

Technical Note

Project: Crymlyn Tip, Coed Darcy

Subject: Crymlyn Tip - Ground Conditions Summary

Client:	St. Modwen Developments	Version:	v1
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I Introduction

In 2008 St. Modwen Developments Ltd (St. Modwen) acquired the Coed Darcy development site located at the former BP Llandarcy oil refinery. Included in the development boundary is Crymlyn Tip ('the Tip') which is subject to an Environmental Permit.

St. Modwen is responsible for the ongoing management of the Tip in accordance with the Environmental Permit and progression towards full closure and surrender of the permit.

Working towards a future permit surrender, proposals for the Tip include the installation of a below ground barrier to prevent the off-site migration of residual free phase hydrocarbon contamination from the Tip and reprofiling of site levels to create a suitable cap and stable long-term landform.

This technical note has been prepared in support of a full planning application for the proposed works at the Tip. The purpose of this note is to provide information on current ground conditions in the area of the proposed works, the extent of which is described in Section 2.1.

2 Site Setting

2.1 Site Extent

The area covered by the planning application is herein referred to as 'the Site' and for the purpose of this technical note has been split into the following areas shown on Figure 1 below:

- 1 The Earthworks Area
- 2 The Temporary Laydown Area

3 Ecological Mitigation Area

4 Coed Darcy Wetlands

The 'Earthworks Area' comprises the Tip Permit area (represented by the green line on Figure 1), the perimeter ash bund to the north and west of the Permit area, a 'peripheral trench' used for recovery of free phase hydrocarbons, and an area of land directly to the east of the Tip. The Earthworks Area will be subject to the works proposed in the planning application.

Immediately south of the Earthworks Area are West Bay, Crymlyn Bog Lagoon and South Bay, known collectively as the Coed Darcy Wetlands. These waterbodies originally formed part of the Permit area but have since been remediated and successfully surrendered. The Coed Darcy Wetlands are to remain unchanged under the proposed works.

The Site boundary extends beyond the Coed Darcy wetlands to include two packages of land shown as dark blue and green hatched areas in Figure 1. The dark blue area (covering approximately 14,000m²) is required as a Temporary Laydown Area for cabins and general storage for the duration of the works. The green hatched area in the south of the Site is proposed as an Ecological Mitigation Area, comprising a Great Crested Newt (GCN) receptor site consisting of two ponds to mitigate the loss of GCN habitat on the Tip.

In total, the Site covers an area of approximately 140,000m².

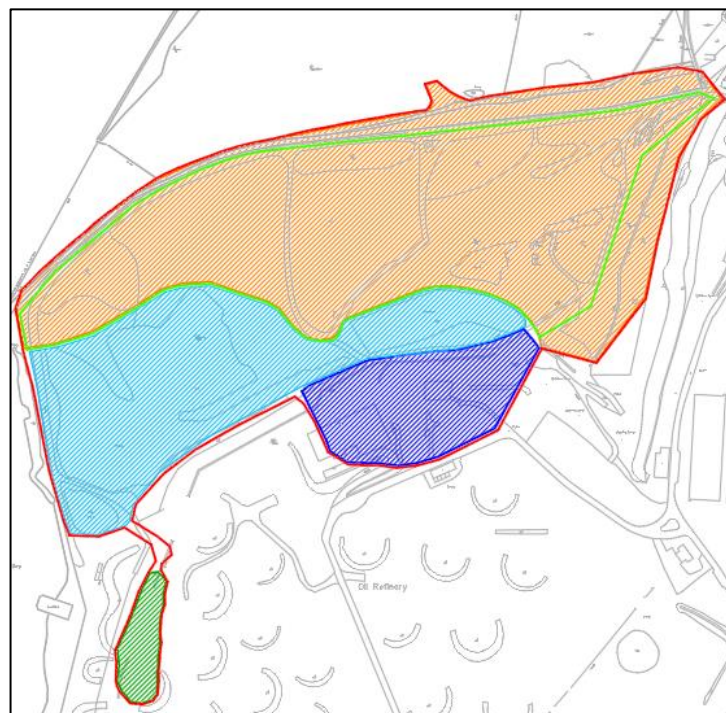


Figure 1: Site boundary and Earthworks Area: orange hatching, Coed Darcy Wetlands: light blue hatching, Temporary Laydown Area: dark blue hatching and Ecological Mitigation Area: green hatching).

2.2 Site Location

The Site is located in the southwestern part of the wider Coed Darcy development site. Immediately to the north and west of the Site is Crymlyn Bog, a designated a Site of Special Scientific Interest (SSSI). Between the Temporary Laydown Area and Ecological Mitigation Area is a small housing development known as the Demonstration Village. This housing remains unoccupied at the time of the writing and it is understood that occupation of this housing is restricted until the provision of new infrastructure within this part of the former refinery. The south and east of the Site is undeveloped, vacant land within the wider Coed Darcy development site. During operation of the former oil refinery, these areas were occupied by a tank farm to the south, and a railhead to the east.

3 Proposed Works

Englobe were commissioned by St. Modwen to carry out a series of risk assessments for the Tip and subsequently to undertake a restoration options appraisal to determine the 'best practicable technique' for the restoration of the Tip.

Restoration works to be undertaken by Englobe are confined to the Earthworks Area and the Temporary Laydown Area will be used for cabins and general storage. Once established, the Ecological Mitigation Area will be fenced off from the rest of the development site and connected with the wider newt receptor site. There are no proposed changes to the Temporary Laydown Area or the Coed Darcy Wetlands and after the works are completed these areas will remain in their pre-works levels and condition.

The restoration proposals in the Earthworks Area comprise:

- Installation of a low permeability barrier, to act to reduce potential movement of residual free phase contamination, as shown on Englobe drawing D1870/23//5289/05;
- Targeted non-aqueous phase liquid (NAPL) recovery within areas of identified significant residual NAPL in the Tip and ash bund. This recovery would be carried out via a proposed network of abstraction and reinjection wells as shown on Englobe drawing D1870/23/5289/06;
- Reprofilng of the Tip to provide a suitable landform to minimise the risks of potential future instability;
- Placement of restoration layers to mitigate potential risks to human health associated with direct exposure and fugitive emissions;
- Decommissioning of peripheral trench;
- Installation of monitoring infrastructure to confirm compliance with environmental remediation target values to support a future permit surrender.

Full details on the proposals are presented in the Englobe Crymlyn Tip Restoration Implementation Plan, referenced R1870/23/5260 dated April 2023.

4 Site History

4.1 Earthworks Area and Coed Darcy Wetlands

Prior to development of the oil refinery, the Earthworks Area and Coed Darcy Wetlands occupied a low-lying area consisting of a series of natural ponds and marshland which formed part of Crymlyn Bog.

The Coed Darcy Wetlands were originally part of the Tip permit boundary. However, this area was never infilled and was removed from the permit by Natural Resources Wales following the submission of a surrender application prepared by Atkins on behalf of St. Modwen in 2017. Further information on the history of the Coed Darcy Wetlands and the partial surrender of the environmental permit is presented in the Partial Surrender Site Condition Report (5041216-RAP-RPT-0001788).

The area forming the Tip within the proposed Earthworks Area was enclosed with an external ash bund built out into Crymlyn Bog. This ash bund formed a boundary structure and was also used as a primary access haul road into the Tip.

Waste disposal is understood to have commenced in the Tip in the early 1920s and continued until the 1970s when relevant regulations for waste disposal were introduced, including the Deposit of Poisonous Wastes Act 1972 and the Control of Pollution Act 1974. Under this act waste disposal at the Tip was controlled by an annual 'season ticket' issued by Neath Rural District Council for disposal of waste streams including non-notifiable waste, oil contaminated waste, oily sludge, pyrophoric material, sanitary waste and asbestos. In 1974, in accordance with the Control of Pollution Act, Neath Borough Council is reported to have issued BP with a Waste Disposal Licence to operate the Tip.

The waste disposal licence was converted to a waste management licence in 1998 under the Waste Management Licensing Regulations 1994.

It is understood that the Tip has not accepted waste since 1999 when the refinery ceased operation and the Tip was recorded as 'closed' by the Environment Agency in 2001.

Immediately prior to the sale of the former oil refinery from BP to St Modwen, the central and eastern parts of the Tip were provided with a capping of material. The materials comprised predominantly cobbly sandy clay/clayey sand and cobble with some mixed general waste. Approximately 15,000m³ material was placed, at thicknesses typically between 0.5 and 1.5m.

Further information on the history of the permit and waste deposition history is available in the Crymlyn Tip Data Review Technical Note produced by PJA in January 2021.

4.2 Temporary Laydown Area

During operation of the former oil refinery the 'Temporary Laydown Area' included the gas and fuel oil blending area and a crude oil pump house. Further information on the history of this area is presented in Atkins' Validation Report for Monitor Phase 58 (5041216-OSW-RPT-0001385) produced in October 2015.

4.3 Ecological Mitigation Area

The Ecological Mitigation Area, located in the southwestern part of the Site, was used during operation of the former oil refinery for the storage of fuel oils in aboveground tanks. Further information on the history of this area is presented in Atkins' Validation Report for Monitor Phase 67 (5041216-OSW-RPT-0001370) produced in October 2015.

5 Ground Investigation and Remediation Works History

This section summarises the ground investigation and remediation history of the Site, with the exception of the Coed Darcy Wetlands which will not be used or changed during the works.

5.1 Earthworks Area

Works carried out in the Earthworks Area have included ground investigation, 'turnover' works, NAPL recovery and source removal over a period of more than 20 years. Works have been carried out by numerous consultants and contractors on behalf of BP and St. Modwen, focusing on different areas for different purposes, some of which relate to Remedial Action Plan (RAP) works required under the Section 106 Agreement for the wider Coed Darcy development.

A brief summary of the work historically carried in the Earthworks Area is included in Table 5-1.

Table 5-1: Summary of Works in the Earthworks Area

Consultant/ Contractor	Year	Summary of Work Completed	Ground Conditions Encountered	Report
URS	1998- 2001	Ground investigations carried out on the behalf of BP. 38 No. monitoring wells were installed between 1998 and 1999. Between 2000 and 2001, an additional 54 boreholes were installed to inform design of a free phase recovery system and an interception feature.	Logs from ten boreholes in the eastern part of the Earthworks Area recorded ash along the northern boundary in excess of 17.5mbgl thick. This was underlain by superficial deposits of silt and sand.	

Consultant/ Contractor	Year	Summary of Work Completed	Ground Conditions Encountered	Report
URS	2008	Ground investigation of the environmental permit area (including wetlands) and the surrounding area. 18 cable percussive boreholes drilled to depths of between 2.0 and 26.4mbgl.	In the central and eastern parts of the Earthworks Area the subsurface sequence was recorded as comprising waste fill, Peat, organic clays, sands and gravels and Glacial Till. Peat was limited to the central area.	Llandarcy Tip Restoration Ground Investigation Report, URS February 2008 (44382540/BDRP 0011)
Celtic	2009	45 boreholes drilled to delineate and recover free phase oils from the central and eastern part of the Tip. An additional 20 boreholes were installed in high productivity areas.	Base of the waste fill was proven in 26 boreholes, with depths ranging from 7.5 to 12mbgl. In each of these locations the waste was underlain by Peat.	Containment Area Free Product Recovery Validation Report, Celtic July 2011 (Report No. R1296/11/3742)
Hydrock	2014-2015	A 'turnover' of materials in the lower, western part of the Tip. Remedial works comprised excavation of waste fill and the removal of identified sources of oil. Oil was skimmed from standing water in the base of excavations and excavated soils were left to drain before replacing in layers.	Waste found to comprise a mix of anthropogenic material including barrels, pipes and hoses, laboratory glassware, timber and asbestos containing material including gaskets, rope and fire blankets. The waste fill was found to have an average thickness of between approximately 3m and 4m, although the base of the waste fill was unconfirmed at depths of 7mbgl in the south east corner, towards the centre of the Tip. The waste fill was found to directly overlie soft brown fibrous Peat, which was noted to be shallower in the northern part of the area (approximately 1.5mbgl), compared to the south (approximately 5mbgl).	N/A
Geo Environmental Applications Ltd	2020	A series of shallow trial pits completed across the Tip to characterise the waste fill and capping materials.	Cover layer in the central and eastern part of the Tip was confirmed as being approximately 0.5m thick and was described as brown silty sand and gravel with frequent cobbles and boulders. Waste confirmed as comprising fire hoses, rope, wire, plastic barrels, rubber hoses, rubber matting, plastic, wood and metal pipe.	
Lankelma	2021	18 cone penetration tests carried out across the central part of the site. The	The investigation confirmed the presence of hydrocarbon	PJA Technical Note: 4020-OUT-

Consultant/ Contractor	Year	Summary of Work Completed	Ground Conditions Encountered	Report
		CPT probe was equipped with a UV camera to detect hydrocarbon contamination. Other parameters measured were cone resistance and pore pressure.	contamination locally in the Tip. The data suggests horizontal and vertical variations in the distribution of hydrocarbon contamination.	TN-R-0057. Crymlyn Tip UV Probe Ground Investigation. July 2021
Englobe	2022	13 boreholes were drilled to gather further data on the Tip, particularly from the periphery where data gaps were identified.	In the northern ash bund, Made Ground was recorded as comprising loose to very loose ash with slag, clinker and brick and clay, silt, sand and gravel. In the western, southern and eastern perimeters the Made Ground was recorded as variable in composition, containing clay, sand, gravel, ash, clinker, bitumen, cobbles of brick, slag, concrete and sandstone.	Crymlyn Tip Restoration Implementation Plan. Englobe. April 2023. R1870/23/5260.

5.2 Temporary Laydown Area and Ecological Mitigation Area

5.2.1 Approach to Ground Investigation, Remediation and Validation

The Temporary Laydown Area and Ecological Mitigation Area have undergone investigation as part of the wider Coed Darcy development in accordance with the requirements of the Section 106 Agreement. The works undertaken are detailed in a series of validation reports which were reviewed and signed off by an independent 'Monitor'.

The Section 106 Agreement stipulated frequencies of investigation and sampling to be achieved, which varied depending on the proposed end use. Contaminant concentrations from environmental samples taken during ground investigation were screened against the relevant Remedial Target Criteria for the proposed end use. Full details on the ground investigations, contamination risk assessment, remediation and validation works carried out in the areas covering the Temporary Laydown Area and Ecological Mitigation Area are presented in the validation reports for Monitor Phases 58 (Atkins report 5041216-OSW-RPT-0001385) and Monitor Phase 67 (Atkins report 5041216-OSW-RPT-0001370) respectively.

5.2.2 Summary of Ground Investigation, Remediation and Validation in Temporary Laydown Area

Ground investigations in 2014 and 2015 encountered variable Made Ground underlain by superficial deposits of a sandy gravel and gravelly sand to sandy and gravelly clays or silts, with varying quantities of cobbles and boulders. Occasional pockets of peat were recorded. This in turn was underlain by weathered sandstone bedrock. Made Ground variably comprised clay, sand and gravel with numerous anthropogenic inclusions. Gravel was described as angular to

rounded fine to coarse fragments of siltstone, sandstone, limestone, brick, concrete, clinker, coal and burnt shale.

Remedial works comprised localised hotspot excavation and validation sampling.

The Temporary Laydown Area was signed off by the independent Monitor for a commercial end use, with the works and associated reporting demonstrating that the area met the minimum requirements defined in the Section 106 Agreement for redevelopment for a commercial end use.

5.2.3 Summary of Ground Investigation, Remediation and Validation in Ecological Mitigation Area

Made ground was found to be underlain by superficial deposits of sandy gravel, gravelly sand, sand and gravel with varying quantities of silt, clay, cobbles and boulders. Made Ground consisted of clay, silt, sand and gravel with occasional pockets of Peat. Gravel in the Made Ground comprised subangular to rounded fine to coarse fragments of siltstone, sandstone, mudstone, brick, concrete, clinker and pulverised fuel ash. Neither weathered nor competent bedrock were encountered in the Ecological Mitigation Area.

The Ecological Mitigation Area was signed off by the independent Monitor for a commercial end use, with the works and associated reporting demonstrating that the area met the minimum requirements defined in the Section 106 Agreement for redevelopment for a commercial end use.

In addition to works required under the Section 106 Agreement, two trial pits were excavated in September 2022 in the location of the proposed newt ponds. The location of the proposed ponds is shown on PJA Drawing 0420-SK913-P0. The trial pits were excavated with the aim of confirming that the ground conditions were as anticipated and free from visual and olfactory signs of contamination.

The trial pits encountered Made Ground comprising brown silty gravelly sand with cobbles and boulders. Gravels were fine to coarse sub angular to subrounded fragments of sandstone, brick and concrete. There were no visual signs of contamination. The trial pits were left open to fill with water for the purposes of inspection. After two weeks the holes had filled with water with no visual or olfactory signs of contamination evident.

6 Anticipated Ground Conditions

6.1 General

This section summarises relevant information presented above to inform the anticipated ground conditions in those parts of the Site which will undergo intrusive works. This covers the Earthworks Area and the Ecological Mitigation Areas only.

6.2 Earthworks Area

The Earthworks Area comprises the landfilled area of the Tip and the ash bund that forms the northern and western boundary.

The ash bund comprises loose to very loose black ash with cobbles of slag, clinker, brick and clay, silt, sand and gravel. The ash is thickest in the east where the topography is higher and a thickness of up to 17.5m of ash have been recorded. The thickness (and width) of the ash bund thins towards the west, and based on the Hydrock works carried out in 2014 it is estimated to be approximately 3-4m thick.

The waste is highly variable across the area, recorded as clay, sand, gravel, sandstone, ash, clinker, bitumen, cobbles of brick, slag, concrete, fire hoses, rope, wire, plastic barrels, rubber hoses, rubber matting, plastic, wood and metal pipe.

In the central and eastern parts of the Earthworks Area the waste deposits have been recorded at proven thicknesses of 12m. This part of the site has also received a capping layer comprising brown silty sand and gravel with frequent cobbles and boulders, believed to be between 0.5 and 1.5m thick. In the western part of the Earthworks Area, the Made Ground is thinner, ranging from approximately 1.5m thick in the north compared to approximately 5.0m thick in the south.

Free phase hydrocarbon contamination is present in the waste deposits and ash bund. Investigation have shown the free phase contamination is variably spread vertically and horizontally because of the heterogenous nature of the waste deposits.

The Tip was formed by the deposition of waste to the south of the ash bund directly onto natural deposits of Peat. Soft brown fibrous Peat has been recorded under the majority of the Earthworks Area, with clay, silt and sand present locally which has been interpreted as Glacial Till.

The proposed works in this area seek to recover NAPL, install a low permeability barrier and reprofile the landform using restoration soils which will all result in improved ground conditions in and around the Earthworks Area.

6.3 Ecological Mitigation Area

Ground conditions in the proposed Ecological Mitigation Area have been proven in September 2022 as Made Ground comprising brown silty gravelly sand with cobbles and boulders. Gravels were fine to coarse subangular to subrounded fragments of sandstone, brick and concrete. No visual or olfactory evidence of contamination was present. The proposals in this area are the construction of shallow ponds to act as a GCN receptor site.