

Wern Nature Reserve - Powys

Flood Consequences Assessment

JUNE 2024

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CONTENTS

1	Introduction.....	1
1.1	Overview.....	1
1.2	Scope of Works.....	1
1.3	Terminology.....	1
1.4	Limitations.....	1
2	Site Background.....	2
2.1	Site Location.....	2
2.2	Site Description.....	2
2.3	Proposed Development.....	3
2.4	Topography.....	3
2.5	Historical Flooding.....	4
2.6	Existing Flood Defences.....	5
3	TAN15 Development and Flood Risk.....	6
3.1	General.....	6
3.2	Categorisation of the Site within TAN15 Flood Zones.....	6
3.3	Assessment of Flood Consequences.....	7
4	Potential Sources of Flooding.....	8
4.1	Overview.....	8
4.2	Flooding from Rivers.....	8
4.3	Flooding from the Sea.....	11
4.4	Flooding from Surface Water.....	12
4.5	Flooding from Groundwater.....	14
4.6	Flooding from Sewers.....	14
4.7	Flooding from Reservoirs, Canals and other Artificial Sources.....	15
5	Conclusions.....	16
	Appendix A.....	17
	General Arrangement.....	17
	Appendix B.....	18
	Fill Details.....	18

Tables

Table 1 Sources of Flooding	8
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Figures

Figure 1 Site Location	2
Figure 2 Site Topography	4
Figure 3 Development Advice Map (site boundary in red)	7
Figure 4 Flood Risk Assessment Wales Map (FRAW) (Rivers)	9
Figure 5 General Arrangement Drawing overlain with FRAW (Rivers) flood extents.	10
Figure 6 Flood Map for Planning (FMP) (Rivers)	11
Figure 7 NRW FRAW (Surface Water and Small Watercourses).....	12

Glossary

Abbreviation	Term
AOD	Above Ordnance Datum
BGS	British Geological Survey
The Trust	Canal & River Trust
DAM	Development Advice Map
DEFRA	Department for Environment, Food and Rural Affairs
FCA	Flood Consequences Assessment
FMP	Flood Map for Planning
FRAW	Flood Risk Assessment Wales
NGR	National Grid Reference
NRW	Natural Resources Wales
PCC	Powys County Council
PFRA	Preliminary Flood Risk Assessment
PPW	Planning Policy Wales
SFCA	Strategic Flood Consequences Assessment
TAN	Technical Advice Note

1 Introduction

1.1 Overview

Arcadis Consulting (UK) Limited (“Arcadis”) has been commissioned by the Canal & River Trust (The Trust) (“the Client”) to undertake a Flood Consequences Assessment (FCA) to support a planning application for the creation of a wetland reserve, herein referred to as ‘the site’, along the Montgomery Canal, between Arddleen and Welshpool. The reserve will provide approximately 1 hectare (ha) of water space and associated habitats and is one of several packages which form a wider scheme to restore the Montgomery Canal.

This report documents the approach taken to assess sources of flood risk to the site including fluvial, tidal, groundwater, surface water and artificial sources.

1.2 Scope of Works

The scope of works for this FCA is as follows:

- Collate publicly available flood risk data
- Undertake a desk-based assessment of flood risk at the site from all sources.
- Produce a FCA report.

1.3 Terminology

Flood risk is a product of both the likelihood and consequences of flooding. Throughout this document, flood events are defined according to their likelihood of occurrence. Floods are described according to an ‘annual chance’, meaning the chance of a particular flood occurring in any one year. This is directly linked to the probability of a flood. For example, a flood with an annual chance of 1 in 100 (a 1 in 100 chance of occurring in any one year), has an annual probability of 1%.

1.4 Limitations

This report has been compiled from a number of sources which Arcadis believes to be trustworthy. However, Arcadis is unable to guarantee the accuracy of information provided by others. The report is based on information available at the time of writing. Additional information may become available in the future which may have a bearing on the conclusions of this report and for which Arcadis cannot be held responsible.

2 Site Background

2.1 Site Location

The site, at National Grid Reference (NGR) SJ 25670 13050, is located to the south of the Montgomery Canal, approximately 2.5 km south of the village of Arddleen in Powys. The site covers an approximate area of 4.2ha. The site boundary can be viewed in Figure 1.

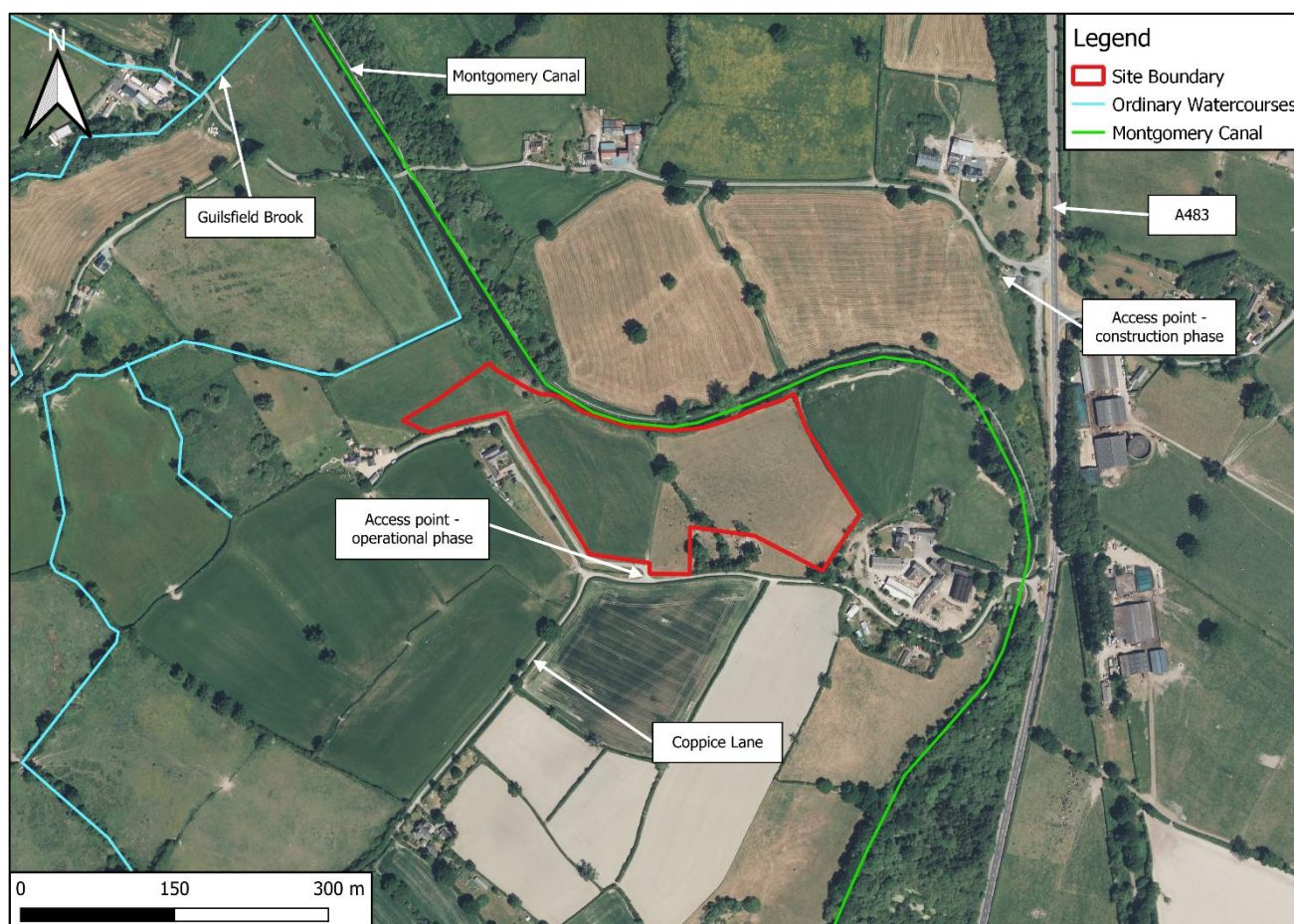


Figure 1 Site Location

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2.2 Site Description

The site is bound to the north by the Montgomery Canal, to the south by Coppice Lane, and to the west and east by agricultural land. The nearest main road is the A483, located approximately 190m east of the site at its closest point. Access to the site during the construction phase will be across the Montgomery Canal to the north, from the unnamed road off the A483. During the operational phase, access to the site will be from Coppice Lane. These access points are shown in Figure 1.

The nearest Natural Resources Wales (NRW) main river to the site is the River Severn, which is located 1.0km southeast of the site boundary at its closest point. There are several ordinary watercourses near the site, as visible in Figure 1. Most notably, Guilsfield Brook flows in a northeasterly direction approximately 380m northwest of the site. It flows under the Montgomery Canal approximately 400m northwest of the site. Several other ordinary watercourses in the vicinity of the site feed into Guilsfield Brook.

2.3 Proposed Development

The development comprises the creation of a wetland reserve. It is part of a wider scheme to restore the Montgomery Canal.

A brief description of the works is as follows:

- Establish site access, compounds and welfare facilities.
- Decommission existing water mains.
- Excavate existing ground to create new reserve profile.
- Install diverted water mains and associated connection chambers.
- Excavate topsoil in locations of bunds.
- Form landscaping bunds using excavated material.
- Construct reinforced concrete channel to connect reserve to canal.
- Allow reserve to fill with water from canal.
- Install gate in existing fence.

It is proposed that temporary access to the site, during construction, will be across Montgomery Canal to the north. The access point will come from the unnamed road north of the site, as indicated in Figure 1. During operation, the site will be accessed from Coppice Lane.

2.4 Topography

The topography of the site has been reviewed using Lidar data¹, which is limited to a 1 metre (m) resolution. An extract of the data is shown in Figure 2 below.

The Lidar data indicates that ground levels across the site slope upwards from the north to the south. Ground levels range from 62.6m Above Ordnance Datum (AOD) in the northwest corner, to 80.4mAOD in the south of

¹ Welsh Government Lidar 2020-22 Composite Dataset, available at: <https://datamap.gov.wales/maps/lidar-viewer/view#/> (Accessed May 2024). <https://datamap.gov.wales/maps/lidar-viewer/view - />

the site.

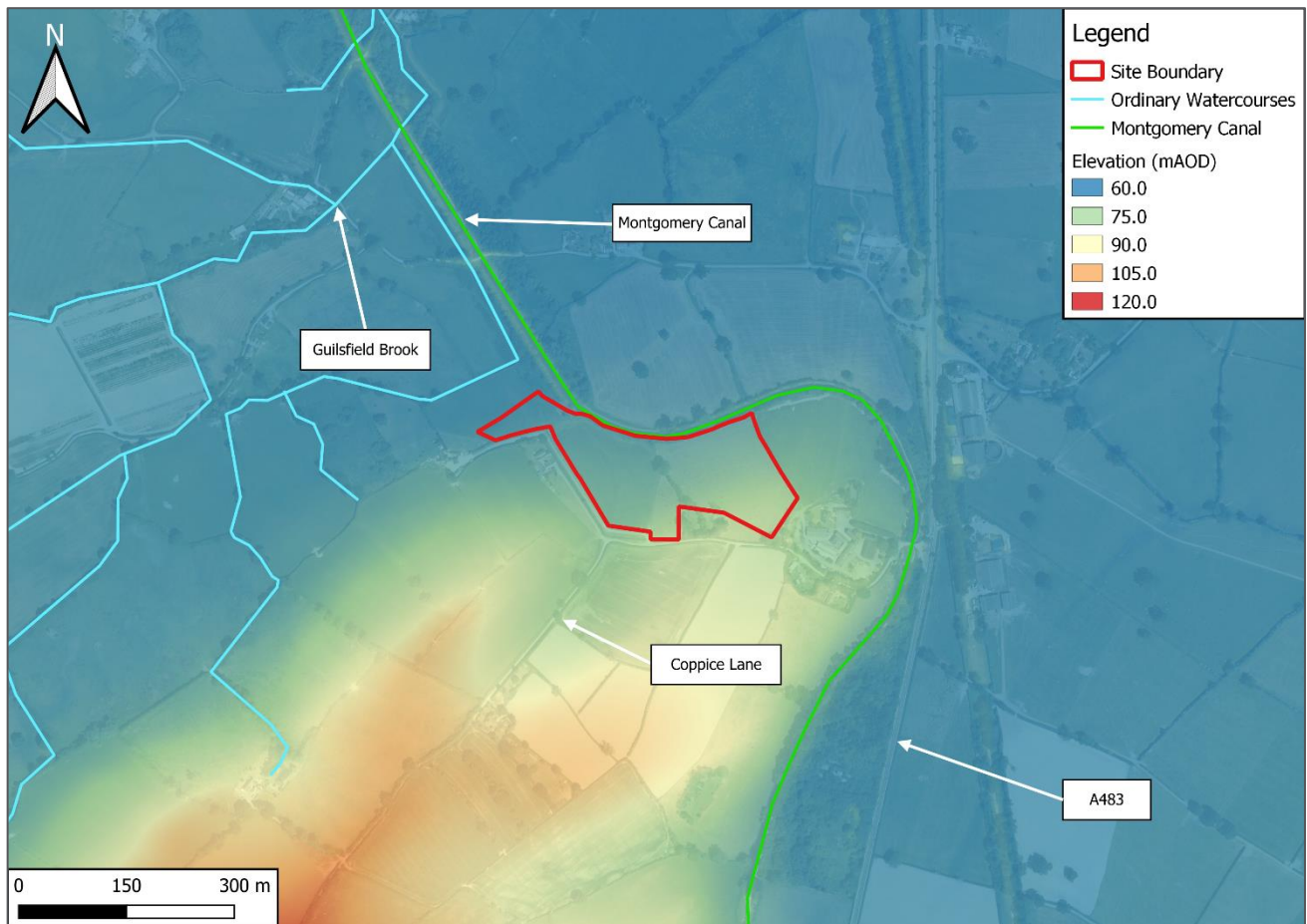


Figure 2 also displays the topographic surroundings of the site. Ground levels to the north of the site are typically between 60mAOD and 64mAOD. To the south of the site, ground levels rise up along a small ridge, running north to south parallel to the River Severn, to approximately 200mAOD.

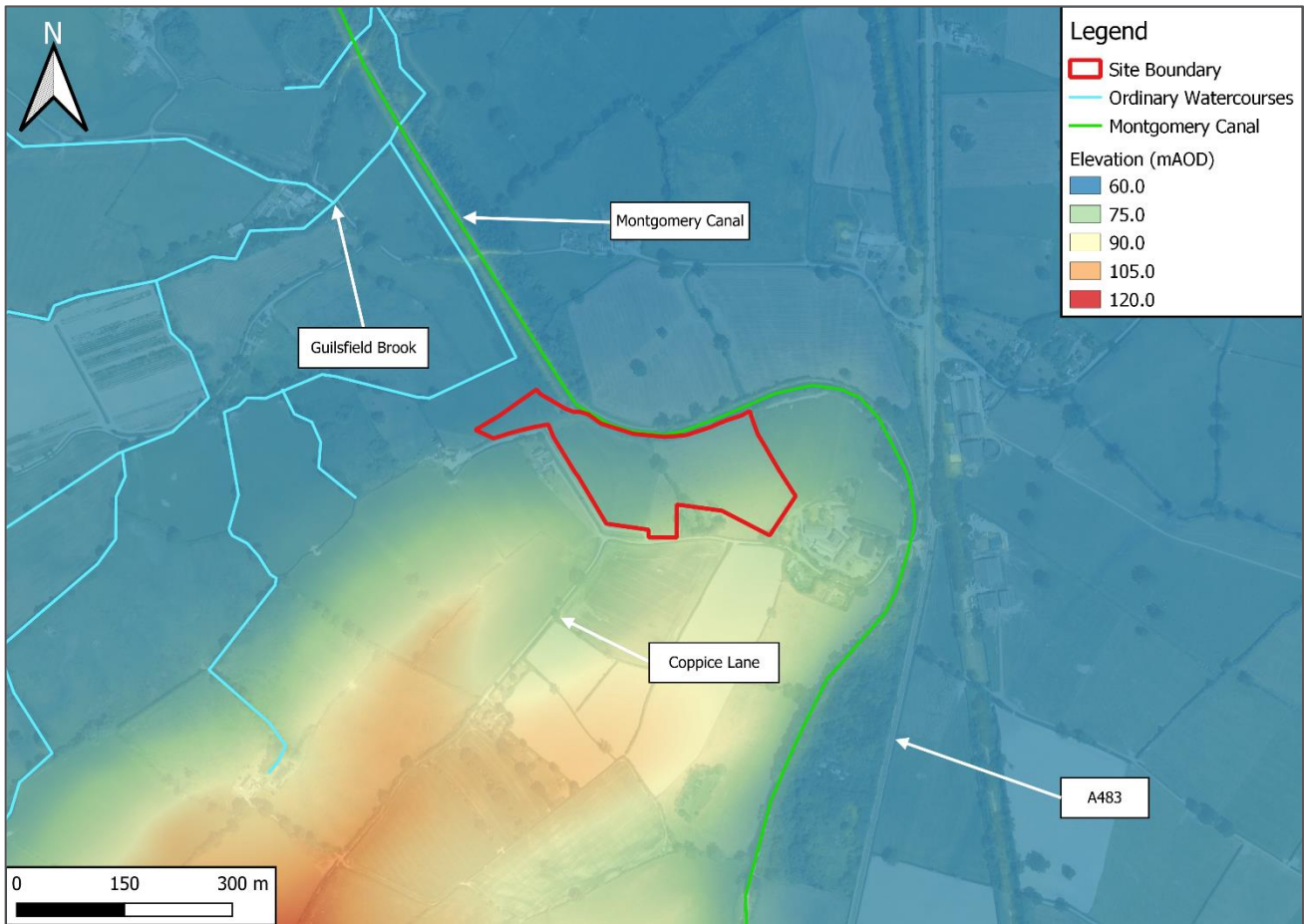


Figure 2 Site Topography

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2.5 Historical Flooding

The NRW Recorded Flood Extents, accessed via the Flood Risk Assessment Wales (FRAW) map² defines the maximum extents of all recorded individual historical flood event outlines resulting from rivers, the sea and groundwater springs, and shows areas of land that have previously been subject to flooding. According to the mapping, flooding of the western part of the site occurred in 1948, 2000, and 2002. The source of these flood extents is assumed to be Guilsfield Brook. The mapped flood extents associated with these events are confined to the northeastern corner of the site, where ground levels are lowest.

There are no records of historic flooding at the site within the Powys County Council (PCC) Stage 1 Strategic Flood Consequences Assessment (SFCA)³. The site is not identified as being at risk of flooding in the PCC

² NRW FRAW Map, available at: <https://naturalresources.wales/flooding/check-your-flood-risk-on-a-map-flood-risk-assessment-wales-map/?lang=en> (Accessed May 2024).

³ PCC SFCA, available at: <https://en.powys.gov.uk/article/5167/Research-Papers> (Accessed May 2024).

Stage 2 SFCA³. There are no records of flooding at the site in the Severn River Basin District Preliminary Flood Risk Assessment (PFRA)⁴.

2.6 Existing Flood Defences

The FRAW Flood Defence Locations map indicates that there are formal flood defences in the vicinity of the site in the form of an embankment. The embankment runs along the eastern side of an ordinary watercourse, named New Cut (this is what Guilsfield Brook becomes downstream of the canal), to the northwest of the site. The embankment connects to Montgomery Canal in the south, and to the River Severn in the north. There are further embankments along the River Severn to the east of the site. The Technical Advice Note (TAN) 15 Defended Zones shown on the FRAW indicate the site does not benefit from flood defences.

⁴ NRW Severn River Basin District PFRA, available at: <https://naturalresources.wales/evidence-and-data/research-and-reports/flooding-reports-evidence-and-data/river-basin-district-preliminary-flood-risk-reports/?lang=en> (Accessed May 2024).

3 TAN15 Development and Flood Risk

3.1 General

Planning Policy Wales (PPW) TAN15 provides guidance to local planning authorities in determining planning applications with regard to flood risk and provides an interpretation of how this guidance applies specifically to a site. It *'provides a framework within which risks arising from both river and coastal flooding and from additional run-off from development in any location can be assessed'*. This *'precautionary framework should be used for both forward planning and development control purposes'*. Its operation is governed by:

- A Development Advice Map (DAM) containing three zones (A, B and C with subdivisions C1 and C2) which should trigger the appropriate planning tests in relation to Sections 6 and 7 and Appendix 1 (TAN15, para 3.2).
- Definitions of vulnerable development and advice on permissible uses in relation to the location of development and the consequences of flooding (TAN15, para 3.2).

The approach is therefore a staged one comprising:

1. Categorisation of the site within TAN15 Flood Zones.
2. Application of TAN15 precautionary framework and determination of whether the site is 'justified' in that zone (TAN15 Section 6 Test).
3. Assessment of flooding consequences (TAN15 Section 7 Test and Appendix 1) and production of a Flood Consequences Assessment report.

3.2 Categorisation of the Site within TAN15 Flood Zones

An extract of the TAN15 DAM overlain with the site boundary is shown in Figure 3 below. The mapping indicates that the site is almost wholly located within Flood Zone A, considered to be at little or no risk of fluvial or coastal flooding. The mapping also indicates that the northeastern corner of the site is classified as Flood Zone C2, defined as land within the extreme flood extent (1 in 1,000 (0.1%) annual probability flood event) without significant flood defence infrastructure.

The DAMs are used alongside PPW and TAN15 to direct new development in respect of flood risk. In relation to the Flood Zones applicable to the site, TAN15 states that:

- Zone A - *'Used to indicate that justification test is not applicable and no need to consider flood risk further'*.
- Zone C2 - *'Used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered'*.

The creation of a wetland reserve does not fall within a specific TAN15 flood vulnerability category. However, to achieve the aims of the project, its proximity to the Montgomery Canal is essential and by its nature the proposed use of the site is of low vulnerability to flooding. Coupled with the vast majority of the site's location in Flood Zone A, the site is therefore justified in the proposed location.

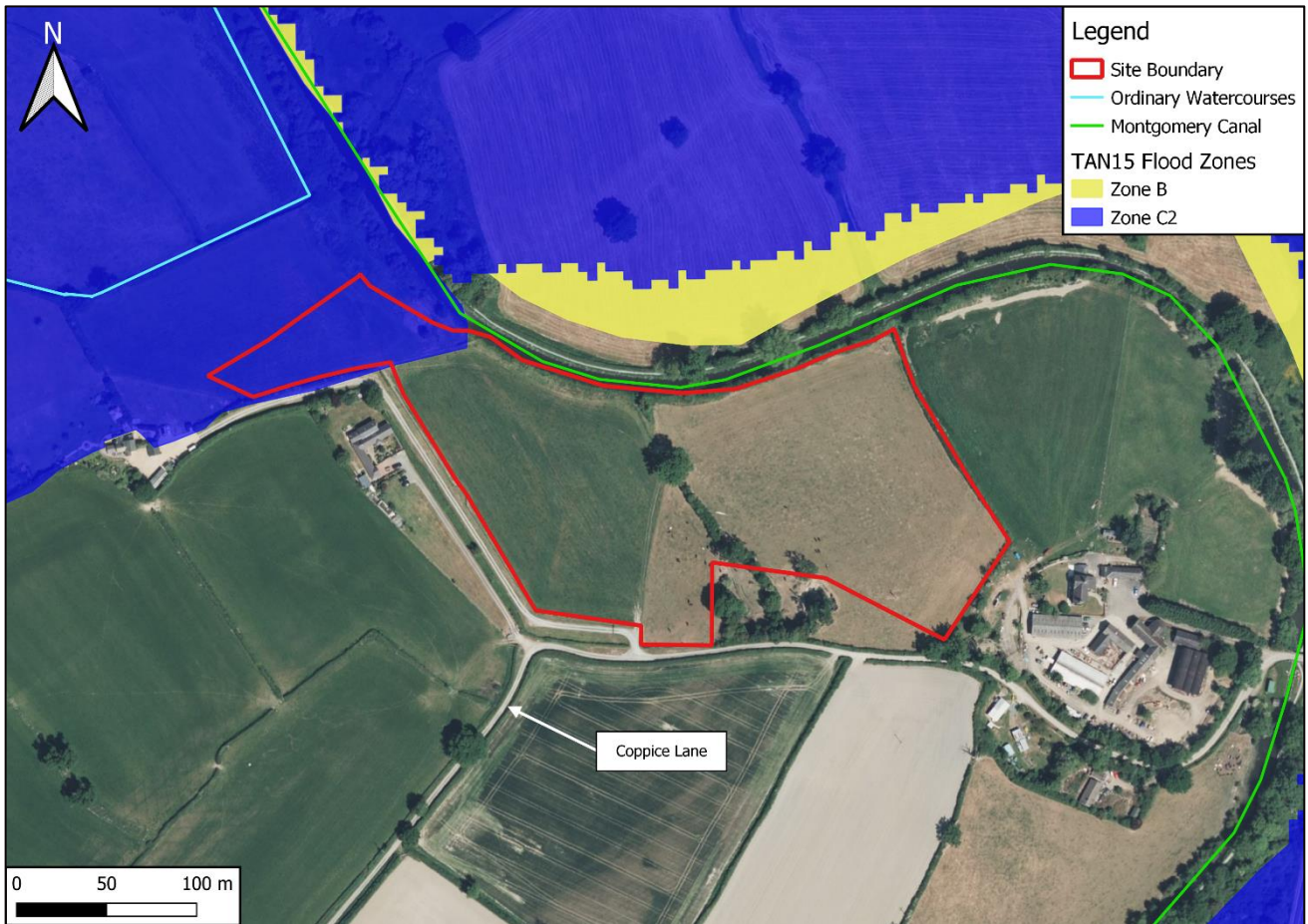


Figure 3 Development Advice Map (site boundary in red)

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3.3 Assessment of Flood Consequences

Having established that the proposed development is justified in its proposed location, the next step is to assess the consequences of flooding. In order to comply with TAN15 guidance, the FCA must demonstrate that the consequences associated with flooding are acceptable and manageable. An assessment of the flood consequences is therefore provided in the following sections.

4 Potential Sources of Flooding

4.1 Overview

This section considers flood risk from the range of possible sources listed in Table 1.

Table 1 Sources of Flooding

Source of Flooding	Description
Flooding from rivers (fluvial)	Flood water originating from a nearby watercourse when the amount of water exceeds the channel capacity of that watercourse.
Flooding from the sea (tidal)	High tides, storm surges and wave action, often acting in combination, flooding low-lying coastal land.
Flooding from surface water (pluvial)	Flooding caused by intense rainfall exceeding the available infiltration and/or drainage capacity of the ground.
Flooding from groundwater	Flooding caused when groundwater levels rise above ground level following prolonged rainfall.
Flooding from sewers	Flooding originating from surface water, foul or combined drainage systems, typically caused by limited capacity or blockages.
Flooding from reservoirs, canals, and other artificial sources	Failure of infrastructure that retains or transmits water or controls its flow.

4.2 Flooding from Rivers

As stated in Section 2.2, the nearest NRW main river is the River Severn, located approximately 1.0km southeast of the site, at its nearest point. Guilsfield Brook, an ordinary watercourse and tributary of the River Severn (via New Cut) is located approximately 380m northwest of the site at its nearest point. There are multiple other smaller watercourses located in the vicinity of the site, including a tributary of Guilsfield Brook which flows in a general north-westerly direction approximately 55m northwest of the site, at its closest point.

The NRW Flood Risk Assessment Wales (FRAW) Map⁵ (Rivers) (Figure 4 below) indicates the risk of flooding from rivers in the present day (i.e. without the impact of climate change included). The mapping shows that

⁵ NRW FRAW, available at <https://naturalresourceswales.gov.uk/flooding/check-your-flood-risk-on-a-map-flood-risk-assessment-wales-map/?lang=en> (Accessed May 2024).

the majority of the site has a very low risk of flooding from rivers, with only the northwestern boundary at a low risk of flooding from rivers.

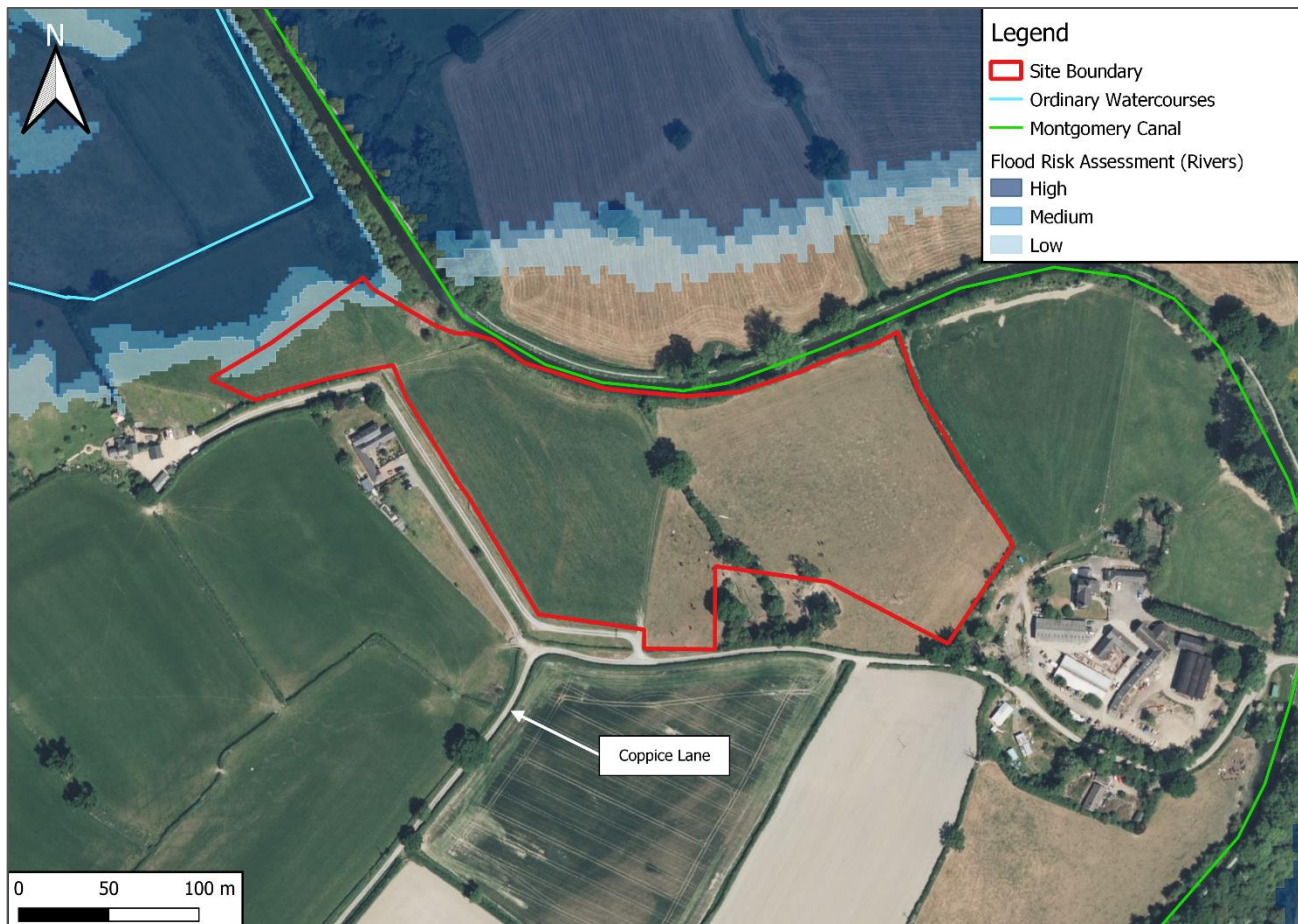


Figure 4 Flood Risk Assessment Wales Map (FRAW) (Rivers)

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The northwestern part of the site, as shown on the design drawings in Appendix A, is proposed to accommodate a raised bund, constructed from the excavated material from the wetland reserve (Bund 1). As shown in Figure 5, flood extents reach the northwestern side of Bund 1 on its northwest and southwest corners only. It is therefore anticipated that the construction of Bund 1 will have a negligible impact on existing fluvial flood extents and flood levels and will not increase flood risk offsite.

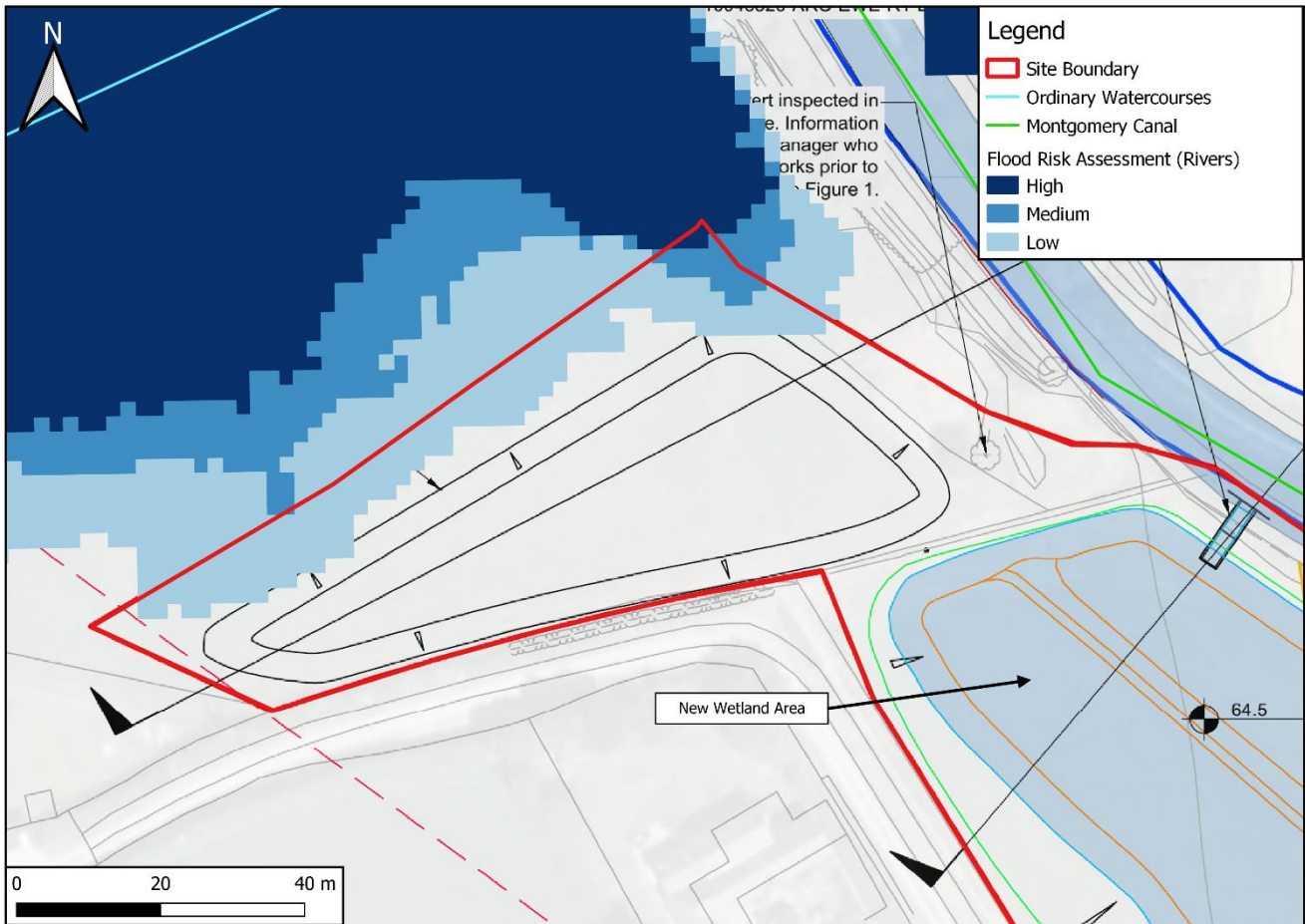


Figure 5 General Arrangement drawing overlain with FRAW (Rivers) flood extents.

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The NRW Flood Map for Planning (Rivers)⁶ (Figure 6), which has been devised to support a forthcoming update to TAN15, shows the potential extent of flooding when the impact of climate change is included. This map shows that almost all the site is located in Flood Zone 1. Flood Zone 1 is defined as land with a chance of flooding less than 0.1% (1 in 1000) in any given year or having a very low risk of river flooding.

The northwestern boundary of the site lies within Flood Zones 2 and 3. Flood Zone 2 is defined as land having a chance of fluvial flooding between 0.1% (1 in 1000) and 1% (1 in 100) in any given year, including the effects of climate change. Flood Zone 3 is defined as land with a chance of flooding greater than 1% (1 in 100) in any given year, with climate change taken into account. This indicates that the majority of the site would remain at a very low risk of flooding from rivers for the lifetime of the development, with only an incremental increase in risk along the northwestern boundary.

⁶ NRW FMfP (Rivers), available at: <https://naturalresources.wales/flooding/flood-map-for-planning-development-advice-map/?lang=en> (Accessed May 2024).



Figure 6 Flood Map for Planning (FMP) (Rivers)

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During the construction phase the access route to the site lies in an area with a high risk of flooding from rivers. Should fluvial flooding occur during construction, this could pose a potential hazard to construction personnel. The operational access would remain at very low risk of flooding from rivers. To manage the temporary risk to users during the construction phase a Flood Warning and Evacuation Plan should be prepared.

The majority of the proposed site is considered to be at ‘very low’ risk of fluvial flooding. The northwestern boundary of the site is at low risk of fluvial flooding, increasing to a medium risk when accounting for climate change. The nature of the development proposal is such that there would be negligible increase in fluvial flood risk off-site as a consequence of the proposals.

4.3 Flooding from the Sea

The site is located approximately 65km inland, and the tidal limit of the River Severn is approximately 145km south of the site boundary. In combination with the elevation of the site, **it is not considered to be at risk of flooding from the sea/tidal sources.**

4.4 Flooding from Surface Water

Flooding from surface water is a potential risk during short, intense rainstorm events or longer duration storms, when the capacity of underlying soils and drainage systems is exceeded, and rainfall runs overland to pond in depressions within the landscape.

The NRW FRAW (Surface Water & Small Watercourses) map (Figure 7) shows the risk of flooding from surface water and smaller watercourses in a defended scenario. This map shows the majority of the site has a very low risk, defined as land having a chance of flooding from surface water and/or small watercourses of less than 1 in 1,000 (0.1%) in any given year.

As shown in Figure 7, there are surface water flow routes running from south to north across the centre of the site and across the northwestern part of the site. There is a low risk of flooding from the surface water flow route across the northwestern part of the site, equivalent to chance between 0.1% (1 in 1000) and 1% (1 in 100) of flooding in any year. The centre of the site is at a medium to high risk of surface water flooding, equivalent to a chance of flooding between 1% (1 in 100) and 3.3% (1 in 30) and greater than 3.3% (1 in 30) respectively.

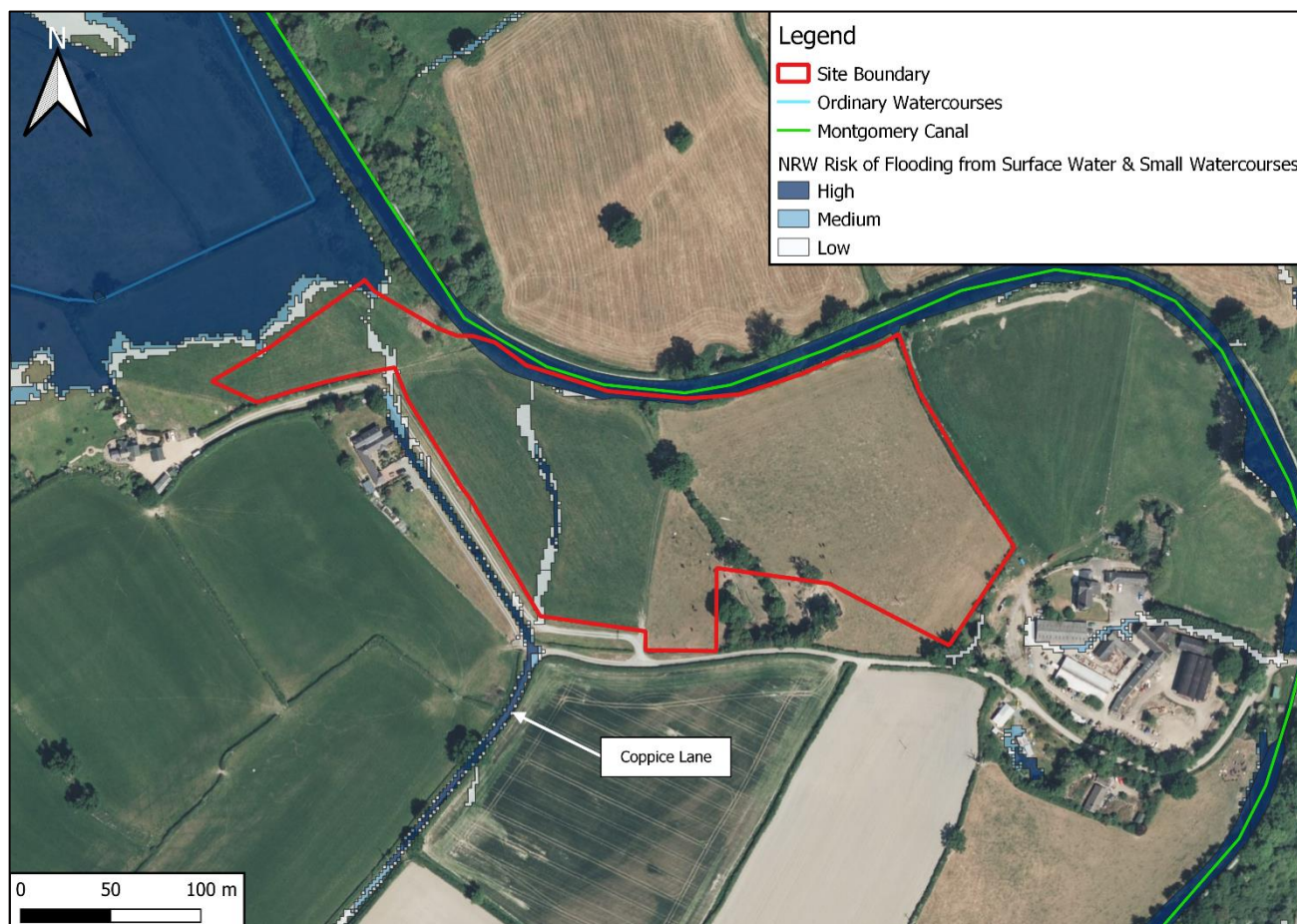


Figure 7 NRW FRAW (Surface Water and Small Watercourses)

Contains Natural Resources Wales information © Natural Resources Wales and/or database right. Contains map data @2023 Bing

Both surface water flow routes run across the proposed location of the bunds that are proposed to be constructed from the excavated material from the wetland reserves (see Appendix B).

The surface water flow route across the centre of the site is crossed by a proposed bund, labelled as Bund 2 (see Appendix B). A review of Lidar data indicates that, when surface water reached Bund 2, it would flow around the western side of the bund towards the proposed wetland reserve. There is a residential property to the west that could be impacted, however, there is an access track running parallel with the toe of the bund that is currently slightly elevated. The space between the toe of the bund and access track would allow surface water to flow around the bund and into the reserve without impacting the residential dwelling.

The surface water flow route across the northwest of the site is crossed by the proposed Bund 1. Lidar indicates that this surface water flow route would be diverted southwest around Bund 1 and eventually into the field to the northwest of the site, which is the destination for this overland flow path currently.

Whilst the proposed bunds are anticipated to slightly disrupt local surface water flow regimes the impact is likely to be minimal as the existing flow paths are only locally affected and the destination (receptors) are not changed by the proposed development. Furthermore, these surface water flow path only occur in the low risk (0.1% (1 in 1000)) chance event.

The majority of the site is considered to be at 'very low' risk of surface water flooding.

4.5 Flooding from Groundwater

Groundwater flooding occurs when groundwater rises to the ground surface. This may happen during winter and/or after prolonged or heavy rainstorms. There are generally two forms of groundwater flooding (i) 'clearwater flooding' associated with the water table rising to the surface in areas of permeable bedrock geology such as chalk; and (ii) 'river-groundwater interaction' where river levels interact with permeable superficial deposits within river valleys, flooding areas far from the river without necessarily overtopping raised riverbanks.

British Geological Survey (BGS) online mapping⁷, indicates that the bedrock geology underlying the site comprises Nant-ysgollon Mudstone Formation, which is overlain by superficial deposits of Devensian Till. The Department for Environment, Food and Rural Affairs (DEFRA) Magic Map⁸ characterises the bedrock of the site as a 'Secondary B' aquifer, defined as 'mainly lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks (called fissures) and openings or eroded layers'⁹. Given the absence of a permeable bedrock geology, the risk of clearwater flooding is remote. The superficial deposits support a Secondary A aquifer, defined as 'permeable layers that can support local water supplies, and may form an important source of base flow to rivers'⁹.

While groundwater flooding is possible by 'river-groundwater interaction' given the presence of more permeable superficial deposits, any groundwater emergence would be likely in the lower lying areas surrounding the site, namely to the north of the site, where the proposed wetland reserve is located.

The Severn River Basin PFRA⁴ states that groundwater flooding is difficult to map and model, but there are very few areas across Wales which are susceptible to groundwater flooding due to the geology, topography and prevalence of disused mines. The PCC SCFA³ suggests that the risk of groundwater flooding in Powys is low.

The site is considered to be at 'low' risk of groundwater flooding.

4.6 Flooding from Sewers

Flooding from sewers can result from lack of sewer capacity, blockages within the sewer network or failure of infrastructure such as pumps. Any area that benefits from sewerage infrastructure has a potential risk of flooding, but the likelihood and consequences are increased by topographic constraints such as low spots or flow paths that could influence the behaviour of floodwater originating from sewers.

The site is rural and slopes towards the Montgomery Canal and River Severn and is not identified as being at risk of having historically flooded due to sewer overloading within the PCC SFCA³.

Based on available information, the proposed development is considered to be at 'low' risk of flooding from sewers.

⁷ British Geological Survey - Geology of Britain Viewer, available at <https://www.bgs.ac.uk/map-viewers/bgs-geology-viewer/> (Accessed May 2024).

⁸ DEFRA Magic Map, available at <https://magic.defra.gov.uk/magicmap.aspx> (Accessed May 2024).

⁹ Environment Agency - Protect groundwater and prevent groundwater pollution (2017), available at <https://www.gov.uk/government/publications/protect-groundwater-and-prevent-groundwater-pollution/protect-groundwater-and-prevent-groundwater-pollution> (Accessed May 2024).

4.7 Flooding from Reservoirs, Canals and other Artificial Sources

The NRW Risk of Flooding from Reservoirs map¹⁰ provides a general indication of areas that could be flooded if a large reservoir were to fail and release the water it holds. The Flooding from Reservoirs map indicates that most of the site is situated outside the extents of reservoir flooding. The western boundary of the site is shown to be within reservoir flood extents. The Reservoirs Act (1975), enforced by NRW, ensures the regular inspection and safety of reservoirs across Wales, making reservoir flooding a very low likelihood event⁴.

The site is located adjacent to Montgomery Canal. The Trust undertakes active water management in periods of heavy rainfall to minimise widespread canal flooding, though under extreme conditions canal flooding could still occur. As noted in Section 2.3, the purpose of the proposed development is to create a wetland reserve and the design indicates that the site will be connected to Montgomery Canal in order to supply water to the wetland reserve. Therefore, it is an essential aspect of the proposed development that Montgomery Canal can spill into the wetland reserve.

The site is considered to be at 'low' risk of reservoir flooding. It is an essential part of the design of the proposed development that the site accepts some excess water from the Montgomery Canal.

¹⁰ Natural Resources Wales - Flood Risk Assessment Wales Map – Reservoirs, available at <https://flood-risk-maps.naturalresources.wales/?locale=en> (Accessed May 2024)

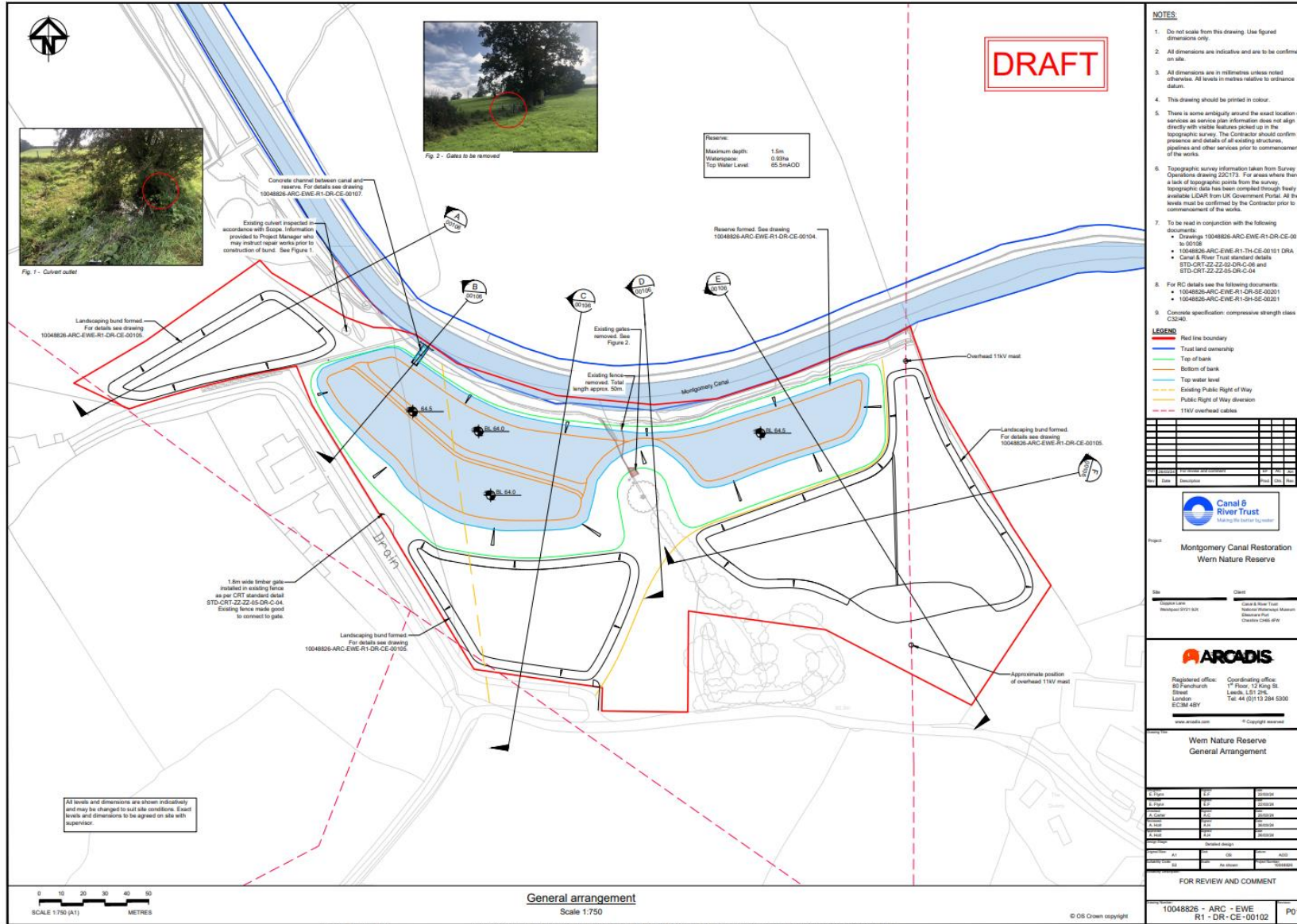
5 Conclusions

This FCA has been prepared to inform the proposed works to create a wetland reserve alongside the Montgomery Canal as part of a wider scheme to restore the Montgomery Canal. Flooding from all sources has been assessed and the following concluded:

- The TAN15 DAM indicates that the site is almost wholly located within Flood Zone A, with a small area in Flood Zone C2.
- Most of the proposed site is considered to be at 'very low' risk of fluvial flooding now and in future. The western boundary of the site is considered to be at 'low' risk of flooding, increasing to a 'medium' to 'high' risk when considering future climate change.
- The majority of the site is considered to be at 'very low' risk of surface water flooding. There are two local surface water flow routes across the site; however, the impact on third parties is not considered to be significant.
- The site is considered to be at risk of flooding from the Montgomery Canal. However, given the purpose of the development, the connection between the wetland reserve and the canal is essential.
- The site is considered to be at low risk from all other sources.
- The creation of the wetland reserve would not increase the risk of flooding off site from any source.
- This FCA has demonstrated that flood risk to the site would be acceptable, and the development would not increase third party flood risk.

Appendix A

General Arrangement



Project: Montgomery Canal Restoration
Wern Nature Reserve

Client: Canal & River Trust
 Making the better by water

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**Wern Nature Reserve
 General Arrangement**

Rev	By	Date	Description
1	ARC	22/08/24	Issue for comment
2	ARC	22/08/24	Issue for comment
3	ARC	22/08/24	Issue for comment
4	ARC	22/08/24	Issue for comment
5	ARC	22/08/24	Issue for comment
6	ARC	22/08/24	Issue for comment
7	ARC	22/08/24	Issue for comment
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41	ARC	22/08/24	Issue for comment
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50	ARC	22/08/24	Issue for comment

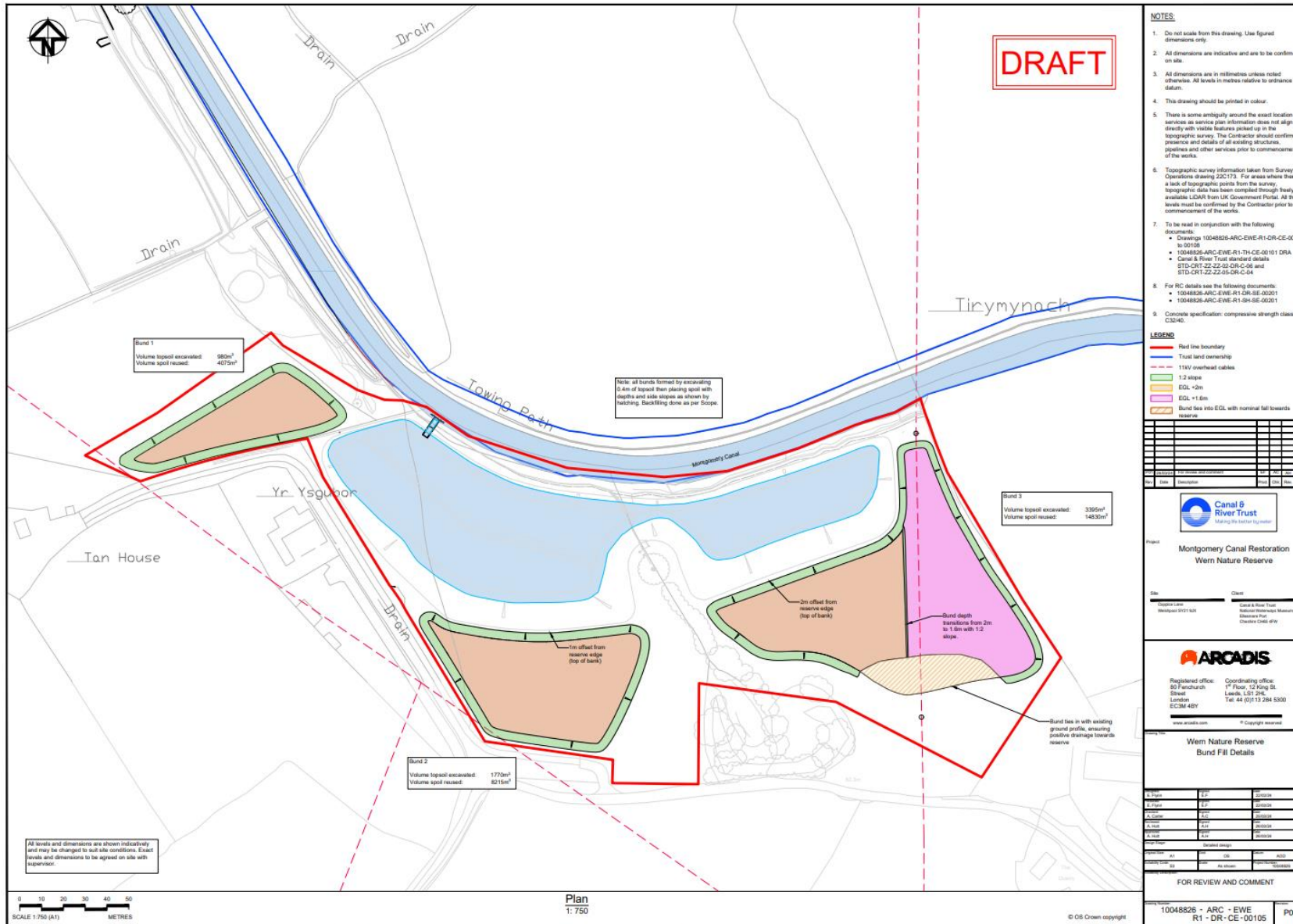
FOR REVIEW AND COMMENT

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Appendix B

Fill Details



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