



Development • Planning • Environment

MARGAM GREEN ENERGY PLANT

EQUIPMENT STORAGE BUILDING,

HEOLCAE'R-BONT, MARGAM

DRAINAGE ASSESSMENT

Final Report v1.1

June 2020

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Report Title	Margam Green Energy Plant Equipment Storage Building, Heolcae'r-Bont, Margam Drainage Assessment Final Report v1.1
Client	Axis PED Ltd
Date of issue	9 June 2020

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1 INTRODUCTION

1.1 PURPOSE OF REPORT

Weetwood Services Ltd ('Weetwood') has been instructed by Axis PED Ltd to prepare a Drainage Assessment (DA) report to accompany a full planning application for the proposed construction of an equipment storage building at the existing Margam Green Energy Plant off Heolcae'r-Bont, Margam.

This report provides an overview of the existing surface water drainage arrangements at the site and presents a strategy for managing this following development.

The assessment has been undertaken in accordance with the requirements of Technical Advice Note 15 (TAN15) and the Statutory Standards for Sustainable Drainage Systems.

1.2 STRUCTURE OF THE REPORT

The report is structured as follows:

Section 1	Introduction and report structure
Section 2	Presents national and local drainage planning policy
Section 3	Provides background information relating to the development site, the development proposals, ground conditions and existing site access arrangements
Section 4	Addresses the effect of the proposed development on surface water runoff and presents an illustrative surface water drainage scheme to ensure that surface water runoff is sustainably managed and flood risk is not increased elsewhere.
Section 5	Presents a summary of key findings

2 PLANNING POLICY AND GUIDANCE

2.1 NATIONAL PLANNING POLICY AND GUIDANCE

2.1.1 Technical Advice Note 15

TAN15 provides an overview of the requirements for the management of surface water to ensure that development does not increase flood risk at the site or elsewhere.

Paragraph 8.3 of TAN15 states that *“the aim should be for new development not to create additional run-off when compared with the undeveloped situation, and for redevelopment to reduce runoff where possible. It is accepted that there may be practical difficulties in achieving this aim”*.

2.1.2 Welsh Government

From 7 January 2019, the Flood and Water Management Act 2010 (Schedule 3) requires new developments to include Sustainable Drainage Systems (SuDS) features that comply with national standards¹.

New developments of more than one dwelling or where the area covered by construction work equals or exceeds 100 m² require approval before construction can commence from the SuDS Approval Body (SAB) to ensure compliance with the SuDS standards.

The SAB is also required to adopt any SuDS features unless the scheme serves only a single property or is a publicly maintained road to which Section 41 of the Highways Act 1980 applies.

The statutory standards are as follows:

Standard S1; Surface water runoff destination

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

Standard S2; Surface water runoff hydraulic control

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

¹ <https://gov.wales/sites/default/files/publications/2019-06/statutory-national-standards-for-sustainable-drainage-systems.pdf>

6. Drainage design proposals should be examined for the likelihood and consequences of any potential failure scenarios (e.g. structural failure or blockage), and the associated flood risks managed where possible.

Standard S3; Surface water quality management

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

Standard S4; Amenity

The design of surface water management systems should maximise amenity benefits.

Standard S5; Biodiversity

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

Standard S6; Design of drainage or construction, operation and maintenance

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

2.2 LOCAL PLANNING POLICY AND GUIDANCE

2.2.1 Local Development Plan (2011-2026), January 2016

Neath Port Talbot County Borough Council (NPTCBC) Local Development Plan was adopted in January 2016 and provides the basis for decisions on land use planning in the County Borough up to 2026.

The following policies are relevant in respect of drainage:

Policy BE1; Design

All development proposals will be expected to demonstrate high quality design which fully takes into account the natural, historic and built environmental context and contributes to the creation of attractive, sustainable places.

Proposals will only be permitted where all of the following criteria, where relevant, are satisfied:

9. Its drainage systems are designed to limit surface water run-off and flood risk and prevent pollution.

2.3 CONSENTS

An Environmental Permit for Flood Risk Activities may be required from the Natural Resources Wales (NRW) for work:

- In, under, over or near a main river (including where the river is in a culvert)
- On or near a flood defence on a main river
- In the flood plain of a main river
- On or near a sea defence

Further information can be found at <https://naturalresources.wales/apply-for-a-permit/flood-risk-activities/flood-risk-activity-permits-information/?lang=en>.

If the location of an activity is on any watercourse that lies within an Internal Drainage District (IDD) an application will need to be made to NRW for a Flood Risk Activity Permit.

Ordinary Watercourse Consent may be required from the lead local flood authority for work to an ordinary watercourse. Undertaking activities controlled by local Byelaws (made under the Water Resources Act 1991) also requires the relevant consent.

2.1 RELEVANT DOCUMENTS

The assessment has been informed by the following documents:

- Building Regulations, 2000 – Drainage and Waste Disposal, Approved Document Part H
- BS EN 12056-2:2000 - Gravity Drainage Systems Inside Buildings. Sanitary Pipework, Layout and Calculation
- BS EN 752:2008 - Drain and Sewer Systems Outside Buildings
- The SuDS Manual (C753), CIRIA, November 2015
- Statutory Standards for Sustainable Drainage, Welsh Government, 2018

3 SITE DETAILS AND PROPOSED DEVELOPMENT

3.1 SITE LOCATION

The approximately 2.88 hectare (ha) site is located to the north of Heolcae'r-Bont at Ordnance Survey National Grid Reference SS 789 863, as shown in **Figure 1**.

The development area (hereafter referred to as “the site”) equates to a much smaller area of approximately 0.11 ha.

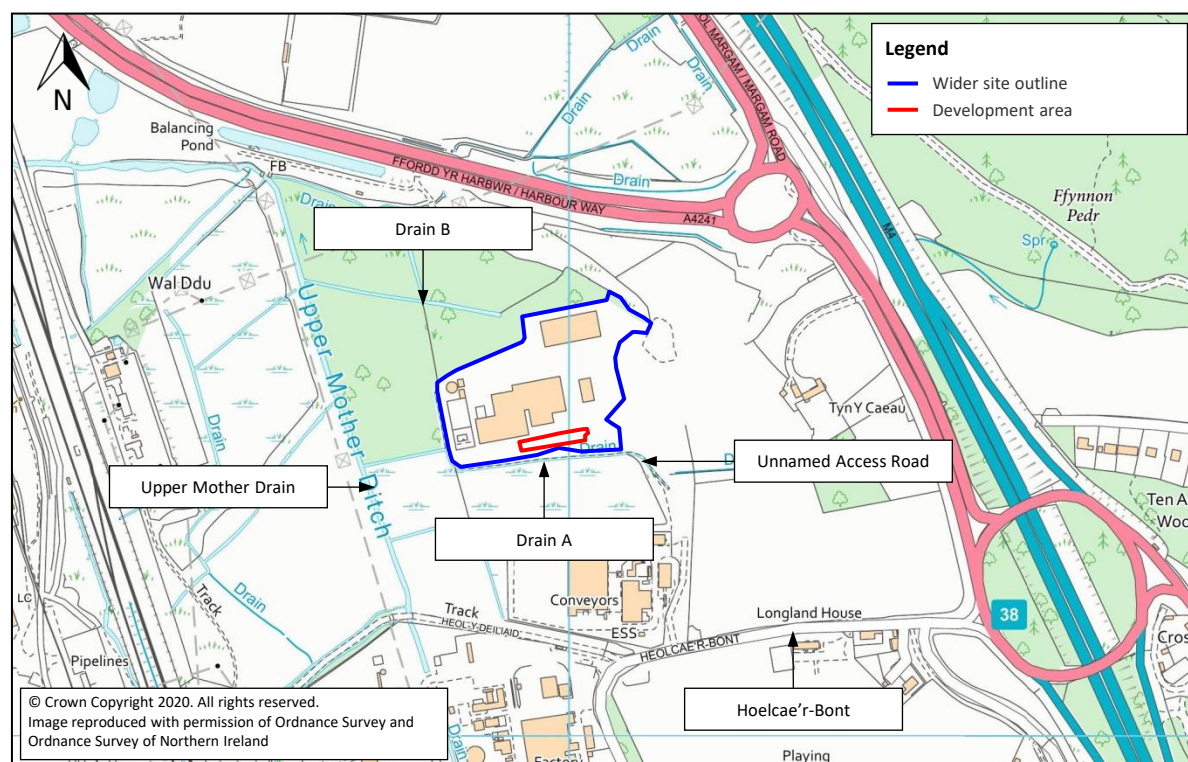


Figure 1: Site Location

3.2 EXISTING AND PROPOSED DEVELOPMENT

The wider site currently comprises the existing Margam Green Energy Plant with associated infrastructure, access and hardstanding areas.

The proposed development is for the construction of an equipment storage building with associated infrastructure, access and hardstanding areas. The proposed equipment storage building will be located in the southern portion of the wider site, adjacent to the southern boundary. The location of the proposed equipment storage building comprises an existing area of hardstanding used for open storage.

The proposed site layout is provided in **Appendix A**.

3.3 WATERBODIES IN THE VICINITY OF THE SITE

The locations of waterbodies within the site's vicinity are shown in **Figure 1**.

Drain A is located adjacent to the southern boundary of the site and flows in westerly direction.

Drain B is located approximately 137 metres (m) north of the site and flows in north-westerly direction.

Upper Mother Drain is located approximately 174 m west of the site and flows in a north-westerly direction.

Drain A, B and Upper Mother Drain are each classified as an 'ordinary watercourse'.

3.4 GROUND CONDITIONS

A Supplementary Geotechnical Assessment report (May 2016) has been produced for the wider site by MLM Consulting Ltd supplemented by exploratory borehole sampling undertaken in March 2016.

This indicates the presence of made ground/lime treated layer to approximately 1.5 m below ground level (bgl), underlain by peat and glacial clay. Groundwater seepages were encountered during fieldwork in the majority of boreholes, at depths ranging from near ground level to 21.5 m bgl. During post-fieldwork monitoring, groundwater levels were recorded at ground level.

BGS Surface Geology mapping² indicates the underlying bedrock formation comprises 'South Wales Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone', which is overlain by 'Tidal Flat Deposits - Clay, Silt And Sand' superficial deposits.

The site is not shown to be located within a designated Groundwater Source Protection Zone.

3.5 SITE LEVELS

In the absence of a topographic survey, LiDAR data has been used to develop a digital elevation model of the site as illustrated in **Figure 2**.

Ground levels in the location of the proposed new equipment storage building are shown to be in the region of 6.04 to 8.55 m Above Ordnance Datum (AOD).

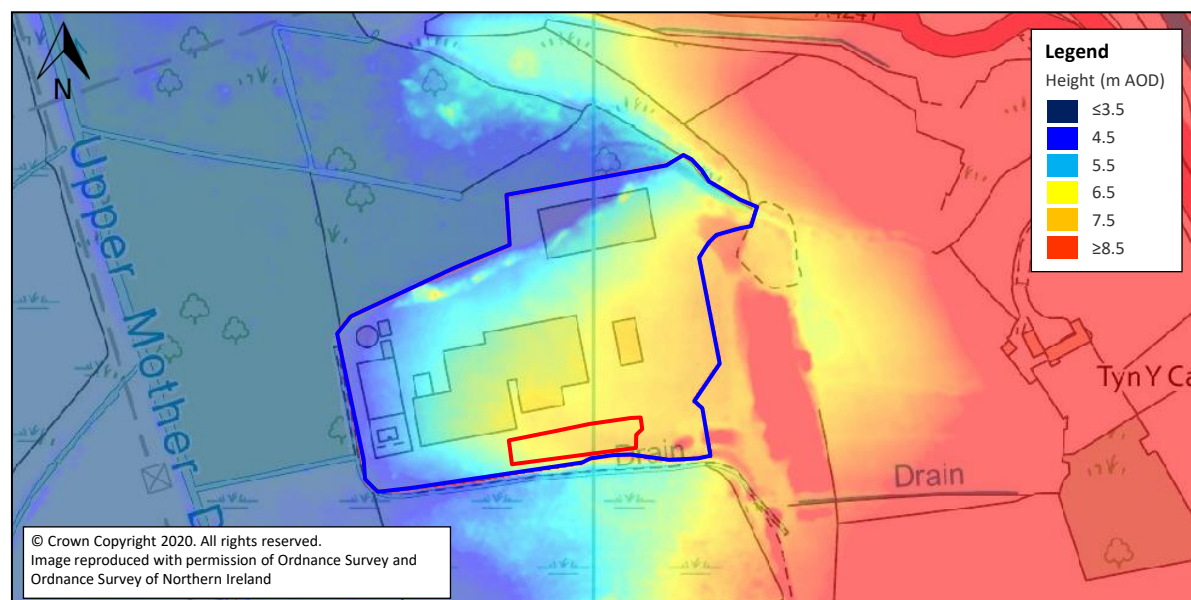


Figure 2: LiDAR

² <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

4 SURFACE WATER MANAGEMENT

4.1 SURFACE WATER DRAINAGE AT THE EXISTING SITE

The wider site is served by an existing surface water drainage system which discharges to Drain A (see **Appendix B**).

The proposed development area currently comprises an existing area of hardstanding/crushed stone that does not form part of the wider site surface water drainage system and surface water would therefore be expected to runoff into Drain A via overland flow.

The existing drainage system will continue to serve the wider site post-development; however, it is not considered appropriate to utilise the existing drainage system at the site for the proposed new development area. The following sections of this report will focus on the proposed development area of the site only.

4.1.1 Existing Runoff Rates

The proposed development area (refer to **Figure 3**) is 0.11 ha in area and is considered to be entirely impermeable based on satellite imagery.

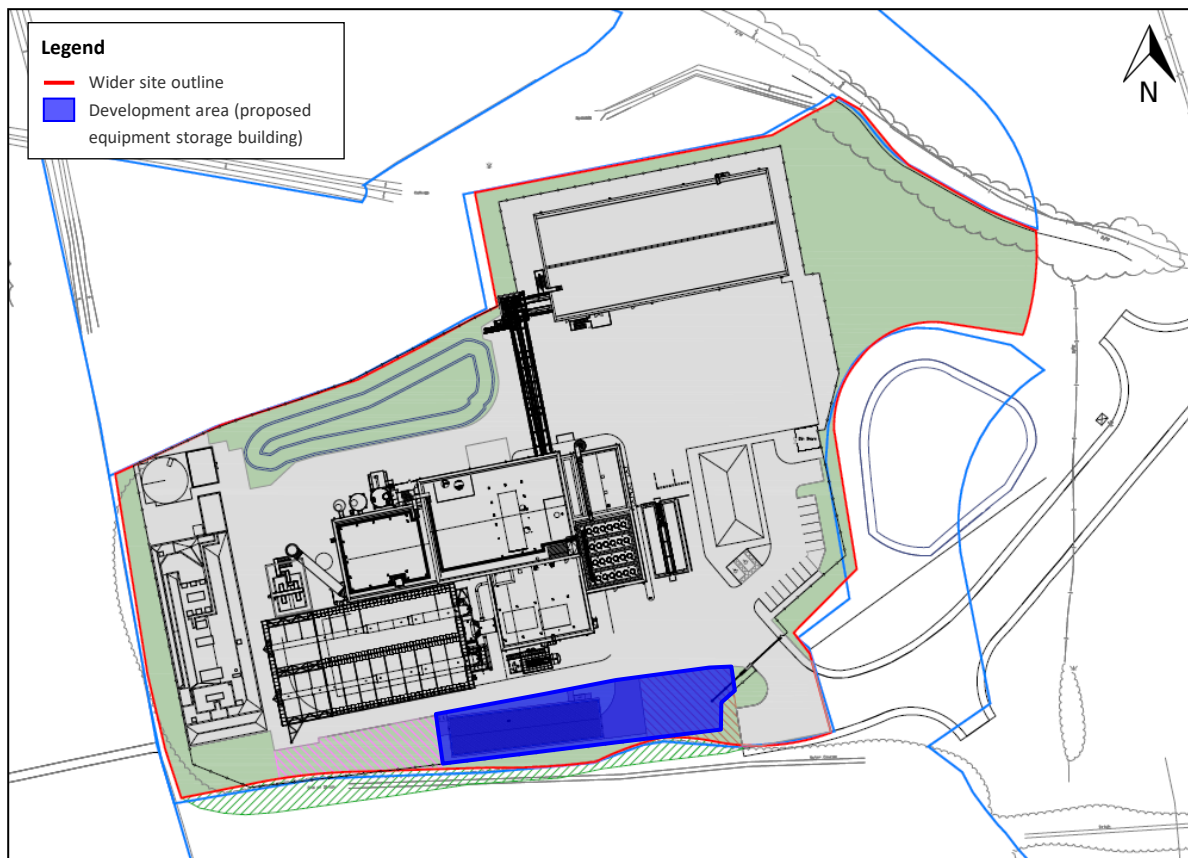


Figure 3: Development Area

The rates of discharge from the existing impermeable surfaces within the development area have been calculated using the Modified Rational Method (MRM) (**Appendix C**) and the results are summarised in **Table 1**.

For completeness, the existing greenfield runoff rates per ha have been provided in **Appendix D**, which can be adjusted pro rata.

Table 1: Peak Runoff Rate - Existing Site

Return Period	MRM Peak Flow Rate (l/s)
1:1	4.4
1:2	5.7
1:30	10.7
1:100	13.7

4.2 SURFACE WATER DRAINAGE AT THE REDEVELOPED SITE

4.2.1 Disposal of Surface Water (Standard S1)

In accordance with Welsh Government guidance, surface water runoff should be disposed of according to the following hierarchy: Rainwater collected for use; Into the ground (infiltration); To a surface water body; To a surface water sewer or highway drain; To a combined sewer.

Given that the development proposals are for the construction of an equipment storage building, collection of rainwater for use is not considered to be appropriate in this instance. Therefore, Priority Level 1 has been discounted for the disposal of surface water.

As detailed in **Section 3.4**, the site is underlain by soils with impeded drainage, with groundwater recorded at ground level in parts of the site. As such the disposal of surface water via infiltration (Priority Level 2) is unlikely to be feasible and has therefore been discounted.

It is subsequently proposed to direct surface water runoff from the proposed development to Drain A (Priority Level 3), utilising a standalone system which will be separate to the existing surface water drainage network serving the wider site.

4.2.2 Post Development Impermeable Area

The area of proposed impermeable surfaces within the development has been estimated to be 0.06 ha, based on **Appendix A**.

4.2.3 Peak Flow Control (Standard S2)

Paragraph G2.24 of the Statutory Standards for Sustainable Drainage Systems states that '*for previously developed sites, site runoff rates should be reduced to the greenfield rates wherever possible*' with betterment of at least 30% considered as a minimum requirement.

Ideally, the proposed discharge rate would be limited to existing greenfield runoff rates; however, in this instance the discharge rates would be extremely low and would significantly increase the risk of blockage of the drainage system. As such, surface water runoff from the development area will be limited so far as is reasonably practicable to a rate of 3.5 l/s, which is the lowest discharge rate considered feasible without significantly increasing the risk of blockage to the drainage system. This flow rate would apply in up to the 1:100 annual probability storm event, including an allowance for climate change. This provides significant betterment when compared to the existing rates presented in **Table 1**.

4.2.4 Volume Control (Standard S2)

The volume of runoff is not expected to increase following development given that impermeable areas at the site will not be increasing. Irrespective, discharge rates are to be reduced so far as reasonably practicable.

4.2.5 Attenuation Storage

Attenuation storage will be provided to restrict surface water runoff generated across roofs and hardstanding.

The attenuation storage facility has been modelled using the Detailed Design module of MicroDrainage Source Control (**Appendix E**). The required storage volume has been sized to store the 1:100 annual probability rainfall event including a 30% increase in rainfall intensity in order to allow for climate change.

To ensure that flooding does not occur for the 1:100 +CC (30%) annual probability event, a total storage volume of 12.38 m³ would be required based on a peak discharge rate of 3.5 l/s. The required surface water storage volume for the site may be provided via a combination of the on site pipe network system (1.70 m³) and an attenuation basin (10.68 m³, detailed below).

The basin would have a base area of approximately 8.10 m² (base invert at 6.22 m AOD), 1 in 3 side slopes and a bank top of 7.02 m AOD. This basin would fill to a depth of 6.72 m AOD providing a minimum 300 mm freeboard. The volume of storage provided in the attenuation basin is approximately 10.68 m³. The maximum capacity of the basin is 23.85 m³ to top of bank level.

4.2.6 Preliminary Surface Water Drainage Layout

A preliminary surface water drainage layout is provided in **Appendix F**.

4.2.7 Exceedance Routes

Flows resulting from rainfall in excess of the 1:100 annual probability rainfall event including an allowance for climate change will be expected to flow directly into Drain A to the south of the building or into the proposed attenuation basin where additional storage capacity should be available.

4.2.8 Water Quality and Pollution Control (Standard S3)

The CIRIA SuDS Manual³ identifies other roofs (typically commercial/industrial roofs) and low traffic roads as having a low pollution hazard level.

Table 26.2 of the CIRIA SuDS Manual 2015 indicates that the pollution hazard indices associated with such uses for total suspended solids, hydrocarbons and metals are 0.50, 0.40 and 0.40 respectively.

Table 26.3 of the CIRIA SuDS Manual 2015 indicates that the SuDS mitigation indices for attenuation basins for total suspended solids, hydrocarbons and metals are 0.50, 0.50 and 0.60 respectively. As such, the proposed drainage system would incorporate adequate water quality treatment.

4.2.9 Amenity and Biodiversity (Standard S4 and Standard S5)

As discussed in **Section 4.2.5**, an attenuation basin is proposed on site. Attenuation basins are normally dry. However, basins can also be mixed, including both a permanently wet area for wildlife or treatment of the runoff and an area that is usually dry to cater for flood attenuation⁴.

Furthermore, the proposed layout includes landscaped areas in a number of locations which will provide aesthetic benefits, along with a wet grassland mix which would be suitable for occasional inundation.

It is generally recommended that native vegetation is used to maximise the biodiversity value of these areas. However, it may be valuable to include some non-native vegetation to support pollinators, such as butterflies and bees.

³ Table 26.2

⁴ https://www.susdrain.org/delivering-suds/using-suds/suds-components/retention_and_detention/Detention_basins.html

Furthermore, the implementation of soft landscaping will help provide users of the site with health and wellbeing benefits.

4.2.10 Maintenance of SuDS (Standard S6)

The pipe network and SuDS elements within the curtilage of the site will remain private and be maintained by the landowner.

An indicative maintenance schedule is presented in **Table 2**.

Table 2: Maintenance Requirements

Schedule	Required action	Frequency
Attenuation Basin		
Regular maintenance	Remove litter and debris	Monthly
	Cut grass	Monthly during grow season Or as required)
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly for first year, then annually or as required
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets/outlets	Annually (or as required)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every two years, or as required
	Remove sediments from inlets/outlets and main basin when required	
Remedial actions	Repair erosion or other damage by reseedling or re-turfing	As required
	Realignment of rip-rap	
	Repair/rehabilitation of inlets/outlets	
	Relevel uneven surface and reinstate design levels	

4.2.11 Summary

The purpose of this report is to demonstrate that a surface water drainage strategy is feasible for the site given the development proposals and the land available. The proposals provide the opportunity for the inclusion of SuDS elements, ensuring that there will be no increase in surface water runoff from the proposed development. The storage calculations may be refined at the detailed design stage and a final decision made on the types of storage to be provided.

5 SUMMARY

This DA has been prepared on behalf of Axis PED Ltd and relates to development at the Margam Green Energy Plant.

A summary of the key findings is presented below:

Surface Water

- Disposal of surface water by infiltration is not expected to be feasible due to ground conditions. Surface water runoff from the development area will therefore be directed to Drain A to the south of the site.
- Surface water runoff from the redeveloped site is to be restricted to 3.5 l/s in up to the 1:100 annual probability event, including an allowance for climate change and as such will provide betterment when compared to the existing situation.
- To ensure that flooding does not occur for the 1:100 +CC (30%) annual probability event, a total storage volume of 12.38 m³ would be required based on a peak discharge rate of 3.5 l/s. The required surface water storage volume for the site may be provided via a combination of the on site pipe network and an attenuation basin.

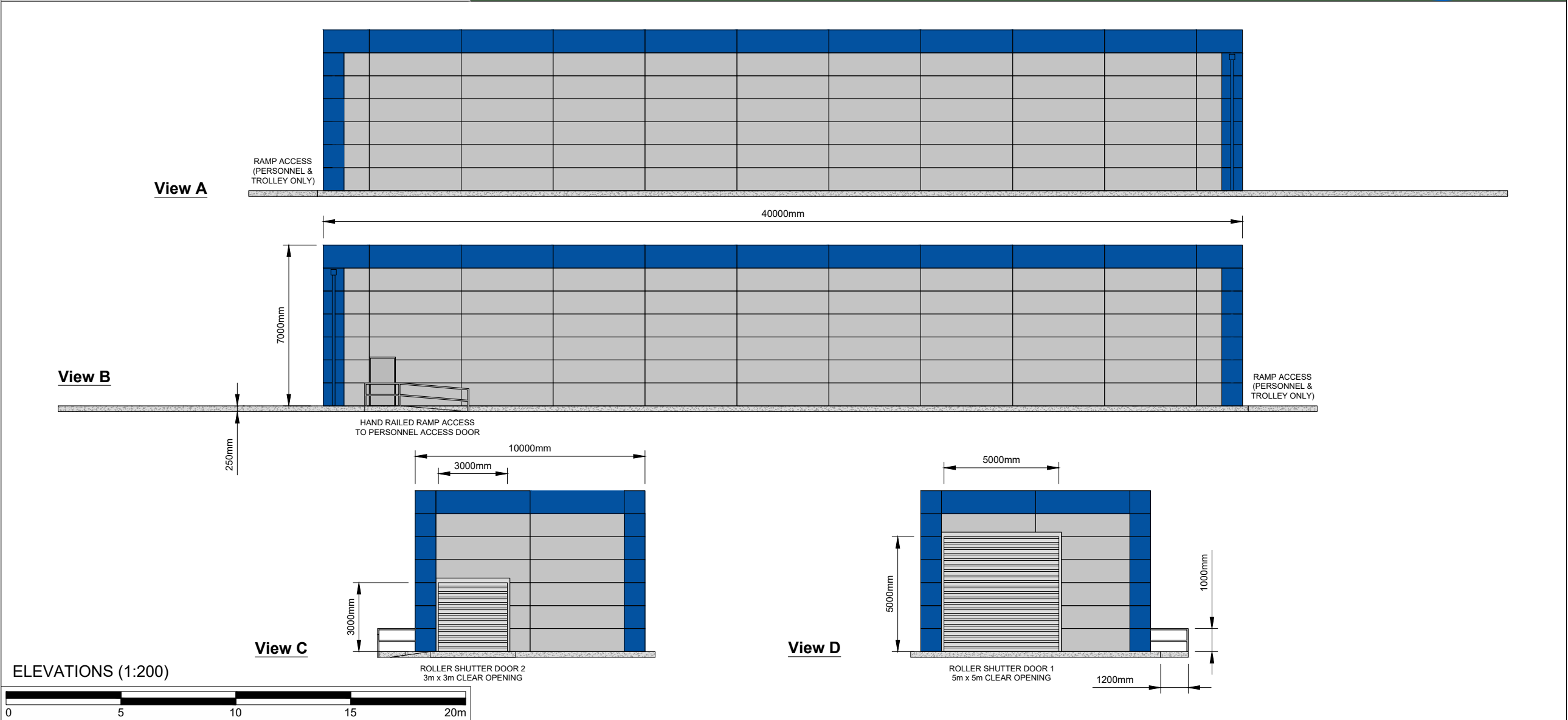
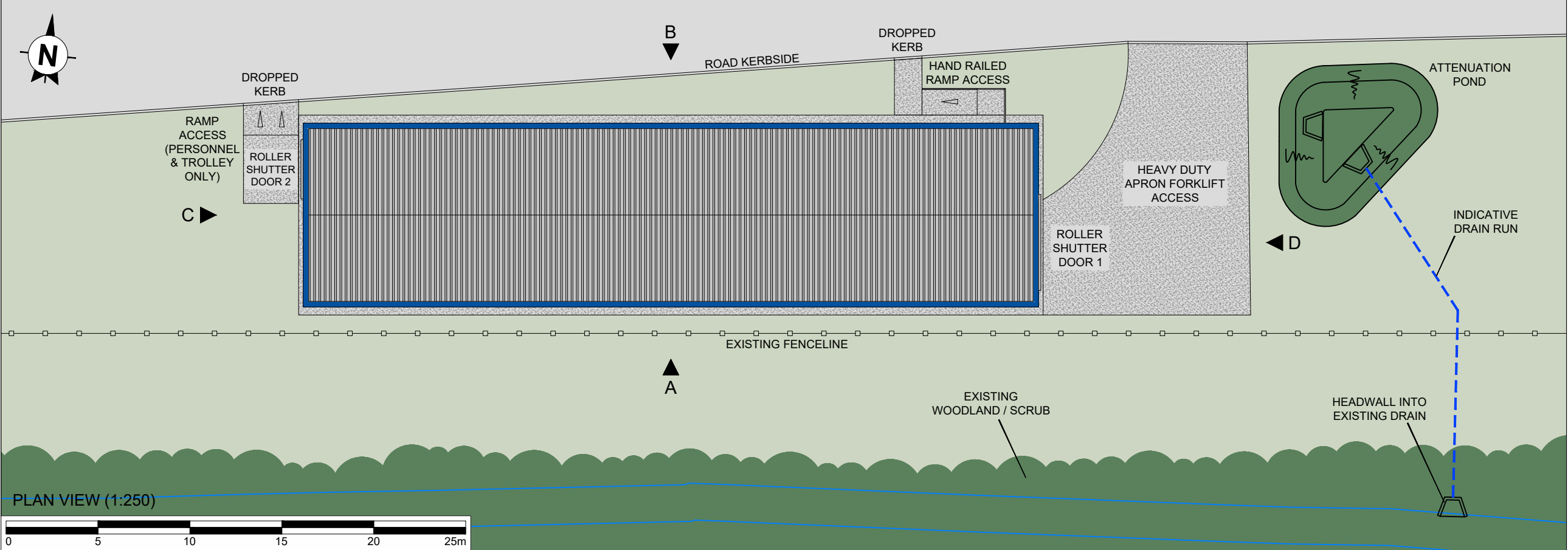
6 RECOMMENDATIONS

This report has demonstrated that the proposed development may be completed in accordance with the requirements of planning policy subject to the following:

- SAB approval to be obtained for the detailed surface water drainage design prior to construction

APPENDIX A:

Development Proposals



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Follow any figured dimensions - do not scale for construction purposes. IF IN DOUBT ASK.

Revision History		Date
A	Updated building height	03-07-20

Client Office: Well House Barns Bretton Cheshire CH4 8DH	South Manchester Office: Canella House 76 Water Lane Wilmslow SK9 5BB	axis
0844 8700 007 - www.axisped.co.uk		
client: ECO2		
project: MARGAM SPARES BUILDING		
drawing title: SPARES BUILDING PLAN AND ELEVATIONS		
date: May 2020	drawn by: SM	checked: AR
drawing number: 2774-01-02	status: --	
scale(s): As Shown @A3	rev: A	
planning environment design		

APPENDIX B:

Existing On Site Drainage (MLM)

APPENDIX C:

Peak Runoff Rate from Existing Site

The peak discharge rates of surface water runoff from the impermeable areas at the site have been calculated based on the Modified Rational Method⁵.

The following parameters have been obtained from the maps in Volume 3 of the Wallingford Procedure:

M5-60 minute rainfall depth:	17.9 mm
Ratio of M5-60 to M5-2 day rainfall:	0.276
Average Annual Rainfall:	1183 mm
Winter Rain Acceptance Potential/ Soil Type :	3/0.4
The Urban Catchment Wetness Index (UCWI) value:	126.8

A time of concentration of 15.0 minutes has been used.

A rainfall estimation calculation has been carried out to convert the M5-60 minute rainfall to the 5-minute duration rainfall for the 1:1, 1:2, 1:30 and 1:100 annual probability rainfall events. The calculated rainfall intensities for these events are 24.5, 31.8, 59.9 and 76.8 mm/hr respectively.

The flow rate as given by the Modified Rational Method is:

$$Q = 2.78 \times C_v \times C_r \times \text{rainfall intensity} \times \text{impermeable area}$$

where:

C_v is the volumetric runoff coefficient = $P_r / \text{PIMP} = 0.82$

where P_r is Percentage Runoff and PIMP is Percentage Impermeable Area

C_r is the routing coefficient = 1.3

Impermeable Area = 0.06 ha

The peak discharges of surface runoff from impermeable areas of the existing site are shown in the table below:

Peak Runoff Rate

Annual probability of rainfall event	Peak discharge for 0.06 ha impermeable area (l/s)
1:1	4.4
1:2	5.7
1:30	10.7
1:100	13.7

⁵ The Wallingford Procedure, Volume 4, 1981

APPENDIX D:

Greenfield Runoff Calculations

Weetwood		Page 1
Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold		
Date 01/04/2020 19:32 File	Designed by OwenAstbury Checked by	
Micro Drainage		Source Control 2020.1
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 1.000 Urban 0.000 SAAR (mm) 1183 Region Number Region 9 Results l/s QBAR Rural 6.3 QBAR Urban 6.3 Q100 years 13.7 Q1 year 5.5 Q30 years 11.1 Q100 years 13.7		
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APPENDIX E:

MicroDrainage Calculations

Weetwood

Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

(4756)
MARGAM GREEN ENERGY PLANT,
HEOLCAE'R-BONT, MARGAM

Date 09/06/2020 15:39
File 2020-06-09 4756 SW CALCULAT...

Designed by OA
Checked by TB

Micro Drainage

Network 2020.1

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S6	7.210	0.750	Open Manhole	600	S1.000	6.460	150				
S5	7.110	0.750	Open Manhole	600	S1.001	6.360	150	S1.000	6.360	150	
S4 HEADWALL	7.020	0.800	Junction		S1.002	6.220	150	S1.001	6.220	150	
S3 HEADWALL	7.020	0.800	Junction		S1.003	6.220	150	S1.002	6.220	150	
S2-FC	7.000	0.880	Open Manhole	1200	S1.004	6.120	150	S1.003	6.120	150	
S1 HEADWALL	6.580	0.600	Open Manhole	0		OUTFALL		S1.004	5.980	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S6	278986.100	186314.808	278986.100	186314.808	Required	
S5	278984.934	186324.220	278984.934	186324.220	Required	
S4 HEADWALL	278998.097	186326.226			No Entry	
S3 HEADWALL	279001.538	186324.405			No Entry	
S2-FC	279007.521	186317.223	279007.521	186317.223	Required	
S1 HEADWALL	279008.516	186306.954			No Entry	

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Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold	(4756) MARGAM GREEN ENERGY PLANT, HEOLCAE'R-BONT, MARGAM	
Date 09/06/2020 15:39 File 2020-06-09 4756 SW CALCULAT...	Designed by OA Checked by TB	
Micro Drainage	Network 2020.1	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S6	7.210	6.460	0.600	Open Manhole	600
S1.001	o	150	S5	7.110	6.360	0.600	Open Manhole	600
S1.002	o	150	S4 HEADWALL	7.020	6.220	0.650	Junction	
S1.003	o	150	S3 HEADWALL	7.020	6.220	0.650	Junction	
S1.004	o	150	S2-FC	7.000	6.120	0.730	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	9.484	95.0	S5	7.110	6.360	0.600	Open Manhole	600
S1.001	13.314	95.0	S4 HEADWALL	7.020	6.220	0.650	Junction	
S1.002	3.893	0.0	S3 HEADWALL	7.020	6.220	0.650	Junction	
S1.003	9.348	93.3	S2-FC	7.000	6.120	0.730	Open Manhole	1200
S1.004	10.317	74.0	S1 HEADWALL	6.580	5.980	0.450	Open Manhole	0

Weetwood		Page 3
Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold	(4756) MARGAM GREEN ENERGY PLANT, HEOLCAE'R-BONT, MARGAM	
Date 09/06/2020 15:39	Designed by OA	
File 2020-06-09 4756 SW CALCULAT...	Checked by TB	
Micro Drainage	Network 2020.1	

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.028	0.028	0.028
1.001	-	-	100	0.030	0.030	0.030
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.058	0.058	0.058

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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S1.004	S1 HEADWALL	6.580	5.980	5.980	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.900	Storm Duration (mins)	30
Ratio R	0.276		

Weetwood		Page 4
Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold	(4756) MARGAM GREEN ENERGY PLANT, HEOLCAE'R-BONT, MARGAM	
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File 2020-06-09 4756 SW CALCULAT...	Checked by TB	
Micro Drainage	Network 2020.1	

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S2-FC, DS/PN: S1.004, Volume (m³): 1.2

Unit Reference	MD-SHE-0095-3500-0580-3500
Design Head (m)	0.580
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	95
Invert Level (m)	6.120
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.580	3.5	Kick-Flo®	0.404	3.0
Flush-Flo™	0.178	3.5	Mean Flow over Head Range	-	3.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.9	3.000	7.5	7.000	11.3
0.200	3.5	1.400	5.3	3.500	8.1	7.500	11.7
0.300	3.4	1.600	5.6	4.000	8.6	8.000	12.0
0.400	3.0	1.800	5.9	4.500	9.1	8.500	12.4
0.500	3.3	2.000	6.2	5.000	9.6	9.000	12.8
0.600	3.6	2.200	6.5	5.500	10.0	9.500	13.1
0.800	4.1	2.400	6.8	6.000	10.4		
1.000	4.5	2.600	7.0	6.500	10.8		

Weetwood		Page 5
Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold	(4756) MARGAM GREEN ENERGY PLANT, HEOLCAE'R-BONT, MARGAM	
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Micro Drainage	Network 2020.1	

Storage Structures for Storm

Tank or Pond Manhole: S4 HEADWALL, DS/PN: S1.002

Invert Level (m) 6.220

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	8.1	0.500	35.1	0.800	58.1

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m ³)	Pipe Volume (m ³)	Storage Structure Volume (m ³)	Total Volume (m ³)
S1.000	S6	0.212	0.157	0.000	0.369
S1.001	S5	0.212	0.230	0.000	0.442
S1.002	S4 HEADWALL	0.000	0.069	23.846	23.915
S1.003	S3 HEADWALL	0.000	0.155	0.000	0.155
S1.004	S2-FC	0.995	0.172	0.000	1.167
Total		1.420	0.782	23.846	26.048

Weetwood		Page 6
Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold	(4756) MARGAM GREEN ENERGY PLANT, HEOLCAE'R-BONT, MARGAM	
Date 09/06/2020 15:39	Designed by OA	
File 2020-06-09 4756 SW CALCULAT...	Checked by TB	
Micro Drainage		Network 2020.1

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 17.900 Cv (Summer) 0.750
Region England and Wales Ratio R 0.276 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 30

PN	US/MH Name	Event	US/CL (m)	Water Surcharged Flooded				
				Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)
S1.000	S6	15 minute 1 year Winter I+0%	7.210	6.504	-0.106	0.000	0.19	
S1.001	S5	15 minute 1 year Winter I+0%	7.110	6.422	-0.088	0.000	0.35	
S1.002	S4 HEADWALL	15 minute 1 year Winter I+0%	7.020	6.302	-0.068	0.000	0.44	
S1.003	S3 HEADWALL	15 minute 1 year Winter I+0%	7.020	6.297	-0.073	0.000	0.24	
S1.004	S2-FC	15 minute 1 year Winter I+0%	7.000	6.287	0.017	0.000	0.19	

PN	US/MH Name	Maximum Vol (m³)	Pipe Flow		Status
			(l/s)		
S1.000	S6	0.011	3.1		OK
S1.001	S5	0.044	5.8		OK
S1.002	S4 HEADWALL	0.901	4.7		OK*
S1.003	S3 HEADWALL	0.101	4.5		OK*
S1.004	S2-FC	0.292	3.5		SURCHARGED

Weetwood		Page 7
Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold	(4756) MARGAM GREEN ENERGY PLANT, HEOLCAE'R-BONT, MARGAM	
Date 09/06/2020 15:39	Designed by OA	
File 2020-06-09 4756 SW CALCULAT...	Checked by TB	
Micro Drainage		Network 2020.1

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 17.900 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.276 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 30

PN	US/MH Name	Event	US/CL (m)	Water Surcharged Flooded				
				Level (m)	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)
S1.000	S6	15 minute 30 year Winter I+0%	7.210	6.538	-0.072	0.000	0.46	
S1.001	S5	30 minute 30 year Winter I+0%	7.110	6.521	0.011	0.000	0.75	
S1.002	S4 HEADWALL	30 minute 30 year Winter I+0%	7.020	6.506	0.136	0.000	0.48	
S1.003	S3 HEADWALL	15 minute 30 year Summer I+0%	7.020	6.370	0.000	0.000	0.34	
S1.004	S2-FC	30 minute 30 year Winter I+0%	7.000	6.492	0.223	0.000	0.19	

PN	US/MH Name	Pipe		
		Maximum Vol (m ³)	Flow (l/s)	Status
S1.000	S6	0.021	7.5	OK
S1.001	S5	0.148	12.5	SURCHARGED
S1.002	S4 HEADWALL	4.544	5.2	SURCHARGED*
S1.003	S3 HEADWALL	0.292	6.2	SURCHARGED*
S1.004	S2-FC	0.570	3.5	SURCHARGED

Weetwood		Page 8
Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold	(4756) MARGAM GREEN ENERGY PLANT, HEOLCAE'R-BONT, MARGAM	
Date 09/06/2020 15:39	Designed by OA	
File 2020-06-09 4756 SW CALCULAT...	Checked by TB	
Micro Drainage		Network 2020.1

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 17.900 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.276 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 30

PN	US/MH Name	Event	US/CL (m)	Water Surcharged Flooded				
				Level (m)	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)
S1.000	S6	15 minute 100 year Winter I+30%	7.210	6.841	0.231	0.000	0.71	
S1.001	S5	15 minute 100 year Winter I+30%	7.110	6.792	0.282	0.000	1.40	
S1.002	S4 HEADWALL	60 minute 100 year Winter I+30%	7.020	6.720	0.350	0.000	0.41	
S1.003	S3 HEADWALL	15 minute 100 year Summer I+30%	7.020	6.370	0.000	0.000	0.32	
S1.004	S2-FC	60 minute 100 year Winter I+30%	7.000	6.705	0.435	0.000	0.19	

PN	US/MH Name	Maximum Vol (m ³)	Pipe Flow		Status
			(l/s)		
S1.000	S6	0.106	11.4		SURCHARGED
S1.001	S5	0.278	23.3		SURCHARGED
S1.002	S4 HEADWALL	10.749	4.4		FLOOD RISK*
S1.003	S3 HEADWALL	0.432	6.0		SURCHARGED*
S1.004	S2-FC	0.811	3.5		FLOOD RISK

APPENDIX F:

Preliminary Drainage Layout

A



- NOTES**
- This drawing to be read in conjunction with all relevant Weetwood drawings.
1. ALL DIMENSIONS IN mm UNLESS NOTED OTHERWISE
2. ALL LEVELS IN METRES
3. ALL PROPOSED DRAINAGE TO BE MINIMUM 1000 UNLESS NOTED OTHERWISE
4. MINIMUM GRADIENTS:
- 4.1. 1:100 SURFACE WATER = 1:100
5. ALL CONNECTING PIPES TO ADAPTABLE DRAINAGE TO BE MINIMUM 1500
6. ALL HIGHWAY GULLY CONNECTIONS TO BE MINIMUM 1500
7. ALL DRAINWATER PRESSES MUST BE FITTED WITH A RODDABLE ACCESS ABOVE GROUND
8. ALL PRIVATE DRAINAGE TO BE INSTALLED IN ACCORDANCE WITH PART 4 OF THE BUILDING REGULATIONS AND BS EN 752 & 12056
9. PRIVATE DRAINAGE TO BE UPVC PIPES WITH GRP OR UPVC INSPECTION CHAMBERS SYSTEM DESIGN & INSTALLATION TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS & 'GOOD PRACTICE GUIDE'
10. PROPOSED SITE LAYOUT TAKEN FROM AXIS PED LTD 'SPARES BUILDING SITE LAYOUT DRAWING (REF: 2774-01-SK007, APR 2020)
11. EXISTING SITE LEVELS TAKEN FROM QUADCONSULT LTD DRAWING 'SITE LAYOUT EXTERNAL WORKS' (REF: 16397, 161, 06/03/2019)
12. EXISTING DRAINAGE INFORMATION TAKEN FROM MIM DRAINAGE PLAN (REF: MIM-981146-981146-024, REV P11, 07/2019) AND QUADCONSULT LTD DRAWING 'SITE LAYOUT EXTERNAL WORKS' (REF: 16397, 161, 06/03/2019)
13. SURFACE WATER TO BE DRAINAGE TO THE WATERCOURSE TO THE SOUTH AT A RESTRICTED RATE OF 3.5 l/s SUBJECT TO APPROVAL BY THE LEAD LOCAL FLOOD AUTHORITY
14. EXISTING ON-SITE PRIVATE SEWERS AND WATERCOURSES TO BE REMOVED AND REPLACED WITH NEW INFORMATION, CONVEYANCE AND CONDITION OF PIPE SIZES ETC.

Spreads

Collects



P2	18/05/20	Amended project name	OA	TB
P1	13/05/20	Issued for information	OA	TB
Rev	Date	Description	Drawn	Check
Weetwood Development • Planning • Easement info@weetwood.net www.weetwood.net				
Client AXIS PED LTD				
Drawing Status PRELIMINARY				
Date		May 2020	Scale	1:250
Project		MARGAM GREEN ENERGY PLANT (EQUIPMENT STORAGE BUILDING)	Drawn	OA
Drawing No		4756	Checked	TB
Title		PROPOSED DRAINAGE LAYOUT	Drawing No	100
Revision		P2	Revision	P2

THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE SPECIFICATION AND ALL OTHER RELEVANT DRAWINGS. DO NOT SCALE FROM THIS DRAWING.

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Flood Risk Assessments
Flood Consequences Assessments
Surface Water Drainage
Foul Water Drainage
Environmental Impact Assessments
River Realignment and Restoration
Water Framework Directive Assessments
Flood Defence Consent Applications
Sequential, Justification and Exception Tests
Utility Assessments
Expert Witness and Planning Appeals
Discharge of Planning Conditions

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