



St Modwen Developments Ltd.

Coed Darcy

Flood Consequence Assessment and Drainage Strategy

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Version Control and Approval

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Purpose

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The revised Construction (Design and Management) Regulations 2015 (CDM Regulations) came into force on April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities under clause 9 (1) is to ensure that the client organisation, in this instance St Modwen Developments Ltd, is made aware of their duties under the CDM Regulations.

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I Executive Summary

- 1.1.1.1 PJA has been commissioned by St Modwen Developments Ltd to prepare a Flood Consequence Assessment (FCA) and Drainage Strategy to support an outline planning application for a new mixed use development of up to 2,000 residential dwellings, commercial and educational development with associated green open space and infrastructure at Coed Darcy, Llandarcy.

Table 1-1: Executive Summary Table

Overview	
Site Location	Coed Darcy, Llandarcy, Skewen, Neath
Development Proposal	Mixed use development including residential, commercial and educational development.
Development Advice Mapping Zone(s)	The majority of the Site lies within DAM Zone A, with a small area of the south-west of the Site being proposed to lie within DAM Zone C2. No development has been proposed in this location.
Fluvial Flood Risk	Low
Tidal Flood Risk	Low
Surface Water Flood Risk	Low
Groundwater Flood Risk	Low
Sewer Flood Risk	Low
Reservoir Flood Risk	Low
Canal Flood Risk	Low
Surface Water Drainage	The proposed Surface Water Drainage Strategy will implement SuDS in the form of basins, swales and conveyance features. The aim of the surface water drainage strategy is to mimic the natural catchment processes as closely as possible and adopt the principles of water management scheme as stated in section 2 of the statutory “<i>Sustainable Drainage Systems Standards for Wales</i>” (SDSSW) document 2018. The proposed maximum peak discharge rate from the proposed development aims to limit surface water runoff to a rate no greater than 5.5l/s/ha into the Crymlyn Bog and a betterment on the previously agreed maximum peak discharge rate (578l/s) into the DCWW network via the Bridge House outfall is being proposed. Given the outline nature of this planning application, it has been agreed with Neath Port Talbot Council, in their role as SAB, that it is not appropriate to submit a SAB application at this stage and that the principles set out within this Report are sufficient to support the outline planning application. Site wide and/or individual SAB applications will be made in due course, at an appropriate stage of design.
Foul Water Drainage	Given the outline nature of this application, two foul water drainage strategy options have been proposed. One solution provided implements a gravity led foul drainage solution and the other option a pumped solution. A gravity led foul drainage solution is considered to be the preferred option; however these strategies will be further developed and refined at the next stage of design.



2 Introduction

2.1 Terms of Reference

- 2.1.1 PJA were commissioned by St Modwen Developments Ltd to prepare a Flood Consequence Assessment (FCA) and Drainage Strategy for a proposed mixed-use development at *Coed Darcy, Llandarcy* (herein referred to as 'the Site').

2.2 Scope of works

Flood Consequence Assessment

- 2.2.1 This Flood Consequence Assessment (FCA) aims to provide information on the nature of identified potential flood risk at the Site and largely follows national guidance with regard to development and flood risk largely in line with Planning Policy Wales 11 and Technical Advice Note (TAN) 15: Development & Flood Risk

Drainage Strategy

- 2.2.2 A sustainable surface water drainage strategy has been prepared which aims to sustainably manage surface water from the Site and has been developed largely in accordance with Statutory Standards For Sustainable Drainage Systems – Designing, Constructing, Operating And Maintaining Surface Water Drainage Systems (2018)
- 2.2.3 A high level foul water drainage strategy has also been developed for the proposed development site.

2.3 Information Sources

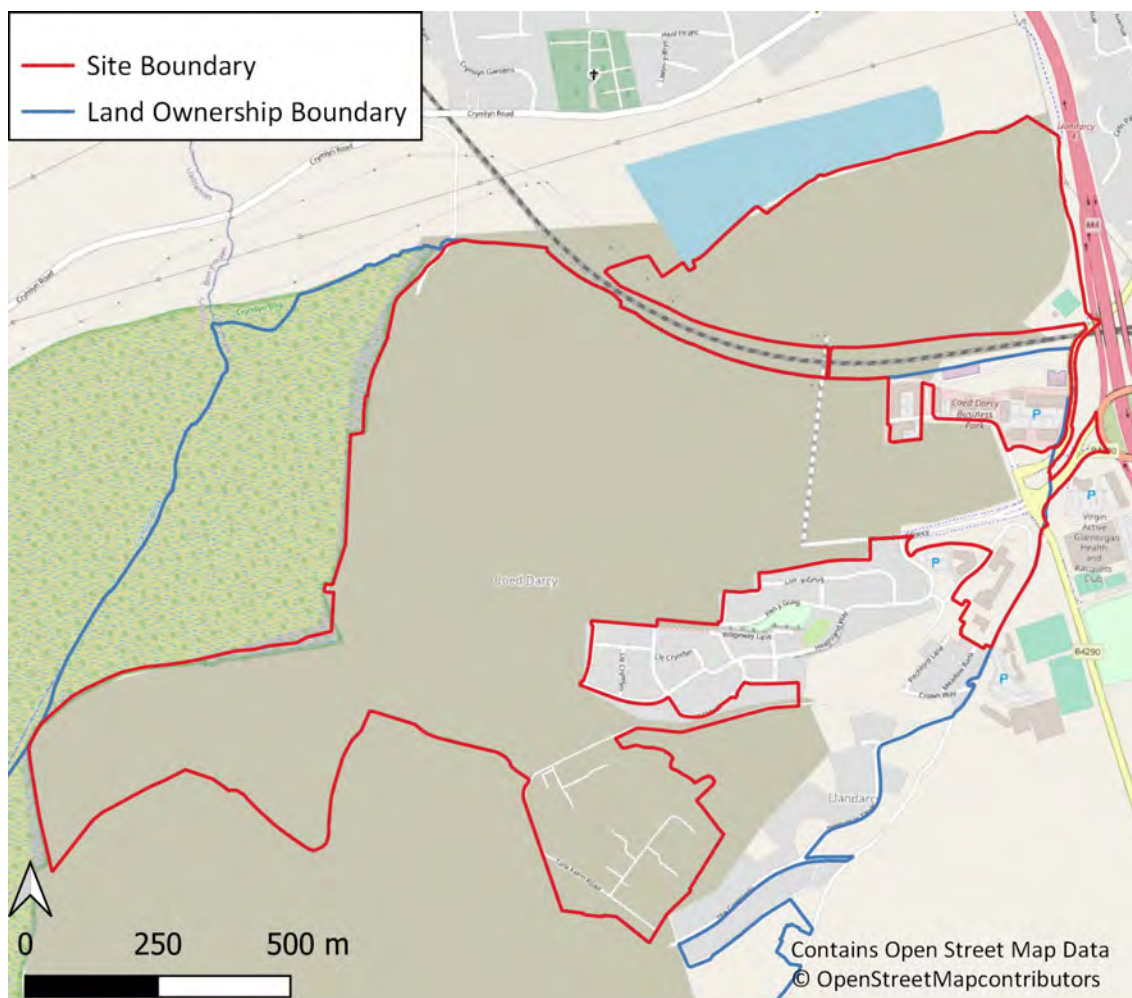
- 2.3.1 This report comprises a review of readily available public information and other relevant information obtained from the following sources:
- Natural Resources Wales (NRW);
 - British Geological Survey (BGS);
 - Dwr Cymru Welsh Water (DCWW); and
 - Neath Port Talbot Council (NPTC).



3 Site Details

3.1 Site Description

- 3.1.1 The Site, which is the focus of this FCA, is brownfield (previously developed) in nature and comprises part of the former BP Oil Refinery Site, covering an area of approximately 134ha.
- 3.1.2 Since the closure of the oil refinery, previous buildings and infrastructure associated with this land use has been demolished and remediation works have since been undertaken on Site and are still ongoing in certain areas.
- 3.1.3 The Site lies to the west of Junction 43 of the M4 Motorway and to the east of the Crymlyn Bog. The north of the Site is bounded by an existing Reservoir, which is known as the 'North Site Reservoir' (NSR), and to the south of the Site is land comprising the former BP Oil Refinery plant which forms part of the wider development Site.
- 3.1.4 Whilst the existing residential development on Site has been excluded from the Site Boundary, the surface water flows from this development currently discharge unattenuated to the NSR. As part of the Site wide drainage strategy, surface water flows from the existing residential development will be managed and attenuated to greenfield runoff rates within these works. Further information is available in Section 6 of this Report.
- 3.1.5 The Site's OS national grid reference is 271426, 195981.
- 3.1.6 A Site location plan is available in Figure 3-1.

**Figure 3-1 – Site Location Plan****Table 3-1: Summary of Site**

Site Address	Coed Darcy, Llandarcy, Skewen, Neath Approximate Postcode: SA10 6FG
Existing Land use	Former BP Oil Refinery.
Proposed Development Type	Mixed Use: residential, commercial and educational.
Site Area	Approximately 134ha
OS grid reference	271426 , 195981
County	Neath Port Talbot
Local Planning Authority	Neath Port Talbot Council (NPTC)
Lead Local Flood Authority & SuDS Approval Body	Neath Port Talbot Council (NPTC)
Local Water Authority	Dwr Cymru Welsh Water (DCWW)

3.2 Site Topography

- 3.2.1 The existing topography of the Site has been reviewed using publicly available Natural Resources Wales (NRW) 2m DTM LiDAR and indicates the Site to be relatively steep. The high point of the Site is identified immediately west of the existing residential development at approximately 77.0mAOD and falls from east to west, towards the Crymlyn bog, down to approximately 9.0mAOD. Levels also fall from this high point to the railway to north, which is in cutting, and towards the existing Coed Darcy Business Park where levels are approximately 29.0mAOD.
- 3.2.2 The topography north of the railway has a plateau through the centre, where levels are approximately 55.0mAOD falling away to approximately 40mAOD along the northern and southern boundaries and approximately 25mAOD in the south-western corner of the Site.
- 3.2.3 An extract of the 2m DTM LiDAR is available in Figure 3-2.

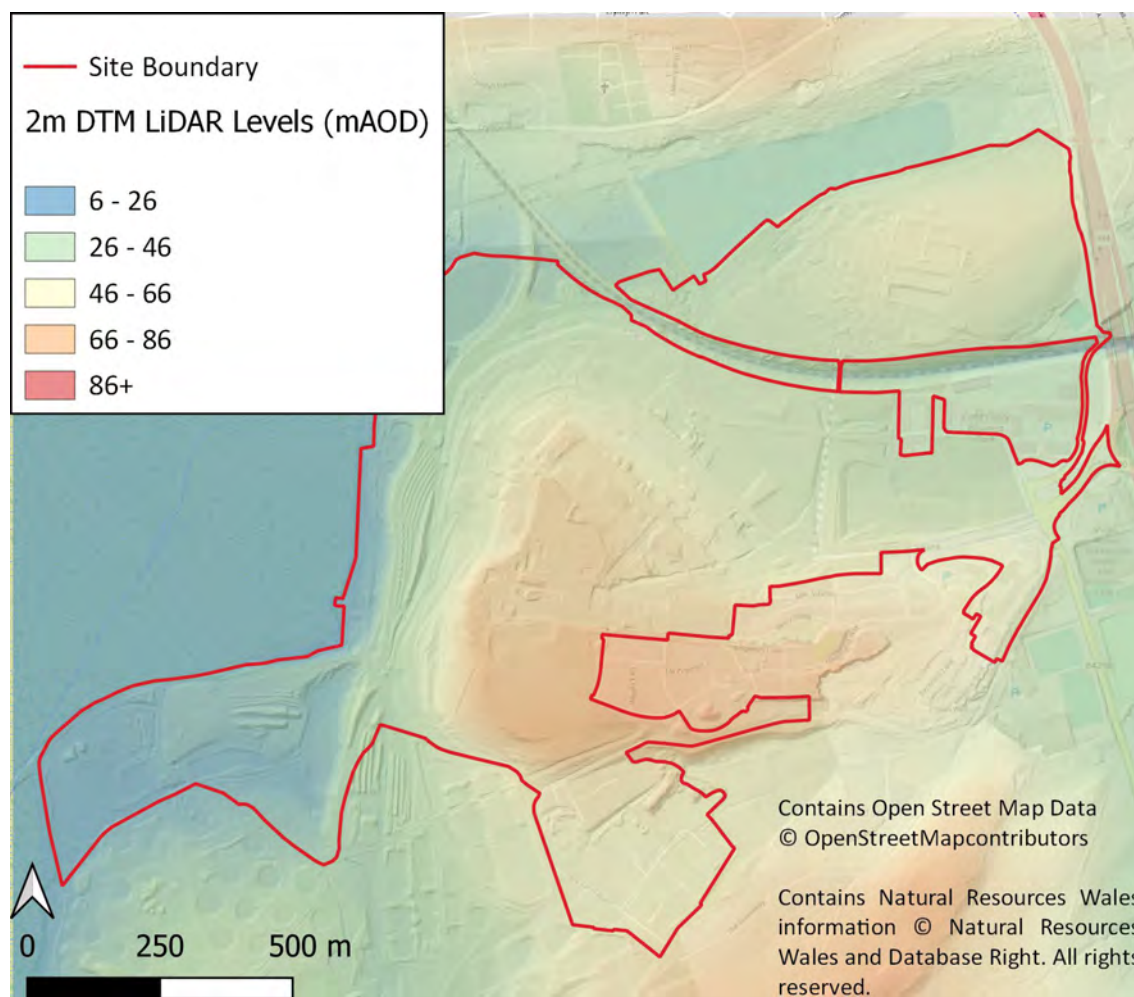


Figure 3-2 – NRW 2m DTM LiDAR Extract



3.3 Site Soils and Geology

- 3.3.1 The British Geological Survey (BGS) Geology of Britain viewer¹ indicates that the majority of the Site is underlain by Sandstone bedrock comprising Hughes and Brithdir Members. A band of Mudstone, Siltstone and Sandstone from the Hughes Member is identified bisecting the centre and south of the Site from west to east. A small area within the south of the Site which is identified to be underlain by a bedrock Mudstone, Siltstone and Sandstone of the Brithdir Member.
- 3.3.2 The Superficial Deposits BGS Geology Mapping has also been reviewed which identifies the majority of the Site to be underlain with Till Devensian – Diamicton and the east of the Site, in proximity to the Crymlyn Bog, is identified to be underlain with superficial deposits of Peat. It should be noted that following the site specific investigation the peat is present locally in the west of the Site only.
- 3.3.3 The Cranfield University Soilscape viewer² describes the soils as *“Slowly permeable seasonally wet acid loamy and clayey soils”*, it also identifies that the underlying soils are likely to have impeded drainage.

3.4 Hydrogeology

- 3.4.1 From review of the publicly available NRW Interactive Mapping³, Aquifer Designation Map (Superficial Drift) the Site majority of the Site is underlain by a Secondary (undifferentiated) aquifer. The Aquifer Designation Map (Bedrock) identifies that the Site is underlain by a Secondary A aquifer.
- 3.4.2 It is also identified that the Site is not underlain by a Source Protection Zone.

3.5 Site-Specific Ground Investigation

- 3.5.1 Extensive ground investigation has been undertaken at the Site in two main phases between 1998 and 2016.
- 3.5.2 Made Ground has been encountered at variable depths across the majority of the site associated with historical cycles of development and subsequent demolition and earthworks. The composition of Made Ground was described as clay, sand and gravel with sandstone gravel and cobbles and anthropogenic inclusions of concrete, brick, shale, coal, clinker, slag, ash, plastic, wire and fabric fragments. Along the western margin of Central Site, Made Ground was predominantly ashy in nature with clinker, associated with the known presence of an ash bund that was formed to a height of up to approximately 6m to facilitate construction of the former railhead in this area. Made

¹British Geological Survey. Geology of Britain Viewer. <https://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html>

²Cranfield Soil and Agrifood Institute. Soilscape Viewer. <http://www.landis.org.uk/soilscales/>

³ NRW Interactive Mapping.

https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer210/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/External_Map_Browser/viewers/EMB_Address/virtualdirectory/Resources/Config/Default&locale=en-gb



Ground is largely absent from the fields in the east of North Site which is consistent with the lack of known historical development in this area.

- 3.5.3 Glacial Till was described as matrices of clay, silt and sand with gravel, cobbles and boulders of sandstone. Discrete layers and pockets of peat were also encountered locally in lower-lying areas in the west of Central Site.
- 3.5.4 Competent bedrock of the Pennant Sandstone Formation was typically found to be overlain by a weathered zone comprising clayey silty sandy tabular sandstone gravel, cobbles and boulders. Depth to bedrock generally increases to the south on North Site and increases to the north and west across Central Site. Bedrock is exposed at current ground level in the centre and south of Central Site.
- 3.5.5 Varying concentrations of residual contamination were encountered at the site associated with historical operation of the oil refinery. Contamination in Made Ground and superficial deposits included petroleum hydrocarbons, polycyclic aromatic hydrocarbons, metals and asbestos with localised pockets of gross contamination in the form of oil-saturated soils and free phase hydrocarbons. Residual free phase hydrocarbons are typically present in bedrock fractures, but rarely in sufficient quantities to enable recovery. Chlorinated solvent contamination is present in the north of Central Site, specific to a refining process that was undertaken in this area of the site.
- 3.5.6 Further information is available in the 'Coed Darcy Phase 1 Geo-environmental Desk Study, PJA, October 2021.'

3.6 Existing Drainage Assets

- 3.6.1 The Site comprises part of the former BP oil refinery and as such, a number of existing drainage assets which remain on Site and are still operational , include:
- The 'North Site Reservoir' (NSR) which forms the northern boundary of the Site. It is our understanding that this currently receives surface water flows from the existing residential development to the south. These flows are stored within the NSR is then pumped to the Dwr Cymru Welsh Water (DCWW) sewers east of the Site (via the Bridge House outfall) which eventually discharge to the River Neath.
 - The 'South Site Reservoir' (SSR) lies within the north eastern area of the Site, currently discharging uncontrolled and unregulated into the Crymlyn Bog via the Tal-y-wedu watercourse.
 - The River Neath lies approximately 650m east of the Site and currently receives surface water runoff from the Site via the DCWW sewer system.
 - The Crymlyn Bog lies immediately west of the Site and has a number of ditch courses running through the area. Given the existing Site topography, surface water flows are understood to discharge to the Crymlyn Bog at present and it is our understanding that previously, the oil



refinery also used to discharge surface water flows to the bog through the SSR and a number of settlement lagoons.

- A number of DCWW sewers cross the Site boundary, including a combined sewer system (which is present in the north-east of the Site) and a foul drainage network which serves the existing residential development and Coed Darcy Business Park. A DCWW surface water sewer leaves the Site from the north east and discharges to the River Neath (known as the 'Bridge House outfall').

3.6.2 The key existing drainage features have been shown on Figure 3-3 and are available in Appendix B. DCWW sewer asset mapping is available in Appendix C.

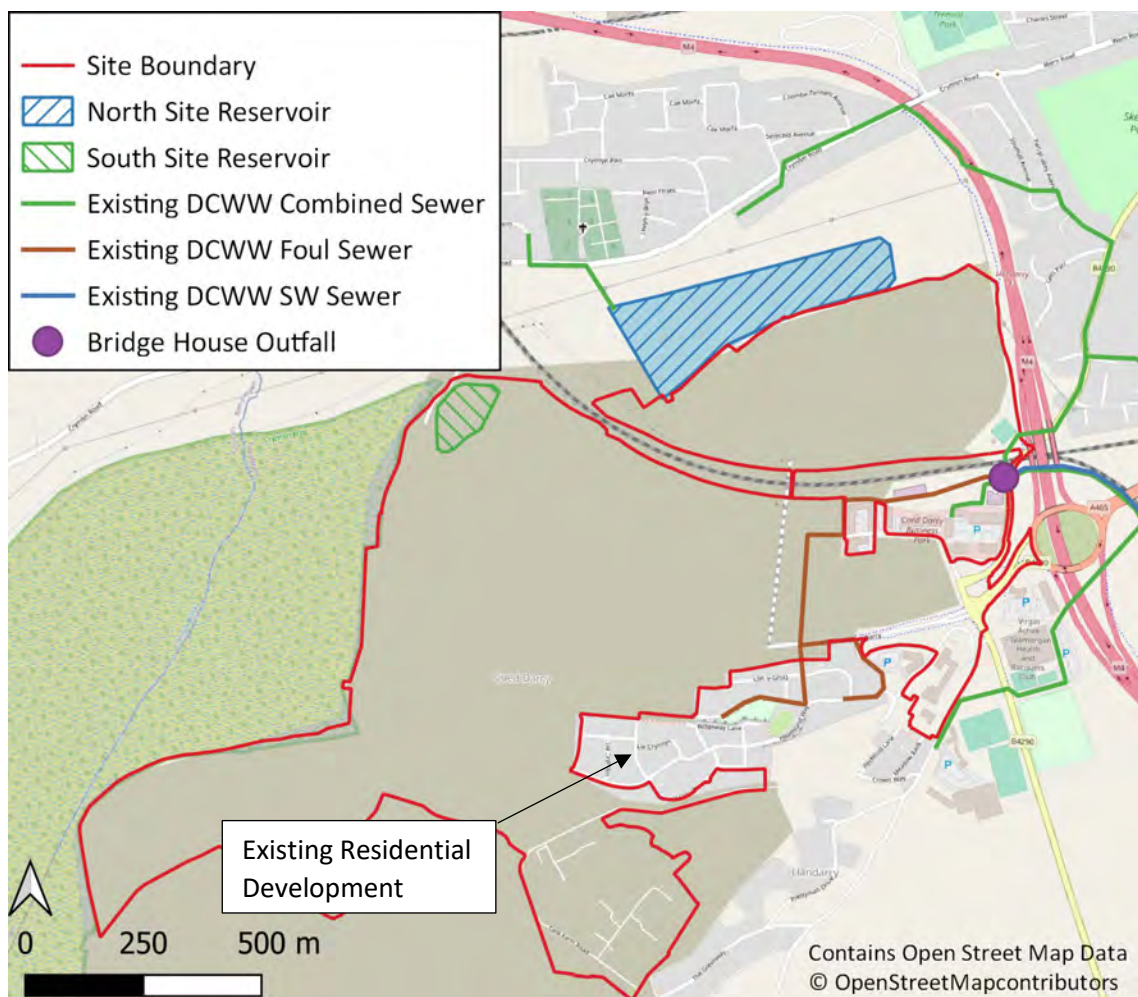


Figure 3-3 – Existing Drainage Features

3.7 Site Proposals

3.7.1 A previous Outline Planning Permission for the redevelopment of the Site, and wider area to the south, was granted in February 2008 (planning reference P2005/0393) to deliver 4,000 new homes, businesses and retail space and commercial, education and community facilities together with



highways, drainage, services, infrastructure, car parking and landscaping. Since this approval, there have been a number of applications submitted for the Site for various works.

- 3.7.2 Aside from infrastructure and remediation works (including the northern access road), the initial phases 1A and 1B have been delivered by Persimmon Homes, comprising development of approximately 300 residential dwellings which are now occupied and have been excluded from the Site as part of this application.
- 3.7.3 The Indicative Concept Masterplan is available in Appendix A.



4 Planning Context

4.1 Planning Policy Wales (PPW) Edition 11 (2021)

- 4.1.1 Section 6.6 of PPW Edition 11 discusses Water and Flood Risk, this notes that any development over 100m² will require a SuDS Approval Body (SAB) application and notes that the provision of Sustainable Drainage Systems (SuDS) should be integral to any development.
- 4.1.2 Paragraph 6.6.20 states *“Development proposals in sewered areas must connect foul drainage to the main sewer, and it will be necessary for developers to demonstrate to planning authorities that their proposal site can connect to the nearest main sewer”*.
- 4.1.3 PPW also note that the Development Advice Mapping (DAM) enable Local Authorities to a strategic approach to flood risk. It also notes *“Planning authorities should be aware of the risk of surface water flooding, usually caused by heavy rainfall, and ensure developments are designed and planned to minimise potential impacts”*.
- 4.1.4 As such, existing flood risk will be reviewed within this document and a proposed surface water and foul water drainage strategy is also included.

4.2 Technical Advice Note (TAN) 15: Development, Flooding and Coastal Erosion

- 4.2.1 Technical Advice Note (TAN) 15 relating to Development and Flood Risk was first published in July 2004 and was most recently updated and released on 28th September 2021 relating to Development, flooding and coastal erosion. However, the adoption of the updated TAN-15 into policy has been suspended until 2023, therefore the following Sections refer to the 2004 version of TAN-15 as directed by Welsh Government.
- 4.2.2 The updated TAN-15 which was due to be adopted reflected the core principles of the National Strategy for Flood and Coastal Erosion Risk Management in Wales, to adopt a risk-based approach in respect of new development in areas at risk of flooding and coastal erosion. This is in contrast to the more precautionary approach presented within the original TAN-15.
- 4.2.3 The overarching aim when considering new development in relation to TAN-15 (2004) is to prevent exposure to risk, by making locational choices in the following order of preference:
- To direct new development away from those areas which are at high risk of flooding, and
 - Where development has to be considered in high risk areas (Zone C) only those developments which can be justified on the basis of the test outlined in section 6 and section 7 of TAN 15 are located within such areas.

- 4.2.4 Given the proposed development being located outside of DAM Zone C1 or C2 it is identified as an appropriate location for development.

4.3 Local Policy

Neath Port Talbot Local Development Plan (NPT LDP) (2011-2026)

- 4.3.1 The NPT LDP was adopted in January 2026, where Policy SRA 1 refers to the Coed Darcy Strategic Regeneration Area however flood risk and drainage are not specifically mentioned in this policy.
- 4.3.2 The LDP does state “*New developments will be expected to avoid unnecessary food risk and to meet the requirements of TAN 15: Development and Flood Risk*”.
- 4.3.3 As such, this FCA will demonstrate that the proposed development avoids any un-necessary flood risk and meets the requirements of TAN 15.

Neath Port Talbot Local Flood Risk Management Strategy (2013)

- 4.3.4 NPT Local Flood Risk Management Strategy (FRMS) identifies the local stakeholders regarding flood risk in the NPT Council Area and does not identify that the area within the vicinity of the Site is within a flood risk community.
- 4.3.5 The document refers to the Local Development Plan for further advice for developers within the Council Area.

4.4 Consultation

Neath Port Talbot SuDS Approval Body (SAB)

- 4.4.1 A meeting was held with Neath Port Talbot as the SAB on the 27th April 2021 where the principles of the surface water drainage strategy for the Proposed Development were discussed and the general principles of surface water management on the Site were agreed.
- 4.4.2 Further discussions were then held on the 16th September 2021 where the SAB were updated on the progress of the surface water drainage design and agreed that the principles of the proposed development were acceptable at this stage and further detail design should be undertaken after planning submission before a formal SAB application is made.
- 4.4.3 Following discussions with the SAB, Surface Water Drainage Parameters Plans have been included within Appendix D, which includes the discharge location, rate and proposed developable areas on Site.



Dŵr Cymru Welsh Water (DCWW)

- 4.4.4 DCWW were consulted with regards to any historic sewer flood records and confirmed they hold no records of flooding for the Site
- 4.4.5 A pre-development enquiry was also received from DCWW and following this, a meeting was held on the 21st September where the following was agreed:
- Given the Site historic and previous agreements with DCWW, Hydraulic Modelling Assessments for potable and / or foul water modelling are not required.
 - DCWW confirmed that a connection to the surface water sewer at the Bridge House Outfall is acceptable in principle.
 - The agreed rate of surface water discharge (583l/s), as identified in the PC22 document (produced by Atkins to support previous discharge of conditions applications) via a connection to the surface water sewer at the Bridge House Outfall remains acceptable in principle; however should be reduced as far as reasonably practicable.
 - All off-Site upgrades will be covered by DCWW.
- 4.4.6 All pre-application correspondence is available in Appendix L and the DCWW pre-development enquiry in Appendix K.

5 Assessment of Flood Risk

- 5.1.1 The flood risk to and from the Site has been assessed based on a review of publicly available information (e.g. NRW flood data). A summary of the flood risk at the Site is provided in Table 5-1 and discussed in more detail in the sections below.

Table 5-1: Potential Sources of Flood Risk

Source of Flooding	On Site Presence
Fluvial	✓ (section 5.3)
Tidal	✗
Surface Water	✓ (section 5.4)
Reservoirs	✓ (section 5.7)
Groundwater	✗
Sewers	✗
Canals	✗

5.2 Historic Flooding

- 5.2.1 No historic flooding within the vicinity of the Site was identified within the NPT Preliminary Flood Risk Assessment (PFRA) (2011).
- 5.2.2 The Site is not identified to fall within the NRW Recorded Flood Extents mapping outlines.

Table 5-2: Summary of Consultation

Source of Flooding	Date Response Received	Comments
DCWW	17 th August 2021	DCWW were consulted with regards to historic flood records and confirmed they hold no records of sewer flood within the Site boundary.

- 5.2.3 All correspondence is available within Appendix L.

5.3 Fluvial and Tidal Sources

- 5.3.1 The River Neath lies approximately 80m east of the Site and the Crymlyn Bog Lies immediately west of the Site, in which lies a number of small watercourses.
- 5.3.2 From review of the NRW Flood Map for Planning, the Site is identified to lie outside the maximum flood extents from Rivers and Seas, an extract of this mapping is available in Figure 5-1.

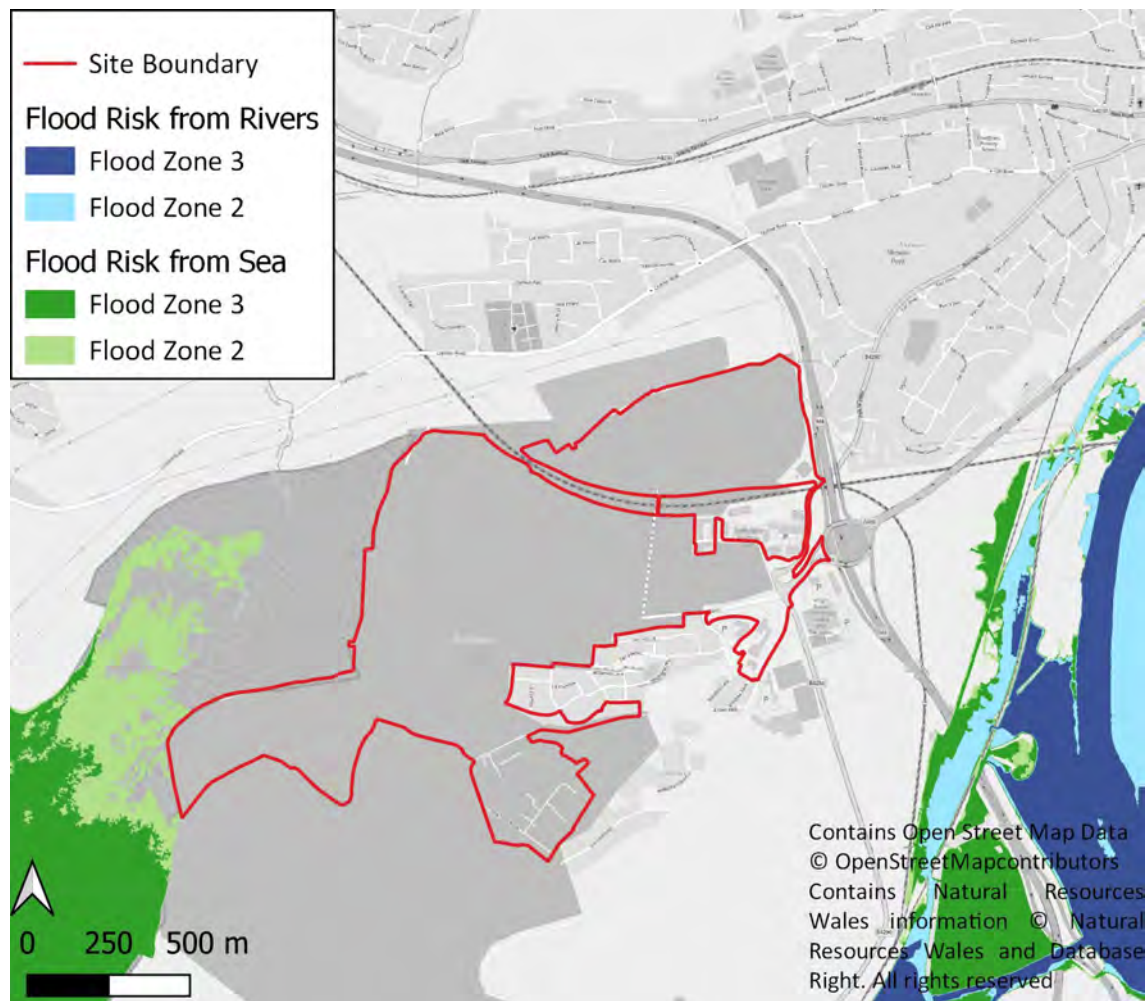


Figure 5-1 – NRW Flood Map for Planning Rivers and Seas Mapping Extract

5.3.3 Furthermore, the majority of the Site lies within Zone A of the Development Advice Mapping (DAM) which is considered the most appropriate area for development with regard to flood risk. A relatively small area to the south-west of the Site is identified in DAM Zone C2, which is defined in TAN 15 as “Areas of the floodplain without significant flood defence infrastructure”. An extract of the DAM is contained in Figure 5-2. The area within the Site which is located within Zone C2 of the DAM appears to be on account of the flows from the Crymlyn Bog.

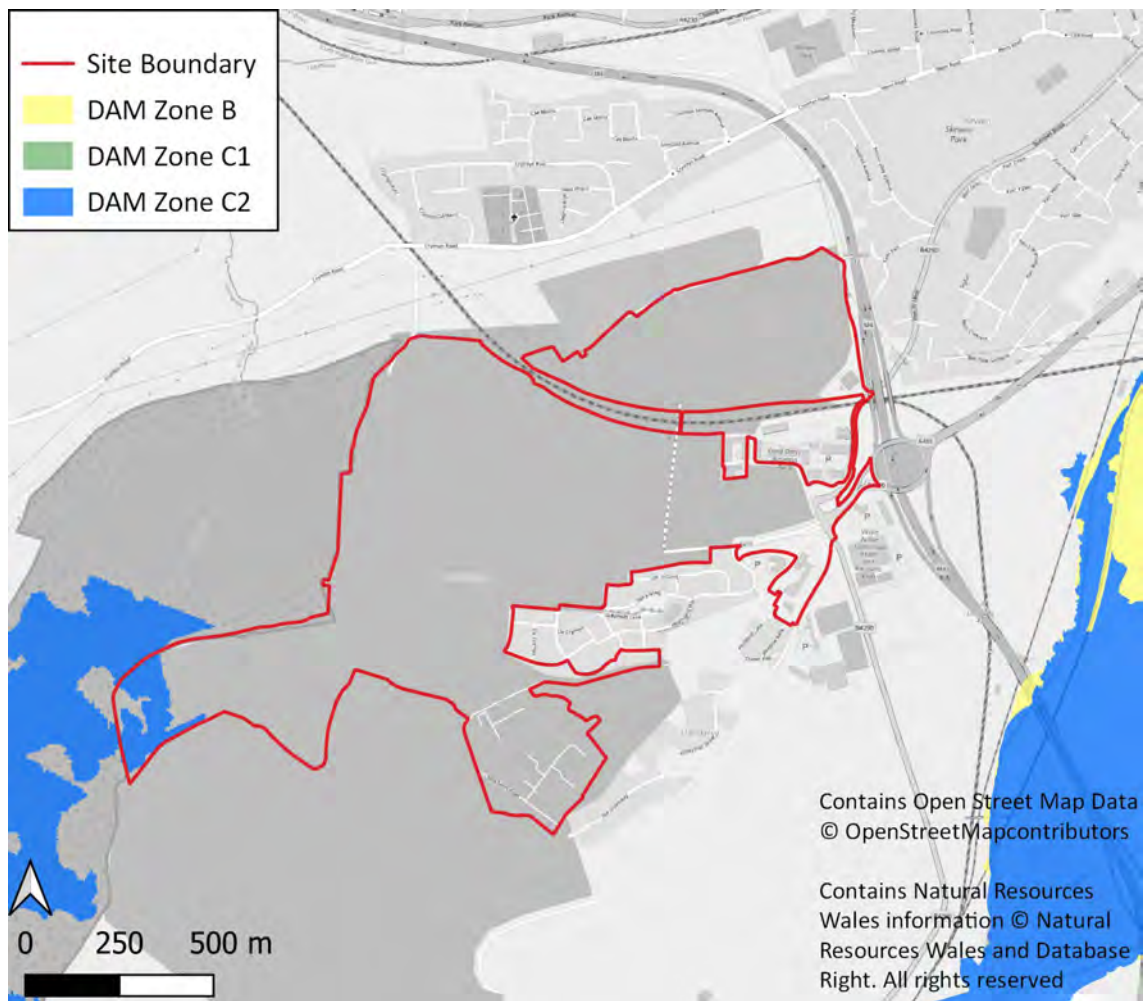


Figure 5-2 - NRW DAM Map Extract

5.3.4 As such, potential flood risk from fluvial and tidal sources is considered low.

5.4 Surface Water Sources

5.4.1 The NRW Flood Map for Planning, Surface Water and Small Watercourses Mapping identifies areas of surface water ponding associated with existing depressions on Site, the SSR and low lying areas in the south-east of the Site.

5.4.2 The low lying areas in the south-east of the Site are not proposed to be developed, the existing Site will be re-profiled and surface water from the Site will be managed by natural based systems such as SuDS.

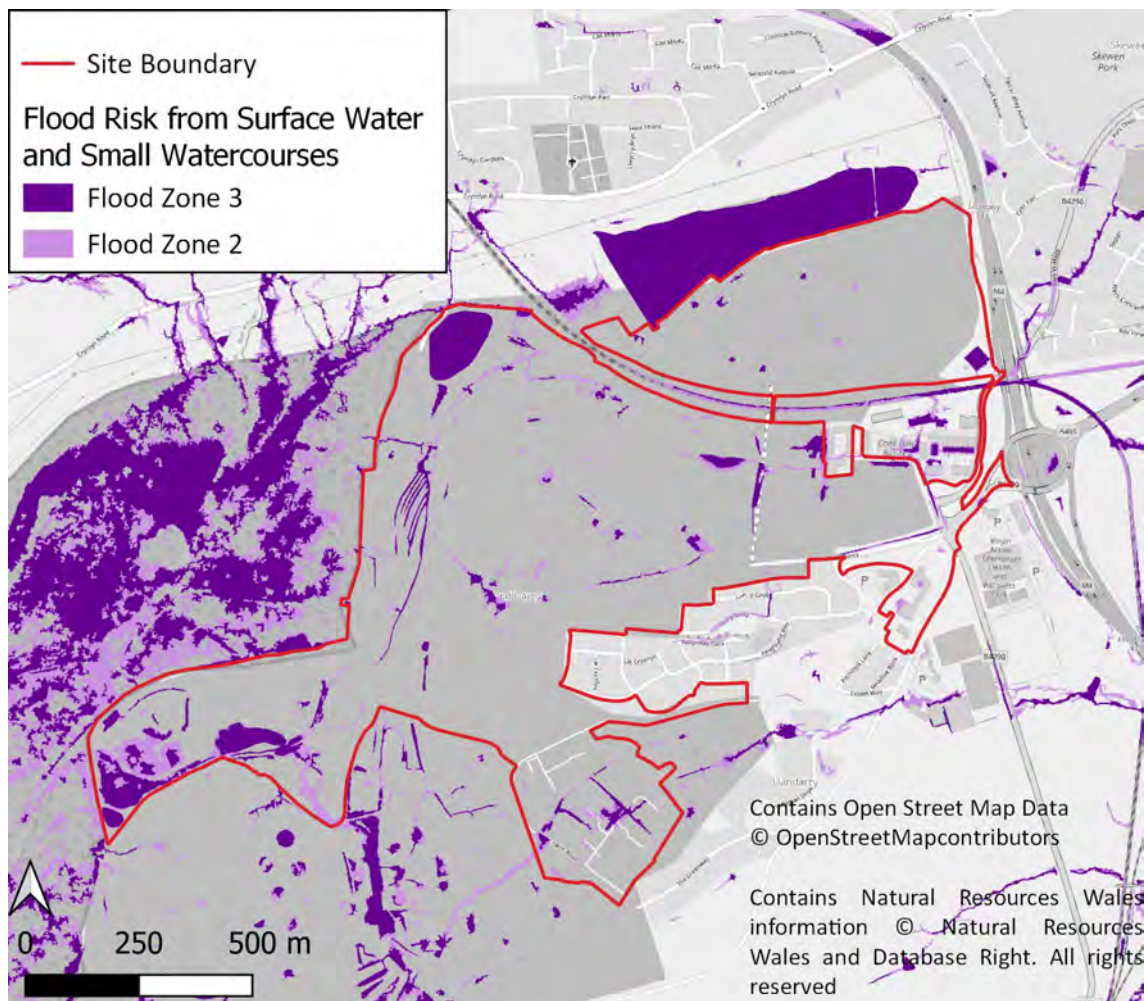


Figure 5-3 – NRW Flood Map for Planning Surface Water and Small Watercourses Mapping Extract

5.4.3 As part of the final Site design, measures will be implemented to ensure there is negligible increase in surface water flood risk on- and off-site and ensure that exceedance flows will be directed away for property.

5.4.4 Given this, potential flood risk from surface water sources may be considered to be Low.

5.5 Groundwater Sources

5.5.1 Groundwater flooding is typically caused by high groundwater levels. It occurs where excess water emerges at the ground surface via springs or within manmade structures such as basements. The risk of groundwater flooding depends on the nature of the geological strata underlying the site, as well as on the local topography.

5.5.2 Section 6.5 of the NPR Preliminary Flood Risk Assessment (PFRA) (2011) States *“There is no local information available which provides evidence on future groundwater flood risk in NPT and overall groundwater is not believed to be a major source of flooding in the County”*.



5.5.3 Figure 6.2 of the PFRA identifies that the Site is located in an area that is at $\geq 25\%$ to $< 50\%$ Susceptible to groundwater flooding.

5.5.4 Given this, potential flood risk from groundwater may be considered to be low.

5.6 Sewer Sources

5.6.1 As set out in Section 3.6, there are a number of foul water sewers present serving the existing residential development within the vicinity of the Site that crosses the Site Boundary. In addition, a combined sewer crosses the north-east of the Site.

5.6.2 The NPT PFRA (2011) does not identify any records of sewer flooding within the vicinity of the Site.

5.6.3 Further to this, DCWW have been consulted with regard to historic flood records and confirmed they hold no records of sewer flooding within the Site. This correspondence is available in Appendix L.

5.6.4 Given this, the Site may be considered to be at low risk of potential sewer flooding.

5.7 Reservoir Failure

5.7.1 The SSR is located within the north western corner of the Site, whilst the NSR borders the Site to the very north. The NRW Flood Risk from Reservoirs mapping identifies the majority of the Site to lie outside the maximum extent of flooding from this source and all built development proposed will be located outside the maximum reservoir flood risk extents. This mapping has been reprinted in Figure 5-4.

5.7.2 NRW state the following with regard to reservoir flood risk⁴:

“Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in Wales, we ensure that reservoirs are inspected regularly and essential safety work is carried out.

The reservoir flood maps do not indicate any likelihood of a flood occurring”.

⁴ <https://naturalresources.wales/flooding/managing-flood-risk/flood-risk-map-guidance/risk-of-flooding-from-reservoirs/?lang=en>

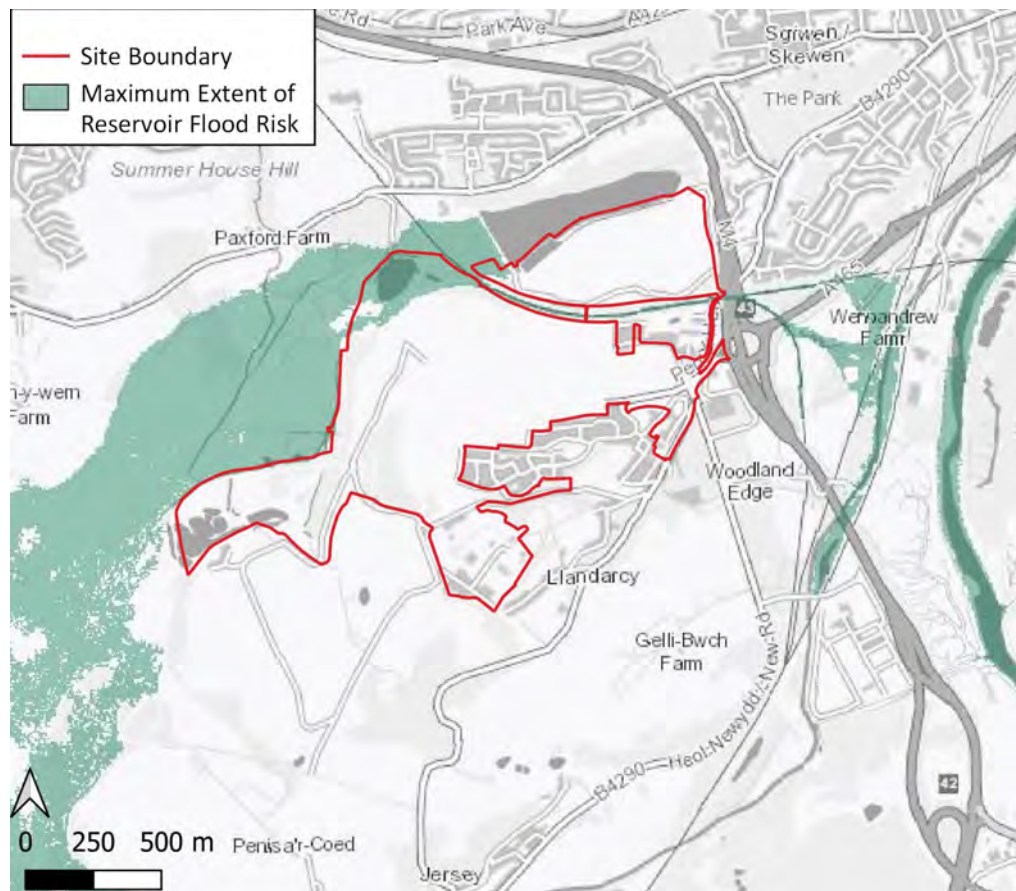


Figure 5-4 – Reservoir Flood Risk Map Extract

- 5.7.3 It is understood that there are plans to decommission the NSR which will include the draining down of the reservoir and naturalising the area where it is currently located. The NSR is outside of the Site and the decommissioning of the NSR is outside the remit of this planning application. It is understood this will form part of a separate study which will be carried out in consultation with NRW to ensure that potential flood risk to the surrounding area is not increased.
- 5.7.4 Given this, potential flood risk from reservoir failure is considered low.



5.8 Canal Failure

- 5.8.1 The nearest canal is the Tennant Canal which runs approximately 600m east of the Site. The topography within the vicinity of the Tennant Canal falls from west to east towards the River Neath and away from the Site.
- 5.8.2 Given this, potential flood risk from canals may be considered to be very low.



6 Surface Water Drainage Strategy

- 6.1.1 A Surface Water Drainage Strategy outlining the means of surface water management and disposal from the Site has been produced largely in line with the latest guidance as follows:
- CIRIA C753 “The SuDS Manual”, November 2015;
 - CIRIA document C522 Sustainable Drainage Systems – Design Manual for England and Wales;
 - CIRIA document C635 Designing for Exceedance in Urban Drainage; and
 - Statutory Standards for Sustainable Drainage Systems – Designing, Constructing, Operating and Maintaining Surface Water Drainage Systems (Welsh Government, 2018).
- 6.1.2 The aim of the surface water drainage strategy is to mimic the natural catchment processes as closely as possible and adopt the principles of water management scheme as stated in section 2 of the statutory “*Sustainable Drainage Systems Standards for Wales*” (SDSSW) document 2018.
- 6.1.3 From the 7th January 2019, Schedule 3 of the Flood and Water Management Act has been implemented by the Welsh Government which requires any development of more than 1 unit or where the construction area is greater than 100m² to comply with the SuDS Approving Body (SAB) design guidance and Welsh Ministers’ standards, which will require all sites to adopt SuDS in their design. The standards are listed below:
- S1 – Surface Water Runoff Designation
 - S2 – Surface Water Runoff Hydraulic Control
 - S3 – Water Quality
 - S4 – Amenity
 - S5 – Biodiversity
 - S6 – Design of Drainage for Construction, Operation and Maintenance
- 6.1.4 The Standards listed will need to be met by the design to comply with the SDSSW. S1 is a hierarchy standard with standards S2-S6 being fixed.
- 6.1.5 Given the outline nature of this planning application, it has been agreed with Neath Port Talbot Council, in their role as SAB, that it is not appropriate to submit a SAB application at this stage and that the principles set out within this Report are sufficient to support the outline planning application. Site wide and/or individual SAB applications will be made in due course, at an appropriate stage of design.

6.2 Existing Surface Water Drainage Features

- 6.2.1 The Site covers (in part) approximately 134ha of a former BP oil refinery which has a number of existing drainage features, as outlined in Section 3.6 and Figure 3-3.



- 6.2.2 The existing residential development, comprising 300 dwellings, located to the south east of the Site is understood to discharge unattenuated surface water runoff, via an open trapezoidal channel and 700mm diameter sewer north of the Site into the NSR. As part of this surface water drainage strategy, it is proposed to capture, manage and attenuate the surface water flows, originating from the existing residential development, before ultimately discharging these to the Crymlyn Bog.

6.3 SI – Surface Water Runoff Destination

- 6.3.1 In accordance with SDSSW, surface water should be sustainably managed and designed in accordance with the discharge hierarchy; collect for re-use; infiltrate to ground; discharge to watercourse; discharge to surface water sewer, highway drain or another drainage system; and lastly discharge to a combined sewer.
- 6.3.2 Table 6-1 identifies the discharge locations for the proposed development based on the Drainage Hierarchy.

**Table 6-1 – Surface Water Runoff Destination**

Discharge Location	Suitability	Comments
Collect for Re-Use	✓ / ×	Water butts and rainwater harvesting systems can collect rainwater for non-potable uses e.g. within gardens and other non-potable uses. The potential to incorporate rainwater harvesting and re-use measures may be assessed during the detailed design stage.
Infiltration	×	Given the former use of the Site as a BP Oil Refinery, the underlying ground is likely to be contaminated. Despite ground remediation that has been undertaken to date and is still ongoing, to minimise risk of mobilising contamination to controlled waters, infiltration has not been proposed. Should areas of the Site be identified where the contamination risk is determined to be low, infiltration testing may be undertaken prior to detailed design to understand whether this is a viable option.
Watercourse	✓	The Crymlyn Bog lies west of the Site and there are a number of small watercourses which run through this area. It is our understanding that this is where the runoff from areas of the existing Site discharge, including the SSR. The proposed surface water drainage strategy will allow for the discharge of surface water runoff into the existing drainage ditches within the Crymlyn Bog at a greenfield runoff rate of 5.5l/s/ha, where practicable, and where topography allows. This has historically been agreed between Atkins and NRW as part of proposals to discharge Planning Conditions 20, 21 and 22 associated with the original outline planning application (2005/0393) for the Site.
Surface Water Sewer	✓	A DCWW surface water sewer discharges from the Site from the Bridge House Outfall. It is our understanding that existing areas of the Site discharge via this sewer, including the existing residential development which discharges to the NSR before being pumped to this outfall. As such, where topography doesn't enable a gravity lead surface water solution to the Crymlyn Bog, surface water flows are proposed to discharge to the DCWW surface water sewer. DCWW were consulted and noted that a surface water discharge to the Bridge House Outfall is acceptable in principle in accordance with the previously agreed maximum peak surface water discharge rate of 583l/s; however, this should be reduced further as far as reasonably practicable.
Combined Sewer	✓ / ×	There is an existing DCWW combined sewer which crosses the north-east of the Site. As such, where it is not feasible to provide a gravity led solution to the Crymlyn Bog or surface water sewer, a connection to the combined sewer may be required.



- 6.3.3 In accordance with the above drainage hierarchy, it is proposed to predominantly discharge surface water runoff to either the Crymlyn Bog west of the Site or the existing DCWW surface water sewer at the Bridge House outfall, depending on the final proposed topography of the Site.
- 6.3.4 Consultation with DCWW is ongoing, however following a meeting on 21st September 2021 DCWW confirmed that a discharge into their sewer surface water, where a connection to the watercourse is not available under gravity, is acceptable in principle. It is understood that DCWW will accept a discharge rate to this surface water sewer to be no greater than the previously agreed maximum peak discharge rate of 583l/s, and should be reduced from this rate as far as reasonably practicable.
- 6.3.5 A pre-development enquiry response and summary of this meeting is available in Appendix K.
- 6.3.6 It is also noted that based on current topography, one of the surface water drainage catchments proposed (Catchment A9 as identified on drawing 05474-SK-0003 Catchment Sketch, PJA, September 2021) consists only of proposed highway drainage. Given this, it is expected that the drainage serving the highway will be discharged to the NPT highway drainage system assumed to be present serving the existing highway infrastructure east of the Site.

6.4 S2 – Surface Water Hydraulic Control

- 6.4.1 This standard requires surface water to be managed to prevent as far as possible any discharge from the development for rainfall events of less than 5mm and that the surface water runoff rate and volume for up to a 1 in 100-year return period should be managed to protect people, properties and the receiving water body. Consideration is also required to the risk associated with runoff from events greater than 1 in 100-year return period with mitigating proposals developed for the scheme.

Interception

- 6.4.2 Interception should be considered under the statutory standards. Interception aims to mimic greenfield runoff conditions by preventing runoff from the majority of all small rainfall events. This can contribute to reducing pollution load to receiving surface water bodies. Meeting the interception criterion is not expected during particularly wet periods, when permeable surfaces and subsoils are saturated, so a suggested target is that 80% compliance should be achieved during the summer and 50% in winter. Refer to table G2.1 in the Statutory Standards for Sustainable Drainage Systems (2018) document published by Welsh Government for details of interception mechanisms and their assumed compliance with the standards.



Flood Risk Mitigation

- 6.4.3 Current guidance requires that all new developments implement SuDS as the primary means of controlling surface water run-off in order to maintain flow rates and volumes discharged to the identified receptor post development.
- 6.4.4 Table 6-2 provides a summary of the SuDS selection process and confirms the features that are proposed as part of the Site's drainage strategy.

**Table 6-2: Summary of SuDS Feature Selection**

Feature	Description	Selection
Green Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation.	✓ / × Green roofs may be proposed for the educational or commercial development. Given the outline nature of this application, this may be further explored at the next stage of design.
Filter Strips	These are wide, gently sloping areas of grass or other dense vegetation that treat runoff from adjacent impermeable areas.	✓ / × Filter strips may be proposed to manage surface water flows for the proposed Highway Access to the school. Given the outline nature of this application, this may be further explored at the next stage of design.
Pervious Surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water.	✓ / × Permeable paving for driveways and communal parking areas. Given the outline nature of this application, this may be further explored at the next stage of design.
Swales	Swales are broad, shallow channels covered by grass or other suitable vegetation. They are designed to convey and/or store runoff, and can infiltrate the water into the ground (if ground conditions allow).	✓ Swales are incorporated within the surface water drainage strategy to convey water to the proposed attenuation basins.
Infiltration Basins	Infiltration basins are depressions in the surface that are designed to store runoff and infiltrate the water to the ground. They may also be landscaped to provide aesthetic and amenity value, particularly relevant to the golf course.	✓ / × Subject to infiltration testing and further understanding of the underlying ground contamination and remediation works, infiltration feature may be further explored at the next stage of design.
Basins / Ponds	Wet ponds are basins that have a permanent pool of water for water quality treatment. They provide temporary storage for additional storm runoff above the permanent water level. Wet ponds may provide amenity and wildlife benefits.	✓ Attenuation basins have been proposed for use on site. Given the outline nature of this application, the exact wet / dry nature will be explored at the next stage of design.
Underground Attenuation	Device Detention basins are normally dry, though they may have small permanent pools at the inlet and outlet. They are designed to detain a certain volume of runoff as well as providing water quality treatment.	✓ / × Whilst underground attenuation has not been proposed at this stage, it may be considered at later design stages to provide the volume of attenuation required to attenuate surface water flows from the site. Given the outline nature of this application, this may be further explored at the next stage of design.

Key: ✓ = Suitable × = Unsuitable ✓ / × = Further Investigation and Detailed Design Required



Greenfield Run-Off

- 6.4.5 Atkins previously undertook a QBar Study, dated 28th January 2021 and available in Appendix G. This identified the greenfield equivalent discharge rate for the catchments draining into the Crymlyn Bog to be between 5.60l/s/ha and 8.95/s/ha.
- 6.4.6 As such, the rate of 5.5l/s/ha was proposed through this QBar Study which represents a betterment in terms of the existing situation and should ensure that the existing flows into the Crymlyn Bog are not exceeded. This maximum peak discharge rate was previously agreed between Atkins and NRW and has been assumed to remain acceptable.
- 6.4.7 As noted in Section 4.4, it was previously agreed with DCWW to discharge at a maximum peak discharge rate of 583l/s into the existing DCWW surface water network via the Bridge House Outfall. Following recent discussions with DCWW, it was agreed that this rate should be the maximum peak discharge rate and that this should be reduced as far as reasonably practicable. Given this, it is currently proposed to outfall to the Bridge House Outfall at a maximum peak discharge rate of 99.3l/s, providing significant betterment over the previously agreed maximum proposed discharge rate.
- 6.4.8 Discussions with DCWW are ongoing and a summary of the key points discussed and agreed during a meeting on 21st September 2021 and a pre-development enquiry response is available in Appendix K.
- 6.4.9 Based on Site topography, the Site has been split into six catchments, a proposed surface water drainage catchment plan is included in Appendix D on drawing 05474-A-0003-P2. The proposed maximum peak discharge rate from the proposed development aims to limit surface water runoff to a rate no greater than 5.5l/s/ha into the Crymlyn Bog and a betterment on the previously agreed discharge rate into the DCWW network via the Bridge House outfall is being proposed.
- 6.4.10 A summary of the proposed discharge rate for each catchment is available in Table 6-3, alongside the discharge location.

**Table 6-3: Proposed Discharge Rates**

Catchment	Proposed Developable Area [ha]	Proposed Discharge Rate [5.5l/s/ha]	Discharge Location
A	13.7	75.2	Crymlyn Bog
B	38.9	213.7	Crymlyn Bog
C	1.4	23.0	Bridge House Outfall
E	4.2	23.1	Crymlyn Bog
F	8.3	76.3	Bridge House Outfall
TOTAL	66.5	411.3	

Proposed Surface Water Drainage Strategy

- 6.4.11 The proposed Surface Water Drainage Strategy is shown on the two Surface Water Drainage Strategy drawings (Ref. 05747-A-0002 and -0004, PJA September 2021), included in Appendix D.
- 6.4.12 In accordance with the drainage hierarchy, as indicated previously, the Site is not expected to be suitable for soakaway drainage through infiltration and therefore the discharge of surface water from the proposed development should be at no greater than 5.5l/s/ha, ensuring that it will have negligible impact on downstream potential flood risk.
- 6.4.13 The discharge locations will be split between the existing DCWW surface water sewer (known as the Bridge House Outfall) and the Crymlyn Bog. As noted previously, one catchment will consist entirely of highway infrastructure and therefore it is assumed this will connect to the NPT highway drainage network serving existing highways to the east of the Site.
- 6.4.14 The proposed Surface Water Drainage Strategy will implement SuDS in the form of basins, swales and conveyance features. A summary of the range of SuDS features which are considered appropriate for this type of development has been provided Table 6-2. Whilst at this stage, attenuation in the form of basins has been modelled, at the detailed design, this will be refined and multiple SuDS techniques will be included to ensure the six SuDS Standards are met.
- 6.4.15 To ensure maximum peak discharge is maintained at 5.5l/s/ha, on-site attenuation will be required. The required storage volume for the attenuation of the 1 in 100 year event plus 40% climate change event has been calculated for each drainage catchment and discharge location (the estimated contributing area is based on an assumed percentage impermeability of the developed areas set out in the illustrative masterplan). Proposed attenuation basins are shown together with their required capacity and indicative location on the Drainage Strategy drawings in Appendix D. Proposed Catchment D comprises the attenuation required to serve the existing residential development which currently discharges to the NSR. Flows from the NSR are then pumped to the Bridge House Outfall.



6.4.16 Table 6-4 sets out the impermeable area for each drainage catchment which has assumed the following breakdown of percentage impermeability based on end use:

- Residential Development: 65%
- Highway Development: 100%
- Commercial Development: 80%
- Educational Development: 35%

6.4.17 Proposed Catchment D comprises the attenuation required to serve the existing residential development which currently discharges to the NSR. Flows from the NSR are then pumped to the Bridge House Outfall.

Table 6-4: Assumed Impermeable area and assumed surface water discharge rate

Assumed Catchment	Proposed Discharge Rate (l/s)	Proposed Impermeable Area [ha]	Proposed Attenuation Volume Required [m ³]
A	145.0	9.05	9,050
B	213.7	26.97	26,000
C	5.1	0.91	-
E	23.1	1.47	930
F	45.8	6.64	7,350
TOTAL	432.7	53.15	43,330

6.4.18 Water butts may be proposed in all residential dwellings to provide an opportunity for water re-use; however, as the attenuation capacity for the water butts cannot be guaranteed during a rainfall event, these have not been accounted for within the surface water drainage strategy attenuation calculations.

6.4.19 Surface water run-off from roofs and hard surfaces across the development is proposed to drain to a new surface water drainage network incorporating SuDS components to manage discharge to receiving watercourses, provide attenuation storage on-site and treatment to run-off. The surface water drainage system will be designed to convey the run-off from the critical 1 in 100 year (+40% climate change allowance) storm event without flooding. The proposed attenuation basins are located at the natural low points of the proposed Site and sized to provide the estimated required attenuation and treatment. Given the outline nature of this planning application, these principles will be refined and developed at the next stage of design.

6.4.20 Vortex flow controls, such as Hydrobrakes, will restrict the rate of surface water discharge downstream to 5.5l/s/ha rate at the proposed discharge locations. This maximum peak discharge rate aims to mimic the pre-development, greenfield conditions of the Site and is therefore considered appropriate to discharge to the Crymlyn Bog.



- 6.4.21 The proposed SuDS features have been sized in MicroDrainage to ensure that the proposed system will be capable of conveying run-off from the design storm event without flooding. Refer to Appendix H for the MicroDrainage outputs.
- 6.4.22 The design calculations confirm that the proposed surface water drainage system is capable of attenuating, and discharging in a controlled manner, the run-off from the design 1 in 100 year storm with a 40% allowance for climate change without flooding of the development and off-site.

Climate Change Impact & Urban Creep

- 6.4.23 In line with paragraph G2.5 of the Statutory Standards for Sustainable Drainage Systems (2018) *“Consideration should be given to likely future pressures on the site drainage system in accordance with current guidance, such as increasing intensity of rainfall due to climate change, and increasing impervious surface area due to urban creep”.*

Climate Change

- 6.4.24 The proposed development and associated surface water drainage scheme has been designed to sustainably manage the run-off from the critical 1 in 100 year storm event with a 40% allowance for climate change.

Urban Creep

- 6.4.25 Over the lifetime of a development, it is possible that the overall impermeable area within the Site could increase by as much as 10% through home owners undertaking activities such as property extensions and introducing paved areas within gardens.
- 6.4.26 Given the outline nature of the development, a percentage impermeability of 65% has been applied to the residential areas, which accommodates 10% development creep.
- 6.4.27 Given commercial end uses of Catchment F (which have been assumed 80% impermeable) and the proposed indicative highways which have been included within the Microdrainage Network for Catchment B (which have been assumed 100% impermeable) no development creep factor have been applied to these.
- 6.4.28 The proposed school development has also been excluded from the proposed urban creep assessment.

Designing for Exceedance

- 6.4.29 During a rainfall event with a return period in excess of that for which the surface water drainage system was designed (in this case a 1 in 30 year for the piped system and 1 in 100 year plus 40% climate change allowance for any SuDS system), or in the event of a blockage, the capacity of the



surface water drainage system may be exceeded, resulting in localised flooding in the areas affected. This may be considered to be a residual risk.

- 6.4.30 The layout and landscaping of the proposed development should be designed to ensure that exceedance flood flow paths are routed away from vulnerable development and contained within highways and directed toward landscaped areas, areas of open attenuation or surrounding green infrastructure.
- 6.4.31 In line with Building Regulations the finished floor levels of the properties will be set at least 150mm above the surrounding ground levels to prevent surface water ingress through doorways. Location of buildings in ground depressions will be avoided to prevent water ponding around dwellings.
- 6.4.32 Minor modifications to topography, the profile of access roads, footpaths and kerbs in addition to strategically placed green/blue infrastructure will be developed to ensure that exceedance flood flows are managed on site and there is little or no risk of property flooding or unacceptable ponding within the highway. Refer to Appendix F for an Exceedance Flood Route Plan based on the current proposed masterplan.

6.5 S3 - Water Quality

Principles of Water Quality Assessment

- 6.5.1 The general principles to mitigate against adverse impacts on water quality in the receiving water environment is described in the CIRIA C753 “The SuDS Manual” (2015). This document recommends the following steps to determine the required water quality management for discharges to surface waters and groundwaters based on the risk posed:
 - 1 Interception: Prevent runoff and associated pollutants from the site to receiving surface waters for the majority of small rainfall events (e.g. <5mm rainfall events);
 - 2 Determine the pollution hazard level associated with the given type of development;
 - 3 Select a risk assessment approach based on receiving water environment and the pollution hazard level; and
 - 4 Undertake a detailed risk assessment for each outfall or discharge point taking into account the pollution hazard level, the status of the receiving water environment and effectiveness of the proposed SuDS techniques.
- 6.5.2 The extent of the treatment required will depend on the water quality status of receiving watercourses, land use, the level of pollution prevention in the catchment and for groundwater, the natural protection afforded by underlying soil layers. The pollution hazard level of the development type should be identified to inform the level of treatment required.



- 6.5.3 Residential roofs are noted as having 'very low' pollution hazard level and require removal of gross solids and sediments only. Residential car parks, access roads, driveways and non-residential car parking with infrequent change (e.g. schools) are shown to present 'low' pollution hazard level.
- 6.5.4 Low pollution hazard levels require application of a 'simple index approach' for water quality risk assessment for discharges to surface and ground waters.

Existing Water Quality of the Proposed Receiving Watercourses

- 6.5.5 The Site falls within the Western Wales River Basin District which extends across the entire western half of Wales from the Vale of Glamorgan in the South, to Denbighshire in the North ⁵. From review of the NRW Water Watch Wales mapping ⁶, the Site falls within the Tawe to Cadoxton Management Catchment and the waterbody *Crymlyn Brook - HW to conf with Tennant Canal* (which is the name of the waterbody).
- 6.5.6 NRW employs a method for assessing the environmental conditions or the 'status' of a water body according to the objectives set out in the Water Framework Directive (WFD). To achieve the purposes of the Directive of protecting all waterbodies, NRW has set out a number of Environmental Objectives. These Environmental Objectives are reported for each waterbody which NRW operates in six year cycles. The achievement of the Environmental Objectives is dependent upon the current Ecological Status, which is assessed as High, Good, Moderate, Poor or Bad.
- 6.5.7 As noted previously, the Site falls into the *Crymlyn Brook - HW to conf with Tennant Canal* waterbody. This waterbody was classified overall as Moderate, according to the NRW Water Watch Wales mapping.
- 6.5.8 NRW have also published the Core Management Plan for the Crymlyn Bog ⁷ which identifies the habitat and vegetation which have been visioned for the Crymlyn Bog.
- 6.5.9 NRW's Water Watch Wales mapping identifies the underlying groundwater body as *Swansea Carboniferous Coal Measures* which covers an area of 758.38km² and has an overall classification of 'Poor'.
- 6.5.10 The principles of the SuDS Management Train should be incorporated into the proposed surface water drainage scheme for new development, to reduce the risk of further pollutants entering watercourses via run-off from roofs and paved areas.
- 6.5.11 SuDS components can reduce pollution in run-off through filtering out pollutants or reducing flow rates to encourage deposition of any contaminants. Suitable components could include:

⁵ <https://cdn.naturalresources.wales/media/674895/ww-rbmp.pdf?mode=pad>

⁶ [Water Watch Wales \(naturalresources.wales.gov.uk\)](https://naturalresources.wales.gov.uk/)

⁷ [Crymlyn Bog SAC Core Management Plan ENGLISH \(naturalresources.wales\)](https://naturalresources.wales/media/674895/crymlyn-bog-sac-core-management-plan-english.pdf)



- permeable paving;
- filter drains;
- swales;
- attenuation basins;
- wetlands; and
- proprietary treatment systems.

6.5.12 To protect biodiversity and amenity assets, polluted surface water run-off should not be discharged directly into permanent ponds but treated through an appropriate treatment train. Where possible, interception storage should be included as part of the treatment train to manage pollutants at source. Later stages of treatment in the train should incrementally reduce the level of pollution in run-off before discharge to the receiving water body.

Contamination and Water Quality

6.5.13 The proposed development will utilise SuDS Management Trains across each network to ensure treatment of run-off and removal of pollutants prior to discharge.

6.5.14 This is likely to include a mixture of components across the site, specified according to the opportunities/constraints presented by:

- the likely pollution hazard of the run-off;
- the available surface space; and
- the proposed ground levels/falls across areas of hardstanding.

6.5.15 Treatment components within each SuDS Management Train may include:

- permeable pavement (for car parking areas);
- channel drains;
- catchpits;
- trapped gullies;
- attenuation basins incorporating pre-treatment (such as a sediment forebay) and low flow channels;
- bioretention areas in greenspace around the site;
- swales and linear wetlands;
- filter drains bordering paved areas such as roads and yards; and
- proprietary treatment systems (such as downstream defenders).

6.5.16 The arrangement and composition of each management train will be confirmed at the detailed design stage.



- 6.5.17 The proposed uses at the site will comprise residential roofs and individual driveways. Roofs are classified as a 'very low' pollution risk and individual driveways are classed as a 'low' pollution risk level in Table 26.2 of CIRIA C753 The SuDS Manual. 'Low' hazard pollution levels require application of a 'simple index approach' for water quality risk assessment for discharge to surface and groundwaters. The "pollution hazard indices" for a low pollution hazard site are given in Table 6-5 below.

Table 6-5: Pollution Hazard Indices for a Low Pollution Hazard Site

Total Suspended Solids (TSS)	Metals	Hydrocarbons
0.5	0.4	0.4

- 6.5.18 The surface water drainage system should provide a sufficient level of water quality treatment to prevent pollution of the receiving waterbodies. During the water treatment design event (5mm rainfall across the entire site) no runoff should leave the site.
- 6.5.19 Table 6-6 provides the indicative SuDS mitigation indices for the proposed SuDS features for the Site. It demonstrates that the mitigation index for the basins or ponds currently proposed are greater than the "pollution hazard index" for each pollutant type. Therefore, the strategy is deemed to comply with the water quality requirements of the SuDS standards.

Table 6-6: Indicative SuDS Mitigation Indices

SuDS component	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Attenuation Basins	0.5	0.5	0.6
Swales	0.5	0.6	0.6

- 6.5.20 This water quality assessment will be reviewed at the detailed design stage and updated based on the proposed SuDS selection at this time.

6.6 S4 – Amenity

- 6.6.1 This standard requires that the design of the surface water management system should maximise amenity benefits.
- 6.6.2 The primary amenity focus of the SuDS scheme should be to improve the health and well-being of the residents. The scheme will need to be based on natural forms that mimic natural landscapes found within the region and the vegetated swales and detention pond areas are designed with natural slope forms, safe and accessible paths and locally contextual species that will encourage natural colonisation. Other key amenity benefits should include improving air quality around the development, increasing carbon sequestration and improving water quality through removal of pollutants via vegetated swales and attenuation basins.



6.6.3 The majority of the proposed basins may be designed as dry features and will have multiple functions, such as amenity and biodiversity assets. Some features may be proposed as permanent wet features and could be designed to also attenuate the required surface water volumes in addition to the permanent water volumes. Given the outline nature of this planning application, the exact wet-dry nature of the proposed attenuation basins will be determined at the detailed design stage.

6.7 S5 – Biodiversity

6.7.1 This standard requires that the surface water management system should maximise biodiversity benefits.

6.7.2 The SuDS scheme biodiversity strategy should centre around the creation of significant and varied habitats to increase the overall biodiversity of the site and ecological value. The inclusion of plant species that will enhance the general eco system and simultaneously act as a water filtration system to clean pollutants and contaminants should be used and where possible provide meandering swales and a large attenuation basin to maximise the variety of habitats available.

6.7.3 The plant species selected should be both locally contextual and appropriate for the varied habitat zones including primary characteristics that shall ensure:

- Good soil binding and filtration species
- Minimised erosion
- Improved filtration via dense root and stem species
- Tolerance to seasonal variations including droughts and inundations
- Good suspended solids retention
- Pollutant tolerant
- Emergent and pioneering species for natural ecological colonisation
- The creation of diverse, self-sustaining and resilient ecosystems for high species biodiversity
- Support for local and regional habitat strategies

6.7.4 In general, the proposed attenuation basins will be the focal habitat for the development and may consist of large basins that are resilient to inundation and a smaller permanent aquatic habitat with a variety of water depths. The ponds should allow for natural colonisation and to ensure high visibility of people particularly children in and around any permanently wetted areas. Sight lines should be left open to attract certain species and shaded areas under adjacent tree canopies further enhance the varied ecosystem potential.

6.7.5 The attenuation basins should be constructed in a manner that avoids compacted sub-bases and healthy organic matter will be backfilled to ensure ideal growing conditions. The pools varying depths will provide refuge for overwintering species and structural diversity and the pond will be



resilient to seasonal changes, drought periods and inundation. Given the outline nature of this planning application, the exact wet-dry nature of the proposed attenuation basins will be determined at the detailed design stage.

6.8 S6 – Design of Drainage for Construction and Maintenance and Structural Integrity

- 6.8.1 The surface water drainage system should be designed with the ethos of simplicity in construction, use and maintenance. This then allows a very simple translation from the principles described within standard S6, namely that all elements of the surface water drainage system should be designed so that they can be constructed, as well as maintained and operated “...*easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).*”
- 6.8.2 With regards to SuDS, more than one property is being proposed and as such, the proposed SuDS could be adopted by Neath Port Talbot in their role as the SAB. Given the outline nature of this planning application, it is currently unknown whether a Private Management Company or the SAB will adopt the SuDS. This will be determined at the detailed design stage and outlined in any future SAB application.
- 6.8.3 The SuDS must be designed and constructed in accordance with the SDSSW document and any conditions of approval stipulated by the SAB.
- 6.8.4 A typical maintenance schedule of the attenuation basins, swales and flow control devices proposed on Site at this stage are contained in the Tables below.

Table 6-7: Flow Control (e.g. Hydrobrake) Indicative Maintenance Schedule

FREQUENCY	ACTION
Monthly	Inspect and identify any areas that are not operating correctly. If required, take remedial action (for three months following installation)
Six Monthly	- Inspect and identify any areas that are not operating correctly. If required, take remedial action. - Remove sediment from pre-treatment structures
Annually	N/A
Following significant events	Inspect and carry out essential recovery works to return the feature to full working order.

**Table 6-8: Attenuation Basin Indicative Maintenance Schedule**

FRQUENCY	ACTION
Monthly	• Litter and debris removal • Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only) • Remove nuisance and invasive vegetation (for 12 months following installation) • Inspect / check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	• Remove nuisance and invasive vegetation
Annually	• Remove all dead growth prior to the start of growing season • Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required • Inspect and document the presence of wildlife • Remove sediment from inlets, outlets and forebay • Manage wetland plants, where required
As Required	• Prune and trim trees and remove cuttings • Remove sediment from forebay, when 50% full and from micropools if volume reduced by more than 25% • Repair erosion or other damage by re-turfing or reseeding • Re-level uneven surfaces and re-instate design levels (typically once every 60 month period) • Remove and dispose of oils or petrol residues using safe standard practices
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order

**Table 6-9 – Swale Indicative Maintenance Schedule**

FRQUENCY	ACTION
Monthly	• Litter and debris removal • Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only) • Remove nuisance and invasive vegetation (for 12 months following installation) • Inspect / check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	• Remove nuisance and invasive vegetation
Annually	• Check for poor vegetation growth due to lack of sunlight or dropping of eaf litter, and cut back adjacent vegetation where required • Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required • Inspect and document the presence of wildlife
As Required	• Repair erosion or other damage by re-turfing, reseeding or replacing filter materials. • Re-level uneven surfaces and re-instate design levels (typically once every 60 month period) • Remove and replace top 300 – 500mm of gravel, clean and replace where required (typically every 60 month period) • Remove and dispose of oils or petrol residues using safe standard practices
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order

- 6.8.5 The proposed maintenance regimes for the devices should be undertaken largely in accordance with The SuDS Manual (CIRIA C753), other best practice guidelines and manufacturer's recommendations. This will ensure the design performance, structural integrity and where applicable, the appearance of each feature is maintained throughout its lifetime.
- 6.8.6 Further details will be provided on the maintenance requirements of each type of SuDS component proposed across the development, as the detailed design of the drainage system is developed.



7 Foul Water Drainage

7.1 Foul Water Drainage Strategy

- 7.1.1 DCWW Asset Mapping has been obtained for the purposes of the foul water drainage strategy and identifies that an existing foul water sewer is present serving the existing residential development, bought forward as part of the initial phases 1A and 1B. This foul sewer flows north east and discharges to the DCWW combined sewer network.
- 7.1.2 An existing DCWW combined sewer is also identified crossing the north-east of the Site.
- 7.1.3 DCWW are the statutory water authority in the area; they have been consulted through a pre-development enquiry to provide comment on the development proposals and opportunities for foul water drainage.
- 7.1.4 The DCWW pre-development response is included at Appendix K however, following the receipt of this, a meeting was held on the 21st September 2021. In this meeting, it was confirmed that given historic agreements relating to the Site, all downstream off-site reinforcements would be undertaken by DCWW in relation to foul drainage.
- 7.1.5 Given the outline nature of this application, two foul water drainage strategy options have been proposed. One solution provided implements a gravity led foul drainage solution and the other option a pumped solution. Refer to Appendix E for a layout of the proposed foul water drainage strategies.
- 7.1.6 A gravity led foul drainage solution is considered to be the preferred option; however these strategies will be further developed and refined at the next stage of design.

7.2 Foul Water Drainage Adoption

- 7.2.1 It is anticipated that the proposed foul sewer network will be offered to DCWW for adoption under Section 104 of the Water Industry Act 1991. To meet the requirements for adoption, the proposed infrastructure must be designed and constructed according to Sewers for Adoption 7th Edition.



8 Conclusion & Recommendations

8.1 Conclusion

- 8.1.1 PJA has been commissioned by St Modwen Developments Ltd to prepare a Flood Consequence Assessment (FCA) and Drainage Strategy for the proposed mixed-use development at the allocated Site '*site location*'.
- 8.1.2 This FCA has been undertaken in accordance with current national and local flood risk policy requirements. This report assesses the existing and future potential flood risk at the Site, including an assessment of the potential effects of the proposed development on flood risk on- and off-Site.
- 8.1.3 The assessment concludes that the Site is considered at low risk of flooding from the potential sources assessed (fluvial, tidal; reservoirs, canals and other artificial sources; surface water, groundwater, and sewers).
- 8.1.4 A Surface Water Drainage Strategy has been prepared to demonstrate that a sustainable drainage solution may be provided for as part of the proposed development. The Surface Water Drainage Strategy has been designed in accordance with the key principles of "*Sustainable Drainage Systems Standards for Wales*" (SDSSW) document 2018. Given the outline nature of this planning application, it has been agreed with Neath Port Talbot Council that it is not appropriate to submit a SAB application at this stage. Individual SAB applications will be made as the detailed design for the Site is progressed.
- 8.1.5 The proposed surface water drainage system will aim to mimic the hydrological regime of the existing site by discharging to Crymlyn Bog or the DCWW sewer system within the vicinity of the Site. Discharge from each proposed drainage catchment will be controlled to a cumulative greenfield runoff rate of 5.5l/s/ha by a number of vortex flow control devices.
- 8.1.6 Due to the historical use of the Site, which comprised part of the former BP Oil Refinery Plant, ground contamination is known to still affect areas of the Site. Although extensive remediation has been carried out, and is still ongoing, the infiltration of surface water runoff is not considered to be viable due to the current ground conditions and the risk of creating source receptor pathways to the underlying aquifers. Given the outline nature of this planning application, this may be further reviewed at the next stage of design.
- 8.1.7 Attenuation storage will be largely provided in the form of open SuDS features such as attenuation basins, however a wider variety of SuDS features may be incorporated into the surface water drainage design to provide the attenuation required which will be determined at the next stage of design.



- 8.1.8 A SuDS Management Train will provide suitable treatment of run-off by removing pollutants prior to discharge, this will be detailed within any future SAB application.
- 8.1.9 Foul flows from the proposed development will discharge via a new connection(s) to the existing public foul sewers north-east of the Site.
- 8.1.10 A developer enquiry response has been received from DCWW and discussions are ongoing to ensure necessary reinforcements are undertaken to the foul network to enable the development to come forwards.
- 8.1.11 The responsibility for the operation and maintenance of each SuDS feature will be confirmed through any future SAB application. The SuDS used on site will be maintained in accordance with manufacturer's recommendations, SAB requirements and current best practice and guidelines to ensure routine operation.
- 8.1.12 This report demonstrates that the proposed development may be undertaken in a sustainable manner without increasing the flood risk either at the Site or to any third-party land in line with PPW Edition 11 requirements.



Appendix A Proposed Masterplan

KEY

DEVELOPMENT

1. New three-form entry primary school with potential for sports facilities managed for wider community use.
2. Potential local centre uses (with residential use above).
3. Higher density housing along main spine road forming gateway into the site.
4. Medium density housing to form body of site.
5. Low density housing in more sensitive areas (to benefit amenity of adjoining residents and around landscape edges).
6. Landmark buildings with flexibly designed ground floor for potential commercial use dependent on demand and residential use above.
7. Potential extra care / mixed use residential.
8. Additional Commercial units extension to Coed Darcy Business Park

ACCESS

9. Primary vehicle access via Ffordd Coed Darcy onto the B4290
10. Secondary vehicle access to the Northern parcel from the B4290
11. Pedestrian / Cycle footbridge over the railway line
12. Tree-lined main spine road.
13. Network of new paths and trim trails to encourage informal recreation, including around residential edges.
14. Pedestrian/cycle access connection to Skewen.
15. Pedestrian/cycle access connection to Tank Farm Road
16. Pedestrian/cycle access connection to Llandarcy.
17. Potential pedestrian/cycle access connection to Jersey Marine (subject to funding)
18. Potential pedestrian/cycle access connection to Heol Crymlyn (subject to funding)
19. Tree-lined secondary green street.
20. Off road cycle route

LANDSCAPE

21. Retained / enhanced areas of woodland
22. Ancient woodland retained
23. New areas of woodland creating continuous buffer
24. Existing hedgrow retained / enhanced.
25. Landscaped bund
26. Attenuation basin surrounded by new and retained planting
27. Community civic space at the centre of the development containing retaining 'Amphitheatre' feature.
28. Incidental public open space responding to Neighbourhood needs
29. Retained prominent rockface.
30. Terraced plateaux with the opportunity for mini ecology areas for biodiversity and educational benefit
31. Natural play opportunities within wider landscape
32. New planting and retained hedgerow
33. Accessible central park alongside sports pitches

ECOLOGY

34. Green Infrastructure design lead by delivering ecological connectivity, including across the wider Coed Darcy site and wider landscape
35. Extensive western green buffer to function as dispersal corridor for faunal species
36. Creation of dedicated ecology areas with no public access.
37. Open space to deliver extensive early successional habitat with floristically rich dry grasslands
38. Significant topographical diversity to be designed into semi-natural greenspace to maximise micro-habitat diversity
39. Network of wetland habitats to provide optimal amphibian habitat
40. Integrated ecological features within main development footprint to include living roof habitat, nesting and roosting boxes.



This drawing must not be scaled.
Figured dimensions and levels to be used.
Any inaccuracies must be notified to the architect.
Detail drawings and large scale drawings take precedence over smaller drawings.

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PRELIMINARY	✓
PLANNING	
DESIGN	
TENDER	
CONSTRUCTION	

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Contract: Coed Darcy Masterplan

Title: Illustrative Masterplan

Drawing No. 21009(05) 104 Rev. D

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Appendix B Existing Drainage Features Plan