TECHNICAL NOTE

JBA Project Code	2020s0309
Contract	West Bridgend Land Promotion
Client	Llanmoor Development Co Ltd
Day, Date and Time	November 2020
Author	Saskia Salwey BSc
Reviewer	Faye Tomalin BSc (Hons) MSc
Subject	High-Level Drainage Strategy

1 Terms of Reference

JBA Consulting have been commissioned by Llanmoor Development Co Ltd to prepare a high-level drainage strategy for a proposed development site to the west of Bridgend. The development site is to be put forward as a candidate site for the revision to the Local Development Plan for Bridgend County Borough Council.

2 The Site

2.1 Site Description

The proposed development site is located to the west of Bridgend, as shown in Figure 1. The site is bounded to the south by the A473 with the residential areas Bryntirion to the east and Laleston to the west. Llangewydd Road forms the north-eastern corner boundary of the site and there is a public footpath running north to south which runs parallel to a public access route.

There is an ordinary watercourse located north of Llangewydd Road, outside of the site boundary. The Ogmore River, a designated Main River, is located approximately 2km to the east of the proposed development site. The site is located within Development Advice Map (DAM) Zone A and is not at a risk of flooding from fluvial sources.

The proposed site is for the development of residential housing and a primary school. A Concept Plan for the site is contained in Appendix A.

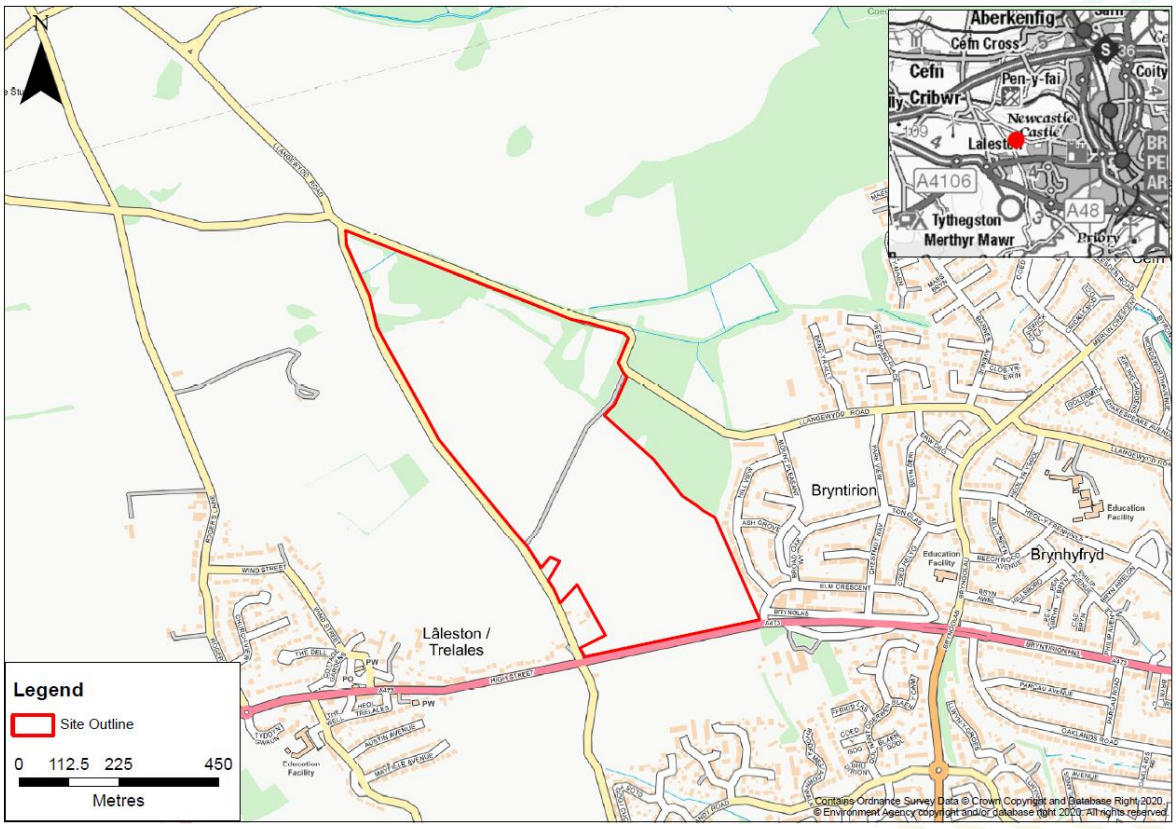

Figure 1 Site Location Plan

2.2 Site Topography and Existing Land-Use

The site is currently Greenfield in nature and used as agricultural land with an area of woodland in the north.

Ground levels fall from the north-western corner towards the southern boundary. Open source 2m LiDAR, shown in Figure 2, indicates that the highest point in the site is along the eastern boundary at 83.5 mAOD with the lowest point of the site at the southern boundary with an approximate ground level of 56.9 mAOD.

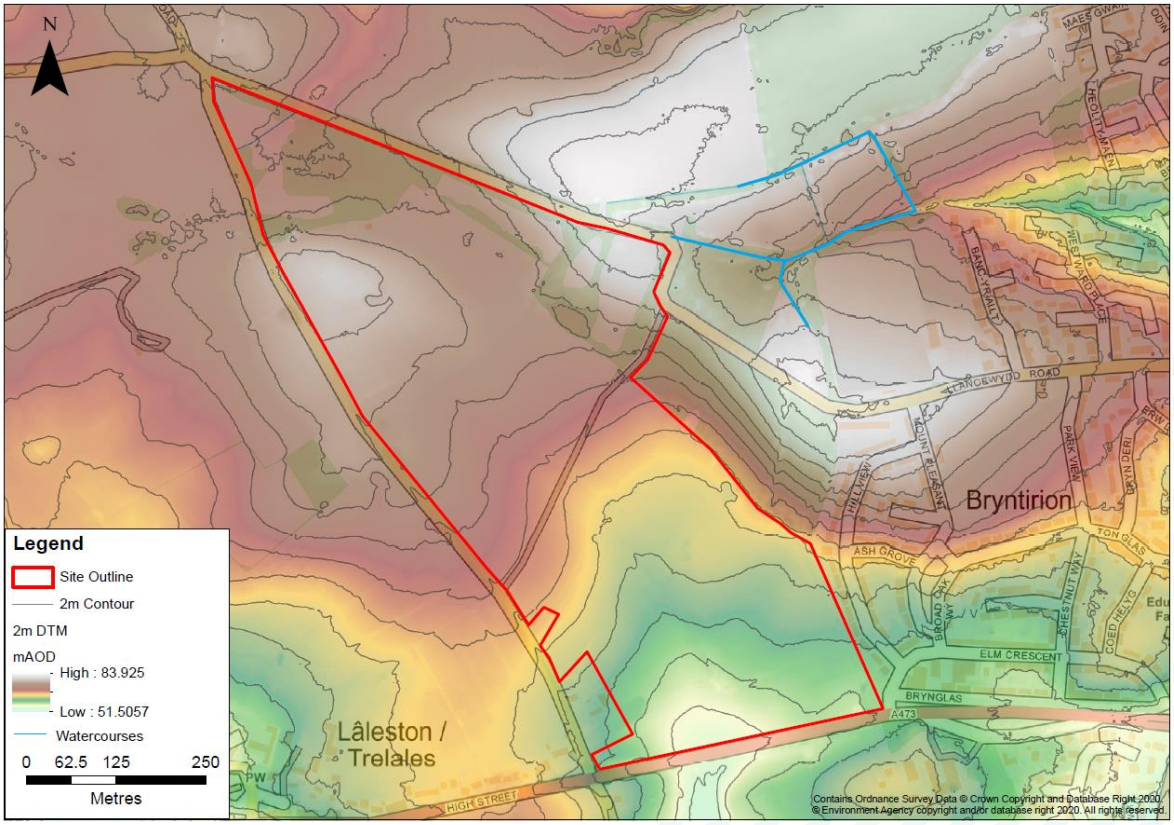

Figure 2 Site Topography

2.3 Consideration of Flood Risk

The proposed development site is located in DAM Zone A, which is used within Technical Advice Note 15: Development and Flood Risk (TAN-15) to indicate that there is considered to be little to no risk of fluvial or tidal flooding to a location. All types of development are permitted within this zone. As a result, no flood consequence assessment is required for proposed development at this site.

2.3.1 Bridgend County Council Strategic Flood Risk Assessment

Bridgend County Council are in the process of preparing an updated Strategic Flood Consequence Assessment (SFCA) which informs the Bridgend Local Development Plan by providing sufficient information of the management of flood risk across the borough. The assessment determines flood risk from all sources and aims to investigate and

identify the extent and severity of flood risk throughout the County Borough. The updated SFCA was prepared by JBA Consulting and issued to Bridgend Council in October 2020.

The proposed development site forms part of a named Strategic Site and Candidate Site 308.C1 within the updated SFCA. The site is flagged as Green in the Red Amber Yellow Green (RAG) assessment, indicating that there is little need to consider flood risk further for this development site.

The SFCA does highlight that a small proportion of the site (4.9%) is subject to surface water flood risk which corresponds with topographic depressions running from north to south. This surface water flood risk should be easily managed through the masterplanning process and surface water drainage strategy. Further detail on surface water flood risk is contained in Section 2.3.2.

2.3.2 Surface Water Flood Risk

Surface water flooding occurs when rain falling on saturated ground flows overland, following the local topography. Surface water flooding and subsequent overland flow can also originate from surcharging blocked sewers or drains. Depending on the return period, sewer flooding can also occur from overloading of sewers due to their flow conveyance capacity being exceeded. This typically occurs in events exceeding the 1 in 30 year. Overland flow can therefore pose a risk to both the development site and surrounding land. Overland flows may originate from the site itself or adjoining land at a higher elevation from which flow migrates onto the development area.

The Natural Resources Wales (NRW) map showing the risk of flooding from surface water and small watercourses, displayed in Figure 3, identifies a path of surface water flowing down into the north-western corner of the site through the topography in the north. This is largely low risk but has small areas of higher risk in several topographic lows. This area of the site is currently comprised of woodland and this woodland is to be retained post-development. It is therefore considered that this area of surface water flood risk will have little influence or impact on development proposals.

A key surface water flow path runs south through the site towards the A473 where a small area of high surface water flood risk is shown. The areas at risk of surface water flooding will be considered throughout the preparation of the drainage strategy and shall be managed with the use of SuDS. Such areas are often ideally suited to SuDS and green infrastructure. More detail on how this surface water flow path is to be considered is contained in Section 4.9.

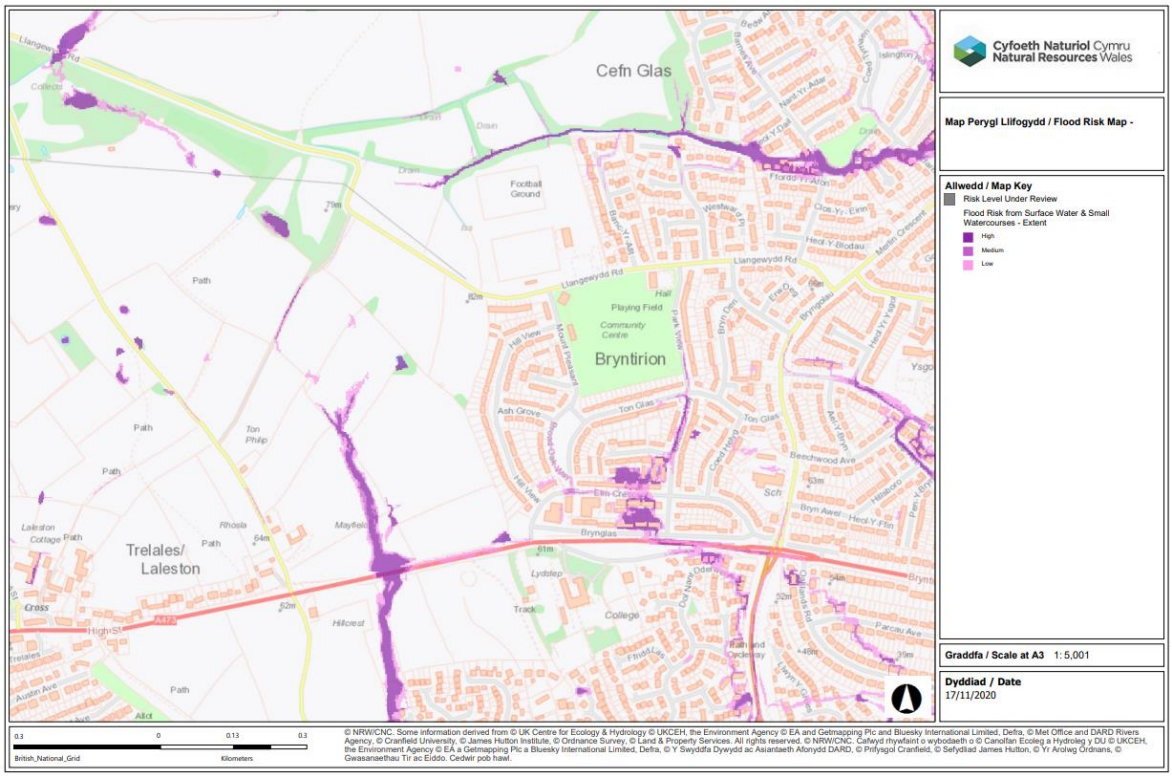

Figure 3 NRW Flood Risk From Surface Water and Small Watercourses

3 Existing Surface Water Regime

3.1 Existing Discharge Location

The Geology of Britain Viewer[1] identifies that the proposed development site is largely underlain by the St Mary's Well Bay Member, comprising of Limestone and Mudstone with a small band of Lavernock Shales Mudstone. Cranfield University Soilscapes[2] has highlighted two soil types across the site. The northern area is made up of slowly permeable, seasonally wet, slightly acid but base-rich loamy and clayey soils. Comparatively, the southern area contains freely draining, slightly acid but base-rich soils.

A site visit undertaken on 9th March 2020 after an unusually wet February presented relatively well drained soils. Few areas of ponding across the site, and little evidence of runoff off at site entrances and exits indicate that there is the possibility of good infiltration potential across the site.

Given the above, it is considered that the site drains as a medium-permeability Greenfield site, with drainage primarily occurring through infiltration, evapo-transpiration losses and runoff towards the small ordinary watercourse in the north-eastern corner of the site.

As a result of the potential for infiltration across the site, it is recommended that infiltration testing is undertaken as soon as possible to inform any future outline or detailed drainage strategy for the site.

3.2 Greenfield Runoff Rates

Table 24.1 of the SuDS Manual[3] indicates that the FEH methods (FEH Statistical and ReFH) should be the preferred methods for calculating peak runoff rates. This is supported by Natural Resources Wales GN008 Flood Estimation: Technical Guidance and Environment Agency research by Faulkner et al which concluded that FEH methods are applicable across a range of catchment sizes and that they should be used in place of outdated methods such as IH124 and ADAS 345 where possible.

MicroDrainage Source Control Module Version 2018.1.1 was used to calculate Greenfield runoff rates for the proposed development site using the FEH statistical method. The MicroDrainage report can be found in Appendix B. Catchment descriptors were extracted from the FEH Web Service. The whole area of the proposed development site is 46 Ha. The calculated Greenfield runoff rates are shown in Table 1.

MicroDrainage Source Control provides Greenfield runoff rates in the form of QMed. This has been converted to QBar using the FSSR14 regional growth curves.

[1] Geology of Britain Viewer: http://mapapps.bgs.ac.uk/geologyofbritain/home.html?
[2] Cranfield University Soilscapes: http://www.landis.org.uk/soilscapes/
3 The SuDS Manual (C753), CIRIA 2015. https://www.ciria.org.

Table 1 Greenfield Peak Runoff Rates

Return Period	Specific Runoff (l/s/ha)	Peak runoff rate for whole site (l/s)
QMed	6.6	307
QBAR	7.1	330

3.3 Greenfield Runoff Volumes

Greenfield runoff volumes were calculated for a six-hour storm event at the site using the FSSR16 method as shown in Equation 1 below.

Runoff volume = Site Area x Rainfall Depth x Percentage Runoff

Equation 1: FSSR16 method for calculating Greenfield runoff volumes

Percentage runoff was calculated using the FSSR16 methodology which accounts for soil type, catchment wetness and storm intensity. The rainfall depths for a six-hour 100-year storm event were extracted from the FEH Web Service and are summarised in Table 2 with the calculated Greenfield runoff volumes.

Table 2 Greenfield Runoff Volume

Return Period	6 hour rainfall runoff depth (mm)	Site runoff volume (m3)
100	64	13,372
100 plus climate change (30%)	83.14	18,194

4 Surface Water Management Approach

4.1 Sustainable Drainage Systems

Sustainable Drainage Systems (SuDS) aim to mimic the natural processes of Greenfield surface water drainage by allowing water to flow along natural flow routes and also aims to reduce the runoff rates and volumes during storm events, whilst providing water treatment benefits. SuDS also have the advantage of providing Blue and Green Infrastructure and ecology and recreational benefits when designed and maintained properly.

Schedule 3 of the Flood and Water Management Act 2010 was enacted in Wales in January 2019, leading to the requirement for all new developments to incorporate the four pillars of SuDS design, shown in Figure 4:

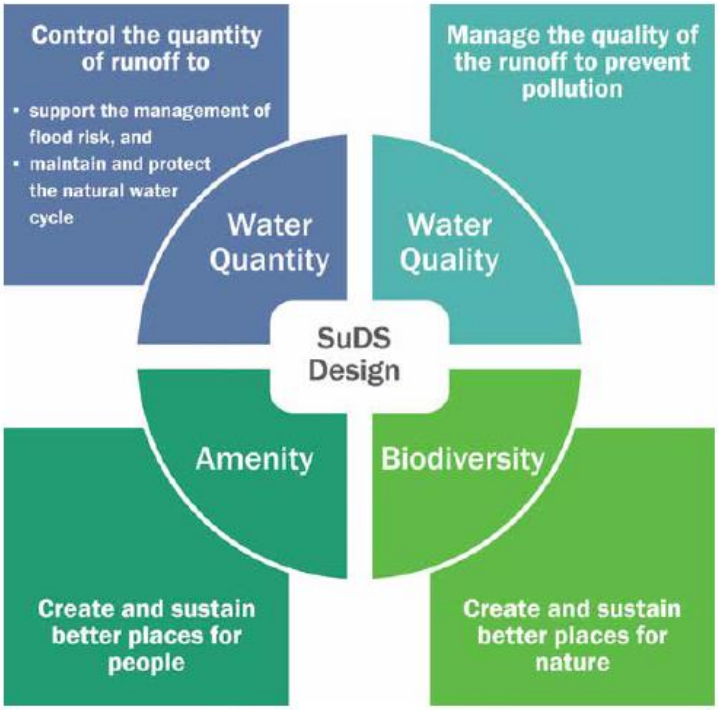

Figure 4 Four Pillars of SuDS Design (Ciria, 2015)

4.2 Design Criteria

The following national guidance documents and design standards have been considered when developing this outline surface water drainage strategy:

- C753 The SuDS Manual (Ciria, 2015)
- Rainfall Runoff Management for Developments – SC030219 (Environment Agency, 2013)
- Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems (Welsh Government, 2018)

- Planning Policy Wales – Edition 10, December 2018
- The Building Regulations 2010 Part H: Drainage and Waste Disposal
- Sewers for Adoption 7th Edition

Bridgend County Council do not currently have county wide SuDS guidance. During detailed design of the proposed surface water drainage system, should any countywide guidance be available, it should be consulted to ensure the system is designed in line with the aspirations and requirements of the SAB.

4.3 S1: Surface Water Runoff Destination

The statutory standards for SuDS in Wales address the use of surface water by the development and where it should be discharged. It has developed a destination hierarchy which sets out the preferred routes for discharge of runoff from the site:

- Priority Level 1: Surface water runoff is collected for reuse
- 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 the combined sewer

Priority Level 1 is the preferred (highest priority) and 4 and 5 should only be used in exceptional circumstances. The following outlines how the proposed development adheres to the drainage hierarchy.

Priority Level 1- water for re-use

It is envisaged that the yield: use ratio will not be sufficient or dependable enough to dispose of a significant volume of surface water runoff across the development site via rainwater harvesting. The possibilities to provide water butts at each property to promote water re-use should be considered. However, water butts should not be included in any storage calculations for the site.

Priority Level 2- infiltration

Given the underlying soil conditions and geology, there is a potential for the development site to infiltrate to the ground. Should infiltration be viable across the site, this should be the preferred means of surface water disposal in line with the drainage hierarchy. It is recommended that infiltration testing is undertaken prior to any outline or detailed design to determine the best means of surface water disposal from the site.

Priority Level 3- discharge to a surface water body

Should infiltration not be viable across the site then opportunities to discharge surface water to a watercourse should be explored.

There are no watercourses crossing or bordering the site, and therefore the remaining developable area of the site will require an alternative means of discharge shall be required.

Priority Level 4- discharge to a surface water sewer

Where priority levels 1-3 are not possible, water shall be discharged to any surface water sewer within the vicinity of the site.

Priority Level 5- discharge to a combined sewer

If all of the above options have been exhausted, the final option is to discharge water to a combined sewer.

4.4 S2: Surface Water Runoff Hydraulic Control: Proposed Discharge Rate

There are typically three design storm events which should be considered when designing the SuDS system for managing flows and volumes:

- 1 in 1 year event, on sloping sites without basements, where surcharging above soffits of any surface water drainage pipework is not permitted.
- 1 in 30 year storm event, where surface water flooding of the site is not permitted at this frequency.
- 1 in 100 year storm event with allowances for future climate change, where runoff should be managed within the extents of the development site, ensuring that it cannot affect people or properties either within the development or surrounding developments.

4.4.1 Interception of Rainfall

When rainfall takes place on Greenfield sites there is, for the majority of rainfall events, no runoff from a site due to evapotranspiration or groundwater recharge. Therefore, interception mechanisms are based on runoff volume reduction using evapotranspiration and infiltration processes. A simplified approach to interception can be used based on assumed compliance of various drainage components. Table G2.1 of the statutory standards for SuDS in Wales lists the interception drainage components which have assumed compliance.

Should infiltration be viable across the site, it is evident that the site shall comply with the requirements for interception. Should an alternative discharge point be required, further consideration shall be required on the use of SuDS to provide sufficient interception of rainfall across the site.

4.4.2 Allowance for Climate Change

The Welsh Government has produced Adapting to Climate Change guidance[4] which contains updated representative climate changes allowances for Wales for peak flows. The guidance contains indicative sensitivity ranges for peak rainfall intensity. As the proposed development site is residential, the assumed lifetime of development is 100 years, and as such the 2070-2115 estimate should be used. The recommended climate change factor for small catchments using the Central estimate for the 2070-2115 epoch is 20%. A sensitivity calculation based on the Upper End estimate of 40% should also be undertaken.

4 Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales: https://gov.wales/sites/default/files/publications/2019-06/adapting-to-climate-change-guidance-for-flood-and-coastal-erosion-risk-management-authorities-in-wales.pdf

Table 3 Climate Change Allowances

Epoch	Total potential change anticipated for 2080s (2070-2115)
Upper Estimate	40%
Central Estimate	20%

4.4.3 Discharge Limits and Attenuation Volume

Should infiltration be viable across the site the discharge rate shall be dictated by the infiltration potential of the underlying soils.

Should infiltration not be viable, the discharge limit for the site should be set to the Greenfield runoff rate of 7.1 l/s/ha.

Currently, the impermeable surfaced proportion of the proposed development is unknown and so the exact required attenuation volume cannot be calculated. Due to the size of the site, a large volume of attenuation volume is likely to the required. This should be considered at all stage of masterplanning and site design to facilitate the implementation of SuDS across the site through Blue-Green Corridors and source control techniques wherever possible.

4.5 S3: Water Quality

The surface water drainage system should provide a sufficient level of water quality treatment to prevent pollution of receiving waterbodies. During the water treatment design event (5mm rainfall across the entire site) no runoff should leave the site. This is usually achieved through source control techniques such as permeable pavements and rain gardens.

Table 4.3 of the SuDS Manual advocates the use of the "simple index approach" to determine an appropriate level of pollution mitigation for development sites. This splits pollution into three contaminant types (Total Suspended Solids, Metals and Hydrocarbons) and assigns a "pollution hazard index" to each type. Different SuDS features are then assigned a "SuDS Mitigation Index" and sufficient treatment is deemed to be provided if the "SuDS Mitigation Index" is equal to or greater than the "pollution hazard index" for each pollutant type. When more than one SuDS component is required a multiplication factor of 0.5 is applied to mitigation indices for secondary and tertiary components to account for reduced performance.

As the proposed development is for residential purposes with low traffic roads, it is defined as having a Low Pollution Hazard Level in line with Table G3.1 of the Statutory Standards for SuDS in Wales.

The "pollution hazard indices" for a low pollution hazard site are given in Table 3 below.

Table 4 Pollution Hazard Indices for a Very Low Pollution Hazard Site

Total Suspended Solids (TSS)	Metals	Hydrocarbons
0.5	0.4	0.4

4.6 S4: Amenity Value

The design of the surface water management system should maximise amenity benefits across the site. SuDS components can enhance the provision of high-quality, attractive public space which can help to provide health and well-being benefits, improve liveability and contribute to improving the climate resilience of new developments.

The aim of Standard 4 is to ensure that wherever possible and having regard to the need to prioritise infiltration drainage, the SuDS scheme makes the best contribution towards maximising benefits for amenity.

Across this development site, SuDS components such as rain gardens and vegetated swales/rills would provide open and accessible areas, creating a pleasant place to live and promoting the well-being of residents across the site. Rain gardens and swales would also assist in the climate resilience of the development, promoting carbon sequestration, and permeable paving would provide amenity benefits from its multifunctionality.

The inclusion of SuDS at the proposed primary school on the site has the potential to be used in education to enable the community to understand the connection between the SuDS scheme and the natural environment.

The provision of SuDS assets across the site will also increase accessibility of green spaces, helping to meet the objectives of Bridgend's Well-being Plan 2018-2033.

4.7 S5: Biodiversity

The surface water drainage system should seek to enhance existing habitats within the site and complement neighbouring habitats. The ecological potential of the SuDS system can be maximised by utilising local planting and locating SuDS adjacent to existing features. The strategy should create a range of habitats and provide varied water depths within the SuDS features which should be sustained by ensuring that an effective management regime is implemented.

Across the development site, the use of SuDS features will help to support and protect the ecosystem services highlighted in the Bridgend County Borough Local Biodiversity Action Plan. SuDS features will contribute to the creation of a diverse, self-sustaining and resilient ecosystem, reconnecting the landscape to existing local habitats.

The site area also contains a Site of Importance for Nature Conservation (SINC), Laleston Meadows, which is made up of woodland, marshy grassland, damp semi-improved grassland and scrub[5]. There are several indicator species present and the area provides potential for bats, dormice, butterflies, reptiles and amphibians. At this stage, it is assumed that the SINC shall be integrated into the site plans. Utilising SuDS across the site has the potential contribute to habitat connectivity, promoting local natural species

[5] Bridgend Sites of Importance for Nature Conservation Review: https://democratic.bridgend.gov.uk/documents/s1040/SINC%20for%20DC%20Committee%2029%20May%202014.pdf

and reconnecting landscapes and habitats, maximising, where possible, the possibilities to enhance this existing habitat on the proposed development site.

4.8 S6: Design for Construction, Maintenance and Structural Integrity

The national SuDS standards state that components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.

Health and Safety

The surface water drainage system should be designed so that it minimises health and safety risk to the site occupants. SuDS are sometimes perceived as unsafe features with fears of drowning and overturning cars, but with correct design, these risks can be mitigated. A CDM Designers Risk Assessment has been provided, demonstrating that the proposed surface water drainage system is fit for purpose, with risks designed out of the proposal, or mitigated wherever necessary.

Adoption and Maintenance

Schedule 3 of the Flood and Water Management Act was implemented in Wales on the 7th January 2019. Under this legislation, SuDS that serve multiple properties must be approved and adopted by the SuDS Approval Body (SAB) – a function performed by the Lead Local Flood Authority at Bridgend County Council.

During detailed design phase, a detailed maintenance plan will be developed to demonstrate the maintenance required to ensure the proposed drainage system functions to optimal capacity in perpetuity.

4.9 Site Opportunities and Constraints

The proposed development site provides many opportunities and constraints for the disposal of surface water via the use of SuDS. Figure 5 shows the locations of these opportunities and constraints. The Concept Masterplan, provided in Appendix A, has also been utilised to inform the site opportunities and constraints.

The access roads marked in the concept plan provide the opportunity for green corridors across the site. A green corridor is shown in Figure 5, which is in line with the primary surface water flow route identified in the NRW flood maps. Green corridors should be used across the site to create wildlife corridors and aid habitat connectivity.

A site visit has been undertaken to further understand the opportunities and constraints for surface water drainage design. Images of this visit can be seen in Table 5 and are referenced in Figure 5.

Across the site, land was saturated, but there were limited areas of pooling water despite extremely wet antecedent conditions. Pooling was mostly seen at field entrances (Picture 4), where heavy machinery entering and exiting the site has the potential to compact soils, reducing their infiltration potential. There was no evidence of large volumes of sheeting surface water runoff from the site. The ponding displayed in photo 1 is within the wooded area at the northern boundary of the site adjacent to Llangewydd Road. Given that this area is located within the Laleston Meadows SINC, it is unlikely to be developed. However, this area indicates the ponding potential across the site. Natural

topographical lows should be utilised where possible for regional SuDS features such as detention basins.

Highway drainage ditches along Llangewydd Road (Photo 2) are located outside of the development boundary. However, these drain to a headwall (Photo 3) on the public access road which crosses the development site from east to west. It is unknown as to the direction, capacity or outfall location of the highway network from this location and therefore further investigation is required to establish its destination and catchment. The flow will ideally be incorporated into the wider drainage strategy.

Adequate consideration should be given to the existing surface water flow paths across the site, by incorporating water sensitive design into the masterplan for the development. These areas have the potential to be used to create green corridors across the site, providing both amenity and biodiversity enhancements. There is the potential for the use of SuDS at the western boundary of the site, where a landscape buffer has been indicated in the Concept Plan. This area also has the potential to provide ecological enhancements and habitat linkage between the site and Laleston Meadows.

Table 5 Images from Site Visit

	
1) Ponding in the North of the site	2) Highway ditches on Llangewydd Road

	
3) Headwall on public access route off of Llangewydd Road	4) Pooling surface water at field entrance

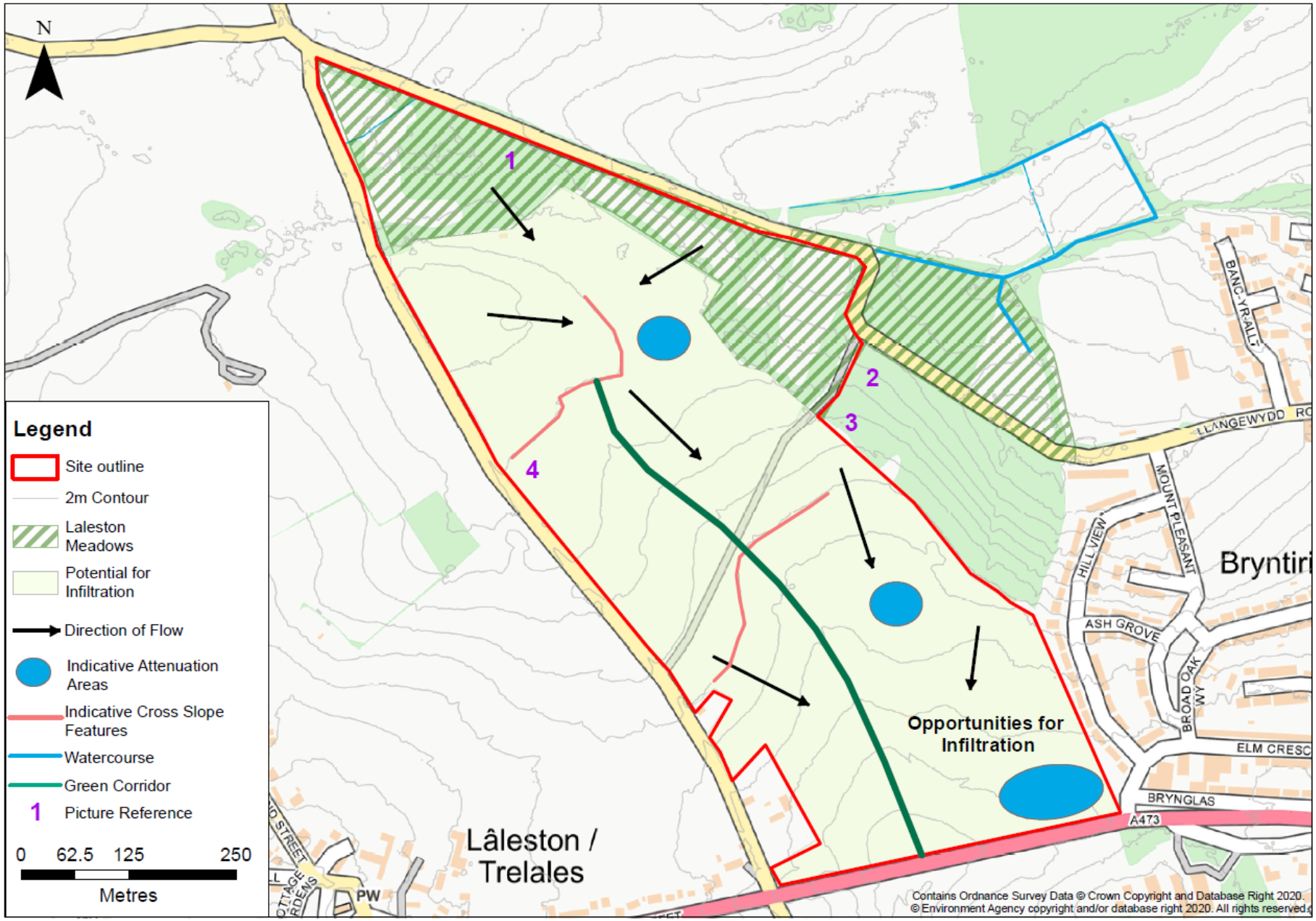

Figure 5 Opportunities and Constraints Plan

4.10 Summary of SuDS Viability on Site

Given the design criteria above, and the opportunities and constraints across the site, consideration has been given to various SuDS components and their viability for use across the proposed development site. Table 6 provides a summary of the SuDS component and their viability, along with indication of the additional benefits they can provide, such as amenity, biodiversity and water quality benefits. This demonstrates that there are a wide range of SuDS options that could potentially be deployed at the site. Such SuDS options would be deployed in combination to form a SuDS 'management train' to achieve the multiple requirements and objectives of the SuDS standards.

Table 6 Viability of SuDS Components on Site

SuDS Component	Site Viability	Amenity Benefits	Biodiversity Benefits	Water Quality Benefits	Comments
Rainwater harvesting	×	✓			Unlikely to establish the yield: use ratio required
Green roofs	✓	✓	✓	✓	Structural and maintenance requirements of these on dwellings to be considered though possibility for inclusion on primary school
Infiltration systems and soakaways	✓	✓	✓	✓	Across site soakaway testing required to establish infiltration rates - may not be viable in northern areas of the site
Filter strips	✓			✓	Opportunities for inclusion within Green Corridors
Filter drains	✓			✓	Beneficial for use within a treatment train
Swales	✓	✓	✓	✓	Consideration to be given to areas of steep site topography and swale gradient requirements. Existing overland flow paths should be retained
Bioretention systems and rain gardens	✓	✓	✓	✓	Beneficial for use within treatment trains and for implementation of SuDS at source - e.g. along highways
Pervious Pavements	✓			✓	Beneficial for use within treatment trains and for implementation of SuDS at source
Attenuation Storage Tanks	✓				Above ground SuDS should be considered prior to the use of below ground storage
Detention Basins	✓	✓	✓	✓	Opportunities for habitat creation and inclusion within areas of public open space

Pond and Wetlands	✓	✓	✓	✓	Opportunities to enhance biodiversity and habitat links to the Laleston Meadows SINC

5 Foul Water Management Approach

5.1 Building Regulations 2010: Part H: Drainage and Waste Disposal

Part H of the Building Regulations 2010 state that foul drainage should be connected to the foul or combined sewer wherever this is reasonably practicable.

Given the Greenfield nature of the site, it is considered unlikely that the site is currently served by Dŵr Cymru Welsh Water (DCWW) infrastructure.

5.2 Dŵr Cymru Welsh Water Engagement

A pre-planning consultation request has been submitted to Dŵr Cymru Welsh Water (DCWW) to determine if there is sufficient capacity within the existing combined sewer network to receive foul flows from the proposed development site.

Results from the DCWW developer enquiry have not yet been received.

Preliminary discussions between the Client and DCWW have suggested that the sewerage infrastructure in close proximity to the site has no capacity to accommodate additional flows and the likely reinforcement works to accommodate the development is expected to be significant. Despite this, a connection point has been identified by DCWW to the east of the development site, as shown in Appendix C. This connection point currently has capacity for 50 dwellings, and reinforcement works shall be required for the remainder of the site. A hydraulic Modelling Assessment (HMA) shall be required to determine the works required at this location. Additionally, DCWW are reviewing whether the removal of surface water flows from the network to offset the additional foul flows would be a suitable option for a connection for this site.

DCWW have confirmed that Penybont Wastewater Treatment Works has capacity available for the whole development.

6 Conclusions

- JBA Consulting were commissioned by Llanmoor Development Co Ltd to prepare a high-level drainage strategy for a proposed development site to the west of Bridgend.
- The development site is to be put forward as a candidate site for the revision to the Local Development Plan for Bridgend County Borough Council.
- The proposed development site is currently Greenfield, agricultural land and is 36 Ha in size. The site generally slopes from the north-western boundary to the southern boundary.
- The site forms part of Candidate Site 308.C1 within the Bridgend SFCA. This site is classified as Green in the RAG assessment, indicating that there is no requirement to consider flood risk further for this site.
- The majority of the site has a very low risk of flooding due to surface water, with a primary surface water flow route through the centre of the site.
- It is advised that existing surface water flow routes are retained where possible and incorporated within the surface water drainage strategy through the use of Green Corridors.
- There are two soil types within the site, the northern portion is slowly permeable, and the southern area is freely draining. Underlying geology is comprised of mudstone and limestone.
- Greenfield runoff rates at the site have been calculated as 7.1 l/s/ha.
- The drainage system shall work to provide multiple amenity and biodiversity benefits and ensure water quality is not adversely affected as a result of the development.
- A review of possible SuDS components for the sites, along with their considerations have been included within this Technical Note.
- A DCWW developer enquiry has been submitted to determine if there is sufficient capacity within the Welsh Water network to receive the envisaged foul flows from the development. The results of this enquiry are yet to be received.

Appendix A – Masterplan Framework

PARC LLANGEWYDD | LAND AT WEST BRIDGEND
MASTERPLAN FRAMEWORK

PLACEMAKING PRINCIPLES

- Site Boundary 36.85ha [91.06ac]
- Residential - High quality, mixed tenure residential community with distinct character areas responding to the site context and creating a sense of place. Variation in built form and density, positively fronting streets and areas of public open space.
- Education- 1.5 form entry Primary School and 45 nursery places, set within 1.6ha green space, incorporating playing fields and SUDS and sensitively integrated within existing hedgerows and tree planting screening views form Laleston.
- Healthy Neighbourhoods - A coherent and attractive network of green streets, walking and cycling friendly routes, and open space promoting active travel, health and well being and enhancing biodiversity.
- Indicative bus stop location on Main Street / The Crescent
- Public Right of Way (PROW)- wayfinding system / interpretation.
- 'Laleston Link'- realigned PROW aligned with existing green corridors.
- Formal shared foot and cycle route set within green corridor.
- 'Y Berth' - Informal track through existing hedgerow corridor.
- Woodland Area / SINC: Nature Conservation Area / Wetland Habitat / Informal green space for people to experience nature.
- Significant multifunctional network of green spaces, retaining/maintaining/ re-providing hedgerows, trees and SUDS features.
- Public Open Space that may incorporate formal play equipment; natural play and landscape detention basins that provide amenity and biodiversity benefits.
- Wetland habitat / flood out area / SUDS feature.
- Western Linear Park- Naturalised green buffer between the Lane and proposed residential area softening views between the site and Laleston and creating/maintaining wildlife corridors.
- Local Equipped Area of Play (LEAP) and Local Area of Play (LAP).
- Local Area of Play (LAP)
- Local Landscape Area of Play (Softer landscape forms and features).
- Trim Trail Adventure Play Zone
- Trim Trail / Station.
- Potential Emergency Access.

Appendix B - Greenfield Runoff Rates

FEH Mean Annual Flood

Input

Site Location GB 288250 179650 SS 88250 79650	
Area (ha)	46.000
SAAR (mm)	1201
URBEXT (1990)	0.0749
SPRHOST	41.340
BFIHOST	0.393
FARL	1.000

Results

QMED Rural (l/s) 307.0 QMED Urban (l/s) 336.4

Appendix C – DCWW Sewer Connection Point

Dŵr Cymru
Welsh Water

Land West
of Bridgend

N
W E
S

LEGEND (Representative of most common features)

- Sluice Valve
- Air Valve SINGLE
- Tap
- Pressure Reducing Valve
- Meter
- Bulk Meter
- Fire Hydrant
- Cap
- Non Dwr Cymru
- Existing Distribution Main
- Gravity Sewer
- Rising Main
- Outfall
- Pumping Station
- Lamphole
- Combined Sewer Overflow
- Special Purpose Chamber
- Treatment Works
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB:
Sewer symbol colour indicates the sewer type.
RED - Combined
GREEN - Surface Water
BROWN - Foul

Notes:

--- Type notes here ---
--- Remembering to manually add line breaks ---

375mm foul sewer SS88799903

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref:	288,179, 180,216
Map scale:	1:2,500
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