDM
(July – October 2007)



On-going re-compaction of materials in LRDM
(July – October 2007)



On-going re-compaction of materials in LRDM
(July – October 2007)



Typical sandstones encountered within LRDM
during excavation and replacement activities



On-going re-compaction of materials in LRDM
(July – October 2007)



Cycleway along northwestern strip following
placement of topsoils along western edge to
narrow road (May 2007)



Trial pit 300507TP1 on northwestern strip



Trial pit 300507TP1 on northwestern strip



Trial pit 300507TP2 on northwestern strip



Trial pit 300507TP4 on northwestern strip
LRDM



Trial pit 300507TP4 on northwestern strip

Appendix E
SGP Sample Logs

**(Note: LRDM originally referred to as
FWTA; all samples labelled accordingly)**

PRE-REMEDIATION SAMPLES

TP221105FWTA1

Grid Ref SJ29685 52494

Depth (m)	Description	Sample	Notes
0.00	Light brown sand. Base of trial pit.	221105FWTA1	Hand dug. Sample collected from site of former N°3 lagoon.

TP221105FWTA2

Grid Ref SJ29711 52526

Depth (m)	Description	Sample	Notes
0.00	Light brown sand and light grey clay. Base of trial pit.	221105FWTA2	Hand dug. Sample collected from base of N°2 lagoon.

TP221105FWTA3

Grid Ref SJ29747 52492

Depth (m)	Description	Sample	Notes
0.00	Light brown clay with small coal fragments. Base of trial pit.	221105FWTA3	Hand dug. Sample collected from base of excavated channel on eastern edge of area.

TP280706FWTA1

Grid Ref SJ29710 52420

Depth (m)	Description	Sample	Notes
0.00	Soft dark brown sediment (silt/clay). Base of trial pit.	280706FWTA1	Hand dug. Slight decaying odour. Snail shells present.

TP280706FWTA2**Grid Ref SJ29694 52437**

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand with sandstone gravels and cobbles. Base of trial pit.	280706FWTA2	Hand dug.

TP280706FWTA3**Grid Ref SJ29705 52445**

Depth (m)	Description	Sample	Notes
0.00	Light brown clayey sand. Base of trial pit.	280706FWTA3	Hand dug. Sample collected from beneath sediment surface in former lagoon N°4.

TP280706FWTA4**Grid Ref SJ29714 52469**

Depth (m)	Description	Sample	Notes
0.00	Light brown clayey sand containing stone gravel. Base of trial pit.	280706FWTA4	Hand dug.

TP280706FWTA5**Grid Ref SJ29696 52486**

Depth (m)	Description	Sample	Notes
0.00	Baked light brown sediment above brown clayey sand. Base of trial pit.	280706FWTA5	Hand dug. Combined sediment and sub-sediment sample from former lagoon N°3.

TP280706FWTA6**Grid Ref SJ29684 52502**

Depth (m)	Description	Sample	Notes
0.00	Baked light grey sediment above light brown clayey sand. Base of trial pit.	280706FWTA6	Hand dug.

TP280706FWTA7**Grid Ref SJ29688 52499**

Depth (m)	Description	Sample	Notes
0.00	Light brown clayey sand containing small coal fragments. Base of trial pit.	280706FWTA7	Hand dug. Sample collected from face of former lagoon N°3.

TP280706FWTA8**Grid Ref SJ29688 52499**

Depth (m)	Description	Sample	Notes
0.00	Light grey baked silt containing sandstone gravel. Base of trial pit.	280706FWTA8	Hand dug.

TP280706FWTA9**Grid Ref SJ29714 52514**

Depth (m)	Description	Sample	Notes
0.00	Light brown baked sediment over dark brown clay. Base of trial pit.	280706FWTA9	Hand dug. Sample collected from former lagoon N°2.

TP2807806FWTA10**Grid Ref SJ29726 52535**

Depth (m)	Description	Sample	Notes
0.00	Light brown baked sediment. Base of trial pit.	280706FWTA10	Hand dug. Sample collected from former lagoon N°2.

TP280706FWTA11**Grid Ref SJ29757 52558**

Depth (m)	Description	Sample	Notes
0.00	Light brown clayey sand containing sandstone gravels, cobbles and boulders. Base of trial pit.	280706FWTA11	Hand dug.

TP280706FWTA12**Grid Ref SJ29764 52491**

Depth (m)	Description	Sample	Notes
0.00	Clayey brown soil with gravel. Base of trial pit.	280706FWTA12	Hand dug.

TP280706FWTA13**Grid Ref SJ29790 52527**

Depth (m)	Description	Sample	Notes
0.00	Clayey brown soil with gravel. Base of trial pit.	280706FWTA13	Hand dug.

TP280706FWTA14**Grid Ref SJ29802 52577**

Depth (m)	Description	Sample	Notes
0.00	Clayey brown soil with gravel. Base of trial pit.	280706FWTA14	Hand dug.

INTERMEDIATE FILL SAMPLES**TP090806FWTA1****Grid Ref SJ**

Depth (m)	Description	Sample	Notes
0.00	Grey and brown sand with crushed concrete, clay, stones and rubble. Base of trial pit.	090806FWTA1	Hand dug. Sample collected from southern end of stockpile located at treatment area gate.

TP090806FWTA2**Grid Ref SJ**

Depth (m)	Description	Sample	Notes
0.00	Light brown and grey sand with limestone gravel, clay and demolition rubble. Base of trial pit.	090806FWTA2	Hand dug. Sample collected from northern end of stockpile located at treatment area gate.

TP150806FTA1**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted light brown / orange sand with sandstone and coal fragments Base of trial pit.	150806FTA1	Hand dug.

TP150806FTA2**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted light brown / orange sand with sandstone, brick and coal fragments Base of trial pit.	15.0806FTA2	Hand dug.

TP150806FTA3**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted brown clay with sand and coal fragments Base of trial pit.	150806FTA3	Hand dug.

TP150806FTA4**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted light brown sandy clay Base of trial pit.	150806FTA4	Hand dug.

TP150806FTA5**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted brown / orange sand with siltstone, sandstone and coal fragments Base of trial pit.	150806FTA5	Hand dug.

TP150806FTA6**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted brown / orange sand and sandstone Base of trial pit.	150806FTA6	Hand dug.

TP150806FTA7**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted orange / brown sand and sandstone Base of trial pit.	150806FTA7	Hand dug.

TP150806FTA8**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted brown sand with coal and brick fragments Base of trial pit.	150806FTA8	Hand dug.

TP150806FTA9**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted brown sandy clay with stones and coal fragments Base of trial pit.	150806FTA9	Hand dug.

TP150806FTA10**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted light brown crushed sandstone Base of trial pit.	150806FTA10	Hand dug.

TP160806FWTA1**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted mottled brown / grey sandy clay Base of trial pit.	160806FWTA1	Hand dug.

TP160806FWTA2**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted brown sandy clay with sandstone fragments Base of trial pit.	160806FWTA2	Hand dug.

TP170806FWTA1**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted mottled brown / grey sandy clay Base of trial pit.	170806FWTA1	Hand dug.

TP170806FWTA2**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Compacted mottled brown grey sandy clay with sandstone fragments Base of trial pit.	170806FWTA2	Hand dug.

TP110906FWTA1**Grid Ref SJ**

Depth (m)	Description	Sample	Notes
0.00	Dark brown clayey sand containing sandstone gravel/cobbles/boulders. Base of trial pit.	110906FWTA1	

TP110906FWTA2**Grid Ref SJ**

Depth (m)	Description	Sample	Notes
0.00	Dark brown clayey sand containing sandstone gravel/cobbles/boulders. Base of trial pit.	110906FWTA2	

TP110906FWTA3**Grid Ref SJ**

Depth (m)	Description	Sample	Notes
0.00	Light brown sand containing gravels and cobbles. Base of trial pit.	110906FWTA3	

TP110906FWTA4**Grid Ref SJ**

Depth (m)	Description	Sample	Notes
0.00	Light brown sand containing sandstone gravels and cobbles. Base of trial pit.	110906FWTA4	

TP270906Fwta1**Grid Ref SJ**

Depth (m)	Description	Sample	Notes
0.00	Brown sand containing gravel and cobble sized sandstone pieces. Base of trial pit.	270906Fwta2	Hand dug. Sample collected from fill area at northernmost end of site.

TP270906Fwta2**Grid Ref SJ**

Depth (m)	Description	Sample	Notes
0.00	Brown sand containing gravel and cobble sized sandstone pieces. Base of trial pit.	270906Fwta2	Hand dug. Sample collected from fill area at northernmost end of site.

TP270906Fwta3**Grid Ref SJ**

Depth (m)	Description	Sample	Notes
0.00	Brown clay containing sandstone gravel and occasional black shale/coal fragments. Base of trial pit.	270906Fwta3	Hand dug. Sample collected from fill area at northernmost end of site.

RESTORATION SURFACE

241006fwt1

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces	241006fwt1	Sample collected from arisings generated for placement of SMP1

241006fwt2

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces and occasional small coal fragments	241006fwt2	Sample collected from arisings generated for placement of SMP2

241006fwt3

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing gravel sized stones and occasional small coal fragments.	241006fwt3	Sample collected from arisings generated for placement of SMP3

241006fwt4

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces.	241006fwt4	Sample collected from arisings generated for placement of SMP4

241006fwt5

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces.	241006fwt5	Sample collected from arisings generated for placement of SMP5

241006fwt6

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces and occasional small coal fragments.	241006fwt6	Sample collected from arisings generated for placement of SMP6

241006fwt7

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing stones and occasional small coal fragments.	241006fwt7	Sample collected from arisings generated for placement of SMP7

241006fwt8

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing stones and occasional small coal fragments.	241006fwt8	Sample collected from arisings generated for placement of SMP8

241006fwt9

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces.	241006fwt9	Sample collected from arisings generated for placement of SMP9

241006fwt10

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces.	241006fwt10	Sample collected from arisings generated for placement of SMP10

241006fwt11

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces, stones and occasional small coal fragments.	241006fwt11	Sample collected from arisings generated for placement of SMP11

241006fwt12

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces and occasional small coal fragments.	241006fwt12	Sample collected from arisings generated for placement of SMP12

241006fwt13

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces.	241006fwt13	Sample collected from arisings generated for placement of SMP13

241006fwt14

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces.	241006fwt14	Sample collected from arisings generated for placement of SMP14

241006fwt15

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces and occasional small coal fragments.	241006fwt15	Sample collected from arisings generated for placement of SMP15

241006fwt16

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing stones.	241006fwt16	Sample collected from arisings generated for placement of SMP16

241006fwt17

Depth (m)	Description	Sample	Notes
0.00	Dark brown clayey sand containing stones and occasional small coal fragments.	241006fwt17	Sample collected from arisings generated for placement of SMP19

241006fwt18

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces.	241006fwt18	Sample collected from arisings generated for placement of SMP21

241006fwt19

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone pieces.	241006fwt19	Sample collected from arisings generated for placement of SMP22

TP121206FWTA1**Grid Ref SJ29764 52504**

Depth (m)	Description	Sample	Notes
0.00	Marbled light and dark brown clayey sand containing sandstone.	121206FWTA1	Sample collected close to SMP9 as extra sample due to earlier exceedance of SGV from sample collected at this location
0.20	Base		

TP121206FWTA2**Grid Ref SJ29761 52508**

Depth (m)	Description	Sample	Notes
0.00	Marbled light and dark brown clayey sand containing sandstone.	121206FWTA2	Sample collected close to SMP9 as extra sample due to earlier exceedance of SGV from sample collected at this location
0.20	Base		

TP121206FWTA3**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	Brown clayey sand containing sandstone and occasional black shale/coal fragments.	121206	Sample collected from area of SMP20

270407Fwta1**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	brown clay and sand containing stones and occasional small coal fragments	270407Fwta1	extra sample collected from replacement material placed in the vicinity of SMP9

270407Fwta2**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	brown clay and sand containing stones and occasional small coal fragments	270407Fwta2	extra sample collected from replacement material placed in the vicinity of SMP9

270407Fwta3**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	brown clay and sand containing stones and occasional small coal fragments	270407Fwta3	extra sample collected from replacement material placed in the vicinity of SMP9

BATTER TOPSOIL SAMPLES**090507Fwta1****Grid Ref SJ 29629 52478**

Depth (m)	Description	Sample	Notes
0.00	brown soil including stones and roots	090507Fwta1	top soil sample

TP090507Fwta2**Grid Ref SJ 29651 52441**

Depth (m)	Description	Sample	Notes
0.00	brown soil including stones and roots	090507Fwta2	top soil sample

270407Fwta4**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	brown soil with stones and roots	270407Fwta4	top soil sample

270407Fwta5**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	sparsely vegetated brown soil/clay containing roots and stones	270405Fwta5	sub soil sample

270407Fwta6**Grid Ref**

Depth (m)	Description	Sample	Notes
0.00	sparsely vegetated brown soil/clay containing roots and stones	270407Fwta6	sub soil sample

270407Fwta7

Grid Ref

Depth (m)	Description	Sample	Notes
0.00	vegetated brown soil containing stones, roots and shales	270407Fwta7	

UNDISTURBED TREE LINED NORTHWESTERN SLOPE**240507Fwta1****Grid Ref SJ 29660 52535**

Depth (m)	Description	Sample	Notes
0.00	vegetated sandy brown soil containing roots, mudstone/shale and stones	240507Fwta1	sample collected from middle of slope

240507Fwta2**Grid Ref SJ 29696 52565**

Depth (m)	Description	Sample	Notes
0.00	vegetated sandy brown soil containing stones and roots	240507Fwta2	sample collected from top of slope

240507Fwta3**Grid Ref SJ 29737 52605**

Depth (m)	Description	Sample	Notes
0.00	sparsely vegetated sandy brown soil containing roots, slag pieces and stones	240507Fwta3	sample collected from toe of slope

240507Fwta4**Grid Ref SJ 29784 52634**

Depth (m)	Description	Sample	Notes
0.00	vegetated sandy brown soil containing stones and roots	240507Fwta4	sample collected from middle of slope

240507Fwta5**Grid Ref SJ 29803 52662**

Depth (m)	Description	Sample	Notes
0.00	vegetated sandy brown soil containing stones, roots and limestone gravel	240507Fwta5	sample collected from top of slope

CYCLE WAY / NORTHWESTERN STRIP

300507TP1

Depth (m)	Description	Sample	Notes
0.00	Grass over dark brown sandy clayey topsoil	300507TP1.S1	Damp
0.20	Dark brown sandy clayey fill with brick and coal and occasional metal and wood fragments		
1.20			Fill
2.30	Orange clay		Possible natural or re-worked overburden
2.40	Base of trial pit		

300507TP2

Depth (m)	Description	Sample	Notes
0.00	Grass over dark brown sandy clayey topsoil	300507TP2.S1	Dry
0.60	Compact sandstone fill with stones and very occasional plastic, metal and wood fragments		
1.60	Very compact shales		Fill
1.79	Base of trial pit		Unable to excavate further to due compact nature of ground and proximity of bank

300507TP3

Depth (m)	Description	Sample	Notes
0.00	Thin vegetation over dark brown sandy clayey topsoil	300507TP3.S1	Dry Fill Unable to excavate further to due compact nature of ground and proximity of bank
0.20	Compact concrete hardcore with very occasional plastic fragments		
1.50	Very compact sandstone fill		
1.55	Base of trial pit		

300507TP4

Depth (m)	Description	Sample	Notes
0.00	Knee high grass over dark brown sandy topsoil		Dry Unable to excavate further to due compact nature of ground
0.20	Compact concrete hardcore / crush		
1.00	Very compact sandstone fill with some brick fragments		
1.10	Base of trial pit		

Appendix F

SGP Analytical Data

**(Note: LRDM originally referred to as
FWTA; all samples labelled accordingly)**

Pre-examination Baseline Soil samples

Sample ID	Depth (m)	Description	Asbestos Screen	Total sulphate	pH Value in Soil	Arsenic	Boron (Water Extraction)	Cadmium	Chromium	Hazardous Organics	Mercury	Nickel	Lead	Selenium	Copper	Zinc	Add Sulphate Sulphate	Total Sulphate	1:1 Sulphate	Free Cyanide Soil	Total Cyanide Soil	Thiocyanate	Total Phenols mg/L	TPH (C1- C40)	TPH (C41- C60)	TPH (C61- C80)	TPH (C81- C100)	TPH (C101- C120)	TPH (C121- C140)	TPH (C141- C160)	TPH (C161- C180)	TPH (C181- C200)	TPH (C201- C220)	TPH (C221- C240)	TPH (C241- C260)	TPH (C261- C280)	TPH (C281- C300)	TPH (C301- C320)	TPH (C321- C340)	TPH (C341- C360)	TPH (C361- C380)	TPH (C381- C400)	TPH (C401- C420)	TPH (C421- C440)	TPH (C441- C460)	TPH (C461- C480)	TPH (C481- C500)	TPH (C501- C520)	TPH (C521- C540)	TPH (C541- C560)	TPH (C561- C580)	TPH (C581- C600)	TPH (C601- C620)	TPH (C621- C640)	TPH (C641- C660)	TPH (C661- C680)	TPH (C681- C700)	TPH (C701- C720)	TPH (C721- C740)	TPH (C741- C760)	TPH (C761- C780)	TPH (C781- C800)	TPH (C801- C820)	TPH (C821- C840)	TPH (C841- C860)	TPH (C861- C880)	TPH (C881- C900)	TPH (C901- C920)	TPH (C921- C940)	TPH (C941- C960)	TPH (C961- C980)	TPH (C981- C1000)	TPH (C1001- C1020)	TPH (C1021- C1040)	TPH (C1041- C1060)	TPH (C1061- C1080)	TPH (C1081- C1100)	TPH (C1101- C1120)	TPH (C1121- C1140)	TPH (C1141- C1160)	TPH (C1161- C1180)	TPH (C1181- C1200)	TPH (C1201- C1220)	TPH (C1221- C1240)	TPH (C1241- C1260)	TPH (C1261- C1280)	TPH (C1281- C1300)	TPH (C1301- C1320)	TPH (C1321- C1340)	TPH (C1341- C1360)	TPH (C1361- C1380)	TPH (C1381- C1400)	TPH (C1401- C1420)	TPH (C1421- C1440)	TPH (C1441- C1460)	TPH (C1461- C1480)	TPH (C1481- C1500)	TPH (C1501- C1520)	TPH (C1521- C1540)	TPH (C1541- C1560)	TPH (C1561- C1580)	TPH (C1581- C1600)	TPH (C1601- C1620)	TPH (C1621- C1640)	TPH (C1641- C1660)	TPH (C1661- C1680)	TPH (C1681- C1700)	TPH (C1701- C1720)	TPH (C1721- C1740)	TPH (C1741- C1760)	TPH (C1761- C1780)	TPH (C1781- C1800)	TPH (C1801- C1820)	TPH (C1821- C1840)	TPH (C1841- C1860)	TPH (C1861- C1880)	TPH (C1881- C1900)	TPH (C1901- C1920)	TPH (C1921- C1940)	TPH (C1941- C1960)	TPH (C1961- C1980)	TPH (C1981- C2000)	TPH (C2001- C2020)	TPH (C2021- C2040)	TPH (C2041- C2060)	TPH (C2061- C2080)	TPH (C2081- C2100)	TPH (C2101- C2120)	TPH (C2121- C2140)	TPH (C2141- C2160)	TPH (C2161- C2180)	TPH (C2181- C2200)	TPH (C2201- C2220)	TPH (C2221- C2240)	TPH (C2241- C2260)	TPH (C2261- C2280)	TPH (C2281- C2300)	TPH (C2301- C2320)	TPH (C2321- C2340)	TPH (C2341- C2360)	TPH (C2361- C2380)	TPH (C2381- C2400)	TPH (C2401- C2420)	TPH (C2421- C2440)	TPH (C2441- C2460)	TPH (C2461- C2480)	TPH (C2481- C2500)	TPH (C2501- C2520)	TPH (C2521- C2540)	TPH (C2541- C2560)	TPH (C2561- C2580)	TPH (C2581- C2600)	TPH (C2601- C2620)	TPH (C2621- C2640)	TPH (C2641- C2660)	TPH (C2661- C2680)	TPH (C2681- C2700)	TPH (C2701- C2720)	TPH (C2721- C2740)	TPH (C2741- C2760)	TPH (C2761- C2780)	TPH (C2781- C2800)	TPH (C2801- C2820)	TPH (C2821- C2840)	TPH (C2841- C2860)	TPH (C2861- C2880)	TPH (C2881- C2900)	TPH (C2901- C2920)	TPH (C2921- C2940)	TPH (C2941- C2960)	TPH (C2961- C2980)	TPH (C2981- C3000)	TPH (C3001- C3020)	TPH (C3021- C3040)	TPH (C3041- C3060)	TPH (C3061- C3080)	TPH (C3081- C3100)	TPH (C3101- C3120)	TPH (C3121- C3140)	TPH (C3141- C3160)	TPH (C3161- C3180)	TPH (C3181- C3200)	TPH (C3201- C3220)	TPH (C3221- C3240)	TPH (C3241- C3260)	TPH (C3261- C3280)	TPH (C3281- C3300)	TPH (C3301- C3320)	TPH (C3321- C3340)	TPH (C3341- C3360)	TPH (C3361- C3380)	TPH (C3381- C3400)	TPH (C3401- C3420)	TPH (C3421- C3440)	TPH (C3441- C3460)	TPH (C3461- C3480)	TPH (C3481- C3500)	TPH (C3501- C3520)	TPH (C3521- C3540)	TPH (C3541- C3560)	TPH (C3561- C3580)	TPH (C3581- C3600)	TPH (C3601- C3620)	TPH (C3621- C3640)	TPH (C3641- C3660)	TPH (C3661- C3680)	TPH (C3681- C3700)	TPH (C3701- C3720)	TPH (C3721- C3740)	TPH (C3741- C3760)	TPH (C3761- C3780)	TPH (C3781- C3800)	TPH (C3801- C3820)	TPH (C3821- C3840)	TPH (C3841- C3860)	TPH (C3861- C3880)	TPH (C3881- C3900)	TPH (C3901- C3920)	TPH (C3921- C3940)	TPH (C3941- C3960)	TPH (C3961- C3980)	TPH (C3981- C4000)	TPH (C4001- C4020)	TPH (C4021- C4040)	TPH (C4041- C4060)	TPH (C4061- C4080)	TPH (C4081- C4100)	TPH (C4101- C4120)	TPH (C4121- C4140)	TPH (C4141- C4160)	TPH (C4161- C4180)	TPH (C4181- C4200)	TPH (C4201- C4220)	TPH (C4221- C4240)	TPH (C4241- C4260)	TPH (C4261- C4280)	TPH (C4281- C4300)	TPH (C4301- C4320)	TPH (C4321- C4340)	TPH (C4341- C4360)	TPH (C4361- C4380)	TPH (C4381- C4400)	TPH (C4401- C4420)	TPH (C4421- C4440)	TPH (C4441- C4460)	TPH (C4461- C4480)	TPH (C4481- C4500)	TPH (C4501- C4520)	TPH (C4521- C4540)	TPH (C4541- C4560)	TPH (C4561- C4580)	TPH (C4581- C4600)	TPH (C4601- C4620)	TPH (C4621- C4640)	TPH (C4641- C4660)	TPH (C4661- C4680)	TPH (C4681- C4700)	TPH (C4701- C4720)	TPH (C4721- C4740)	TPH (C4741- C4760)	TPH (C4761- C4780)	TPH (C4781- C4800)	TPH (C4801- C4820)	TPH (C4821- C4840)	TPH (C4841- C4860)	TPH (C4861- C4880)	TPH (C4881- C4900)	TPH (C4901- C4920)	TPH (C4921- C4940)	TPH (C4941- C4960)	TPH (C4961- C4980)	TPH (C4981- C5000)	TPH (C5001- C5020)	TPH (C5021- C5040)	TPH (C5041- C5060)	TPH (C5061- C5080)	TPH (C5081- C5100)	TPH (C5101- C5120)	TPH (C5121- C5140)	TPH (C5141- C5160)	TPH (C5161- C5180)	TPH (C5181- C5200)	TPH (C5201- C5220)	TPH (C5221- C5240)	TPH (C5241- C5260)	TPH (C5261- C5280)	TPH (C5281- C5300)	TPH (C5301- C5320)	TPH (C5321- C5340)	TPH (C5341- C5360)	TPH (C5361- C5380)	TPH (C5381- C5400)	TPH (C5401- C5420)	TPH (C5421- C5440)	TPH (C5441- C5460)	TPH (C5461- C5480)	TPH (C5481- C5500)	TPH (C5501- C5520)	TPH (C5521- C5540)	TPH (C5541- C5560)	TPH (C5561- C5580)	TPH (C5581- C5600)	TPH (C5601- C5620)	TPH (C5621- C5640)	TPH (C5641- C5660)	TPH (C5661- C5680)	TPH (C5681- C5700)	TPH (C5701- C5720)	TPH (C5721- C5740)	TPH (C5741- C5760)	TPH (C5761- C5780)	TPH (C5781- C5800)	TPH (C5801- C5820)	TPH (C5821- C5840)	TPH (C5841- C5860)	TPH (C5861- C5880)	TPH (C5881- C5900)	TPH (C5901- C5920)	TPH (C5921- C5940)	TPH (C5941- C5960)	TPH (C5961- C5980)	TPH (C5981- C6000)	TPH (C6001- C6020)	TPH (C6021- C6040)	TPH (C6041- C6060)	TPH (C6061- C6080)	TPH (C6081- C6100)	TPH (C6101- C6120)	TPH (C6121- C6140)	TPH (C6141- C6160)	TPH (C6161- C6180)	TPH (C6181- C6200)	TPH (C6201- C6220)	TPH (C6221- C6240)	TPH (C6241- C6260)	TPH (C6261- C6280)	TPH (C6281- C6300)	TPH (C6301- C6320)	TPH (C6321- C6340)	TPH (C6341- C6360)	TPH (C6361- C6380)	TPH (C6381- C6400)	TPH (C6401- C6420)	TPH (C6421- C6440)	TPH (C6441- C6460)	TPH (C6461- C6480)	TPH (C6481- C6500)	TPH (C6501- C6520)	TPH (C6521- C6540)	TPH (C6541- C6560)	TPH (C6561- C6580)	TPH (C6581- C6600)	TPH (C6601- C6620)	TPH (C6621- C6640)	TPH (C6641- C6660)	TPH (C6661- C6680)	TPH (C6681- C6700)	TPH (C6701- C6720)	TPH (C6721- C6740)	TPH (C6741- C6760)	TPH (C6761- C6780)	TPH (C6781- C6800)	TPH (C6801- C6820)	TPH (C6821- C6840)	TPH (C6841- C6860)	TPH (C6861- C6880)	TPH (C6881- C6900)	TPH (C6901- C6920)	TPH (C6921- C6940)	TPH (C6941- C6960)	TPH (C6961- C6980)	TPH (C6981- C7000)	TPH (C7001- C7020)	TPH (C7021- C7040)	TPH (C7041- C7060)	TPH (C7061- C7080)	TPH (C7081- C7100)	TPH (C7101- C7120)	TPH (C7121- C7140)	TPH (C7141- C7160)	TPH (C7161- C7180)	TPH (C7181- C7200)	TPH (C7201- C7220)	TPH (C7221- C7240)	TPH (C7241- C7260)	TPH (C7261- C7280)	TPH (C7281- C7300)	TPH (C7301- C7320)	TPH (C7321- C7340)	TPH (C7341- C7360)	TPH (C7361- C7380)	TPH (C7381- C7400)	TPH (C7401- C7420)	TPH (C7421- C7440)	TPH (C7441- C7460)	TPH (C7461- C7480)	TPH (C7481- C7500)	TPH (C7501- C7520)	TPH (C7521- C7540)	TPH (C7541- C7560)	TPH (C7561- C7580)	TPH (C7581- C7600)	TPH (C7601- C7620)	TPH (C7621- C7640)	TPH (C7641- C7660)	TPH (C7661- C7680)	TPH (C7681- C7700)	TPH (C7701- C7720)	TPH (C7721- C7740)	TPH (C7741- C7760)	TPH (C7761- C7780)	TPH (C7781- C7800)	TPH (C7801- C7820)	TPH (C7821- C7840)	TPH (C7841- C7860)	TPH (C7861- C7880)	TPH (C7881- C7900)	TPH (C7901- C7920)	TPH (C7921- C7940)	TPH (C7941- C7960)	TPH (C7961- C7980)	TPH (C7981- C8000)	TPH (C8001- C8020)	TPH (C8021- C8040)	TPH (C8041- C8060)	TPH (C8061- C8080)	TPH (C8081- C8100)	TPH (C8101- C8120)	TPH (C8121- C8140)	TPH (C8141- C8160)	TPH (C8161- C8180)	TPH (C8181- C8200)	TPH (C8201- C8220)	TPH (C8221- C8240)	TPH (C8241- C8260)	TPH (C8261- C8280)	TPH (C8281- C8300)	TPH (C8301- C8320)	TPH (C8321- C8340)	TPH (C8341- C8360)	TPH (C8361- C8380)	TPH (C8381- C8400)	TPH (C8401- C8420)	TPH (C8421- C8440)	TPH (C8441- C8460)	TPH (C8461- C8480)	TPH (C8481- C8500)	TPH (C8501- C8520)	TPH (C8521- C8540)	TPH (C8541- C8560)	TPH (C8561- C8580)	TPH (C8581- C8600)	TPH (C8601- C8620)	TPH (C8621- C8640)	TPH (C8641- C8660)	TPH (C8661- C8680)	TPH (C8681- C8700)	TPH (C8701- C8720)	TPH (C8721- C8740)	TPH (C8741- C8760)	TPH (C8761- C8780)	TPH (C8781- C8800)	TPH (C8801- C8820)	TPH (C8821- C8840)	TPH (C8841- C8860)	TPH (C8861- C8880)	TPH (C8881- C8900)	TPH (C8901- C8920)	TPH (C8921- C8940)	TPH (C8941- C8960)	TPH (C8961- C8980)	TPH (C8981- C9000)	TPH (C9001- C9020)	TPH (C9021- C9040)	TPH (C9041- C9060)	TPH (C9061- C9080)	TPH (C9081- C9100)	TPH (C9101- C9120)	TPH (C9121- C9140)	TPH (C9141- C9160)	TPH (C9161- C9180)	TPH (C9181- C9200)	TPH (C9201- C9220)	TPH (C9221- C9240)	TPH (C9241- C9260)	TPH (C9261- C9280)	TPH (C9281- C9300)	TPH (C9301- C9320)	TPH (C9321- C9340)	TPH (C9341- C9360)	TPH (C9361- C9380)	TPH (C9381- C9400)	TPH (C9401- C9420)	TPH (C9421- C9440)	TPH (C9441- C9460)	TPH (C9461- C9480)	TPH (C9481- C9500)	TPH (C9501- C9520)	TPH (C9521- C9540)	TPH (C9541- C9560)	TPH (C9561- C9580)	TPH (C9581- C9600)	TPH (C9601- C9620)	TPH (C9621- C9640)	TPH (C9641- C9660)	TPH (C9661- C9680)	TPH (C9681- C9700)	TPH (C9701- C9720)	TPH (C9721- C9740)	TPH (C9741- C9760)	TPH (C9761- C9780)	TPH (C9781- C9800)	TPH (C9801- C9820)	TPH (C9821- C9840)	TPH (C9841- C9860)	TPH (C9861- C9880)	TPH (C9881- C9900)	TPH (C9901- C9920)	TPH (C9921- C9940)	TPH (C9941- C9960)	TPH (C9961- C9980)	TPH (C9981- C10000)	TPH (C10001- C10020)	TPH (C10021- C10040)	TPH (C10041- C10060)	TPH (C10061- C10080)	TPH (C10081- C10100)	TPH (C10101- C10120)	TPH (C10121- C10140)	TPH (C10141- C10160)	TPH (C10161- C10180)	TPH (C10181- C10200)	TPH (C10201- C10220)	TPH (C10221- C10240)	TPH (C10241- C10260)	TPH (C10261- C10280)	TPH (C10281- C10300)	TPH (C10301- C10320)	TPH (C10321- C10340)	TPH (C10341- C10360)	TPH (C10361- C10380)	TPH (C10381- C10400)	TPH (C10401- C10420)	TPH (C10421- C10440)	TPH (C10441- C10460)	TPH (C10461- C10480)	TPH (C10481- C10500)	TPH (C10501- C10520)	TPH (C10521- C10540)	TPH (C10541- C10560)	TPH (C10561- C10580)	TPH (C10581- C10600)	TPH (C10601- C10620)	TPH (C10621- C10640)	TPH (C10641- C10660)	TPH (C10661- C10680)	TPH (C10681- C10700)	TPH (C10701- C10720)	TPH (C10721- C10740)	TPH (C10741- C10760)	TPH (C10761- C10780)	TPH (C10781- C10800)	TPH (C10801- C10820)	TPH (C10821- C10840)	TPH (C10841- C10860)	TPH (C10861- C10880)	TPH (C10881- C10900)	TPH (C10901- C10920)	TPH (C10921- C10940)	TPH (C10941- C10960)	TPH (C10961- C10980)	TPH (C10
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Restoration Surface

Sample ID	Location	Description	Total Sulphate	Al Value in Soil	Arsenic	Boron (Water Soluble)	Cadmium	Chromium	Fluoride in Chloride	Mercury	Nickel	Lead	Selenium	Copper	Zinc	Ammonium Sulphate	Total Sulphate	Free Cyanide Sol	Total Cyanide Sol	Thiosulfate	Total Phosphate	SPH (C6)	Headspace	Residue	Total 15 PAH	
241006FWTA1	CMPT		100	8.47	5	1	0.3	17.2	5.0	0.0	25.2	20	3	20	57.5	50	0.01	1	1	1	0.15	45	3476	15	4860	
241006FWTA2	CMPT		100	8.61	10	5	0.3	14.5	0.3	0.0	27.4	23	3	18	72.2	50	0.01	1	1	1	0.15	35	2920	12	5068	
241006FWTA3	CMPT		174	9.70	5	4	0.3	20.1	0.3	0.0	28.5	29	3	18	45.5	50	0.02	1	1	1	0.15	65	4078	12	4930	
241006FWTA4	CMPT		118	9.02	10	4	0.3	21.9	0.1	0.0	28.5	17	3	18	45.5	50	0.01	1	1	1	0.15	36	2784	12	3234	
241006FWTA5	CMPT		151	8.43	5	1	0.3	24.5	0.3	0.0	23.5	29	3	18	15.3	50	0.01	1	1	1	0.15	77	3555	12	4142	
241006FWTA6	CMPT		100	9.69	7	2	0.3	18.0	0.3	0.0	22.3	16	3	18	47.3	50	0.01	1	1	1	0.15	72	2284	12	2787	
241006FWTA7	CMPT		274	3.91	8	7	0.3	23.0	0.3	0.0	23.3	28	3	21	13.8	50	0.07	1	1	1	0.15	104	3533	12	4441	
241006FWTA8	CMPT		122	8.74	7	1	0.3	31.0	12.0	0.4	22.7	17	3	18	46.1	50	0.02	1	1	1	0.15	53	3175	12	3855	
241006FWTA9	CMPT		247	7.71	5	1	0.3	18.2	3.0	0.0	25.5	27	3	21	73.2	50	0.02	1	1	1	0.15	102	2542	12	2634	
241006FWTA10	CMPT		134	8.53	5	1	0.3	18.8	0.3	0.0	25.1	13	3	18	46.1	50	0.02	1	1	1	0.15	58	3691	12	4781	
241006FWTA11	CMPT		229	8.52	5	1	0.3	18.0	0.3	0.0	23.1	28	3	20	47.3	50	0.02	1	1	1	0.15	75	3749	12	4460	
241006FWTA12	CMPT		214	9.43	5	1	0.3	48.2	3.0	0.0	32.4	28	3	24	85.7	50	0.06	1	1	1	0.15	113	5286	12	5366	
241006FWTA13	CMPT		100	8.44	2	1	0.3	25.5	0.3	0.0	28.1	10	3	9	44.8	50	0.02	1	1	1	0.15	72	2411	12	2858	
241006FWTA14	CMPT		186	9.08	3	4	0.3	18.8	0.2	0.0	28.8	32	3	20	69.9	50	0.02	1	1	1	0.15	58	2810	12	3168	
241006FWTA15	CMPT		233	9.78	5	1	0.3	51.8	3.0	0.0	28.1	30	3	19	81.1	50	0.02	1	1	1	0.15	86	4198	12	6086	
241006FWTA16	CMPT		126	9.85	3	1	0.3	24.5	0.3	0.0	35.7	17	3	20	74.9	50	0.02	1	1	1	0.15	85	4081	12	5363	
241006FWTA17	CMPT		204	4.65	5	7	0.3	19.8	0.3	0.0	27.1	15	3	8	46.1	50	0.02	1	1	1	0.15	102	2542	12	2634	
241006FWTA18	CMPT		100	8.67	11	1	0.3	27.0	0.3	0.0	21.3	114	3	91	10.3	50	0.03	1	1	1	0.15	81	5410	12	5593	
241006FWTA19	CMPT		174	9.53	3	1	0.3	30.5	0.3	0.0	34.4	37	3	12	89.1	50	0.02	1	1	1	0.15	64	4876	17	6297	
241006FWTA20	CMPT		194	8.81	5	1	0.3	22.7	0.4	0.0	28.0	37	3	82	104.5	50	0.04	1	1	1	0.15	136	2856	24	4047	
241006FWTA21	CMPT		545	8.89	5	1	0.3	16.3	0.3	0.0	34.8	31	3	76	98.4	50	0.03	1	1	1	0.15	117	2654	12	3625	
241006FWTA22	CMPT		272	8.50	5	3	0.3	16.2	0.3	0.0	23.7	17	3	9	50.7	50	0.04	1	1	1	0.15	30	23	41	864	
241006FWTA23	CMPT		260	7.87	3	3.5	0.3	150.0	3.0	0.0	33.5	34	7	16	75.0	50	0.07	1	1	1	0.15	38	150	36	570	
241006FWTA24	CMPT		580	8.88	3	3.5	0.5	30.7	0.4	0.0	32.2	44	9	35	88.0	50	0.08	1	1	1	0.15	220	44	25	490	
241006FWTA25	CMPT		300.05	6.96	3	3.5	0.3	150	24.0	0.0	30	30	3	21	60	50	0.06	1	1	1	0.15	88	34	18	460	
No of samples			25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	
Min Value			100	7.71	3	1	0.3	14.6	3.5	0.0	21.3	10	3	9	44.20	50	0.01	1	1	1	0.15	35	25	12	480	
Max Value			994	9.91	11	6	0.6	451.7	24.0	0.6	58.0	114	3	78	580.20	88	0.08	1	1	1	0.15	220	10436	67	12863	
US25															121.00											
Guidelines Value																										
Source (CLEA 30)																										
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Sample Identity	Location	Description	Total Sulphate mg/kg	pH Value in Soil	Arsenic mg/kg	Boron (Water Soluble) mg/kg	Cadmium mg/kg	Chromium mg/kg	Manganese Dioxide mg/kg	Mercury mg/kg	Nickel mg/kg	Lithium mg/kg	Selenium mg/kg	Copper mg/kg	Zinc mg/kg	Sold & Mobile Sulphate mg/kg	Total Aluminum mg/kg	PYR Oxidant Sol. mg/kg	Total Cyanide Sol. mg/kg	Thiocyathals mg/kg	Total Phospho MPLC mg/kg	SPH (C16- C28) mg/kg	Hachidine mg/kg		Total SO PAH
270407Fsite1			690	7.65	3	3.2	0.4	86.0	15.0	0.5	18.0	88	3	28	110.0	20	0.07	-	-	-	0.15	150	87	480	5300
270407Fsite2			610	7.65	3	3.0	0.4	71.0	24.0	0.5	18.0	110	3	21	110.0	50	0.10	-	-	-	0.15	280	205	120	1700
270407Fsite3			880	7.65	8	4.8	0.6	36.0	30.0	0.6	17.0	88	3	22	120.0	50	0.09	-	-	-	0.15	180	41	88	1300
270407Fsite7			1100	7.68	3	3.8	0.6	470.0	24.0	0.8	32.0	100	3	41	170.0	50	0.14	-	-	-	0.15	290	200	220	4000
080507Fsite1			690	7.60	8	3.0	0.4	31.0	8.3	0.8	16.0	87	3	22	88.0	50	0.06	-	-	-	0.15	140	32	72	940
080507Fsite2			770	7.18	6	3.5	0.4	43.0	3.0	0.6	18.0	83	3	23	100.0	50	0.10	-	-	-	0.15	190	81	84	1600
No of samples			8	8	0	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Min Value			610	7.18	3	3.0	0.4	51.0	0.3	0.5	16.0	82.0	3.0	21.0	88.00	50	0.07	-	-	-	0.15	140	32	72	940
Max Value			1100	8.08	8	3.8	0.6	470.0	30.0	0.8	32.0	110.0	0.0	41.0	170.00	60	0.14	-	-	-	0.15	290	200	220	5300
USP90																									
Guideline Value Source (CLEA etc)			10	20	3	35	5000	200	15	160	450	240	150	300							10	4,300	10,400	800	1,000,000
			Lithium Milligram	CLEA	ICRCL 18/98	CLEA	SSAC	OLEA	SSAC	CLEA	CLEA	ICRCL 30/93	SSAC									TPHCWG			

Tree-lined Undisturbed Soils

Sample Identity	Location	Description	Total Sulphate	pH Value in Soil	Arsenic	Boron (Water Soluble)	Calcium	Chromium	Hexavalent Chromium	Mercury	Manganese	Lead	Nickel	Copper	Zinc	Acid Soluble Sulphate	Total Sulphur	Free Cyanide Sol	Total Cyanide Sol	Thiocyanate	Total Phosphate (HPLC)	BPH (D15-C48)	Northwest	Southwest	Total 16 PAH
			mg/kg	pH Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
240507F001			470	7.39	12	3.5	0.8	80	6.0	0.6	38	74	3	28	200	50	0.08	1	1	1	0.15	280	340	58	780
240507F002			910	7.71	11	3.5	2.1	120	15.0	0.6	80	250	3	47	580	80	0.12	1	1	1	0.15	240	220	180	2000
240507F003			800	7.39	6	3.5	0.8	240	6.0	0.6	28	81	3	23	190	50	0.08	1	1	1	0.15	220	190	88	1450
240507F004			605	8.14	8	3.5	0.3	77	15.0	0.8	13	70	3	20	81	87	0.13	1	1	3	0.15	210	310	87	1760
240507F005			810	7.09	7	3.5	0.8	660	3.0	0.8	23	82	3	30	140	50	0.08	1	1	1	0.15	270	180	50	920
No of samples			6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
Min Value			470	8.14	7	3.5	0.3	77	3.0	0.6	13	70	3	20	81	87	0.08	1	1	1	0.15	210	180	58	780
Max Value			910	7.39	11	3.5	2.1	660	15.0	0.6	80	250	3	47	580	87	0.15	1	1	3	0.15	290	240	180	2000
USE5																									
Guideline Value				<3	20	3	30	8000	200	15	150	450	280	130	300						10	4,000	10,400	800	1,000,000
Source (CLEA etc)				Unleaded (Unleaded)	CLEA	ICRCL 30/53	CLEA	SSAC		CLEA	SSAC	CLEA	CLEA	SSAC	ICRCL 30/53						U	TPHCWD	SSAC	SSAC	TPHCWD

Cycleway Surface

Sample Identity	Location	Description	Total Sulphate	pH Value in Soil	Arsenic	Boron (Water Soluble)	Calcium	Chromium	Hexavalent Chromium	Mercury	Manganese	Lead	Nickel	Copper	Zinc	Acid Soluble Sulphate	Total Sulphur	Free Cyanide Sol	Total Cyanide Sol	Thiocyanate	Total Phosphate (HPLC)	BPH (D15-C48)	Heavy Metals	Light Metals	Total 16 PAH	
			mg/kg	pH Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg Sol	mg/kg Sol	mg/kg	mg/kg	mg/kg	mg/kg		
300507R01	cycleway	concrete fines	790	8.19	3	3.5	0.8	300	0.2	0.6	23	27	3	11	64	50	0.08	1	1	1	0.15	400	140	100	2700	
300507R02	cycleway	concrete fines	720	8.47	3	3.5	1.0	100	0.3	0.6	13	71	3	8	75	50	0.08	1	1	1	0.15	490	580	1800	28000	
300507R03	cycleway	concrete fines	870	8.98	3	3.5	1.2	820	0.8	0.6	80	50	3	24	110	50	0.13	1	1	1	0.15	1200	800	120	1800	
300507R04	cycleway	concrete fines	1100	9.34	3	3.5	1.2	1800	0.8	0.6	44	54	3	34	120	50	0.13	1	1	1	0.15	1800	840	130	2600	
300507R05	cycleway	concrete fines	1800	8.60	3	3.5	1.2	1800	0.4	0.6	40	48	3	24	94	50	0.23	1	1	1	0.15	3100	800	120	1700	
No of samples			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
Min Value			720	8.47	3	3.5	0.8	100	0.3	0.6	13	27	3	8	64	50	0.08	1	1	1	0.15	400	680	100	1800	
Max Value			1800	9.60	3	3.5	1.2	1800	0.8	0.6	80	71	3	24	120	50	0.23	1	1	1	0.15	1800	840	1800	28000	
USE5																										
Guideline Value Source (CLEA etc)				<3	20	3	30	8000	200	15	150	450	280	130	300						10	4,000	10,400	800	1,000,000	
				Unleaded (Unleaded)	CLEA	ICRCL 30/53	CLEA	SSAC		CLEA	SSAC	CLEA	CLEA	SSAC	ICRCL 30/53						U	TPHCWD	SSAC	CLEA	TPHCWD	

Undisturbed Northwestern Strip

Sample Identity	Location	Description	Total Sulphate	pH Value in Soil	Arsenic	Boron (Water Soluble)	Calcium	Chromium	Hexavalent Chromium	Mercury	Lead	Nickel	Copper	Zinc	Acid Soluble Sulphate	Total Sulphur	Free Cyanide Sol	Total Cyanide Sol	Thiocyanate	Total Phosphate (HPLC)	BPH (D15-C48)	Heavy Metals	Trace Metals	Total 16 PAH	
			mg/kg	ppm/10	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
300507TP1.01	1.2m bu		1800	8.05	23	3.5	8.0	1000	3.0	0.6	220	230	3	180	480	50	0.18	1	1	1	0.15	820	2600	320	8200
300507TP2.01	1.2m bu		840	8.14	3	3.5	1.8	880	3.0	0.6	40	62	3	30	180	50	0.11	1	1	1	0.15	1300	1250	120	2400
300507TP3.01	0.5m bu		2200	10.11	3	3.5	1.4	1800	0.8	0.6	80	94	3	27	120	50	0.18	1	1	1	0.15	1800	550	120	1800

Pre-reclamation Soil samples

Leachate Analysis

Pre-Reclamation Soil Samples

Pre-reclamation Data Summary																										
	Sample Identity	Depth (m)	Description	pH of Leachate	Mercury Low Dutch Leach	Arsenic on Leachate by ICP-MS	Boron on Leachate by ICP-MS	Cadmium on Leachate by ICP-MS	Chromium on Leachate by ICP-MS	Hexavalent Chrome On Leach	Copper on Leachate by ICP-MS	Nickel on Leachate by ICP-MS	Lead on Leachate by ICP-MS	Selenium on Leachate by ICP-MS	Zinc on Leachate by ICP-MS	Total Cyanide in Leachate	Free Cyanide Leachate	Thiocyanate Leachate	Sulphide On Leachate	Sulphate in Leachate	Free Sulphur Leachate	Tot. Phenols on Leach HPLC	Naphthalene	Benzo(a)pyrene	PAH 16 Total	PAH (9 DWS specified parameters TS)
				pH Units	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	ug/l
Pre-reclamation	221105Wta1			7.19	0.05	1	34	0.4	5	0.03	1	1	1	1	43	0.05	0.05	0.05	0.05	3	0.05	0.01	0.01	0.01	0.01	0.01
	221105Wta2			7.96	0.05	1	31	0.4	5	0.03	1	1	1	1	26	0.05	0.05	0.05	0.05	3	0.05	0.01	0.01	0.01	0.01	0.01
	221105Wta3			7.95	0.05	1	23	0.4	7	0.03	1	1	1	1	16	0.05	0.05	0.05	0.05	3	0.05	0.01	0.01	0.01	0.01	0.01
	230706FWTA1			8.34	0.05	1	44	0.4	1	0.03	1	1	1	1	4	0.05	0.05	0.05	0.50	53	0.05	0.01	0.01	0.01	14.64	0.01
	230706FWTA5			7.24	0.05	1	15	0.4	1	0.03	1	1	1	1	5	0.05	0.05	0.05	0.50	19	0.05	0.01	0.01	0.01	1.42	0.01
	230706FWTA2			7.91	0.05	1	20	0.4	1	0.03	1	1	1	1	3	0.05	0.05	0.05	0.50	40	0.05	0.01	0.01	0.01	0.01	0.01
	230706FWTA14			6.30	0.05	1	10	0.4	1	0.03	12	1	1	1	5	0.05	0.05	0.05	0.50	3	0.05	0.01	0.01	0.01	0.01	0.01
	No of samples				7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
	Min Value			7.19	0.05	1	10	0.40	1	0.03	1	1	1	1	3	0.05	0.05	0.05	0.05	3	0.05	0.01	0.01	0.01	0.01	0.01
	Max Value			8.34	0.05	1	44	0.40	7	0.03	12	1	1	1	43	0.05	0.05	0.05	0.50	53	0.05	0.01	0.01	0.01	14.64	0.01
	USE5																									
	GAC			<6, >9		50	2,000							10		0.05	0.05		250	400		0.03	10	0.01		0.1
	SSAC				1			400	5950		112	200	2340		3860											
	Source (CLEA etc)			EQS	P20	EQS	EQS	P20	P20		P20	P20	P20	WHO DWS	P20	UK DWS	UK DWS		EQS	BRE SD1		EQS	EQS	UK DWS	UK DWS	UK DWS

Post-Reclamation Soil Samples

	Sample Identity	Depth (m)	Description	pH of Leachate	Mercury Low Dutch Leach	Arsenic on Leachate by ICP-MS	Boron on Leachate by ICP-MS	Cadmium on Leachate by ICP-MS	Chromium on Leachate by ICP-MS	Hexavalent Chrome On Leach	Copper on Leachate by ICP-MS	Nickel on Leachate by ICP-MS	Lead on Leachate by ICP-MS	Selenium on Leachate by ICP-MS	Zinc on Leachate by ICP-MS	Total Cyanide in Leachate	Free Cyanide Leachate	Thiocyanate Leachate	Sulphide On Leachate	Sulphate in Leachate	Free Sulphur Leachate	Tot. Phenols on Leach HPLC	Naphthalene	Benzo(a)pyrene	PAH 16 Total	PAH 16 DWS specified parameters
				pH Units	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	ug/l
Intermediate Fill	150806FTA4			8.16	0.05	1	71	0.4	14	0.03	3	1	1	6	17	0.05	0.05	0.05	0.50	5	0.05	0.01	1.76	0.010	2.13	0.01
	150806FTA5			8.16	0.05	3	42	0.4	9	0.03	10	1	1	2	17	0.05	0.05	0.05	0.50	3	0.05	0.01	0.11	0.010	0.59	0.01
	110806FWTA2			7.97	0.05	1	75	0.4	2	0.03	12	1	1	1	3	0.05	0.05	0.05	0.50	3	0.05	0.02	0.06	0.010	0.31	0.01
	110906FWTA4			7.85	0.05	1	25	0.4	2	0.03	1	1	5	1	3	0.05	0.05	0.05	0.50	3	0.05	0.01	0.24	0.010	0.24	0.01
Restoration	270906FWTA2			6.02	0.05	1	15	0.4	4	0.03	1	1	1	1	3	0.05	0.05	0.05	0.50	3	0.05	0.01	0.01	0.010	0.01	0.01
	241006FWTA1			7.89	0.05	1	35	0.4	2	0.03	1	2	1	1	9	0.05	0.05	0.05	0.50	3	0.05	0.01	0.29	0.010	0.29	0.01
	241006FWTA4			7.85	0.05	1	21	0.4	10	0.03	1	1	1	1	15	0.05	0.05	0.05	0.50	4	0.05	0.01	0.01	0.010	10.00	0.01
	241006FWTA7			6.07	0.05	3	10	0.4	5	0.03	3	1	3	2	24	0.05	0.05	0.05	0.50	15	0.05	0.01	0.01	0.010	10.00	0.01
	241006FWTA10			7.90	0.05	1	70	0.4	1	0.03	1	1	1	1	8	0.05	0.05	0.05	0.50	8	0.05	0.01	0.21	0.010	10.00	0.01
	241006FWTA13			7.71	0.05	1	10	0.4	2	0.03	1	1	1	1	3	0.05	0.05	0.05	0.50	5	0.05	0.01	0.01	0.010	10.00	0.01
	241006FWTA16			7.73	0.05	2	10	0.4	11	0.03	3	4	4	2	27	0.05	0.05	0.05	0.50	5	0.05	0.01	0.27	0.010	0.37	0.01
	241006FWTA19			7.78	0.05	1	10	0.4	1	0.03	1	2	41	1	5	0.05	0.05	0.05	0.50	6	0.05	0.01	0.21	0.010	1.20	0.01
	131206FWTA2			7.99	0.05	1	15	0.4	28	0.04	5	11	1	1	23	0.05	0.05	0.05	0.50	5	0.05	0.03	0.01	0.010	0.28	0.01
	270407Wta1			7.54	0.05	3	70	0.4	57	0.06	4	1	1	2	3	0.05	0.05	0.05	0.50	14	0.05	0.01	0.03	0.010	0.54	0.01
270407Wta2			7.87	0.05	1	70	0.4	1	0.30	9	2	2	2	3	0.05	0.05	0.05	0.50	3	0.05	0.01	0.03	0.010	0.73	0.01	
	No of samples			15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
	Min Value			7.89	0.05	1	10	0.40	1	0.03	1	1	1	1	3	0.05	0.05	0.05	0.50	3	0.05	0.01	0.01	0.01	0.01	0.01
	Max Value			8.16	0.05	3	75	0.40	57	0.30	12	11	41	9	27	0.05	0.05	0.05	0.50	15	0.05	0.03	1.76	0.09	10.00	0.01
	USE5																									
	GAC			<6, >9		50	2,000							10		0.05	0.05		250	400		0.03	10	0.01		0.1
	SSAC				1			400	8950		112	200	2340		3860											
	Source (CLEA etc)			EQS	P20	EQS	EQ6	P20	P20		P20	P20	P20	WHO DWS	P20	UK DWS	UK DWS		EQS	BRE SD1		EQS	EQS	UK DWS	UK DWS	UK DWS

North-Western Section (cycleway and slope)

North-Western section (cycleway and shops)																											
	Sample Identity	Depth (m)	Description	pH of Leachate	Mercury Low Dutch Leach	Arsenic on Leachate by ICP-MS	Boron on Leachate by ICP-MS	Cadmium on Leachate by ICP-MS	Chromium on Leachate by ICP-MS	Hexavalent Chrome On Leach	Copper on Leachate by ICP-MS	Nickel on Leachate by ICP-MS	Lead on Leachate by ICP-MS	Selenium on Leachate by ICP-MS	Zinc on Leachate by ICP-MS	Total Cyanide in Leachate	Free Cyanide Leachate	Thiocyanate Leachate	Sulphide On Leachate	Sulphate in Leachate	Free Sulphur Leachate	Tot. Phenols on Leach HPLC	EPH	Naphthalene	PAH (9 DWS specified parameters)		
				pH Units	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	Benzo(a)pyrene	PAH 16 Total	
	300507RS1		cycleway	8.16	0.05	1	52	0.4	15	0.06	3	2	1	2	5	0.05	0.05	0.05	0.50	12	0.05	0.01	10	0.04	0.009	0.15	0.08
	300507RS4		cycleway	8.16	0.05	2	130	0.4	100	0.10	5	9	3	1	14	0.05	0.05	0.05	0.50	12	0.05	0.01	110	0.05	0.009	0.41	0.08
	300507TF1.S1		side section	8.16	0.05	3	17	0.4	25	0.04	10	2	2	1	44	0.05	0.05	0.05	0.50	3	0.05	0.01	10	0.04	0.009	0.04	0.08
	300507TF3.S1		side section	8.16	0.05	7	57	0.4	130	0.13	10	2	1	1	3	0.05	0.05	0.05	0.50	25	0.05	0.01	110	0.05	0.009	0.60	0.08
	No of samples			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
	Min Value			8.16	0.05	1	17	0.4	15	0.04	3	2	1	1	5	0.05	0.05	0.05	0.50	3	0.05	0.01	10	0.04	0.01	0.04	0.08
	Max Value			10.87	0.05	3	130	0.4	130	0.13	10	9	3	2	44	0.05	0.05	0.05	0.50	25	0.05	0.01	110	0.05	0.01	0.60	0.08
	USE5																										
	GAC			<6, >9		50	2,000							10		0.05	0.05		250	400		0.03	100	10	0.01	0.1	
	SSAC				1			400	5950		112	200	2340		3860												
	Source (CLEA etc)			EQS	P20	EQS	EQS	P20	P20		P20	P20	P20	WHO DWS	P20	UK DWS	UK DWS		EQS	BRE SD1		EQS	UK DWS	EQS	UK DWS	UK DWS	UK DWS

Topsoil Analysis

Project: Brymbo Steelworks
Job No: R175
Area of Site: Fron Water Treatment Area

Date: 27.07.06
Copies: Parkhill Estates
Jason Parry

Date sampling: 07/07/06
Samples Collected: 3
Staff: DB (SGP)
Record: Complete analysis results and sample logs attached
Sample Locations: Samples collected from topsoil pile on eastern edge of existing FronWater Treatment Area, located at southern end of the former Brymbo Steelworks site.

Contaminant	Soil standard adopted (mg/kg)	Source	Maximum value (mg/kg)
pH	<3	United Utilities	6.76
arsenic	20	CLEA SGV	6
cadmium	pH3 = 1; pH7 = 2; pH8 = 8	CLEA SGV	<1
chromium	130	CLEA SGV	27
mercury	8	CLEA SGV	<1.2
lead	450	CLEA SGV	90
nickel	50	CLEA SGV	10
selenium	35	CLEA SGV	<3
copper	130	ICRCL plants	12
zinc	300	ICRCL plants	92
boron	3	ICRCL plants	1
TPH C6-40	4000	TPHCWG	<10
total 16 PAH	1000	TPHCWG	2.20
naphthalene	9.7	CLEA SS	0.25

BaP	0.9	CLEA SS	0.11
-----	-----	---------	------

Note: Criteria for hydrocarbons based on criteria agreed with WCBC for housing formation surfaces and batter topsoil. Specific criteria for topsoils to be used in landscaped areas have not been derived.

Samples collected from topsoil exposed on eastern edge of Fron Water Treatment Area by Parkhill Estates to allow sample collection. Soil destination is to be landscaped areas of ERLIC on NWDM and other areas to be determined.

Lagoon N°1 still containing water.

TP070706TS1

Grid Ref SJ

Depth (m)	Description	Sample	Notes
0.00	Vegetated clayey brown soil with gravel sized stones, root matter and occasional light brown pieces of sandy clay. Base of trial pit.	070706TS1	

TP070706TS2

Grid Ref SJ

Depth (m)	Description	Sample	Notes
0.00	Vegetated clayey brown soil with gravel sized stones and root matter. Base of trial pit.	070706TS2	

TP070706TS3

Grid Ref SJ

Depth (m)	Description	Sample	Notes
0.00	Vegetated clayey brown soil with gravel – cobble sized stones and root matter. Base of trial pit.	070706TS3	



Smith Grant Partnership LLP
Station House
Station Road
Ruabon
Wrexham
LL14 6DL

ATTN: Simon Dennis

17 NOV 2004

CERTIFICATE OF ANALYSIS

Date: 10 November, 2004

Our Reference: 04/15900/02/01

Your Reference: 8352/BY

Location: Not Specified

A total of 2 samples was received for analysis on Tuesday, 12 October 2004 and completed on Wednesday, 03 November 2004. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Signed

Hazel Davidson

Operations Manager
Analytical Services

Compiled By

Gemma Rowland



ALcontrol Geochem TEST SCHEDULE

JOB NUMBER : 04/15900/02

CLIENT : Smith Grant Partnership LLP

CONTACT : Simon Dennis

DATE OF RECEIPT : 12/10/04

LOCATION : Not Specified

BATCH NUMBER : 1

CLIENT REF/CODE : 8352/BY

ORDER NUMBER :

TURNAROUND : 10 days

Numeric values indicate
additional scheduling
* Indicates test subcontracted

Sample Number	Sample Identity	P / V	Depth (m)	Sample Type	ISO 17025 Accredited ?														
						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1 2	BL2 BL3	TUB TUB	UNKNOWN UNKNOWN	SOIL SOIL		PAH Spec by MS (S)	X	X											
						Dioxins (S)*	X	X											
						Arsenic	X	X											
						Cadmium	X	X											
						Chromium	X	X											
						Copper	X	X											
						Mercury	X	X											
						Lead	X	X											
						Nickel	X	X											
						Zinc	X	X											
Total Number of Tests						2	2	2	2	2	2	2	2	2	2	2	2	2	2

ALcontrol Geochem Analytical Services

Sample Descriptions

Job Number: 04/15900/02/01
Client: Smith Grant Partnership LLP
Client Ref : 8352/BY

Grain sizes	
<0.063mm	Very Fine
0.1mm - 0.063mm	Fine
0.1mm - 2mm	Medium
2mm - 10mm	Coarse
>10mm	Very Coarse

[illegible]

* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

Validated ☒
Preliminary ☐

ALcontrol Geochem Analytical Services

Table Of Results

* ISO 17025 accredited
M MCERTS accredited
* Subcontracted test
» Shown on prev. report

Job Number: 04/15900/02/01 Matrix: SOLID
Client: Smith Grant Partnership LLP Location: Not Specified
Client Ref. No.: 8352/BY Client Contact: Simon Dennis

Sample Identity	BL2	BL3								Method Code	LoD/Units
Depth (m)											
Sample Type	SOIL	SOIL									
Sampled Date	12.10.04	12.10.04									
Sample Received Date	12.10.04	12.10.04									
Batch	1	1									
Sample Number(s)	1	2									
PAH by GCMS											
Naphthalene	39041	3174								TM074 ^M	<10 ug/kg
Acenaphthylene	93	76								TM074 ^M	<5 ug/kg
Acenaphthene	2648	731								TM074 ^M	<14 ug/kg
Fluorene	1956	650								TM074 ^M	<12 ug/kg
Phenanthrene	2425	1328								TM074 ^M	<21 ug/kg
Anthracene	402	322								TM074 ^M	<9 ug/kg
Fluoranthene	517	840								TM074 ^M	<25 ug/kg
Pyrene	389	640								TM074 ^M	<22 ug/kg
Benz(a)anthracene	172	399								TM074 ^M	<12 ug/kg
Chrysene	220	558								TM074 ^M	<10 ug/kg
Benzo(b)fluoranthene	128	465								TM074 ^M	<16 ug/kg
Benzo(k)fluoranthene	81	325								TM074 ^M	<25 ug/kg
Benzo(a)pyrene	118	410								TM074 ^M	<12 ug/kg
Indeno(123cd)pyrene	83	275								TM074 ^M	<11 ug/kg
Dibenzo(ah)anthracene	25	90								TM074 ^M	<8 ug/kg
Benzo(ghi)perylene	107	275								TM074 ^M	<10 ug/kg
PAH 16 Total	48405	10558								TM074 ^M	<25 ug/kg

All results expressed on a dry weight basis.

Date 10.11.2004

ALcontrol Geochem Analytical Services
Table Of Results - Appendix

Job Number: 04/15900/02/01
Client: Smith Grant Partnership LLP
Client Ref. No.: 8352/BY

Report Key :

NDP	No Determination Possible	*	Subcontracted test
NFD	No Fibres Detected	»	Result previously reported (Incremental reports only)
#	ISO 17025 accredited	M	MCERTS Accredited
		EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

Summary of Method Codes contained within report:

[illegible]

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

ALcontrol Geochem Analytical Services
Table Of Results - Appendix

Job Number: 04/15900/02/01
Client: Smith Grant Partnership LLP
Client Ref. No.: 8352/BY

Summary of Coolbox temperatures

Batch No.	Coolbox Temperature (°C)
1	16

APPENDIX

APPENDIX

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following:
NRA Leach tests, flash point, ammoniacal N₂ by the BRE method, VOC TICS, SVOC TICS, TOF-MS SCAN/SEARCH and TOF-MS TICS.
2. Samples will be run in duplicate upon request, but an additional charge may be incurred.
3. A sub sample of all samples received will be retained free of charge for one month for both soils and waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.
4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.
5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.
6. When requested, an asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD – no fibres detected. If asbestos is detected, then identification and quantification is carried out by ALcontrol Technichem. If a sample is suspected of containing asbestos, then drying and crushing will be suspended on that sample until the asbestos results are known. If asbestos is present, then no analysis requiring dry sample will be undertaken.
7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace is present in the volatile sample.
8. NDP – No determination possible due to insufficient/unsuitable sample.
9. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.
10. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

Last updated June 2004

ALCONTROL GEOCHEM - MCERTS UPDATE (1st November 2004)

Annex A (normative)

Table 1 - Performance characteristics (metals and organometallics)	UKAS	MCERTS
Antimony	yes	p
Arsenic	yes	p
Barium	yes	p
Beryllium	yes	p
Boron (water soluble)	yes	p
Cadmium	yes	p
Cobalt	yes	p
Copper	yes	p
Chromium	yes	p
Iron	yes	p
Lead	yes	p
Manganese	yes	p
Mercury	yes	p
Molybdenum	yes	p
Nickel	yes	p
Organolead compounds	no	no
Organotin compounds	no	no
Selenium	yes	p
Thallium	yes	p
Vanadium	yes	p
Zinc	yes	p

Table 2 - Performance characteristics (inorganics)	UKAS	MCERTS
Easily liberated cyanide	yes	yes
Complex cyanide	yes	yes
Sulphide	yes	no - p
Sulphate	yes	p
Sulphur	yes	no - p
Thiocyanate	yes	yes

Table 3 - Performance characteristics (organics)	UKAS	MCERTS
Benzene	yes	yes
Benzo[a]pyrene	yes	p
Chlorobenzene	yes	yes
Chloromethane	yes	p
Chlorophenol	yes	p
Chlorotoluene	yes	p
1,2-dichloroethane	yes	p
Dichloromethane	yes	p
"Dioxins"	no	no
Ethylbenzene	yes	yes
"Furans"	no	no
Hexachloro-1,3-butadiene	yes	p
"Hydrocarbons"	yes	yes
"Nitroaromatics"	yes	p
Pentachlorophenol	p	no - p
"Phenols"	yes	p
"Phthalate esters"	p	no - p
"Polycyclic aromatic hydrocarbons" - 16	yes	13
"Polychlorinated biphenyls"	yes	no - p
Tetrachloroethane	yes	p
Tetrachloroethene	yes	yes
Tetrachloromethane (carbon tetrachloride)	yes	yes
Toluene	yes	yes
Trichloroethane	yes	p
Trichloroethene	yes	yes
Trichloromethane (chloroform)	yes	p
Vinyl chloride	yes	yes
Xylene	yes	yes

yes - accreditation awarded

p = pending - data meeting MCERTS criteria submitted to UKAS - awaiting certification

no - p = data not yet submitted - will be in next few weeks

no = not being submitted in the near future



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ORG.NR 556152-0916 STYRELSENS SÄTE: LINKÖPING

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Uppdragsgivare

ALcontrol Laboratories
Chester

Chester street
CH48RD Chester, UK

Avser

Information about the project

Soil

Project number : 04/15900

Information about sample and sampling

Project number	: 04/15900	Day of sampling	: 2004-10-14
Sample description	: Soil	Day of arrival	: 2004-10-19
Sample name	: 1 (Order No 8706)	Receiving time	: 1600
		Reference	: A Clarkson

Results of the analyses

Metodbeteckning	Analys/Undersökning av	Resultat	Enhet	Mätosäkerhet
SS-EN-1948-2/3:1996	Rec 123789 HxCDF Sampl spike	73	%	
SS-EN-1948-2/3:1996	Rec 234678 HxCDF Extr spike	75	%	
SS-EN-1948-2/3:1996	Rec 1234678 HpCDF Extr spike	75	%	
SS-EN-1948-2/3:1996	Rec 1234789 HpCDF Samplspike	81	%	
SS-EN-1948-2/3:1996	Rec OCDF Extr spike	88	%	
SS 028113-1	Dry substance DS	67.3	%	10%

Angiven mätosäkerhet är beräknad med täckningsfaktor k = 2. Vid intervallangivelse avser det högre talet mätosäkerheten vid halter nära rapporteringsgränsen

RAPPORT

Sida 2 (2)

utfärdad av ackrediterat laboratorium
REPORT issued by an Accredited Laboratory

**Rapport Nr 04179684**

ALcontrol Laboratories
Chester

Chester street
CH48RD Chester, UK

Linköping 2004-11-01

Berit Jonsson
Analyst



ALcontrol AB

Box 1083, 581 10 Linköping Tel: 013-25 49 00 Fax: 013-12 17 28
ORG NR 556152-0918 STYRELSENS SÄTE: LINKÖPING

Vid frågor kontakta vår kundtjänst vid Tel: 020-25 49 00

Uppdragsgivare

ALcontrol Laboratories
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Chester street
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Avser

Information about the project

Project number : 04/15900



RAPPORT

Sida 1 (2)

utfärdad av ackrediterat laboratorium
REPORT issued by an Accredited Laboratory

Rapport Nr 04179684

ALcontrol Laboratories
Chester

Chester street
CH48RD Chester, UK

Information about sample and sampling

Project number	: 04/15900	Day of sampling	: 2004-10-14
Sample description	: Soil	Day of arrival	: 2004-10-19
Sample name	: 1 (Order No 8706)	Receiving time	: 1600
		Reference	: A Clarkson

Results of the analyses

Metodbeteckning	Analys/Undersökning av	Resultat	Enhet	Mätosäkerhet
SS-EN-1948-2/3:1996	2378 TCDD	<2	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	12378 PeCDD	<1	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123478 HxCDD	<1	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123678 HxCDD	2.3	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123789 HxCDD	2.4	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	1234678 HpCDD	24	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	OCDD	78	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	2378 TCDF	4.2	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	12378 PeCDF	16	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	23478 PeCDF	2.8	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123478 HxCDF	3.2	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123678 HxCDF	2.6	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123789 HxCDF	<1	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	234678 HxCDF	3.7	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	1234678 HpCDF	35	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	1234789 HpCDF	2.8	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	OCDF	38	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	TCDD-ekv I-TEQ Lower Bound	4.8	ng/kg DS	+/-35%
SS-EN-1948-2/3:1996	TCDD-ekv I-TEQ Upper Bound	7.5	ng/kg DS	+/-35%
SS-EN-1948-2/3:1996	Rec 2378 TCDD Extr spike	73	%	
SS-EN-1948-2/3:1996	Rec 12378 PeCDD Extr spike	74	%	
SS-EN-1948-2/3:1996	Rec 123478 HxCDD Extr spike	77	%	
SS-EN-1948-2/3:1996	Rec 123678 HxCDD Extr spike	70	%	
SS-EN-1948-2/3:1996	Rec 1234678 HpCDD Extr spike	81	%	
SS-EN-1948-2/3:1996	Rec OCDD Extr spike	83	%	
SS-EN-1948-2/3:1996	Rec 2378 TCDF Extr spike	72	%	
SS-EN-1948-2/3:1996	Rec 12378 PeCDF Sample spike	71	%	
SS-EN-1948-2/3:1996	Rec 23478 PeCDF Extr spike	70	%	
SS-EN-1948-2/3:1996	Rec 123478 HxCDF Extr spike	71	%	
SS-EN-1948-2/3:1996	Rec 123678 HxCDF Extr spike	78	%	

Angivna mätosäkerhet är beräknad med täckningsfaktor k = 2. Vid intervallangivelse avses det högre (niet mätosäkerhet) vid närmare rapporteringsgränser

(forts.)



ALcontrol Laboratories

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RAPPORT

Sida 2 (2)

utfärdad av ackrediterat laboratorium
REPORT issued by an Accredited Laboratory

Rapport Nr 04179685

ALcontrol Laboratories
Chester

Chester street
CH48RD Chester, UK

Avser

Information about the project

Soil

Project number : 04/15900

Information about sample and sampling

Project number	: 04/15900	Day of sampling	: 2004-10-14
Sample description	: Soil	Day of arrival	: 2004-10-19
Sample name	: 2 (Order No 8706)	Receiving time	: 1600
		Reference	: A Clarkson

Results of the analyses

Metodbeteckning	Analys/Undersökning av	Resultat	Enhet	Mätosäkerhet
SS-EN-1948-2/3:1996	Rec 123789 HxCDF Sampl spike	71	%	
SS-EN-1948-2/3:1996	Rec 234678 HxCDF Extr spike	75	%	
SS-EN-1948-2/3:1996	Rec 1234678 HpCDF Extr spike	72	%	
SS-EN-1948-2/3:1996	Rec 1234789 HpCDF Sampl spike	76	%	
SS-EN-1948-2/3:1996	Rec OCDF Extr spike	70	%	
SS 0281 13-1	Dry substance DS	61.9	%	10%

Angiven mätosäkerhet är beräknad med täckningsfaktor k = 2. Vid intermedieär avser det högre talat mätvärden som ett högre värde rekommenderas.

Linköping 2004-11-01

Berit Jonsson

Berit Jonsson
Analyst

11/16 00051



ALcontrol AB

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ORG.NR 556152-0916 STYRELSENS SÄTE: LINKÖPING

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Uppdragsgivare

ALcontrol Laboratories
Chester

Chester street
CH48RD Chester, UK

Avser

Information about the project

Project number : 04/15900

Soil

RAPPORT

Side 1 (2)

utfärdad av ackrediterat laboratorium
REPORT issued by an Accredited Laboratory



1006
ISO/IEC 17025

Rapport Nr 04179685

ALcontrol Laboratories
Chester

Chester street
CH48RD Chester, UK

Information about sample and sampling

Project number : 04/15900
Sample description : Soil
Sample name : 2 (Order No: 8706)

Day of sampling : 2004-10-14
Day of arrival : 2004-10-19
Receiving time : 1600
Reference : A Clarkson

Results of the analyses

Metodbeteckning	Analys/Undersökning av	Resultat	Enhet	Måttavskallning
SS-EN-1948-2/3:1996	2378 TCDD	<2	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	12378 PeCDD	1.9	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123478 HxCDD	<1	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123678 HxCDD	3.8	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123789 HxCDD	3.3	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	1234678 HpCDD	25	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	OCDD	71	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	2378 TCDF	5.8	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	12378 PeCDF	15	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	23478 PeCDF	12	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123478 HxCDF	6.7	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123678 HxCDF	5.2	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123789 HxCDF	2.0	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	234678 HxCDF	5.5	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	1234678 HpCDF	25	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	1234789 HpCDF	2.8	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	OCDF	29	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	TCDD-ekv I-TEQ Lower Bound	14	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	TCDD-ekv I-TEQ Upper Bound	14	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	Rec 2378 TCDD Extr spike	83	%	
SS-EN-1948-2/3:1996	Rec 12378 PnCDD Extr spike	81	%	
SS-EN-1948-2/3:1996	Rec 123478 HxCDD Extr spike	75	%	
SS-EN-1948-2/3:1996	Rec 123678 HxCDD Extr spike	71	%	
SS-EN-1948-2/3:1996	Rec 1234678 HpCDD Extr spike	78	%	
SS-EN-1948-2/3:1996	Rec OCDD Extr spike	71	%	
SS-EN-1948-2/3:1996	Rec 2378 TCDF Extr spike	67	%	
SS-EN-1948-2/3:1996	Rec 12378 PeCDF Sample spike	71	%	
SS-EN-1948-2/3:1996	Rec 23478 PeCDF Extr spike	68	%	
SS-EN-1948-2/3:1996	Rec 123478 HxCDF Extr spike	68	%	
SS-EN-1948-2/3:1996	Rec 123678 HxCDF Extr spike	75	%	

Angivna mätvärden är beräknade med tätningsfaktor $z = 2$. Vid övervakningspunkter där högre än i analyskriteriet vid halter nära rapporteringsgränser.

(Fölts.)



ALcontrol Geochem

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email: mkt@alcontrol.co.uk
website: www.alcontrol.co.uk

RECEIVED

30 NOV 2005

Smith Grant Partnership LLP
Station House
Station Road
Ruabon
Wrexham
LL14 6DL

ATTN: Derek Boothby

CERTIFICATE OF ANALYSIS

Date: 17 November, 2005
Our Reference: 05/15760/02/01
Your Reference: 8352/BY
Location: NONE

A total of 9 samples was received for analysis on Monday, 24 October 2005 and completed on Thursday, 17 November 2005. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials- whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Signed

Diane Whittlestone
Environmental Chemist
Analytical Services

Compiled By

Gemma Rowland

ALcontrol Geochem

JOB NUMBER : 05/15760/02

CLIENT : Smith Grant Partnership LLP

CONTACT : Derek Boothby

DATE OF RECEIPT : 24/10/05

LOCATION : NONE

BATCH NUMBER : 1

CLIENT REF/CODE : 8352/BY

ORDER NUMBER :

TURNAROUND : 10 days

Numeric values indicate additional scheduling

* Indicates test subcontracted

[illegible]

ALcontrol Geochem Analytical Services

Sample Descriptions

Job Number: 05/15760/02/01
Client: Smith Grant Partnership LLP
Client Ref : 8352/BY

Grain sizes	
<0.063mm	Very Fine
0.1mm - 0.063mm	Fine
0.1mm - 2mm	Medium
2mm - 10mm	Coarse
>10mm	Very Coarse

[illegible]

* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

W ISO 17025 accredited
M MCERTS accredited
* Subcontracted test
» Shown on prev. report

Client Contact: Derek Boothby

[illegible]

Page 5 of 10

[†] ISO 17025 accredited
^M MCERTS accredited
^{*} Subcontracted test
[»] Shown on prev. report

Client Contact: Derek Boothby

[illegible]
$$\mathbb{D}_N \subseteq \mathcal{L} \subseteq \mathcal{L}(0)$$

ALcontrol Geochem Analytical Services
Table Of Results - Appendix

Job Number: 05/15760/02/01
Client: Smith Grant Partnership LLP
Client Ref. No.: 8352/BY

Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03×10^{-7}

NDP	No Determination Possible	*	Subcontracted test
NFD	No Fibres Detected	»	Result previously reported (Incremental reports only)
#	ISO 17025 accredited	M	MCERTS Accredited
PFD	Possible Fibres Detected	EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

Summary of Method Codes contained within report :

[illegible]

[†] Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.

Table Of Results - Appendix

Client Ref. No.: 8352/BY

Summary of Coolbox temperatures

[illegible]

APPENDIX

APPENDIX

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following:
NRA Leach tests, flash point, ammoniacal N₂ by the BRE method, VOC TICS, SVOC TICS, TOF-MS SCAN/SEARCH and TOF-MS TICS.
2. Samples will be run in duplicate upon request, but an additional charge may be incurred.
3. A sub sample of all samples received will be retained free of charge for one month for both soils and waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.
4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.
5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.
6. When requested, an asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD – no fibres detected. If asbestos is detected, then identification and quantification is carried out by ALcontrol Shutler. If a sample is suspected of containing asbestos, then drying and crushing will be suspended on that sample until the asbestos results are known. If asbestos is present, then no analysis requiring dry sample will be undertaken.
7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace is present in the volatile sample.
8. NDP – No determination possible due to insufficient/unsuitable sample.
9. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.
10. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.
11. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.
12. **Surrogate recoveries** – Currently the only analyses which are surrogate corrected are EPH and PAHs on soils.
13. **Product analyses** – Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.
14. MCERTS – When many instruments are used for MCERTS analysis, there may be occasions when the precision and bias do not fall within the set MCERTS criteria (which are even lower than those required by USEPA). Under these circumstances, although the analysis will have been conducted using the full MCERTS method, the certificate will be issued omitting the "m" signifying MCERTS accreditation. Precision and bias data is available on request.

ALCONTROL GEOCHEM - MCERTS UPDATE (19th October 2005)

Annex A (normative)

Table 1 - Performance characteristics (metals and organometallics)	UKAS	MCERTS
Antimony	yes	p
Arsenic	yes	yes
Barium	yes	yes
Beryllium	yes	yes
Boron (water soluble)	yes	yes
Cadmium	yes	yes
Cobalt	yes	yes
Copper	yes	yes
Chromium	yes	yes
Iron	yes	yes
Lead	yes	yes
Manganese	yes	yes
Mercury	yes	p
Molybdenum	yes	yes
Nickel	yes	yes
Organolead compounds	no	no
Organotin compounds	no	no
Selenium	yes	yes
Thallium	yes	p
Vanadium	yes	yes
Zinc	yes	yes

Table 2 - Performance characteristics (inorganics)	UKAS	MCERTS
Easily liberated cyanide	yes	yes
Complex cyanide	yes	yes
pH	yes	yes
LOI	yes	yes
Sulphide	yes	p
Sulphate	yes	yes
Sulphur	yes	yes
Thiocyanate	yes	yes

Table 3 - Performance characteristics (organics)	UKAS	MCERTS
Benzene	yes	yes
Benzo[a]pyrene	yes	yes
Chlorobenzene	yes	yes
Chloromethane	yes	yes
Chlorophenol (2-chlorophenol)	yes	yes
Chlorotoluene (2-chlorotoluene, 4-chlorotoluene)	yes	yes
1,2-dichloroethane	yes	yes
Dichloromethane	yes	yes
"Dioxins"	no	no
Ethylbenzene	yes	yes
"Furans"	no	no
Hexachloro-1,3-butadiene	yes	yes
"Hydrocarbons"	yes	yes
"Nitroaromatics"	yes	no
Loss on Ignition	yes	yes
Pentachlorophenol	p	p
"Phenols"	yes	yes
"Phthalate esters"	p	p
"Polyaromatic hydrocarbons" - 16	yes	yes - 16
"Polychlorinated biphenyls"	yes	p
Tetrachloroethane	yes	no
Tetrachloroethene	yes	yes
Tetrachloromethane (carbon tetrachloride)	yes	yes
Toluene	yes	yes
Trichloroethane	yes	yes
Trichloroethene	yes	yes
Trichloromethane (chloroform)	yes	yes
Vinyl chloride	yes	yes
Xylene	yes	yes

yes - accreditation awarded

p = pending - data meeting MCERTS criteria submitted to UKAS - awaiting certification

no = not being submitted in the near future



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RAPPORT

Sida 1 (2)

utförd av ackrediterat laboratorium
REPORT issued by an Accredited Laboratory

Rapport Nr 05207738

ALcontrol Laboratories
Chester
Gemma Rowland
Chester street
CH48RD Chester, UK

Avser

Information about the project

Solid

Project number : 15760

Information about sample and sampling

Project number	: 15760 P.O. No 10920	Day of sampling	:
Sample description	: Solid	Day of arrival	: 2005-10-27
Sample name	: 15760-2	Receiving time	: 13.10
		Reference	: G Rowland

Results of the analyses

Metodbeteckning	Analys/Undersökning av	Resultat	Enhet	Metosäkerhet
SS-EN-1948-2/3:1996	2378 TCDD	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	12378 PeCDD	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123478 HxCDD	<2	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123678 HxCDD	8.4	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123789 HxCDD	4.8	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	1234678 HpCDD	56	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	OCDD	430	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	2378 TCDF	4.7	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	12378 PeCDF	4.1	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	23478 PeCDF	6.2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123478 HxCDF	6.3	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123678 HxCDF	4.2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123789 HxCDF	5.3	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	234678 HxCDF	5.3	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	1234678 HpCDF	320	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	1234789 HpCDF	4.5	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	OCDF	500	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	TCDD + TEQ Lower Bound	12	ng/kg DS	+/-35%
SS-EN-1948-2/3:1996	TCDD + TEQ Upper Bound	15	ng/kg DS	+/-35%
SS-EN-1948-2/3:1996	Rec 2378 TCDD Extr spike	97	%	
SS-EN-1948-2/3:1996	Rec 12378 PeCDD Extr spike	89	%	
SS-EN-1948-2/3:1996	Rec 123478 HxCDD Extr spike	141	%	
SS-EN-1948-2/3:1996	Rec 123678 HxCDD Extr spike	69	%	
SS-EN-1948-2/3:1996	Rec 1234678 HpCDD Extr spike	95	%	
SS-EN-1948-2/3:1996	Rec OCDD Extr spike	106	%	
SS-EN-1948-2/3:1996	Rec 2378 TCDF Extr spike	95	%	
SS-EN-1948-2/3:1996	Rec 12378 PeCDF Extr spike	78	%	
SS-EN-1948-2/3:1996	Rec 23478 PeCDF Extr spike	100	%	
SS-EN-1948-2/3:1996	Rec 123478 HxCDF Extr spike	122	%	
SS-EN-1948-2/3:1996	Rec 123678 HxCDF Extr spike	90	%	

Angivna mätvärden är beräknade med tätningsfaktor k = 2. Vid intervallgivelse avser det högre ättet mätvärket och vid högre värden rapporteringsgränsen.



ALcontrol Laboratories

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RAPPORT

Sida 2 (2)

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REPORT issued by an Accredited Laboratory

Rapport Nr 05207738

ALcontrol Laboratories
Chester
Gemma Rowland
Chester street
CH48RD Chester, UK

Avser

Information about the project

Solid

Project number : 15760

Information about sample and sampling

Project number	: 15760 P.O No: 10920	Day of sampling	: -
Sample description	: Solid	Day of arrival	: 2005-10-27
Sample name	: 15760-2	Receiving time	: 13.10
		Reference	: G Rowland

Results of the analyses

Metodbeteckning	Analys/Undersökning av	Resultat	Enhet	Mätosäkerhet
SS-EN-1948-2/3:1996	Rec 123789 HxCDF Extr spike	111	%	
SS-EN-1948-2/3:1996	Rec 234678 HxCDF Extr spike	97	%	
SS-EN-1948-2/3:1996	Rec 1234678 HpCDF Extr spike	93	%	
SS-EN-1948-2/3:1996	Rec 1234789 HpCDF Extr spike	86	%	
SS-EN-1948-2/3:1996	Rec GCDF Extr spike	94	%	
SS 028113-1	Dry substance DS	70.4	%	10%

Angiven mätosäkerhet är beräknad med täckningsfaktor k = 2. Vid intervallgivning avser det högre värdet mätosäkerheten vid halver nära rapporteringsgränsen.

Linköping 2005-11-11

Jan Molander
Analyst



ALcontrol AB

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RAPPORT

Sida 1 (2)

utfärdad av ackrediterat laboratorium
REPORT issued by an Accredited Laboratory

Rapport Nr 05207739

ALcontrol Laboratories
Chester
Gemma Rowland
Chester street
CH48RD Chester, UK

Avser

Information about the project

Solid

Project number : 15760

Information about sample and sampling

Project number	: 15760 P.O. No 10920	Day of sampling	:
Sample description	: Solid	Day of arrival	: 2005-10-27
Sample name	: 15760-5	Receiving time	: 13:10
		Reference	: G Rowland

Results of the analyses

Metodbeteckning	Analys/Undersökning av	Resultat	Enhet	Måttavvikelse
SS-EN-1948-2/3:1996	2378 TCDD	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	12378 PeCDD	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123478 HxCDD	<2	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123678 HxCDD	4.7	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123789 HxCDD	2.6	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	1234678 HpCDD	4.3	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	OCDD	19	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	2378 TCDF	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	12378 PeCDF	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	23478 PeCDF	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123478 HxCDF	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123678 HxCDF	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123789 HxCDF	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	234678 HxCDF	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	1234678 HpCDF	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	1234789 HpCDF	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	OCDF	<5	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	TCDD I-TEQ Lower Bound	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	TCDD I-TEQ Upper Bound	6.1	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	Rec 2378 TCDD Extr spike	88	%	
SS-EN-1948-2/3:1996	Rec 12378 PeCDD Extr spike	85	%	
SS-EN-1948-2/3:1996	Rec 123478 HxCDD Extr spike	124	%	
SS-EN-1948-2/3:1996	Rec 123678 HxCDD Extr spike	79	%	
SS-EN-1948-2/3:1996	Rec 1234678 HpCDD Extr spike	94	%	
SS-EN-1948-2/3:1996	Rec OCDD Extr spike	106	%	
SS-EN-1948-2/3:1996	Rec 2378 TCDF Extr spike	88	%	
SS-EN-1948-2/3:1996	Rec 12378 PeCDF Extr spike	72	%	
SS-EN-1948-2/3:1996	Rec 23478 PeCDF Extr spike	96	%	
SS-EN-1948-2/3:1996	Rec 123478 HxCDF Extr spike	112	%	
SS-EN-1948-2/3:1996	Rec 123678 HxCDF Extr spike	88	%	

Angivna måttavikelser är beräknade med täckningsfaktor k = 2. Vid konvationsgränser avser det högre eller lägre värde. Vid högre värde gäller närmast närmaste konvationsgränser.

**ALcontrol AB**

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**RAPPORT**

Sida 2 (2)

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REPORT issued by an Accredited Laboratory

Rapport Nr 05207739

ALcontrol Laboratories
Chester
Gemma Rowland
Chester street
CH48RD Chester, UK

*Avser***Information about the project****Solid**

Project number : 15760

Information about sample and sampling

Project number	: 15760 P.O. No 10920	Day of sampling	: -
Sample description	: Solid	Day of arrival	: 2005-10-27
Sample name	: 15760-5	Receiving time	: 13.10
		Reference	: G Rowland

Results of the analyses

Metodberäkning	Analys/Undersökning av	Resultat	Enhet	Mätosäkerhet
SS-EN-1948-2/3:1996	Rec 123789 HxCDF Extr spike	103	%	
SS-EN-1948-2/3:1996	Rec 234678 HxCDF Extr spike	94	%	
SS-EN-1948-2/3:1996	Rec 1234678 HpCDF Extr spike	91	%	
SS-EN-1948-2/3:1996	Rec 1234789 HpCDF Extr spike	88	%	
SS-EN-1948-2/3:1996	Rec OCDF Extr spike	94	%	
SS 028113-1	Dry substance DS	84,8	%	10%

Angiven mätosäkerhet är beräknad med täckningsfaktor k = 2. Vid intervallangivelse avser det högre talet mätosäkerheten vid höfter nära rapporteringsgränsen.

Linköping 2005-11-11

Jan Molander
Analyt



ALcontrol AB

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RAPPORT

Sida 1 (2)

utfärdad av ackrediterat laboratorium
REPORT issued by an Accredited Laboratory

Rapport Nr 05207740

Avser

Information about the project

Solid

Project number : 15760

Information about sample and sampling

Project number	: 15760 P.O. No 10920	Day of sampling	:
Sample description	: Solid	Day of arrival	: 2005-10-27
Sample name	: 15760-8	Receiving time	: 13.10
		Reference	: G Rowland

Results of the analyses

Metodbeteckning	Analys/Undersökning av	Resultat	Enhet	Målnöjdhets
SS-EN-1948-2/3:1996	2378 TCDD	<2	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	12378 PeCDD	2.8	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123478 HxCDD	<2	ng/kg DS	+/-25%
SS-EN-1948-2/3:1996	123678 HxCDD	25	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123789 HxCDD	13	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	1234678 HpCDD	60	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	OCDD	160	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	2378 TCDF	7.0	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	12378 PeCDF	5.9	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	23478 PeCDF	8.5	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123478 HxCDF	7.3	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123678 HxCDF	6.9	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	123789 HxCDF	2.6	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	234678 HxCDF	7.4	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	1234678 HpCDF	28	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	1234789 HpCDF	4.6	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	OCDF	25	ng/kg DS	+/-30%
SS-EN-1948-2/3:1996	TCDD I-TEQ Lower Bound	15	ng/kg DS	+/-35%
SS-EN-1948-2/3:1996	TCDD I-TEQ Upper Bound	17	ng/kg DS	+/-35%
SS-EN-1948-2/3:1996	Rec 2378 TCDD Extr spike	80	%	
SS-EN-1948-2/3:1996	Rec 12378 PeCDD Extr spike	84	%	
SS-EN-1948-2/3:1996	Rec 123478 HxCDD Extr spike	106	%	
SS-EN-1948-2/3:1996	Rec 123678 HxCDD Extr spike	71	%	
SS-EN-1948-2/3:1996	Rec 1234678 HpCDD Extr spike	77	%	
SS-EN-1948-2/3:1996	Rec OCDD Extr spike	73	%	
SS-EN-1948-2/3:1996	Rec 2378 TCDF Extr spike	78	%	
SS-EN-1948-2/3:1996	Rec 12378 PeCDF Extr spike	71	%	
SS-EN-1948-2/3:1996	Rec 23478 PeCDF Extr spike	76	%	
SS-EN-1948-2/3:1996	Rec 123478 HxCDF Extr spike	91	%	
SS-EN-1948-2/3:1996	Rec 123678 HxCDF Extr spike	66	%	

Angiven målnöjdhets är beräknad med täckningsfaktor k = 2. Vid intervallöverskridning avser det högre eller lägre målnöjdhetsintervallet vid främre eller bakre rapporteringsgränsen.



ALcontrol Laboratories

ALcontrol AB

Box 1083, 581 10 Linköping · Tel: 013-25 49 00 · Fax: 013-12 17 28
ORG.NR 556152-0916 STYRELSENS SÄTE: LINKÖPING

Vid frågor kontakta vår kundtjänst. Tel: 020-25 49 00

Uppdragsgivare

ALcontrol Laboratories
Chester

Chester street
CH48RD Chester, UK



RAPPORT

Sida 2 (2)

utfärdad av ackrediterat laboratorium
REPORT issued by an Accredited Laboratory

Rapport Nr 05207740

ALcontrol Laboratories
Chester
Gemma Rowland
Chester street
CH48RD Chester, UK

Avser

Information about the project

Solid

Project number : 15760

Information about sample and sampling

Project number	: 15760 P.O No 10920	Day of sampling	:
Sample description	: Solid	Day of arrival	: 2005-10-27
Sample name	: 15760-8	Receiving time	: 13.10
		Reference	: G Rowland

Results of the analyses

Metodbeteckning	Analys/Undersökning av	Resultat	Enhet	Mätosäkerhet
SS-EN-1948-2/3:1996	Rec 123789 HxCDF Extr spike	83	%	
SS-EN-1948-2/3:1996	Rec 234678 HxCDF Extr spike	76	%	
SS-EN-1948-2/3:1996	Rec 1234678 HpCDF Extr spike	70	%	
SS-EN-1948-2/3:1996	Rec 1234789 HpCDF Extr spike	80	%	
SS-EN-1948-2/3:1996	Rec OCDF Extr spike	68	%	
SS 028113-1	Dry substance DS	74.7	%	10%

Angiven mätosäkerhet är beräknad med täckningsfaktor $k = 2$. Vid intervallangivelse avser det högre talet mätosäkerheten vid halter nära rapporteringsgränsen.

Linköping 2005-11-08

Jan Svensson
Analyst



Smith Grant Partnership LLP
Station House
Station Road
Ruabon
Wrexham
LL14 6DL

ATTN: Derek Boothby

CERTIFICATE OF ANALYSIS

Date: 19 December, 2006
Our Reference: 06/19166/02/01
Your Reference: 8352/BY
Location: NOT SPECIFIED

A total of 21 samples was received for analysis between Monday, 30 October 2006 and Friday, 01 December 2006. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials- whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Signed

Diane Whittlestone **Jane Seymour** **David O'Hare** **Caroline Suttie**
Customer Services Customer Services Customer Services Customer Services

Valid if signed by any of the above signatories.

Compiled By

Gemma Farrer



ALcontrol Geochem TEST SCHEDULE

JOB NUMBER : 06/19166/02

CLIENT : Smith Grant Partnership LLP

CONTACT: Derek Boothby

DATE OF RECEIPT : 30/10/08

LOCATION: NOT SPECIFIED

BATCH NUMBER: 1

CLIENT REF/CODE : 8352/BY

ORDER NUMBER :

TURNAROUND : 10 days

Numeric values indicate additional scheduling

* indicates test subcontracted

Sample Number	Sample Identity	UKAS Accredited ?			Dioxins/Furans (S)*	PAH Spec MS (S)	Arsenic (S)	Cadmium (S)	Chromium (S)	Copper (S)	Mercury (S)	Lead (S)	Nickel (S)	Zinc (S)
		P / V	Depth	Sample Type										
1	BL1	500g TUB	UNKNOWN	SOLID	Sample on Hold									
2	BL1	500g TUB	UNKNOWN	SOLID	Sample on Hold									
3	BL1	JAR 250g	UNKNOWN	SOLID	2 X X	X			3	X	X	X	X	
4	BL2	500g TUB	UNKNOWN	SOLID	Sample on Hold									
5	BL2	500g TUB	UNKNOWN	SOLID	Sample on Hold									
6	BL2	JAR 250g	UNKNOWN	SOLID	2 X X	X		3		X	X	X	X	
7	BL3	500g TUB	UNKNOWN	SOLID	Sample on Hold									
8	BL3	500g TUB	UNKNOWN	SOLID	Sample on Hold									
9	BL3	JAR 250g	UNKNOWN	SOLID	2 X X	X		3		X	X	X	X	X
				Total Number of Tests			3	3	3	3	3	3	3	3

ALcontrol Geochem Analytical Services

Sample Descriptions

Job Number: 06/19166/02/01
Client: Smith Grant Partnership LLP
Client Ref : 8352/BY

Grain sizes	
<0.063mm	Very Fine
0.1mm - 0.063mm	Fine
0.1mm - 2mm	Medium
2mm - 10mm	Coarse
>10mm	Very Coarse

[illegible]

* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

¹ Sample Description supplied by client

* ISO 17025 accredited
 M MCERTS accredited
 † Subcontracted test
 ‡ Shown on prev. report

Client Contact: Derek Boothby

[illegible]

Page 4 of 24

* ISO 17025 accredited
 ** MCERTS accredited
 * Subcontracted test
 † Shown on prev. report

Client Contact: Derek Boothby

[illegible]

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- [†] ISO 17025 accredited
- ^{§†} MCERTS accredited
- * Subcontracted test
- » Shown on prev. report

Client Contact: Derek Boothby

[illegible]

ALcontrol Geochem Analytical Services
Table Of Results - Appendix

Job Number: 06/19166/02/01
Client: Smith Grant Partnership LLP
Client Ref. No.: 8352/BY

Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03×10^{-7}

NDP	No Determination Possible	*	Subcontracted test
NFD	No Fibres Detected	»	Result previously reported (Incremental reports only)
#	ISO 17025 accredited	M	MCERTS Accredited
PFD	Possible Fibres Detected	EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

Summary of Method Codes contained within report :

[illegible]

¹Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.