

DRAINAGE STRATEGY REPORT (DSR)

Pallet Recycling Centre
West Way Road
Newport
NP20 2RZ

Prepared for: ASR
Project Ref: 23172



DOCUMENT CONTROL

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Client:	ASR
Vale Consultancy Ref:	23171

Issue	Prepared by	Approved by	Date	Status
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CONTENTS

1	INTRODUCTION	3
1.1	Site Location.....	3
1.2	Proposed Development	4
1.3	Existing Geology	4
1.4	Flood Risk	4
2	SURFACE WATER	5
2.1	Existing Drainage Systems.....	5
2.2	Proposed Drainage Systems.....	5
2.2.1	S1: SuDS hierarchy of surface water discharge locations.....	5
2.2.2	S2: Surface Water Runoff Hydraulic Control	6
2.2.3	S3: Water Quality.....	7
2.2.4	S4: Amenity.....	7
2.2.5	S5: Biodiversity	8
2.2.6	S6: Operation and Maintenance Requirements.....	8
3	CONCLUSIONS	9
	APPENDIX A: Existing Site Plans.....	10
	APPENDIX B: Proposed Site Plans.....	11
	APPENDIX C: Ground Investigation Reports	12
	APPENDIX D: Design Calculations	13
	APPENDIX E: Management & Maintenance Plan	14



1 INTRODUCTION

1.1 Site Location

Vale Consultancy has been instructed by ASR (the Client) to undertake a drainage strategy report (DSR) for the proposed development at Pallet Recycling Centre, West Way Road, Newport NP20 2RZ.

Refer to **Appendix A** – Existing Site Plans

The proposed development is located approximately 250m west of Alexandra Docks and circa 500m west of the River Usk. The site is in an urban setting and can be accessed via West Way Road. This site is surrounded by other industrial units. As there is no site requirement for rainwater harvesting and infiltration is not suitable on the contaminated land, it is our proposal to discharge surface water into an existing surface water connection which discharges into Alexandra docks.

The proposed development site is undeveloped and is therefore classed as a **‘brownfield’** site. 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 intention of the proposed project is to construct 2 portal frame units used for pallet storage and manufacturing, whilst also incorporating SuDS features such as raised planters to increase biodiversity and amenity.

The total site area is approximately 1.49ha, only a proportion of the site is to be developed and as such the development/SAB boundary be 0.51ha.

Refer to **Appendix B** – Proposed Plans

1.3 Existing Geology

Infiltration testing for this site was not carried out as it is known to be a contaminated area.

British Geological Survey records note that the site is listed to have the following:

Superficial deposits: Tidal flat deposits – Clay and Silt. Sedimentary deposits formed between 0 and 2588 thousand years ago during the Quaternary period.

Bedrock geology: Mercia Mudstone Group – Mudstone. Sedimentary rocks formed between 201.3 and 247.1 million years ago during the Triassic period.

Refer to **Appendix C** – British Geological Survey record

1.4 Flood Risk

Flood risk has been assessed using the NRW Flood Map for Planning (FMfP) and detailed view map. The site is located within Flood Zone 2, so is therefore considered to be a 0.1% - 0.5% chance of flooding from the sea in a given year. As a result, a FCA has been completed for this site which showed the proposed development to be flood free across all modelled events. Furthermore, the scheme is classified as a 'Less Vulnerable' use and therefore does not represent an increased vulnerability classification from the existing site.

Refer to **Appendix C** – Natural Resource Wales Flood Map for Planning (FMfP) and Flood Consequence Assessment (FCA)



2 SURFACE WATER

2.1 Existing Drainage Systems

The development is situated on a brownfield site and therefore there is some existing drainage apparatus. There are 2 existing ACO channels which are 400mm and 550mm deep. The ACO channels collect run off from the concrete yard and convey this to an existing connection in the southern corner of the site. From this connection, the flow is discharged into Alexandra Docks.

Our proposal is to continue to drain the concrete surface as existing, and utilise this same outflow connection for the runoff from the proposed roof catchments.

Refer to the existing site plan in **Appendix A** for the location of existing drainage apparatus.

2.2 Proposed Drainage Systems

2.2.1 **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 ensuring 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 is not proposed due to the practicalities of such a system as well as there being no foreseeable demand for non-potable water within the development proposals throughout its design life. There is also no foreseeable need to harvest water as DCWW has not identified any potential stresses on the mains water supply.

The need for non-potable water is low and the cost for such a system is high therefore it is deemed not feasible. The costs for installing such a system for a residential property set against the money saving due to reduced usage of potable water from the water provider typically results in a 50-60 year return.

No solution, move to next Priority Level

Priority Level 2 – Discharge via infiltration:

As explained in section 1.3, infiltration testing was not carried out for this site as it is known to be situated on contaminated land and therefore this would not be a suitable discharge method.

No solution, move to next Priority Level



Priority Level 3 – Discharge into open surface water body:

It is proposed that the surface water drainage system to serve this development will discharge to Alexandra Docks, via an existing connection.

Priority Level 3 solution

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

Proposed SuDS drainage system

The proposed surface water drainage system will connect and discharge to Alexandra Docks, via an existing connection.

The concept is to discharge roof run-off from the portal frame units through raised planters (SuDSPlanters) into bottle gullies which will connect to below ground pipes, connecting to the sites existing connection in the southern corner. Across the site there will be 20 extra large SuDSPlanters, which will be situated beneath the rainwater pipes on each building.

Refer to **Appendix B** for the proposed surface water drainage layout illustrating how surface water is collected and conveyed towards their discharge location.

Hydraulic Control

The proposed SuDS drainage system will use SuDSPlanters to collect, filtrate and slow the surface water runoff. The drainage system will be designed such that no flooding will occur for a 1 in 100-year storm event plus 40% climate change allowance.

Alexandra Docks is a large body of water with a controlled water level. Any overflow from the dock is discharged directly to the Bristol Channel. Any rise in water level attributed to the run off from this development would be minimal, and as a result there is no requirement to attenuate and store surface water on the site prior to disposal.

For hydraulic design of the drainage network refer to **Appendix D – Design Calculations**.

Interception of runoff

For greenfield sites the majority of rainfall events during the year create no noticeable surface water runoff, the rainwater will normally evapotranspire or recharge groundwater. Whereas, impermeable surfaces generate runoff from virtually all rainfall events. Therefore, the development of greenfield sites changes its surface water runoff characteristics and can have a negative impact on the morphology and ecology of receiving watercourses.

It is believed that interception compliance is not a requirement for this site as retaining the first 5mm of rainfall on site to protect the morphology and ecology of the receiving surface water body is not relevant in this case.



Exceedance Event Analysis & Management

It is necessary to assess the risk and consequence of flooding for exceedance events. This is to determine the likely flood volumes and water flow paths that would be caused by a storm event that exceeds the critical 1 in 100-year + 40% climate change allowance that the surface water drainage system is designed for. Please refer to **Appendix E** – Design Calculations for the detailed hydraulic design.

Each Extra Large SuDSPlanter is designed for a receiving roof catchment area of 150m². The combined total roof area of the proposed portal frames is 3025m² and therefore 20 SuDSPlanters will be used.

If the drainage systems fail in an exceedance event surface water will flood from the proposed features and flows will largely fall towards the southern corner of the site and towards the dock, as is the existing condition.

Refer to **Appendix B** for a flood exceedance plan.

2.2.3 **S3:** Water Quality

To assess that the water quality being provided by the proposed SuDS solution is sufficient, the simple index approach as per section 26.7.1 of the CIRIA SuDS Manual 2015 is applied.

To deliver adequate water quality treatment the total SuDS mitigation index must be more than or equal to the pollution hazard index for each contaminant type. The pollution hazard and mitigation indices have been taken from tables 26.2 and 26.3 of the CIRIA SuDS Manual 2015.

Water quality - Simple Index Approach

Land Use	Pollution Hazard Level	Pollution hazard index			SuDS Components for land use	Mitigation Index			Mitigation hazard index > Pollution hazard index (for each contaminant type)
		Total Suspended Solids (TSS)	Metals	Hydro-carbons		Total Suspended Solids (TSS)	Metals	Hydro-carbons	
Commercial roofs	Low	0.3	0.2	0.05	Bioretention system (SuDSPlanters)	0.8	0.8	0.8	Yes

The proposed design will ensure that surface water runoff will pass through the proposed SuDS features before discharging to the existing watercourse. Surface water will be treated by SuDS components before discharging to the local tributary to the rear of the site that leads to the Alexandra Dock. The SuDS components will separate the smaller particles and chemicals from the surface water discharge as it traverses through the feature, providing sufficient water quality treatment to any discharging water.

2.2.4 **S4:** Amenity

Infiltration drainage is not viable for the majority of the site due to contaminated land; however, SuDSPlanters have been incorporated to boost the amenity benefits to the site and surrounding area. The design aims to keep surface water as close to the ground surface as possible without over complicating the SuDS solution.

Given the nature of the development proposals, the proposed SuDS solution maximises amenity benefits by providing raised planters used for drainage that can incorporate planting and biodiversity benefits. The



proposed SuDS features will incorporate areas of planting in an environment that would traditionally be dominated by hardstanding ground.

2.2.5 **S5:** Biodiversity

In urban areas, it is of particular importance to provide biodiversity. As these areas can be generally inhabitable for wildlife. By providing small biodiverse areas across larger urban environments wildlife can start to link areas and create networks, providing habitat as well as improving biodiversity and sustainability.

The use of planters 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. A list of plants species suitable for the SuDSPlanters are included on the drainage details drawings, refer to **Appendix B**.

2.2.6 **S6:** Operation and Maintenance Requirements

The construction management plan and construction phasing plan will be developed by the appointed contractor, as the SuDS scheme requires coordination with all other elements of the development that will be constructed as part of the scheme. We understand that the construction management plan and construction phasing plan can be conditioned to the SAB approval.

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.

An inspection and maintenance plan has been produced for the site proposals, providing the site owner, who is responsible for the maintenance, guidance on the types and frequency of inspections and maintenance work that is required for the proposed SuDS element. It also provides a cost estimate for the inspection and maintenance requirements over the development's lifetime.

Refer to **Appendix E – Management & Maintenance Plan**.



3 CONCLUSIONS

The 1.49ha brownfield site on West Way Road, Newport, NP20 2RZ is to be developed such that 2 portal frame commercial units are to be constructed. The total site area is approximately 1.49ha, only a proportion of the site is to be developed and as such the development/SAB boundary will be 0.51ha. All surface water incident upon each respective catchment is collected, conveyed and discharged towards the downstream SuDS components as illustrated on the drainage plan which can be found in **Appendix B**. In an exceedance event, surface water runoff will generally flow towards the southern corner of the site.

The development is situated on a brownfield site and therefore there is some existing drainage apparatus. There are 2 existing ACO channels which are 400mm and 550mm deep. The ACO channels collect run off from the concrete surface and convey this to a connection in the southern corner of the site. From this connection, the flow is discharged into Alexandra Docks.

Following the hierarchical approach to discharge location of surface water for new developments as set out in the Statutory Standards for SuDS. The proposed development will provide the site with a new sustainable surface water drainage system that will incorporate SuDS features and provide a solution that will intercept and treat surface water runoff before discharging to the open body of water.

There is no requirement for attenuation of surface water run off on this site as it is discharging to an open body of water as any rise in water level attributed to the run off from this development would be minimal.

The SuDS components considered suitable for this site are raised planters (SuDSPlanters). Surface water will convey from the roofs of the units and will discharge directly into the SuDSPlanters before being conveyed via below ground drainage to the existing discharge location. The SuDS solution provides improvements to water quality, amenity and biodiversity.

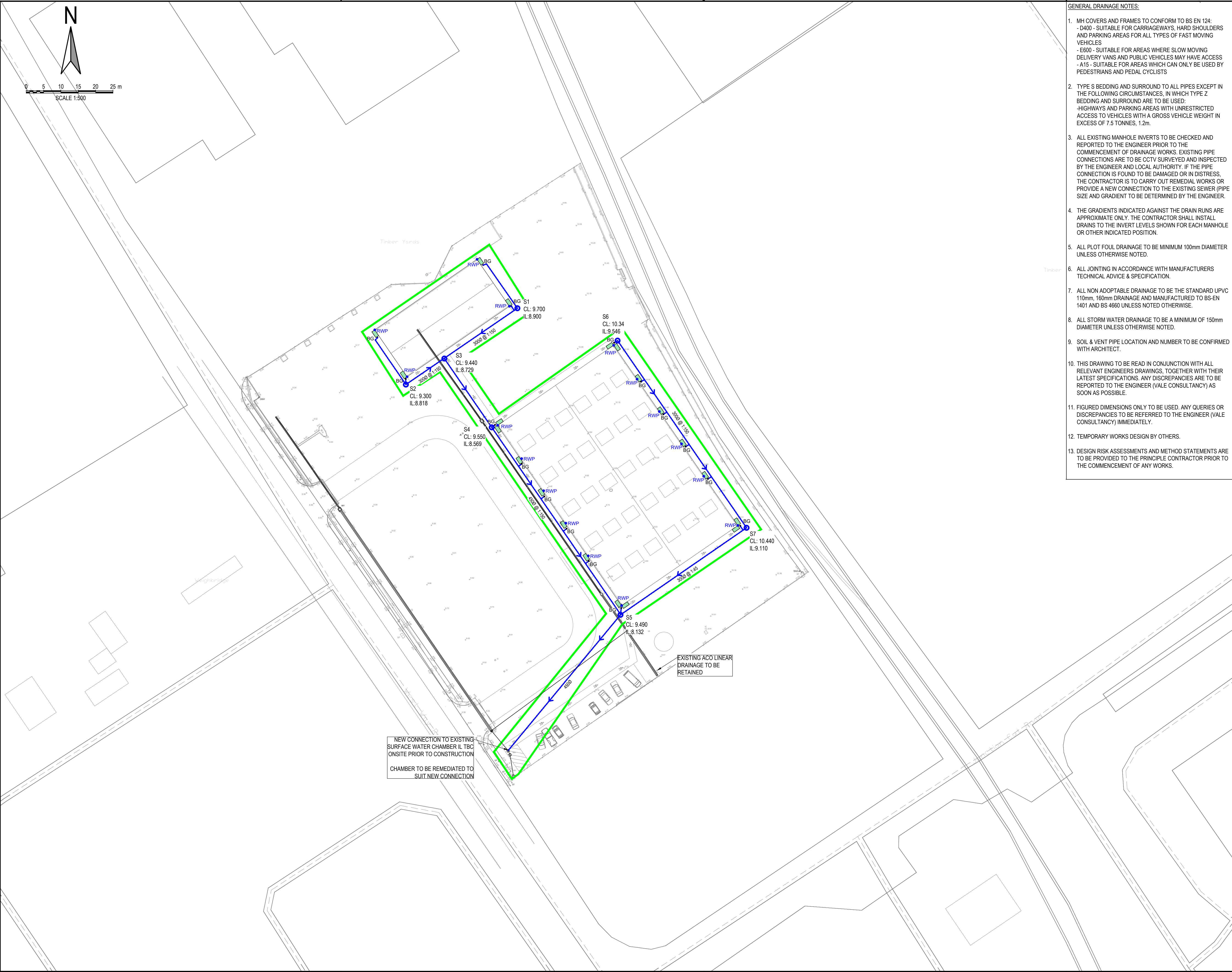
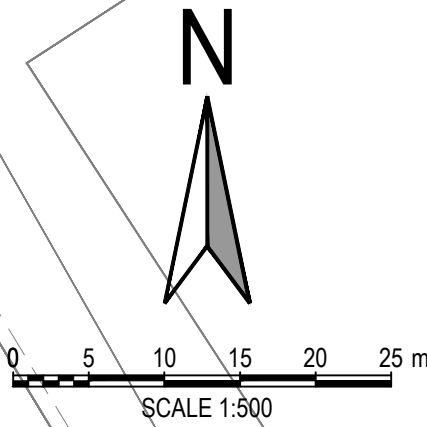
Overall, the proposed surface water drainage system seeks to be a cost effective and easily maintainable sustainable drainage solution. The surface water discharge locations are the most appropriate and preferred method within the sites constraints and the SuDS components incorporated in the design provide suitable surface water management as close to the source as possible and also provide water quality, amenity and biodiversity benefits.



APPENDIX A: Existing Site Plans



APPENDIX B:
Proposed Site Plans



GENERAL DRAINAGE NOTES:

- MH COVERS AND FRAMES TO CONFORM TO BS EN 124:
 - D400 - SUITABLE FOR CARRIAGEWAYS, HARD SHOULDERS AND PARKING AREAS FOR ALL TYPES OF FAST MOVING VEHICLES
 - E600 - SUITABLE FOR AREAS WHERE SLOW MOVING DELIVERY VANS AND PUBLIC VEHICLES MAY HAVE ACCESS
 - A15 - SUITABLE FOR AREAS WHICH CAN ONLY BE USED BY PEDESTRIANS AND PEDAL CYCLISTS
- TYPE S BEDDING AND SURROUND TO ALL PIPES EXCEPT IN THE FOLLOWING CIRCUMSTANCES, IN WHICH TYPE Z BEDDING AND SURROUND ARE TO BE USED:
 - HIGHWAYS AND PARKING AREAS WITH UNRESTRICTED ACCESS TO VEHICLES WITH A GROSS VEHICLE WEIGHT IN EXCESS OF 7.5 TONNES, 1.2m.
- ALL EXISTING MANHOLE INVERTS TO BE CHECKED AND REPORTED TO THE ENGINEER PRIOR TO THE COMMENCEMENT OF DRAINAGE WORKS. EXISTING PIPE CONNECTIONS ARE TO BE CCTV SURVEYED AND INSPECTED BY THE ENGINEER AND LOCAL AUTHORITY. IF THE PIPE CONNECTION IS FOUND TO BE DAMAGED OR IN DISTRESS, THE CONTRACTOR IS TO CARRY OUT REMEDIAL WORKS OR PROVIDE A NEW CONNECTION TO THE EXISTING SEWER (PIPE SIZE AND GRADIENT TO BE DETERMINED BY THE ENGINEER.
- THE GRADIENTS INDICATED AGAINST THE DRAIN RUNS ARE APPROXIMATE ONLY. THE CONTRACTOR SHALL INSTALL DRAINS TO THE INVERT LEVELS SHOWN FOR EACH MANHOLE OR OTHER INDICATED POSITION.
- ALL PLOT FOUL DRAINAGE TO BE MINIMUM 100mm DIAMETER UNLESS OTHERWISE NOTED.
- ALL JOINTING IN ACCORDANCE WITH MANUFACTURERS TECHNICAL ADVICE & SPECIFICATION.
- ALL NON ADOPTABLE DRAINAGE TO BE THE STANDARD UPVC 110mm, 160mm DRAINAGE AND MANUFACTURED TO BS-EN 1401 AND BS 4660 UNLESS NOTED OTHERWISE.
- ALL STORM WATER DRAINAGE TO BE A MINIMUM OF 150mm DIAMETER UNLESS OTHERWISE NOTED.
- SOIL & VENT PIPE LOCATION AND NUMBER TO BE CONFIRMED WITH ARCHITECT.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS DRAWINGS, TOGETHER WITH THEIR LATEST SPECIFICATIONS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER (VALE CONSULTANCY) AS SOON AS POSSIBLE.
- FIGURED DIMENSIONS ONLY TO BE USED. ANY QUERIES OR DISCREPANCIES TO BE REFERRED TO THE ENGINEER (VALE CONSULTANCY) IMMEDIATELY.
- TEMPORARY WORKS DESIGN BY OTHERS.
- DESIGN RISK ASSESSMENTS AND METHOD STATEMENTS ARE TO BE PROVIDED TO THE PRINCIPLE CONTRACTOR PRIOR TO THE COMMENCEMENT OF ANY WORKS.

NOTES:

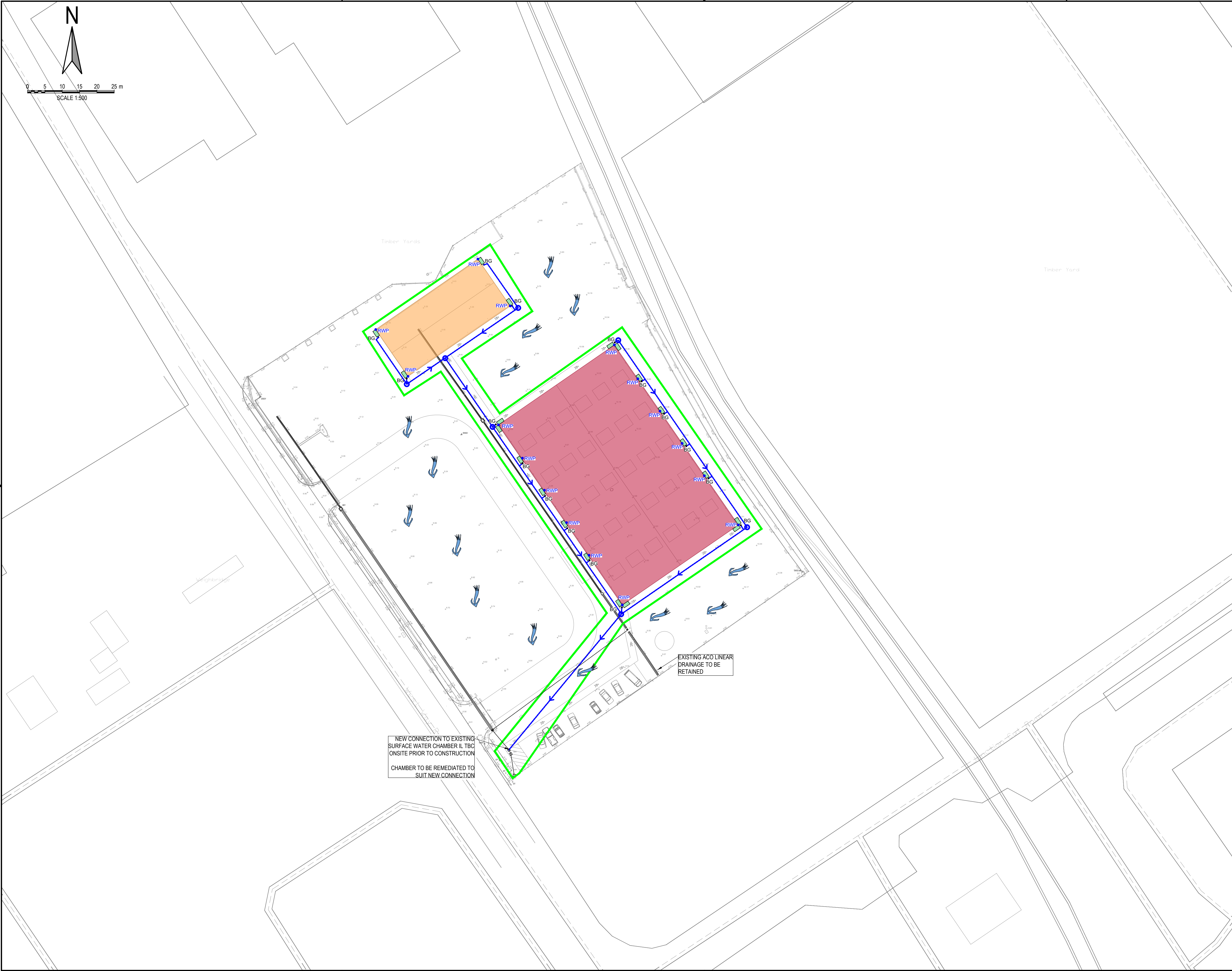
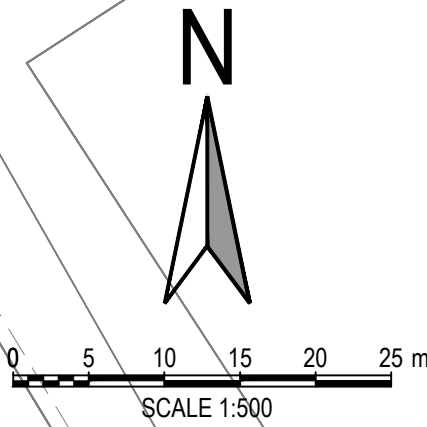
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- ALL LEVELS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
- DO NOT SCALE FROM THE DRAWING. USE FIGURED DIMENSIONS ONLY.
- ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
- 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.

LEGEND

- PROPOSED SURFACE WATER DRAINAGE
- EXISTING COMBINED DRAINAGE
- PROPOSED RAINWATER PIPE
- SUDS PLANTER
- EXISTING SURFACE WATER DRAINAGE
- PROPOSED BOTTLE GULLY
- SAB BOUNDARY

PRELIMINARY

01	SM	DR	MJ	10.04.26	PRELIMINARY ISSUE
rev.	drawn	chekd	approved	date	description
Client					
ASR					
Project					
PORTAL FRAMES PALLET RECYCLING CENTRE NEWPORT					
Title					
DRAINAGE LAYOUT					
Vale Consultancy 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		
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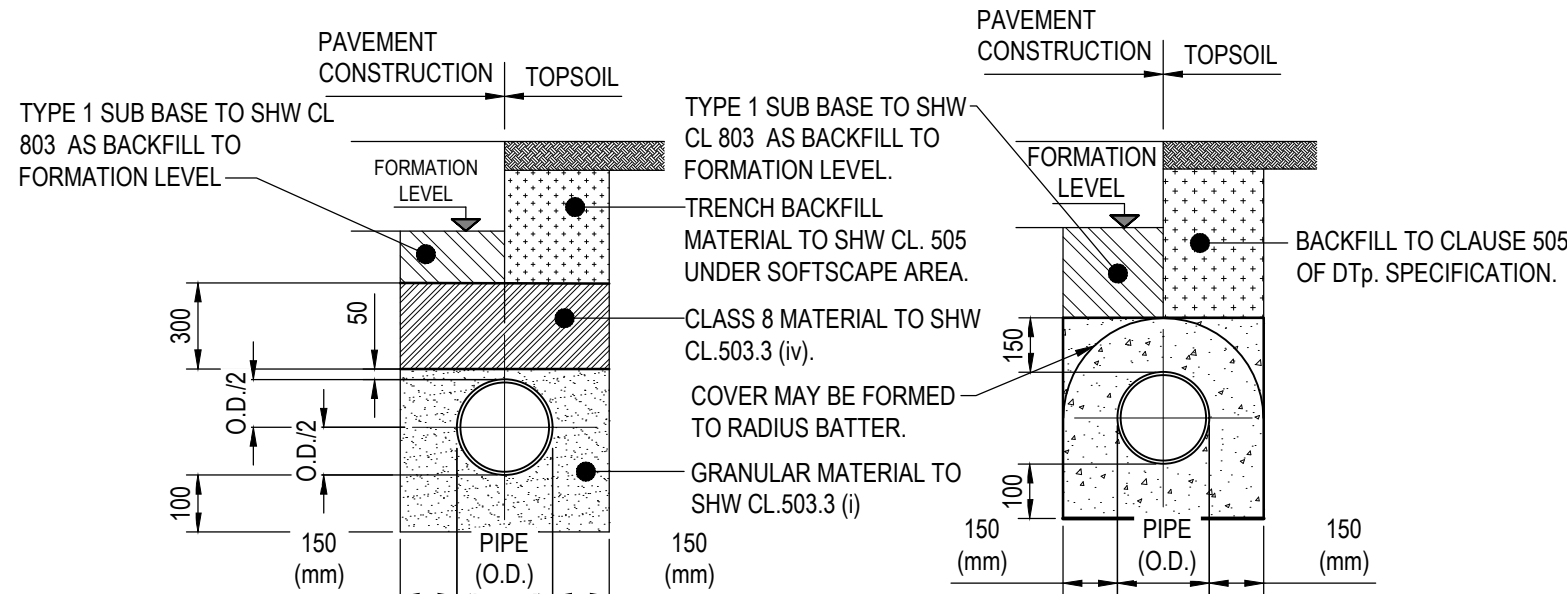
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- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
 - ALL LEVELS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
 - DO NOT SCALE FROM THE DRAWING. USE FIGURED DIMENSIONS ONLY.
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LEGEND

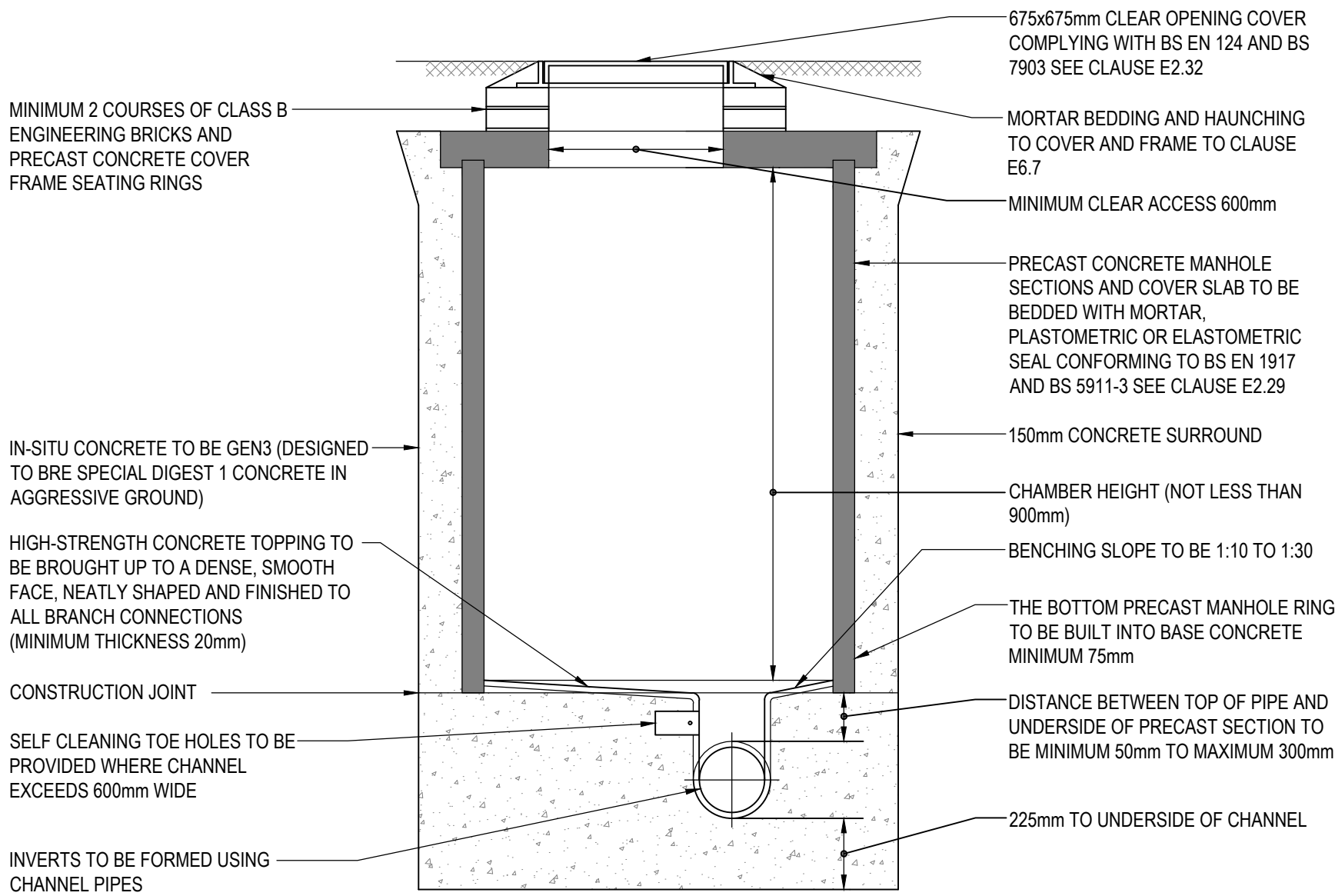
-  CATCHMENT AREA A = 2506m²
-  CATCHMENT AREA B = 525m²
-  SAB BOUNDARY

PRELIMINARY

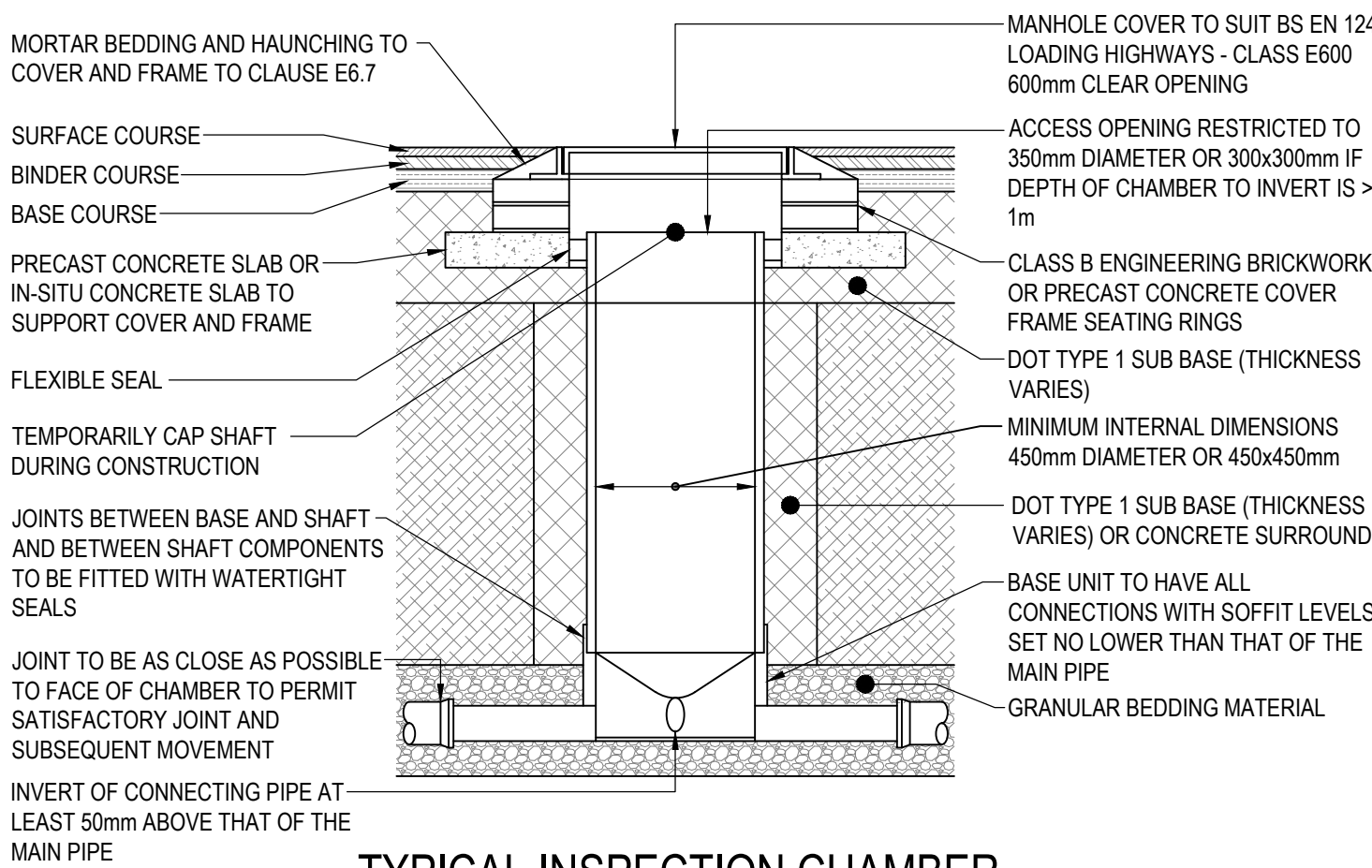
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rev.	drawn	chekd	approved	date	description
Client ASR					
Project PORTAL FRAMES PALLET RECYCLING CENTRE NEWPORT					
Title EXCEEDANCE FLOW & CATCHMENT AREA PLAN					
 CONSULTING CIVIL & STRUCTURAL ENGINEERS 29 Bocam Park, Old Field Road, Pencoed, Bridgend CF35 5LJ. Phone: 01656 863794 Email: enquiries@vale-consultancy.co.uk					
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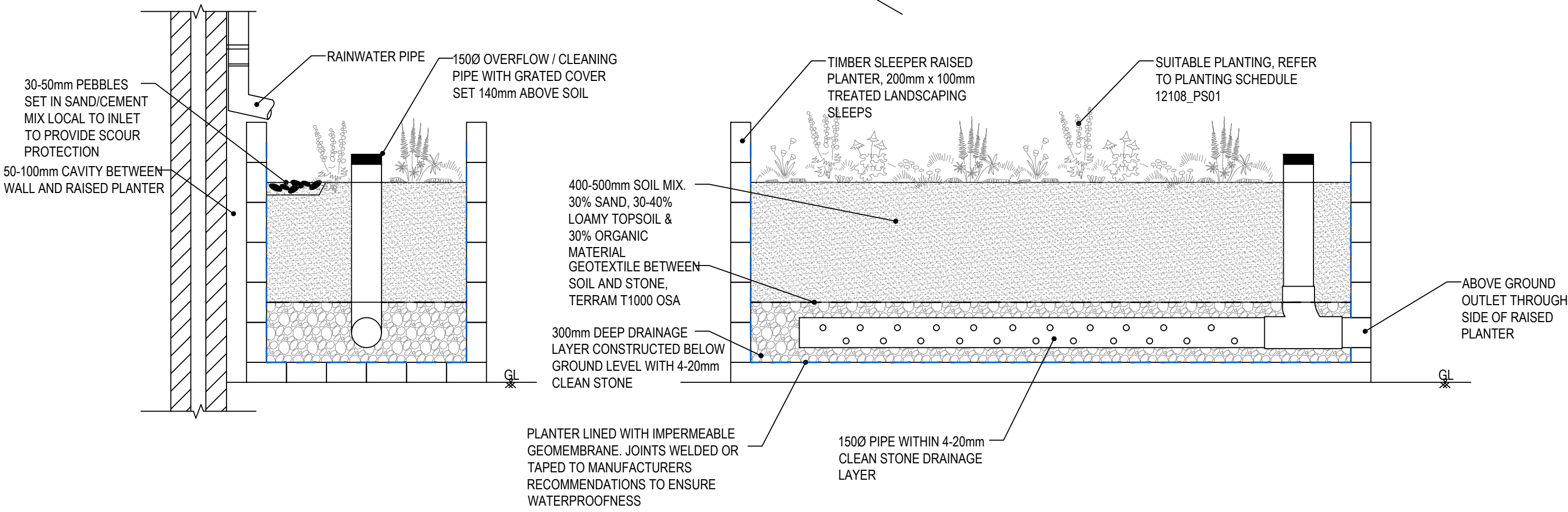
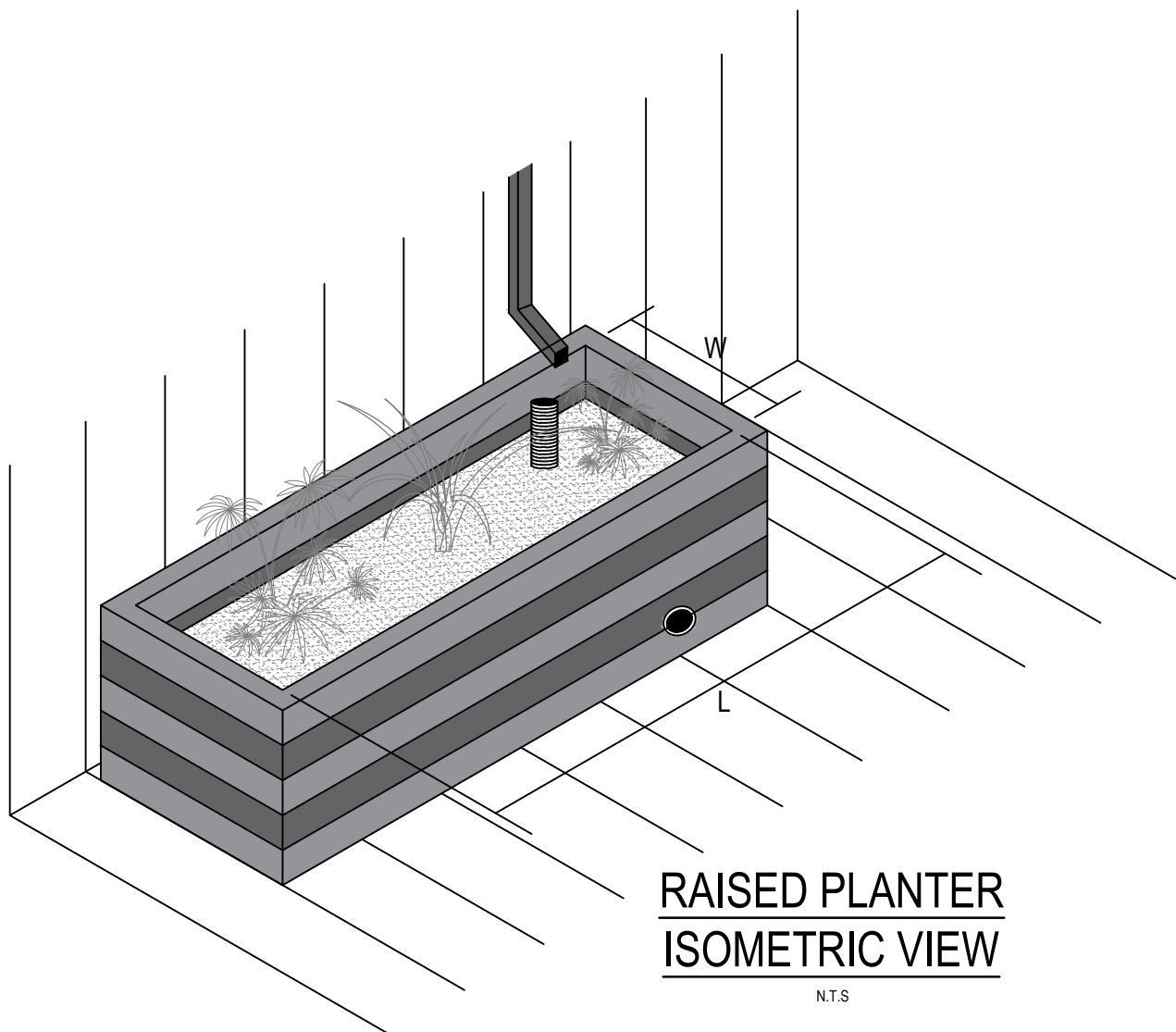
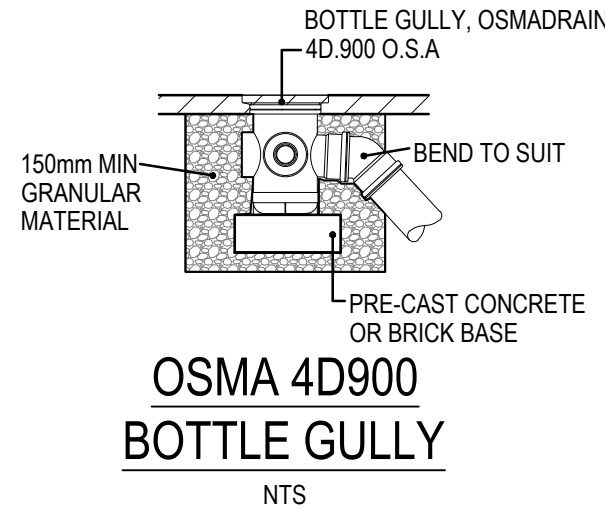
BEDDING DETAILS
SCALE 1:20



TYPICAL MANHOLE DETAIL TYPE 2 - 1200Ø
(REFER TO FIG. B.12 OF SEWERS FOR ADOPTION 7th ED)
(MAXIMUM DEPTH FROM COVER TO SOFFIT LEVEL OF PIPE - 3.0m)
SCALE 1:20



**TYPICAL INSPECTION CHAMBER
DETAIL - TYPE 3**
(REFER TO FIG. B.16 OF SEWERS FOR ADOPTION 7th ED)
(DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE 3m)
(FLEXIBLE MATERIAL DETAIL)



**RAISED PLANTER DETAIL
(OUTLET ABOVE GROUND)
TYPICAL CROSS-SECTION**
SCALE 1:20

**RAISED PLANTER DETAIL
(OUTLET ABOVE GROUND)
TYPICAL LONG-SECTION**
SCALE 1:20

- NOTES:
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
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PLANTING SCHEDULE - BIORETENTION AREAS (RAISED PLANTERS)

PLANTS WITHIN BIORETENTION AREAS (RAINGARDENS) SHOULD BE PLANTED WITH THE FOLLOWING SPECIES AT A DENSITY OF 4NO PLANTS/M2:

- PURPLE LOOSESTRIPE (LYTHRUM SALICARIA)
- WATER MINT (MENTHA AQUATICA)
- HEMP AGRIMONY (EUPATORIUM CANNABINUM)
- RAGGED ROBIN (LYCHNIS FLOS-CUCULI)
- MARSH WOUNDWORT (STACHYS PALUSTRIS)
- SOFT RUSH (JUNCUS EFFUSUS)
- ROYAL FERN (OSMUNDA REGALIS)
- BUGLE (AJUGA REPTANS)
- CHIVES (ALLIUM SCHOENOPRASUM)
- CHOISYA DEWITTEANA WHITE DAZZLER
- CORNUS STOLONIFERA 'KELSEY'
- CORNUS SANGUINEA 'MIDWINTER FIRE'

REPLACEMENT PLANTING TO BE CARRIED OUT, AS REQUIRED, BASED ON SPECIES SPECIFIED WITHIN SCHEDULE.

PRELIMINARY

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Client
ASR

Project
**PORTAL FRAMES
PALLET RECYCLING CENTRE
NEWPORT**

Title
DRAINAGE DETAILS

Vale Consultancy
CONSULTING CIVIL & STRUCTURAL ENGINEERS
29 Bocam Park, Old Field Road, Pencoed, Bridgend CF35 5LJ.
Phone: 01656 863794 Email: enquiries@vale-consultancy.co.uk

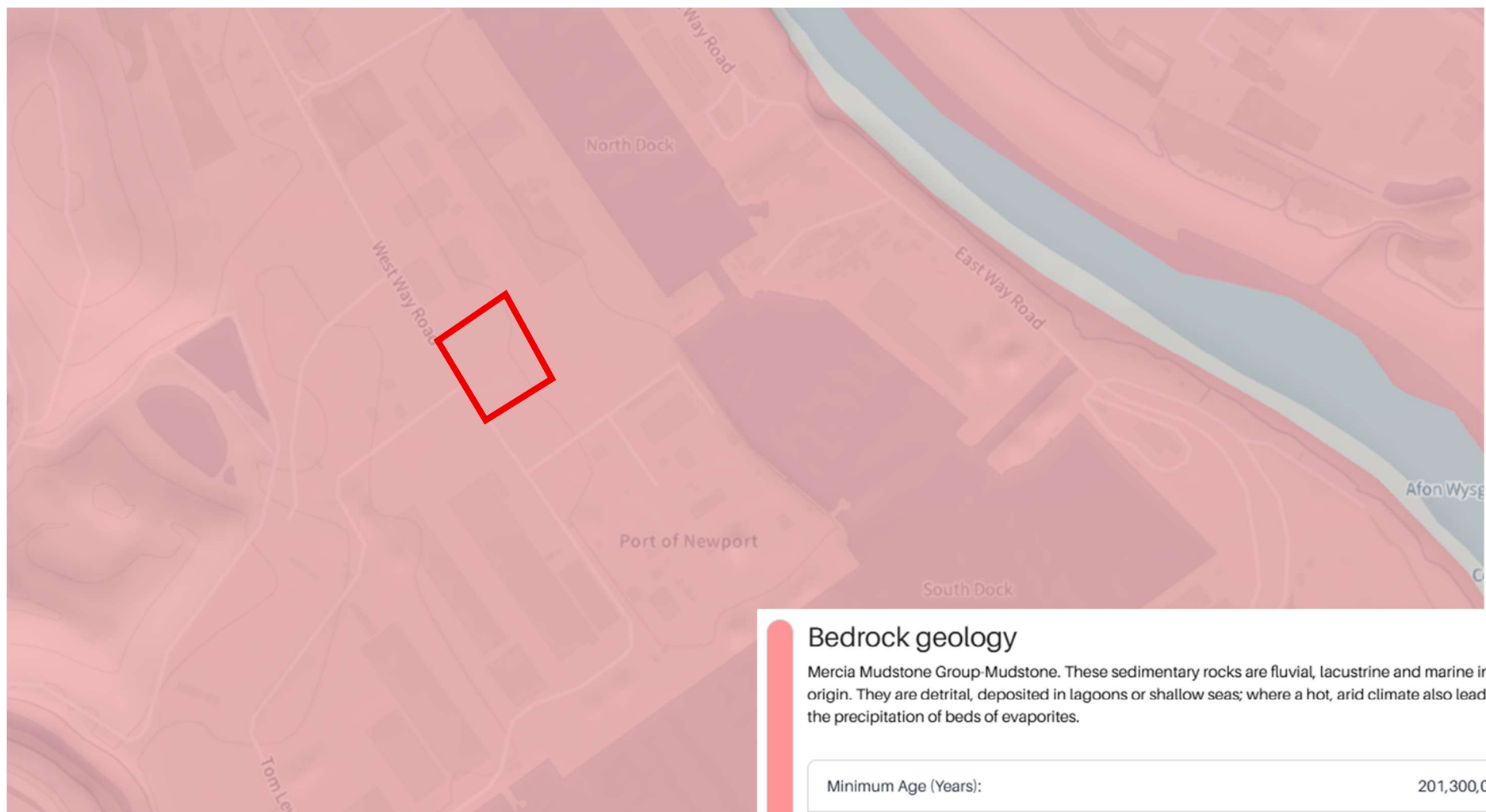
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status	drg. no.	rev.
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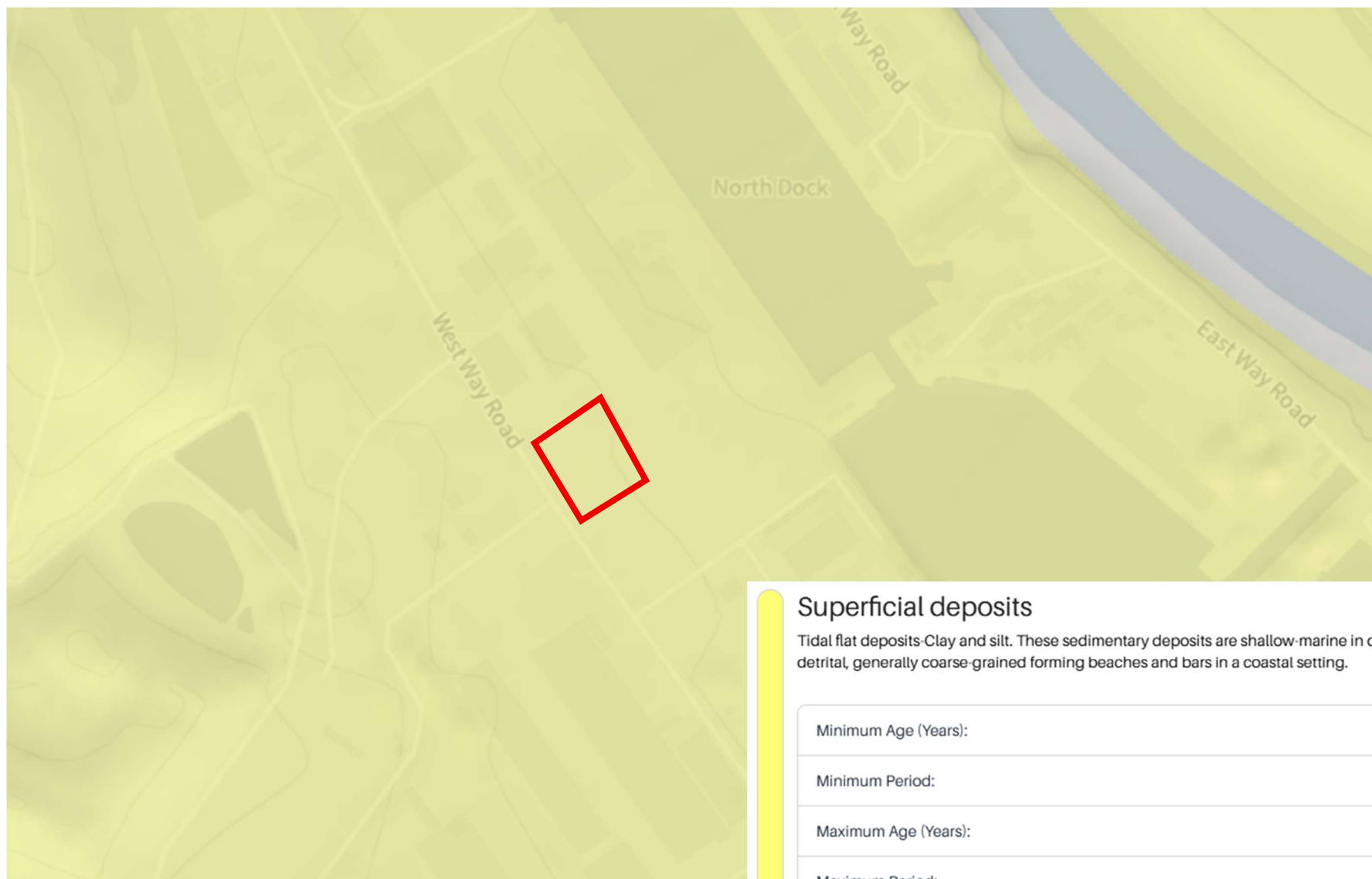
APPENDIX C:
BGS Records and NRW FMfP



Bedrock geology

Mercia Mudstone Group-Mudstone. These sedimentary rocks are fluvial, lacustrine and marine in origin. They are detrital, deposited in lagoons or shallow seas; where a hot, arid climate also leads to the precipitation of beds of evaporites.

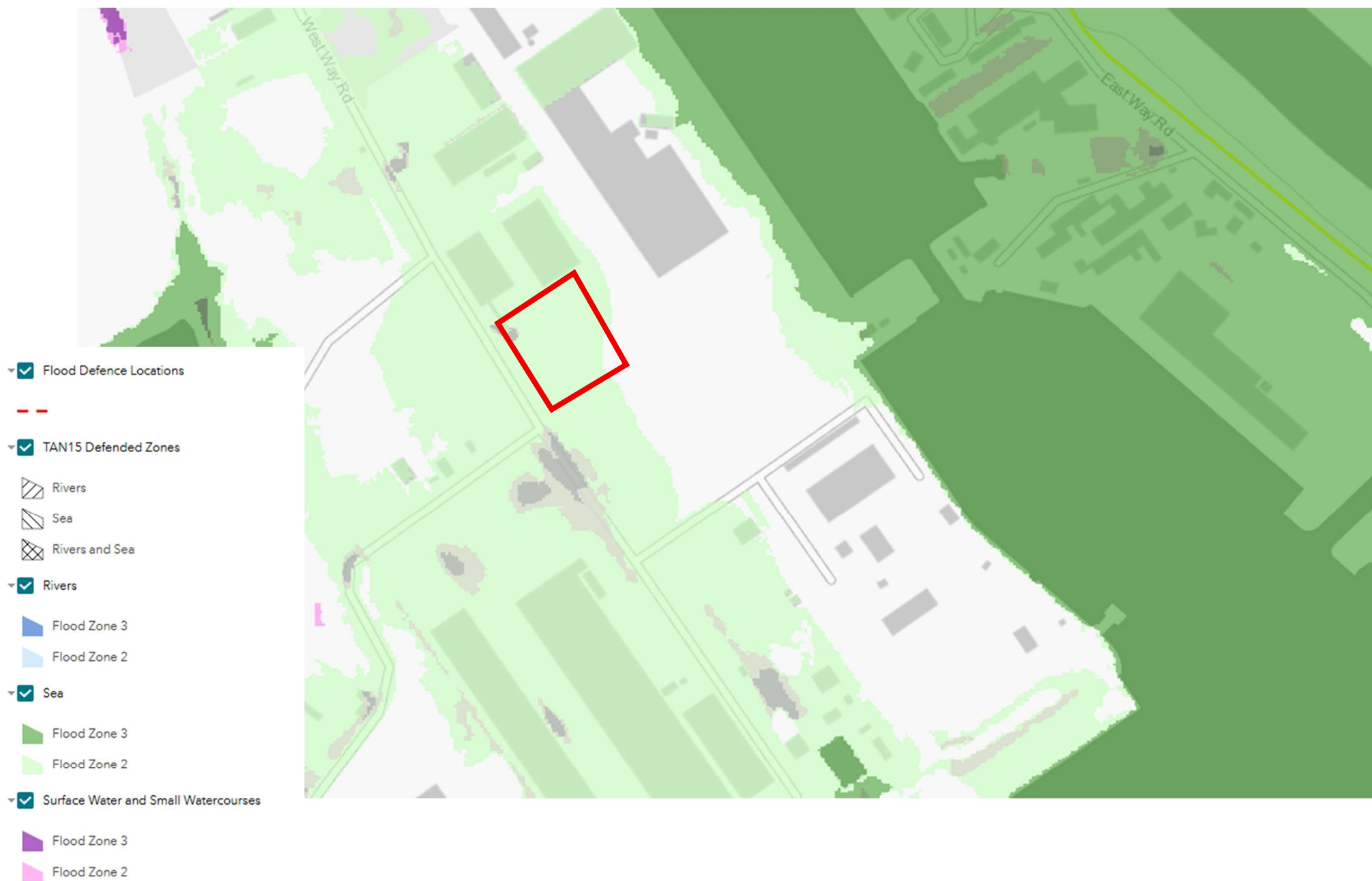
Minimum Age (Years):	201,300,000
Minimum Period:	Triassic
Maximum Age (Years):	247,100,000
Maximum Period:	Triassic
BGS Maps Portal Link:	View



Superficial deposits

Tidal flat deposits-Clay and silt. These sedimentary deposits are shallow-marine in origin. They are detrital, generally coarse-grained forming beaches and bars in a coastal setting.

Minimum Age (Years):	0
Minimum Period:	Quaternary
Maximum Age (Years):	2,588,000
Maximum Period:	Quaternary
BGS Maps Portal Link:	View





APPENDIX D: Design Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.026	5.00	9.700	1200	331500.943	185255.942	0.800
S2	0.026	5.00	9.300	1200	331469.128	185234.225	0.482
S3			9.440	1200	331480.882	185242.173	0.711
S4	0.125	5.00	9.550	1350	331494.622	185222.420	1.131
S5			9.490	1350	331531.775	185168.497	1.508
S6	0.125	5.00	10.340	1200	331530.882	185247.407	0.794
S7			10.440	1200	331568.043	185193.489	1.331
EX1			8.790	600	331499.315	185129.267	1.147

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.001	S1	S3	24.332	0.600	8.900	8.729	0.171	142.3	300	5.31	50.0
1.002	S2	S3	14.189	0.600	8.818	8.729	0.089	159.4	300	5.19	50.0
1.003	S3	S4	24.062	0.600	8.729	8.569	0.160	150.0	300	5.62	50.0
1.004	S4	S5	65.483	0.600	8.419	7.982	0.437	150.0	450	6.28	50.0
3.000	S6	S7	65.484	0.600	9.546	9.109	0.437	150.0	300	5.85	50.0
3.001	S7	S5	44.045	0.600	9.109	8.132	0.977	45.1	300	6.16	50.0
1.005	S5	EX1	50.918	0.600	7.982	7.643	0.339	150.0	450	6.79	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.001	1.316	93.0	4.7	0.500	0.411	0.026	0.0	45	0.694
1.002	1.242	87.8	4.7	0.182	0.411	0.026	0.0	47	0.666
1.003	1.281	90.6	9.4	0.411	0.681	0.052	0.0	65	0.835
1.004	1.657	263.6	32.0	0.681	1.058	0.177	0.0	105	1.136
3.000	1.281	90.6	22.6	0.494	1.031	0.125	0.0	102	1.069
3.001	2.347	165.9	22.6	1.031	1.058	0.125	0.0	74	1.656
1.005	1.657	263.6	54.6	1.058	0.697	0.302	0.0	138	1.319

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.001	24.332	142.3	300	Circular	9.700	8.900	0.500	9.440	8.729	0.411
1.002	14.189	159.4	300	Circular	9.300	8.818	0.182	9.440	8.729	0.411
1.003	24.062	150.0	300	Circular	9.440	8.729	0.411	9.550	8.569	0.681
1.004	65.483	150.0	450	Circular	9.550	8.419	0.681	9.490	7.982	1.058
3.000	65.484	150.0	300	Circular	10.340	9.546	0.494	10.440	9.109	1.031
3.001	44.045	45.1	300	Circular	10.440	9.109	1.031	9.490	8.132	1.058
1.005	50.918	150.0	450	Circular	9.490	7.982	1.058	8.790	7.643	0.697

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	S1	1200	Manhole	Adoptable	S3	1200	Manhole	Adoptable
1.002	S2	1200	Manhole	Adoptable	S3	1200	Manhole	Adoptable
1.003	S3	1200	Manhole	Adoptable	S4	1350	Manhole	Adoptable
1.004	S4	1350	Manhole	Adoptable	S5	1350	Manhole	Adoptable
3.000	S6	1200	Manhole	Adoptable	S7	1200	Manhole	Adoptable
3.001	S7	1200	Manhole	Adoptable	S5	1350	Manhole	Adoptable
1.005	S5	1350	Manhole	Adoptable	EX1	600	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	20.6
Rainfall Events	Singular	Drain Down Time (mins)	240	5 year (l/s)	33.5
Summer CV	1.000	Additional Storage (m³/ha)	20.0	Check Discharge Volume	x
Winter CV	1.000	Starting Level (m)			
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
5	0	0	0
30	0	0	0
100	40	0	0
200	40	0	0

Pre-development Discharge Rate

Site Makeup	Brownfield	Time of Concentration (mins)	5.00
Brownfield Method	MRM	Betterment (%)	0
Contributing Area (ha)	1.490	Q 2 year (l/s)	20.6
PIMP (%)	100	Q 5 year (l/s)	33.5
CV	1.000		

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	11	8.933	0.033	2.4	0.0582	0.0000	OK
15 minute summer	S2	10	8.852	0.034	2.4	0.0743	0.0000	OK
15 minute summer	S3	11	8.775	0.046	4.7	0.0524	0.0000	OK
15 minute summer	S4	11	8.492	0.073	15.6	0.2654	0.0000	OK
15 minute summer	S5	12	8.078	0.096	26.2	0.1377	0.0000	OK
15 minute summer	S6	11	9.621	0.075	11.5	0.3218	0.0000	OK
15 minute summer	S7	12	9.162	0.053	11.3	0.0594	0.0000	OK
15 minute summer	EX1	12	7.737	0.094	25.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.001	S3	2.3	0.461	0.025	0.1338	12.1
15 minute summer	S2	1.002	S3	2.3	0.460	0.027	0.0792	
15 minute summer	S3	1.003	S4	4.5	0.671	0.050	0.1627	
15 minute summer	S4	1.004	S5	15.5	0.802	0.059	1.3319	
15 minute summer	S5	1.005	EX1	25.9	1.066	0.098	1.2394	
15 minute summer	S6	3.000	S7	11.3	1.046	0.125	0.7207	
15 minute summer	S7	3.001	S5	10.9	1.336	0.066	0.3605	

Results for 5 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	8.953	0.053	6.6	0.0948	0.0000	OK
15 minute summer	S2	10	8.873	0.055	6.6	0.1212	0.0000	OK
15 minute summer	S3	11	8.808	0.079	13.0	0.0888	0.0000	OK
15 minute summer	S4	11	8.541	0.122	43.9	0.4439	0.0000	OK
15 minute summer	S5	11	8.150	0.168	75.0	0.2405	0.0000	OK
15 minute summer	S6	10	9.674	0.128	31.8	0.5499	0.0000	OK
15 minute summer	S7	11	9.199	0.090	31.4	0.1016	0.0000	OK
15 minute summer	EX1	12	7.803	0.160	73.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.001	S3	6.5	0.589	0.070	0.2798	33.3
15 minute summer	S2	1.002	S3	6.5	0.582	0.074	0.1655	
15 minute summer	S3	1.003	S4	12.9	0.901	0.142	0.3443	
15 minute summer	S4	1.004	S5	43.7	1.022	0.166	2.8997	
15 minute summer	S5	1.005	EX1	73.6	1.424	0.279	2.6558	
15 minute summer	S6	3.000	S7	31.4	1.371	0.346	1.5128	
15 minute summer	S7	3.001	S5	31.2	1.796	0.188	0.7655	

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	8.969	0.069	11.0	0.1221	0.0000	OK
15 minute summer	S2	10	8.890	0.072	11.0	0.1586	0.0000	OK
15 minute summer	S3	11	8.833	0.104	21.7	0.1171	0.0000	OK
15 minute summer	S4	10	8.580	0.161	73.6	0.5857	0.0000	OK
15 minute summer	S5	11	8.210	0.228	125.6	0.3266	0.0000	OK
15 minute summer	S6	10	9.719	0.173	52.9	0.7395	0.0000	OK
15 minute summer	S7	11	9.228	0.119	52.1	0.1345	0.0000	OK
15 minute summer	EX1	11	7.857	0.214	125.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.001	S3	10.8	0.667	0.116	0.4073	55.5
15 minute summer	S2	1.002	S3	10.9	0.650	0.124	0.2413	
15 minute summer	S3	1.003	S4	21.7	1.037	0.239	0.5027	
15 minute summer	S4	1.004	S5	73.3	1.150	0.278	4.2829	
15 minute summer	S5	1.005	EX1	125.4	1.622	0.476	3.9495	
15 minute summer	S6	3.000	S7	52.1	1.551	0.575	2.2077	
15 minute summer	S7	3.001	S5	52.3	2.062	0.315	1.1171	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	8.991	0.091	19.2	0.1625	0.0000	OK
15 minute summer	S2	10	8.918	0.100	19.2	0.2202	0.0000	OK
15 minute summer	S3	11	8.872	0.143	38.1	0.1612	0.0000	OK
15 minute summer	S4	10	8.639	0.220	129.2	0.8003	0.0000	OK
15 minute summer	S5	11	8.316	0.334	219.8	0.4784	0.0000	OK
15 minute summer	S6	10	9.806	0.260	92.4	1.1135	0.0000	OK
15 minute summer	S7	11	9.271	0.162	90.9	0.1830	0.0000	OK
15 minute summer	EX1	11	7.949	0.306	219.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.001	S3	19.0	0.763	0.205	0.6175	96.8
15 minute summer	S2	1.002	S3	19.1	0.727	0.217	0.3756	
15 minute summer	S3	1.003	S4	38.0	1.199	0.420	0.7633	
15 minute summer	S4	1.004	S5	128.9	1.307	0.489	6.6059	
15 minute summer	S5	1.005	EX1	219.5	1.830	0.833	6.1342	
15 minute summer	S6	3.000	S7	90.9	1.725	1.004	3.3923	
15 minute summer	S7	3.001	S5	91.7	2.238	0.553	1.8525	

Results for 200 year +40% CC Critical Storm Duration. Lowest mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	8.997	0.097	21.4	0.1719	0.0000	OK
15 minute summer	S2	10	8.925	0.107	21.4	0.2356	0.0000	OK
15 minute summer	S3	11	8.881	0.152	42.5	0.1720	0.0000	OK
15 minute summer	S4	10	8.653	0.234	144.1	0.8532	0.0000	OK
15 minute summer	S5	11	8.340	0.358	240.4	0.5123	0.0000	OK
15 minute summer	S6	11	9.909	0.363	103.1	1.5536	0.0000	SURCHARGED
15 minute summer	S7	10	9.276	0.167	95.2	0.1884	0.0000	OK
15 minute summer	EX1	11	7.969	0.326	238.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.001	S3	21.2	0.782	0.228	0.6697	108.0
15 minute summer	S2	1.002	S3	21.2	0.741	0.242	0.4101	
15 minute summer	S3	1.003	S4	42.4	1.231	0.468	0.8282	
15 minute summer	S4	1.004	S5	144.3	1.337	0.547	7.1081	
15 minute summer	S5	1.005	EX1	238.7	1.850	0.905	6.5754	
15 minute summer	S6	3.000	S7	95.2	1.734	1.051	3.6206	
15 minute summer	S7	3.001	S5	96.1	2.306	0.579	2.0040	



APPENDIX E:
Management & Maintenance Plan

Vale Consultancy

CONSULTING CIVIL & STRUCTURAL ENGINEERS

MANAGEMENT & MAINTENANCE PLAN

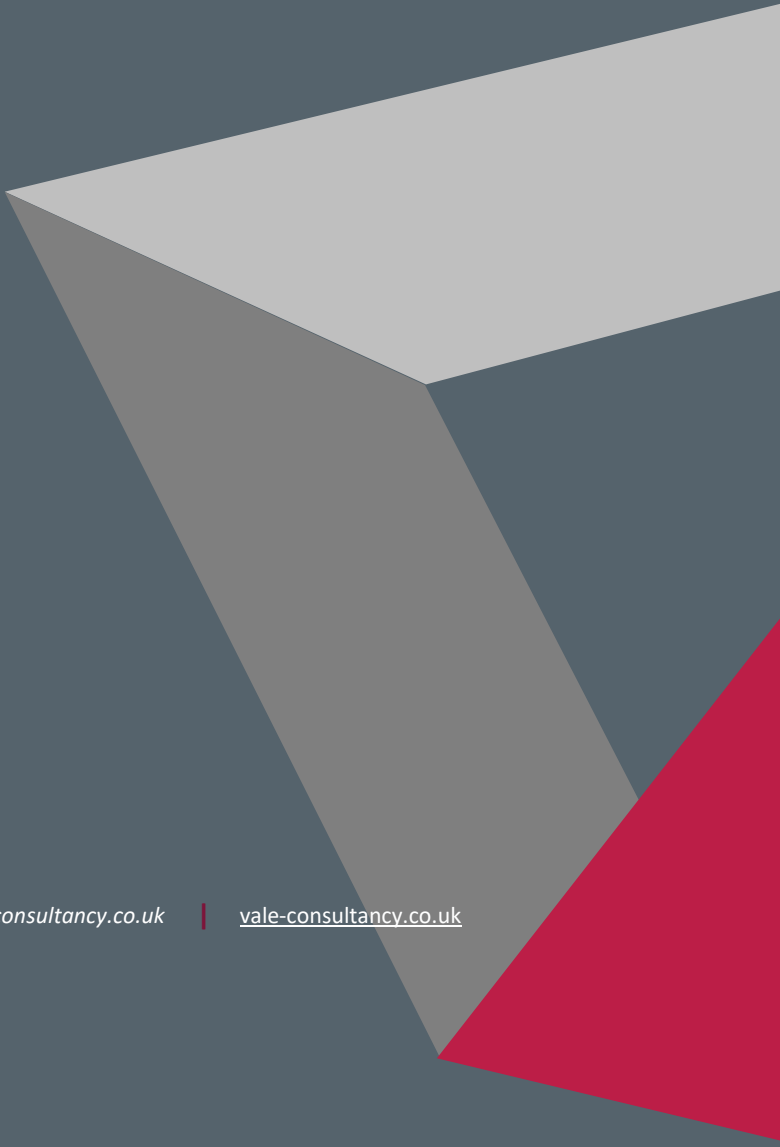
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DOCUMENT CONTROL

Project:	Portal Frames, Paller Recycling Centre, Newport
Client:	ASR
Vale Consultancy Ref:	23171

Issue	Prepared by	Approved by	Date	Status
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CONTENTS

1	INTRODUCTION.....	3
2	MANAGEMENT RESPONSIBILITIES.....	3
3	MANAGEMENT OBJECTIVES.....	3
4	INSPECTION AND MAINTENANCE ACCESS	3
5	MAINTENANCE VISITS OR INSPECTIONS	4
6	GENERAL.....	4
7	LITTER COLLECTION	4
8	ORNAMENTAL PLANTING.....	5
9	TRADITIONAL DRAINAGE	6
10	SUMMARY OF INSPECTION AND MAINTENANCE FOR SUDS.....	6
11	LIFETIME MANAGEMENT AND MAINTENANCE COSTS FOR SUDS.....	8



1 INTRODUCTION

- 1.1 This SuDS Management and Maintenance Plan has been prepared by Vale Consultancy in support of a SuDS scheme for the proposed development at Pallet Recycling Centre, West Way Road, Newport NP20 2RZ.
- 1.2 The intention of the proposed project is to construct 2 portal frame units used for pallet storage and manufacturing, whilst also incorporating SuDS features such as raised planters to increase biodiversity and amenity.
- 1.3 The scheme incorporates a sustainable drainage system for surface water runoff, which consists of Raised Planters (SuDSPlanters)
- 1.4 The method for disposal of surface water runoff is to discharge to Alexandra Docks via an existing connection.
- 1.5 The purpose of this document is to set out the overall management and maintenance objectives for the proposed SuDS components and to describe the long-term maintenance required to allow the system to continue operating as is intended.
- 1.6 All references to SuDS components are based on the SAB submission drawings:

- **23171_500 – Drainage Layout**
- **23171_501 – Exceedance Flow and Catchment Area Plan**
- **23171_502 – Drainage Details**

2 MANAGEMENT RESPONSIBILITIES

- 2.1 The current site owner(s) shall be responsible for the implementation of the Management and Maintenance Plan. If deemed necessary, all maintenance operations shall be undertaken by suitable and qualified contractor appointed by the site owner.
- 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

- 3.1 The site shall be managed and maintained as an attractive, tidy, and safe finish to all landscape elements.
- 3.2 The proposed planting shall enhance the biodiversity and nature conservation interests.
- 3.3 The Site Owner(s) shall ensure establishment and long-term health of all landscape elements for the benefit of the tenants and visual amenity of the area.
- 3.4 Best Health & Safety practices shall always be used.
- 3.5 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.

4 INSPECTION AND MAINTENANCE ACCESS

- 4.1 Access to the site(s) for inspection and maintenance can be gained via West Way Road.
- 4.2 Maintenance vehicles can park on site for maintenance of the various SuDS features as required.



5 MAINTENANCE VISITS OR INSPECTIONS

- 5.1 The Site Owner or appointed maintenance contractor shall carry out a minimum of 12 maintenance visits or inspections per year to check drainage SuDS components. Visits shall be monthly. Additional visits may be needed to deal with extreme weather conditions or specific horticultural requirements.

6 GENERAL

- 6.1 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.
- 6.2 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.
- 6.3 The Site Owner and their appointed contractors shall comply with all relevant Health and Safety regulations and good working practices.
- 6.4 The Site Owner 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.
- 6.5 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.

7 LITTER COLLECTION

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



8 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:

- 8.1 All shrub beds in the SuDSPlanters 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.
- 8.2 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.
- 8.3 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.
- 8.4 Pruning of herbaceous planting:
- 8.5 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.
 - If necessary, 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.
- 8.6 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



9 TRADITIONAL DRAINAGE

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

10 SUMMARY OF INSPECTION AND MAINTENANCE FOR SUDS

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

10.2 General

Operation and maintenance requirements for traditional drainage components		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspection of traditional drainage including rainwater pipes, channel drains, gullies and inspection chambers (as applicable).	Bi-annually
	Remove litter or build-up of foliage	Bi-annually (or as required)
Occasional maintenance	Clear channel drains and gullies of silt build up	Every 5 years (or as required)
Remedial Actions	Jet/vac inspection chambers and below ground pipework when blocked or performance is affected due to partial blockages	Every 20 years (or as required)



10.3 Bioretention areas (SuDSPlanters)

Operation and maintenance requirements for Bioretention Raingardens		
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



11 LIFETIME MANAGEMENT AND MAINTENANCE COSTS FOR SUDS

11.1 Lifetime management and maintenance costs have been broken down for each SuDS drainage system. Costs are based on a 60-year design life.

11.2 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 10, as follows:

11.3 General

- General monthly inspection by the site owner (incl. litter removal) – no cost as is incorporated in general site maintenance undertaken by site owner
- Biannual check of traditional drainage - no cost as is incorporated in general site maintenance undertaken by site owner
- Annual check of flow control chamber - no cost as is incorporated in general site maintenance undertaken by site owner

11.4 Bioretention areas (SuDSPlanters)

- Annual inspection - no cost as is incorporated in general site maintenance undertaken by site owner.
- Annual pruning/fertilising - no cost as is incorporated in general site maintenance undertaken by site owner.
- Plant replacement over 60 years, assuming 10% of plants need to be replaced each year with Meadowmat SuDS & Slopes seed mix (10% of 40 m² = 4 m²) @ £2 / m² / year - £480

11.5 The total sum of management and maintenance costs for the proposed SuDS over a 60-year design life - £480 or circa £8 a year.

