

SUSTAINABLE DRAINAGE ASSESSMENT

**LAND AT MODEL FARM
RHOOSE, BARRY CF62 3BB**

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Sustainable Drainage
Assessment
1.4
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1 INTRODUCTION

1.1 Purpose of Report

This Sustainable Drainage Assessment (SDA) has been prepared by RPS Planning and Environment on behalf of Legal & General (Strategic Land) Ltd. The assessment is in support of an outline planning application for the proposed employment development at Model Farm, Rhoose, Barry CF62 3BB. Hereafter referred to as the 'site'.

The application area sits within a predominately agricultural setting, with agricultural land to the north and east, Porthkerry County Park to the south and Cardiff Airport to west, within the Vale of Glamorgan Council authority area.

The SDA reviews existing surface water and foul water drainage arrangements at the site and presents a strategy for managing surface water and foul water from the developed site.

Outline design principles for the proposed development were discussed with the SuDS Approval Body during a pre-app meeting with Vale of Glamorgan Council (the SAB) on 10 April 2019.

A complete application form for pre-application advice on SuDS on new developments and this Sustainable Drainage Assessment report v1.1 were submitted to the SAB on 26 April 2019 (Pre-Application No. SAB/PRE/2019/009 Model Farm, Rhoose.)

The SAB made an appraisal of the pre-application in line with Welsh Governments Statutory Standards for Sustainable Drainage Systems on 10 May 2019 and offer no objection in principle to the proposed drainage scheme.

1.2 Information Source

The assessment has been undertaken in accordance with the below documents and guidance:

- Welsh Government Planning Policy Wales (PPW) 10th Edition, December 2018;
- Welsh Government Statutory standards for sustainable drainage systems, 2018;
- Welsh Government Sustainable Drainage (SuDS) Statutory Guidance, 2019;
- Welsh Ministers Standards for Gravity Sewers and Lateral Drains (2012);
- Welsh Government Building Regulations Guidance, Part H Drainage and waste disposal;
- Vale of Glamorgan Local Development Plan 2011-2026, June 2017;
- The SuDS Manual – CIRIA, November 2015;
- National Resources Wales (NRW);
- Ordnance Survey (OS);

2 PLANNING POLICY AND GUIDANCE

2.1 Planning Policy Wales (PPW) 10th Ed. December 2018

PPW sets out the land use planning policies of the Welsh Government. Chapter 6 'Distinctive and Natural Placemaking and Well-being' outlines the Welsh Government's objectives in terms of addressing water and flood risk.

Paragraphs 6.6.17 to 6.6.20 state that: *"New developments of more than one dwelling or where the area covered by construction work equals or exceeds 100 square metres also require approval from the SuDS Approval Body (SAB) before construction can commence. Adoption and management arrangements, including a funding mechanism for maintenance of SuDS infrastructure and all drainage elements are to be agreed by the SAB as part of this approval. This will ensure that SuDS infrastructure is properly maintained and functions effectively for its design life."*

"The provision of SuDS must be considered as an integral part of the design of new development and considered at the earliest possible stage when formulating proposals for new development. In guiding new development the planning system should at the very least ensure the incorporation of measures at an individual site scale, particularly in urban areas, in order to secure cumulative benefits over a wider area. A concerted effort of this nature will bring benefits over a whole catchment. At a development plan level, however, there will be considerable advantages associated with developing collaborative approaches which, drawing on evidence obtained through green infrastructure assessments, integrate SuDS as part of growth strategies for particular areas."

"Development proposals should incorporate design for surface water management, based on principles which work with nature to facilitate the natural functioning of the water cycle, providing issues such as land contamination would not result in the mobilisation of contaminants which may have an impact over a wider area. Design for multiple benefits and green infrastructure should be secured wherever possible and as part of Green Infrastructure Assessments suitable approaches towards the provision of SuDS should be identified. It may, in some circumstances, be necessary for 'hard' infrastructure solutions to be preferred because of practical or archaeological considerations, but taking into account the role of water services in contributing to the quality of place, nature based solutions should be the preference".

"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. To ensure consistency of design and facilitate long-term maintenance, sewers should be built to Welsh Government standards and adopted. Lack of capacity or plans to improve capacity in the sewer is not a valid reason for a sewerage undertaker to refuse connection under Section 106 of the Water Industry Act 1991 and Natural Resources Wales may refuse to issue an environmental permit for private treatment in such circumstances. Developers need an adoption agreement in place before construction commences and should consult sewerage undertakers in the early stages of design and planning."

2.2 Local Policy and Guidance

2.2.1 Vale of Glamorgan Council - Local Development Plan (2011-2026)

The document sets out detailed planning policies and proposals for Vale of Glamorgan Council.

The Local Development Plan provides a framework for sustainable development within the Vale of Glamorgan up to 2026. The policy document will guide the growth of the Vale of Glamorgan over a fifteen-year period and identifies the infrastructure needs of communities in terms of employment, facilities and services needed to support growth.

The policies and objectives relevant to hydrology and flood risk are outlined below:

Objective 2 – To ensure that development within the Vale of Glamorgan makes a positive contribution towards reducing the impact and mitigating the adverse effects of climate change.

The LDP will seek to ensure that new development makes a positive contribution towards reducing the impact of and mitigating against the adverse effects of climate change. New development will be located in sustainable locations that minimise the need to travel, incorporate sustainable design and building solutions. The Council's Renewable Energy Assessment (2016) has identified opportunities in the Vale of Glamorgan for a range of renewable energy schemes, particularly from standalone solar PV developments, small clusters of wind energy potential, biomass, and micro generation including Building Integrated Renewables [BIR]. Accordingly, to contribute towards meeting national renewable energy targets the Plan includes monitoring targets to meet 21.19% of projected electricity demand and 1.48% of projected heat demand in the Vale of Glamorgan through renewable sources by 2026. Therefore, the LDP will also promote energy conservation and local renewable energy generation. To mitigate the adverse effects of climate change new development will avoid areas susceptible to flooding.

Policy MD1 – Location of New Development

New development on unallocated sites should provide a positive context for the management of the water environment by avoiding areas of flood risk in accordance with the sequential approach set out in national policy and safeguard water resources.

New development will be expected to avoid unnecessary flood risk and to meet the requirements of TAN 15: Development and Flood Risk. No highly vulnerable development will be permitted within Development Advice Map (DAM) Zone C2 and development will only be considered in areas at risk of flooding where it can be demonstrated that the site can comply with the justification and assessment requirements set out in TAN 15.

Policy MD7 – Environmental Protection

Development proposals will be required to demonstrate they will not result in an unacceptable impact on people, residential amenity, property and / or the natural environment from either:

- Pollution of land, surface water, groundwater and the air;
- Land Contamination;
- Flood Risk and consequences.

Where impacts are identified the Council will require applicants to demonstrate that appropriate measures can be taken to minimise the impact identified to an acceptable level. Planning conditions may be imposed or legal obligation entered into, to secure any necessary mitigation and monitoring processes.

In respect of flood risk, new developments will be expected to avoid unnecessary flood risk and meet the requirements of TAN15. No highly vulnerable development will be permitted within DAM Zone C2. Development will only be permitted in areas at risk of flooding where it can be demonstrated that the site can comply with the justification and assessment requirements set out in TAN15.

MG9 (2), MG10, SP2 (3) Land adjacent to Cardiff Airport and Port Road, Rhoose (part of St Athan – Cardiff Airport Enterprise Zone)

The Local Development Plan allocates 77.4 ha gross strategic employment land which forms part of the undeveloped land between Rhoose/Cardiff Airport and West Barry. The site is designated as an Enterprise Zone by the Welsh Government and is allocated to meet the regional employment needs as part of the St Athan Strategic Opportunity Area.

2.2.2 Welsh Government SuDS Statutory Standards (2018)

The Flood and Water Management Act 2010 (Schedule 3), which comes into effect in Wales on 7 January 2019, requires new developments to include Sustainable Drainage Systems (SuDS) features that comply with national standards. The Welsh Government published interim national standards on an advisory basis in January 2016. The aim was to enable designers; property developers; local authorities and other interested parties to both demonstrate that they have taken account of the Welsh Government's planning advice on Development and Flood Risk, Nature Conservation and Planning and to test the standards, so that if necessary they could be revised before being placed on a statutory footing.

Following consultation through 2017, the Welsh Ministers have now commenced Schedule 3 with effect from 7 January 2019. The interim non-statutory national standards and guidance have formed the basis for these Statutory Standards, with minor amendments to take into account comments received throughout the consultations. They are for the design, construction, operation and maintenance of SuDS serving new developments in urban or rural areas of more than one dwelling or where the area covered by construction work equals or exceeds 100 metres squared. They provide information for designers, property developers, local authorities and other interested parties, such as sewerage undertakers and Natural Resources Wales (NRW). They also contain links to additional supporting information relating to SuDS.

Although these standards apply for new developments, the SuDS approach is increasingly being applied to existing developments to address sewerage capacity and local flood risk problems. These standards can provide a useful framework for the delivery of such “retro-fit” schemes.

From 7 January 2019, new developments of more than one dwelling or where the area covered by construction work equals or exceeds 100 square metres require approval before construction can commence from the SuDS Approval Body (SAB). Adoption and management arrangements, including a funding mechanism for maintenance of SuDS infrastructure and all drainage elements are to be agreed by the SAB as part of this approval. This will ensure that SuDS infrastructure is properly maintained and functions effectively for its design life.

Although these Standards apply for developments which include road drainage, they are not intended to be applied to the trunk road network managed by the Welsh Government. Equivalent provision for SuDS for these roads is contained in Volume 4 of the Design Manual for Roads and Bridges.

The Planning (Wales) Act 2015 introduced a statutory purpose for the planning system. Any statutory body carrying out a planning function must exercise those functions in accordance with the principles of sustainable development as defined in the Well-being of Future Generations Act 2015. The Well-being of Future Generations (Wales) Act 2015 places a duty on public bodies that they must carry out sustainable development. This means the process of improving the economic, social, environmental and cultural well-being of Wales by taking action, in accordance with the sustainable development principle, aimed at achieving the well-being goals. The use of SuDS is a way of helping to achieve sustainable development in both new and existing developments.

Standard S1 – Surface water runoff destination

This Standard addresses the use of surface water by the development and where it should be discharged. The aim is to ensure that runoff is treated as a resource and managed in a way that minimises negative impact of the development on flood risk, the morphology and water quality of receiving waters and the associated ecology. This will ensure that early consideration is given to the use of rainwater harvesting systems to both manage runoff and deliver a source of non-potable water for the site where practical. Where it is not, prioritisation should be given to infiltration. Discharges to sewerage systems must be limited where possible.

- Priority Level 1: Surface water runoff is collected for use;
- Priority Level 2: Surface water runoff is infiltrated to ground;
- Priority Level 3: Surface water runoff is discharged to a surface water body;
- Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system;
- Priority Level 5: Surface water runoff is discharged to a combined sewer.

Standard S2 – Surface water runoff hydraulic control

The aim of Standard S2 is to manage the surface water runoff from and on a site to protect people on the site from flooding from the drainage system for events up to a suitable return period, to mitigate any increased flood risk to people and property downstream of the site as a result of the development, and to protect the receiving water body from morphological damage.

- 1) Surface water should be managed to prevent, so far as possible, any discharge from the site for the majority of rainfall events of less than 5mm.
- 2) The surface water runoff rate for the 1 in 1 year return period event (or agreed equivalent) should be controlled to help mitigate the negative impacts of the development runoff on the morphology and associated ecology of the receiving surface water bodies.
- 3) The surface water runoff (rate and volume) for the 1% (1 in 100 year) return period event (or agreed equivalent) should be controlled to help mitigate negative impacts of the development on flood risk in the receiving water body.
- 4) The surface water runoff for events up to the 1% (1 in 100 year) return period (or agreed equivalent) should be managed to protect people and property on and adjacent to the site from flooding from the drainage system.
- 5) The risks (both on site and off site) associated with the surface water runoff for events greater than the 1% (1 in 100 year) return period should be considered. Where the consequences are excessive in terms of social disruption, damage or risk to life, mitigating proposals should be developed to reduce these impacts.
- 6) Drainage design proposals should be examined for the likelihood and consequences of any potential failure scenarios (e.g. structural failure or blockage), and the associated flood risks managed where possible.

Standard S3 – Surface water quality management

Standard S3 addresses the drainage design requirements to minimise the potential pollution risk posed by the surface water runoff to the receiving water body.

- Treatment for surface water runoff should be provided to prevent negative impacts on the receiving water quality and/or protect downstream drainage systems, including sewers.

Standard S4 – Amenity

Standard S4 addresses the design of SuDS components to ensure that, where possible, they enhance the provision of high quality, attractive public space which can help provide health and wellbeing benefits, they improve liveability for local communities and they contribute to improving the climate resilience of new developments.

- The design of the surface water management system should maximise amenity benefits.

Standard S5 – Biodiversity

Standard S5 addresses the design of SuDS to ensure, where possible, they create ecologically rich green and blue corridors in developments and enrich biodiversity value by linking networks of habitats and ecosystems together. Biodiversity should be considered at the early design stage of a development to ensure the potential benefits are maximised.

- The design of the surface water management system should maximise biodiversity benefits.

Standard S6 – Design of drainage for Construction, Operation and Maintenance and Structural Integrity

Standard S6 deals with designing robust surface water drainage systems so they can be easily and safely constructed, maintained and operated, taking account of the need to minimise negative impacts on the environment and natural resources.

- 1) All elements of the surface water drainage system should be designed so that they can be constructed easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).
- 2) All elements of the surface water drainage system should be designed to ensure maintenance and operation can be undertaken (by the relevant responsible body) easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).
- 3) The surface water drainage system should be designed to ensure structural integrity of all elements under anticipated loading conditions over the design life of the development site, taking into account the requirement for reasonable levels of maintenance.

3 SITE DETAILS AND PROPOSED DEVELOPMENT

3.1 Site Location

The application area comprises several adjoining parcels of land occupying approximately 44.75 ha, the proposed new enterprise zone is situated immediately to the east of Cardiff Airport at Ordnance Survey National Grid Reference ST 081 673, as shown in **Figure 1**.

- OS X (Eastings) 308120
- OS Y (Northings) 167380

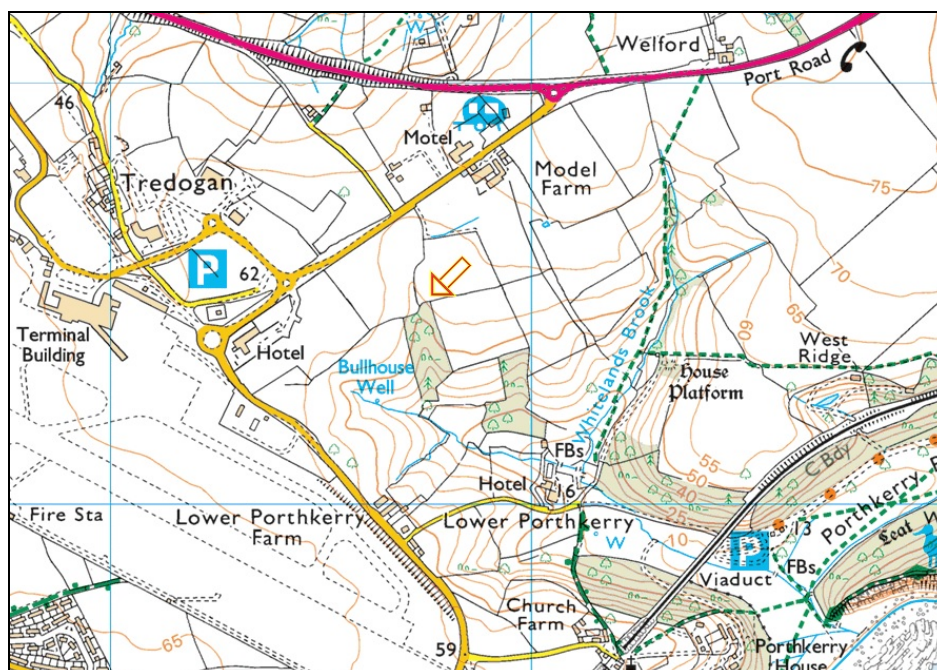


Figure 1: Site Location

3.2 Existing and Proposed Development

The assessment area consists of agricultural land which is a mixture of arable cultivation, improved pasture, and permanent pasture.

It is understood that the application is for the development of a new Enterprise Zone. High-level masterplan illustration identifies a mixed employment area.

In the absence of detailed development plans a roughly estimate of 85% low permeable hardstand has been assumed for calculations purposes.

An indicative concept masterplan drawing is included within **Appendix A** for reference.



Figure 2: Existing Site Aerial View

3.3 Waterbodies in the Vicinity of the Site

The closest watercourse to the potential application site is ordinary Bullhouse Brook, which flows in easterly direction within the southern extent of the site and is a tributary of the Whitelands Brook.

The Whiteland Brook flows in a southerly direction across the eastern extent of the Enterprise Zone and Employment Allocation area. The Whiteland Brook discharges into the Bristol Channel within the Porthkerry Country Park approximately 900 m south east of the application area.

There are several ponds, ditches and drains in the wider area, with the closest unnamed drain / ditch being approximately 500 m to the north west and being a tributary of the Main River Waycock. Many of the smaller brooks have been culverted in places to accommodate road structures.

3.4 Site Levels and Topography

A topographical survey was undertaken by RPS Consulting Services in December 2018 (Refer to **Appendix B**). The survey indicates that the site levels range from 72 m AOD to the northeast of the site and to 50 m AOD at the southern extent of the development platform.

LiDAR data has been used to provide an indication of the ground levels surrounding the Site to Ordnance Datum (**Figure 3**).

The ground levels at site generally fall from the north boundary with Port Road to the southeast at approximately at 1:25 gradient. There is a valley in the centre of the development which separates the site in two different catchment areas (East and West platforms).

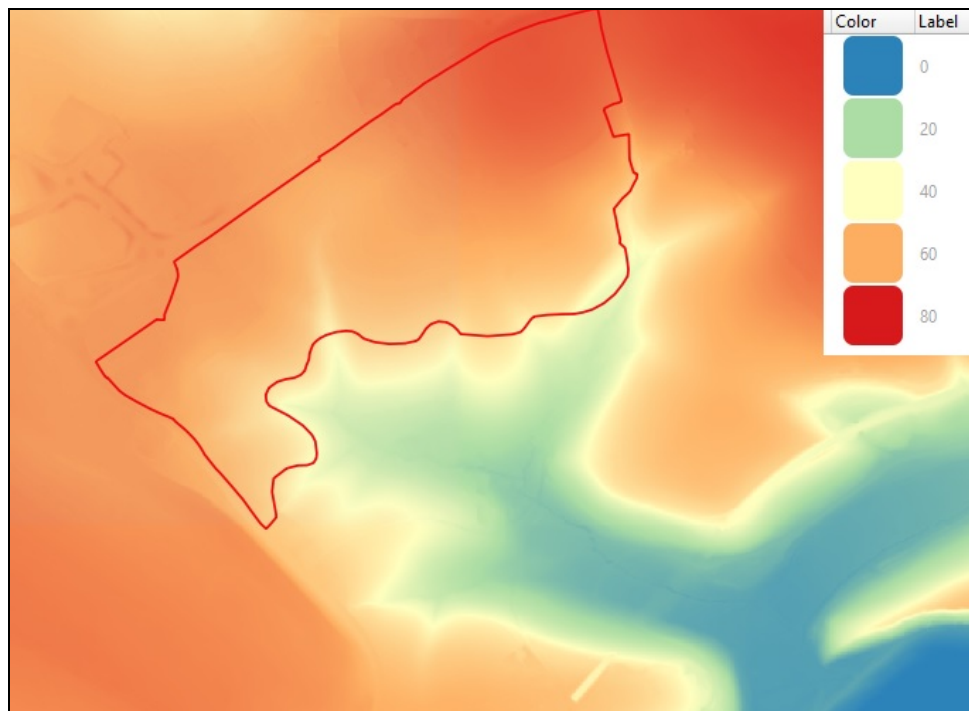


Figure 3: Digital Terrain Model

To the north of the site the levels on Port Road vary from 74 to 60m AOD, its lowest point coincides with the valley in the centre of the site which receives the surface water runoff from the surrounding areas.

Porthkerry Road is located to the west of the site with levels varying northwest to southeast from 64 to 52m AOD. To the south there is a road access from Porthkerry Road to the DC Welsh Water Porthkerry Sewerage Pumping Station which is located 350m to the southeast of the site, on the south embankment of the Whitelands Brook at approximately 15m AOD.

3.5 Geology and Hydrogeology

Geological maps published by the British Geological Survey (BGS) indicate that the site is likely to be underlain by bedrock of the Porthkerry Member – Limestone and Mudstone Interbedded. Sedimentary Bedrock formed approximately 191 to 201 million years ago in the Jurassic Period. No superficial deposits are recorded.

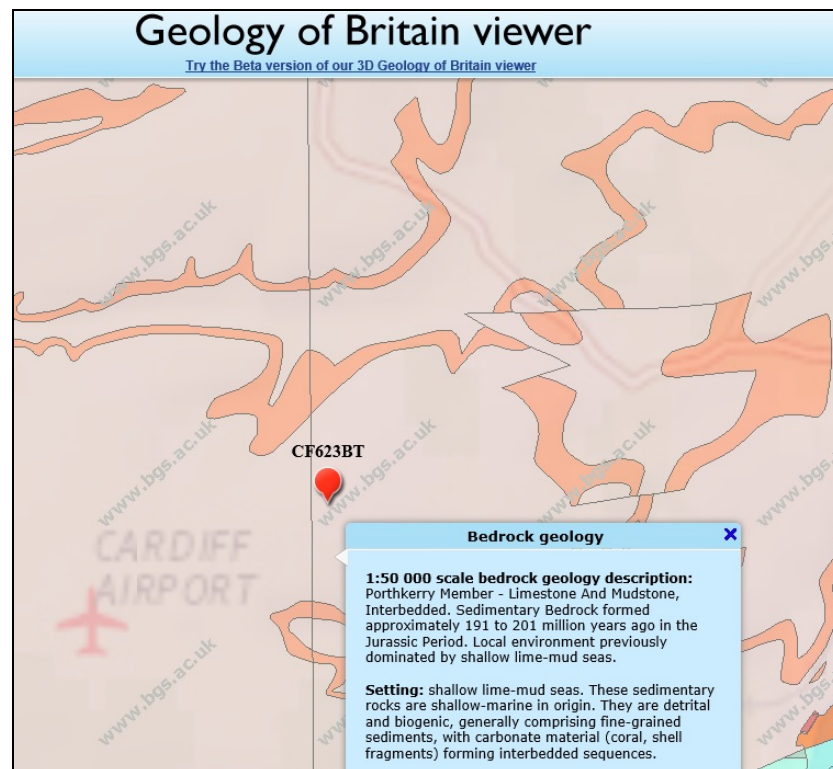


Figure 4: BGS Geology Map

Soakaway infiltration tests for 5no selected locations across the site were undertaken in accordance with Building Research Establishment (BRE) Digest 365. Soakaway Design 2003 between 9th and 12th April 2019.

The underlying strata typically consists of low permeability gravelly and cobbly CLAYS underlain by limestone and mudstone bedrock. Limestone bedrock was present at about 0.5 mbgl at its shallowest.

There were test failures at two locations (TP2, TP3) indicating very low infiltration rates. Where results were obtained these ranged from 3.86 x 10⁻⁶ metres per second (m/s) (at TP1) to 2.05 x 10⁻⁵ m/s (at TP4). Refer to **Appendix C** for the Infiltration testing report.

3.6 Flood Risk Assessment

The Bullhouse and Whitelands brook discharge into the Bristol Channel to the south east of the application area. These waterbodies are determined to be tidally dominated.

TAN 15 DAM indicates the majority of the application area is within Zone A defined as areas considered to be at little or no risk of fluvial or coastal/tidal flooding. Localised areas associated with Bullhouse and Whitelands Brooks are designated to be within Zone B defined as Areas known to have been flooded in the past, evidenced by sedimentary deposits.

The NRW Long Term Flood Risk Map indicate the entire site is located within Flood Zone 1, defined as land at less than 0.1% chance of flooding in any year, this is sometimes known as having a 1:1,000 year chance.

NRW risk of flooding from rivers and sea map, which takes into account the effect of any local flood defences, indicates the entire site is at a very low risk of fluvial or tidal flooding, having a less than 1 in 1,000 (0.1%) risk of flooding in each year.

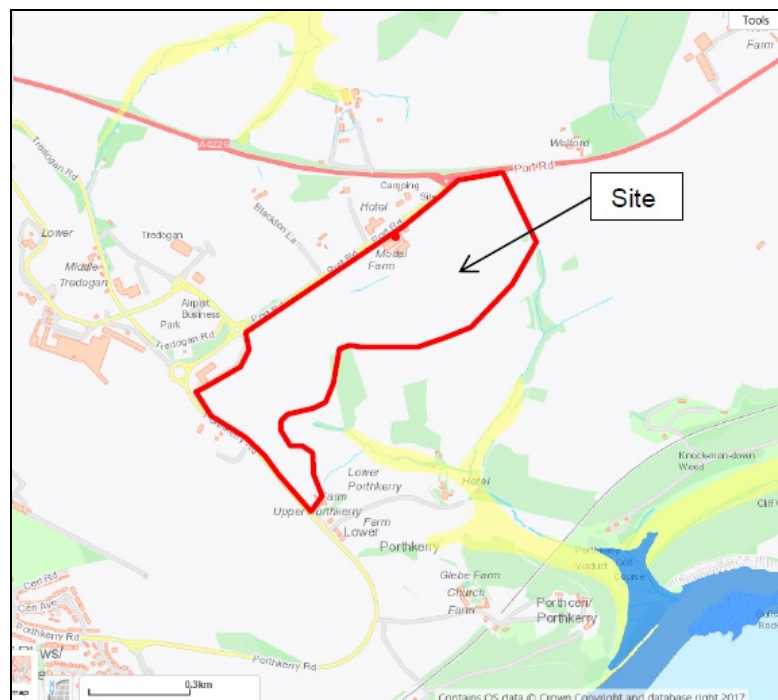


Figure 5: TAN 15 Development Advice Map

The Vale of Glamorgan Council Preliminary Flood Risk Assessment 4.2.5 2011/2017 (PFRA) indicates that application area is not within an indicative flood risk area.

3.7 Drainage at the Existing Site

An extract of the public sewer record obtained from DC Welsh Water is provided in **Figure 6** (refer to **Appendix G** for the full record).



Figure 6: DC Welsh Water Public Sewer Map

The public sewer record indicates a 375mm public foul sewer crossing the site in the western area which would require a public sewer diversion agreement and/or a build over/near a public sewer agreement with Welsh Water.

In Port Road to the north-west of the site there is a public foul manhole (ref: ST076745) where 2no foul rising mains are connected (a 100mm dia. pipe running along Port Road and a 250mm dia. pipe serving the north-eastern areas). From this manhole a gravity 375mm concrete public foul sewer convey the foul loadings generated in the area to the DCWW PorthKerry Foul Pumping Station.

From the public foul manhole located in Porthkerry Road (ref: ST07674101) the 375mm dia. public foul sewer runs in parallel to the road in south-easterly direction.

There are no DC Welsh Water public surface water sewers crossing or in the vicinity of the site. However, according to site surveys it is assumed that the highway drains in Port Road

discharge in its lower area the surface water runoff via a pipe connection to the existing ditch in the centre of the site which runs from north to south following the topography towards the woodland (**Figure 7**).

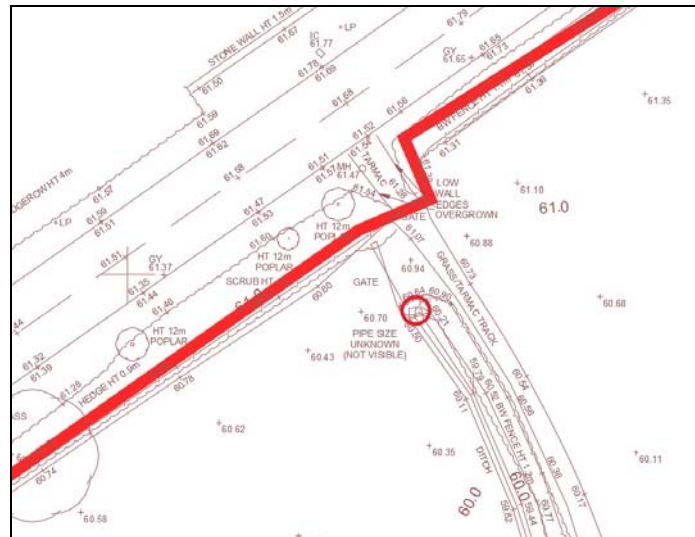


Figure 7: Location of the Highway Drain Discharging to the Existing Ditch

The topographical survey also identified a 375mm surface water pipe crossing the site from the northwest to the south which discharges to the Bullhouse Brook at 37.36m AOD (**Figure 8**).

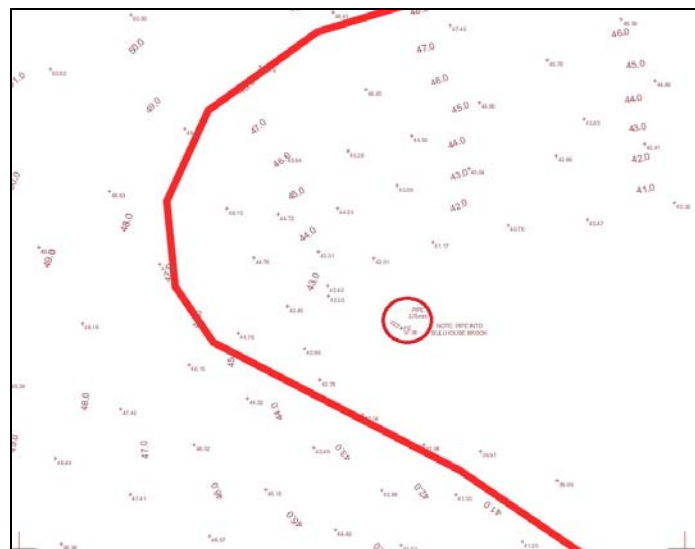


Figure 8: Location of the 375mm dia. Sewer Discharging to the Bullhouse Brook

A further drainage survey is recommended to confirm the condition, alignment and connectivity of the surface water sewers identified in the topographical survey. Diversionary works of live sewers crossing the site may be required.

4 SURFACE WATER DRAINAGE

4.1 Site Characteristics

The total area of the proposed employment site is 44.75 ha. A central green corridor separates the site in two development platforms and/or proposed catchment areas. Approximately the extension of the western development platform is 12.2 ha and the extension of the eastern development platform 26.6 ha.

The proposed green corridor and the landscaping areas to the south of the site where the strategic attenuation basins are located would occupy approximately 6 ha of the total area.

Assuming a conservative 85% of hardstanding for both development platforms the proposed impermeable areas would be 10.4ha (West) and 22.6ha (East) respectively

A longitudinal section of the green corridor which separates the site in two different catchment areas and a scheme of the proposed trunk drainage networks is provided in **Figure 9**.

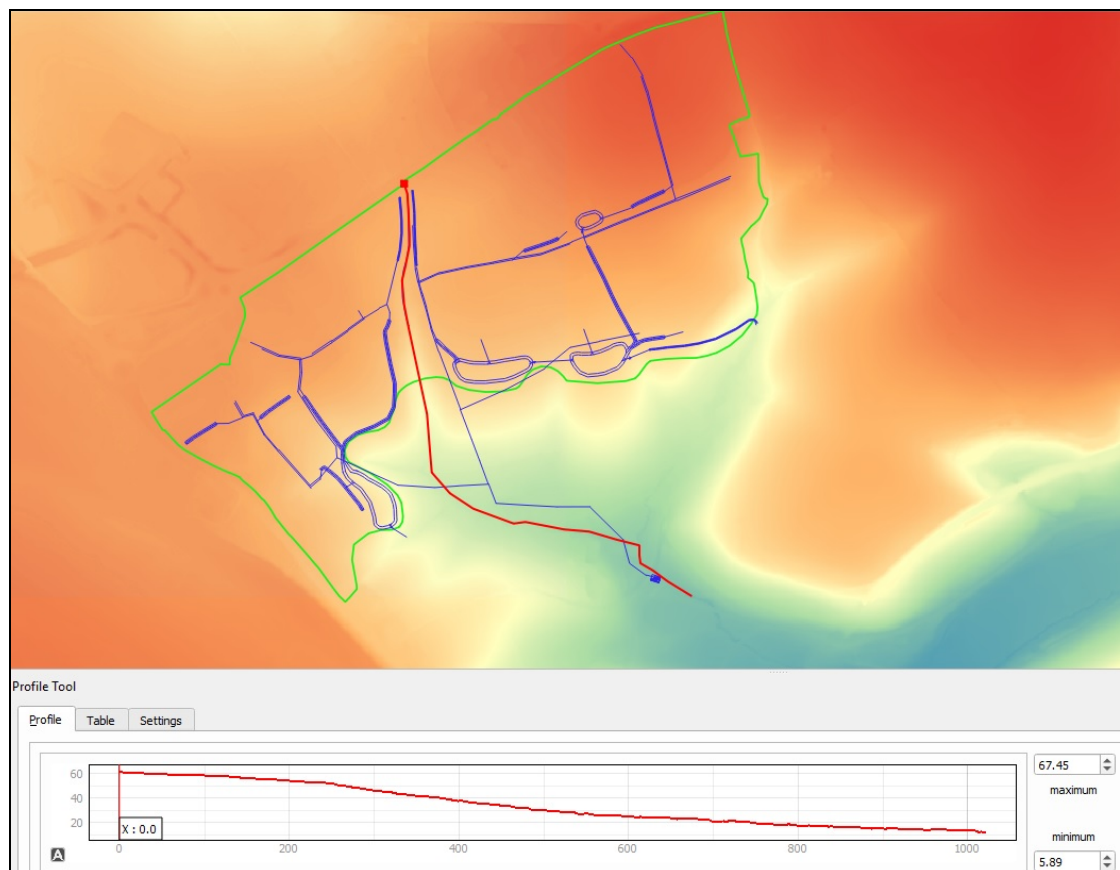


Figure 9: Proposed Trunk Drainage Networks and Existing LiDAR Levels Map with a Longitudinal Section of the Green Corridor-Watercourses below.

The approximate extent of the existing and proposed site areas is summarised in **Table 1**.

	Area (ha)	Assumed 85% Impermeable (ha)
West Platform (ha)	12.2	10.4
East Platform (ha)	26.6	22.6
Landscaping (ha)	6.0	0.0
Total (ha)	44.8	33.0

Table 1: Site Areas

4.2 Surface Water Drainage at the Developed Site

4.2.1 Development Layout

There are proposed 5no B1 outline plots in the western area of the site and 3no B1, 2no B1/B2 and 3no B8 plots in the eastern area. A green corridor is proposed in the valley between both development platforms to serve as flood route during exceedance storm events.

4.2.2 Disposal of Surface Water

In accordance with the Welsh Government Statutory Standards for Sustainable Drainage systems – Designing, Constructing, Operating and Maintaining Surface Water Drainage systems, surface water runoff should be disposed of according to the following hierarchy:

1. Is collected for use;
2. Is infiltrated to the ground;
3. Is discharged to a surface water body;
4. Is discharged to a surface water sewer, highway drain, or another drainage system;
5. Is discharged to a combined sewer

Geological maps published by the British Geological Survey (BGS) indicate that the Site likely to be underlain by bedrock of the Porthkerry Member (Limestone and Mudstone Interbedded).

Table 25.1 of The SuDS manual, CIRIA (C753) shows that mudstone is a poor infiltration media with a typical infiltration coefficient $<3.0 \times 10^{-8}$ m/s. The minimum infiltration rate value deemed acceptable within the SuDS manual is 1.0×10^{-6} m/s. Therefore, it is reasonable to consider that the sub soils across the site will be impermeable with low infiltration potential.

Infiltration testing carried out on site demonstrates that disposal by infiltration is not feasible, there were test failures at two locations (TP2, TP3) indicating very low infiltration rates. Where

results were obtained these ranged from 3.86×10^{-6} metres per second (m/s) (at TP1) to 2.05×10^{-5} m/s (at TP4).

It is proposed that the surface water runoff from the site mimic the pre-development conditions and is discharged to the Bullhouse Brook and Whitelands Brook which are located in lower areas to the southeast of the site.

4.2.3 Surface Water Discharge Rates

Surface water from the development will be treated and controlled at source wherever possible and then directed to the existing watercourses via new outfalls utilising a variety of sustainable drainage measures.

Surface water runoff from impermeable surfaces will be restricted to existing greenfield runoff rates through the provision of end of pipe filtration/detention basins and low-tech complex control chambers (SuDS Site Control Structures).

Greenfield Discharge Rates have been calculated using the ICP SuDS method within MicroDrainage (**Appendix D**). The results per hectare are summarised in **Table 2**:

Annual probability of rainfall event	Greenfield Runoff Rate (l/s/ha)	Proposed Discharge Rate (l/s/ha)
1 in 1	5.6	5.6
Qbar	6.4	6.4
1 in 30	11.3	11.3
1 in 100	14.0	14.0

Table 2: Greenfield Discharge Rates (per hectare of developable area)

The SAB confirmed in the pre-application letter response dated on 10th May 2019 that the above greenfield/proposed discharge rates per hectare are acceptable in principle and requested further hydraulic calculations demonstrating the proposed discharge to both watercourses (**Appendix E**).

The proposed West development platform (Total Catchment Area: 12.2 ha) will discharge the surface water runoff generated on its catchment to the Bullhouse Brook and the proposed East development platform (Total Catchment Area: 26.6 ha) will discharge to the Whitelands Brook.

The proposed attenuation SuDS structures (storage tanks, basins) will be sized to store runoff from the 1 in 100 annual probability rainfall events including a 30% increase in rainfall intensity in order to allow for climate change and will comply with local bird strike mitigation and drain

down time requirements. The required total surface water storage volumes for these events have been calculated using MicroDrainage Source Control (**Appendix F**).

The greenfield/proposed maximum discharge rates and maximum total storage volumes associated to the West and East Catchment Areas are presented in **Table 3** and **Table 4** respectively:

Annual probability of rainfall event	West Platform Greenfield Runoff Rates (l/s)	West Platform Proposed Peak Discharge Rates (l/s)	Maximum Total Storage Volume (m3)
1 in 1	68.3	68.3	-
1 in 30	137.8	137.8	-
1 in 100	170.8	-	-
1 in 100 + 30%CC	-	170.8	5,000

Table 3: Greenfield/ Peak Discharge Rates to Bullhouse Brook (West Catchment Area)

Annual probability of rainfall event	East Platform Greenfield Runoff Rates (l/s)	East Platform Proposed Peak Discharge Rates (l/s)	Maximum Total Storage Volume (m3)
1 in 1	149.0	149.0	-
1 in 30	300.6	300.6	-
1 in 100	372.4	-	-
1 in 100 + 30%CC	-	372.4	11,500

Table 4: Greenfield/ Peak Discharge Rates to Whitelands Brook (East Catchment Area)

It is not expected to receive and attenuate surface water runoff from outside of the proposed development (West and East catchment areas). Ground levels around the proposed green corridor and a low water channel will be designed to convey potential external overland flows from Port Road along the green corridor towards the woodland area and finally to the Bullhouse Brook as per the existing pre-development conditions.

4.2.4 Managing Surface Water within the Development

The SuDS networks must be designed so that:

- Flooding does not occur on any part of the site for a 1 in 30 annual probability rainfall event, unless an area is designed to hold and/or convey water as part of the design;
- Flooding does not occur in any part of a building during a 1 in 100 annual probability event; and
- Flows resulting from rainfall in excess of a 1 in 100 annual probability rainfall event are managed in exceedance routes that minimise the risks to people and property, so far as is reasonably practicable.

The proposed green swales will be designed in accordance with best practice, including as set out in The SUDS Manual. The overall design principle for conveyance swales is that they are relatively broad, shallow vegetated channels with a base width of 1 m and minimum of 1 in 3 side slopes. A filter trench with gravels and a perforated pipe underneath the base of the swale will allow that the surface water runoff is filtrated through highly permeable topsoil and permeable geotextiles before the discharge to the filtration/detention basin.

Filtration/Detentions basins with a permeable base (filter central trench underneath with a perforated pipe) and permeable check dams will allow filtration of the surface water runoff for daily storm events. Water volumes attenuated within the proposed basins up to 1 in 100y+30%CC will be discharged to the watercourses at greenfield discharge rates via low-tech complex control chambers.

It is assumed that all permeable surfaces within the development platform will be landscaped to ensure that they do not contribute to runoff leaving the site. This, together with the proposed density means that the volume of surface water runoff would be expected to be reduced post development. As such long term storage is not required.

Additional SuDS source control structures will be provided within the proposed private plots: Rainwater harvesting for single properties, permeable pavings in car parking bays, oil interceptors for industrial plots with trucks circulation, etc. to complete the SuDS treatment train following a cascade in accordance with The SuDS Manual C753 and Welsh Government SuDS Statutory Standards.

The proposed SuDS Source Control Structures (Rainwater Harvesting Tanks, Permeable Pavings, Storage Tanks, Oil Interceptors) and Site Control structures (green swales and detention basins with filter trenches) will offer the required attenuation, amenity, biodiversity and the better water quality treatments through natural processes inherent in the system.

Refer to **Appendix H** for the Preliminary Levels Strategy Layout Drawing.

Refer to **Appendix I** for the Preliminary Drainage Strategy Layout Drawing.

4.3 Water Quality Treatment

The proposed water quality treatment of the surface water runoff generated at the proposed development is sufficient in line with the simple index approach outlined in chapter 26 of the CIRIA SuDS Manual:

The pollution hazard level for the proposed employment development is considered to be Medium in general and High for the industrial plots. Indices as follows:

Land use	Pollution hazard level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Commercial yard and delivery areas, non-residential car parking and all roads.	Medium	0.7	0.6	0.7
Industrial Plots	High	0.8	0.8	0.9

Table 5: Pollution Hazard Indices for Different Land Uses (SuDS Manual C753)

The proposed SuDS site control structures have the following indices and the total SuDS mitigation index ($\text{Index 1} + 0.5(\text{Index 2})$), exceeds the minimum required by The SuDS Manual.

Additional SuDS source control components will provide more than adequate pollution control before the surface water runoff is discharged to the Bullhouse and Whitelands Brooks:

Site Control Components	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Swales	0.5	0.6	0.6
Filter Drains	0.4	0.4	0.4
Detention Basins	0.5	0.5	0.6
Combined	0.95	1.05	1.10
Extra Source Control Components	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Permeable Pavement	0.7	0.6	0.7
Class I Oil Interceptor	0.5	0.4	0.8

Table 6: SuDS Mitigation Indices for Discharges to Surface Waters (SuDS Manual C753)

4.4 Assumptions and Limitations

Detailed plots design, roads and platform levels have not been confirmed and it is assumed that post development ground levels will remain similar as existing, with the exception of the proposed levels around the retaining structures, attenuation basins and localised ground raising to enable sufficient cover above the pipe network.

4.5 Maintenance of SuDS

The maintenance arrangements for the surface water drainage system are yet to be confirmed although it is anticipated that the proposed surface water drainage network serving more than a single property drainage system would be adopted by the Vale of Glamorgan Council (The SAB and Highways Authority for this area).

An indicative maintenance schedule is presented in **Table 7** below:

Table 7: Illustrative Maintenance Schedule

Attenuation/Detention Basin		
Regular maintenance	Remove litter and debris	Monthly
	Cut grass	Monthly (during grow season, or as required)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly (for first year), then annually or as required
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets/outlets	Annually (or as required)
Occasional maintenance	Reseed areas of poor vegetation growth	As required

	Prune and trim any trees and remove cuttings	Every two years, or as required
	Remove sediments from inlets/outlets and main basin when required	Every 5 years, or as required
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets/outlets	As required
	Relevel uneven surface and reinstate design levels	As required
Swales		
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect filtration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for >48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
Occasional Maintenance	Reseed areas of poor vegetation growth, later plant types to better suit conditions, if required.	As required or if bare soil is exposed over 10% or more of the swales treatment area
Remedial Actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve filtration performance, break up silt deposits and prevent compaction of the soil surface	As required

	Remove build-up of sediment on top of filter trench	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required
Filter Trenches		
Regular maintenance	Remove litter and debris from filter drain surface, access chambers and pre-treatment devices (catchpit manholes)	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment devices, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six Monthly
	Remove sediment from pre-treatment devices	Six Monthly (or as required)
Occasional Maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required
Class I Separator Oil Interceptor Unit		
Regular maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	Six Monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – Indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six Monthly

	Inspect filter media and establish appropriate replacement frequencies	Six Monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first year of operation, then every six months
Permeable Pavements		
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site specific observations of clogging.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depression, rutting and cracked or broken blocks considered detrimental to the structural performance on a hazard to users, and replace lost jointing material.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if filtration performance is reduced due to significant clogging.
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chamber	Annually

5 FOUL WATER DRAINAGE

5.1 Foul Water Loadings

The peak foul flow rate from the proposed employment development is estimated to be 39 l/s (0.6 l/s/ha of developable land) using the methodology set out in Sewers for Adoption 7th Edition and The Welsh Ministers Standards for New Gravity Foul Sewers and Lateral Drains.

5.2 Connection to Public Sewer

A sewer capacity check was submitted to DC Welsh Water to determine whether there is adequate capacity within the existing sewer network to service the development without the need for off-site reinforcement.

No problems are envisaged with the Waste Water Treatment Works for the treatment of domestic discharges from the site. However, it is likely that the pumping capacity and emergency storage tank in the existing DCWW Porthkerry Foul Pumping Station may require an increase/upgrade to accommodate the proposed development.

Refer to **Appendix G** for the DC Welsh Water Pre-Development Enquiry Response Letter.

5.3 Foul Water Drainage at the Developed Site

Foul water for the development would drain by gravity to the existing DCWW Porthkerry foul water pumping station. Foul water would then be pumped via the existing 350mm dia. rising main to the east of the site.

The proposed foul water pipe network and the upgraded foul pumping station would be designed to adoptable standards, as set out in The Welsh Ministers Standards for Gravity Sewers and Lateral Drains (October 2012), together with any supplementary requirements of Welsh Water.

Refer to **Appendix I** for the Preliminary Drainage Strategy Layout Drawing.

6 SUMMARY

This drainage assessment has been undertaken by RPS Planning & Environmental on behalf of Legal & General (Strategic Land) Ltd. The assessment is in support of an outline planning application for the proposed employment development at Model Farm, Rhoose, Barry CF62 3BB.

The drainage assessment reviews existing surface water and foul water drainage arrangements at the site and presents a strategy for managing surface water and foul water from the developed site.

Surface Water

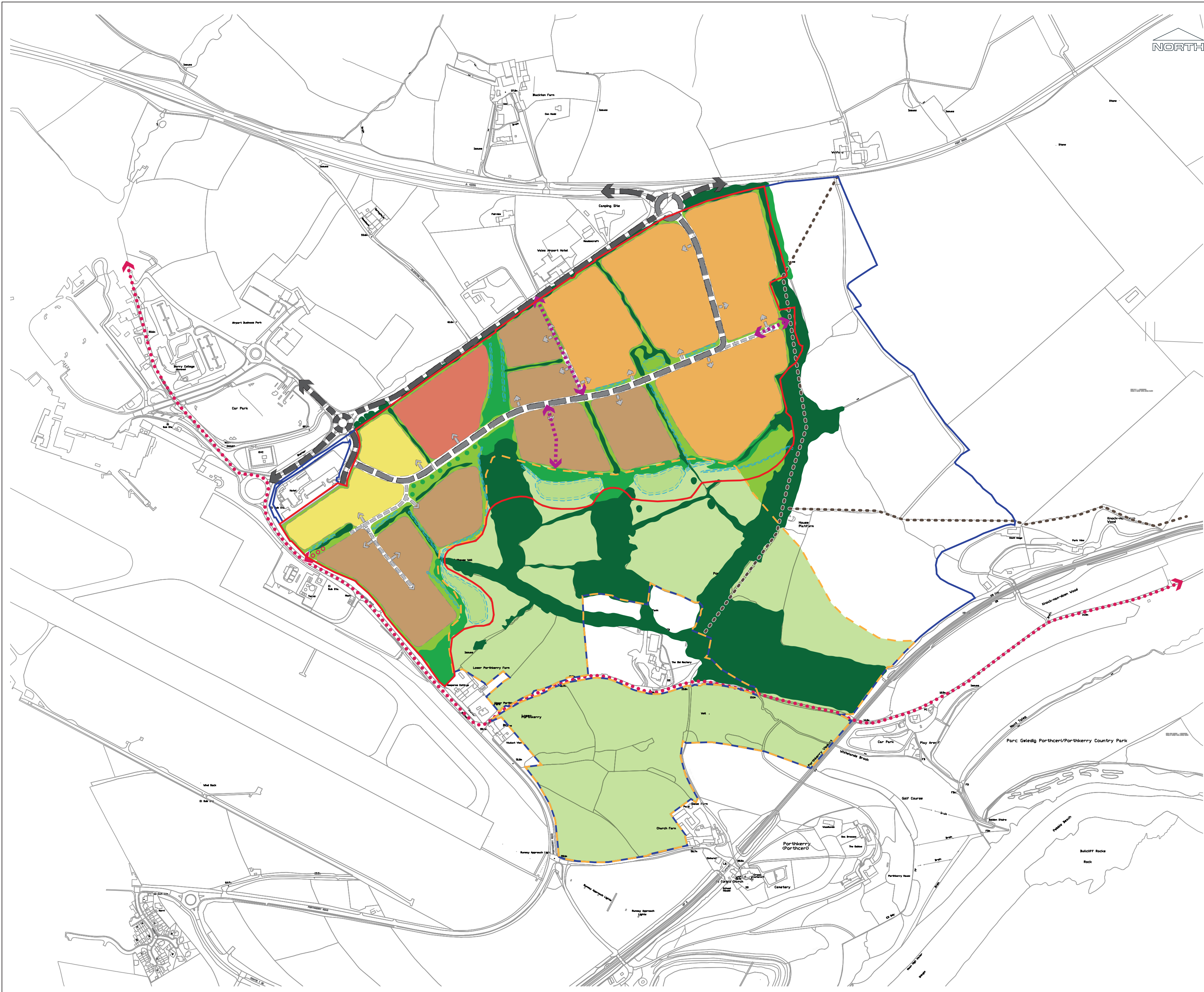
- Surface water from the existing site is believed to be directed overland to the lower areas to the southeast of the site towards the Bullhouse Brook and Whitelands Brook.
- Surface water from the development will be treated and controlled at source wherever possible and then directed to the existing watercourses via new outfalls utilising a variety of sustainable drainage measures.
- Surface water runoff from impermeable surfaces will be restricted to existing greenfield runoff rates through the provision of green swales, end of pipe detention basins and low-tech complex control chambers (SuDS Site Control Structures).
- The proposed surface water drainage scheme provides SuDS elements to control the disposal of runoff from the redeveloped site and to provide quality treatment via a SuDS treatment train.

Foul Water

- Foul water will be directed to the existing DCWW Porthkerry foul water pumping station located to the southeast of the site via a proposed adoptable drainage network

Appendices

Appendix A – Indicative Concept Masterplan



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Notes

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2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.

Land In Ownership of L&G

Site Boundary

Allocated Porthkerry Park Extension Boundary

B1 (Office)

B1/B8

B2/B8

B8

Existing Road Network

Proposed Spine Road Corridor
(setting of spine road shown in a corridor to allow flexibility for final alignment)

Access Roads

Existing PROW

Existing Cycle Route

Proposed Link to Cycle Route

Proposed Pedestrian Link

Proposed Native Woodland Planting

Existing Tree Belts / Existing hedgerows

Landscape Buffer/Open Space

Combined Ecology and Drainage Corridors

SUDS Attenuation Areas/Swales

Rev	Description	Date	Initial	Checked

MAKING
COMPLEX
EASY

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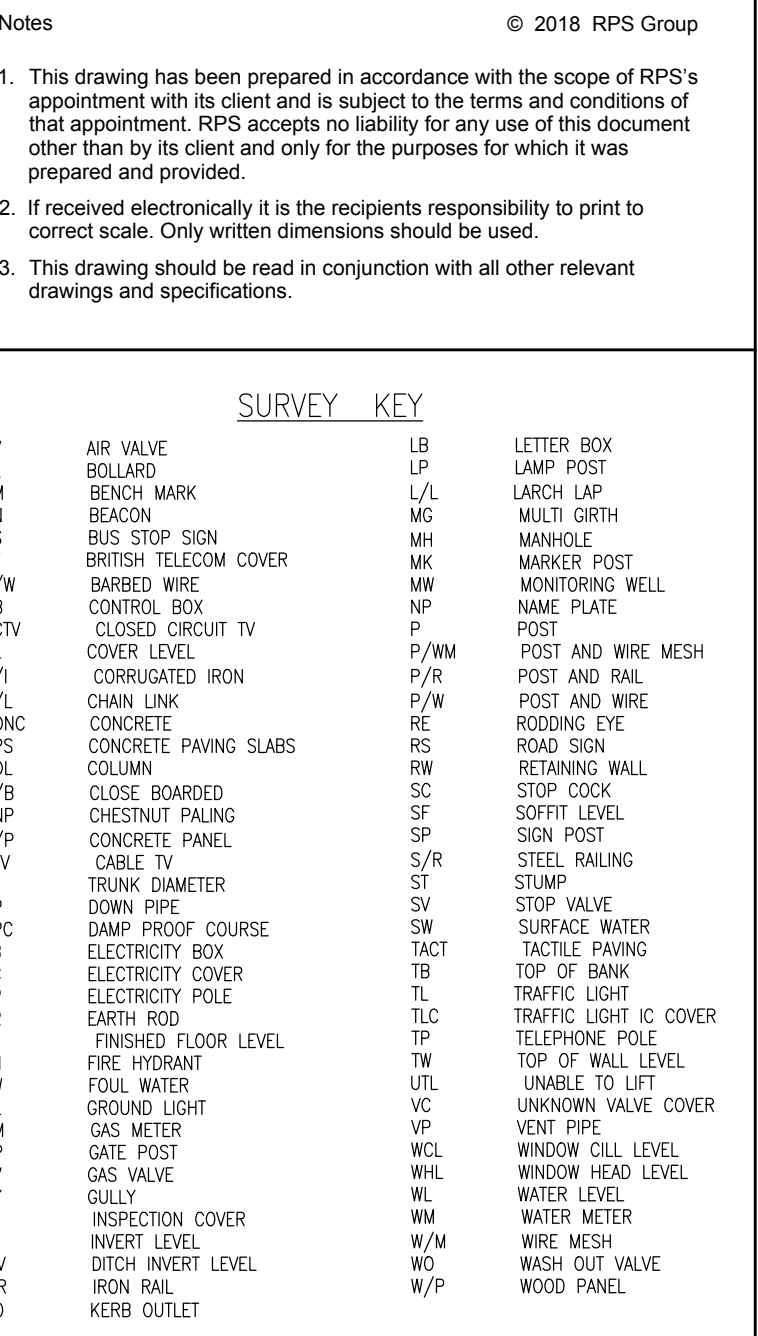
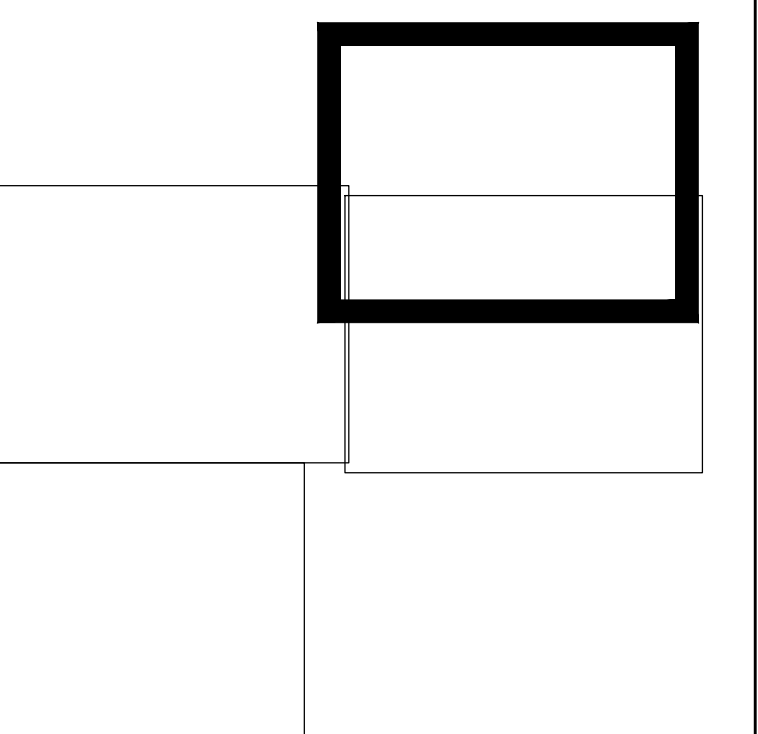
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Appendix B – Topographical Survey

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ORIGINAL DRAWING ISSUE		DJR AHP 13:12:18	
Description	By	Chk'd	Date



Client

Project LAND NEAR CARDIFF
AIRPORT, MODEL FARM,
RHOOSE.

Title TOPOGRAPHICAL SURVEY

Status	Scale	Date Created
FINAL	1:500 @A0	13th Dec. 2018
Project Leader	Drawn By	Checked by
AHP	PMC/JL/DJR	AHP

Document Number	Revision	Subletty
JKK9669 - 04	A	

