

WERN RESERVE

DRAINAGE STRATEGY REPORT

MARCH 2024

Wern Reserve

Drainage Strategy Report

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Document Ref. 10048826-ARC-XX-ZZ-RP-CE-0002

Date MARCH 2024

Version Control

Version	Date	Author	Checker	Reviewer	Approver	Changes
01	20.03.2024	D Hadaway	T Fairlie	S Davies	S. Davies	First Issue

This report dated 01 March 2024 has been prepared for Canals & Rivers Trust (the “Client” in accordance with the terms and conditions of appointment dated 01 March 2024 (the “Appointment”) between the Client and Arcadis Consulting (UK) Ltd (“Arcadis”) for the purposes specified in the Appointment. For avoidance of doubt, no other person(s) may use or rely upon this report or its contents, and Arcadis accepts no responsibility for any such use or reliance thereon by any other third party.

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1 Introduction

1.1 Overview

This Drainage Strategy Report has been prepared by Arcadis Consulting (UK) Ltd. for 'Canal & River Trust' as part of the Montgomery Canal Restoration Scheme. 1st March 2024, Arcadis are commissioned to undertake a Drainage Strategy assessment to support the planning application for the proposed new wetland at Wern, adjacent to the Montgomery Channel, herein referred to as the 'proposed development site'.

2 Existing Site

2.1 Location

The Proposed Development is located to the North of Coppice Lane, SY21 9JX, approximately 2.5km Northwest of the village of Trewern and 3km South of Arddleen. The development is West of the Coppice Lane junction with the A483 (Grid Reference: OS 325600, 313050). The Montgomery Canal borders the north of the site which is proposed to become wetland. The site location can be viewed on Figure 1 and a proposed site plan is provided at **Appendix A**.



Figure 1 – Satellite Mapping Extract Showing Wern Site Location

2.2 Site Topography

A detailed topographical survey '22C173/001-003' of the site has been undertaken by Survey Operations and contained in **Appendix B**.

The topographical survey details the fields south of the canal and indicates that ground levels across the proposed development area range approximately from 66m to 69m above Ordnance Datum (AOD) in the location of the proposed site area.

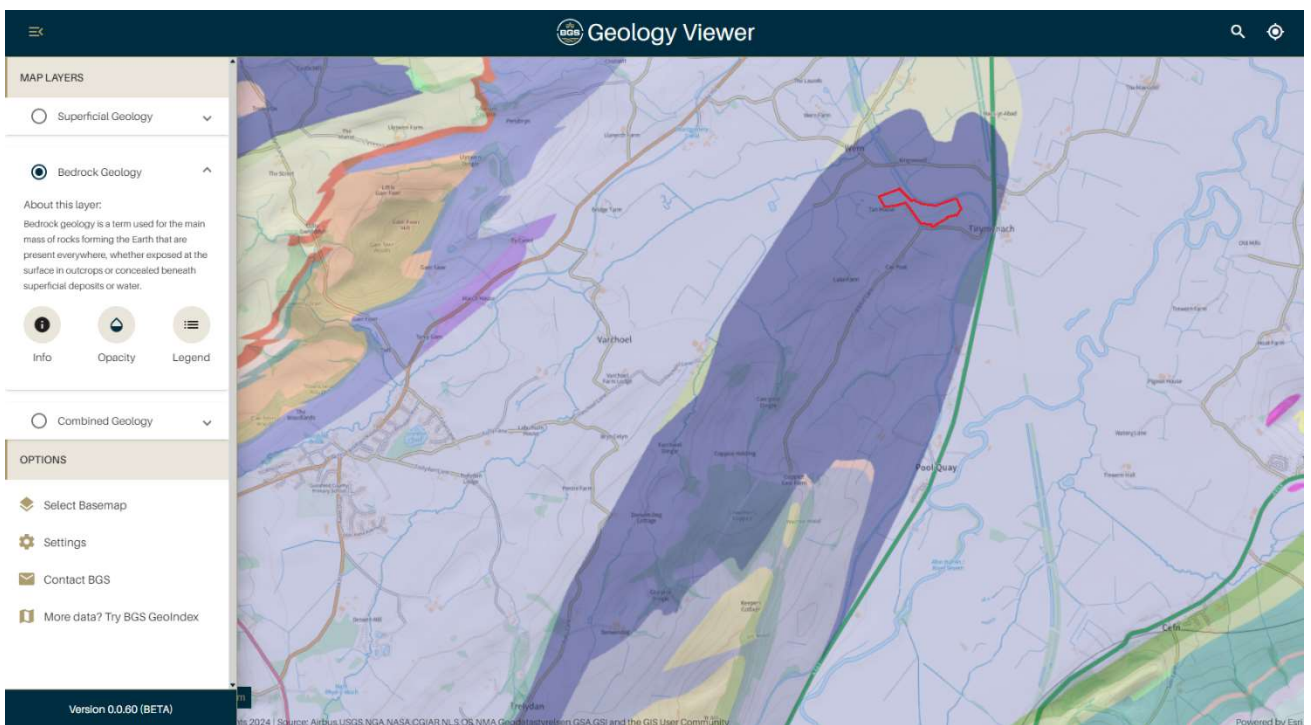
The prevailing surrounding topography falls from South to North.



Figure 2: Site Topography

2.3 Ground Conditions

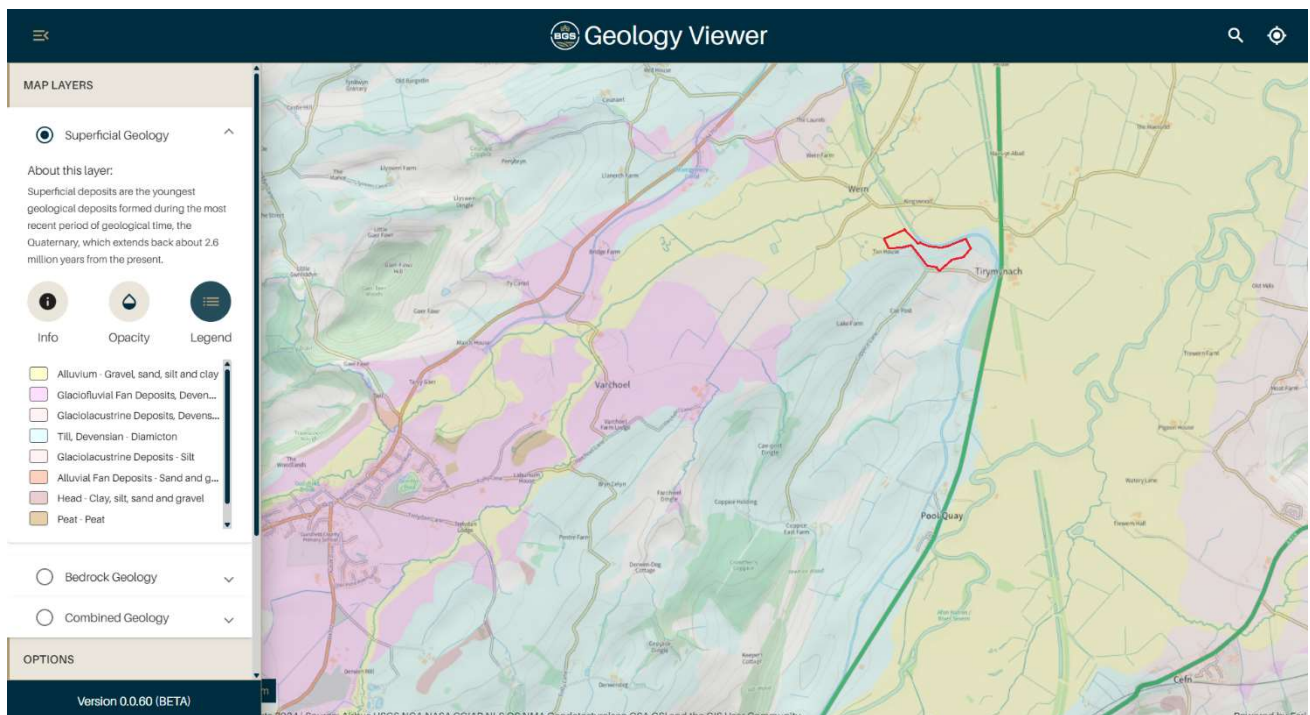
From a review of the British Geological Survey (BGS) online viewer, the ground conditions comprise mainly of 'Nant-ysgollon Mudstone Formation' which is comprised of mudstone strata.



- Mottled Mudstone Member , Wenl...
- Nant-ysgollon Mudstone Formatio...
- Nantglyn Flags Formation - Mudst...
- Nantglyn Flags Formation - Slump...

Figure 3 – British Geological Survey Mapping (bedrock)

The superficial deposits within the site outlined by the BGS geology viewer are describes as Devensian Till deposits (consolidated clay with sand and gravel), which is described as Diamicton material.



- Glaciofluvial Fan Deposits, Deven...
- Glaciolacustrine Deposits, Devens...
- Till, Devensian - Diamicton
- Glaciolacustrine Deposits - Silt

Figure 4 - British Geological Survey Mapping (superficial deposits)

The Montgomery Canal Reserves had a Leakage Assessment '10048826-ARC-EWE-R1-TN-GH-00103' completed by Arcadis in December 2022 and this outlined the ground conditions within the Wern Reserve site. Please refer to the Leakage Assessment for a detailed description of the ground investigation carried out at Wern Reserve.

The ground conditions determined through the investigation are considered as being consistent with the anticipated geology.

2.4 Existing Watercourses

The proposed development sits to the south of the Montgomery Canal which is a partially restored canal in eastern Powys and northwest Shropshire. The canal runs 33 miles (53km) from the Llangollen Canal at Frankton Junction to Newtown via Llanymynech and Welshpool and crosses the England–Wales border.

The nearest main rivers to the site are the River Severn (0.8km East) and Guilsfield Brook (0.4km Northwest). Both of these watercourses can be seen below in Figure 5.

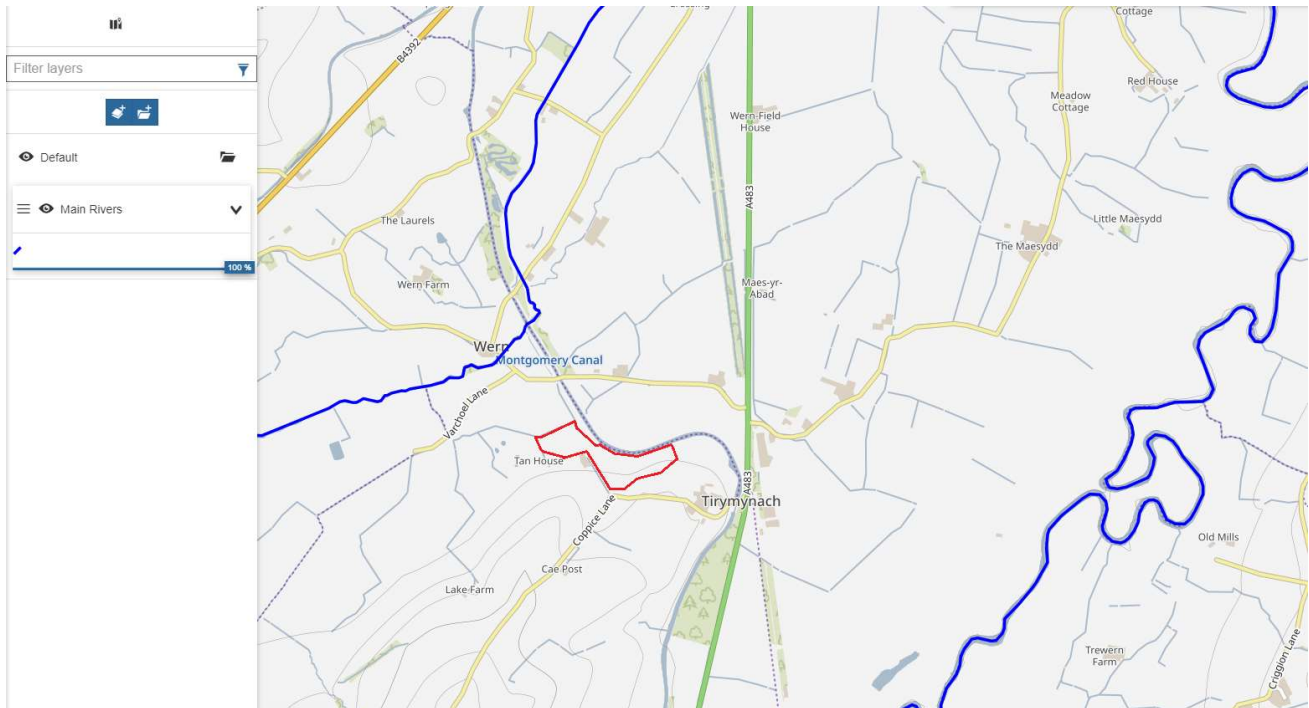


Figure 5 - Main River Datamap Wales

2.5 Existing Site Drainage

The existing site is agricultural land and does not have any formal land drainage, the surface water overland flows follow the fall of site from South to North and enter the existing canal, as such there is no existing formal drainage within the site. The proposed development also does not require any formal drainage and as this is not a requirement in the design no further investigation works have been undertaken to confirm the closest public sewer.

2.6 Existing Flood Risk

Natural Resources Wales flood risk search results have concluded that the site was at Low Risk of flooding from rivers and the sea. It also considered the risk of flooding from other sources, with no notable sources of flood risk to the site identified. Please see below figures that illustrate the results of the search undertaken.

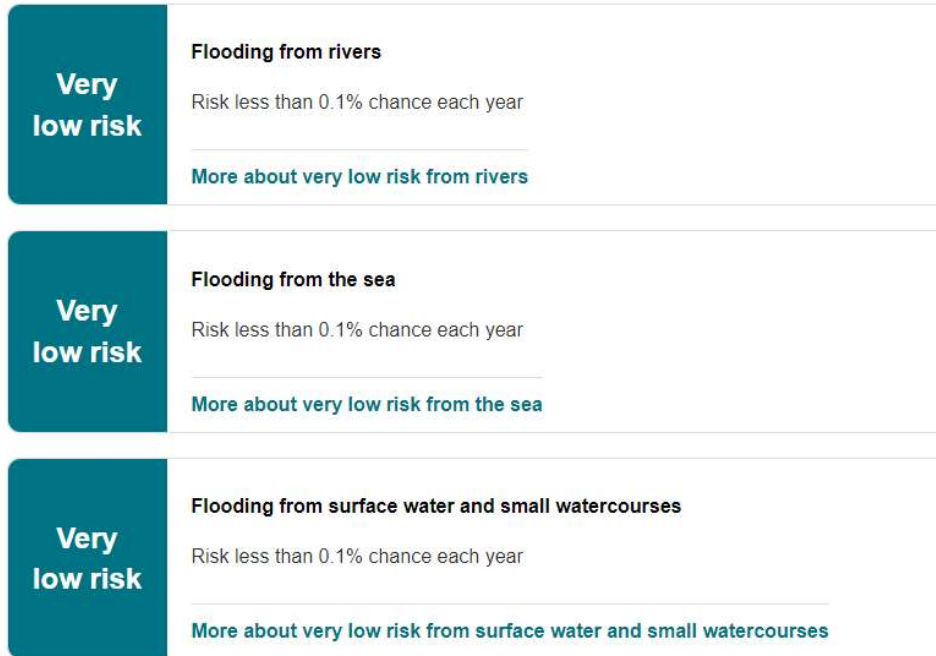


Figure 6: Extract of NRW flood risk results search.

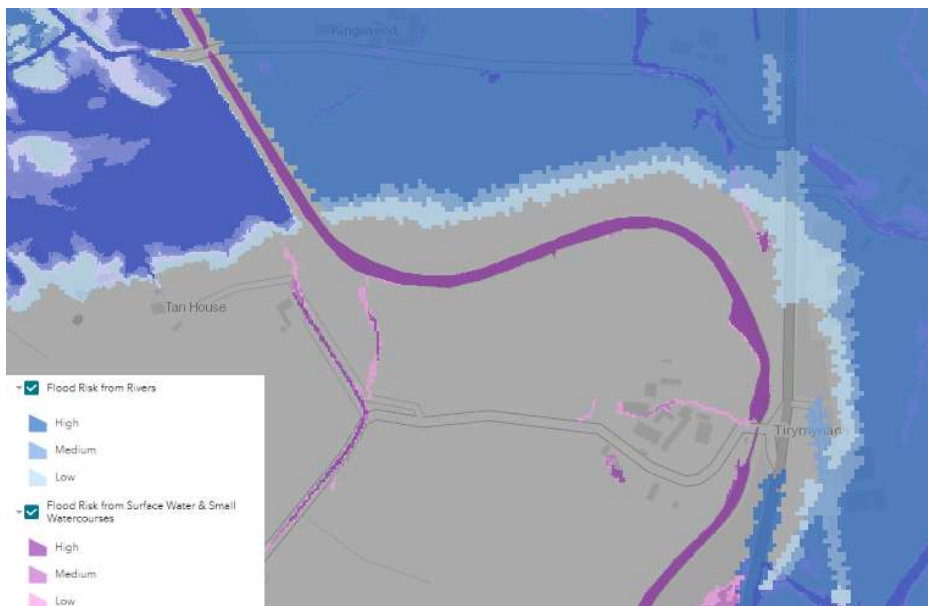


Figure 7: NRW Flood Risk from Rivers Map

Background Mapping © OpenStreetMap contributors. Contains Natural Resources Wales information © Natural Resources Wales and/or database right

3 Proposed Development

The Montgomery Canal Restoration Programme has secured extensive Levelling Up funding from the UK Government and in partnership with Powys County Council, the Canal & River Trust will deliver a range of significant enhancements along a 7 kilometre (km) stretch of the canal. The reserve will provide additional habitat to facilitate the canal restoration back to navigation.

The Proposed Development involves construction of a nature reserve adjacent to the Montgomery Canal, known as Wern Reserve, comprising the construction of a new offline nature reserve, which will be connected to the canal, together with associated landscaping and enabling works. The works also require a grass track public footpath diversion through the site, connecting the offside embankment of the Montgomery Canal and Coppice Lane, hereby known as the Proposed Development.

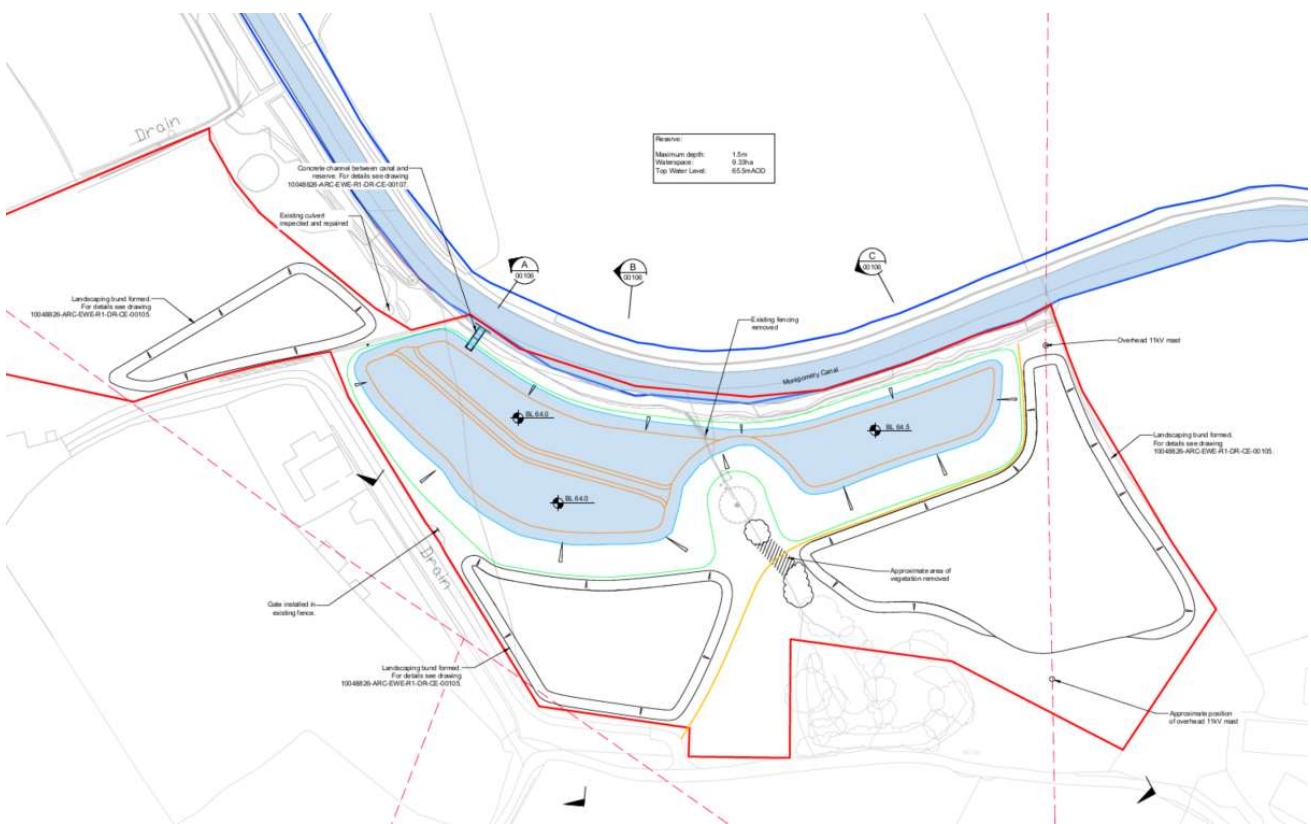


Figure 8: Proposed General Arrangement

4 National Planning Policy Framework

The Sustainable Drainage Statutory Guidance 2019 sets out the government's planning policies for Wales and how these are expected to be applied. The principal aim is to achieve sustainable development. This includes ensuring that flood risk is considered at all stages of the planning process, avoiding inappropriate development in areas at risk of flooding and directing development away from those areas where risks are highest. Where development is necessary in areas of flooding, aims to ensure that it is safe, without increasing flood risk elsewhere.

Planning Policy Wales (Edition 10) sets out the land use policies of the Welsh Government and is supported by Technical Advice Note (TAN) 15 (Development and Flood Risk). In all zones, development should reduce and must not increase the risk of flooding on site or elsewhere, in accordance with PPW Paragraph 6.6.26 and TAN15 Paragraph 8.3.

In accordance with Schedule 3 to the Flood and Water Management Act (FWMA) 2010, January 2019, all new development where the construction area is of 100m² or more will require SUDS to manage on-site surface water. A separate SUDS approval process is required from the SAB before construction work can commence.

Early adoption of, and adherence to, the principles set out in the Sustainable Drainage Statutory Guidance and Sustainable Drainage Systems Standards for Wales, with respect to flood risk, should ensure that detailed designs and plans for developments take due account of flood risk and the need for appropriate mitigation, if required.

The Sustainable Drainage Statutory Guidance 2019 specifies that surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development. Opportunities to reduce the flood risk to the site itself and elsewhere, taking climate change into account.

Welsh Government Sustainable Drainage (SuDs) Statutory Guidance contain a set of 6 principles:

- S1 - Runoff destination
- S2 - Hydraulic control
- S3 - Water quality
- S4 - Amenity
- S5 - Biodiversity
- S6 - Construction, operation and maintenance

5 Surface Water Management Strategy

The proposed surface water drainage system that will serve the proposed development will need to be designed in accordance with national and local planning policy, and relevant sections of the Sustainable Drainage Systems (SuDS) Manual (CIRIA C753). Proposed SuDS components will need to aim to emulate the natural drainage of the site as closely as is practicably achievable.

SuDS are water sensitive drainage systems which mimic natural catchment processes to manage urban runoff. A 'treatment train' of various SuDS is required to capture, detain, convey and discharge water from an urban environment. The treatment train concept is fundamental to designing a successful SuDS strategy. The treatment train philosophy uses drainage techniques to systematically control the three elements of runoff.

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The treatment train philosophy uses drainage techniques to systematically control the three elements of runoff: pollution, flow rates and volume. This is achieved in the three main steps: Source Control, Conveyance Control and Discharge Control as shown in **Figure 9** below. Source control is preferred to those further down the train as they lead to the retention of pollutants and control of water before it enters the proposed or existing drainage network or watercourse. All of the methods suggested are recommended controls considered for SuDS and will be utilised where practical.

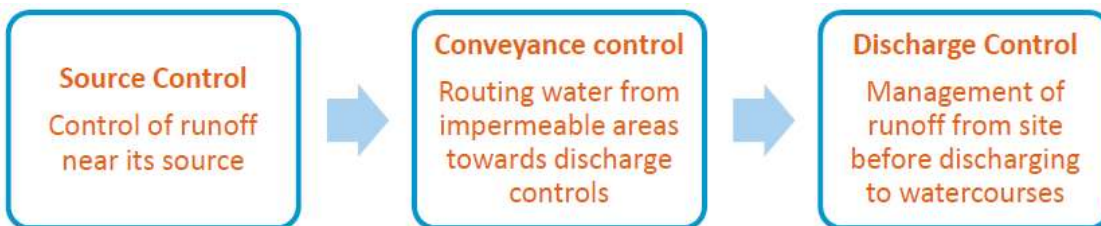


Figure 9: SuDS Treatment Train

Individual SuDS components are not treated in isolation but work together as a suite of drainage features. The SuDS components suggested for inclusion into the proposed drainage system reflect the desirability to have a mix of SuDS components across the site, as different components have different capacities for treatment of individual pollutants.

5.1 Design Guidance

The following design guidance was adhered to for the proposed drainage systems serving the proposed site.

- Powys County Council Guidance
- Planning Policy Wales Edition 12 February 2024 SuDS Manual, CIRIA C753
- Sustainable Drainage Systems Standards for Wales
- Welsh Government Sustainable Drainage (SuDs) Statutory Guidance

5.2 Climate Change

Surface water drainage systems provided for the new development site should be designed to retain all runoff for events up to the 1 in 100-year rainfall event, with an appropriate allowance for climate change. This is to prevent downstream flooding. If attenuation is required an allowance of 45% should be made for climate change in accordance with SuDS Manual, CIRIA C753.

5.3 Greenfield run-off rates

Both national and local planning policies state that for any proposed development, peak rates of surface water discharge to either a watercourse or a sewer should be restricted to as close as is reasonably practicable to the equivalent greenfield rates of runoff from impermeable areas introduced to the site from the proposed development, especially if the existing site is a greenfield site.

If impermeable areas are introduced runoff rate should be limited post development peak rates of runoff from all storm events up to and including 1 in 100-year storm events (with a 45% allowance for climate change if required) to no greater than the greenfield peak flow rate (QBAR).

QBAR Greenfield runoff rates have been calculated using the Wallingford runoff calculation for reference only as the proposed development does not introduce any impermeable areas. These calculations are summarised below in **Table 1**, and can be found in full in **Appendix C**.

Table 1: QBAR Rates (See Appendix C)

Drained Area	QBAR Greenfield Runoff Rate
5.53 ha	28.49 l/s

5.4 Proposed Surface Water Discharge Arrangements

In accordance with the discharge hierarchy as set out within the CIRIA SuDS Manual (C753), the proposed surface water runoff discharge arrangement was identified in order of priority (Table 4.2):

Table 2: Proposed surface water discharge arrangement

Discharge arrangement	Description/justification
into the ground (infiltration)	As noted in Section 2.3 , the site sits over mudstone, infiltration is unlikely.
To a surface water body (watercourse)	The proposed development sits adjacent the Montgomery Canal from which existing natural overland surface water flows currently discharge to.
To a surface water sewer, highway drain, or another drainage system	N/A
To a combined sewer	N/A

5.5 Proposed Surface Water Drainage Strategy

The proposed wetlands will not comprise of formal surfaces or hardstanding, no impermeable areas are to be introduced and as such the site permeable area will remain as existing. Additionally, the proposed site levels and development arrangement is designed not to impede the existing surface water overland flows and will therefore also remain as existing.

The sites existing levels fall from north to south and this will be maintained in the proposed design, keeping the proposed surface water overland flows as existing, however the proposed wetlands pond will intercept the surface water prior to it entering the existing canal.

The pond water level is designed to sit at a similar level to the canal. As surface water enters the pond overflow water will slowly be released into the canal through a proposed concrete channel link, this will slow and control the egress of the surface water into the canal.

The proposed ponds will not be lined, as noted previous the geology is mudstone however there will still be the opportunity for infiltration even if limited.

As summarised above the existing drainage regime will not be changed but betterment to the control of discharge of surface water into the canal will be provided. No formal drainage networks will be required for this proposed scheme.

5.6 Construction

The Montgomery canal is a Special Area of Conservation (SAC), as such a Habitats Regulation Assessment (HRA) , this includes a section on 'Measures to Control Pollution Risk and Biosecurity' to ensure that there is no risk from pollution during the construction phase, a Construction Environment Management Plan (CEMP) will be prepared and implemented. The CEMP will incorporate best practice in relation to construction activities within or near the water environment and will typically include (but not be limited to):

- Toolbox talks to Contractor, including INNS issues;
- Ecological supervision and monitoring during construction;
- Clear demarcation of working areas and use of temporary protective fencing and signage, as necessary;
- Buffer zones around retained habitats;
- Use of sediment traps, e.g. straw bales, regularly checked and replaced as needed;
- Contractors to arrive and leave site with clean footwear and machinery and wheel wash facilities to be provided;
- Fuel storage and re-fuelling to take place in designated areas away from the canal;
- All vehicles and plant to be stored in a secure site compound overnight;
- Plant nappies and spill kits to be carried as standard; and
- Emergency pollution incident protocols in place.

5.7 Water Quality

To ensure proposed developments and drainage design meets the water quality design criteria and good practice design standards, the simple index approach as defined in Section 26 in the CIRIA SuDS Manual C753 should be considered.

Table 26.2 of the CIRIA SuDS Manual provides the pollution hazard indices for different land use classifications. The proposed site does not fall under any of the categories listed within Table 26.2 and as such the proposed wetlands will not have any implication on water quality and pollution entering the existing canal.

It is therefore determined that no further pollution control measures will be required.

However, as noted within the pre-app the response the proposed wetlands will provide betterment to water quality for surface water falling on the site prior to entering the canal.

5.8 Amenity and Biodiversity

The proposed wetland will create a significant biodiversity betterment to the existing agricultural field creating a diverse natural habitat adjacent the Montgomery canal. The current PRow will be retained and will be diverted within the site.

5.9 Operation and Maintenance Schedule

The Wern reserve will become a Canal & River Trust asset and will fall into the Trust's asset management system. The Trust's principal assets are subject to a hierarchy of inspections, which will provide information on the condition, serviceability, and details of any defects. Assets are maintained under the Trust's Planned Preventative Maintenance standard, which sets out the requirements and responsibilities of PPM for the Trust's structures. Day to day operation of the reserve will be managed by the local Waterway team.

The reserve will also be added to the Montgomery canal reserves management plan which is written and delivered by the Trust's ecologists.

5.10 SAB Pre-application

A pre-application was submitted to the SUDs Approval Body and subsequently further correspondence was undertaken with the SAB to clarify some items raised in the pre-app response **Appendix E**, these are outlined below, and this report has been updated accordingly.

- Noted no hardstanding areas are introduced.
- Existing levels maintained and overland flow routes maintained.
- The proposed wetlands will offer a benefit to water quality and biodiversity.
- SAB response notes that when hardstanding areas are introduced attenuation to control 1 in 100 year storm plus climate change will be required. In the instance of this site no hard standing areas are being introduced.
- Noted that exceedance flows be reduced or slowed.
- Noted that the management proposals were pleasing.
- Detail of required maintenance indicated as being required, Section 5.9 Operation and Maintenance Schedule added to this report.

6 Conclusions

This report has set out the principles of why the sites existing surface water drainage regime will remain and formal drainage will not be required for the site. Surface water overland flows from the development will discharge to the canal as existing.

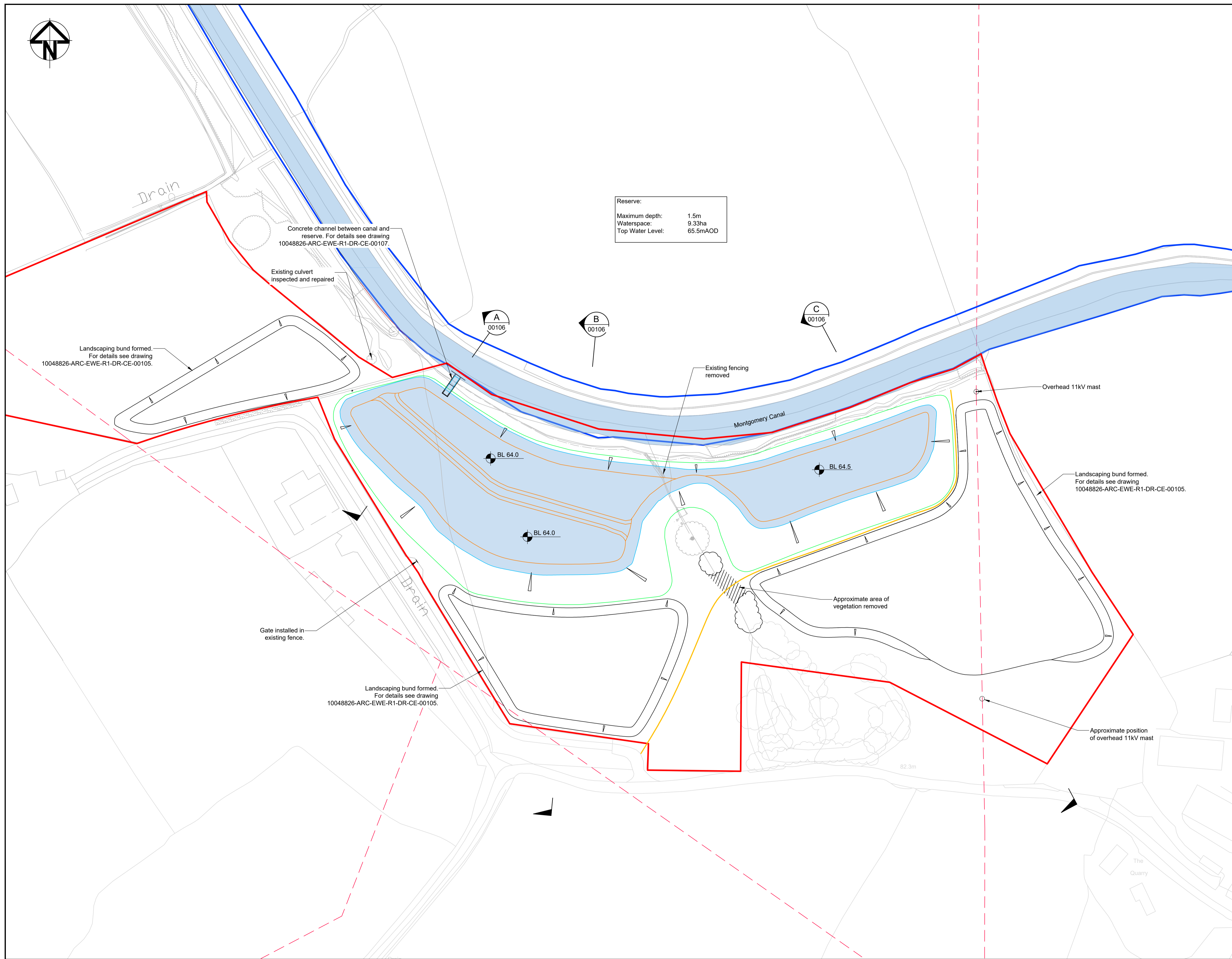
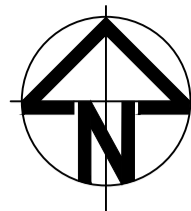
The key principles are:

- The site is within a low flood risk area.
- There are no impermeable areas or sources of containments being introduced as part of the proposed scheme.
- The PROW diversion route will be a grassed path.
- The proposed site levels will not alter existing overland flow routes.
- Discharge of surface water to the Montgomery Canal will remain as existing.
- The wetlands pond will help to control and slow the egress of surface water overland flows into the canal via the proposed concrete channel link.
- The wetlands pond will significantly increase amenity and biodiversity.

Surface Water Drainage for the proposed development will continue as per the existing overland flows drainage regime, therefore achieving the aims and objectives of both local and national policies.

Appendix A

Proposed General Arrangement



Reserve:
 Maximum depth: 1.5m
 Waterspace: 9.33ha
 Top Water Level: 65.5mAOD

NOTES:

- Do not scale from this drawing. Use figured dimensions only.
- All dimensions are indicative and are to be confirmed on site.
- All dimensions are in millimetres unless noted otherwise. All levels in metres relative to ordnance datum.
- Services information reproduced from plans provided by utility owners and is indicative only. This drawing does not show all services. The Contractor should confirm the presence and details of all existing structures, pipelines and other services prior to commencement of the works.
- Topographic survey information taken from Survey Operations drawing 22C173. For areas where there is a lack of topographic points from the survey, topographic data has been compiled through freely available LiDAR from UK Government Portal. All these levels must be confirmed by the Contractor prior to commencement of the works.
- To be read in conjunction with the following documents:
 - Drawings: 10048826-ARC-EWE-R1-DR-CE-00101 to 00107
 - 10048826-ARC-EWE-R1-TH-CE-00101 DRA
 - Specification

LEGEND

- Red line boundary
- Trust land ownership
- Top of bank
- Bottom of bank
- Public Right of Way diversion
- 11kV overhead cables

DRAFT

Rev	Date	Description	Prod.	Chk.	Rev.	App.
PD1		For review and comment			EF	



Project: **Montgomery Canal Restoration**
Wern Nature Reserve

Site: Coppice Lane, Welshpool SY21 9UX
 Client: Canal & River Trust, National Waterways Museum, Ellesmere Port, Cheshire CH65 4FW



Registered office: 80 Fenchurch Street, London EC3M 4BY
 Coordinating office: 1st Floor, 12 King St. Leeds, LS1 2HL
 Tel: 44 (0)113 284 5300

Drawing Title: **Wern Nature Reserve**
General Arrangement

Designed: M. Shaw	Signed:	Date:
Produced: E. Flynn	Signed:	Date:
Checked: A. Carter	Signed:	Date:
Reviewed: A. Holt	Signed:	Date:
Approved: A. Holt	Signed:	Date:

Original Size: A1	Grid: OS	Datum: AOD
Suitability Code: S3	Scale: As shown	Project Number: 10048826

Suitability Description: **FOR REVIEW AND COMMENT**

Drawing Number: **10048826 - ARC - EWE**
R1 - DR - CE - 00102 Revision: **P01**

General arrangement
 Scale 1:750

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Appendix B

22C173- Topographical Survey

Appendix C

Greenfield Runoff Calculations

Calculated by:	Daniel Hadaway
Site name:	Wern Reserve
Site location:	Wern

Site Details

Latitude:	52.70992° N
Longitude:	3.10188° W
Reference:	188074268
Date:	Mar 19 2024 10:35

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	740	740
Hydrological region:	4	4
Growth curve factor 1 year:	0.83	0.83
Growth curve factor 30 years:	2	2
Growth curve factor 100 years:	2.57	2.57
Growth curve factor 200 years:	3.04	3.04

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	28.49	28.49
1 in 1 year (l/s):	23.65	23.65
1 in 30 years (l/s):	56.98	56.98
1 in 100 year (l/s):	73.22	73.22
1 in 200 years (l/s):	86.61	86.61

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix D

SAB Pre-application response

SAB Pre App 2400203

CRT Wern Reserve

Introduction

Please find below the SAB pre application response for CRT Wern Reserve.

In response to your pre application form submission together with accompanying documents, the SAB make the following comments.

Standard S1 – Surface Water Runoff Destination

The SAB note that the underlying geology is mudstone, and therefore infiltration is likely. The SAB also note that no hardstanding areas will be introduced, and so the existing level of infiltration will be maintained. We understand that the existing levels will be maintained and therefore any overland flow route will also be maintained. Based on these specific circumstances, we would accept that infiltration testing has not been undertaken.

The introduction of the wetlands and pond would help to ensure that the first 5mm will stay onsite whilst also offering benefits to water quality and biodiversity.

Standard S2 – Surface Water Runoff Hydraulic Control

The SAB accept that as no areas of hardstanding are being introduced, that the existing greenfield runoff scenario is being maintained. However, where possible, this should be limited to the 1 in 1 year or QBAR runoff rate in all situations. We note that ponds and wetlands are being proposed, and therefore exceedance flow may be reduced or slowed, but where possible, a restricted flow should be introduced. We are pleased to see that where proposals change to introduce hardstanding areas, that attenuation will be designed to accommodate the 1 in 100 year event plus climate change. We would be satisfied with a 40% allowance for climate change, though 45% would be pleasing, and would request the associated calculations with the full application.

Standard S3 – Water Quality

The SAB understand the argument being made that the proposed development isn't categorized in Table 26.2 of The SuDS Manual, but we would consider that the development by its very nature is improving the water quality when compared to the previous situation, and that the introduction of a wetland is a benefit to water quality in this location.

Standard S4 / S5 – Amenity/Biodiversity

The development proposals will complement the enjoyment of the site and adjacent Montgomery Canal and it is pleasing to see that there will be a new PROW link through the site.

It is also pleasing to note the careful management proposals for the site as a whole during construction which should also ensure that any existing green space is not unnecessarily removed or damaged.

Planting is welcomed and with careful planning can be extremely effective in replenishing/rewilding the site whilst also reducing runoff. They can also help provide quality habitat conditions for wildlife, contributing positively to biodiversity enhancement.

Standard S6 – Design of Drainage for Construction and Maintenance and Structural Integrity

The SAB are pleased to see that a phased approach is proposed for construction. However, greater detail would be welcomed on how the wetlands will be maintained for the lifetime of the development – e.g. vegetation management and the frequency at which this may be undertaken.

Reviewed Documents.

This report is based on the following information.

Drainage Strategy (Draft) Report v.01, Arcadis, Dated 20th March 2024

SAB Pre Application Form dated 5th April 2024

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