

**RECLAMATION VALIDATION REPORT FOR RESIDENTIAL
DEVELOPMENT ON LAND AT WATER'S EDGE, WHITEHAVEN,
CUMBRIA**

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CONTENTS

1	INTRODUCTION	1
2	SOURCES OF INFORMATION	2
3	BACKGROUND INFORMATION	3
3.1	Site Location and Description	3
3.2	Site History	3
3.3	Summary of Investigation Results.....	4
4	RECLAMATION AND MATERIAL MANAGEMENT PROPOSALS	5
4.1	Reclamation Works	5
5	PARTIES TO THE REMEDIATION WORKS	6
5.1	Parties to the Contract	6
5.2	Parties to be Consulted	7
6	ENABLING WORKS	7
6.1	General.....	7
6.1.1	Site Preparation and Clearance.....	7
6.1.2	Disconnection of Services	8
6.1.3	Inspection of Formation Level	9
7	RECLAMATION	9
7.1	Treatment of Relict Structures.....	9
7.2	Excavation and Reinstatement of Made Ground.....	10
7.3	Treatment of Unidentified Contamination Hotspots	10
7.4	Importation of Materials.....	10
8	BUILT DEVELOPMENT	11
8.1	Provision of Clean Cover	11
8.2	Gas Protection Measures	12
8.3	Materials for In-Ground Concrete and Services	13
9	WASTE DISPOSAL	13
9.1	Waste Characterisation and Acceptance Criteria	13
9.2	Liaison with Waste Disposal Operators	13
9.3	Chain of Custody	14
10	QUALITY ASSURANCE AND CONTROL.....	14
10.1	Environmental Engineer Role in Verification	14
11	VALIDATION	14
11.1	Earthworks – Site Won Materials	14

11.2	Imported Materials	15
11.3	Offsite Disposal	16
11.4	Built Development	16
12	CONCLUSIONS OF VALIDATION REPORT.....	17
13	REFERENCES	18

APPENDICES

1	DRAWINGS	
1.1	FWS DRAWINGS	
	8190OD01	SITE FEATURES
	8190OD04	PROPOSED ANTIDIG LAYER TO GARDENS AND POS AREAS
	8190OD05	PROPOSED VAPOUR MEMBRANES TO PLOTS
1.2	THIRD PARTY	
	N/A	SITE PLAN
	21201-D001-Rev2	ENGINEERING LAYOUT
	21201-D601-Rev1	FOMRATION CUT AND FILL
	BP001	BLOCK PLAN
	N/A	CONSTRUCTION PHASE STOCKPILES
2	SITE RECORDS AND PHOTOGRAPHS	
3	GARDEN VALIDATIONS	
4	GAS PROTECTION MEASURES VERIFICATION	
5	DISPOSAL TICKETS	
6	NOTES ON LIMITATIONS	

RECLAMATION VALIDATION REPORT FOR RESIDENTIAL DEVELOPMENT ON LAND AT WATER'S EDGE, WHITEHAVEN, CUMBRIA

1 INTRODUCTION

FWS Consultants Ltd (FWS) has been instructed by Gleeson Homes Cumbria (the 'Client') to audit the enabling and remediation works for the residential development at Water's Edge, Whitehaven (the 'site'), as shown in Gleeson Homes Cumbria Drawing Site Plan and Engineering Layout 21201-D001, Appendix 1.2.

Previous site investigations covering the wider area of the main production site of the former Albright & Wilson Works were carried out by URS Corporation Ltd in February 2008 (Ref. 1) and Integra Consulting Engineers in May 2013 (Ref. 2).

A Due Diligence report (Ref. 3) was carried out by FWS in April 2019 which identified potential contamination and soil gas risks from the former chemical works. A subsequent Phase I Preliminary Contamination Risk Assessment and the Phase II Ground Investigations that were carried out between 22 and 23 August 2019 and 20 to 23 January 2020 (Ref. 5), along with supplementary contamination and geotechnical (Ref. 7 to 11) investigations carried out between November 2022 and March 2024.

The investigations determined the following:

- The principal historic land use of this area has been the Rhodia Chemical Works, which operated between 1938 to 2005.
- Ground conditions comprise predominantly cohesive made ground of between 0.3 and 1.5 m thick although extended to depths of up to 3.5 m bgl in the southeast and southwest of the site. Firm to stiff cohesive Glacial Till of low permeability was encountered beneath the made ground and was proven to extend to depths of up to 4.45 m bgl across most of the site. In the east and southeast where either the made ground was locally thicker or shallow bedrock was encountered the glacial till was either thin or absent.
- A laterally discontinuous shallow perched groundwater has been proven in the made ground across parts of the site with an inferred hydraulic gradient radially to the south (beyond the site boundary) and to the east and northeast (across the site). The main water table is expected at a depth of between 20 to 31.5 m bgl within the underlying Whitehaven Sandstone Formation bedrock and is classified as a Secondary A Aquifer.
- The investigations have proven only localised total contamination in the made ground or natural soils (PAHs, hydrocarbons and sulphates).
- Characteristic Situation 2 soil gas conditions have been determined beneath the whole site, with the requirement for vapour proof membranes to plots along the southwestern boundary.

FWS prepared a Reclamation Method Statement (RMS, Ref. 6) detailing the proposed reclamation works, the specification for the mitigation measures to be incorporated into the built development and the validation procedures that needed to be adopted during redevelopment of the site.

Following preparation of the RMS, FWS have undertaken a number of supplementary investigations across the site as summarised below:

- A technical note for foundation recommendations to Plots 14 to 16, March 2023 (Ref. 8).
- Controlled Waters Risk Assessment, May 2023 (Ref. 9).
- Additional Ground Investigation and Hotspot Delineation (Ref. 10).
- Additional Ground Investigation and Hotspot Delineation Near Plot 26 (Ref. 11).

As detailed in Ref. 10, as part of the site enabling and earthworks FWS have undertaken hotspot delineation of the localised hydrocarbon hotspot in the southwest of the site associated with a former drainage alignment and following the recent removal of the stockpile in the western part of the site further exploratory investigations to determine if possible buried structures remain within this part of the site and spot sampling and assessment of the chemical quality of the recycled aggregate imported to use as part of the new road construction (Ref. 10, copy included in Appendix 2).

As detailed in Ref. 11, during February 2024 FWS were informed of a potential contamination hotspot associated with a relic drainage route which was exposed during the foundation works of Plot 26 (assumed northern extent of the previous drainage alignment). FWS subsequently undertook hotspot delineation of the localised drainage alignment (Ref. 11, copy included in Appendix 2).

Interim validation reports have also previously been issued for the completed areas relating to Plots 1 to 8 (Ref. 12) and Plots 38 to 40 (Ref. 13).

The main reclamation works were carried out under the management of Gleeson Homes Cumbria. This comprised an initial pre-enabling works phase, then site preparation and set-up, and then the enabling earthworks comprising the Roads and Sewers construction and the preparation of the sub formation to Plots 01 to 08 and 38 to 40.

This Reclamation Validation Report details the reclamation works undertaken by Gleeson Homes and their Contractors in terms of the main earthworks undertaken across the site and the verification testing carried out to provide a validation of the reclamation works across the site, including installation of gas protection measures to the buildings, use of contamination resistant materials to services and installation of clean soil covers to garden areas.

With the exception of the supplementary investigations noted above, FWS has not had any direct site supervisory involvement during the remediation works undertaken onsite, other than the post remediation collation of the information and site records provided by the Client and third parties that have been used for the preparation of this interim validation report.

2 SOURCES OF INFORMATION

Previous investigations of the site include: -

INVESTIGATION	PREPARED BY	DATE	REF.
Due Diligence Report for Land at Water's Edge, Whitehaven.	FWS	2019	3
Coal Mining Risk Assessment for Land at Water's Edge, Whitehaven.	FWS	2019	4
Phase 1 and 2 Geoenvironmental Investigation for Residential Development on Land at Water's Edge, Whitehaven.	FWS	2022	5
Reclamation Method Statement for the Proposed Residential Development on Land at Water's Edge, Whitehaven.	FWS	2022	6
Supplementary Ground Investigations for the Proposed Residential Development on Land at Water's Edge, Whitehaven.	FWS	2022	7

INVESTIGATION	PREPARED BY	DATE	REF.
Technical Note – Ground Conditions and Foundation Recommendations for Plots 14, 15 and 16 Residential Development at Waters Edge, Whitehaven	FWS	2023	8
Controlled Waters Risk Assessment for Residential Development on Land at Water's Edge, Whitehaven	FWS	2023	9
Additional Ground Investigation and Hotspot Delineation for Residential Development on Land at Water's Edge, Whitehaven	FWS	2023	10
Additional Ground Investigation and Hotspot Delineation Near Plot 26 of Residential Development on Land at Water's Edge, Whitehaven.	FWS	2024	11
Interim Reclamation Validation Report for Plots 01 to 08 at Residential Development on Land at Water's Edge, Whitehaven, Cumbria	FWS	2023	12
Interim Reclamation Validation Report for Plots 01 to 08 and 38 to 40 at Residential Development on Land at Water's Edge, Whitehaven, Cumbria	FWS	2024	13

3 BACKGROUND INFORMATION

3.1 Site Location and Description

The 1.4 ha site at National Grid Reference 296680E, 516290N is located off High Road at Water's Edge, Whitehaven, as shown on the Client's Site Plan in Appendix 1.2.

The site is generally flat-lying at an elevation of around 93 m AOD in the north and northeast to around 96 m AOD in the southwest and is surfaced by demolition fill with localised hardstanding in the southeast.

At the time of the initial ground investigation (August 2019 and January 2020), the site contained three stockpiles (Stockpile 3 in the west, Stockpile 2 in central area, and Stockpile 1 in the northeast of the site). Since the previous investigations, it was understood that the original Stockpiles 1 and 2 were disposed offsite, and original Stockpile 3 (renamed by the site management as Stockpile 1 on current drawings) has recently been removed offsite as it has been decided by the Client that it is no longer viable to consider re-use of this material on site as part of the proposed development works.

The site is bordered by residential development to the north and east with derelict open space to the south and west.

3.2 Site History

The principal historic land use of this area has been the Rhodia Chemical Works, which operated between 1938 to 2005 (Ref. 2). The development site is located in the north-western corner of these chemical works, which was primarily used for offices and storage warehouses, with the main chemical process areas located to the south that are still currently derelict land following a sequence of investigations and focused remedial works in 2008 (Ref. 1). The only area for the former chemical works site to have been re-developed to date is the northern part of the former offices / stores area located immediately to the north of the current development boundary.

A summary of the site history is presented below and illustrated in Drawing 8190OD01 Appendix 1.1:

- Pre-1850s to 1920s - Agricultural land.
- 1920s - Railway/sidings constructed in the southwest of the site.

- 1938 to 1957 - Building constructed in the north of the site as part of the development of the Rhodia chemical works, extending beyond the site boundary to the north, which is indicated to be a steel frame warehouse. 'L' shaped building constructed in the southeast of the site and indicated to be an office, with adjacent ancillary 'works' buildings and possible tanks/storage silos in the southeast and west as shown on Drawing 8190OD01Rev1, Appendix 1.1.
- Possible tanks/storage silos in the southeast and west have been removed by 1976 along with a number of the ancillary 'works' buildings in these areas.
- Railway/sidings in the southwest of the site have been removed by 1983.
- We understand that the main site operations ceased in 2005 and the majority of the former works buildings and infrastructure had been demolished and removed by 2012.

3.3 Summary of Investigation Results

Ground and Groundwater Conditions Summary

The ground investigations have proven locally granular and predominantly cohesive made ground of between 0.3 and 1.5 m thick across the site. Locally in the southeast and southwest made ground extended to depths of up to 3.5 m bgl associated with the former silos and railway embankment.

A buried relict concrete slab at depths between 2.6 and 2.8 m bgl which may be associated with either the former railway or ancillary buildings was encountered in the southwest of the site. Although no other significant below ground relict structures were recorded across the site.

Cohesive Glacial Till was encountered beneath the made ground and was proven to extend to depths of up to 5 m bgl across the central and western parts of the site, whilst in the east and southeast where either the made ground was locally thicker or shallow bedrock was encountered the glacial till was either thin or absent.

The solid geology comprises sandstones, mudstone and siltstones within thin coals belonging to the Whitehaven Sandstone Formation dipping in a north-westerly direction. Weathered sandstone bedrock recovered as clayey gravelly sand was encountered between 0.4 and 1.6 m bgl in the southeast and 1 to 2.4 m bgl in the east of the site, underlain by competent sandstone bedrock at depths of between 0.8 and 2.4 m bgl in the southeast and 1.1 and 2.5 m bgl in the east.

Locally perched and laterally discontinuous groundwater was encountered at approximate elevations of between 92 to 95.5 m AOD in the made ground across parts of the site, and as isolated water strikes within the underlying natural superficial soils at approximate elevations of between 93.15 to 95.56 m AOD.

Contamination

Testing of the granular and cohesive made ground has identified localised contamination, as summarised below:-

- None of the localised made ground topsoil or granular stockpiled made ground samples tested contained concentrations of contaminants above the generic assessment criteria.

- General granular made ground and cohesive made ground samples across the site (Hazard 1) recorded elevated concentrations of sulphate aqueous extract which pose a risk to the proposed properties.
- Cohesive stockpiled made ground (Hazard 2) recorded elevated concentrations of sulphate aqueous extract however, these materials have been removed from site and as such will not pose a risk to the proposed development.
- Made ground in the areas of the former tanks / silos (Hazard 3) recorded elevated benzo(b)fluorene, benzo(a)pyrene, dibenzo(a,h)anthracene and sulphate aqueous extract in the west and sulphate aqueous extract in the south of the site, which pose a risk to human health and the proposed properties, respectively.
- Made ground in the area of the former railway (Hazard 4) recorded elevated sulphate aqueous extract and chrysotile/amosite asbestos fibres in the southwest/west of the site which pose a risk to human health and the proposed properties (Drawing 8190OD05, Appendix 1.1).
- Localised granular made ground (Hazard 1) along the southern boundary recorded elevated concentrations of TPH aromatic 12-16, 16-21 and 21-35 hydrocarbons and sulphate aqueous extract which pose a risk to human health and the proposed properties, respectively.

Characteristic Situation 2 gas conditions have been determined across the site and as such gas protection measures will be required for the proposed development. A hydrocarbon resistant membrane is also required to plots along the south/southwestern boundary (Drawing 8190OD04, Appendix 1.1). No radon protection measures are required.

4 RECLAMATION AND MATERIAL MANAGEMENT PROPOSALS

4.1 Reclamation Works

As detailed in the RMS (Ref. 6), the enabling works were to meet the following reclamation requirements:-

Earthworks

- Excavation of cohesive fill arisings within Stockpiles 1 and 2 and although it was originally intended to be retained onsite part of Stockpile 3 for reuse, due to site constraints it is understood that these stockpiled materials will also be removed for offsite disposal.
- Site preparation by excavation of surface vegetation and made ground to a depth of 0.2 m and existing hardstand areas to a depth of 0.4 m.
- Site turnover and regrade of site levels including a cut of 1,953 m³ and proposed fill of 3,751 m³, with an overall net shortfall of material of ~264 m³ to achieve the proposed formation level.

This was to involve the sequential excavation and reinstatement:-

- Removal of relic structures.
- Excavation of localised contaminated granular made ground (contaminated Class 1 General Fill) and localised contaminated cohesive made ground (contaminated Class 2 General Fill) and of natural clay (Class 2 General Fill or Class 4 Landscape Fill) as part of the site turnover and cut to the proposed sub-formation levels.
- Reinstatement of Site Won Contaminated Class 1 and 2 General Fill as an engineered fill to achieve the proposed subformation levels beneath carriageways, plots and garden areas.

- Excavation of localised contaminated granular made ground (contaminated Class 1 General Fill) and localised contaminated cohesive made ground (contaminated Class 2 General Fill) to cut the private drainage and foundation arisings. From the earthworks materials balance and proposed phasing, it is anticipated that these arisings will require be reinstated beneath buildings and structures (as part of the construction make-up) and any surplus arisings will then be disposed offsite.
- Placement of 0.6 m thick anti-dig layer comprising compacted engineered fill and/or a geotextile membrane in the southwest of the site (Drawing 8190OD05, Appendix 1.1).
- Reuse of clean Site Won natural clay (Class 4 Landscape Fill; Volume TBC) and importation of clean Class 4 Landscape Fill (Volume TBC) for placement as a clean cover layer in future gardens and landscaped areas.
- Reuse of Imported Won Class 5 Topsoil (Volume TBC) for placement as a clean cover layer in future gardens and landscaped areas.

Buildings and Infrastructure

- Incorporate a clean soil cover in garden and landscaped areas where underlain by contaminated made ground. As a minimum the clean cover soil layer in garden areas should comprise 0.45 m thick subsoil and 0.15 m thick topsoil and in landscaped areas should comprise 0.3 m of subsoil and 0.15 m of topsoil.
- An anti-dig layer comprising compacted engineered fill and/or a geotextile membrane should be installed in all domestic gardens and soft landscaped in the southwest of the site to mitigate the risk from localised asbestos. A capping layer comprised of at least 0.6 m thick inert material should be installed above the anti-dig layer.
- Implement gas protection measures in the buildings to mitigate soil gas conditions designed for Characteristic Situation 2. Localised hydrocarbon contamination was recorded in the south/southwest of the site and as such, hydrocarbon resistant membranes should be installed within proposed buildings in this area (Drawing 8190OD04, Appendix 1.1).
- Subject to the approval from the Water Authority, the water supply pipework will either need to be hydrocarbon resistant, or alternatively the service corridor backfilled with inert materials.
- In-ground concrete should be designed for Sulphate Class DS-2 ACEC Class AC-2 for future structures in contact with the made ground.

5 PARTIES TO THE REMEDIATION WORKS

The following are details of interested parties within the development:-

5.1 Parties to the Contract

Employer

Gleeson Homes Cumbria
Rural Enterprise Centre
Redhills
Penrith
Cumbria
CA11 0DT
Contact Tel: 01768 807853

Consulting Engineer

RWO Northeast
 19-20 Brenkley Way
 Newcastle Upon Tyne
 NE13 6DS
 Contact Tel: 0191 258 5632

Environmental Engineer

FWS Consultants Ltd
 City West Business Park
 St John's Road
 Meadowfield Industrial Estate
 Durham
 DH7 8ER
 Contact Tel: 01388 420633

Main Contractor

Gleeson Homes Cumbria
 Rural Enterprise Centre
 Redhills
 Penrith
 Cumbria
 CA11 0DT
 Contact Tel: 01768 807853

5.2 Parties to be Consulted

Council

Contaminated Land Officer
 Copeland Borough Council
 The Market Hall
 Market Place
 Whitehaven
 CA28 7JG
 Tel 01946 598300

6 ENABLING WORKS

6.1 General

The enabling works comprised:-

- Site preparation and clearance;
- Disconnection of services, and;
- Inspection of Formation Level;

6.1.1 Site Preparation and Clearance

A secure site compound was established prior to commencement of the works. Site clearance included the removal of existing structures, surface detritus including any fly tipping and surface

vegetation to be disposed off-site as non-hazardous waste. In addition, we understand that Stockpiles 1 and 2 were also removed (pre-works) and that Stockpile 3 has subsequently been removed (around December 2023) as part of the site works.

The Client retains all original copies of the waste transfer notes for these materials removed.

6.1.2 Disconnection of Services

As part of their site inspections, the Client and their Contractors have not noted any existing or redundant buried services or drainage that required disconnecting and removal, with the exception of the following.

Photographs provided by the Client are included in Appendix 2.

Hydrocarbon Hotspot (Southwestern Area)

As detailed in Ref. 10 and included in Appendix 2, FWS attended site during December 2023 to delineate and assess the extent of the previously identified hydrocarbon hotspot following the removal of the stockpile in this area.

This comprised excavation of 2no trenches to a depth of up to 1.8 m to locate and delineate the full extent of the hydrocarbon hotspot in the southwest of the site. As part of these investigations 3no made ground samples (from excavated and stockpiled material) and 2no samples of remaining insitu cohesive made ground were tested for TPH/CWG and BTEX/MTBE suite. In addition, 3no verification samples of the remaining natural cohesive soils (insitu/base of excavation) were also tested for TPH/CWG and BTEX/MTBE suite.

In the area of the hydrocarbon hotspot, cohesive made ground was proven to depths of between 1 to 1.50 m bgl comprising dark grey sandy gravelly clay containing gravel of sandstone, mudstone, slag, ceramic and clay pipe with frequent pockets of black stained granular material containing evidence of hydrocarbon contamination. The underlying superficial deposits consisted of firm to stiff brown slightly sandy gravelly clay with gravel of sandstone mudstone and coal to depths of at least 1.80 m bgl. Groundwater was not encountered during this ground investigation with the exception of wet granular pockets in the area of the hydrocarbon hotspot.

Visual evidence of hydrocarbon contamination (black stain and slight oily sheen) was noted in the granular pockets in the made ground, however, no significant olfactory contamination was noted (PID values of <3.3 ppm). No significant concentrations of contaminants were reported with the made ground material within the hydrocarbon hotspot area, with the exception of elevated concentrations of TPH (aromatic C12-C16) recorded at 1,200 mg/kg (Assessment Value for aromatic C12-C16: 140 mg/kg), which pose a risk of harm to human health. It should be noted that the level of contamination appears to have further reduced since the original investigations.

As part of the delineation investigations, all visually contaminated materials have been removed from the former drain alignment in this area. Following removal of the contaminated material, the underlying insitu natural clay was tested, and no significant concentrations of contaminants was identified, indicating that the hydrocarbon hotspot did not spread into the wider environment and was successfully removed.

Hydrocarbon Hotspot (Plot 26 Foundation Excavations)

As detailed in Ref. 11 and included in Appendix 2, FWS attended site during February 2024 following being informed of a potential contamination hotspot associated with a relic drainage route which was exposed during the foundation works of Plot 26 (assumed northern extent of the previous drainage alignment associated with the southern hotspot detailed above). FWS subsequently undertook hotspot delineation of the localised drainage alignment comprising excavation of 2no trenches to a depth of up to 1.4 m to locate and delineate the full extent of the hydrocarbon hotspot. As part of these investigations 3no made ground samples (from excavated material) and 1no sample of insitu natural cohesive soils (insitu/base of excavation) were tested for TPH/CWG and BTEX/MTBE suite.

In the area of the drainage alignment, mixed granular and cohesive made ground to depths of between 0.4 to up to 1.10 m bgl were proven, including a strong solvent odour was noted throughout the made ground material. The excavations identified a possible former pipe trench at the interface between the made ground material and natural soils where contaminated material was present, however, a short section of an approximately 10cm wide clay pipe was only locally found to be present at around 0.40 m bgl at the interface between the made ground and natural soils.

Visual evidence of contamination (black stain and slight oily sheen) was noted within granular material in the made ground, with an associated distinct solvent odour. The extent of the visually contaminated material was around 0.20 m either side of the clay pipe in P26B at a depth of around 0.40 m bgl. No significant evidence of contamination remained in P26B following removal of the contaminated material. However, in the area of P26A, where visual and olfactory evidence of contamination appeared to extend up to 1.0 m from the alignment of the pipe, the full extent of the contamination could not be identified at the time of investigation.

As part of the delineation investigations, all visually contaminated materials encountered were removed from the former drain alignment. Following removal of the contaminated material, the underlying insitu natural clay showed no significant visual or olfactory evidence of contamination indicating that the hydrocarbon hotspot had not spread into the wider environment.

6.1.3 Inspection of Formation Level

With the exception of the two areas noted above in Section 6.1.2, on completion of the site clearance, the Client and their Contractors have not noted any other additional significant unrecorded visual and olfactory evidence of contamination as part of their site inspections.

Site inspection records and photographs provided by the Client are included in Appendix 2.

7 RECLAMATION

7.1 Treatment of Relict Structures

The Client and their Contractors have not noted any significant surface or below ground relict structures as part of their site inspections and subsequent ground across the site.

Photographs provided by the Client are included in Appendix 2.

As detailed in Ref. 10 and included in Appendix 2, FWS attended site during December 2023 and undertook additional excavation of trial pits in the west (beneath the former stockpile that had been recently removed at that time) to provide comment on possible buried structures remaining in this area. This comprised excavation of 3no trial pits (TPA to TPC) to depths of up to 1.80 m bgl to enable the made ground to be examined and identify any potential buried structures. No evidence of any remaining relict buried structures was recorded.

7.2 Excavation and Reinstatement of Made Ground

The cut and fill earthworks are complete across the site, including:

- Cut to the access road from existing levels of around 94.6 m AOD in the east and around 94 m AOD in the west by around 0.5 m to allow a future construction buildup of 0.94 m. Photographs of the road cut and initial construction reinstatement observed by FWS are included in Appendix 2.
- Fill to Plots 01 to 08 from existing levels of between 93.7 m AOD (Plot 1) and 94.5 m AOD (Plot 8) by between 0.5 to 1.5 m to the underside of the plot build-up and to achieve the proposed finished development levels in garden areas. Photographs provided by the Client are included in Appendix 2.
- Fill to Plots 38 to 40 from existing levels of between 93 m AOD (Plot 38) and 93.6 m AOD (Plot 40) by between 0.5 to 1.5 m to the underside of the plot build-up and to achieve the proposed finished development levels in garden areas. Photographs provided by the Client are included in Appendix 2.
- Generally, fill to remaining Plots 9 to 37 from existing levels of between 93.30 m AOD (Plot 32) and 95.97 m AOD (Plot 16) by between 0.5 to 1.5 m to the underside of the plot build-up and to achieve the proposed finished development levels in garden areas. Locally, small areas of cut (up to 0.5 m) have been undertaken to Plots 27 to 29.

7.3 Treatment of Unidentified Contamination Hotspots

With the exception of the two areas noted above in Section 6.1.2, the Client and their Contractors confirm that no other unidentified visual or olfactory evidence of significant contamination was encountered during the works across the site. All other materials encountered during the works were as anticipated, based on the ground conditions proven within the previous ground investigations.

7.4 Importation of Materials

As part of the earthworks, we understand that only coarse granular material (recycled aggregate) has been imported for the road subbase construction and natural quarried stone for backfill to services and drainage routes.

In accordance with the RMS, it is not acceptable to import materials from sources having known former contaminative use. Therefore, the following records are required to be provided for the imported recycled aggregate materials:

- Review of available data; desk study and ground investigation information available for the source site shall be provided to the Engineer for review.
- Source material inspection; to confirm that there is no historical or visual evidence of hazardous contamination or materials.
- Source material testing; a minimum of three samples per sourced of imported materials shall be tested to demonstrate compliance with the acceptance criteria detailed in the RMS.

These records are still to be provided by the Client and their Contractors, however, in the absence of sufficient Contractor records demonstrating the chemical and geotechnical suitability of these materials, additional chemical testing was carried out on one sample of the recycled aggregate. As detailed in Ref. 10 and included in Appendix 2, FWS attended site during December 2023 and where accessible along the new road alignment one trial pit was excavated and a sample of the imported coarse granular material (recycled aggregate) was collected for testing. Four distinct layers were noted (first three related to the road build up / construction) with the final layer comprising compacted mixed brown granular/cohesive fill with gravel of sandstone, cement, brick, plastic and slag (imported coarse granular materials placed as the sub-formation to the road construction).

No significant evidence of visual and olfactory contamination was noted, with the exception of a light organic odour throughout the made ground material in TPA. However, slightly elevated concentrations of PAHs were present within the coarse granular materials, with benzo(b)fluoranthene at 4.2 mg/kg, benzo(a)pyrene at 6.5 mg/kg and dibenzo(a,h)anthracene at 0.9 mg/kg (Assessment Value: 2.6, 2.2 and 0.24 mg/kg respectively) which may pose a risk of harm to human health. No other elevated concentrations of contaminants were present. As such, the recycled aggregate would be classified as contaminated fill materials that would only be suitable for re-use beneath clean soils or building and hardstanding. If any of this material has been used elsewhere on site other than under cover soils, hardstanding or buildings, it should either be replaced with suitable material or a suitable clean cover system should be adopted in accordance with the Reclamation Method Statement.

Original delivery tickets for the natural quarried stone used in service and drainage routes are held by the Client.

8 BUILT DEVELOPMENT

8.1 Provision of Clean Cover

Localised elevated concentrations of hydrocarbons and isolated asbestos in the southwestern area were recorded in the made ground that would present a risk of harm to end-users in future garden and landscaped areas. In addition, the made ground materials present across the rest of the site would be unsuitable as a rooting medium for plant growth.

Therefore, as part of the works the following clean covers have been installed across the site:

- General Plots / Gardens = 600 mm (Total Clean Cover)
 - 250 mm topsoil/growing medium.
 - 350 mm sub-soil.

- Southwestern Area Plots / Gardens = 1000 mm (Total Clean Cover)
 - 250 mm topsoil/growing medium.
 - 150 mm sub-soil.
 - 600 mm of inert compacted material or geotextile membrane that will act as a break layer for any potential asbestos contamination.
- Landscape / POS areas = 450 mm (Total Clean Cover)
 - 250 mm topsoil/growing medium.
 - 200 mm sub-soil.
 - (southwestern area only; additional 600 mm of inert compacted material or geotextile membrane that will act as a break layer for any potential asbestos contamination).

Where localised asbestos contaminated made ground is to remain in the southwestern part of the site, the designed clean cover soil layer to the front gardens of Plots 27 to 29 and the adjacent landscaped areas were to include an inert 'insulation' layer (Drawing 8190OD05, Appendix 1.1).

This will prevent both direct contact/reduce potential exposure with contamination within made ground and provide a suitable rooting medium.

All imported materials utilised as part of the gardens / landscaping were tested (copies in Appendix 3) by GEO Environmental Engineering Ltd (GEE) at the source site (Ashfield Road; Gleeson Homes development site) prior to export and were deemed to be suitable by GEE.

Validation of the thickness and chemical quality of emplaced topsoil and subsoil has been carried out upon completion of each plot by GEE, for which the completed reports are presented in Appendix 3. These plots are reported to have recorded a sufficient depth, and chemical quality of emplaced materials.

8.2 Gas Protection Measures

The gas monitoring identified Characteristic Situation 2 conditions and, therefore, buildings across this site required gas preventive measures in accordance with BS8485 (Ref. 14) for the residential buildings and fitted following the principles of CIRIA C735 (Ref. 15). For a Type A private residential building (high risk) the designed gas protection system should have a minimum 3.5 points in compliance with BS8485:2015 (Ref. 14), which can be achieved from a range of measures as including a structural barrier (floor and substructure design), ventilated sub floor void and propriety gas resistant and vapour proof membrane. In addition, localised hydrocarbon contamination was recorded in the south/southwest of the site and as such, hydrocarbon resistant membranes were recommended to be installed within proposed buildings in this area.

A Gas Verification Strategy was prepared by GEE (December 2022, revised October 2023) that sets out the proposed protection measures to be incorporated and the verification requirements on completion of the works. A copy of this is included in Appendix 4.

Validation of the as-built subfloor / floor construction and installed membrane has been undertaken by GEE, for which the completed reports are included in Appendix 4. These plots have been reported to be installed with the appropriate gas protection measures complying with Characteristic Situation 2 conditions.

8.3 Materials for In-Ground Concrete and Services

In-ground Concrete

On the basis of the previous ground investigations, it was recommended that all in-ground concrete in contact with made ground onsite should be designed to a worst-case Design Sulphate Class DS-2 ACEC Class AC2 in accordance with BRE Special Digest 1:2005, Concrete in Aggressive Ground (Ref. 16).

A copy of the concrete delivery tickets have not been provided, but a copy of these records is understood to have been retained by the Client.

Services

Where in-ground potable water supply pipes shall be in contact with made ground materials and the localised hydrocarbon contamination in the southwest of the site, these were to be designed to be chemically resistant, or placed within a clean corridor, as specified by the respective statutory undertaker, to accommodate for the contaminants identified onsite.

We understand that hydrocarbon resistant / barrier water supply pipe work has been installed across the site as required by the Statutory Water Authority and these records are retained by the Client (Water Authority approval and data sheets for the materials utilised).

9 WASTE DISPOSAL

9.1 Waste Characterisation and Acceptance Criteria

All wastes generated onsite were characterised by the Client and their Contractors in accordance with The Landfill Directive, the List of Wastes (England) Regulations 2005, the Hazardous Waste (England and Wales) Regulations 2005 and Technical Guidance WM3 Guidance on the classification and assessment of waste (1st edition 2015), including any subsequent amendments.

9.2 Liaison with Waste Disposal Operators

The following waste disposal operators were used during the construction works:-

TYPES OF WASTES GENERATED	DATE REMOVED FROM SITE	WASTE CODE	WASTE DISPOSAL OPERATOR
Stockpile 1 and 2 Quantity: approx. 3,675 m ³ (6611.5 t) (Disposal Tickets in Appendix 5)	August to October 2022	170504	Overby Quarry
Stockpile 3 Quantity: 4,233 m ³ (Noted as Stockpile 7 in Appendix 1.2)	October to December 2023	Records held by Gleeson Homes Cumbria	
Surplus mixed materials from cut and fill, foundations and drainage works Quantity: 2,697 m ³ (Appendix 1.2)	Throughout the works	Records held by Gleeson Homes Cumbria	

TYPES OF WASTES GENERATED	DATE REMOVED FROM SITE	WASTE CODE	WASTE DISPOSAL OPERATOR
Surplus mixed materials from cut and fill, foundations and drainage works and Hydrocarbon Hotspot (southwestern and Plot 26 area) Quantity: 700 m ³	Around January 2024 to April 2024	170504	FCC Recycling UK Ltd Lillyhall Landfill Dixon House Workington CA14 4JH Permit Ref. EPR/JP3290VP

9.3 Chain of Custody

Originals of waste transfer notes, the waste carrier licences and details of the receiving licenced waste facilities are maintained by the Client, with copies (where provided), included in Appendix 5.

10 QUALITY ASSURANCE AND CONTROL

10.1 Environmental Engineer Role in Verification

This report includes an audit of information collated during the site reclamation and earthworks operations and included the following:-

- Inspect and validate all occurrences of unidentified contamination reported by the Contractor and undertake liaison with the Regulators, as necessary.
- Audit that the sampling and laboratory analyses of materials handled during the works are undertaken in compliance with the Method Statement.
- Audit compliance testing records of the imported clean materials and verification of the thickness of clean cover soils placed within garden and landscaped areas.
- Audit compliance testing records for the construction of the gas protection measures to ensure they are undertaken in compliance with the Method Statement and verified by a suitable independent contractor.
- Collate documentary records to be provided by the Client and their Contractors on the remediation procedures undertaken and prepare the Validation Report to be submitted on completion of the remediation works.

11 VALIDATION

11.1 Earthworks – Site Won Materials

Relict Structures

The Client and their Contractors have not noted any significant surface or below ground relict structures as part of their site inspections and subsequent ground works across the site. No evidence of any remaining relict buried structures was recorded across the southwestern part of the site following the removal of the remaining stockpile in this area.

Excavation and Reinstatement of Made Ground

The cut and fill earthworks are complete across the site and included:

- Photographs of the road cut and initial construction reinstatement observed by FWS are included in Appendix 2.

- Photographs of the fill to Plots 1 to 8 and 38 to 40 provided by the Client are included in Appendix 2.
- Copies of photographs of the fill to the remaining Plots 9 to 37 are retained by the Client.
- waste transfer notes, the waste carrier licences and details of the receiving licenced waste facilities are maintained by the Client.

Unidentified Contamination Hotspots

With the exception of the two areas noted above in Section 6.1.2 and summarised below, the Client and their Contractors confirm that no other unidentified visual or olfactory evidence of significant contamination was encountered during the works across the site. All other materials encountered during the works were as anticipated, based on the ground conditions proven within the previous ground investigations.

Hydrocarbon Hotspot (Southwestern Area)

As detailed in Ref. 10 and included in Appendix 2, FWS attended site during December 2023 to delineate and assess the extent of the previously identified hydrocarbon hotspot following the removal of the stockpile in this area. As part of the delineation investigations, all visually contaminated materials have been removed from the former drain alignment in this area. Following removal of the contaminated material, the underlying insitu natural clay was tested, and no significant concentrations of contaminants was identified, indicating that the hydrocarbon hotspot did not spread into the wider environment and was successfully removed.

Hydrocarbon Hotspot (Plot 26 Foundation Excavations)

As detailed in Ref. 11 and included in Appendix 2, FWS attended site during February 2024 following being informed of a potential contamination hotspot associated with a relic drainage route which was exposed during the foundation works of Plot 26 (assumed northern extent of the previous drainage alignment associated with the southern hotspot detailed above). As part of the delineation investigations, all visually contaminated materials encountered were removed from the former drain alignment. Following removal of the contaminated material, the underlying insitu natural clay showed no significant visual or olfactory evidence of contamination indicating that the hydrocarbon hotspot had not spread into the wider environment.

11.2 Imported Materials

As part of the earthworks, we understand that only coarse granular material (recycled aggregate) has been imported for the road subbase construction and natural quarried stone for backfill to services and drainage routes.

The records demonstrating the chemical and geotechnical suitability of these materials are still to be provided by the Client and their Contractors, however, in the absence of sufficient Contractor records limited additional chemical testing was carried out on one sample of the recycled aggregate. Although no evidence of visual and olfactory contamination was noted, the imported coarse granular materials (recycled aggregate) contained elevated PAH concentrations, which may pose a risk of harm to human health. As such, the recycled aggregate would be classified as contaminated fill materials that would only be suitable for re-use beneath clean soils or building and hardstanding. If any of this material has been used elsewhere on site other than

under cover soils, hardstanding or buildings, it should either be replaced with suitable material or a suitable clean cover system should be adopted in accordance with the Reclamation Method Statement.

11.3 Offsite Disposal

Stockpile 1 & 2

Materials from Stockpiles 1 and 2 were removed offsite as part of the site enabling works. Original waste transfer notes, the waste carrier licences and details of the receiving licenced waste facilities are maintained by the Client and copies are included in Appendix 5.

Stockpile 3

Materials from Stockpile 3 were removed offsite as part of the ongoing site enabling and phased construction works. Copies of waste transfer notes, the waste carrier licences and details of the receiving licenced waste facilities are maintained by the Client.

Surplus Mixed Materials

A range of mixed surplus materials generated from the site regrading (cut and fill), and plot foundation and drainage works have been periodically removed offsite as part of the development of the site. Copies of waste transfer notes, the waste carrier licences and details of the receiving licenced waste facilities are maintained by the Client.

Surplus Mixed Materials and Hydrocarbon Hotspot (Southwestern and Plot 26 Area)

As part of the delineation investigations, all visually contaminated materials have been removed from the former drain alignment in the southwestern / Plot 26 part of the site. Following removal of the contaminated material, the underlying insitu natural clay showed no significant visual or olfactory evidence of contamination indicating that the hydrocarbon hotspot had not spread into the wider environment. Original waste transfer notes, the waste carrier licences and details of the receiving licenced waste facilities are maintained by the Client and copies are included in Appendix 5.

11.4 Built Development

Clean Cover Soils

All plots are reported to have recorded a sufficient depth, and chemical quality of emplaced materials, including additional inert layer / warning membrane to the front gardens of Plots 27 to 29.

Gas Protection Measures

All plots have been reported to be installed with the appropriate gas protection measures complying with Characteristic Situation 2 conditions, including additional vapour barrier to Plots 20, 28 and 29.

In-Ground Materials

Records of in-ground concrete specification utilised and confirmation of Water Authority approval and data sheets for the hydrocarbon resistant / barrier pipework materials utilised are retained by the Client.

12 CONCLUSIONS OF VALIDATION REPORT

From the records/documents provided by the Client and their Contractors detailing the works undertaken as part of the site enabling and subsequent main reclamation works phases, the works have been undertaken in general accordance with the objectives of the FWS Reclamation Method Statement (Ref. 6).



A ROBINSON
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M LAKEY
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13 REFERENCES

- 1 URS Corporation Ltd, February 2008. Former Albright & Wilson Works, Whitehaven, Cumbria. Ref. MARP0002.
- 2 Integra Consulting Engineers, May 2013. Geotechnical Ground investigation at Land at Former Rhodia Offices, High Road, Whitehaven, Cumbria for Story Homes, Ref. 2599.
- 3 FWS Consultants Ltd, April 2019. Due Diligence Report for Land at Water's Edge, Whitehaven. Report Ref. 8190OR01.
- 4 FWS Consultants Ltd, April 2019. Coal Mining Risk Assessment for Land at Water's Edge, Whitehaven. Report Ref. 8190OR02.
- 5 FWS Consultants Ltd, March 2022. Phase 1 and 2 Geoenviromental Investigation for Residential Development on Land at Water's Edge, Whitehaven. Report Ref. 8190OR03Rev02.
- 6 FWS Consultants Ltd, October 2022. Reclamation Method Statement for the Proposed Residential Development on Land at Water's Edge, Whitehaven. Report Ref. 8190OR04Rev02
- 7 FWS Consultants Ltd, November 2022. Supplementary Ground Investigations for the Proposed Residential Development on Land at Water's Edge, Whitehaven. Report Ref. 8190OR08.
- 8 FWS Consultants Ltd, March 2023. Technical Note – Ground Conditions and Foundation Recommendations for Plots 14, 15 and 16 Residential Development on Land at Water's Edge, Whitehaven. Report Ref. 8190OR10.
- 9 FWS Consultants Ltd, May 2023. Controlled Waters Risk Assessment for Residential Development on Land at Water's Edge, Whitehaven. Report Ref. 8190OR13.
- 10 FWS Consultants Ltd, December 2023. Additional Ground Investigation and Hotspot Delineation for Residential Development on Land at Water's Edge, Whitehaven. Report Ref. 8190OR15.
- 11 FWS Consultants Ltd, March 2024. Additional Ground Investigation and Hotspot Delineation Near Plot 26 of Residential Development on Land at Water's Edge, Whitehaven. Report Ref. 8190OR18.
- 12 FWS Consultants Ltd, October 2023. Interim Reclamation Validation Report for Plots 01 to 08 at Residential Development on Land at Water's Edge, Whitehaven, Cumbria. Report Ref. 8190OR14.
- 13 FWS Consultants Ltd, January 2024. Interim Reclamation Validation Report for Plots 01 to 08 and 38 to 40 at Residential Development on Land at Water's Edge, Whitehaven, Cumbria. Report Ref. 8190OR16.