Flood Risk and Drainage Assessment

Proposed Treatment Shed at Pontrilas Sawmill, Herefordshire

On Behalf of

Pontrilas Sawmills Limited

Quality Management

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1 Introduction

1.1 Background

This Flood Risk Assessment has been prepared by Hydrogeo Ltd. (Hydrogeo) to support a planning application for proposed commercial development comprising a wood treatment building at Pontrilas Saw Mill, Hereford, HR2 0BE (the Planning Site). The Planning Site is located within the wider Pontrilas Saw Mill site, shown below in Figure 3-2.

This FRA also includes an assessment of the existing and proposed surface water drainage for the proposed development.

The location of Pontrilas Saw Mill and the Planning Site is discussed in Section 2.

This FRA has been carried out in accordance with guidance contained in the National Planning Policy Framework (NPPF)[1] and associated Planning Practice Guidance[2]. This FRA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

It is recognised that developments which are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works. The development design should be such that future users will not have difficulty obtaining insurance or mortgage finance, or in selling all or part of the development, as a result of flood risk issues.

1.2 National Planning Policy Framework (NPPF)

One of the key aims of the NPPF is to ensure that flood risk is taken into account at all stages of the planning process; to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk.

It advises that where new development is exceptionally necessary in areas of higher risk, this should be safe, without increasing flood risk elsewhere, and where possible, reduce flood risk overall.

A risk-based approach is adopted at stages of the planning process, applying a source pathway receptor model to planning and flood risk. To demonstrate this, an FRA is required and should include:

- Whether a proposal is likely to be affected by current or future flooding from all sources;
- Whether it will increase flood risk elsewhere;
- Whether the measures proposed to deal with these effects and risks are appropriate;

[1] Ministry of Communities, Housing and Local Government (2019) National Planning Policy Framework.
[2] Communities and Local Government (2014) Planning Practice Guidance - Flood Risk and Coastal Change.

- If necessary, provide the evidence to the Local Planning Authority (LPA) that the Sequential Test can be applied; and
- Whether the development will be safe and pass part c) of the Exception Test if this is appropriate.

1.3 Report Structure

This FRA has the following report structure:

- Section 2 details the sources of information that have been consulted;
- Section 3 describes the location area and the existing and proposed development;
- Section 4 outlines the flood risk to the existing and proposed development;
- Section 5 details the sequential and exception tests;
- Section 6 describes and details the surface water drainage for the Planning site and assesses the potential impacts of the proposed development of surface water drainage
- Section 7 Summarises and concludes the report with recommendations.

2 Sources of Information

2.1 Regulatory Guidance

Review of guidance from the relevant regulators has been undertaken during the preparation of this FRA including with the Environment Agency (EA), the Local Planning Authority (LPA), the Lead Local Flood Authority (LLFA) and Sewerage Undertakers.

2.2 Environment Agency

The Flood and Water Management Act 2010 gives the EA a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for the prevention, mitigation, and remediation of flood damage for main rivers and coastal areas. The EA is the statutory consultee with regards to flood risk and planning.

EA Flood Risk Standing Advice for England, the NPPF and the Planning Practice Guidance to the NPPF has been consulted and reviewed during this FRA. This has confirmed the level of FRA required and that a surface water drainage assessment is to be undertaken. Information regarding the current flood risk at the Planning Site and local flood defences has been obtained from the EA.

2.3 Herefordshire County Council

Herefordshire County Council is the LLFA and therefore has responsibilities for 'local flood risk', which includes surface runoff, groundwater and ordinary watercourses. Planning guidance written by Herefordshire County Council as the LPA regarding flood risk was consulted to assess the mitigation policies in place. The Herefordshire Strategic Flood Risk Assessment (SFRA) which covers the Planning Site has been reviewed.

2.4 Dwr Cymru Welsh Water

Dwr Cymru, Welsh Water is responsible for the disposal of wastewater and supply of clean water for this area. All Water Companies have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system.

3 Location & Development Description

3.1 Site Location

Pontrilas Sawmill (the Site) is located in Herefordshire, near the village of Pontrilas, approximately 10 miles south of Hereford. The postcode for the Site is HR2 0BE, and the National Grid Reference is SO403284.

Figure 3-1 **Pontrilas Saw Mill Development Area Locaiton**

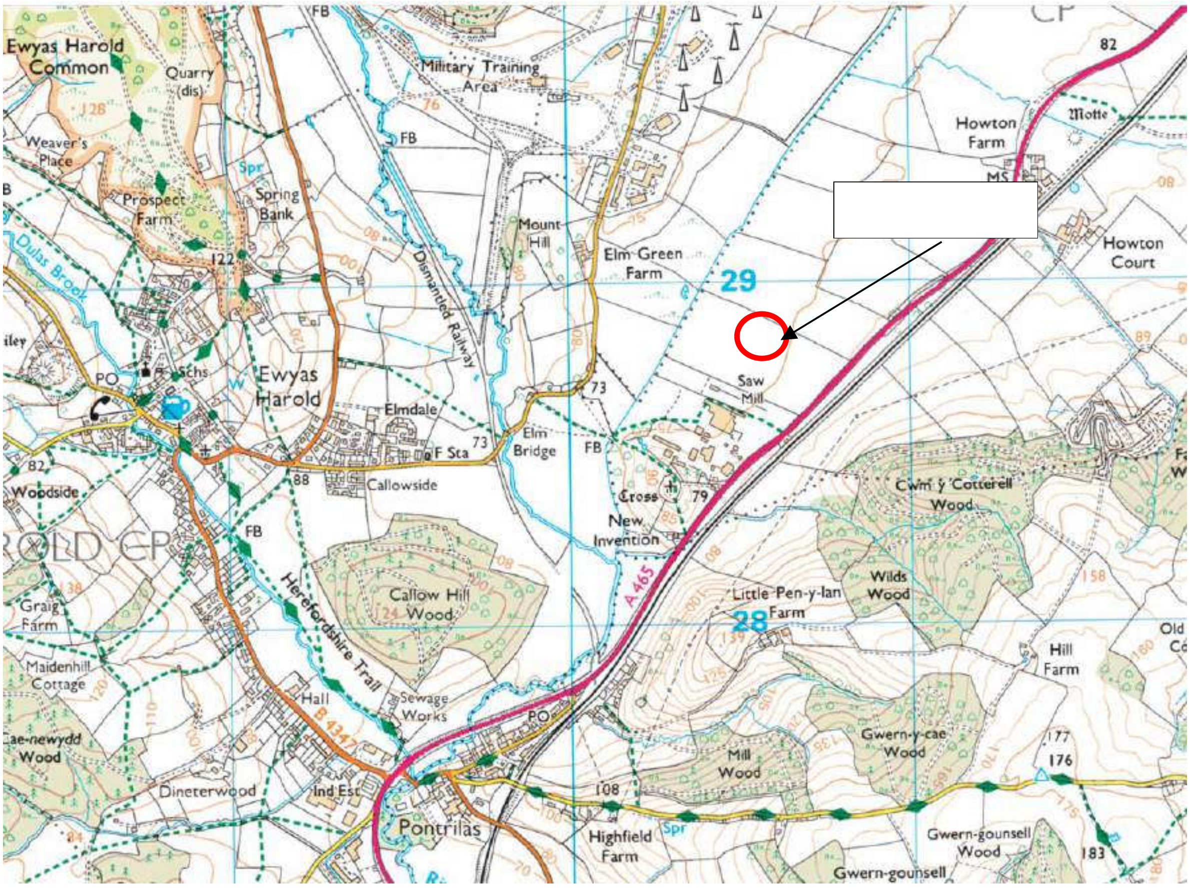

Figure 3-2 Development Site boundary

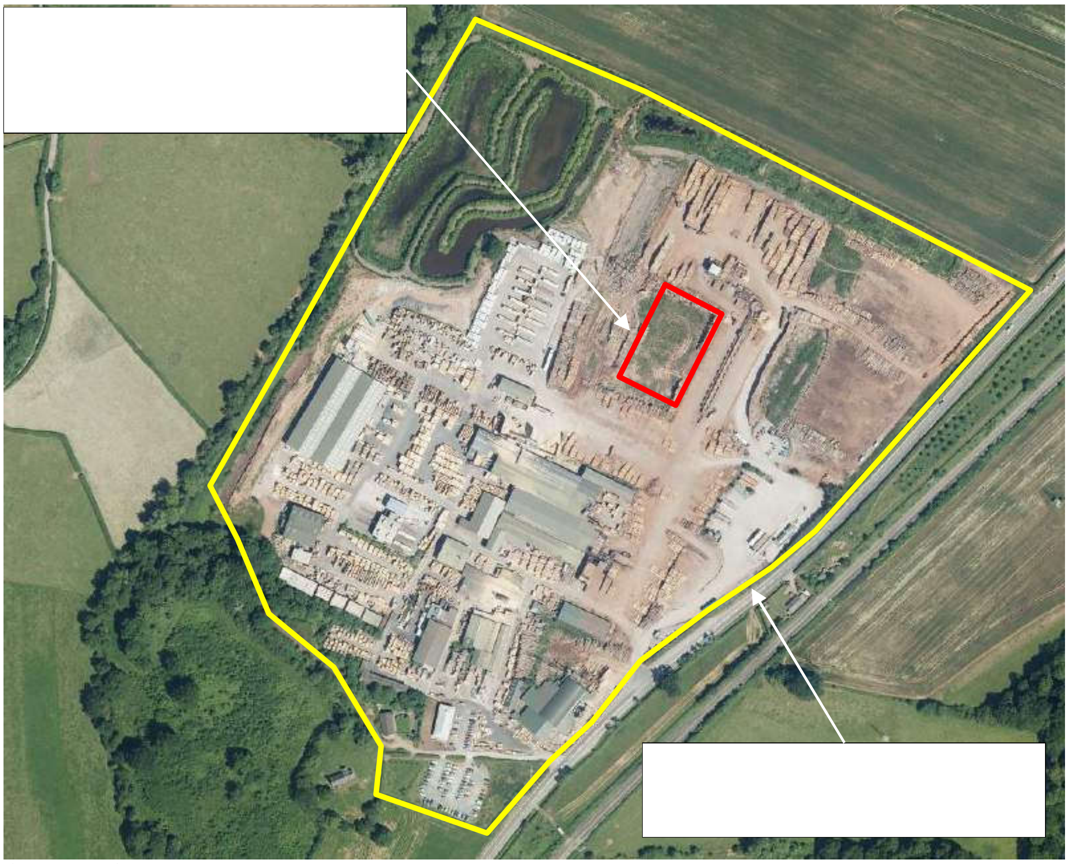

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Figure 3-3 Proposed treatment building location

3.2 Existing Development

The Site has been occupied by Pontrilas Sawmills since 1947. Two sawmill operations occur on site for both hardwood and softwood timber. The hardwood mill is the smaller of the two mills. The Pontrilas Sawmill site occupies an area of approximately 24ha.

The Site is bounded to the east by the A465 and to the west by Worm Brook. Areas to the north and south of the Site are dominated by agricultural lands.

Worm Brook poses the primary flood risk to the western and north-western areas of the Site. Figure 3-4 below shows evidence of Worm Brook exceeding the Banks.

Figure 3-4 Silty deposits on the banks of Worm Brook following a flood event in February 2021.

An area of 3.5ha in the north-western corner of the Site has been transformed into a biodiverse wetland to mitigate the extension of the timber site. This established wetland comprises a series of planted pools formed as terraces, which are fed from interceptor drains laid underneath and across the northern part of the Site. An area of approximately 9,600m^2 along the northern site boundary has been formed into an Attenuation Wetland, which treats and attenuates rainwater runoff form the sawmill processes.

3.3 Proposed Development

The proposed development consists of a treatment building that will occupy an area of the existing sawmill site of approximately 0.3ha (shown in Figure 3-5). The building dimensions are 46m x 36m. The treatment building consists of a steel portal frame, rectangular in form with a shallow pitched roof.

The treatment process area will be fully bunded to ensure there is a reduced risk of contamination of the Site in the unlikely event of a spillage.

Surface water runoff from the proposed treatment building will connect to the existing drainage of the Site. Stormwater drainage from the roof of the proposed treatment building will discharge to the existing drainage via sub-surface stormwater drains.

Surface water drainage for the Planning Site has been discussed in Section 6.

Figure 3-5 Proposed treatment building location looking to the north.

A plan of the proposed development at the Planning Site and its context within the Site has been attached at Appendix A.

3.4 Previous Reports

Pontrilas Saw Mill drainage infrastructure has been designed by Opus in 2014 and implemented by the Client.

The drainage infrastructure consists of a number of catchpits, trenches and gullies that drain water to a series of established attenuation basins along the northern sawmill site boundary. These attenuation basins then drain into the established biodiverse wetlands located to the north-western corner of the Site. This water then eventually discharges into the Worm Brook which runs adjacent to the western boundary of the Site.

The drainage layout in the 2014 Opus design was sized and designed to allow for future site developments (red systems on Opus design) and therefore the proposed treatment building development will not be in addition to areas already assessed and designed for drainage.

The Opus drainage description has been included in Appendix C.

3.5 Ground Levels

A topographical survey conducted by Opus, dated 22 September 2014 indicates that the site level varies from 78.7mAOD in the car and lorry parking area, to levels of 71.4mAOD in the Wetlands area.

3.6 Catchment Hydrology/Existing Drainage

The River Dore flows to the West of the site boundary. The river is a tributary of the River Monnow and has a catchment area of 84.36km^{2}.

Worm Brook runs adjacent to the Western boundary of the Site and is the primary source of any potential flooding.

Wetland and attenuation basins are present along the northern site boundary.

There are no public surface water sewers located within the vicinity of the Site.

Stormwater drains via underground drainage systems, attenuation basins, a flow restriction device and a bioretention wetland area into the Worm Brook, adjacent to the western site boundary. The drainage of the Planning Site will be connected to the existing Site drainage network, as discussed in further detail in Section 6.

3.7 Ground Conditions

The British Geological Survey (BGS) GeoIndex Onshore viewer, and BGS map sheet 215, Ross-on-Wye, Solid and Drift, 1:50,000 (2000) have been consulted to determine the Ground conditions of the Site. There is record of 1no. borehole on site, and several others in the vicinity, which have also been used to determine expected ground conditions on site and in the vicinity.

The bedrock geology underlying the Site consists of the Raglan Mudstone Formation, which is described as interbedded Red Mudstones and Silty Mudstones with calcretes and sandstones.

The formation was deposited under fluvial conditions during the Silurian Period, approximately 419 to 424 million years ago.

Superficial deposits underlying the Site consist of Alluvium, described as clay, silt, sand and gravels. Alluvium is an unconsolidated detrital material deposited by a body of running water as a sorted or semi-sorted sediment in the bed of the waterbody or on its floodplain or delta. Superficial deposits formed up to 2 million years ago in the Quaternary Period.

Information from the National Soil Resource Institute[3] details the Site area as Soilscape 8: slightly acid loamy and clayey soils with impeded drainage.

The ground conditions encountered from the borehole record are shown in table 3-1 below:

[3] https://www.landis.org.uk/soilscapes/

The historic borehole, reference: S042NW2 is located in the southern carpark area of the Site, British National Grid:340,390,228380. The borehole was advanced to a depth of 30.8mBGL.

Table 3-1 Geology

Reference	Depth (mBGL)	Geology
SO42NW2	0.0 – 6.1	Red Marl (Raglan Mudstone Formation)
	6.1 – 11.5	Red Marl and Sandstone (Raglan Mudstone Formation)
	11.5 – 28.7	Red Marl, Clay, Pieces of Sandstone (Weathered Raglan Mudstone Formation)
	28.7 – 29.3	Brown Sandy Clay
	29.3 – 30.8	Red Marl (Raglan Mudstone Formation)

3.8 Site Walkover

Hydrogeo conducted a site walkover on 08/02/2021 in order to capture the current site layout and record surface water features. Photographs taken during the walkover visit have been included throughout the report to aid site and drainage description and understanding.

4 Flood Risk

4.1 Sources of Flooding

All sources of flooding have been considered, these are; Fluvial (river) Flooding, Tidal (coastal) Flooding, Groundwater Flooding, Surface Water (pluvial) Flooding, Sewer Flooding and Flooding from Artificial Drainage Systems/Infrastructure Failure.

4.2 Historic Flooding

The Environment Agency historic flood map shows that the Planning Site has historically flooded.

Historically the Site and Planning Site have fallen within areas of flooding, the special extent of this historic flooding is highlighted in Drawing 1 of the report. It shows that a large area of the Site, which includes the Planning site falls within the historically flooded.

However, it is likely that the historic flood events predate any planned or existing flood defence measures along the western site boundary. These flood defences are discussed below in 4.3.

4.3 Existing and Planned Flood Defence Measures

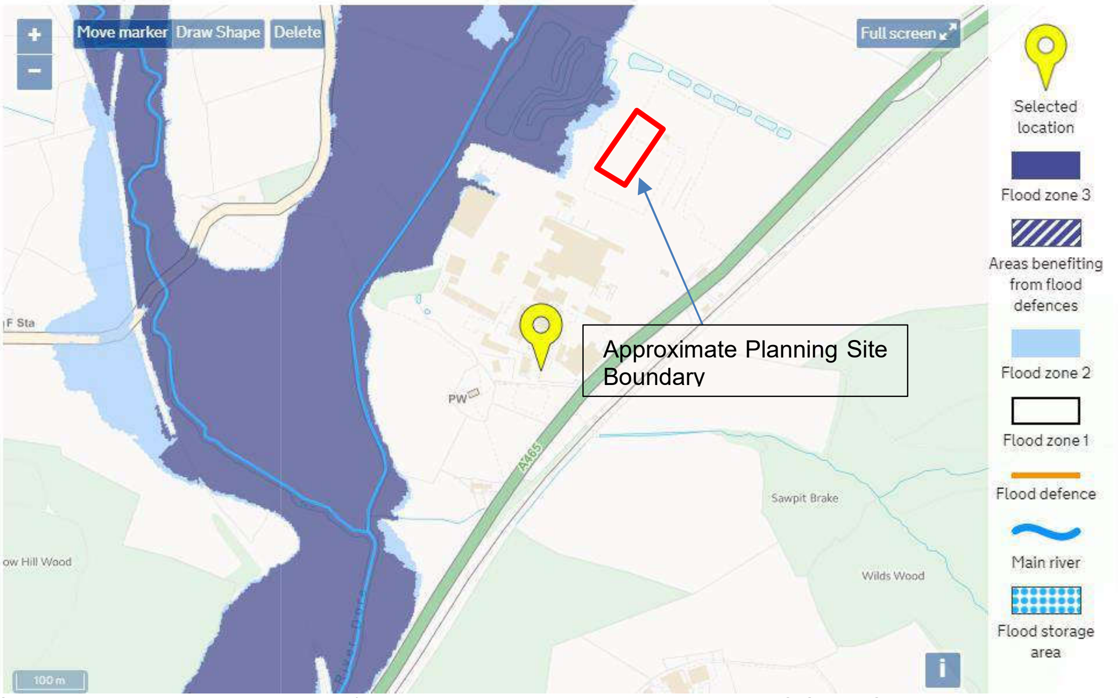
Several flood defences exist along the western boundary of the Site adjacent to Worm Brook. These defences include existing tree and shrubbery planting, as well embankments and bunds.

There is a weir within Worm Brook which is likely used to alter the Brooks flow characteristics, such as the height of the Brook water level.

4.4 Environment Agency Flood Zones

A review of the Environment Agency's Flood Zones indicates the Planning Site is located within Flood Zone 1 and therefore has a 'low probability' of fluvial flooding, with less than a 1 in 1000 annual probability of river flooding in any year (<0.1%), as shown in Figure 4-1.

Figure 4-1 Environment Agency flood map



The Environment Agency Flood Zones are precautionary. The Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development. The Flood Zones show the worst-case scenario.

The Environment Agency Flood Zones and acceptable development types are explained in Table 4-1. Table 4-1 shows that all development types are generally acceptable in Flood Zone 1.

Table 4-1 Environment Agency flood zones and appropriate land use

Flood Zone	Probability	Explanation	Appropriate land use
Zone 1	Low	Less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)	All development types generally acceptable
Zone 2	Medium	Between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% 0.1%) in any year	Most development type are generally acceptable
Zone 3a	High	A 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year	Some development types not acceptable
Zone 3b	'Functional Floodplain'	Land where water has to flow or be stored in times of flood. SFRAs should identify this zone (land which would flood with an annual probability of 1	Some development types not acceptable

Flood Zone	Probability	Explanation	Appropriate land use
		in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1% flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes)	

4.5 Flood Vulnerability

In the Planning Practice Guidance to the NPPF, appropriate uses have been identified for the Flood Zones. Applying the Flood Risk Vulnerability Classification in the Planning Practice Guidance, the proposed development ('general industry') is classified as 'less vulnerable'.

Table 4-2 of this report and the Planning Practice Guidance to the NPPF state that 'less vulnerable' uses are appropriate within Flood Zone 1.

Table 4-2 Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception test required	✓	✓
Zone 3a	Exception test required	✓	×	Exception test required	✓
Zone 3b 'Functional Floodplain'	Exception test required	✓	×	×	×

Key: *✓: Development is appropriate, ×: Development should not be permitted.*

4.6 Climate Change

Projections of future climate change in the UK indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Guidance included within the NPPF recommends that the effects of climate change are incorporated into FRAs. Recommended precautionary sensitivity ranges for peak rainfall intensities and peak river flows are outlined in the associated Planning Practice Guidance to the NPPF[4].

Table 4-3 shows peak river flow allowances by river basin district. The proposed lifetime of the development is 100 years, as per EA advice. The flood risk assessments: climate change allowances guidance recommends that for 'less vulnerable' uses in Flood Zone 1

[4] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#high-allowances.

that the higher central allowances are used over the lifetime of the proposed development. Therefore, the design event for the Site is the 1 in 100 year (+35%) event.

Table 4-3 Peak river flow allowances by river basin district (use 1961 to 1990 baseline)

River basin district	Allowance category	2015 to 2039	2040 to 2059	2060 to 2115
Severn	Upper end	+25%	+40%	+70%
	Higher central	+15%	+25%	+35%
	Central	+10%	+20%	+25%

4.7 Fluvial (river) Flooding

The Worm Brook that flows adjacent to the western boundary of the Site poses the primary flood risk to the Planning Site. The Planning Site is located in a ‘very low risk’ zone from fluvial flooding. This indicates that the Planning Site has a chance of flooding of less than 0.1%. The effects of flood defences in the area are considered. These defences reduce, but do not completely mitigate the chance of flooding.

The flood risk to the Planning Site from fluvial flooding can be considered to be limited. Any overbank flow would follow the contours of the surrounding area and would flow away from the Planning Site rather than flowing towards the Planning Site. The flood risk can also be considered to be limited due to the difference in elevations. The ground levels of the Planning Site are approximately 4m above the level of Worm Brook.

Therefore, the risk of fluvial flooding is considered to be of **very low significance**.

4.8 Tidal (coastal) Flooding

The Planning Site is not located within the vicinity of tidal flooding sources and the risk of tidal flooding is considered to be **not significant**.

4.9 Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

Groundwater flooding tends to occur sporadically in both location and time. When groundwater flooding does occur, it tends to mostly affect low-lying areas, below surface infrastructure and buildings (for example, tunnels, basements, and car parks) underlain by permeable rocks (aquifers).

The risk of groundwater flooding is considered to be low, and it is not considered to be a significant issue within the catchment. This risk is based upon the available geological information and mapping, where the site is underlain by low permeability clays, with an absence of highly permeable deposits such as sands and gravels. There are no subsurface structures related to the treatment building. Therefore, the risk of flooding from groundwater flooding is considered to be **not significant**.

4.10 Surface Water (pluvial) Flooding

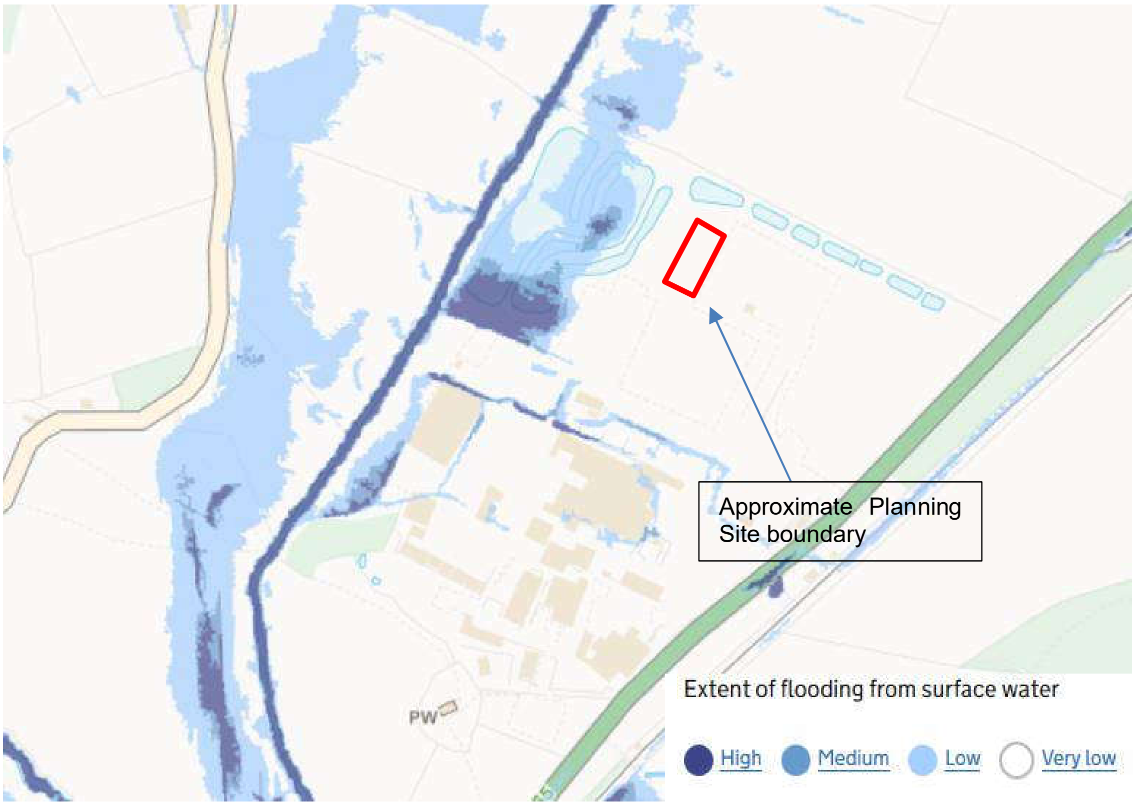
Surface water flooding tends to occur sporadically in both location and time. The Planning Site is not situated on, or adjacent to large areas of poor permeability with the majority of the surrounding area being in a greenfield state. The Environment Agency Surface Water flood map shows that the Planning Site has a very low risk of surface water flooding. Very low risk means that each year this area has a chance of flooding of less than 0.1% chance (1 in 1000 years).

Excess surface waters are drained down gradient towards Worm Brook, adjacent to the western boundary of the Site. This is aided by the presence of a series of several attenuation ponds, which collectively drain into the diverse wetlands area in the north-western corner of the Site.

Flooding from surface water is difficult to predict as rainfall location and volumes are difficult to forecast. Additionally, local scale features can greatly influence the chances and severity of surface water flooding.

An existing surface water drainage strategy has previously been prepared by Opus in 2014. The designed strategy accommodates for a 1 in 100-year rainfall event. Drainage particulars and further discussion of the drainage infrastructure is discussed below in Section 6. Any resulting flooding would be expected to be very infrequent and to have a have a very low predicted depth. Therefore, the risk of flooding from surface water flooding is considered to be **not significant.**

Figure 4-2 Environment Agency surface water flood map



In conclusion, the risk of flooding from surface water flooding is considered to be **not significant**.

4.11 Sewer Flooding

Sewer flooding occurs when urban drainage networks become overwhelmed and maximum capacity is reached. This can occur if there is a blockage in the network causing water to back up behind it or if the sheer volume of water draining into the system is too great to be handled. Sewer flooding tends to occur sporadically in both location and time such flood flows would tend to be confined to the streets around the development.

There are no surface water or foul sewers at the Planning Site and therefore the risk of flooding from sewer flooding is considered to be **not significant**.

4.12 Flooding from Artificial Drainage Systems/Infrastructure Failure

There are several nearby artificial water bodies and artificial drainage systems that could be considered a flood risk to the Planning Site. A series of attenuation basins are located to the north-east of the proposed treatment building location. Water is drained from these attenuation basins into the Wetlands area located in the north-western corner of the Site.

Figure 4-3 below shows the attenuation basin that the development area would discharge to via the existing drainage. A low water level is retained in the basin, which demonstrates that attenuation storage volume is provided by the high and low pipe level discharge arrangement. The adjacent (and final) attenuation pond in the series (Figure 4-4), was holding water back, due to a flow control device, following the recent high rainfall period preceding the site visit. The site drainage therefore appears to be operating as designed.

It is recommended as part of the drainage strategy that all attenuation basins are inspected, cleaned if necessary and maintained in fully functional condition. This will ensure that surface water runoff from the proposed treatment building is discharged effectively and without increasing the risk of flooding.

Figure 4-3 Established attenuation basin (No. 6).

The Environment Agency Reservoir flood map shows that the Planning Site is not at risk of reservoir flooding due to reservoir failure, therefore the risk of flooding from artificial drainage systems/infrastructure failure is considered to be **not significant**.

4.13 Impact of the Proposed Development on Flood Risk

Drainage from the proposed treatment building will be connected to the existing drainage network at the Site, which includes stormwater drainage which discharges via an existing engineered surface water drainage system prior to discharge into Worm Brook adjacent to the western site boundary.

Surface water runoff from impermeable surfaces at the Site discharges into the series of attenuation basins along the northern sawmill site boundary. The water from the attenuation basins then discharges into the wetlands area in the north-western corner of the Site (Figure 4-5). It is understood that the flow from the final attenuation basin into the wetland is controlled by a Hydrobrake vortex flow control device, limited to 14.6l/s.

The control chamber for the discharge has been shown below in Figure 4-4.

Figure 4-4 Flow control from the final attenuation pond to the wetland

Details of the drainage associated with the treatment building is attached in Appendix C.

Figure 4-5 Wetlands in north west corner of the site

4.14 Summary of Site-Specific Flood Risk Assessment

A summary of the sources of flooding and a review of the risk posed by each source at the Planning Site is shown in Table 4-4.

Table 4-4 Risk posed by flooding sources

Sources of flooding	Potential flood risk	Potential source	Probability/significance
Fluvial (river) flooding	Yes	Worm Brook	Very low significance
Tidal (coastal) flooding	No	None reported	Not significant
Groundwater flooding	No	None reported	Not significant
Surface water (pluvial) flooding	No	None Reported	Not significant
Sewer flooding	No	None reported	Not significant
Flooding from artificial drainage Systems/infrastructure failure	No	None reported	Not significant

The Planning Site is not at risk of flooding from a major source (e.g., fluvial and/or tidal) as the Planning Site is located within Flood Zone 1. The Environment Agency Surface Water flood map shows that the Planning Site has a very low risk of surface water flooding with a chance of flooding of less than 1 in 1000 (0.1%) years.

The risk of flooding from surface water flooding is considered to be **not significant**.

Measures to mitigate flood risk both on and off site as a result of the proposed development are discussed in Section 6.

5 Sequential Approach

5.1 Sequential Test

The risk-based Sequential Test in accordance with the NPPF aims to steer new development to areas at the lowest probability of flooding (i.e., Flood Zone 1). The Planning Site is located within Flood Zone 1; the proposed development site complies with the sequential approach which should be applied at all stages of planning. Therefore, the Sequential Test will not need to be undertaken as part of this planning application.

5.2 Exception Test

Applications located within Flood Zone 1 are not subject to the Exception Test as confirmed within Table 3 of the Planning Practice Guidance to the NPPF.

6 Surface Water Drainage

6.1 Surface Water Management Overview

It is recognised that consideration of flood issues should not be confined to the floodplain. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. For example, replacing vegetated areas with roofs, roads and other paved areas can increase both the total and the peak flow of surface water runoff from a development site.

Changes of land use on previously developed land can also have significant downstream impacts where the existing drainage system may not have sufficient capacity for the additional drainage.

The requirement for managing surface water runoff from developments depends on the pre-developed nature of a site. In the case of brownfield sites, drainage proposals will be measured against the existing performance of the site. The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development unless specific off-site arrangements are made and result in the same net effect.

The drainage infrastructure has previously been designed by Opus in 2014 and implemented by the Client. The drainage particulars, highlighting the design of the infrastructure has been included in Appendix C. The overview of the drainage concept is included in Appendix B.

The proposed treatment building is situated within the ‘future development’ drained area of the Site and therefore the drainage assessment within this report outlines how surface waters from the proposed treatment building will be integrated into this existing drainage system.

It should be acknowledged that the satisfactory collection, control and discharge of surface water runoff are now a principle planning and design consideration. This is reflected in recently implemented guidance and the National Sustainable Drainage Systems (SuDS) Standards. It is necessary to demonstrate that the surface water from the proposed development can be discharged safety and sustainably.

6.2 Opportunities for Discharge of Surface Water

There are four possible options to discharge the surface water runoff in accordance with the requirements of the Defra non-statutory technical standards for SuDS. The runoff destination is (in order of preference):

a. To ground;

b. To surface water body;

c. To road drain or surface water sewer;

d. To combined sewer.

It is necessary to identify the most appropriate method of controlling and discharging surface water.

6.3 Discharge to Ground

The site is underlain by clay therefore discharge to ground is not feasible.

The surface water drainage scheme for the development area has been designed and installed in advance, with water discharged (via established attenuation basins and wetlands) to Worm Brook which flows adjacent to the western sawmill site boundary. The proposed treatment building will not alter the discharge location.

6.4 Discharge to a Water Body

The existing site drainage infrastructure consists of surface water systems, ditches, gullies, catchpits, and a culvert. This infrastructure drains waters into a series of 7 no. of attenuation basins, which have an outfall into the biological wetland area in the north-western corner of the Site. The outfall from pond 7 is controlled by a flow control chamber, which restricts the flow rate to 14.6l/s. Catchpits with high intensity intake grated covers drain waters directly into attenuation ponds 1, 2 and 3. Site drainage particulars are presented in Appendix B and C.

It is proposed that the drainage for the treatment building will be connected to this designed and installed drainage system.

By restricting the discharge rate, negligible additional pressure is placed upon the existing site drainage infrastructure and the risk of flooding will not be increased. Therefore, it would be possible to discharge surface water runoff from the Planning Site into a surface waterbody.

This is considered to be the most feasible option for continued discharge of surface water.

6.5 Discharge to Sewers

The surface water drainage scheme has already been designed and installed, with water discharged to Worm Brook which flows adjacent to the western sawmill site boundary. The proposed treatment building will not alter the discharge location.

6.6 Site Areas

The proposed treatment building development is entirely located within the existing drainage area that was designed by Opus in 2014. There will be no increase to impermeable areas within the Site, as the drainage infrastructure has been developed based upon 100% impermeable concrete/tarmacadam coverage.

The proposed treatment building development will occupy an area of the existing sawmill site that is approximately 0.3ha. The proposed surface area of the roof is approximately 1,674m^2.

6.7 Surface Water Runoff Rates

Hydraulic calculations for the drainage infrastructure at the Site have previously been conducted by Opus in 2014, and therefore are not required as part of this report.

The proposed treatment building development does not increase the impermeable area used in the hydraulic calculations by Opus. The roof of the proposed treatment building simply replaces an equivalent area of impermeable concrete used in the calculations.

6.8 SuDS and Water Quality

Current guidance promotes sustainable water management through the use of SuDS. SuDS measures should be used to control the surface water runoff from the proposed development, thereby managing the flood risk to the Planning Site and surrounding areas from surface water runoff.

One of the aims of the NPPF is to provide not only flood risk mitigation but also to maximise additional gains such as improvements in runoff quality and provision of amenity and bio-diversity.

Systems incorporating these features are often termed SuDS and it is the requirement of NPPF that these are considered as the primary means of collection, control and disposal for storm water as close to source as possible.

A hierarchy of techniques is identified[5]:

1. Prevention – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
2. Source Control – control of runoff at or very near its source (such as the use of rainwater harvesting, permeable paving, soakaways and/or green roofs).
3. Site Control – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole site, swales and/or infiltration trenches).
4. Regional Control – management of runoff from several sites, typically in a detention pond, basins, tanks and/or wetland.

It is generally accepted that the implementation of SuDS as opposed to conventional drainage systems, provides several benefits by:

- Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- Reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed sites;
- Improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- Reducing potable water demand through rainwater harvesting;
- Improving amenity through the provision of public open spaces and wildlife habitat; and
- Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

The most appropriate attenuation system will need to satisfy three main characteristics, firstly, provide the required volume of storage, secondly, minimise the loss of developable land and thirdly, where possible provide local amenity.

The application of the SuDS Manual requires that the runoff from sites is not only restricted to meet the greenfield runoff characteristics but also that SuDS systems are utilised to improve the quality of the runoff prior to outfall to watercourses. The SUDS Manual and

[5] CIRIA (2004) Report C609, Sustainable Drainage Systems – Hydraulic, Structural and Water Quality advice.

EA guidance applies a sustainability hierarchy to the various types of SuDS systems, this is summarised in Table 6-1.

Table 6-1 Sustainability hierarchy

Most sustainable	SuDS technique	Flood reduction	Pollution reduction	Landscape & wildlife
	Living roofs	✓	✓	✓
↑	**Basins and ponds** - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices - Soakaways	✓	✓	✓
↓	**Permeable surfaces and filter drains** - Gravelled areas - Solid paving blocks - Permeable paving	✓	✓	
Least sustainable	**Tanked systems** - Over-sized pipes/tanks - Cellular storage	✓		

Systems at the top of the hierarchy provide a combination of attenuation, treatment and ecology and are deemed the most sustainable options.

In addition to the above hierarchy the SuDS Manual identifies the number of treatment trains or SuDS devices through which flow should pass from various point sources of runoff (Table 6-2). This is designed to ensure that the receiving environments are not put at risk of pollution by new development therefore one treatment train will be used for surface water runoff from the proposed development at the Planning Site.

The usual approach is to consider the 'SuDS train' where each of the above options are considered in turn until a suitable solution is found. Thus, source control techniques such as soakaways, rainwater harvesting and/or infiltration trenches, if suitable on a site, are considered preferable to permeable conveyance and passive treatment systems such as tanks or ponds. The various options have been considered.

Table 6-2 Number of treatment train components

Runoff catchment characteristic	Receiving watercourse sensitivity		
	Low	**Medium**	**High**
Roof only	1	1	1
Residential roads Parking areas Commercial zones	2	2	3

Refuse collection Industrial areas Loading bays Lorry parks Highways	3	3	4

6.9 Water Treatment

According to the SuDS Standards (see Table 6-3), the proposed development is a low hazard (roof water).

Table 6-3 Level of hazard

Hazard	Source of hazard
Low	Roof drainage
Medium	Residential, amenity, commercial, industrial uses including car parking spaces and roads
High	Areas used for handling and storage or chemicals and fuels, handling of storage and waste (incl. scrap-yards).

Residential roofs have a 'low' pollution hazard level, as per Table 26.2 of the SuDS Manual.

The pollution hazard indices for the roof have been shown in Table 6-4.

Table 6-4 Pollution hazard indices

Land use	Pollution hazard level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Commercial/industrial roofing: Low potential for metal leaching	Low	0.3	0.4	0.05

* Indices values range from 0-1

Table 6-5 demonstrates that a detention basin followed by a wetland area provides sufficient treatment for the proposed development at the Planning Site.

Table 6-5 SuDS mitigation indices

Type of SuDS component	TSS	Metals	Hydrocarbons
Detention basin	0.5	0.5	0.6
Pond or wetland	0.7	0.7	0.5

The existing site drainage system has been designed by Opus to account for any possible pollutants from the site's use as a sawmill. The roof runoff from the proposed development is expected to present a much lower pollution risk when compared to the runoff from potential concreted surfaces, therefore the development represents a slight reduction of the risk at the Site as a whole.

6.10 Proposed SuDS Strategy

The objective of this SuDS strategy is to ensure that a sustainable drainage solution can be achieved which reduces the peak discharge rate to manage and reduce the flood risk posed by the surface water runoff from the Planning Site. The SuDS strategy takes into account the following principles:

- No increase in the volume or runoff rate of surface water runoff from the Planning Site.
- No increase in flooding to people or property off-site as a result of the development.
- No surface water flooding of the Planning Site.

In line with adopting a 'management train' it is recommended that water is managed as close to source as possible. This will reduce the size and cost of infrastructure further downstream and also shares the maintenance burden more equitably. It is therefore recommended that attenuation is provided as part of the wider drainage system at the Site, and that one stage of treatment is required for the proposed development at the Planning Site. The drainage system will comprise the following aspects:

- It is proposed that the surface water runoff from the proposed development is connected via traditional guttering and sub-surface pipework to the existing drainage to the western boundary of the Site.
- Exisitng drainage will drain surface and roof water runoff directly into attenuation pond 6. This attenuation pond is one of 7 attenuation ponds in series, which are located along the northern sawmill site boundary.
- Outflows of waters occur from attenuation pond 7, into a biodiverse wetland located in the north-western corner of the Site. Flow from this pond is controlled through a Hydrobrake Optimum flow control chamber which restricts flow rate to 14.6l/s.
- The water then discharges form the biodiverse wetlands into Worm Brook which flows adjacent to the western sawmill site boundary.

The drainage particulars from Opus are appended in Appendix C.

No additional hydraulic calculations have been undertaken as there is no additional impermeable surface area. The Opus drainage design has already taken account for the development site area.

The above manages and mitigates the flood risk from surface water runoff to the proposed development from surface water runoff generated by the development and to offsite locations as well the risk from surface water runoff generated offsite.

The design of the formal drainage system will allow any silt and debris from the development an opportunity to settle within the basins and wetland area.

These methods will reduce peak flows, the volume of runoff, and slow down flows and will provide a suitable SuDS solution for the Planning Site.

It has been demonstrated that the additional development does not increase the risk of flooding to the wider sawmill site or the surrounding areas.

6.11 Designing for Local Drainage System Failure/Design Exceedance

When considering residual risk, it is necessary to make predictions as to the impacts of a storm event that exceeds the design event, or the impact of a failure of the local drainage system. The SuDS strategy applies a safe and sustainable approach to discharging rainfall runoff from the Planning Site and this reduces the risk of flooding however, it is not possible to completely remove the risk. This section is therefore associated with the way the residual risk is managed.

As part of the SuDS strategy, it must be demonstrated that the flooding of property would not occur in the event of local drainage system failure and/or design exceedance. It is not economically viable or sustainable to build a drainage system that can accommodate the most extreme events. Consequently, the capacity of the drainage system may be exceeded on rare occasions, with excess water flowing above ground[6].

The design of the Planning Site provides an opportunity to manage this local drainage system failure/exceedance flow and ensure that indiscriminate flooding of property does not occur.

The Site, including the Planning Site, is located on a slope; with the land falling to the west, towards Worm Brook.

During an event in exceedance of the 1 in 100-year threshold, exceedance flows will flow down gradient, towards the western Site boundary and eventually into Worm Brook. This area is situated downslope and away from any buildings and proposed developments, therefore the risk to the proposed development is low.

It is not considered that there is an increased risk to the proposed development at the Planning Site, existing buildings/structures at the Site or buildings located in the vicinity of the Site.

The above manages and mitigates the flood risk from surface water runoff to the proposed development and to offsite locations.

[6] CIRIA (2006) Designing for exceedance in urban drainage – good practice.

7 Summary and Conclusions

7.1 Introduction

This report presents an FRA in accordance with the NPPF for the proposed development at Pontrilas Sawmills. The FRA includes an assessment of the existing and proposed surface water drainage for the developed areas.

7.2 Flood Risk

The Planning Site is not at risk of flooding from a major source (e.g., fluvial and/or tidal) as the Planning Site is located within Flood Zone 1.

The Environment Agency surface water flood map shows that the Planning Site has a very low risk of surface water flooding with a chance of flooding of less than 1 in 1000 (0.1%) years.

In conclusion, the risk of flooding from surface water flooding is considered to be **not significant**.

7.3 Sequential Approach

The development proposals should be considered by the LPA to satisfy the Sequential and Exception Tests as set out in the NPPF.

7.4 SuDS Strategy

The objective of this SuDS strategy is to ensure that a sustainable drainage solution can be achieved which reduces the peak discharge rate to manage and reduce the flood risk posed by the surface water runoff from the developed area of the Planning Site. The SuDS strategy takes into account the following principles:

- No increase in the volume or runoff rate of surface water runoff from the Drainage Site.
- No increase in flooding to people or property off-site as a result of the development.
- No surface water flooding of the Planning Site.

In line with adopting a 'management train' it is recommended that water is managed as close to source as possible. This will reduce the size and cost of infrastructure further downstream and also shares the maintenance burden more equitably. The drainage strategy for the proposed development comprises the discharge of surface water runoff to the existing drainage system at the Site, designed by Opus in 2014 and implemented by the Client. The drainage strategy at the Planning Site will be in the form of:

- Traditional guttering and sub-surface pipework discharging surface water runoff from the roof of the proposed treatment building to the existing drainage to the western boundary of the Site.
- The existing drain discharges water to an attenuation basin (basin number 6) at the northern boundary of the Site.

- After passing through a final detention basin, surface water will be discharged to an existing well established wetland area to the west of the Site via a Hydrobrake vortex flow control device.
- Following storage and treatment in the wetland area, water will discharge to Worm Brook.

The above manages and mitigates the flood risk from surface water runoff to the proposed development from surface water runoff generated on impermeable surfaces at the Planning Site.

The proposed SuDS methods will reduce peak flows, reduce the volume of runoff, slow down flows and will provide a suitable SuDS solution for the Planning Site.

7.5 Conclusions and recommendations

In conclusion, the proposed development would be expected to remain dry in all but the most extreme conditions. Providing the recommendations made in this FRA are instigated, flood risk from all sources would be minimised, the consequences of flooding are acceptable, and the development would be in accordance with the requirements of the NPPF.

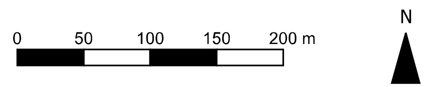
The SuDS strategy will reduce the risk of flooding to the Planning Site and off-site locations. This FRA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF. The development should not therefore be precluded on the grounds of flood risk or water quality.

It is recommended that as part of the development proposal, the site owner should undertake inspection and maintenance of the existing drainage features, including ensuring that water flows correctly through all attenuation basins and into the wetland area. It is recommended that the Hydrobrake flow restriction device is inspected and cleaned if required.

Drawings

Drawing 1

Historic flood extent



Date	By	Paper	Scale	Rev
02 2021	SG	A3	1:4000	1

Drawing 2

Flood Zones

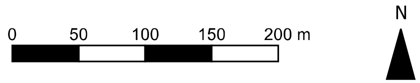
Date	By	Paper	Scale	Rev
02 2021	SG	A3	1:4000	1

Drawing 3

Flooding extent from surface waters

HYG866 Pontrilas Saw Mill FRA

DRAWING 3 Surface water flood extent

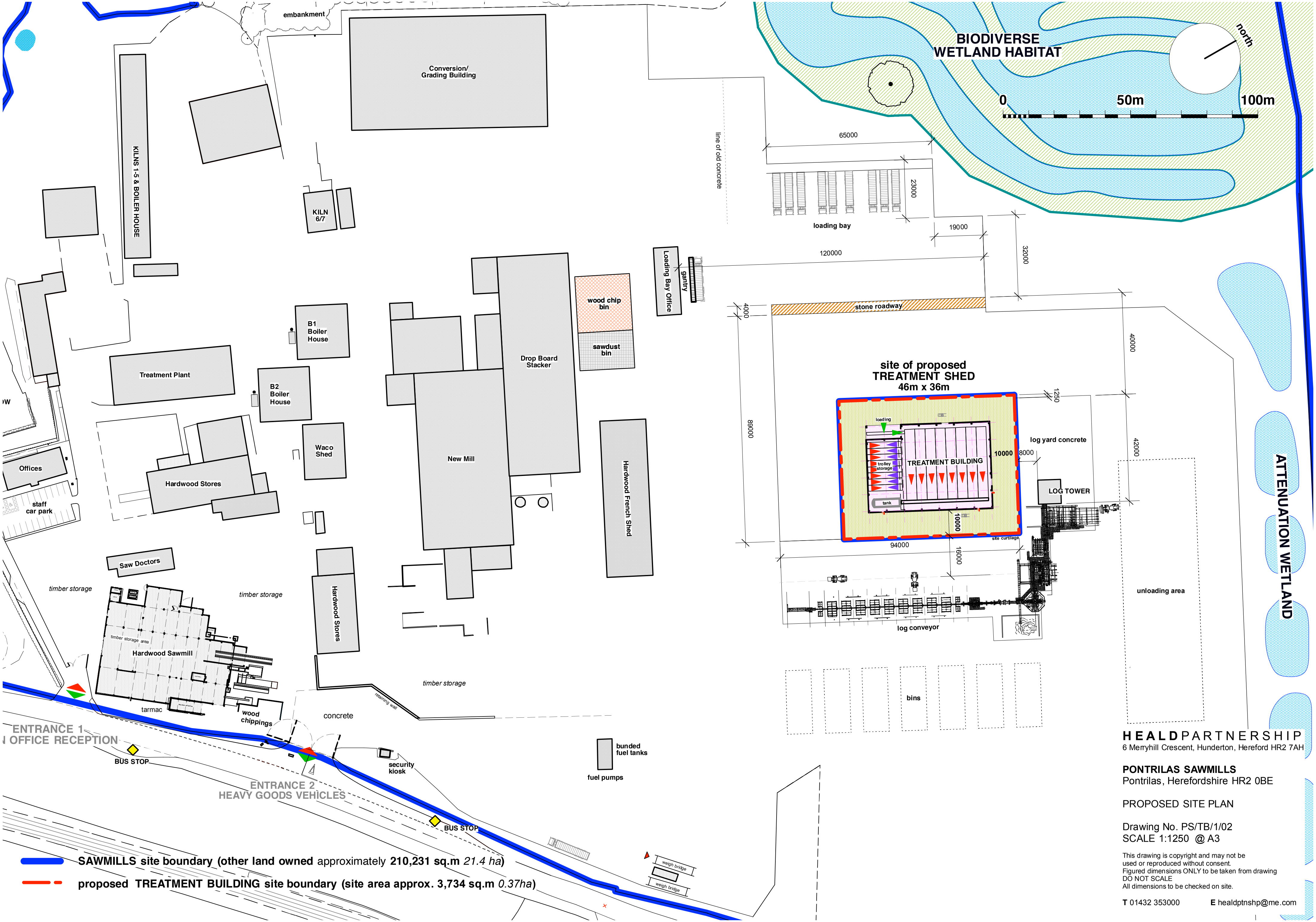


Date	By	Paper	Scale	Rev
02 2021	SG	A3	1:4000	1

Appendices

Appendix A

Proposed development plan



HEALDPARTNERSHIP
6 Merryhill Crescent, Hunderton, Hereford HR2 7AH

PONTRILAS SAWMILLS
Pontrilas, Herefordshire HR2 0BE

PROPOSED SITE PLAN

Drawing No. PS/TB/1/02
SCALE 1:1250 @ A3

Figured dimensions ONLY to be taken from drawing
DO NOT SCALE
All dimensions to be checked on site.

T 01432 353000 **E** healdptnshp@me.com

Appendix B

Overview of Pontrilas Timber wetlands

Biologic Design

Wetland Ecosystem Treatment

Integrated whole site water reticulation systems for wastewater purification, resource production & habitat creation

Overview

Constructed Wetland areas for the proposed development at Pontrilas Sawmills, Pontrilas, Herefordshire, HR2 0BE

New Yard Area at Pontrilas Sawmills

Pontrilas Sawmills are proposing to increase their works area, by creating a new yard for the handling, processing and storage of logs, increased lorry parking, as well as to make their current site safer for the workforce and the contractors who use it to deliver logs and take milled timber and woodchip both around and off-site.

Area of adjacent field

The proposed development at Pontrilas Sawmills is to be located in an arable field, directly adjacent to the existing sawmill, processing and storage yards.

This field has a total area of approximately 10 hectares (100,000 m^2).

Existing Flood Plain

There is an area of approximately 3.5 hectares (35,000 m^2) at the lowest, North Western, boundary of the field - the area closest to the Worm Brook - which is in a Zone 3 Flood Risk Area (an area liable to occasional flooding) and this being the case it will **not** be included within the proposed yard development.

New Yard Area

The remaining 6.5 ha (65,000m^2) is above the Flood Risk Zone, and it is within this area that the new yard area will be created. As well as the new yard area here, Biologic Design will create an Attenuation Wetland in order to prevent an increased level of rainwater runoff from the new yards to the Worm Brook.

The hardstanding for the proposed new yards will have an area of 56,300m^2

The 8,445m^3 topsoil from this area (the top 15 cm of the field surface) will not be covered by the new concrete yards but will be removed and transferred to an adjacent field via an existing field gateway. The adjacent field is in the same ownership (Kenchurch Estates) and thus none of the topsoil will need to leave the field by road or go to a site which is within a different ownership.

Attenuation Wetland

An area of approximately 8,700 m^2 (290m long x 30m wide) along the North Eastern boundary hedge of this part of the field, will be formed into an 'Attenuation Wetland' with the aim of both absorbing and slowing down the flow of rainwater runoff from the proposed new log handling, processing and storage yard areas.

The aim of this wetland system is to slow down the rate of runoff to the Worm Brook so that it is no more than the current Greenfield Runoff Rate.

This Attenuation Wetland will comprise a series of eight densely planted pools, formed formed in pairs, as four terraces, which will be fed from interceptor drainage channels laid across the new concrete yard areas.

The Topsoil and the Subsoil from the creation of the Attenuation Wetland will be used in their construction and none shall leave the field.

Drainage Channels

Four drainage channels, installed by others into the fabric of the new yard area, will be equipped with oil separators so that any fuel or oil spillage on the new hardstanding area will be prevented from entering the wetland.

These interceptor channels will be approximately 1.0m deep and will also function to remove any solids from the processing, movement and storage of the logs, preventing the solid materials from entering the wetland.

Each drain will serve approximately one quarter of the yard area and will direct the rainwater falling onto this hardstanding into the Attenuation Pools. The top drainage channel to the top pair of ponds, the second drain to the second pair of ponds and so on…

The working volume of the pools in the Attenuation Wetland are:

Pool 1	500m^3	+	**Pool 2**	800m^3	=	**1,300m^3**
Pool 3	600m^3	+	**Pool 4**	1,200m^3	=	**1,800m^3**
Pool 5	800m^3	+	**Pool 6**	1,600m^3	=	**2,400m^3**
Pool 7	600m^3	+	**Pool 8**	4,000m^3	=	**4,600m^3**

The Attenuation wetland will have a total working volume of 10,100m^3

The total volume of this Attenuation Wetland is such that it will have ample capacity to hold onto the runoff from a 1:100 year storm event.

This rainfall event is unlikely to equal 120mm rain falling over a 6 hour period, on both the new yard area and the Attenuation Wetland itself and is thus: **65,000m^2 x 0.12m = 7,800m^3**

Flow Control Pipework

Between each of the pools, within in the four sets of paired pools, will be two pipework runs, a small diameter low-level pipe will be set at a level which will enable there to always be 0.5m depth of water in the pools.

This low level pipe will allow the water to flow through the pools sequentially at a throttled rate, whilst the water level during more extreme events will rise beyond this until it reaches the Top Water Level, at which point a larger diameter overflow pipe will take the water to the next pool.

The base section of the pond (up to 0.5m in depth) will be lined with a Geosynthetic Clay Liner in order to ensure that these ponds are kept wet for most of the year in order to keep the wetland habitat hydrated.

The flow from the bottom pond is held at no more than the current greenfield runoff rate by a Hydro-Brake 'Optimum' flow control system.

The overall effect will be that the new development will have no negative effects on the flood risk posed to the Worm Brook, even in a period of intense rainfall occurring over a short period of time.

Mitigation or Wildlife Wetland - A New Area of Wetland Habitat

It is proposed that the Zone 3 Flood Risk area within the field will be transformed by Biologic Design into a biodiverse wetland habitat planted with wetland trees and marginal plants.

The series of pools which comprise the Attenuation Wetland will flow into the Mitigation or Wildlife Wetland. The new wetland area will be formed by excavation and contouring to give large area of both pond and wetland.

Mitigation of loss of habitat

The creation of this area, with a higher range of native wetland species and thus a greater biodiversity than the arable field it will replace, is seen as going some way towards mitigating the loss of the former arable field to the proposed new development.

The new ‘Mitigation Wetland’ will have earth banks of no more than 0.5 metres above original ground level, and will be laid out in such a way as to enable the Worm Brook, when in spate, to access this area as it would do an unmodified flood plain.

Wildlife Habitat

This new wildlife wetland will comprise two large pools, up to 2.5 metres in depth, with linking channels from between 0.5 and 1.0 metre depth and will create a large, new area, of undisturbed wetland habitat.

The first of two large ponds will have a surface area of 5,000m^2 and a maximum volume of 9,250m^3 whilst the second will have a surface area of 10,000m^2 and a maximum working volume of 23,500m^3.

The linking channels will be curved, not straight edged, in order to create an increased amount of 'wetland edge' to the new wetland area - this will be ideal for water fowl breeding.

The first channel is 300m long and will link the last pool of the Attenuation Wetland with the new wildlife wetland. This first pond will be connected via another narrow channel, 100m long, with the second, larger, pond.

The newly created wetland margins will be both seeded and planted with a variety of indigenous native wetland trees, reeds, rushes and sedges as well as marginal flowering species.

In this area of the field the sandy/clay subsoil gives way to gravel at around 2.0 metres depth and so these ponds will be connected directly to the groundwater and will have levels which will fluctuate seasonally with the groundwater level and rainfall over the site.

This being the case the new wetland will be planted in an appropriate manner with species which are both tolerant of seasonal inundation as well as relatively dry periods.

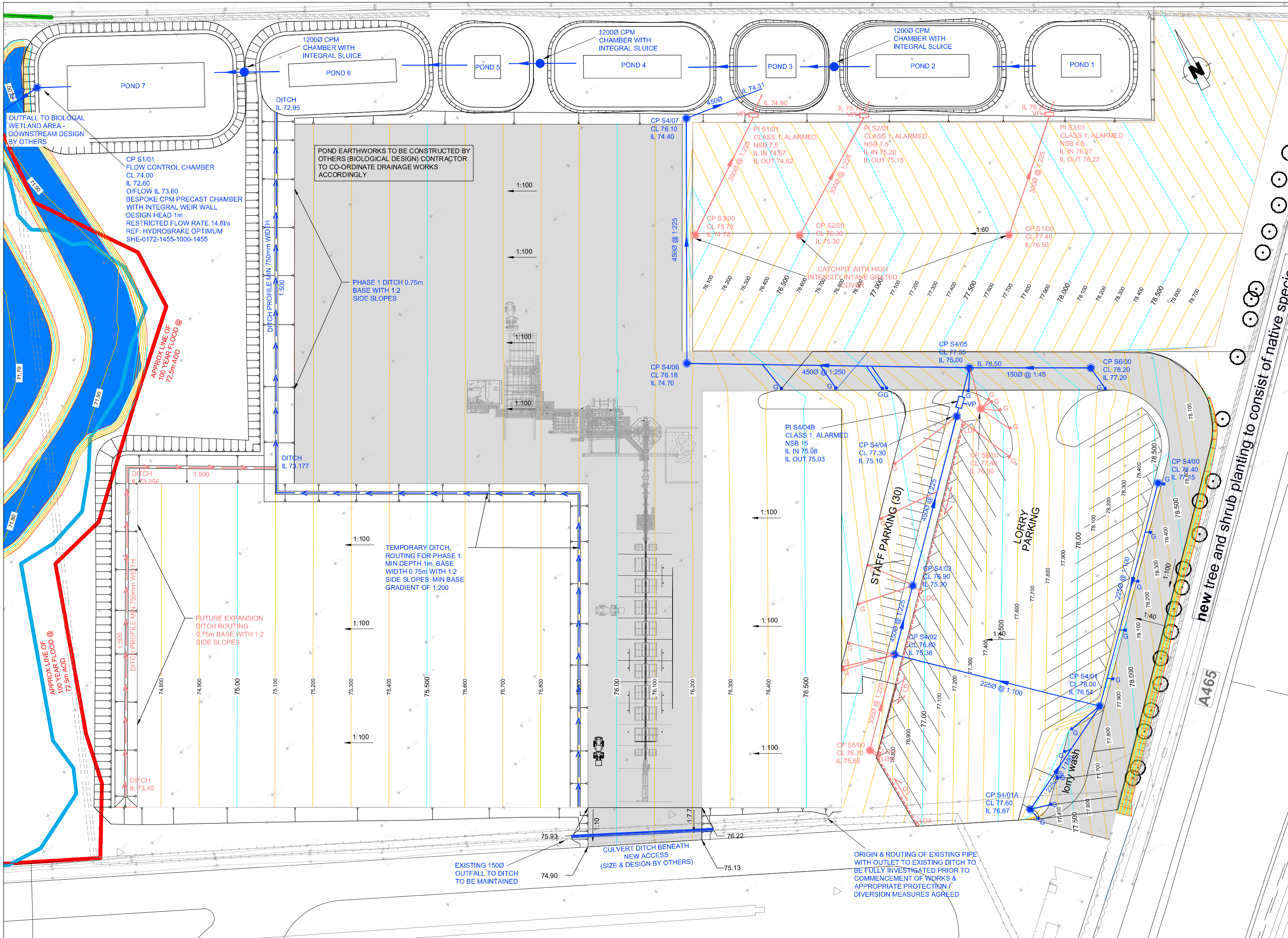
Topsoil and Subsoil spoil from excavation of the Mitigation Wetland

The topsoil from this Mitigation Wetland area will be used within the new wetlands as the growth and planting medium for the wetland species.

The 33,500m^3 of subsoil spoil from the creation of the Mitigation Wetland in this area will be used to raise an area further up in the field - which is not in the flood risk zone - and will therefore create a more level area on which the concrete yards can be located precluding the need to move this spoil off site.

Appendix C

Site drainage layout (Opus 2014)



LEGEND / KEY TO SYMBOLS

PHASE 1 DRAINAGE WORKS

- PROPOSED SURFACE WATER SYSTEM
- PROPOSED DITCH ROUTE
- PROPOSED TEMPORARY DITCH (PHASE I ONLY)
- CP — CATCHPIT
- G — GULLY
- VP — VENT PIPE
- PHASE 1 WORKS AREA

FUTURE EXPANSION DRAINAGE WORKS

- PROPOSED SURFACE WATER SYSTEM
- PROPOSED DITCH ROUTE
- PROPOSED TEMPORARY DITCH (PHASE I ONLY)
- LD — LINEAR DRAIN - ACO MULTIDRAIN REF: M200D 10.0
- CP — CATCHPIT
- G — GULLY
- VP — VENT PIPE
- LDO — LINEAR DRAIN OUTLET
- LDA — LINEAR DRAIN ACCESS UNIT

FOR APPROVAL

NOTES

1. REFER TO DRAWING C8352-111 FOR DRAINAGE NOTES AND SCHEDULES

1:500@a1 0 5 10 15 20 25 30 35 40 45 50 m

Revision	Amendment	Approved	Revision Date

OPUS
Cardiff Office
+44 29 2077 7373

Unit 2 Fountain Court
Fountain Lane, St Mellons
Cardiff CF3 0FB

Designed	Approved	Approved Date
LKC	MWL	22.09.2014

Drawn	Scales
LKC	1:500 @ A1

Project
Pontrilas Sawmills
Site Expansion

Sheet
DRAINAGE LAYOUT

Project Drawing No.	Sheet. No.	Revision
CD-V-C8352	110	R0

Original Sheet Size A1 [841x594] Plot Date 22 Sep 2014 @ 5:06 PM Path G:\live\C\C8352.00 - Pontrilas Saw Mill Car Park\05 - Documents\02 - Drawings\03 - Civils\A - Preliminary\CD-V-C8352-110-R0-111-R0-Drainage Layout.dwg 110