

**Drainage Strategy Report (DSR) For:
Proposed extension of existing commercial
unit at:
Mardon Park, Baglan, Neath Port Talbot,
SA12 7AX.**

**Prepared for:
GBV Properties Ltd
13892 - DSR - 1**

24/11/2021

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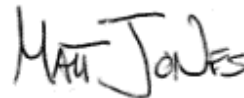
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Purpose of the Report

The purpose of the report is to describe the proposed strategies for the discharge of surface water emanating from the development proposals; in support of a full SuDS Approval Body (SAB) application for **Neath Port Talbot Council**. The SAB consent legislation came into effect on 7th January 2019, when the Welsh Government introduced Schedule 3 of the Flood and Water Management Act 2010.

1 INTRODUCTION

1.1 Site Location

Vale Consultancy has been instructed by Mr Jon Ridd of GBV Properties (*The Client*) to undertake a DSR for the proposed extension of a commercial unit (Unit 21) at Mardon Park, Baglan, Neath Port Talbot, SA12 7AX (*273952E, 192594N*).

The site is located at Mardon Park; eastwards of Baglan Town. The site is bounded by Mardon Park Rd to the north, an industrial unit to the east, Rd No 3 to the south and an unnamed road to the west. Access to the site is provided from Central Avenue and Rd No 3. **Refer to Figure 1 below.** A **Site Location Plan** is also provided in **Appendix A**.

Historically, much of the land use surrounding the site (predominantly westwards) was occupied, and served the BP Petrochemical Plant at Baglan Bay. However, the site is currently disused land comprising Landscaped Ground and overgrown vegetation.

The following drainage strategy will cover the hydraulic design criteria of the surface water drainage network only.

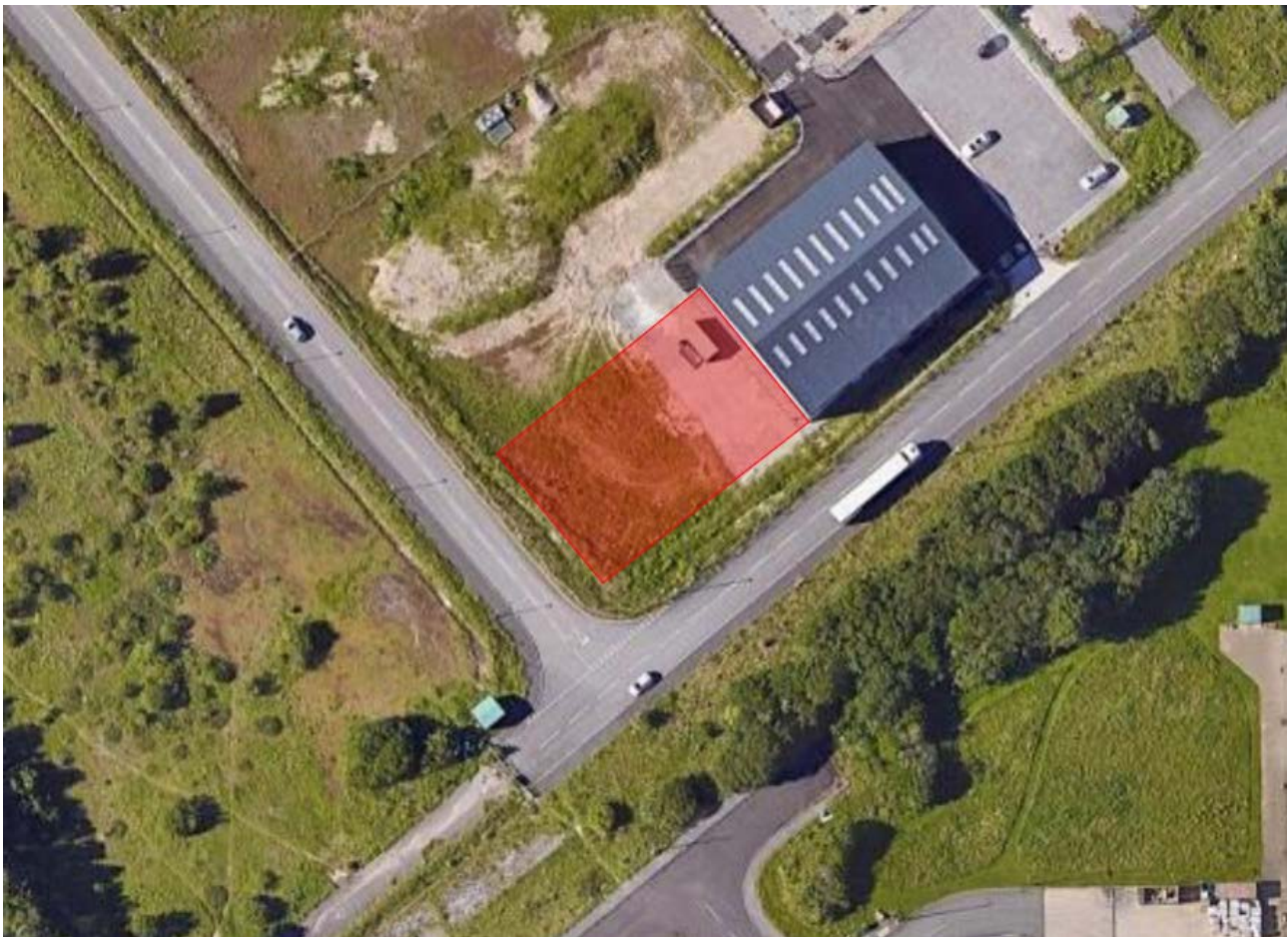


Figure 1: Site Location Satellite Plan

1.2 Proposed Development

The proposal is for the extension of an existing commercial unit with associated parking and service yard within the approximate **0.16ha** site.

The proposed extension will result in approximately an additional **626m²** to the building footprint of Unit 21. The proposed development will add an additional **1478m²** to the site. The site will include SuDS features comprising bioretention swales which utilises the existing soft landscaped bunds around the perimeter of the site. These measurements have been taken from the DWG file provided by the client.

Refer to the Proposed Development Plan in Appendix A.

1.3 Existing Topography

The local topography is relatively flat and there is only a fall of approximately **0.7m** across the whole site. A topographical survey of the site has been undertaken and is included in **Appendix B**. Reference to the topographical survey indicates a maximum level of **7.90m AOD** and a minimum level of **7.20m AOD**. The wider topography generally slopes from east to west – towards the sea at Baglan Bay.

Topographic levels to metres Above Ordnance Datum (m AOD) have been derived from a 1m resolution NRW composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). A review of LiDAR data corroborates the findings of the topographical survey. A **LiDAR extract** is included in **Appendix B**.

1.4 Existing Geology

Two trial pits were excavated (approx. **0.8m** deep) around the site and soakaway tests were undertaken in accordance with BRE 365 specification in order to determine the suitability of infiltration. The trial pits revealed that the site is underlain by hardcore (engineered) topsoil generally to **0.2m** and then sand to at least **0.8m**. No groundwater was encountered.

Soakaway tests concluded that infiltration on site is a viable option due to the very high infiltration rates observed. The infiltration rates observed are summarised in **Table 1** below.

Table 1 – Summary of Infiltration Rates

Trial Pit	Infiltration Rate	Average Infiltration Rate	Lowest Coefficient Observed (m/s)	Lowest Coefficient Observed (m/hr)
1	2.78×10^{-4}	2.78×10^{-4}	2.78×10^{-4}	1
2	2.78×10^{-4}			

Taking a precautionary approach to the design, the **lowest** infiltration rate has been used for design purposes. Refer to **Appendix C – Soakaway Test Report**.

The trial pits indicate that the underlying substrate comprises of hardcore topsoil and sand.

Upon reviewing the British Geological Survey (BGS) records, superficial deposits are identified as Blown Sand at the site. Bedrock is listed as South Wales Middle Coal Measures Formation comprising mudstone, siltstone and sandstone. BGS records also identify extensive Landscaped Ground of variable composition across the site. Landscaped Ground is defined as an area where the land surface (natural or artificial) has been

extensively remodelled, but where it is impracticable or impossible to delineate separate zones of made ground, worked ground, or disturbed ground.

The Cranfield University 'Soilscapes' map (accessed August 2020) indicates that the site is underlain by freely draining sandy soils at the location of the site.

1.5 Flood Risk

The Natural Resources Wales (NRW) Flood Risk Map confirms that the site is located outside of the extreme flood extent (Flood Zone 1), meaning it has a less than 0.1% annual probability of flooding from Rivers and Sea.

The NRW Flood Risk Map confirms that the site is not at risk of flooding from Surface Water and Small Watercourses.

The Welsh Government Development Advice Map indicates the site to be in Zone A – an area considered to be at little or no risk of fluvial or coastal / tidal flooding.

There are no other sources of flood risk, therefore the flood risk to the site is considered to be very low.

2 DRAINAGE SYSTEMS ASSESSMENT

2.1 Existing Drainage Systems

A site investigation was undertaken by Vale Consultancy on the 2nd of September 2021 which incorporated the soakaway tests.

It is assumed that the site is not currently served by any formal drainage as none was observed and the land is currently disused.

No Dwr Cymru Welsh Water (DCWW) asset plans have been acquired for the site and the surrounding area.

Although the large majority of the site's developable area is currently disused / vacant land, and considered to be 100% permeable; it is classified as a *brownfield* or *previously developed* site. It is assumed that surface water infiltrates into the highly permeable underlying ground, unfettered.

There are currently ditches located along some extents of the site perimeter; most notably along the southern and western extents of the site boundary. It is likely that these ditches informally provide surface water drainage to the site and help to convey surface water runoff around and off of the site via infiltration. There are no other surface water features within the close vicinity of the site. Baglan Brook is located approximately 550m north of the site and discharges into the River Neath further downstream (north) at approximately 273210E, 193274N.

2.2 Legislation

The Flood and Water Management Act 2010 (Schedule 3), requires new developments to include SuDS features that comply with national standards. The Welsh Governments published statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems (2018), which became mandatory as of 7th January 2019, and determines the most effective way of

embedding SuDS principles in new developments. The statutory national standards are accepted by local authorities that they have taken account of the Welsh Government planning advice on Development and Flood Risk, and the impact of surface water runoff from the development, which is based on limiting the peak runoff rate and runoff volume for extreme events for the 1 in 100-year return period *plus* climate change. In aiming to replicate 'greenfield' runoff rates for extreme events, this will help to ensure that flood risk is not increased by the development proposals.

This surface water drainage strategy will comply with the Statutory National Standards for Sustainable Drainage Systems (SuDS) for Wales including the Standard Principles and itemised **Standards 1 to 6** as outlined in sections **3.1.1 – 3.1.6**.

In accordance with best practice and the Welsh Government Publication titled: "Statutory standards for sustainable drainage (SuDS) in Wales – designing, constructing, operating and maintaining surface water drainage" systems: G2:23 and G2:24. Runoff rate for previously developed sites should replicate the predeveloped site (greenfield) or at least a 30% betterment should be considered as an absolute minimum from the runoff rate from the previously developed site contributing catchment area).

3 PROPOSED SURFACE WATER DRAINAGE SYSTEMS

As already mentioned, the proposal is for the extension of an existing commercial unit on the currently disused *brownfield* site. For the purposes of the surface water drainage strategy design the site is considered to be *brownfield* or *previously developed*.

The drainage strategy only covers the hydraulic design criteria of the surface water drainage network.

The proposed SuDS drainage solution is designed to mimic the characteristics of the site's current arrangement as much as possible. The proposal includes two vegetated (dry) swales to be constructed along the perimeters of the south and west extent of the site boundary; thus utilising the existing ditches and excellent percolation conditions provided by the underlying substrate.

The swales will comprise of a shallow depression in the ground which surface water runoff will be discharged to via underdrains and perforated surface water drainage pipes, and vegetated with a variety of plants, shrubs and grass. The swales will be connected (*conveyance*) and fed via perforated drainage pipes (underdrains) to maximise the efficiency and capacity of the system, and also to minimise the chances of the system surcharging. Anecdotal evidence indicates that many developments in this area have adopted a similar approach and design to the drainage and management of surface water, with success.

For the purposes of this report these SuDS features are referred to as *Bioretention Swales (1 and 2)*.

Furthermore, there will be some porous parking bays in the western extent of the site.

Refer to Drawing **13892_SAB_500_01** in **Appendix D** for the proposed surface water drainage layout illustrating how surface water is collected and conveyed towards their discharge location.

The Bioretention Swales will have perforated drainage pipes to enable conveyance of surface water more evenly and thus reducing the risk of the system surcharging. From here, flows will percolate into the highly permeable underlying substrate via infiltration, as per the existing scenario. Although the existing site is considered to be *brownfield*, it is considered to be 100% permeable and thus replicates the pre-existing or historical greenfield conditions.

Taking a precautionary design approach, the bioretention swales have been designed for the total proposed impermeable area of 1478m² and the hydraulic design calculations (**Appendix E**) show that the system has the capacity for the 1 in 100-year event plus 40% climate change (CC). The bioretention swales require a maximum depth of 0.1m deep. As they are existing features the depth varies between 0.5 – 1m deep which provides a significant freeboard above the water level for the extreme design storm event.

Refer to the **Hydraulic Design Calculations, Appendix E**.

Proposed / Considered SuDS:

Swales

Swales are shallow, flat bottomed, vegetated open channels designed to convey, treat and often attenuate surface water runoff. When incorporated into site design, they can enhance the natural landscape and provide aesthetic and biodiversity benefits.

A dry swale is a vegetated conveyance channel, designed to include a filter bed of prepared soil that overlays an underdrain system. This underdrain provides additional treatment and conveyance capacity beneath the base of the swale, and prevents waterlogging.

The enhanced drainage beneath the swale can provide increased flow and storage capacity, extra interception performance, a reduced risk of localised ponding and marshy areas developing where gradients are flat, and improved conditions for infiltration (where ground conditions allow). The underdrain allows multiple swales to be connected.

Dry swales can be vegetated with a variety of plants, flowers and grasses to provide amenity spaces.

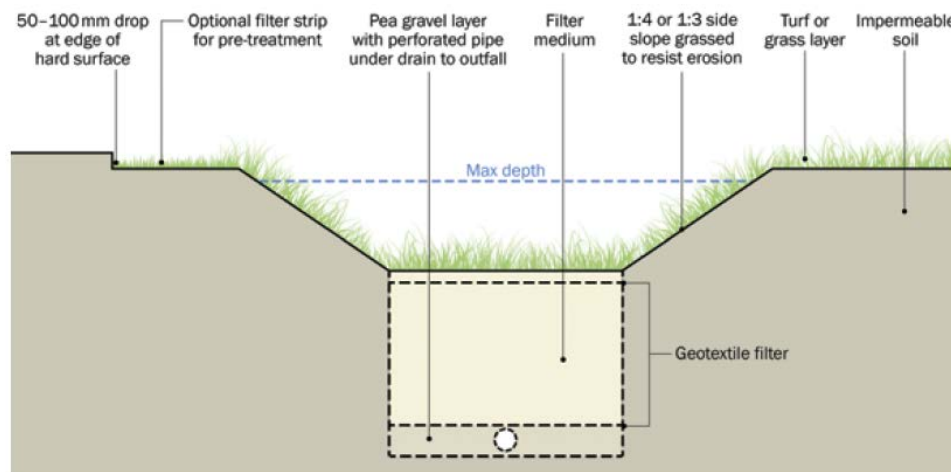


Figure 2 – CIRIA C753 Figure 17.2 – Typical dry swale

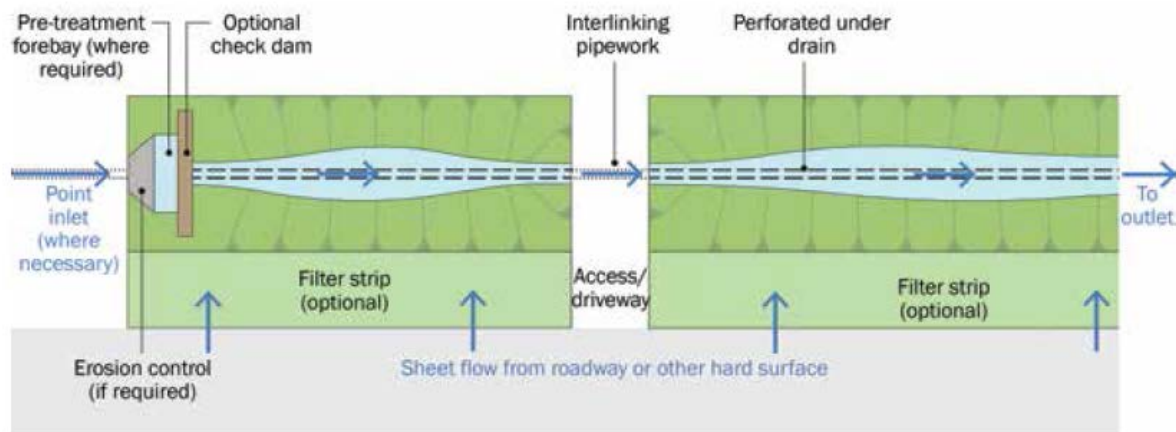


Figure 3 – CIRIA C753 Figure 17.5 – Typical plan view of a swale

Incorporated into design

Porous Car Parking Spaces

Porous asphalt can be used as an independent surface or to provide a stronger base to concrete block permeable pavements where it is to be trafficked frequently by trucks. Porous asphalt surfacing reduces traffic noise. **Figure 4** below reflects a system where all the rainfall passes into the substructure (where it may be stored temporarily) from where it infiltrates into the soil beneath. Normally, there will be no discharge from the system to a sewer or watercourse. Although porous asphalt will not be used in this case, **CellWeb** will be used for some of the parking spaces in the eastern site extent; to be infilled with granular stone / gravel thus providing a permeable SuDS solution including surface water quality treatment.

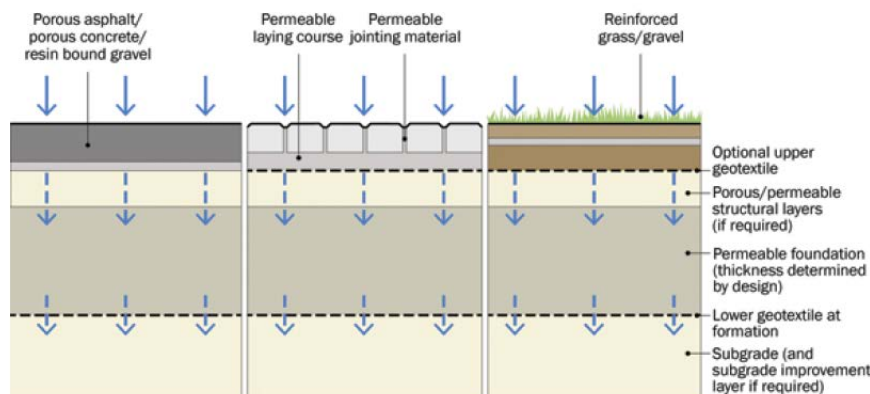


Figure 4 – CIRIA C753 Figure 20.12 – Pervious pavement system types: Type A – total infiltration

Incorporated into design

Trees

Trees can be planted within a range of infiltration SuDS components (e.g. bioretention systems, detention basins, swales) to improve their performance, or they can be used as standalone features within soil-filled tree pits, tree planters or structural soils.

Tree pits and planters can be designed to collect and attenuate runoff by providing additional storage within the underlying structure. The soils around trees can also be used to filter out pollutants from runoff directly.

Discounted – Due to potential for sufficient and alternative SuDS components and also spatial constraints

Soakaways

Soakaways are excavations that are filled with a void – forming material that allows the temporary storage of water before it soaks into the ground. Historically, small soakaways draining runoff from a single property were either filled with rubble or lined with brickwork and were sited below gardens and drives with no formal provision for access and inspection. Many small soakaways are now constructed with geocellular units available from builders' merchants pre-wrapped in geotextile. The geocellular units provide good overall storage capacity compared to rubble fill, and they allow the size of the structure required for any application to be minimised.

Discounted – Due to potential for sufficient bioretention areas

Water Butts

Within the site curtilage the simple water conservation / rainwater harvesting technique could be provided by off the shelf water butts which will collect some of the roof water runoff from the unit (min size 0.5m³), and when full the overflow arrangement will convey excess water away from the building and over the planted basins.

Scope to be included yet not essential

3.1.1 **S1: SuDS hierarchy of surface water discharge locations**

The following receptors have been considered for surface water runoff on site, in order of SuDS preference. The aim of SuDS Standards is to ensure that the most effective drainage scheme is delivered with the most preferred levels of surface water destination, where the design can move to the next means of discharge only under exception criteria.

1. Surface Water collection for reuse.
2. Discharge by infiltration into ground
3. Discharge into open surface water body
4. Discharge into surface water sewer, highway drain, or other drainage system
5. Discharge into combined sewer.

Priority Level 1 - Surface water collected for reuse:

Rainwater harvesting has not been used as there is no foreseeable demand for non-potable water within the development proposals. There is no foreseeable need to harvest water as DCWW has not identified any potential stresses on the mains water supply. The use of rainwater harvesting is not a cost-effective / viable option for managing surface water runoff in comparison to the water supply benefit for this development.

No solution, move to next Priority Level

Priority Level 2 – Discharge via infiltration:

Soakaway tests were undertaken in two trial pits around the site; strategically located where the SuDS features were proposed. The trial pit excavations confirmed that the underlying soils comprised of hardcore (engineered) topsoil and then sand.

The soakaway tests were undertaken in accordance with BRE 365. Infiltration on site has been found to be a viable option due to the very high infiltration rates observed. After a 10-minute period trial pits 1-2 had completely drained during each test.

Refer to **Table 2** – Summary of infiltration rates and the **Soakaway Test Report** in **Appendix C**.

Priority Level 2 solution, priority levels 3-5 are less desirable so are therefore not explored or required.

3.1.2 **S2**: Surface Water Runoff Hydraulic Control

The proposed SuDS drainage system will maintain the characteristics of the sites current surface water drainage arrangement as much as possible which reflects the original sites greenfield conditions.

The proposed SuDS drainage system has been designed to accommodate the 1 in 100-year event plus 40% CC.

Urban creep has not been incorporated into hydraulic design calculations as the proposed development has been maximised within the site curtilage.

Interception

Conveyance swales and dry vegetated swales deliver Interception because there is usually no runoff from them for the majority of small rainfall events. The water soaks into the surface vegetated soil layers and into the underlying soils or other media, and is removed by evapotranspiration and infiltration. The extent of the volumetric reduction in runoff will depend on the infiltration rate of the surrounding soil, the capacity of any underlying filter media, the catchment area, the area of the swale, the type of vegetation and the climate.

The proposed surface water drainage system will deliver interception via two key processes;

- Infiltration
- Evapotranspiration using temporary shallow ponding or storage within the soil or upper aggregate layers.

Where SuDS are designed to infiltrate more than 5mm from the contributing catchment for all events, then Interception will be effectively delivered.

A review of Table 24.6 of CIRIA C753 The SuDS Manual confirms that bioretention swales are considered a viable interception method that can be assumed to be compliant for zero runoff for the first 5mm rainfall for 80% of events during the summer and 50% in winter.

For instance; Any filter strip / swale that is unlined, has a gradient less than 1 in 100 and has an infiltration capability greater than 1×10^{-6} m/s can be assumed to comply with Interception for a contributing area up to 25 times the area, or a larger area where infiltration capacities and design characteristics allow.

Flows

As already mentioned, the site is considered as *brownfield* or *previously developed* land despite its currently prevailing disused state.

Swales can help reduce flow rates from a site by facilitating infiltration and / or by providing attenuation storage.

The proposed SuDS drainage system is designed to revert back to the pre-developed or greenfield characteristics of the sites surface water drainage arrangement whilst also reducing the rate and volume of surface water runoff with the incorporation of SuDS features including bioretention swales and porous parking bays.

Attenuation Storage

The surface water drainage system is designed for the 1 in 100-year plus 40% climate change (CC) event. Reference to the hydraulic design calculations included in **Appendix E** illustrate that the design is sufficient for the design event (1 in 100-year plus 40% CC).

The Bioretention Swales will provide surface water attenuation storage for the 1 in 100-year event plus 40% CC. Surface water will be conveyed via perforated underdrains to reduce the risk of the system surcharging i.e. due to blockages.

Reference to the hydraulic calculations indicate that the bioretention swales will comfortably accommodate the design event and need only have a maximum depth of 100mm. Refer to the **Hydraulic Design Calculations (Appendix E)** which shows the depths to accommodate the *h_{max}* (maximum depth of water) values for the critical storm durations. The depth (depression) also vastly helps facilitate populate the swale with plants and vegetation.

It should be noted that the porous parking spaces will not (formally) provide any attenuation storage. However, they do provide water quality treatment and ensure the scheme has been designed with the recognition of *SuDS Management Train* approach.

Exceedance Event

As already mentioned, the surface water drainage system has been designed for the 1 in 100-year plus 40% CC event. In the highly unlikely event of the system surcharging or becoming over-capacitated during storm events in excess of the design storm event; provision has been made for 'controlled' and shallow surface water flooding around the site. **Refer to the Flow Exceedance Plan, Appendix D.**

Hydraulic Control

An additional factor of safety of 1.5 has been incorporated into the calculations. The hydraulic design calculations indicate that the system can sufficiently accommodate the 1 in 100-year event plus 40% CC. Where the *h_{max}* values are negative; this is due to the infiltration rate being greater than the inflow rate into the system.

The bioretention swales has been calculated and designed using CIRIA C753 Equation 25.4 which determines the maximum depth of water for 3D infiltration systems.

The site is not currently served by any formal surface water drainage system. The proposed SuDS system will therefore provide betterment over the current unfettered arrangement.

Refer to Hydraulic Design Calculations, Appendix E.

3.1.3 **S3**: Water Quality

The existing sites drainage system did not provide any water quality improvement. For 'commercial yard / delivery areas' and 'other roof' areas pollutant levels are expected to be medium and low as illustrated in **Table 2** below. These indices are in accordance with the CIRIA C753 publication 'The SuDS Manual' (2015).

Table 2 – Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Other roofs (typically commercial/industrial roofs)	Low	0.5	0.4	0.4

From a review of **Table 3** below, it can be concluded that the inclusion of the relevant SuDS features will provide sufficient treatment.

Table 3 – SuDS Mitigation Indices

Type of SuDS	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Bioretention Swale	0.8	0.8	0.8
Infilled CellWeb	0.7	0.6	0.7

The proposed design will ensure that surface water runoff will pass through a bioretention swale system. This will separate the smaller particles and chemicals from the surface water discharge as it filters through.

Planted dry swales can provide effective water treatment such as the removal of fine sediments and associated pollutants which are trapped within the surface vegetation and groundcover. As surface water passes through the filter medium beneath further removal of fine particles and contaminants takes place. A wide range of water quality improvements can be achieved by using vegetated surfaces as part of SuDS.

Grass is particularly effective at dealing with sediments and pollution where sheet flow is used, and planted components that dry out between each rainfall event are an efficient means of promoting bioremediation. Therefore, the extensive soft landscaped areas across the site provide additional water quality treatment.

As outlined by CIRIA C753 The SuDS Manual, conveyance and dry swales provide the following treatment to surface water runoff:

- Coarse to medium sediments and associated pollutants (such as nutrients, free oils / grease and metals) can be removed by filtration through surface vegetation and groundcover.
- Fine particulates and associated contaminants can be removed by infiltration through the underlying soil and / or filter medium layers. This provides treatment by filtration, dissolved pollutant removal by sorption of pollutants to the filter medium, and some biological uptake by vegetation and subsoil biota.
- Organic contaminants can be removed through photolysis and volatilisation.

The porous parking bays will provide additional surface water quality treatment.

The proposed SuDS scheme will be sufficient in removing contaminants and pollutants for the proposed site and will only have a positive impact on the receiving water quality when compared to the existing scenario.

3.1.4 S4: Amenity

The use of bioretention swales will provide an attractive, high quality landscaped strip that will be used to serve the site. The SuDS components will effectively drain surface water as close to the source as possible. The use of these SuDS components also provides significant aesthetic benefits that surround the perimeters of the site for visitors and occupants alike.

Bioretention areas can deliver water-efficient landscaping and are also potentially beneficial to the local microclimate by cooling air through evapotranspiration. They also provide an important water quality and cleansing function.

Exposure to green spaces and features can help to promote good mental health which is of particularly relevance in industrial / commercial settings.

Surface water management systems that integrate surface water features can be more readily modified than underground systems, and therefore are more adaptable providing greater resilience to climate change. The scheme will be mostly above ground SuDS features. Benefits of blue / green features also include cooling the ambient air which reduces the urban heat island effect.

The porous parking bays are multifunctional in that they provide parking space and surface water quality treatment.

Within the site constraints the proposed solution looks to maximise amenity benefits.

3.1.5. S5: Biodiversity

The use of bioretention swales can help to provide a new quality habitat for wildlife, having a positive contribution to biodiversity in the area. The use of planting native species can support local biodiversity by providing habitat and food for invertebrates and birds. Furthermore, ephemeral water bodies can be a specific requirement for the life cycle of some plants and animals. The use of planting native species can support local biodiversity. Plant species should be selected to suit the existing landscape characteristics of the site and / or meet its visual and design intent.

Swales can include a variety of planting (including wildflower grass seed mixes in areas where the grass length is not required to be regularly maintained) that will help make a positive contribution to urban biodiversity – providing habitat and food for insects, invertebrates and birds.

Native plant species should normally be used in providing a dense and durable cover of vegetation that creates appropriate habitat for indigenous species. A Landscape and Ecology Architects Plan has been developed by Catherine Etchell Associates; giving recommended plant species suitable to the environment which can be incorporated into the bioretention swales.

Refer to **Appendix F – Landscape and Ecology Architects Plan and SuDS Planting Schedule**.

3.1.6. S6: Operation and Maintenance Requirements

To ensure SuDS components continue to operate reliably, regular inspection and maintenance should be carried out. In most cases, appropriate information should be provided by the relevant manufacturer on what has been installed, how it works, when to inspect it and whether maintenance will be required. CIRIA C753 The SuDS Manual also provides information on the operation and maintenance requirements for various SuDS components.

Conventional surface water drainage features such as gullies, channels, silt traps and manholes should be inspected as an absolute minimum annually, and where practicable after intense storm events, with silt removal. Maintenance of the guttering and RWP's is key to sufficiently collecting the surface water.

The bioretention swales will require regular maintenance to ensure continuing operation to design performance standards. Maintenance of swales is relatively straightforward for landscape contractors, and typically there should only be a small amount of extra work (if any) required for a swale over and above what is necessary for standard public open space.

The major maintenance requirement for dry swales is mowing. Mowing should ideally retain grass lengths of 75 – 150mm across the main treatment surface, to assist in filtering pollutants and retaining sediments and to reduce the risk of flattening during runoff events. However, longer vegetation lengths, where appropriate, are not considered to pose a significant risk to functionality.

Figure 5, 6 and 7 below / overleaf shows CIRIA C753 The SuDS Manuals maintenance requirements for the SuDS components relevant to the proposals for this site. It is recommended that the persons responsible for the maintenance of the SuDS drainage systems follows the requirements below, unless specific maintenance information is provided by the manufacturer or installer during or after construction.

Furthermore, a standalone **Management and Maintenance Plan** with maintenance costs is included as **Appendix G**. The maintenance contractor will be Greenwise Construction.

TABLE 17.1 Operation and maintenance requirements for swales		
Maintenance schedule	Required action	Typical frequency
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 infiltration 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
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseed	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Figure 5: CIRIA C753 Table 17.1 – Operation and maintenance requirements for swales

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

Figure 6: CIRIA C753 Table 18.3 – Operation and maintenance requirements for bioretention systems

Maintenance schedule	Required action	Typical frequency
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 or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
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 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or 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 infiltration 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 – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Figure 7: CIRIA C753 Table 20.15 – Operation and maintenance requirements for pervious pavements

4 CONCLUSIONS

The proposal is for the extension of an existing commercial unit (Unit 21) with associated parking and service yard within the 0.16ha curtilage of the site.

The site is considered to be *brownfield* and is not currently served by any formal surface water drainage. Instead, surface water drainage and treatment is unfettered.

The proposed site surface water drainage design incorporates natural SuDS solutions comprising of bioretention swales and some porous car parking spaces.

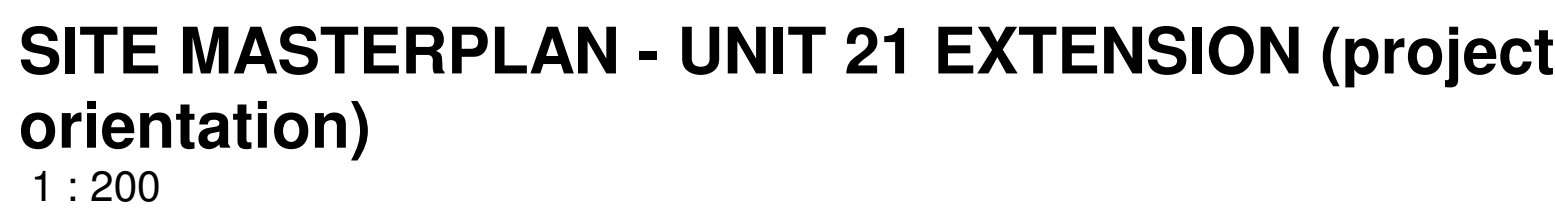
100% of the surface water run-off on-site will discharge back into the underlying substrate. This provides a betterment in comparison to the existing unfettered surface water discharge. The SuDS system has been designed based on the 1 in 100-year event + 40% climate change allowance.

The surface water drainage system will provide sufficient storage for the 1 in 100-year plus 40% climate change event. Attenuation will be provided by the bioretention swales. However, and as illustrated within the hydraulic design calculations, the surface water system has more than enough capacity for the design event and is not shown to 'fill' or surcharge.

The scheme seeks to be cost effective, easily maintainable, improve amenity and biodiversity where possible and improve surface water runoff quality from the area.

It is concluded that the drainage strategy as outlined by this DSR complies with the Statutory National Standards for Sustainable Drainage Systems (SuDS) for Wales including the Standard Principles and itemised **Standards 1 to 6** as required by the SuDS Scheme Application for SuDS Approving Body (SAB) Approval – Wales.

APPENDIX A: Site Location & Proposed Development Plans





- [illegible]

STATUS	PURPOSE OF ISSUE
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PROJECT

Mardon Park
Baglan Energy Park,
South Wales

TITLE
UNIT 21 EXTENSION

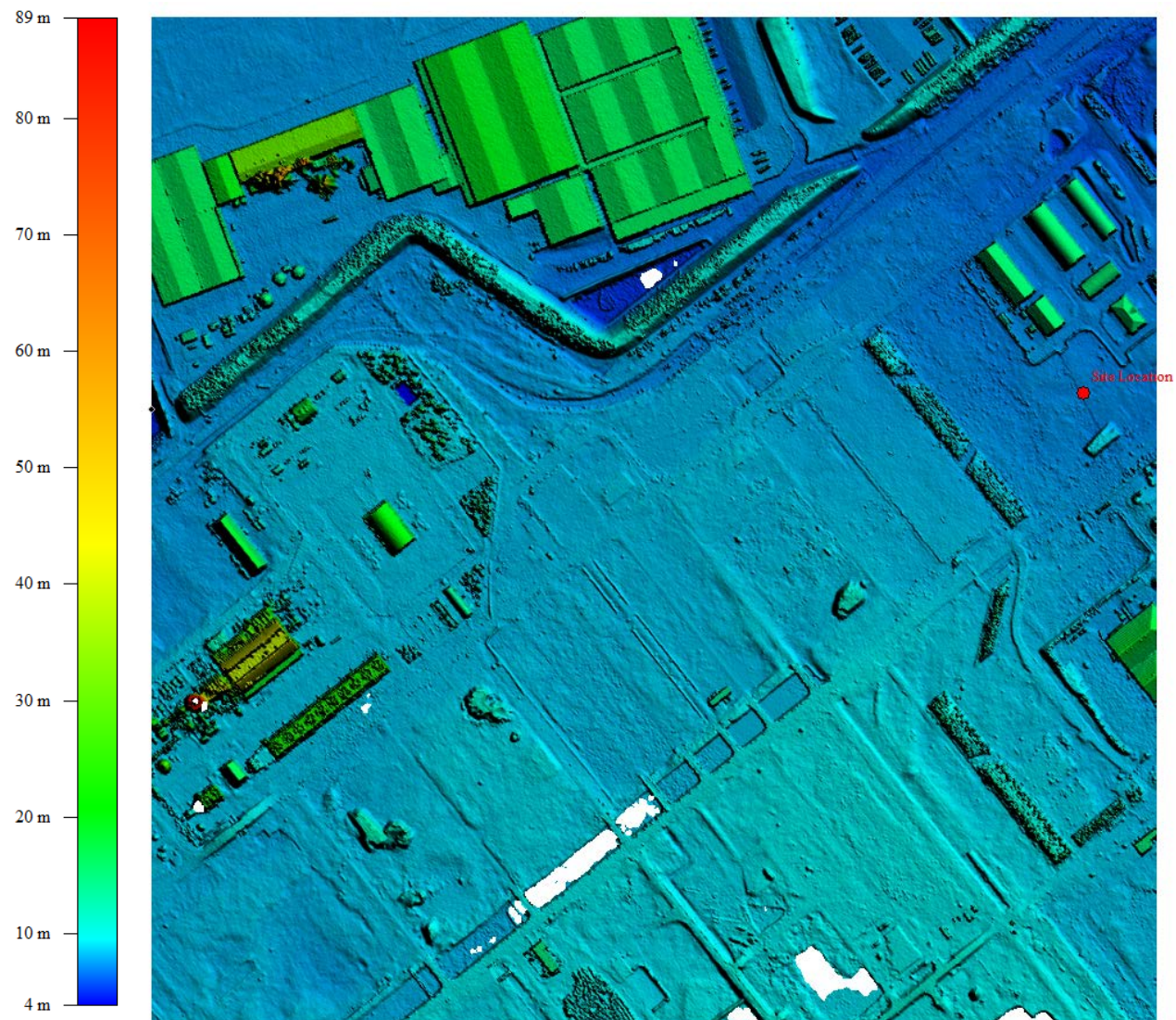
CLIENT

GBV Properties Ltd

DRAWN BY Author	CHECKED BY Checker	DATE 09/23/21
SCALE (@ A1) As indicated	PROJECT NUMBER Project Number	
DRAWING NUMBER A1 - A601		REV

APPENDIX B: Topographical Data





LiDAR Extract – Digital Terrain Model (DTM) to metres above ordnance datum (m AOD)

APPENDIX C: Soakaway Test Report

Infiltration Test For:

Mardon Park Unit 21 Extension, Baglan

SA12 7AX

Prepared for:

**GreenWise
Construction**

13892 - 1

November 2021



Vale Consultancy
CONSULTING CIVIL & STRUCTURAL ENGINEERS

Document Control

Project	Mardon Park, Baglan
Client	GreenWise Construction
Vale Consultancy Ref:	13892 - 1

Document Checking:

Prepared By: Richard Peskett

Signed:



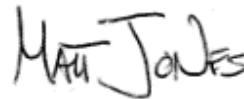
Checked By: Leighton Roberts

Signed:



Verified By: Matt Jones

Signed:



Issue	Date	Status
01	November 2021	First issue
02		
03		

1 Contents

1	Introduction	3
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1.2	Site Investigations	3
2	Site findings	3
2.1	Trial pit soil conditions	3
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1 Introduction

1.1 Brief

Vale Consultancy has been instructed by GreenWise Construction (*The Client*) to undertake soil infiltration tests to the BRE 365 digest standard at the Mardon Park site at **273949E, 192593N**.

Two infiltration tests have been proposed around the site to determine the local geology and permeation rates on site. These tests will be approximately 0.5m³ in size and tested a maximum of 3 times or as many as possible in the timeframe allowed.

Refer to **Appendix A** – Site Trial Pits.

1.2 Site Investigations

The site currently comprises undeveloped land immediately adjacent to Unit 21, Mardon Park, Baglan, SA12 7AX. The proposal is for extension of the existing commercial unit with a building footprint of approximately 600m² or 0.06ha.

The two trial pits are located in the area where SuDS features are proposed illustrated in **Appendix A**. The tests were performed on the 2nd September 2021 by Vale Consultants. At the time of testing the weather was sunny and dry - no rain was present at any point from the beginning to the end of the testing process.

Refer to **Appendix C** – Site photographs.

2 Site findings

The following tests were performed to the BRE 365 Digest Standard and to the best of the ability of those involved, subject to site constraints and weather conditions.

2.1 Trial pit soil conditions

Two pits were dug to a depth of approximately 0.8m without issue and no groundwater was found in any of the pits. The trial pits revealed that the site is underlain by hardcore topsoil and sandy strata. The findings encountered were logged at the following approximate depths:

Pit 1

Topsoil: 0 - 0.1m - Topsoil
Superficial soils: 0.1 - 0.225m - Hardcore
Superficial soils: 0.225m – 0.82m - Sand
Bedrock: Not encountered

Pit 2

Topsoil: 0 - 0.1m - Topsoil
Superficial soils: 0.1 - 0.25m - Hardcore
Superficial soils: 0.25m – 0.73m - Sand
Bedrock: Not encountered

Cranfield University Soilscales online mapping indicates freely draining sandy soils at the location of the site.

Upon reviewing the British Geological Survey (BGS) records superficial deposits are identified as Blown Sand at the site. Bedrock is listed as South Wales Middle Coal Measures Formation comprising mudstone, siltstone and sandstone. BGS records also identify extensive Landscaped Ground of variable composition across the site. Landscaped Ground is an area where the land surface (natural or artificial) has been extensively remodelled, but where it is impracticable or impossible to delineate separate zones of made ground, worked ground, or disturbed ground.

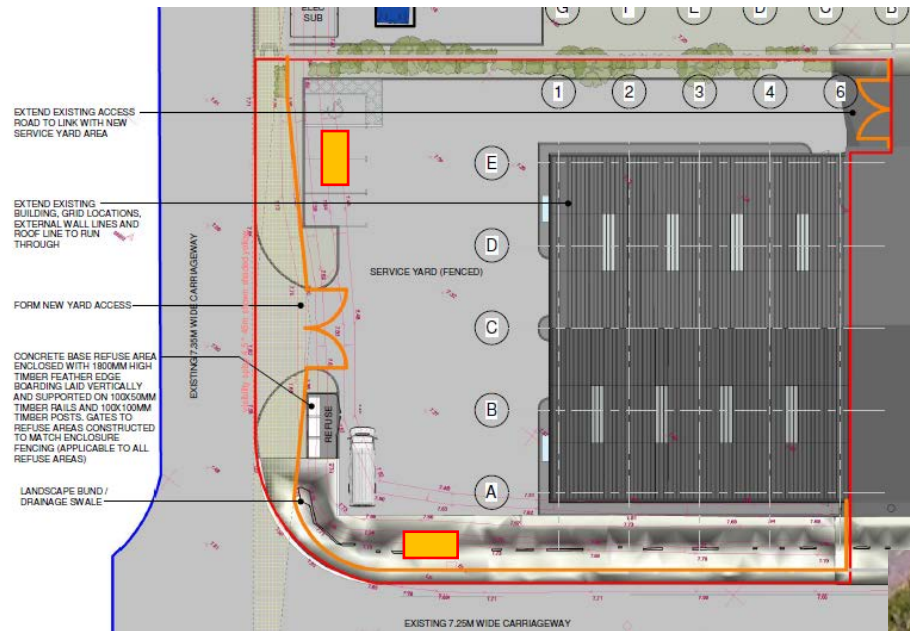
2.2 Test results

The following tests were performed 3 times at the two trial pits which both drained in a very short period of time.

3.0 Conclusions

Infiltration on site has been found to be a viable option due to the very high infiltration rates observed. For every single test the trial pits had completely drained within 10 minutes. Refer to **Appendix B – Infiltration test results**.

APPENDIX A: Site Trial Pits



 Soakaway Test Pit Location



Figure 1 - Trial pit locations

Trial Pit	Easting	Northing
1	273953	192571
2	273933	192593

Figure 2 - GPS co-ordinates of trial pit locations

Trial Pit	Infiltration Rate
1	2.78×10^{-4}
2	2.78×10^{-4}

Figure 3 – Summary of Infiltration Rates

APPENDIX B: Infiltration Test Results

Trial Pit 1		Date:	02/09/2021		
		Performed by:			
Dimensions	(m)	Weather:	Dry and overcast		
Width	0.5	Topsoil:	Hardcore (engineered)		
Length	1	Superficial soil:	Sand		
Effective storage depth	0.5	Comments:			
Test No.	Time (min)	Depth (mm)			
1	0	110			
	1	95	Vp75-25 =	0.05	m ³
	2	81	As50 =	0.5	L m ²
	3	71	tp75-25 =	233	s
	4	59			
	5	44	f =	2.78 x 10 ⁻⁴	m/s
	6	28			
	7	16			
	8	2			
	9	-			
	10	-			

Trial Pit 1		Date:	02/09/2021
		Performed by:	
Dimensions	(m)	Weather:	Dry and overcast
Width	0.5	Topsoil:	Hardcore (engineered)
Length	1	Superficial soil:	Sand
Effective storage depth	0.11	Comments:	
Test No.	Time (min)	Depth (mm)	
2	0	110	
	1	96	Vp75-25 = 0.05 m ³
	2	83	As50 = 0.5 L m ²
	3	72	tp75-25 = 237 s
	4	59	
	5	46	f = 2.78 x 10 ⁻⁴ m/s
	6	31	
	7	19	
	8	6	
	9	-	
	10	-	

Trial Pit 1		Date:	02/09/2021
		Performed by:	Matt Jones
Dimensions	(m)	Weather:	Dry and overcast
Width	0.5	Topsoil:	Hardcore (engineered)
Length	1	Superficial soil:	Sand
Effective storage depth	0.11	Comments:	
Test No.	Time (min)	Depth (mm)	
3	0	110	
	1	96	Vp75-25 = 0.05 m ³
	2	83	As50 = 0.5 L m ²
	3	76	tp75-25 = 244 s
	4	67	
	5	58	f = 2.78 x 10 ⁻⁴ m/s
	6	46	
	7	31	
	8	20	
	9	11	
	10	3	
	11	-	
	12	-	
	13	-	
	14	-	
	15	-	

Trial Pit 2		Date:	02/09/2021	
		Performed by:		
Dimensions	(m)	Weather:	Dry and overcast	
Width	0.5	Topsoil:	Hardcore (engineered)	
Length	1	Superficial soil:	Sand	
Effective storage depth	0.13	Comments:		
Test No.	Time (min)	Depth (mm)		
1	0	135		
	1	125		
	2	111		
	3	93		
	4	73		
	5	52		
	6	33		
	7	15		
	8	-		
	9	-		
	10	-		
			Vp75-25 =	0.06 m ³
			As50 =	0.5 L m ²
			tp75-25 =	242 s
			f =	2.78 x 10 ⁻⁴ m/s

Trial Pit 2		Date:	02/09/2021
		Performed by:	
Dimensions	(m)	Weather:	Dry and overcast
Width	0.5	Topsoil:	Hardcore (engineered)
Length	1	Superficial soil:	Sand
Effective storage depth	0.13	Comments:	
Test No.	Time (min)	Depth (mm)	
2	0	135	$Vp75-25 = 0.06 \text{ m}^3$ $As50 = 0.5 \text{ L m}^2$ $tp75-25 = 243 \text{ s}$ $f = 2.78 \times 10^{-4} \text{ m/s}$
	1	124	
	2	108	
	3	95	
	4	73	
	5	54	
	6	33	
	7	14	
	8	3	
	9	-	
	10	-	

Trial Pit 2		Date:	02/09/2021
		Performed by:	
Dimensions	(m)	Weather:	Dry and overcast
Width	0.5	Topsoil:	Hardcore (engineered)
Length	1	Superficial soil:	Sand
Effective storage depth	0.13	Comments:	
Test No.	Time (min)	Depth (mm)	
3	0	135	$Vp75-25 = 0.06 \text{ m}^3$ $As50 = 0.5 \text{ L m}^2$ $tp75-25 = 248 \text{ s}$ $f = 2.78 \times 10^{-4} \text{ m/s}$
	1	128	
	2	112	
	3	96	
	4	75	
	5	55	
	6	38	
	7	21	
	8	7	
	9	-	
	10	-	

APPENDIX C: Site Photos

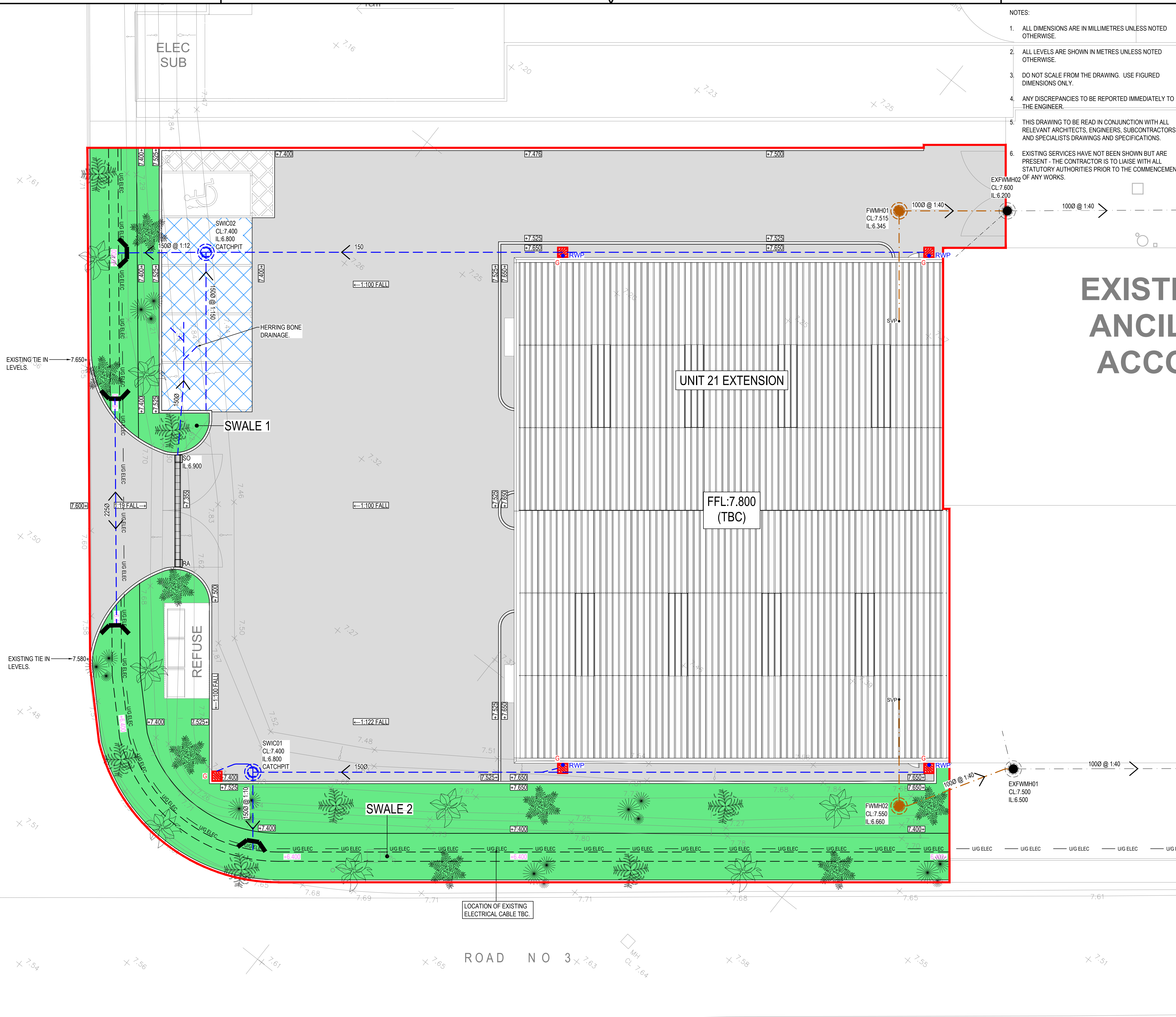
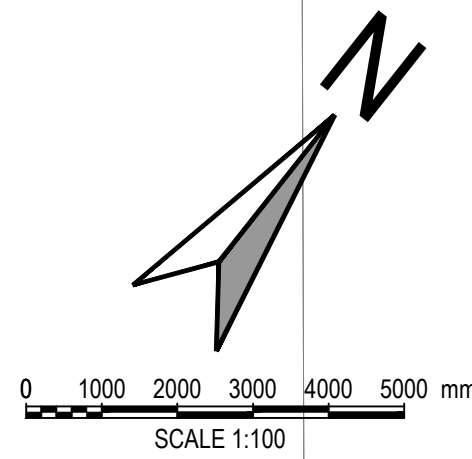
Figure 1 – Trial Pit



Figure 2 – Trial Pit Drained. Good illustration of the sandy substrate



APPENDIX D: Proposed Surface Water Drainage



- NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
 2. ALL LEVELS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
 3. DO NOT SCALE FROM THE DRAWING. USE FIGURED DIMENSIONS ONLY.
 4. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
 5. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
 6. EXISTING SERVICES HAVE NOT BEEN SHOWN BUT ARE PRESENT - THE CONTRACTOR IS TO LIAISE WITH ALL STATUTORY AUTHORITIES PRIOR TO THE COMMENCEMENT OF ANY WORKS.

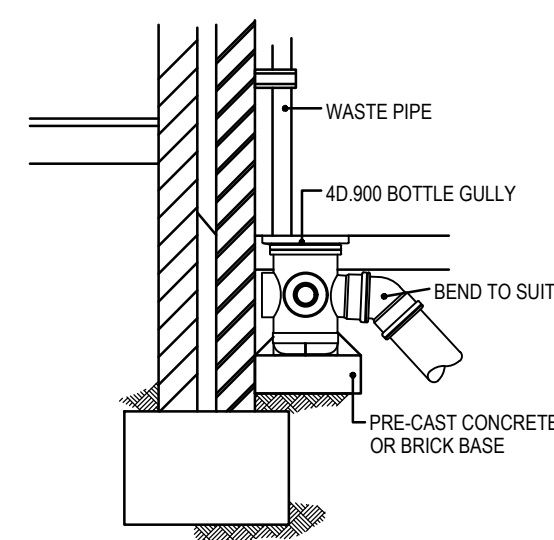
- GENERAL NOTES:
1. THE DEVELOPER MUST SELF VET AND CERTIFY THAT THE DESIGN CRITERIA, MATERIAL STANDARDS AND WORKMANSHIP SPECIFICATIONS FOR THE PROPOSED ADOPTABLE SEWERS ARE IN ACCORDANCE WITH THOSE SET OUT IN "SEWERS FOR ADOPTION" 7TH EDITION, THE WELSH MINISTERS STANDARDS AND THE REQUIREMENTS OF DCWW AS THE STATUTORY SEWERAGE UNDERTAKER.
 2. SUBJECT TO A SECTION 104 ADOPTION AGREEMENT BEING COMPLETE, A SECTION 106 APPLICATION TO CONNECT MUST BE MADE TO DCWW. THE DEVELOPER SHALL GIVE 21 DAYS NOTICE PRIOR TO CONNECTION. THE WORKS MAY ONLY BE UNDERTAKEN BY A SIPS REGISTERED CONTRACTOR.
 3. **HAZARDOUS WASTE**:- CONTRACTOR TO PROVIDE EVIDENCE OF THE PROPOSED REMOVAL OF THE EXISTING PITCH FIBRE DRAINAGE RUN.
 4. CONTRACTOR TO CONFIRM PRIOR TO THE ABANDONMENT OF SEWER THAT NO EXISTING CONNECTION UPSTREAM EXIST. (TO ENSURE NO EXISTING USERS ARE CUT OFF.)
 5. COMPLIANCE WITH HEALTH & SAFETY MATTERS ON ANY TRENCH/MANHOLE IS OBLIGATORY AND A PERMIT TO ENTER A CONFIRMED SPACE IS REQUIRED WHEN CONNECTING SITE DRAINAGE TO THE EXISTING PUBLIC SEWERAGE SYSTEM. A PERMIT TO ENTER A CONFINED SPACE WILL BE OBTAINED FROM DWR CYMRU/WELSH WATER PRIOR TO THE WORKS COMMENCING ON ANY PUBLIC SEWERAGE SYSTEM.
 6. MH COVER & FRAMES SHALL BE DUCTILE IRON WITH A MINIMUM SQUARE OPENING OF 675x675mm. COVERS SHALL BE DOUBLE TRIANGLE FOR 675mm SQUARE OPENINGS AND BE PROVIDED WITH LOOSE BOLTED CONNECTIONS. FRAME DEPTH SHALL BE 150mm.
 7. ALL IRONWORK TO BE KITE MARKED BY BSI OR CERTIFIED BY EQUAL INSPECTION AUTHORITY.
 8. PLANTING CLOSE TO ADOPTABLE DRAINAGE RUNS INDICATED IS TO ACCORD WITH THE SPECIFICATIONS IN SFA 7th EDITION SECTION C3.1.13 TO COMPLY WITH THE REQUIREMENTS OF SFA 7th & THE WELSH MINISTERS STANDARDS.

DRAINAGE LEGEND

- 1500 @ 1:150 PROPOSED SURFACE WATER DRAINAGE WITH PIPE SIZE AND GRADIENT
- 1000 @ 1:40 PROPOSED FOUL WATER DRAINAGE WITH PIPE SIZE AND GRADIENT
- RWP PROPOSED RAINWATER PIPE
- SO RA PROPOSED ACO MD100 DRAINAGE CHANNEL
- CONCRETE FILLED SANDBAG HEADWALL
- OSMA 40900 BOTTLE GULLY, BEND TO SUIT, INSTALLED ON A PRE-CAST CONCRETE OR BRICK BASE.
- IMPERMEABLE ASPHALT
- GRAVEL SURFACE
- SWALE DITCH
- GRASS / SOFT LANDSCAPING
- +11.300 PROPOSED SPOT LEVEL
- +8.92 EXISTING SPOT LEVEL
- +10.280 DRAINAGE FORMATION LEVEL
- SAB BOUNDARY

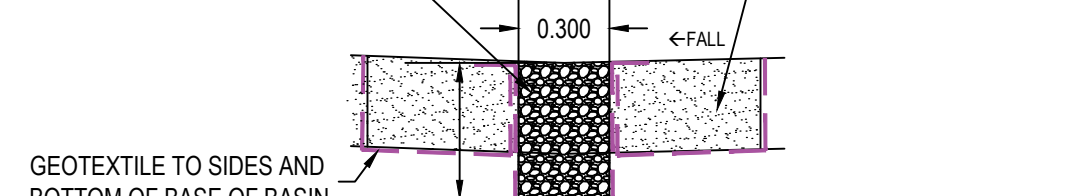
APPROVAL

01	SU	MJ	MJ	23.11.21	ISSUED FOR SAB APPROVAL.
rev.	drawn	chkd	approved	date	description
Client					
GBV PROPERTIES					
Project					
MARDON PARK UNIT 21 EXTENSION					
Title					
SAB DRAINAGE LAYOUT					
ValeConsultancy					
CONSULTING CIVIL & STRUCTURAL ENGINEERS					
29 Bocam Park, Old Field Road, Pencoed, Bridgend CF35 5LJ. Phone: 01656 863794 Email: enquiries@vale-consultancy.co.uk					
date	drawn	checked	approved		
23.11.21	SU	MJ	MJ		
scale @ A1			project no.		
1:100			13892		
status	drw. no.				rev.
A	13892_SAB_500				01



SINGLE SIZED STONE TO
LOW FLOW CHANNEL

MIN. 300mm DEEP ROOT
ZONE GROWING MEDIUM



FLEXIBLE JOINT SEALANT

SURFACE OF GRATING TO BE 3mm BELOW FINISH LEVELS

150

CAR PARK CONSTRUCTION

COMPRESSIBLE FILLER 20mm THICK

150 MIN

ACO M150PPD/M100PPD OR SIMILAR APPROVED

CLASS 2 SULPHATE RESISTING ST4 CONCRETE.

- NOTES:
1. DRAINAGE CHANNELS TO BE ACO M150PPD OR SIMILAR APPROVED
 2. FOUNDATION FOR CHANNELS TO BE LAID ON A ROLLED SUB-BASE OF 150mm MINIMUM THICKNESS.
 3. GRATING LOAD CLASSIFICATION TO BE C250/ D400

CONCRETE SACK HEADWALLS AT 5° INCLINE WITH CONCRETE FILLED HESSIAN SANDBAGS 450 X 300 X 150mm ALL IN ACCORDANCE WITH SHW CLASS 5/9. BAGWORK VERTICAL ADJACENT TO PIPES. BAG FILLING TO BE C8/10 CONCRETE SOAKED AND COMPACTED.

STEEL SPIKES TO HOOK OVER TOP OF BAGWORK.

PROPOSED GROUND PROFILE

5°

PIPE TO BE CUT TO PROFILE OF DITCH

EXISTING GROUND PROFILE.

0.200M
MINIMUM

0.600

0.450

GEOTEXTILE
MEMBRANE

1500 PERFORATED
PLASTIC PIPE.

150MM SINGLE SIZE GRANULAR
BED AND SURROUND (WASHED
GRAVEL OR CLINKER 20 - 50MM
GRADE).

ALTERNATIVE MAXIMUM DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE
3M FOR AREAS NOT SUBJECT TO VEHICLE LOADING OR AREAS SUBJECT
TO LIGHT VEHICLE LOADING, NON-ENTRY.
N.T.S.

MORTAR BEDDING AND HAUNCHING TO COVER AND FRAME TO CLAUSE E6.7
 SURFACE COURSE
 BINDER COURSE
 BASE COURSE
 PRECAST CONCRETE SLAB OR IN-SITU CONCRETE SLAB TO SUPPORT COVER AND FRAME
 FLEXIBLE SEAL
 TEMPORARILY CAP SHAFT DURING CONSTRUCTION
 JOINTS BETWEEN BASE AND SHAFT AND BETWEEN SHAFT COMPONENTS TO BE FITTED WITH WATER-TIGHT SEALS
 JOINT TO BE AS CLOSE AS POSSIBLE TO FACE OF CHAMBER TO PERMIT SATISFACTORY JOINT AND SUBSEQUENT MOVEMENT
 LOADING HIGHWAYS - CLASS D400 600mm CLEAR OPENING
 ACCESS OPENING RESTRICTED TO 350mm DIAMETER OR 300x300mm IF DEPTH OF CHAMBER TO INVERT IS $> 1\text{m}$
 CLASS B ENGINEERING BRICKWORK OR PRECAST CONCRETE COVER FRAME SEATING RINGS
 DOT TYPE 1 SUB BASE (THICKNESS VARIES)
 MINIMUM INTERNAL DIMENSIONS 600mm DIAMETER OR 600x600mm
 CONCRETE SURROUND
 BASE UNIT TO HAVE ALL CONNECTIONS WITH SOFFIT LEVELS SET NO LOWER THAN THAT OF THE MAIN PIPE
 GRANULAR BEDDING MATERIAL
 INVERT OF CONNECTING PIPE AT LEAST 50mm ABOVE THAT OF THE MAIN PIPE

PAVEMENT CONSTRUCTION

TOPSOIL

TYPE 1 SUB BASE TO SHW CL

803 AS BACKFILL TO FORMATION LEVEL

FORMATION LEVEL

300

50

100

O.D./2

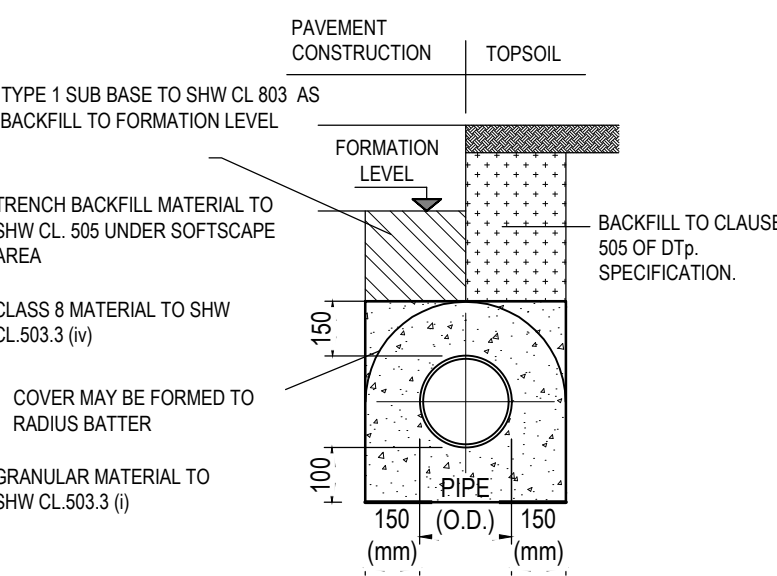
O.D./2

PIPE

150 (O.D.) 150 (mm)

NOTES: SCALE 1:20

1. REFER TO SHW TABLE 5/3 AND SHW TABLE 6/1
2. BEDDING BENEATH AND AT SIDES OF THE PIPE TO BE WELL COMPACTED IN ACCORDANCE WITH CL 505.
3. CONCRETE CRADLES AND ARCHES MAY BE EXTENDED TO THE SIDES OF THE TRENCH.
4. GEOTEXTILES MAY BE USED WHERE DIRECTED OR APPROVED BY THE ENGINEER TO CONTAIN BEDDING MATERIAL IN CERTAIN SOILS EG. RUNNING SAND.
5. IN VERY WET CONDITIONS, WHERE DIRECTED OR APPROVED BY THE ENGINEER, A TEMPORARY LAND DRAIN MAY BE LAID WITHIN THE GRANULAR BED.



NOTES: (TYPE Z ONLY)

6. WHERE PIPES WITH FLEXIBLE JOINTS ARE USED, THE 6. CONCRETE PROTECTION IS TO BE INTERRUPTED OVER ITS FULL CROSS SECTION AT INTERVALS NOT EXCEEDING 5 METRES (OR AS DIRECTED BY THE ENGINEER) BY A SHAPED FORMER OF BITUMEN IMPREGNATED COMPRESSIBLE FILLER. THESE JOINTS SHALL BE PROTECTED WITH JOINTS - SEE DIMENSIONS FOR PIPE BEDDING TABLE FOR THICKNESS OF COMPRESSIBLE FILLER.

7. CONCRETE TO BE GRADE GEN 3. WHERE FLEXIBLE PIPES ARE USED, CARE MUST BE TAKEN

8. TO PREVENT THE PIPES FROM FLOATING.

SCALE 1:10

CROSS SECTION:

- FLOOR CONSTRUCTION
- FFL = VARIES
- WALL
- 1100 MAXIMUM
- 100
- 100
- UNDERSIDE OF FOUNDATION
- FOUNDATION

PLAN VIEW:

- 0.35 - Domestic Gardens & pathways
- 0.9m - Domestic Driveways/Parking areas
- 0.9m - Agricultural land/Public open space
- 1.2m - Highways/Parking Areas
- BACKFILL AS DETAILED FOR PIPES WITH CONCRETE SURROUND
- GROUND LEVEL
- GAS PROTECTION METHODS BY OTHERS
- PERMITTED LOCATION WHERE PIPE $\leq$ DN150
- PERMITTED AREA
- NOT PERMITTED (CONSULT UNDERTAKER)
- PERMITTED LOCATION 150mm ABOVE FOUNDATION FORMATION
- WHERE THE TRENCH IS LESS THAN 1m FROM BUILDING, THE TRENCH TO BE FILLED WITH CONCRETE TO THIS LEVEL
- CONTRACTOR TO OVER EXCAVATE DRAINAGE RUNS BY 300mm TO SIDE AND BOTTOM AND BACKFILL WITH SUITABLE CLEAN MATERIAL
- CLASS 2 SULPHATE RESISTING GEN CONCRETE.
- PERMITTED LOCATION (PIPES SHOULD BE ENTIRELY WITHIN PERMITTED AREA)

NOTES:

1. FLEXIBLE JOINTS SHALL BE PROVIDED IN CONCRETE, BY INSERTING COMPRESSIBLE BOARD AT INTERVALS NOT EXCEEDING 5000mm. PRECUT TO DIAMETER, HEIGHT AND WIDTH EQUAL TO THE CONCRETE CROSS SECTION.

TABLE:

Nominal pipe size	DN	100	150	225	300
Transition depth (m)	6.0	5.4	4.0	2.9	
Maximum trench width (mm)	600	700	800	900	

Labels in diagram:

- 1200
- 45°
- 150
- 1200 (A)
- 'A' - Y MAX

Footnote:

"Y" = Where the depth of the cover exceeds the transition depth for the size of pipe, trench width up to 300 mm above crown of pipe to be not more than:

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6. MH COVER & FRAMES SHALL BE DUCTILE IRON WITH A MINIMUM SQUARE OPENING OF 675x675mm. COVERS SHALL BE DOUBLE TRIANGLE FOR 675mmSQUARE OPENINGS AND BE PROVIDED WITH LOOSE BOLTED CONNECTIONS. FRAME DEPTH SHALL BE 150mm.
7. ALL IRONWORK TO BE KITE MARKED BY BSI OR CERTIFIED BY QUALITY INSPECTION AUTHORITY.
8. PLANTING CLOSE TO ADAPTABLE DRAINAGE RUNS INDICATED IS TO ACCORD WITH THE SPECIFICATIONS IN SFA 7th EDITION SECTION C3.1.13 TO COMPLY WITH THE REQUIREMENTS OF SFA 7th & THE WELSH MINISTERS STANDARDS.

APPROVAL

0 500 1000 1500 2000 2500 mm
SCALE 1:50

rev.	drawn	01	ISSUED FOR SAB APPROVAL.
	thkd.	SU	
	apprvd.	MJ	
	date	MJ	
		23.11.21	

Client	GBV PROPERTIES
--------	----------------

Project
MARDON PARK
UNIT 21 EXTENSION

Title	SAB DRAINAGE DETAILS
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29 Bocam Park, Old Field Road, Pencoed, Bridgend CF35 5LJ.
Phone: 01656 863794 Email: enquiries@vale-consultancy.co.uk

date	drawn	checked	approved
23.11.21	SU	MJ	MJ
		23.11.21	23.11.21
scale @ A1		project no.	
AS STATED		13892	
status	drg. no.		rev.
A	13892 SAB 501		01

DRAWING STATUS
A - Approval, AB - As-Built, C - Construction, D - Draft, P - Preliminary, T - Tender



status	drg. no.	rev.
A	13892_502	01

APPENDIX E: Hydraulic Design Calculations

Detention Basin Infiltration Storage Design

Hydraulic Design Parameters				
Town/City	Rainfall method	Storm duration D (hours)	Return Period (Years)	Rainfall depth (mm)
Baglan	FEH 2013 (exported from FEH Web Service)	0.25	100	19.07
		0.5	100	26.89
		0.75	100	32.19
		1	100	36.31
		2	100	43.49
		4	100	52.58
		6	100	58.76
		10	100	67.41
		12	100	70.72
		24	100	84.32

Infiltration Storage Calculation					
Base Area (m2) =		327.00	Base perimeter (m) =		251.00
Catchment Area (m2) =		1478.00	Climate change factor =		1.4
Infiltration rate (m/h) =		1.00	Void ratio =		0.95
Factor of Safety =		1.50			
Storm duration (mins)	Depth of rainfall (mm) 100 year storm + 40% CC	Rainfall intensity (m/h)	a (m)	b (h ⁻¹)	h _{max} (m)
5	40.05	0.4806	-1.52	0.81	0.099
10	56.47	0.3388	-0.69	0.81	0.087
15	67.60	0.2704	-0.29	0.81	0.053
30	76.25	0.1525	0.41	0.81	-0.135
60	91.33	0.0913	0.77	0.81	-0.424
120	110.42	0.0552	0.98	0.81	-0.784
240	123.40	0.0308	1.12	0.81	-1.077
360	141.56	0.0236	1.16	0.81	-1.155
600	148.51	0.0149	1.22	0.81	-1.215
1440	177.07	0.0074	1.26	0.81	-1.259
Therefore critical storm duration = 5 mins					

Infiltration rate (m/s) =	2.78E-04
---------------------------	----------

Design note

Calculation based on CIRIA SuDS Manual 2015 equation 25.4.

h_{max} is the maximum depth of water for the stated parameters.

A maximum depth of 0.099m is calculated which means a minimum depth of 0.1m is required. **Pass.**

A factor of safety of 1.5 is applied as per the Statutory National Standards for SuDS.

General notes:

1. Outflow discharge rate is dependant on site specific requirements.
2. Void ratio is dependant on storage structure i.e. Detention Basin - 0.95, Geocellular - 0.95, Permeable paving - 0.32.
3. Climate change factor e.g. 30% = 1.3, 40% = 1.4.

Key

Input

APPENDIX F: Landscape and Ecology Architects Plan & SuDS Planting Schedule

Bioretention Areas Planting Schedule:

Proposed extension of existing unit at
Mardon Park, Baglan,
Neath Port Talbot,
SA12 7AX

Prepared for:

**GBV Properties
Ltd**
13892-1

November 2021



Vale Consultancy
CONSULTING CIVIL & STRUCTURAL ENGINEERS

Document Control

Project	Bioretention Areas for Mardon Park, Baglan
Client	GBV Properties Ltd
Vale Consultancy Ref:	13892-SuDS Planting Schedule-1

Document Checking:

Prepared By: R Peskett

Signed:



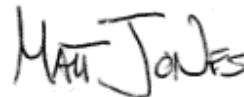
Checked By: S Hardacre

Signed:



Verified By: M Jones

Signed:



Issue	Date	Status
01	November 2021	First issue
02		
03		

1 Contents

1	Introduction	3
2	Planting Schedule	3
2.1	Marginals / Aquatics	3
2.2	Shrubs around the top edges of the features – the dry parts	3

1 Introduction

Sedges will make up most of the planting proposals and create habitat for a range of reptiles and invertebrates. The introduction of sedges and ferns will create a more simplified palette of plants able to cope with the change of soil conditions dependant on drainage surges.

The following list of plants have been selected as appropriate for use within the conveyance swales because of their resilience within the intended environment and will also contribute towards local biodiversity.

2 Planting Schedule

2.1 Marginals / Aquatics

Angelica Sylvestris 'Wild angelica'

Baldelia ranunculoides 'Lesser water plantain'

Botomus umbellatus 'Flowering rush'

Carex pendula 'Sedge'

Carex divulsa 'Sedge'

Carex pendula 'Sedge'

Iris pseudocorus / *Iris laevigata*

Lythrum salicaris 'Purple loosestrife'

Mentha aquatica 'Watermint'

Osmunda regalis 'Regal fern'

Ranunculus lingua grandiflora 'Greater spearwort'

2.2 Shrubs around the top edges of the features – the dry parts

Caryopteris clandon 'Heavenly Blue'

Lavandula angustifoia 'Hidcote'

Perovskia atriplicifolia 'Blue Spire'

Spiraea japonica 'Anthony Waterer'

Verbena bonariensis 'Purpletop vervain'

APPENDIX G: SuDS Maintenance & Management Plan

Management and Maintenance Plan for Sustainable Drainage (SuDS):

Proposed extension of existing commercial
unit at Mardon Park, Baglan, Neath Port
Talbot, SA12 7AX

Prepared for:

**GBV Properties
Ltd**

13892-1

November 2021



Vale Consultancy
CONSULTING CIVIL & STRUCTURAL ENGINEERS

Document Control

Project	Mardon Park, Baglan
Client	GBV Properties Ltd
Vale Consultancy Ref:	13892-1

Document Checking:

Prepared By: R Peskett

Signed:



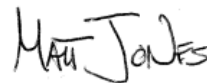
Checked By: S Hardacre

Signed:



Verified By: M Jones

Signed:



Issue	Date	Status
1	November 2021	First issue

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1. INTRODUCTION AND MANAGEMENT RESPONSIBILITIES

- 1.1. This SuDS Management and Maintenance Plan has been prepared by Vale Consultancy in support of a SuDS scheme for the proposed extension of an existing commercial unit at Mardon Park, Baglan, Neath Port Talbot, SA12 7AX. The specification, planting regime and type of plants within the landscape features serving the development will be by specialists.
- 1.2. The proposal is for the extension of an existing commercial unit with associated parking and service yard within the **0.16ha** curtilage of the site.
- 1.3. The scheme incorporates a sustainable drainage system for surface water runoff, which consists of bioretention swales and some porous parking bays. The method for disposal of surface water runoff is infiltration. Soakaway tests to BRE365 standards have been undertaken and which indicated excellent infiltration rates to prove the viability of infiltration as a means of surface water discharge.
- 1.4. The purpose of this document is to set out the overall management objectives for the common external areas and retained structural vegetation within the dry swale and to describe the long-term maintenance required to allow the planting to flourish and reach its design potential.
- 1.5. All references to planting treatments are based on the SAB submission drawings:
 - ***13892-500: Drainage Layout***
 - ***13892-501: Drainage Details***
- 1.6. Maintenance is to be carried out by Greenwise Construction.

2. MANAGEMENT RESPONSIBILITIES

- 2.1. Greenwise Construction shall be responsible for the implementation of the Landscape Management and Maintenance Plan. If deemed necessary, all landscape operations shall be undertaken by a suitable and qualified landscape contractor appointed by the Site Owner. The site will be owned by GreenWise Construction.
- 2.2. All inspections and maintenance work must be recorded. This allows for future assessment of the maintenance activities and their response to the system. It can also provide protection against legal claims should the system be exceeded in a storm event leading to flooding elsewhere.

3. MANAGEMENT OBJECTIVES

- 2.1. The site shall be managed and maintained as an attractive, tidy, and safe finish to all landscape elements. The proposed structure planting will give a cohesive site character, provide a visual buffer, and provide green framework to the newly built development.
- 2.2. The proposed planting shall enhance the biodiversity and nature conservation interests.
- 2.3. The Site Owner shall ensure establishment and long-term health of all landscape elements for the benefit of the site occupants and visual amenity of the area.
- 2.4. Best Health & Safety practices shall always be used.
- 2.5. To monitor standards and make amendments where required, it is expected that the Site Owner will review the management work (with reference to this document) at least quarterly for the first year and annually thereafter.

3 INSPECTION AND MAINTENANCE ACCESS

- 3.1. Access for inspection and maintenance can be gained from Central Avenue and Rd No 3. Parking and access are incorporated into the proposed development. This can be utilised and will provide parking and access for maintenance vehicles and any necessary machinery required for maintenance.

4 MAINTENANCE VISITS OR INSPECTIONS

- 4.1. The Site Owner or appointed maintenance contractor shall carry out a minimum of 20 maintenance visits or inspections per year to check drainage components and ensure plant establishment and health. Visits shall be twice monthly during March to October, and monthly during the rest of the year. Additional visits may be needed to deal with extreme weather conditions or specific horticultural requirements.

5 GENERAL

- 5.1. All materials and workmanship are to be to the highest possible standards and shall be in accordance with relevant British Standards, good horticultural and arboricultural practices, and the landscape specification.
- 5.2. The Site Owner shall employ suitably qualified staff for all work and when using sprays and mechanical equipment. All equipment shall be kept in a sound condition, fit for use and purpose.
- 5.3. The Site Owner and their appointed contractors shall comply with all relevant Health and Safety regulations and good working practices.
- 5.4. The Site Owner / appointed contractor shall take care when work is beside any structure or

paved area and will, at their own cost, be responsible for making good any damage caused.

- 5.5. All work shall be carried out while soil and weather conditions are suitable.
- 5.6. Weeds, pruning's, leaves, rubbish and other arisings shall be removed from site for composting, where possible. No material shall be left on site, and the area shall be left in a neat and tidy condition after each visit.
- 5.7. Entomological or disease infestation shall be dealt with as required and shall be checked at each visit. Control shall be either by spraying with approved chemicals, pruning all dead wood by cutting back to an outward pointing bud or by removal of the affected plants.
- 5.8. Watering during the first two years after planting may be necessary during times of drought in summer months and, when watering is required, it shall be carried out on a regular basis to suit climatic conditions. If conditions are severe or soils are particularly free-draining, careful monitoring and more frequent watering may be necessary to maintain good plant health and avoid plant failure.
- 5.9. All shrubs / hedges shall be pruned to remove deadwood, overhanging / tangled and damaged branches. Winter flowering shrubs shall be pruned in spring. Shrubs flowering in March-July shall be pruned immediately after the flowering period and shrubs flowering in July-October shall be cut back to old wood in winter. Shrubs that require spring pruning to provide seasonal colour shall be pruned in March and shrubs that require seasonal pruning to promote continual flowering will be pruned appropriately.
- 5.10. Plants shall be re-firmed when necessary to ensure that plants are securely planted and upright.
- 5.11. Bark mulch levels shall be maintained, being topped up when necessary to a minimum depth of 50mm. Any spillages shall be swept back on to the bed from surrounding areas, ensuring no plants are smothered.
- 5.12. Edge valleys in beds shall be maintained to reduce mulch spillage and grass edges shall be cut at each maintenance visit.

6 ORNAMENTAL PLANTING

Specific objectives:

- To ensure early establishment and healthy growth
- To maintain a dense canopy cover
- To maintain year-round appearance and visual interest

Maintenance Operations:

- 6.1. All bioretention areas shall be maintained substantially free of weeds. Work shall be done either manually or with appropriate selective weed killer in accordance with manufacturer's recommendations. If weed killer is used the dead weeds shall be removed at the next

maintenance visit. Care must be taken to avoid damage to adjacent planting and grass and replaced immediately if affected by weed killer.

6.2. Once established, shrubs shall be selectively thinned or reduced in height as appropriate by removal or pruning to allow room for growth and avoid overcrowding / overshadowing and create a natural form rather than cube or cloud shapes. Care shall be taken to avoid over pruning and so creating obvious gaps in the shrub beds.

6.3. Ground cover plants shall be clipped or pruned if necessary, to give a neat and tidy finish and contained within the planting bed. Work to remove dead vegetation shall be carried out during the winter months.

6.4. Pruning of herbaceous planting:

In spring cut stems close to the 'crown' or 'dormant' top of the plant, avoiding the removal of new shoots.

- Tidy up the base of the plant, removing dead foliage and debris.
- Remove all material from site.
- Apply a 50mm layer of fine horticultural mulch. This will help moisture retention in the soil, contribute to weed suppression and allow delicate stems to grow.
- Leave dried flower head over winter for relevant species e.g. ornamental grasses.

6.5. Fertilising:

- One application, just before or at the time of spring growth.
- A balanced fertiliser is required, one high in Phosphorus (which encourages blooming as well as strong roots and disease resistance). Fertilisers high in nitrogen should not be used as nitrogen promotes excess foliage at the expense of flowers and roots which can result in weak stems

7 GRASSED AREAS

Specific objectives

- To create an attractive grass sward with height and colour
- To provide habitats for reptiles, insects, bees & butterflies

Maintenance Operations

7.1. Refer to the planting schedule for guidance on the proposed extent of grass / plants to be used in the swale.

7.2. Cutting to be carried out using appropriate large wheeled, rotary mower to avoid injury to reptiles unless specified otherwise.

7.3. Remove any litter, debris, stones, and earth clods larger than 25mm in any dimension prior to

mowing.

- 7.4. Sward heights to be kept to minimum 5cm with two cuts per year in May and September after the first year.
- 7.5. No fertiliser or nutrients to be added.
- 7.6. Top dress if required with additional appropriate native origin seed if slow to establish.
- 7.7. When necessary grass areas shall be sprayed with a suitable approved selective herbicide in accordance with the manufacturer's recommendations to control injurious or invasive weeds. Alternatively, spot treatment weeding of isolated weed growth may be carried out by hand or herbicide application. All arisings shall be removed from site.
- 7.8. Reinstatement by re-seeding of damaged, defective, or bare areas shall be carried out as appropriate. Any dips or holes within the grass shall be filled as above to restore even falls and reseeded, as necessary.
- 7.9. Where necessary compacted areas shall be aerated with appropriate equipment in autumn.
- 7.10. Depressions to be filled in over time by adding a top dressing and over-seeding, using a sandy soil.
- 7.11. Year One
 - First cut to 5cm March/April (Spring Seeding 1st cut in May)
 - Cut every 2 months or when sward reaches 15cm
 - Final cut September/October
 - Allow cut grass to dry and disperse seed before removing arisings
 - The requirements in the first year are to control weeds and reduce competition from grasses. Cut the sward to a height of 5 cm every two months or when the sward reaches 15 cm. Remove all cut material to avoid smothering the sward. Where persistent weeds are a problem, spot treat with Glyphosate or dig-out
- 7.12. Future years
 - One cut in May and September to 5cm
 - Remove all cuttings
 - Allow cut grass to dry and disperse seed before removing arisings
 - The requirements in future years is to maintain a species diverse sward of value to wildlife
- 7.13. The site may require further cuts in the autumn period to remove untidy growth in an extended growing season.

8 PLANT REPLACEMENT

- 8.1. An annual inspection of trees and shrubs shall be undertaken in September of each subsequent year after planting to assess the condition of stock and prepare a list of necessary remedial work and replacement planting. Replacement planting shall be implemented in accordance with the planning requirements.
- 8.2. All work shall be carried out by appropriately qualified horticultural operatives with adequate insurance. All work shall be carried out in accordance with good horticultural practice and B.S. standards. All debris arising from the works shall be removed from site.
- 8.3. Any new replacement planting shall be tagged so the local SAB, the Site Owner are aware that these plants will have a further one year's defect liability period.
- 8.4. Replacement shrub planting shall take place in the following November-February, dormant winter period during suitable weather conditions. All stock shall be of the same size and species as originally specified.
- 8.5. Approval of all remedial and replacement work shall be obtained before commencing any remedial work.

9 LITTER COLLECTION

- 9.1. All hard surfacing shall be swept as necessary, and all rubbish removed from site.
- 9.2. Litter picking/clearance shall take place during each maintenance visit and all waste shall be removed from site.
- 9.3. During autumn maintenance visits all fallen leaves shall be collected and removed from site.

10 Hard Surfaces

- 10.2 A common-sense approach to the maintenance of the *CellWeb* will be adopted, the maintenance program as outlined as follows and is designed to ensure the structural and hydraulic performance of the *CellWeb* system.
- 10.3 The management company is to inspect each of the respective assigned areas of the hard landscape for which they have responsibility on a six-monthly basis to identify and repair any damaged areas.
- 10.4 Seasonal maintenance (leaf and snow clearance, de-icing). To be proactively managed with the checking of weather reports.
- 10.5 Surfaces to be always kept weed and litter free. Spray paved areas every 5 years or as required with herbicide to keep weed free.
- 10.6 Drainage systems associated with hard surfaces to be inspected annually and maintenance

work undertaken, as necessary.

- 10.7 Visually inspect the surface on a regular basis typically 2 per year (Spring and Autumn). Ensure no displacement of any organic matter has occurred on the surface, particularly after heavy precipitation. The paving should be agitated (e.g. brushed, vacuumed, etc.) at least once a year, ideally in the spring to ensure no vegetation of any sort can grow and develop in the voids.

Note: If the infiltration rate of the paving becomes prolonged, allowing ponding to develop, the laying course material may require cleaning/replacing. This should happen every 35-50 years.

- 10.8 Repair any subsidence or breakages promptly in accordance with best practice, manufacturer's guidance and using matching materials.

Inspect and repair all edging on a regular basis making good any damage or wear promptly to maintain the good upkeep of the development.

11 TRADITIONAL DRAINAGE

- 11.1. A monthly site inspection should be carried out, checking for any areas that are not operating correctly and collecting/removing litter and debris.
- 11.2. All rainwater pipes, linear drains, gullies and inspection chambers should be inspected biannually, typically spring and autumn.
- 11.3. Any excessive sediment build-up in rainwater pipes, linear drains, gullies or inspection chambers causing blockage or poor performance shall be cleared and cleaned as required.

12 SUMMARY OF INSPECTION AND MAINTENANCE

- 14.1. The following briefly summarises the frequency and type of inspections and maintenance required for the SuDS components and drainage system used in this scheme:

14.2. General

- General inspections of SuDS areas (swales, **CellWeb** paving, inlets and outlets) – every 2 weeks between March to October and monthly for the rest of the year and shall include litter collection.
- Biannual check of traditional drainage including rainwater pipes, linear drains, gullies and inspection chambers.

14.3. Bioretention areas (Swales)

- Inspect surfaces for silting and ponding, record de-watering time to determine if any remedial work is required – annually
- Pruning, weed removal and plant replacement, assess plants for disease infection, poor growth and invasive species – annually

- Inspect inlets for damage or blockage at general inspections
- Clear inlet/outlets of sediment build-up – as required

14.4. Stone infilled *CellWeb*

- Initial inspection – within 3 months of completion
- Visual inspection - 2 times a year
- General brushing of surface - once a year
- Weed removal – as required
- Remediate areas of Rutting and depressions – as required
- Rehabilitate surface with brushing and water jetting when clogging becomes apparent – as required, typically every 10 - 15 years
- Replace surface and binder layers if rehabilitation fails due to significant clogging – expect every 50 years

Inspection for performance and clogging and ancillary drainage components – once a year

13 LIFETIME MANAGEMENT AND MAINTENANCE COSTS

15.1. The costs associated with the management and maintenance of the SuDS system over the 60-year design life of the scheme has been estimated based on the inspection and maintenance activities in section 14 are as follows:

15.2. General

- General 2 weekly inspection (incl. litter removal) – 1 hour for each inspection – 1560 inspections over 60 years @ £15 each - £23,400
- Biannual check of traditional drainage including rainwater pipes, linear drains, gullies and inspection chambers @ £15 each - £1,800

15.3. *CellWeb*

- Annual brush/sweep – 60 sweeps at £0.12 / m² x 95m² - £684
- Weed kill every 5 years @ £0.90 / m² x 95m² - £1026
- Brush/water jetting rehabilitation every 15 years @ £2.50 / m² x 95m² - £60

15.4. Bioretention Areas (swales)

- Annual pruning / fertilising and inspection for plant replacement over 60 years @ £70 / day - £8,400

15.5. The total approximate sum of management and maintenance costs for the proposed SuDS over a 60-year design life - **£35,370 or circa £590 a year**

Design of Drainage elements for Construction, Operation, Maintenance and Structural Integrity:

All elements of the proposed SuDS scheme will be designed with ease of construction and minimal lifecycle carbon costs in mind. The majority of the system will be above ground and will only require shallow excavation. SuDS features will be formed of pre-cast, standard products as much as possible. All relevant materials will be specified such that vehicular loading from maintenance vehicles (including jetties) can be tolerated.

The construction plan can be conditioned with the SAB approval under section G6.3 of the Welsh Government National Standards. The implementation of the SuDS drainage is as follows:

- The programming of the SuDS construction will be established and formalised as to who is responsible for construction and completing the work with a point of contact for the SAB inspections and construction access and the location of the site laydown areas and accommodation
- Full scheme site plans and drawings issued to the appointed contractor
- Suitable measures and protection to be put in place to prevent pollution and sediment entering the SuDS under construction / runoff from works flowing offsite
- Site strip / clearance and site preparation to formation levels and protected against construction traffic and protection of infiltration system
- Subsurface piped drainage network. The layering of geotextiles / liners on prepared ground
- SuDS components to be constructed at an early stage during the earthworks and can assist in the management of runoff and the settlement of high-volume sediment created during the construction process
- Complete reinstatement of all the SuDS components will be required on completion of the construction / formation works
- Final construction and placement of porous parking infilled CellWeb bays
- Final construction with the placement of filter medium and bioretention swales planting material
- Planting of bioretention swales by appropriately skilled person and physical requirements of planting
- Inspection at key stages and handover

Appendix A
Imported topsoil criteria

Reference documents BS 8545 2014
BS 3882 2015
BS 8601 2012
BS 3998 2010
BS 5837 2012
BS 4043 1989
BS 4428 1989
BS 3936-1 1992

Defra leaflet: *CONSTRUCTION CODE OF PRACTICE FOR THE
SUSTAINABLE USE OF SOILS ON CONSTRUCTION SITES*

Imported Topsoil shall not contain weed seeds in quantities that cause noticeable weed infestations in the final planting beds. Imported Topsoil shall meet the following physical and chemical criteria:

- Soil texture: loam, sandy clay loam or sandy loam with clay content between 15 and 25%. And a combined clay/silt content of no more than 55%.
- pH value shall be between 5.5 and 7.0.
- Percent organic matter (OM): 2.0-5.0%, by dry weight.
- Soluble salt level: Less than 2 mm ho/cm.
- Soil chemistry suitable for growing the plants specified.
- Imported Topsoil shall be a harvested soil from fields or development sites. The organic content and particle size distribution shall be the result of natural soil formation. Manufactured soils where Coarse Sand, composted organic material or chemical additives has been added to the soil to meet the requirements of this specification section shall not be acceptable. Retained soil peds shall be the same color on the inside as is visible on the outside. Imported soil must be supplied with Product data and certificates: For each type of manufactured product, submit data and certificates for the product.