Llandegla Forest, Llandegla

Drainage Strategy

August 2022

Assessment | Modelling | Design

Project Information	
Project:	Llandegla Forest, Llandegla
Report Title:	Drainage Strategy
Client:	OnePlanet Adventure Ltd
Instruction:	The instruction to undertake this Drainage Strategy was received from Jim Gaffney of OnePlanet Adventure Ltd
File Ref:	14648-Drainage Strategy-02

Approval Record	
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	Document History	
Revision	**Date**	**Comment**
01	29/07/2022	First issue
02	08/08/2022	Second issue – Updated site boundary

This report will remain valid for a period of twelve months (from the date of last issue) after which the source data should be reviewed in order to reassess the findings and conclusions on the basis of latest available information.

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Introduction

Waterco has been commissioned to undertake a Drainage Strategy in relation to a holiday lodge development at Llandegla Forest, Llandegla, Wrexham, LL11 3AA.

The aim of the Sustainable Drainage Strategy is to identify water management measures, including Sustainable Drainage Systems (SuDS), to provide surface water runoff reduction and treatment. This report has been prepared in accordance with the Welsh Government 'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems' (2018) – herein referred to as 'the Statutory Standards for SuDS'.

This report is supported by a Limited Habitats Regulation Assessment (HRA) (document reference: 14648 - HRA - 02).

Existing Conditions

The site covers an area of approximately 1.505ha and is located at National Grid Reference (NGR): 323785, 352316. A location plan and an aerial image are included in Appendix A.

Online mapping (including Google Maps / Google Streetview imagery, accessed July 2022) shows that the site comprises commercial woodland. The site is bordered by an unnamed access road to the north, Llandegla Forest and OnePlanet Adventure Cafe to the east, Llandegla Forest to the south and Hafren Dyfrdwy water treatment works to the west. Access to the site is provided from the unnamed access road to the north which is accessible via the A525.

Local Topography

A topographical survey has been undertaken by Powers and Tiltman Ltd in November 2019. The topographical survey shows that the developable area of the site slopes from approximately 339.8 metres Above Ordnance Datum (m AOD) in the east to 331.9m AOD in the north-west.

Topographic levels to have also been derived from a 1m resolution Natural Resources Wales (NRW) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). The LiDAR data generally supports the findings of the topographical survey.

Topographical data is provided as Appendix B.

Ground Conditions

The British Geological Survey (BGS) online mapping (1:50,000 scale) indicates that the site is underlain by superficial deposits of Devensian Till generally comprising diamicton. The northern extent of the site is underlain by bedrock of the Cefn-Y-Fedw Sandstone Formation comprising sandstone interbedded with Argillaceous rock. The southern extent of the site is underlain by the Dolhir Formation consisting of mudstone and limestone.

The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a site-specific

basis.

According to the NRW Aquifer Designation data, obtained from the BGS GeoIndex online mapping [accessed July 2022], the Devensian Till is classified as Unproductive Strata. Unproductive Strata are 'rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow'.

The underlying Cefn-Y-Fedw Sandstone Formation is described as a Secondary A Aquifer which can be defined as 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.

The underlying Dolhir Formation is classified as a Secondary B Aquifer. Secondary B Aquifers are 'predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers'.

The NRW 'Source Protection Zones' data, obtained from the Welsh Government 'Lle' geoportal [accessed July 2022], indicates that the site is not located within a Groundwater Source Protection Zone.

The Cranfield University 'Soilscapes' map [accessed July 2022] indicates that the site is underlain by *'loamy upland soils with a wet peaty surface'*

Statutory Designations

The site is located within the River Dee Catchment. The River Dee is a designated Special Area of Conservation (SAC). As such, treatment of wastewater from the development and effect on phosphorous load on the River Dee SAC will be given careful consideration and suitable mitigation will be provided as to reduce the overall phosphate loading on the River Dee SAC.

The site is also located within 1km of multiple Sites of Special Scientific Interest (SSSI's), which are associated with Llandegla Moor as well as Ruabon / Llantysilio Mountains and Minera.

Site Walkover

A site walkover was undertaken by Waterco in June 2022. A photographic record from the site walkover is included in Appendix C. The site comprises woodland with notable features including a watercourse on the western boundary flowing north. 2no. ditches originate on site orientating east to west. The ditches were dry at the time of the site visit and their locations shown on the topographical survey. Land in the north-western extent of the site was boggy with water witnessed at the surface.

A number of upturned trees were located on site (following wind damage) exposing the underlying geology. The underlying geology was witnessed as clay and peat with a number of boggy areas on site.

Existing Drainage

Public sewer records have been obtained from DCWW and are included in Appendix D. The DCWW sewer records show that there are no public sewers within the vicinity of the site. The nearest public sewer is

located in Gwynfryn, approximately 1.75km from the site.

Foul drainage associated with the existing One Planet Adventure café / toilets currently discharges to a septic tank (circa 20 years old). The septic tank discharges effluent to a small pool downstream which overflows to woodland below (and ultimately to the ditches on site).

Development Proposals

The proposed development is for 14no. holiday lodges with associated parking, footpaths, open space (to be restored to broadleaf woodland), an attenuation pond, sewage treatment plant and soft landscaping. A development plan is included in Appendix E. Existing ditches on site will be retained and formalised as part of the proposed surface water drainage system.

The proposed development will introduce hardstanding areas in the form of buildings and parking areas. Hardstanding will comprise approximately 1,630m^2 or 10.8% of the total site area. The remaining permeable areas will occupy 13,422m^2 or 89.2% of the total site area.

Measurements of hardstanding have been taken from a pdf version of the '0002-MS-XX-XX-DR-L-0002-Landscape General Arrangement' plan and are approximate only.

Planning Policy

The Denbighshire County Council (DCC) Local Development Plan 2006 – 2021 was adopted on 4th June 2013 and is the current development plan for the county. The Local Development Plan contains the following policy relating to drainage:

'Policy VOE 6 – Water Management

All development will be required to eliminate or reduce surface water run-off from the site, where practicable. The run-off rates from the site should maintain or reduce pre-development rates….

Large developments, or the cumulative impact of smaller developments, incorporating water storing measures could by reducing surface water run-off, have the potential to reduce flow levels in water courses and water tables, and thereby have a negative impact on biodiversity. A balance must be achieved between management of water recycling and ensuring no adverse impact on the water environment and biodiversity.

The use of Sustainable Drainage Systems (SuDS) to manage surface water flows can also be an important tool in minimising flood risk by increasing permeable surfaces in an area which allows water to seep into the ground rather than running off into the drainage system. The effective use of permeable surfaces, soakaway and water storage areas should be incorporated in all new development where technically possible. SuDS can also reduce the impact of diffuse pollution from runoff and flooding securing environmental, biodiversity and aesthetic benefits. Early consideration of SuDS is required in order that a range of techniques can be

considered and developers are encouraged to enter into early discussions with the Council.

The Council supports Natural Resources Wales in promoting sustainable drainage systems which maintain oreduce pre-development rates of run-off and will seek advice from the agency to determine allowable rate of run-off.'

Consultation

A pre application request was sent to the Sustainable Drainage Approval Body (SAB) in May 2022. In their response (Appendix F) the SAB have stated that:

'We would have no objections in principle to the intention of discharging the surface water from the site into a watercourse, providing that the following conditions are met:

1. Confirmation that permission is in place to connect to the watercourse.

2. Ordinary watercourse consent is obtained.

3. Evidence that the watercourse you will be connecting to can cope with the additional discharge from the site.

4. Evidence is provided to illustrate that infiltration will not work at the site.'

With regards to foul drainage, the SAB have stated that:

'We would need to consult with the county ecologist and NRW before we could advise if the below approach is acceptable. This is something that would commence during the technical assessment stage of the SAB application'

NRW have provided a response to a pre-application enquiry for an Environmental Permit (relating to discharge of foul flows from the development) in July 2022. The NRW response, included in Appendix G, states:

'In terms of the new development, this will obviously need to go through Planning and NRW will be consulted as part of that process. I note that the proposal will improve the existing discharge, but it will also increase the volume of wastewater produced, so it would be subject to an HRA'

Surface Water Management

The site currently comprises woodland. Surface water currently informally drains to the ditches within the woodland and to the watercourse on the western site boundary.

The proposed development will introduce 1,630m² of hardstanding in the form of the holiday lodges and the car park / access road.

The introduction of hardstanding area will result in an increase in surface water runoff rates and volumes. In order to ensure the proposed development will not increase flood risk elsewhere, surface water discharge from the site will be controlled.

The existing greenfield runoff rates have been estimated using the Revitalised Flood Hydrograph Model (ReFH2) method. A summary of the greenfield runoff rates for a range of events is provided as Appendix H. The 1 in 1 year greenfield runoff rate for the 1,630m² proposed hardstanding area is 1.37 l/s. A discharge rate of 2 l/s is proposed to ensure the drainage system is self-cleansing.

Discharge Method

Standard S1 of the Statutory Standards for SuDS sets out the following hierarchy of drainage options:

Priority Level 1: Surface water runoff is collected for use;

Priority Level 2: Surface water runoff is infiltrated to ground;

Priority Level 3: Surface water runoff is discharged to a surface water body;

Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system;

Priority Level 5: Surface water runoff is discharged to a combined sewer.

Priority Level 1: Surface water runoff collected for use

In line with section G1.4 of the Statutory Standards for SuDS, rainwater harvesting is not proposed for this site as:

1. There is no foreseeable need to harvest water at the site as the relevant water undertaker's water resources and drought management plans do not identify potential stresses on mains water supplies;

2. The use of rainwater harvesting is not a viable/ cost-effective part of the solution for managing surface water runoff on the site, taking account of the potential water supply benefits of such a system.

With regards to the second point above, section G1.6 of the Statutory Standards for SuDS states that; in most cases, rainwater harvesting alone will not be adequate to deal with the site drainage and provision will be required for an overflow to a Level 2 or lower priority runoff destination. As downstream provision of

attenuation storage will be required to accommodate for rainwater harvesting system overflows, rainwater harvesting is not considered a cost-effective solution for managing surface water runoff.

Furthermore, with the development being for holiday use and units only occupied on an intermittent basis, rainwater harvesting systems would not be fully utilised. In addition to this, the holiday lodges will discharge runoff directly from the roof to the ground surface (to french drains which will collect the water and discharge to an attenuation feature downstream) and no rainwater downpipes are proposed. As such, it is not considered practical to formally collect roof water into a rainwater harvesting tank.

Priority Level 2: Surface water runoff is infiltrated to ground

As described above, the site is underlain by superficial deposits of Devensian Till generally comprising diamicton. The underlying geology recorded during the site visit was identified as clay and peat with boggy areas on site. As such, infiltration techniques are unlikely to be feasible.

Priority Level 3: Surface water runoff is discharged to a surface water body

The nearest watercourse is an unnamed watercourse which flows north along the western boundary of the site. Discharge to the watercourse on the western boundary at a limited discharge rate of 2 l/s appears to be feasible. A gravity connection can be achieved.

The approximate flow capacity of the watercourse on the western boundary has been estimated using the Chezy-Manning Formula. Calculations are provided as Appendix I. It is estimated that the watercourse can convey a flow of up to 1.61m^3/s (1,610 l/s) and therefore has sufficient capacity to accommodate the discharge rate of 2 l/s from the development.

Attenuation Storage

In order to achieve a discharge rate of 2 l/s, attenuation storage will be required. An attenuation storage estimate has been provided using MicroDrainage and is included in Appendix J. An estimated storage volume of 147m^3 will be required to accommodate the 1 in 100 year plus 40% Climate Change (CC) event. The storage estimate is based on a discharge rate of 2 l/s, storage within a tank or pond structure, an impermeable drainage area of 1,630m^2, a design head of 1m and hydro-brake flow control.

The attenuation volume is provided for indicative purposes only and should be verified at the detailed design stage.

Sustainable Drainage Systems (SuDS)

Attenuation will be provided in the form of SuDS. As shown on the proposed development plan (Appendix E) attenuation storage will be provided in the form of a pond located in the lower north-western extent of the site as to facilitate gravity drainage.

A 1m deep pond with a base (invert) area of 85m^2, 1 in 3 side slopes and a total surface area of 212m^2 (at the top water level) will provide 148.2m^3 of attenuation storage, sufficient to accommodate the 1 in 100 year plus 40% CC event. A 300mm freeboard above the top water level should also be provided. The total pond depth will exceed 1m as to allow a permanent retention of water beneath the outfall pipe.

Other sustainable drainage systems will include french drains at the base of each lodge to collect rainwater from the roof. The french drains will discharge to the existing ditches on site which will be formalised and extended as to connect to the proposed attenuation pond. A new ditch will be formed from the outlet of the attenuation pond to the watercourse on the western boundary. The ditch will flow through an existing area of wet woodland.

The proposed access road and car park will be formed from a permeable stone material. An interception drain (french drain) will be placed along the northern boundary of the road and car park to intercept runoff and direct it to the attenuation pond.

A Concept Drainage Sketch is included in Appendix K.

Exceedance Event

Storage will be provided for the 1 in 100 year plus 40% CC event. Storm events in excess of the 1 in 100 year plus 40% CC event should be permitted to produce temporary shallow depth flooding within landscaped and wooded areas. Finished floor levels will be set at a minimum of 150mm above surrounding ground levels ensuring exceedance flooding will not affect the lodges.

Surface Water Treatment

In accordance with the CIRIA C753 publication 'The SuDS Manual' (2015), residential roofs (applicable to the lodges) have a 'very low' pollution hazard level, with low traffic roads and car parks with infrequent change classified as having a 'low' pollution hazard level. Table 1 shows the pollution hazard indices for each land use.

Table 1 – Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Low Traffic Roads	Low	0.5	0.4	0.4

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.2

* Indices values range from 0-1.

Runoff from roofs and roads will be directed to a pond via french drains and existing ditches. Table 2 demonstrates that a pond provides sufficient treatment.

Table 2 – SuDS Mitigation Indices

	Mitigation Indices		
Type of SuDS	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Pond	0.7	0.7	0.5

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.3

Amenity

The Statutory Standards for SuDS provide the following guidance in relation to Standard S4 – Amenity:

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

The proposed development will include a pond, ditches and permeable surfacing which will maximise the amenity value of the proposed drainage system.

Biodiversity

The Statutory Standards for SuDS provide the following guidance in relation to Standard S5 – Biodiversity:

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

The proposed pond and ditches will maximise the biodiversity value of the proposed drainage system.

Construction, Operation and Maintenance

Standard S6 of the Statutory Standards for SuDS states:

S6 – Design of drainage for Construction, Operation and Maintenance

1) All elements of the surface water drainage system should be designed so that they can be constructed easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).

2) All elements of the surface water drainage system should be designed to ensure maintenance and operation can be undertaken (by the relevant responsible body) easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).

3) The surface water drainage system should be designed to ensure structural integrity of all elements under anticipated loading conditions over the design life of the development site, taking into account the requirement for reasonable levels of maintenance.

All drainage systems will be readily accessible for maintenance access. Maintenance of the drainage system

will be the responsibility of the site owner.

Maintenance schedules for a pond, swales (applicable to the ditches) and filter drains (applicable to french drains) are included in Appendix L.

Foul Drainage

The site is located in a rural area and it not served by public sewers. Therefore, a private package sewage treatment plant will be required to serve the development. The new package sewage treatment plant will be located in the north-western extent of the site to facilitate gravity drainage. Treated effluent will be discharged to the watercourse on the western site boundary, subject to obtaining appropriate consent from NRW.

The package sewage treatment plant will be located a minimum of 7m from holiday lodges and 10m from a watercourse.

Details of the package sewage treatment plant, including data on treatment, are included in Appendix M.

Wastewater Treatment (Phosphate Loading)

The proposed development (14 holiday lodges) in isolation and without mitigation, has potential to increase phosphate loading on the River Dee SAC.

Treatment of wastewater from the development and effect of phosphorus load on the River Dee SAC has been given careful consideration. A whole site approach is proposed whereby foul flows from the proposed holiday lodges together with foul flows from the existing OnePlanet Adventure café / toilets will be discharged to a new package treatment plant. A Klargester commercial BioDisc is proposed which will reduce phosphate to 0.3mg/l.

Approximately 55% of foul flows to the new package sewage treatment plant will be derived from the existing OnePlanet Adventure café / toilets. Phosphate generation from the existing OnePlanet Adventure facility is likely to be higher in comparison to the proposed holiday lodges due to the detergents within wastewater from the café. As such, the foul drainage proposals are considered to provide significant betterment in terms of phosphate loading, whereby the existing OnePlanet Adventure Café / toilets currently discharges to a septic tank which provides little to no phosphate removal. The septic tank currently drains to a small pool which overflows to ditches downstream. The septic tank will be decommissioned as part of the development with the new package treatment plant sized to accommodate peak foul flows from holiday lodges as well as the OnePlanet Adventure café / toilets.

In additional to the above, measures will be undertaken to limit the phosphate generated by the proposed lodges. These measures include:

- No washing machines or dishwashers are proposed (meaning less use of detergents, which are a significant contributor to phosphates in wastewater).

- Phosphate free products (soaps etc.) will be provided to guests together with literature (a welcome book) to raise awareness of phosphate pollution.

Discharge from the new package sewage treatment plant will be made to a new ditch which will flow through and disperse flow to an existing wet woodland prior to discharge to the watercourse on the western site boundary. The wet woodland and proposed ditch (vegetated areas) will provide an element of additional treatment and phosphate removal.

Conclusions

The proposed development is for 14no. holiday lodges with associated parking, footpaths, open space (to be restored to broadleaf woodland), an attenuation pond, sewage treatment plant and soft landscaping.

The proposed development will introduce impermeable drainage area in the form of holiday lodges, parking and access. This will result in an increase in surface water runoff. In order to ensure the increase in surface water runoff will not increase flood risk elsewhere, flow control will be used and attenuation provided on site to accommodate storm events up to and including the 1 in 100 year plus 40% climate change event.

All methods of surface water discharge have been assessed. Discharge of surface water will be made to a watercourse on the western boundary of the site at a limited discharge rate of 2 l/s. A gravity connection can be achieved.

Attenuation storage will be required on site in order to restrict surface water discharge to 2 l/s. Attenuation storage will be provided within a pond, located in the lower north-western extent of the site.

Other sustainable drainage systems will include french drains at the base of each lodge to collect rainwater from the roof. The french drains will discharge to the existing ditches on site which will be formalised and extended as to connect to the proposed attenuation pond. A new ditch will be formed from the outlet of the attenuation pond to the watercourse on the western boundary. The ditch will flow through an existing area of wet woodland.

The proposed access road and car park will be formed from a permeable stone material. An interception drain (french drain) will be placed along the northern boundary of the road and car park to intercept runoff and direct it to the attenuation pond.

The site is located in a rural area and is not served by public sewers. Therefore, a private package sewage treatment plant will be required to serve the development. The new private package sewage treatment plant will be located in the north-western extent of the site to facilitate gravity drainage. Treated effluent will be discharged to the watercourse along the western site boundary, subject to obtaining consent from NRW.

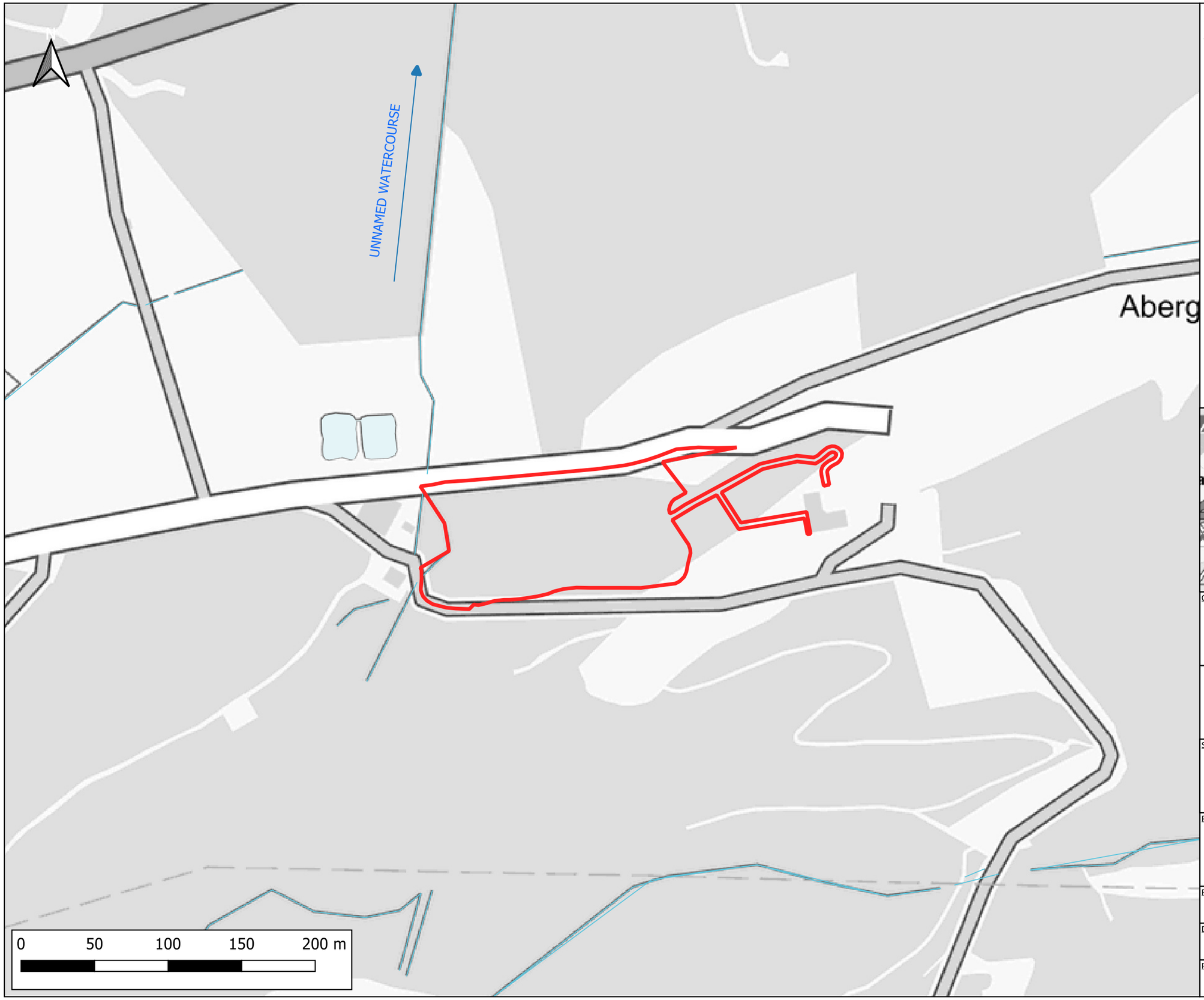
Treatment of wastewater from the development and effect of phosphorus load on the River Dee SAC has been given careful consideration. A whole site approach is proposed whereby foul flows from the proposed holiday lodges together with foul flows from the existing OnePlanet Adventure café / toilets will be discharged to a new package treatment plant. The foul drainage proposals are considered to provide significant betterment in terms of phosphate loading, whereby the existing OnePlanet Adventure Café / toilets currently discharges to a septic tank which provides little to no phosphate removal. The septic tank currently drains to a small pool which overflows to ditches downstream. The septic tank will be decommissioned as part of the development with the new package treatment plant sized to accommodate peak foul flows from holiday lodges as well as the OnePlanet Adventure café / toilets.

A Concept Designer's Risk Assessment (cDRA) has been prepared to inform future designers of any identified hazards associated with the scheme. The cDRA has been included in Appendix N.

Recommendations

1. Submit this Drainage Strategy to the Planning Authority in support of the Planning Application.
2. Verify the attenuation volumes included in this report when undertaking detailed drainage design.
3. Apply for an Environmental Permit from NRW for the discharge of treated effluent to a watercourse.

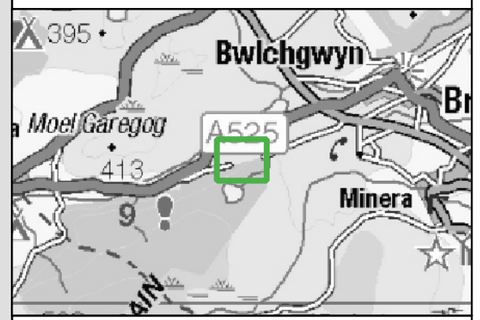
Appendix A Location Plan and Aerial Image



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site Boundary
- Watercourses
- Waterbodies



CLIENT:

oneplanet ADVENTURE

waterco
www.waterco.co.uk

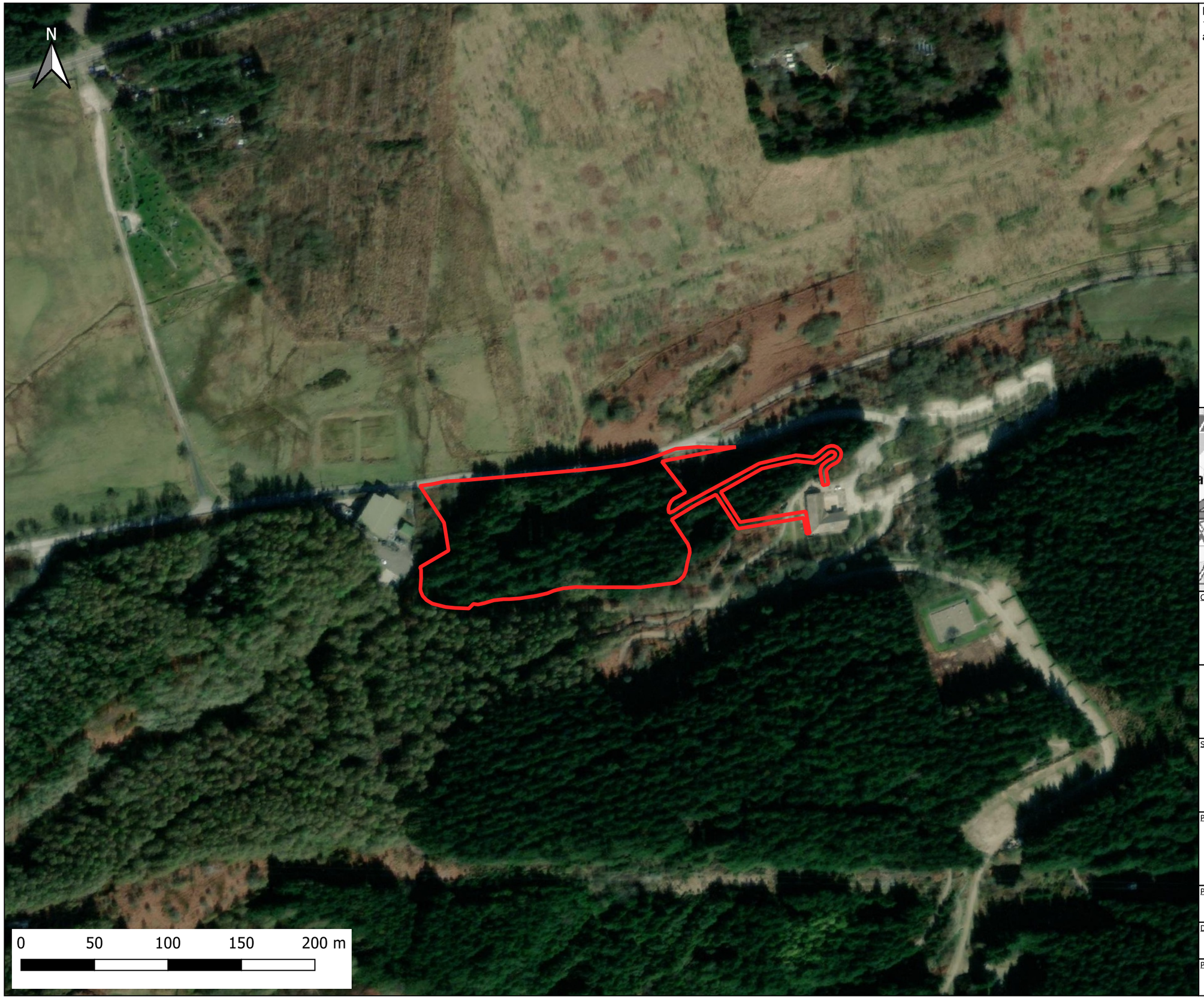
SCHEME:

Llandegla Forest, Llandegla

PLOT TITLE:

Location Plan

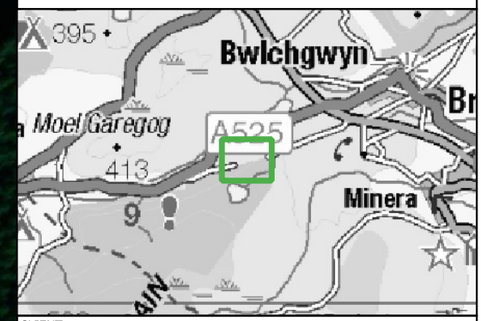
PLOT STATUS:			DATE:
FINAL			08-08-2022
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
IH	AW	MW	1:2500
PLOT NAME:			REVISION:
14648_Location_Plan			-



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

Site Boundary



CLIENT:

oneplanet ADVENTURE

waterco
www.waterco.co.uk

SCHEME:

Llandegla Forest, Llandegla

PLOT TITLE:

Aerial Plan

PLOT STATUS:			DATE:
FINAL			08-08-2022
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
IH	AW	MW	1:2500
PLOT NAME:			REVISION:
14648_Aerial_Plan			-

Appendix B Topographical Information

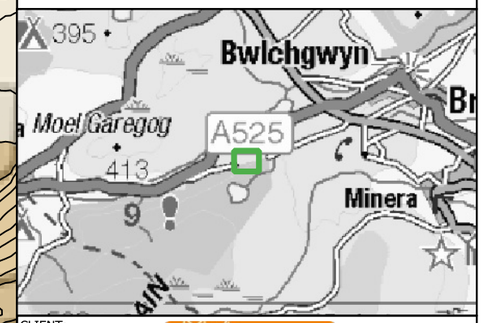
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site Boundary
- Site Levels (m AOD)

Ground Elevation (m AOD)

- <= 332
- 332 - 344
- 344 - 356
- 356 - 368
- > 368



CLIENT:

oneplanet ADVENTURE

waterco
www.waterco.co.uk

SCHEME:

Llandegla Forest, Llandegla

PLOT TITLE:

LiDAR Plan
1m Resolution
Data from Natural Resources Wales

PLOT STATUS:	DATE:
FINAL	08-08-2022

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
IH	AW	MW	1:1200

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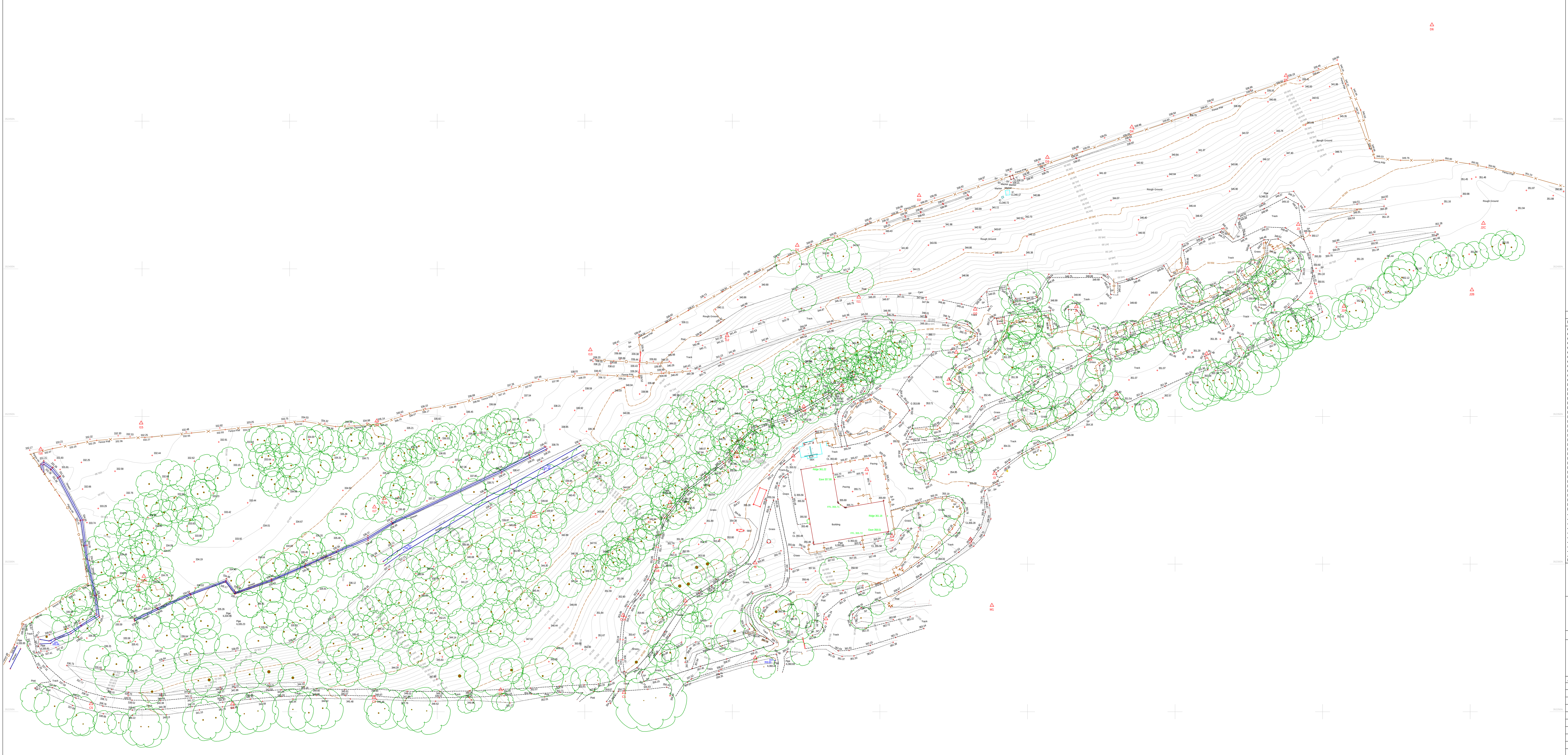
14648_LiDAR_Plan	-



Symbol	Description	Symbol	Description
	Top/Bottom of bank	G	Gulley
	Building	GAS	Gas cover
	Channel	IC	Inspection cover
	Concrete slab	LP	Lamp post
	Closeboard fence	MH	Manhole
	Chainlink fence	Marker	Marker post
	Concrete post & panel fence	OSBM	OSBM
	Iron railing fence	RE	Rodding eye
	Palisade fence	RS	Road sign
	Post & Panel fence	SP	Sign post
	Post & rail fence	Stump	Stump
	Post and Wire Fence	SV	Sluice Valve
	Hedge	TP	Telegraph Pole
INV	Invert		Trees
	Kerb line (bottom)	TRL	Traffic lights
	Kerb line (top)	Trial Pit	Trial pit
	Overhead Power lines		Tree Trunk
SBX	Switchbox	W	Water cover
	Steel	Bus Stop	Bus stop
	Tree spreed	BT	BT rectangle 3 pts
	Verge		
	Wall		
BH	Borehole		
Bol	Bollard		
CATV	Cable tv		
Elec	Electric cover		
EP	Electricity pole		
Earth	Earth rod		
FH	Fire hydrant		

SURVEY STATIONS

Name	Easting	Northing	Height
C1	323913.295	352256.473	355.011
C1A	323912.988	352282.626	353.665
C1B	323924.366	352299.115	353.452
C1C	323928.915	352320.836	349.822
C1C1	323882.810	352317.471	339.967
C1D	323951.446	352337.754	350.248
C1E	323974.181	352353.331	351.482
C1F	323987.164	352360.378	351.820
C2	323871.518	352257.400	351.118
C3	323828.615	352254.809	346.606
C4	323780.647	352252.718	342.011
C5	323732.753	352252.697	338.418
D1	323971.981	352407.933	339.630
D2	324013.300	352424.790	338.900
D3	324056.740	352437.768	338.924
D4	324085.350	352447.994	338.867
D5	324137.594	352465.390	339.118
D6	324187.046	352482.582	340.001
I1	323981.754	352281.430	361.430
I10	324032.290	352386.295	349.693
I11	323992.842	352390.375	345.864
I12	323948.259	352377.334	341.531
I13	323901.903	352372.528	338.156
I14	323829.571	352348.425	335.142
I15	323749.705	352347.746	332.222
I16	323715.634	352338.873	332.118
I17	323828.740	352319.314	335.878
I17A	323832.057	352322.242	336.496
I18	323748.685	352292.635	335.120
I18A	323750.628	352295.865	335.221
I1A	323957.790	352268.260	359.682
I2	324030.690	352308.455	356.906
I3	324038.851	352330.625	354.755
I3A	324004.107	352309.523	355.570
I3B	324080.173	352357.553	351.441
I4	323995.540	352332.002	355.711
I4A	324023.375	352362.465	352.808
I5	323970.661	352336.585	355.393
I6	323957.751	352300.418	355.886
I7	323934.095	352287.485	356.773
J1	324110.702	352371.257	351.457
J1A	324071.162	352370.610	350.290
J2	324146.173	352391.892	351.211
J2A	324157.269	352387.316	351.890
J2B	324200.619	352392.832	353.716
J2C	324204.514	352415.407	351.617
J3	324141.757	352414.981	349.546
J4	324104.191	352400.205	350.002
J5	324066.587	352387.161	348.992
J6	324025.886	352371.675	351.857
M1	324037.952	352286.010	365.822

DRAINAGE DISCLAIMER

ONLY DRAINAGE DISCOVERED WHILST ON SITE IS DISPLAYED ON THIS DRAWING
FURTHER INVESTIGATIONS MAY NEED TO BE CARRIED OUT TO ASCERTAIN
THE FULL EXTENT OF THE DRAINAGE FOR THE SITE

KEY DIMENSIONS SHOULD BE CHECKED ON SITE BEFORE COMMENCEMENT OF ANY WORKS

NOTE

Grid and Level related to OS
using active GPS data network OSGB36
and transformations OSTN15/OSGM15

Amendments

	Date	Surveyor	Description of work

Powers&Tiltman Ltd
Land Surveyors

Meridian House
58/60 Hillside Road, Frodsham, Cheshire WA6 6AG
Tel: 01928 734473 Fax: 01928 735573
Email: mail@powerstiltman.co.uk
www.powerstiltman.co.uk

Llandegla Forest Cabin & Parking Area

Llandegla

Topographical Survey

Client : Planit

Surveyed By : JL	Date : 28/11/19	A0 @ 1:500
Drawn By : JL	Drawing No : 8529/01	
Checked By : DG	Amendment :	

Appendix C Photographic Record

PHOTOGRAPHIC LOG

Photo No.1	**14648 – Llandegla Forest**
Date: 12/05/2022	
Description: Pool at outlet of existing septic tank from OnePlanet Adventure.	

Photo No. 2	**14648 – Llandegla Forest**
Date: 12/05/2022	
Description: Existing septic tank serving OnePlanet Adventure	

PHOTOGRAPHIC LOG

Photo No.3	**14648 – Llandegla Forest**
Date: 12/05/2022 Description: Fallen tree uncovering the underlying clayey deposits	

Photo No. 4	**14648 – Llandegla Forest**
Date: 12/05/2022 **Description:** Clay deposits underlying the site.	

Photo No.5	**14648 – Llandegla Forest**
Date: 12/05/2022	
Description: Watercourse along the western site boundary	

Photo No. 6	**14648 – Llandegla Forest**
Date: 12/05/2022	
Description: Ditch originating in the center of the site, orientating from east to west	

Appendix D DCWW Sewer Plan

Dŵr Cymru
Welsh Water

Llandegla Wrexham LL11 3AA

N
W E
S

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow
- Special purpose chamber
- Treatment works
- Pumping station
- Outfall
- Lamphole
- Storm Overflow
- Rising main
- Gravity sewer
- Private sewer
- Private sewer subject to Sect. 104 adoption agreement
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB: Sewer symbol colour indicates the type.

RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases, pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Map Ref:	323917,352282
Map scale:	1:4950
Printed by:	Zara Howells
Printed on:	27 Jul 2022

Appendix E Development Plans

Notes

Date	Suit	Rev	Description	Drawn by	Approved
15-07-22	S1	P01	DRAFT issue for comment	SR/FF	SR/FF
22-07-22	S1	P02	DRAFT issue for comment	SR/FF	SR/FF
29-07-22	S1	P03	Issued for Planning	SR/FF	SR/FF
04-08-22	S1	P04	Issued for Planning	SR/FF	SR/FF

MAKE SPACE

Contact
T: 01928 789 944
E: hello@makespace land

Make Space Landscape Architecture Limited
201 Manchester Road,
Altrincham,
WA15 5NU

Client
OnePlanet Adventure

Project
Llandegla Forest Pods

Drawing size	Drawing scale	Workstage
A1	1:500	Stage 3

Drawing title
Landscape General Arrangement

Drawing number	Suitability	Rev
0002-MS-XX-XX-DR-L-0002	S1	P04

Appendix F SAB Correspondence

Megan Williams

From: Daniel Jones <Daniel.Jones@denbighshire.gov.uk>
Sent: 12 May 2022 13:36
To: Megan Williams
Cc: Land Drainage Consultations
Subject: RE: 14648 - SAB request

Good Afternoon Megan,

Thank you for the information below regarding proposals at Llandegla Forest, Wrexham.

We would have no objections in principle to the intention of discharging the surface water from the site into a watercourse, providing that the following conditions are met:

1. Confirmation that permission is in place to connect to the watercourse.
2. Ordinary watercourse consent is obtained.
3. Evidence that the watercourse you will be connecting to can cope with the additional discharge from the site.
4. Evidence is provided to illustrate that infiltration will not work at the site.

Kind regards,

Daniel Jones BSc (Hons)
Swyddog Perygl Llifogydd / Flood Risk Officer
Cyngor Sir Ddinbych / Denbighshire County Council
Priffyrdd a Gwasanaethau Amgylcheddol / Highways & Environmental Services
Ffon/Phone: 01824 706822 / 07824 409601
Gwefan/Website: www.sirddinbych.gov.uk / www.denbighshire.gov.uk

---

From: Megan Williams [mailto:megan.williams@waterco.co.uk]
Sent: 04 May 2022 14:27
To: Land Drainage Consultations <landdrainage.consultations@denbighshire.gov.uk>
Subject: 14648 - SAB request

Dear Sir / Madam,

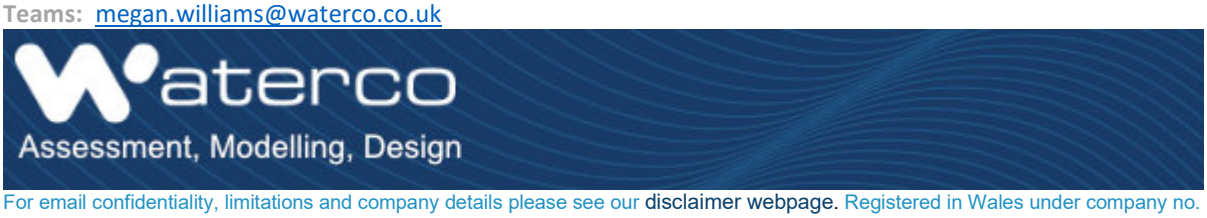
Please find attached a completed SuDS Pre application form, along with supporting evidence.

If you require any additional information or have any queries, then please do not hesitate to contact me.

Kind regards,

Megan Williams BSc (Hons)
Environmental Consultant

DDI: 01244 668122
Office: 01824 702220
Teams: megan.williams@waterco.co.uk



Dilyn ni ar Twitter: http://twitter.com/cyngorsDd - Follow us on Twitter: http://twitter.com/DenbighshireCC
Ymwelwch a ni ar-lein ar http://www.sirddinbych.gov.uk - Visit us online at http://www.denbighshire.gov.uk

Megan Williams

From: Daniel Jones <Daniel.Jones@denbighshire.gov.uk>
Sent: 26 May 2022 17:02
To: Megan Williams
Cc: Land Drainage Consultations
Subject: RE: 14648 - Foul Drainage proposal

Good Afternoon Megan,

We would need to consult with the county ecologist and NRW before we could advise if the below approach is acceptable. This is something that would commence during the technical assessment stage of the SAB application.

Kind regards,

Daniel Jones BSc (Hons)
Swyddog Perygl Llifogydd / Flood Risk Officer
Cyngor Sir Ddinbych / Denbighshire County Council
Priffyrdd a Gwasanaethau Amgylcheddol / Highways & Environmental Services
Ffon/Phone: 01824 706822 / 07824 409601
Gwefan/Website: www.sirddinbych.gov.uk / www.denbighshire.gov.uk

---

From: Megan Williams [mailto:megan.williams@waterco.co.uk]
Sent: 18 May 2022 10:14
To: Land Drainage Consultations <landdrainage.consultations@denbighshire.gov.uk>
Subject: 14648 - Foul Drainage proposal

Proposed holiday lodge development at Llandegla Forest, Llandegla, LL19 9LD. NGR: 323797 , 352316

Dear Sir/Madam,

We are currently preparing a Drainage Strategy for the site at the above address. This email is in relation to foul flows (a SAB pre-app will be submitted for surface water drainage).

Development proposals include approximately 14 holiday lodges. Please see attached an initial development plan for reference.

The site is located in the River Dee catchment which is designated as a Special Area of Conservation (SAC). We are therefore aware that the development should not increase phosphate loading on the SAC. The site is not in an area served by public sewers and a private treatment solution for foul flows is required.

With the development being for Holiday Lodges (no dishwashers, washing machines etc.), there is very limited potential for phosphate generation. The developer (Oneplanet Adventure) is willing to provide phosphate free products (sops, washing liquid etc.) to guests to make the wastewater generated by the development free of phosphates.

As the above is difficult to govern or condition as part of the planning process, a site wide approach is also proposed for foul drainage to provide overall phosphate reduction. The wider site / Client land ownership includes the Oneplanet Adventure café and toilet facilities which discharge to a septic tank. Effluent from the septic tank discharges to a pool downstream which once full, runs overland to the woodland below (where watercourses are located).

The foul drainage proposal is to discharge foul flows from the development to a new package treatment plant with treated effluent discharged to a reed bed providing additional treatment prior to discharge to a watercourse. Treated foul flows from the existing septic tank serving the Oneplanet adventure café and toilets will be re-directed into the proposed reed bed as to provide additional treatment and phosphate reduction when compared to the current situation.

Whilst data surrounding phosphate is relatively limited, DEFRA studies suggest reed beds can remove up to 70% of phosphates from wastewater.

Please can you advise if the above approach is acceptable in principle. The site wide approach would ensure phosphate quantity is reduced post-development.

If you have any questions or require any further information to process my request then please don't hesitate to contact me.

Kind regards,

Megan Williams BSc (Hons)
Environmental Consultant

DDI: 01244 668122
Office: 01824 702220
Teams: megan.williams@waterco.co.uk

Appendix G NRW Correspondence

Megan Williams

From: Roberts, Angela <Angela.Roberts@cyfoethnaturiolcymru.gov.uk>
Sent: 14 July 2022 11:33
To: Megan Williams
Cc: Redmond, Rebecca
Subject: Pre-application enquiry

Good Morning Megan
Thank you for your recent enquiry.
Comments made with regards to private foul drainage are made on the understanding that there is no public sewer available.
I assume the postcode for the proposed development in question is LL11 3AA (rather than the one on the enquiry form)
In terms of the new development, this will obviously need to go through Planning and NRW will be consulted as part of that process. I note that the proposal will improve the existing discharge, but it will also increase the volume of wastewater produced, so it would be subject to a HRA. For further information on this, please refer to Natural Resources Wales / Advice to planning authorities for planning applications affecting phosphorus sensitive river Special Areas of Conservation which covers what other information will need to be submitted.
The current system, from the description provided does not meet the regulations as septic tanks should not discharge to surface water, so improvements are needed. I could not find a record of it on our system and so is also unregistered/permitted.
An application for a permit can be made to NRW, however it is not possible to pre-determine the outcome of this application. For further information, please refer to Natural Resources Wales / Apply for a permit to discharge domestic sewage
Kind Regards
Angela

Angela Roberts

Swyddog yr Amgylchedd / Environment Officer

Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn/ Phone: 03000 65 3810
Bwcle / Buckley

(I work part time (tues, weds, thurs am)

Appendix H Greenfield Runoff Rates

DOCUMENT VERIFICATION RECORD	
Project:	14648 – Llandegla Forest, Llandegla
Client:	OnePlanet Adventure Ltd
Report Title:	Drainage Strategy
Date:	29/07/2022

DOCUMENT REVIEW & APPROVAL	
Author:	Megan Williams BSc (Hons)
Checker:	Aled Williams BSc (Hons) MCIWEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

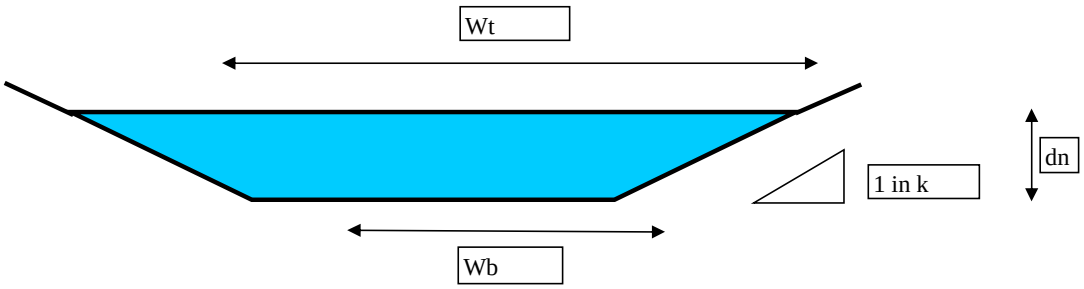
ReFH2 RUNOFF RATES*	
Return Period (Years)	**Peak Flow (l/s) – Greenfield Runoff Rates**
1	1.36654475
2	1.568084137
5	2.309155502
10	2.921906649
30	4.124044338
50	4.786585479
75	5.359515737
100	5.788981067
200	6.884953846
1000	9.744720147

*Runoff Rates printed from the ReFH Flood Modelling software package

Appendix I Watercourse Flow Capacity Calculations

waterco consultants	*Eden Court, Lon Parcwr, Ruthin, 01824 702220*	Calculations	ref	14648
Scheme:	14648 - Llandegla Forest		Prefix Page no.	A
Section:	Drainage Strategy		Date:	27/07/2022

Trapezoidal Channel Flow
Output Discharge



Manning Formula **V=(1/n)*R^(2/3)*S^(1/2)** **Q=A*V**

Bottom width Wb (m)	0.500	
Side slope (1 in k)	0.310	
Bed slope(1 in x)	20.00	
Manning "n"	0.035	
Depth dn (m)	0.800	
Bed slope s (m/m)	0.050000	1 / x
Top width Wt (m)	0.996	Wb + 2*k*dn
Area A (m2)	0.598	(Wb + Wt)/2)*dn
Perim P (m)	2.175	Wb + 2*dn*SQRT(1+k^2)
Hyd Rad R (m)	0.275	A / R
Velocity V (m/s)	**2.702**	1/n*R^(2/3)*S^(1/2)
Discharge Q (m3/s)	**1.6171**	A*V

Appendix J MicroDrainage Simulations

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.407	0.407	1.9	59.9	O K
30 min Summer	9.568	0.568	1.9	83.4	O K
60 min Summer	9.750	0.750	1.9	110.2	Flood Risk
120 min Summer	9.864	0.864	1.9	126.9	Flood Risk
180 min Summer	9.921	0.921	1.9	135.4	Flood Risk
240 min Summer	9.954	0.954	2.0	140.3	Flood Risk
360 min Summer	9.983	0.983	2.0	144.6	Flood Risk
480 min Summer	9.990	0.990	2.0	145.5	Flood Risk
600 min Summer	9.983	0.983	2.0	144.5	Flood Risk
720 min Summer	9.975	0.975	2.0	143.3	Flood Risk
960 min Summer	9.952	0.952	2.0	139.9	Flood Risk
1440 min Summer	9.901	0.901	1.9	132.5	Flood Risk
2160 min Summer	9.817	0.817	1.9	120.2	Flood Risk
2880 min Summer	9.737	0.737	1.9	108.3	Flood Risk
4320 min Summer	9.560	0.560	1.9	82.3	O K
5760 min Summer	9.413	0.413	1.9	60.7	O K
7200 min Summer	9.326	0.326	1.9	47.9	O K
8640 min Summer	9.269	0.269	1.9	39.6	O K
10080 min Summer	9.235	0.235	1.9	34.6	O K
15 min Winter	9.407	0.407	1.9	59.8	O K
30 min Winter	9.567	0.567	1.9	83.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	150.128	0.0	61.1	16
30 min Summer	105.573	0.0	85.7	31
60 min Summer	70.903	0.0	115.5	62
120 min Summer	42.355	0.0	138.0	122
180 min Summer	31.182	0.0	152.4	182
240 min Summer	25.047	0.0	163.2	240
360 min Summer	18.352	0.0	179.4	360
480 min Summer	14.742	0.0	192.2	480
600 min Summer	12.437	0.0	202.7	560
720 min Summer	10.821	0.0	211.6	614
960 min Summer	8.670	0.0	225.9	740
1440 min Summer	6.326	0.0	246.5	1008
2160 min Summer	4.576	0.0	268.4	1428
2880 min Summer	3.626	0.0	283.7	1844
4320 min Summer	2.598	0.0	304.8	2636
5760 min Summer	2.068	0.0	323.5	3344
7200 min Summer	1.768	0.0	345.7	4032
8640 min Summer	1.579	0.0	370.7	4752
10080 min Summer	1.457	0.0	399.0	5440
15 min Winter	150.128	0.0	61.1	16
30 min Winter	105.573	0.0	85.7	31

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.750	0.750	1.9	110.2	Flood Risk
120 min Winter	9.865	0.865	1.9	127.1	Flood Risk
180 min Winter	9.924	0.924	1.9	135.8	Flood Risk
240 min Winter	9.958	0.958	2.0	140.8	Flood Risk
360 min Winter	9.989	0.989	2.0	145.4	Flood Risk
480 min Winter	9.999	0.999	2.0	146.8	Flood Risk
600 min Winter	9.994	0.994	2.0	146.2	Flood Risk
720 min Winter	9.982	0.982	2.0	144.4	Flood Risk
960 min Winter	9.952	0.952	2.0	139.9	Flood Risk
1440 min Winter	9.884	0.884	1.9	130.0	Flood Risk
2160 min Winter	9.764	0.764	1.9	112.3	Flood Risk
2880 min Winter	9.639	0.639	1.9	93.9	O K
4320 min Winter	9.371	0.371	1.9	54.6	O K
5760 min Winter	9.223	0.223	1.9	32.8	O K
7200 min Winter	9.151	0.151	1.8	22.2	O K
8640 min Winter	9.113	0.113	1.7	16.7	O K
10080 min Winter	9.094	0.094	1.6	13.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	70.903	0.0	115.5	62
120 min Winter	42.355	0.0	138.0	120
180 min Winter	31.182	0.0	152.4	178
240 min Winter	25.047	0.0	163.2	236
360 min Winter	18.352	0.0	179.4	350
480 min Winter	14.742	0.0	192.2	462
600 min Winter	12.437	0.0	202.7	570
720 min Winter	10.821	0.0	211.6	670
960 min Winter	8.670	0.0	225.9	760
1440 min Winter	6.326	0.0	246.6	1068
2160 min Winter	4.576	0.0	268.4	1536
2880 min Winter	3.626	0.0	283.6	1988
4320 min Winter	2.598	0.0	304.9	2680
5760 min Winter	2.068	0.0	323.5	3336
7200 min Winter	1.768	0.0	345.7	3968
8640 min Winter	1.579	0.0	370.6	4592
10080 min Winter	1.457	0.0	399.0	5248

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 323808 352313 SJ 23808 52313
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.163

Time (mins) From:	To:	Area (ha)
0	1	0.163

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	147.0	1.000	147.0

Hydro-Brake® Optimum Outflow Control

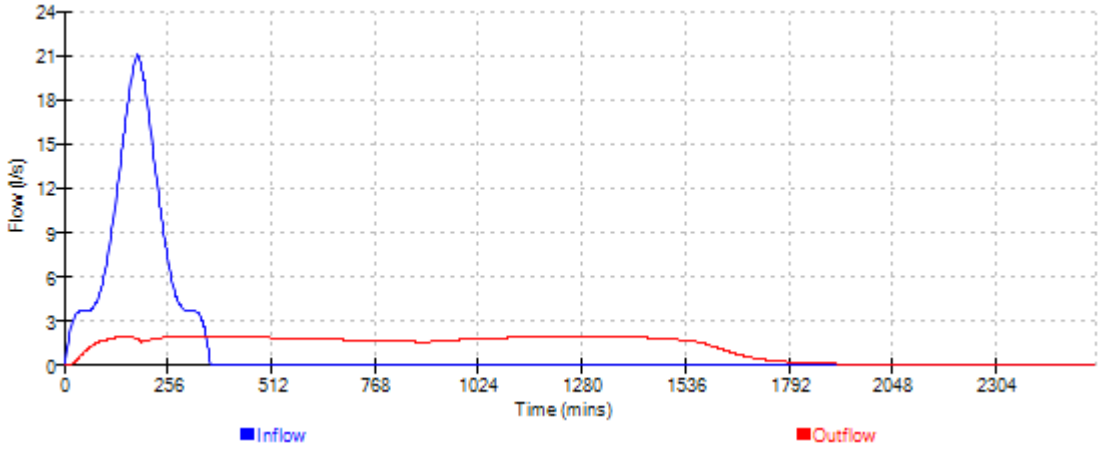
Unit Reference	MD-SHE-0067-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	67
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

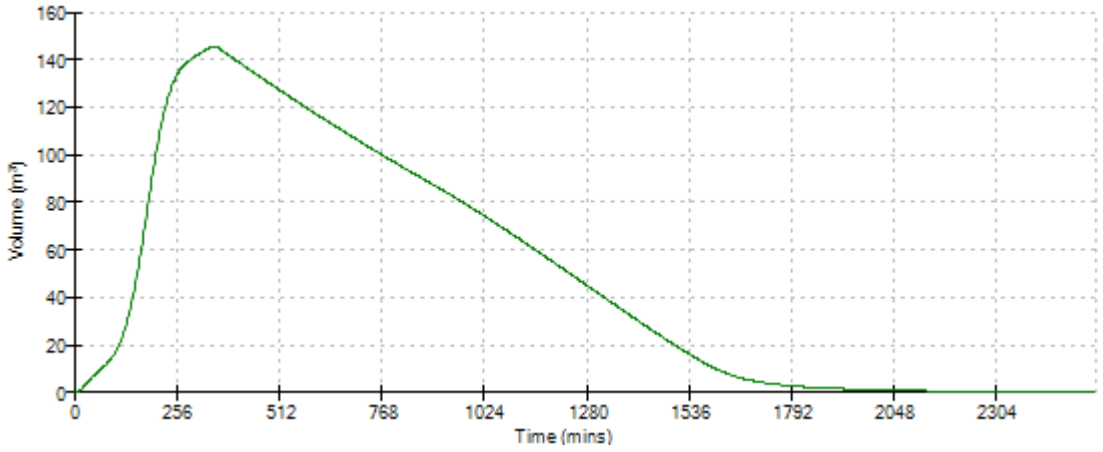
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.0
Flush-Flo™	0.296	1.9
Kick-Flo®	0.599	1.6
Mean Flow over Head Range	-	1.7

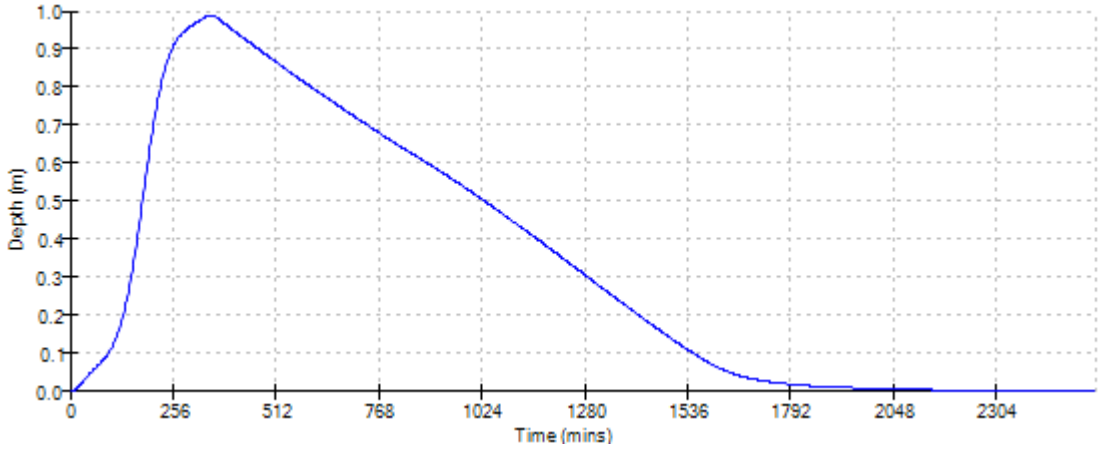
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6	1.200	2.2	3.000	3.3	7.000	4.9
0.200	1.9	1.400	2.3	3.500	3.5	7.500	5.1
0.300	1.9	1.600	2.5	4.000	3.8	8.000	5.2
0.400	1.9	1.800	2.6	4.500	4.0	8.500	5.4
0.500	1.8	2.000	2.7	5.000	4.2	9.000	5.5
0.600	1.6	2.200	2.9	5.500	4.4	9.500	5.7
0.800	1.8	2.400	3.0	6.000	4.6		
1.000	2.0	2.600	3.1	6.500	4.7		

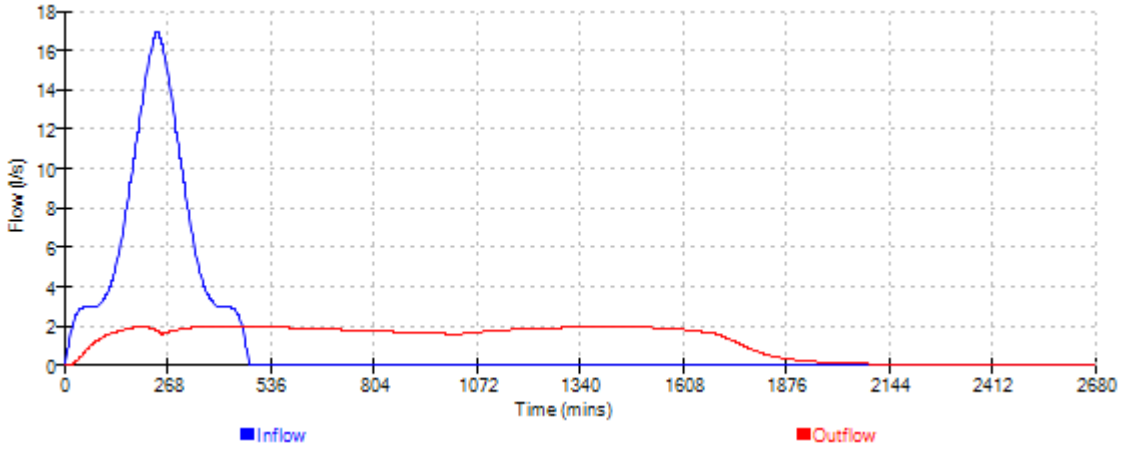
Event: 360 min Winter

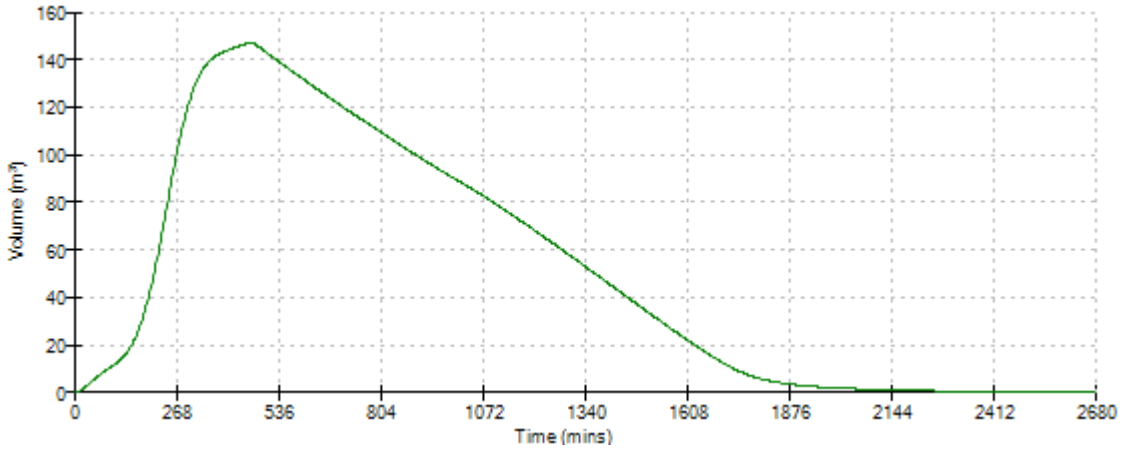


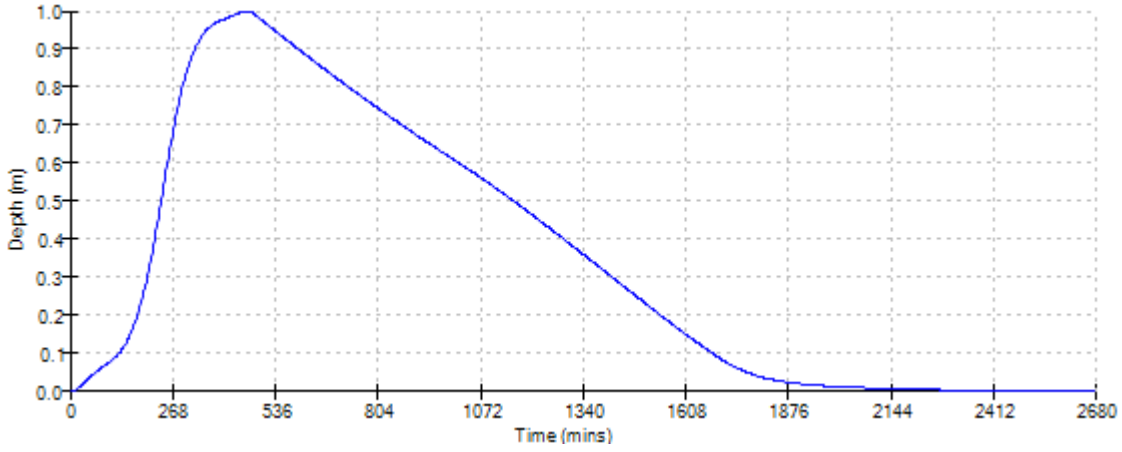




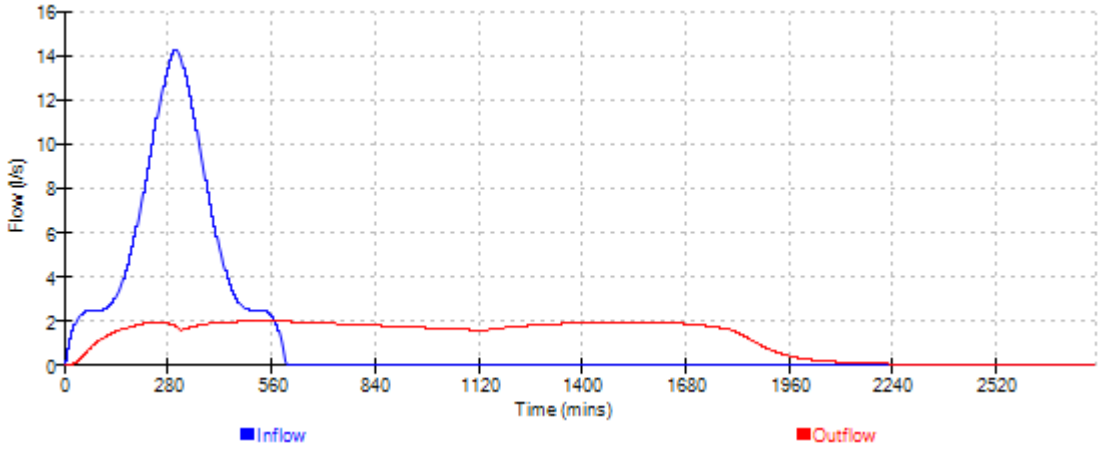
Event: 480 min Winter

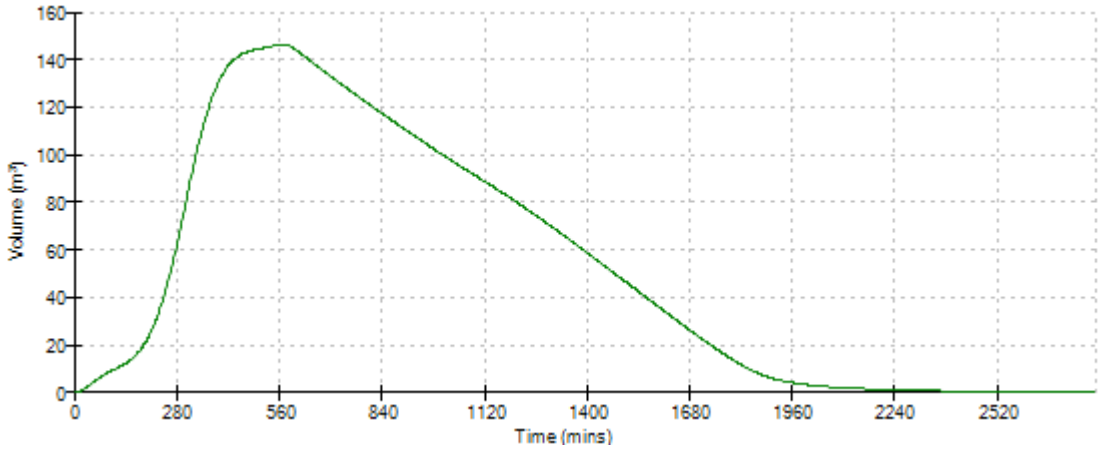


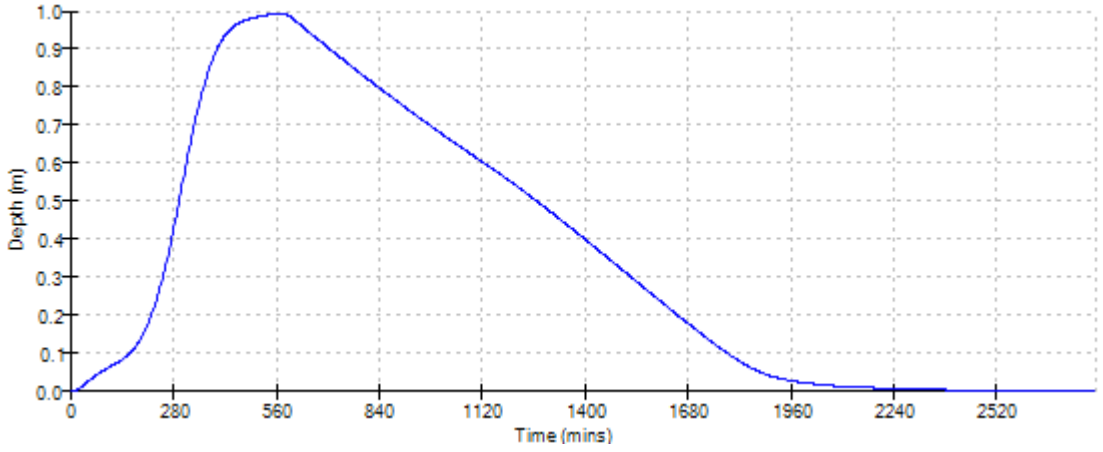




Event: 600 min Winter







Appendix K Concept Drainage Sketch

Ditch connecting to watercourse

Hydrobrake chamber limiting flows to 2l/s

Proposed new ditch to convey flow from attenuation pond to watercourse

Attenuation pond providing 148.2m³ of storage, sufficient to accomodate the 1 in 100 year + 40% CC event.

Access road and car park formed from permeable stone surface

Piped outlet from treatment tanks to ditch

Proposed inspection chamber

Service route

Existing septic tank to be removed once new system is installed

Proposed new ditch linking existing ditch to attenuation pond

Natural regeneration of moorland/ heath woodland vegetation

Broadleaf plantation along roadside boundaries for screening

Pedestrian/cycle connection to visitor centre through existing woodland retained.

Proposed site-won stone surfacing to vehicular access route

Controlled access barrier

Existing tarmac surfacing retained

Scrub vegetation to site boundary

Grass verge to allow for visibility splays

Proposed fenceline to match existing

Existing vegetation retained to boundary

Grass verge to allow for visibility splays

Existing wet woodland retained

Surface water attenuation pond

2no. water treatment tanks

Social gathering spaces with site-won bark chipping surfacing and timber furniture

Covered gathering spaces with picnic tables

Proposed wet woodland with proposed pond linked to the existing ditch

Proposed fire-track & turning head for fire tender access (gated access)

Proposed single lodge (2 person) 9no total

Proposed site-won stone to pedestrian/cycle path network

Brash habitat piles/screening features created using site-won material

Broadleaf plantation woodland

Proposed double lodge (4 person) 5no total

Proposed lighting bollards

Proposed boardwalk crossings over existing ditches & streams

Accessible lodge

4 no. electric vehicle charging points

Proposed timber-clad bin store housing 3no. 1100L wheelie bins

Existing vegetation retained to boundary

Natural regeneration of broadleaf woodland

Existing visitor centre w panels installed to roof.

0 25 50 m

Notes:
1) This sketch has not been subject to formal checks or approvals. Its validity and use must therefore be limited to discussion and information purposes only.
2) Unless otherwise noted the risks associated with this proposal are not considered to be extra ordinary and within the remit of an experienced and competent contractor.
3) All dimensions in millimetres and all levels in metres above ordnance datum unless shown otherwise.
4) This drawing is an ammendment of the 'Landscape General Arrangement' drawing by 'MakeSpace Landscape Architecture Limited'. This drawing provides a concept only and is not intended for detailed design.

LEGEND

- Site Boundary
- Proposed attenuation pond
- Proposed new ditch
- Proposed flow control chamber
- Proposed foul inspection chamber
- Proposed surface water drain
- Proposed foul drain
- Proposed French drain

CLIENT: oneplanet ADVENTURE

waterco
www.waterco.co.uk

SCHEME:
Llandegla Forest, Llandegla

PLOT TITLE:
Concept Drainage Sketch

PLOT STATUS:	DATE:
SKETCH	08-08-2022

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
IH	AW	MW	1:1000

PLOT NAME:	REVISION:
14648_Concept_Drainage_Sketch	-

Appendix L Maintenance Schedules

Operation and Maintenance Requirements for Filter Drains

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet / outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment decides	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (e.g. NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Ref. Table 16.1, CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Operation and Maintenance Requirements for Ponds and Wetlands

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season), or as required
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage, and / or physical damage.	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options.	Half yearly
	Check any mechanical devices e.g. penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level	Annually
	Remove sediment from any forebay	Every 1 – 5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, e.g. 25-50 years
Remedial actions	Repair erosion or other damage	As required
	Replant where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair/rehabilitate of Inlets, outlets and overflows	As required

Ref. Table 23.1 CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Operation and Maintenance Requirements for Swale

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as Required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swales treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oil or petrol residues using safe standard practices	As required

Ref. Table 17.1 CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Appendix M Package Sewage Treatment Plant Specifications

018316
INSTALLATION & OPERATION GUIDELINES FOR SINGLE PIECE UNITS BIODISC® BN

Kingspan Environmental Service Contact Numbers:

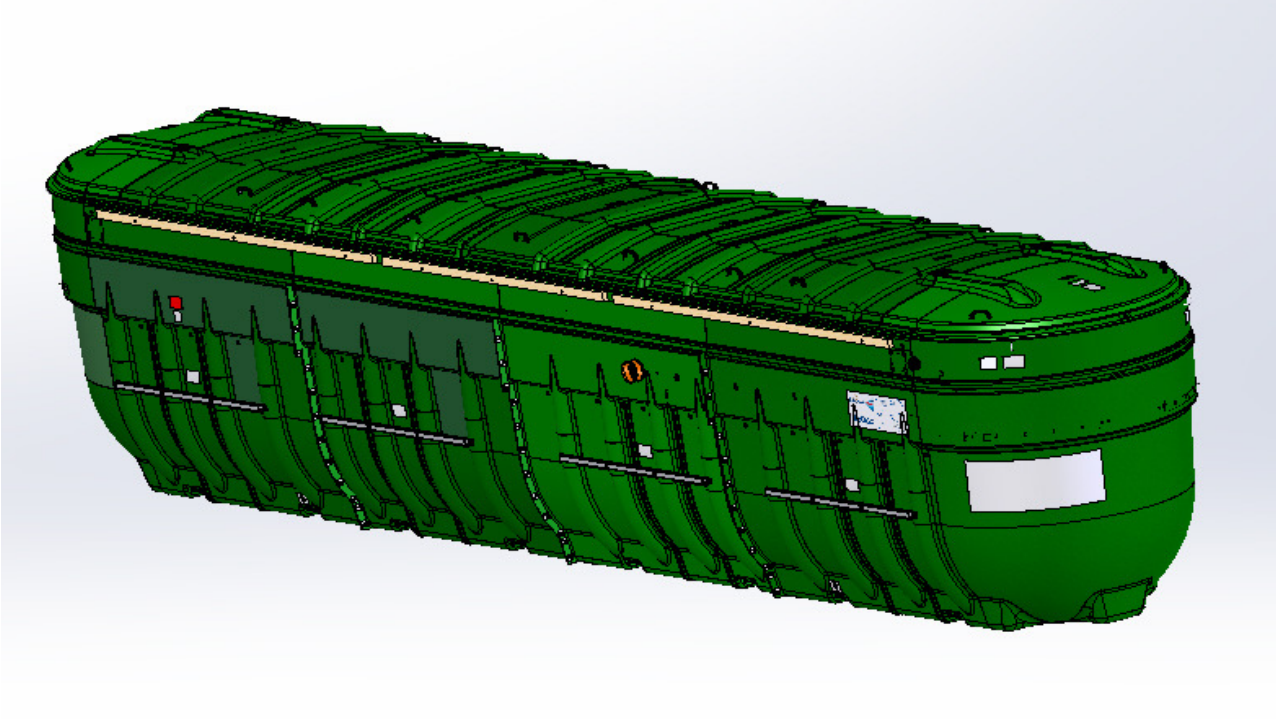
GB: 0844 846 0500

NI: 028 3025 4077

IRL: 048 3025 4077

Enclosed Documents

DS1334	BN BioDisc General Assembly – Sales Drawing



Issue	Description	Date
01	Initial Issue – CC1392	August 2017

HEALTH AND SAFETY

These warnings are provided in the interest of safety. You must read them carefully before installing or using the equipment.

It is important that this document is retained with the equipment for future reference. Should the equipment be transferred to a new owner, always ensure that all relevant documents are supplied in order that the new owner can be acquainted with the functioning of the equipment and the relevant warnings.

Installation should only be carried out by a suitably experienced contractor, following the Guidelines supplied with the equipment.

We recommend the use of a dust mask and gloves when cutting GRP components.

Electrical work should be carried out by a qualified electrician.

Sewage and sewage effluent can carry micro-organisms harmful to human health. Any person carrying out maintenance on the equipment should wear suitable protective clothing, including gloves. Good hygiene practice should also be observed.

Covers must be kept locked.

Observe all hazard labels and take appropriate action to avoid exposure to the risks indicated.

The correct ongoing maintenance is essential for the proper operation of the equipment. Kingspan offer a range of maintenance contracts, details on request.

Should you wish to inspect the operation of the equipment, please observe all necessary precautions, including those listed below, which apply to maintenance procedures.

BioDisc units contain rotating machinery and associated transmission equipment.

Ensure that you are familiar with the safe working areas and accesses.

Ensure that the working area is adequately lit.

The power supply to the equipment must be isolated at the control panel(s) before lifting the covers. Where a specific maintenance procedure requires the equipment to be running with the covers off, all care must be taken to avoid contact with moving parts and electrical components or conductors. Drive guards must be replaced and secured if removed during maintenance.

Once power has been isolated, the control panel must be kept locked shut to avoid accidental re-connection whilst work or inspection is being carried out.

Use only the designated access walkways. Do not walk on the cover.

Take care to maintain correct posture, particularly when lifting. Use appropriate lifting equipment when necessary. Keep proper footing and balance at all times. Avoid any sharp edges.

Desludging should be carried out by a contractor holding the relevant permits to transport and dispose of sewage sludge. The contractor must refer to the desludge instructions in the Operation section of this manual.

CONTENTS

1 Introduction

Thank you for choosing a Kingspan product. This manual will help you to keep it operating efficiently over a long service life. Please read this manual thoroughly, preferably before installation.

This manual should be referred to by :

a) The installer.

b) The electrician.

c) The maintenance engineer.

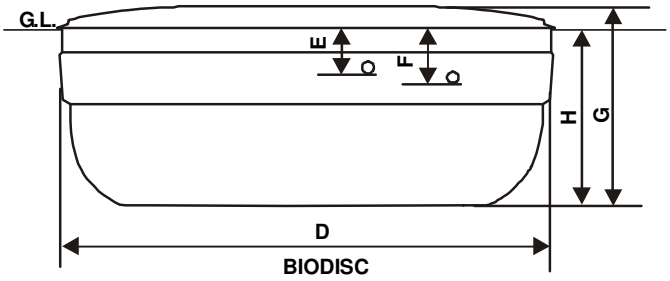
d) The desludge contractor.

e) The owner/user

These Guidelines represent Best Practice for the installation of these Kingspan BioDisc Units. Many years of specialist experience has led to the successful installation of thousands of BioDisc units. It must be noted, however, that these Guidelines are necessarily of a general nature. It is the responsibility of others to verify that they are appropriate for the specific ground conditions and in-service loads of each installation. Similarly, any information or advice given by employees or agents of Kingspan regarding the design of an installation must be verified by a qualified specialist (e.g. Civil engineering consultant).

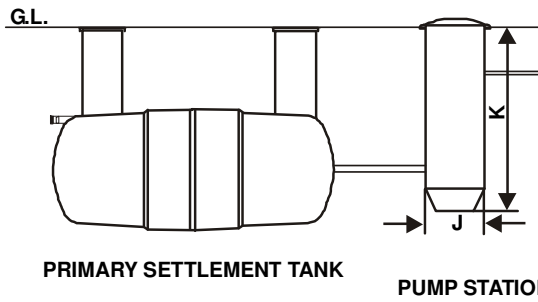
2 Technical Data

STANDARD - SINGLE PIECE SYSTEM

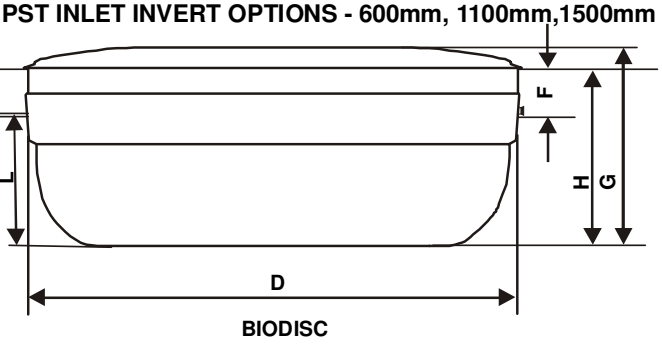


Note: Illustrations are schematic. Refer to General Arrangement Drawings for true pipework orientation.

OPTION - PUMP FED THREE PIECE SYSTEM



PST INLET INVERT OPTIONS - 600mm, 1100mm,1500mm



GL = Ground Level

2.1.1 The loadings given below are representative of typical domestic housing applications for a discharge consent of 20/30/20. The sizing of sewage treatment plants requires specialised knowledge and experience. Please consult Kingspan for an assessment of your application.

2.1.2

Unit	BN	
PE	300	
Maximum Daily BOD **(kg)**	18	
Maximum Daily Flow **(m^3)**	45	
Peak Flow Rate **(m^3)**	7.5	
BOD **(mg/l)**	20	
Suspended Solids **(mg/l)**	30	
Ammonium NH_4^+-N **(mg/l)**	20	
Primary Settlement Tank		
Please Refer To Klargester Sales For Applications Requiring A Primary Settlement Tank For Sizing And Dimensional Information.		
BioDisc	BN	
Inlet Invert Depth **E mm**	600	1000
Length **D mm**	13100	
Width **mm**	2582	
Depth Below Inlet Invert **L mm**	1790	
Outlet Invert Depth **F mm**	750	1150
Overall Height **G mm**	2850	3250
Height To rim cover **H mm**	2490	2890
Empty Weight **kg**	5500	5650
Standard Power Supply	400V 3 Phase	
Motor Rating 1 Phase **Watts**	2 x 370	
Full Load Current 3 Phase **Amps**	2 x 1.35	
Sludge Return Pump Rating **Watts**	480	
Pump Station		
Diameter **J mm**	900	
Flange Height **K mm**	2530	
Standard Power Supply	1ph	
Pump Rating **Watts**	480	

3 Handling & Storage

3.1.1 Care must be taken to ensure that the unit is not damaged during delivery and handling on site. If there is any damage it should be reported to the Warranty Team (0844 225 2785) within 48 hours of delivery.

3.1.2 The design requirements of Kingspan products will frequently mean that the centre of gravity of the unit is “offset”. Care must therefore be taken to ensure that the unit is stable when lifting. Rainwater may also collect inside units, particularly if they have been stored on site prior to installation, adding weight and increasing instability. Check units before lifting and pump out any excess water.

3.1.3 When lifting units, use webbing slings of a suitable specification. When lifting BioDisc units the slings must be passed through the indicated channels in the base of the unit.

3.1.4 A suitable spreader bar should be used to ensure that the unit is stable and that loads are evenly distributed during lifting. When lifting BioDisc units the spreader bar length should be equal to the width of the BioDisc to avoid compression damage to the covers or sides of the unit.

3.1.5 Do not use chains. Do not use the U-bolts or horizontal beams on the BioDisc case for lifting.

3.1.6 Lifting equipment should be selected by taking into account the unit weight, length and the distance of lift required on site.

3.1.7 Kingspan Environmental accepts no responsibility for the selection of lifting equipment.

3.1.8 Whenever Kingspan BioDiscs are stored or moved on site, ensure that the storage location is free of rock, debris and any sharp objects, which may damage the unit. The BioDisc must be placed on ground, which is flat and level to evenly support the base of the unit.

4 Site Planning

The following points should be considered before installation of the equipment:

4.1.1 The discharge must have the consent of the relevant Environmental Regulator.

4.1.2 The installation should have Planning and Building Control approval.

4.1.3 Ground conditions and water table level should be assessed. If the water table will be above the base of the unit at any time of the year, adequate concrete backfill must be provided to avoid flotation. In poorly draining ground, consideration should also be given to the likelihood of flotation due to surface water collecting in the backfill. It should be borne in mind that the inlet drain trench will act as a land drain, directing surface water to the backfill around the unit.

4.1.4 If discharge is to a soakaway, a porosity test should be carried out in accordance with BS 6297 to assist in assessing sub-soil drainage and designing the sub-surface irrigation system.

4.1.5 The use of Borehole soakaways with Kingspan sewage treatment products is only acceptable when the Environment Agency discharge license allows them. Borehole soakaways are not accepted under building regs or BS6297 so it is only under special circumstances that the EA will allow such a system. Maintenance of the borehole is essential to maintain permeability.

4.1.6 The BioDisc system must be installed at a level, which will allow connection to the incoming drain and a free discharge at the system outlet. Effluent pumping station are available to lift the discharge to a higher level and/or pump to remote discharge points.

4.1.7 The unit should be installed so that the bottom lip of the cover is 65mm or more above local ground level. If the unit has to be recessed, measures must be taken to ensure that it cannot be flooded by surface water run-off.

4.1.8 There must be at least 1 metre of clear, level ground all around the unit to allow for routine servicing, plus adequate space to allow complete removal of the covers.

4.1.9 Adequate access must be provided for routine de-sludging and maintenance, including crane access. Vehicles should not be permitted within a distance equal to the depth of the unit, unless suitable structural protection is provided to the installation.

4.1.10 BioDisc covers are not suitable for walking on. Where necessary the BioDisc should be fenced off or otherwise protected. Maintenance access must be maintained as above.

4.1.11 The drainage system connected to the BioDisc must be adequately vented in accordance with the Building Regulations. The head of the drainage system should be connected to a stack pipe, open at high level, so as to draw foul air from the system and sited with consideration to prevailing wind direction. Tile vents & Air admittance valves should not be used as the sole drainage ventilation facility, but if this cannot be avoided, the BioDisc should be independently ventilated. All inspection points within the drain system should be sealed so as to enable ventilation at high level.

4.1.12 An adequate electrical supply must be provided, complying with current electrical regulations. The electrical details in section 2.1.1 will enable selection of suitable cable and current overload protection, taking into account the distance from the power source to the control panel and any other relevant factors. In most cases steel wire armoured (S.W.A) cable, minimum 2.5 mm^2 will be suitable, but this is a minimum recommendation and selection is the responsibility of the installing electrician. Although not obligatory for an installation of this type, RCD protection is suggested as an extra precaution.

4.1.13 Pump stations or any other associated equipment should have a separate power supply.

4.1.14 Proximity to a mains water hosepipe connection point is recommended, for maintenance purposes. Such a supply should be connected in accordance with water bylaws and regulations. **Never leave a hose connected and immersed in sewage.**

4.1.15 Installation should only be carried out by suitably qualified and experienced contractors in accordance with the Health and Safety at Work Act. Electrical work should be carried out by a qualified electrician, working to the latest edition of IEE.

5 Installation

5.1 General

5.1.1 When units are installed in unstable ground conditions where movement of the surrounding material and/or unit may occur, the connecting pipe work should be designed to minimise the risk of damage from differential movement of the unit(s) and/or surrounding material.

5.1.2 In situations where the excavation will not maintain a vertical wall, it will be necessary to support sidewalls of the excavation (E.g. with suitable trench sheets and bracing systems) to maintain a vertical wall from the bottom to the top of the excavation. DO NOT completely remove the shoring system until after the backfilling is complete, but before the concrete fully hardens.

5.1.3 In areas where the water table is above the bottom of the excavation and/or the excavation is liable to flood, the excavation should be de-watered, using suitable pumping equipment, until the installation is complete. In such conditions it may be advisable to line the excavation with polythene sheeting, to prevent cement being washed out of the concrete surround/base.

5.1.4 During installation care must be taken to ensure that the body of the unit is uniformly supported so that point loads through the unit are avoided.

5.1.5 Refer to the drawings attached for dimensions of units.

5.1.6 The Concrete Specification is not a site-specific installation design.

GENERAL CONCRETE SPECIFICATION IN ACCORDANCE WITH BS EN 206-1 (BS 8500-1)		
TYPE OF MIX		(DC) DESIGN
PERMITTED TYPE OF CEMENT		BS 12 (OPC): BS 12 (RHPC): BS 4027 (SRPC)
PERMITTED TYPE OF AGGREGATE ((coarse & fine)		BS 882
NOMINAL MAXIMUM SIZE OF AGGREGATE		20 mm
GRADES: C25 /30 C25 /30 C16 /20		REINFORCED & ABOVE GROUND WITH HOLDING DOWN BOLTS REINFORCED (EG. FOR HIGH WATER TABLE) UNREINFORCED (NORMAL CONDITIONS)
MINIMUM CEMENT CONTENT	C30 C20	270 - 280 Kg/M^3 220 - 230 Kg/M^3
SLUMP CLASS		S1 (25mm)
RATE OF SAMPLING		READY MIX CONCRETE SHOULD BE SUPPLIED COMPLETE WITH APPROPRIATE DELIVERY TICKET IN ACCORDANCE WITH BS EN 12350-1
NOTE: STANDARD MIXES SHOULD NOT BE USED WHERE SULPHATESOR OTHER AGGRESSIVE CHEMICALS EXIST IN GROUND WATER		

5.2 BioDisc Installation

5.2.1 Excavate a hole of sufficient length and width to accommodate the unit and a minimum of 200mm concrete surround and to a depth, which allows for the burial depth of the unit plus a minimum 300mm thick concrete base.

5.2.2 Construct a suitable concrete base slab, a minimum of 300mm thick, appropriate to site conditions. In wet or unstable ground conditions it may be necessary to lay a hard-core sub-base. Ensure that the slab is flat and level. Allow the slab to set sufficiently to support the installed load.

5.2.3 Ensure that the slab is free of any stones or other material, which could damage the unit. Lower the unit onto the slab using suitable webbing slings and lifting equipment.

5.2.4 Remove the package tied to the outside of the unit. This contains a copy of the Installation Guidelines and a cover key.

5.2.5 Remove the covers by undoing the locks and folding the end covers back over the inner covers before lifting them off. Then unlock and remove the centre covers.

5.2.6 Remove the Control Panel, from the walkway inside the unit.

5.2.7 Check that the inlet and outlet orientation is correct and that the unit is level. It is essential that the unit is installed in a level plane to avoid undue stress on the bearings. The unit must be level to within ±5mm from side to side, measured at the walkway on either side of the rotor. If necessary, lift the unit off the base and apply further concrete as needed to level up.

Note: The top flange of the BioDisc should not be used for levelling as manufacturing tolerances may result in it not being parallel with the rotor shaft.

5.2.8 It is essential that the unit levels are checked regularly throughout the installation process. Should the unit become out of level, immediate remedial action is advised, to maintain the unit within the levels stated in section 5.2.7.

5.2.9 Pour no more than 1 metre depth of water into both primary (inlet) chambers and the final (outlet) chamber ensuring that there is never more than 250mm difference in water level between any of the sections.

5.2.10 Place concrete backfill to approximately 500mm depth around the unit ensuring good compaction to avoid voids. **Do not use vibrating pokers.**

5.2.11 Continue backfilling with concrete to just below the level of the inlet spigot. Keep the concrete at an even level all round the unit, compacting in layers. As backfilling progresses keep the ballast water level inside the unit 250-500mm above the concrete backfill level, but do not attempt to fill the unit with water above the outlet level.

5.2.12 Remove blanking cap from the cable duct at the outlet end of the unit.

5.2.13 Continue to backfill, with concrete or free flowing granular material, up to ground level. **Do not use sand.** The finished surface should be 65 mm minimum lower than the lip of the cover.

Important: Refer to Front Page regarding delayed electrical installation.

5.3 Control Panel – Installation

5.3.1 The control panel is supplied fixed to the pedestrian walkway at the outlet end of the unit, cut cable ties to remove.

5.3.2 The control panel is suitable for internal or external wall mounting, with volt-free contacts for an optional beacon or telemetry. Kiosks are available as an option on request.

5.3.3 It is important that the control panel is situated in an accessible location for servicing and maintenance.

5.3.4 The panel key is in the protective bag on the front of the panel.

5.4 Control Panel - Connection

5.4.1 It is necessary to supply (by others) SWA cable to connect the control panel with the internal junction box inside the unit.

5.4.2 The gearbox, loss of rotation alarm and sludge return pump are all pre-wired into the internal junction box within the unit.

5.4.3 The SWA cable connecting the control panel and internal junction box must be ducted through the 4” port at the outlet end of the unit.

5.4.4 Refer to the wiring diagram inside the panel for connection details.

5.5 Ancillary Equipment

5.5.1 Ancillary items should be installed in accordance with the Installation Guide supplied e.g.

- Primary Settlement Tank
- Sewage Pump Station
- Effluent Pump Station
- Sample Chamber
- Grease Trap

6 Start Up

6.1.1 Every care is taken to ensure that all mechanical components are correctly fitted, adjusted and lubricated prior to leaving the factory. However, subsequent handling during transportation and installation may result in the movement of components and a subsequent need to re-adjust prior to starting the unit. If, on inspection, you consider that any components require adjustment, please contact Kingspan.

6.1.2 Once the unit has been installed it should be left filled with water. Please switch on the motor, following the procedure below and leave the unit running, even if there is no sewage being fed into the plant. **If the unit has been installed with no operational power supply, then remove the motor/gearbox unit and store it in a dry or heated environment until such time as the unit is ready for permanent operation.** Kingspan or an experienced contractor should then replace the motor gearbox unit.

6.1.3 We recommend that Kingspan should commission the system: details on request.

6.1.4 Where circumstances dictate an immediate start-up the following basic procedures should be carried out.

6.1.5 Check that the Primary Settlement Tank (where applicable) and the BioDisc are full of water to their outlet levels.

6.1.6 Check that the power supply is connected to the control panel. Check that all electrical components and conductors are earthed.

6.2 Automatic grease cartridges

6.2.1 The shaft roller bearings are fitted with pressurised grease cartridges. These should be activated before the unit is started.

6.2.2 Turn the control knob and it's linked dial until the figure 6 is against the arrow on the casing, as opposite (this will give a lubrication period of 12 months at the temperature in the BioDisc).

6.2.3 Depress the red button. This secures the setting and releases the control knob from dial.

6.2.4 Rotate the knob clockwise to activate the unit. **Note: Grease cartridges must be changed every 12 months.**

Setting a discharge duration of 12 months

6.3 Optional Pump Station

6.3.1 Check that the pumps have been installed and wired to the Pump Control Panel.

6.3.2 The pumps should be set to pump little and often in order to prevent excessive loading on the BioDisc.

6.3.3 Check the setting of the high level float in the pump chamber. This must be set to operate the pumps so as not to exceed the balancing volume of the unit. To ensure this the float must operate below the level of the inlet of the unit. Ensure that the float(s) can operate freely without risk of entanglement. Check that the Pump Control Panel timer is set correctly, as shown on the wiring diagram.

6.4 BioDisc

6.4.1 Check that the BioDisc is in order, with no obvious damage or misalignment of parts. If any possible problems are discovered, contact Kingspan.

6.4.2 Check that all electrical components: Drive Motors, Sludge Return Pump and LOR Alarm sensors, are connected to the Control Panel.

6.4.3 Check that the Sludge Return Timer in the BioDisc Control Panel is set correctly, as indicated on the wiring diagram.

6.5 Switch-on

6.5.1 Open the BioDisc control panel, check that all circuit breakers are in the “on” position and switch on the main isolator switch. Close and lock the panel. Immediately upon switching on the sludge return pump should start and run for the set time.

6.5.2 Open the Pump Control Panel (where installed), check that all circuit breakers are in the “on” position and switch on the main isolator switch. Close and lock the panel. Immediately upon switching on the isolator, one of the pumps may start and run for the set time.

6.6 Process Initiation

6.6.1 During installation, the unit will have been filled with water to prevent flotation in the concrete surround. Allow sewage to enter the unit, this will gradually displace the clean water used during installation.

6.6.2 The colonisation by micro-organisms will commence naturally and a full operating biomass will establish itself on the discs in 4-8 weeks, depending on individual site circumstances.

7 Operation

7.1.1 The biological treatment process of your BioDisc is self-regulating and it requires no specialised operational knowledge, but it is important that you are aware of the following points.

7.1.2 Your BioDisc system uses colonies of live natural micro-organisms (biomass), to break down the pollutants in the sewage. Many chemicals used in households and commercial establishments can inhibit or kill these micro-organisms; particularly if used in excessive amounts.

7.1.3 Bear in mind that treatment plants serving small populations do not have the benefit of dilution that occurs at a large sewage works. A bottle of bleach tipped down the toilet in Birmingham would be virtually lost amongst the millions of gallons of sewage arriving at the city's treatment works; a bottle of bleach in a plant serving a hotel could be a lethal dose for the biomass.

7.1.4 If the biomass is damaged, it will usually recover over time. But in the meanwhile one of the more obvious symptoms is an unpleasant smell, so it is in the users interest to avoid this.

7.1.5 Generally speaking all common household cleaning fluids are acceptable, provided they are used in accordance with the makers instructions and stipulated concentrations. The following “Do’s and Don’ts” includes the most common household chemicals, but it is not an exhaustive list and the golden rule is "If in doubt - leave it out."

7.1.6 Bear in mind too that it isn't only the toilet that is connected to the treatment plant; anything that goes down the sink, bath etc. also ends up there.

7.2 Do's and Don'ts

7.2.1 **Washing machine and dishwasher detergents, washing up liquids:**

These are generally all right to use in the normal concentrations and usage found in domestic housing applications. All commercial applications are individually assessed before installation for their laundry load. Please contact Kingspan for advice if any changes are contemplated e.g. addition of extra laundry facilities.

7.2.2 **Floor cleaners, disinfectants and bleaches:**

These are safe to use in accordance with the makers recommendations and in the minimum necessary concentration. Do not pour neat disinfectant or bleach down sinks or outside gullies. If these are smelly it usually indicates a build up of decaying material or a plumbing problem and should be dealt with accordingly.

7.2.3 **Nappy disinfectants and bottle sterilising fluids E.g. Milton:**

When disposing of the used fluid, ensure that it is well diluted with water. The easiest way of doing this is usually to flush it away down the toilet.

7.2.4 **Waste disposal units:**

These do not inhibit the biomass, but, depending on use, they can present the treatment plant with considerable extra load. This can result in the treatment process becoming unbalanced, leading to problems. Much better to compost your vegetable peelings etc - its cheaper and environmentally friendly.

7.2.5 **Home beer and wine making.**

This presents a similar problem to waste disposal units. The BioDisc has to work as hard to treat one pint of beer tipped down the drain as it does to treat all the normal waste produced by one person in 24 hours. See also the notes above regarding sterilising fluids.

7.2.6 **THE FOLLOWING MUST NOT BE DISCHARGED INTO THE DRAINS**

- **Motor oil, grease, anti-freeze, brake fluid etc**.
- **Cooking oil and fat.**
- **Weed-killers, insecticides, fungicides and other gardening chemicals.**
- **Paint, thinners, white spirit, turpentine, creosote etc.**
- **Medicines.** Take unused medicines to a pharmacist for safe disposal.
- **Photographic developing fluids.**
- **Nappies, sanitary towels, rags, soft toys, tennis balls etc.**

This may seem obvious, but it is amazing what gets flushed down the loo from time to time. Although such items are not directly damaging to the biomass they can cause problems, not the least of which is simple blockage of the drains.

Even so-called disposable nappies and sanitary towels often do not degrade fully in the treatment plant and can lead to malfunction, so it is best to dispose of them by other means.

7.3 Automatic Restart

7.3.1 BioDiscs are designed to re-start automatically when power is resumed, but the re-start may not succeed in some circumstances, such as extended power cuts. This will cause the alarm to activate when power is re-established after power cuts, check that the rotor is turning correctly. In the event of any difficulties, contact Kingspan.

8 Running Checks

8.1.1 Check that the rotors are running smoothly in the correct direction of rotation (see section 8.1.2) and are not contacting any part of the fixed structure.

8.1.2 Check that the forward feed buckets are discharging correctly from both first to second stage Biozones.

8.2 Loss of Rotation Alarm

8.2.1 Check operation of the Loss of Rotation (LOR) Alarms as follows:

8.2.1.1 Open the Control Panel and switch off the drive motor circuit breakers. After a delay of 2-3 minutes the alarm should activate.

8.2.1.2 Push the “Beacon Off” button on the front of the Control Panel. The alarm beacon should stop flashing and the red indicator light on the panel front should remain illuminated.

8.2.1.3 Switch on the drive motor circuit breakers and close the Control Panel. The alarm should cease after approximately one minute.

8.2.1.4 Depress and release the “Beacon Off” button to reset it.

8.2.2 Malfunctioning of the LOR Alarm does not prevent operation of the BioDisc System, but it should be reported to your maintenance engineer for early rectification.

8.3 Customer Checks

8.3.1 The following periodic checks should be carried out monthly. Your attention is specifically drawn to the Health and Safety section of this manual.

8.3.1.1 Visually check the general condition of the plant and listen for any unusual noises. Report any aspects of concern to your maintenance engineer.

8.3.1.2 Check the appearance of the Biomass. It should be light grey to grey at both first banks, gradually changing to brown in both second stages and dark brown at the drive end of each second stage. If the growth is excessively thick and the colour predominantly grey throughout, an overload condition is indicated.

8.3.1.3 Visually check that all fixings are secure.

8.3.1.4 Clear any debris from inlet and outlet pipes.

8.3.1.5 Check dosing buckets and transfer pipes for any build up of debris. Clean, if required, using a stiff bristled brush.

8.3.1.6 Check the Loss of Rotation Warning Devices for correct operation (see section 8.2). If the alarm does not operate properly, contact your maintenance engineer.

9 Desludging and Maintenance

9.1.1 These are vital to the plant's ongoing operation and should be carried out in accordance with the guidelines in this manual.

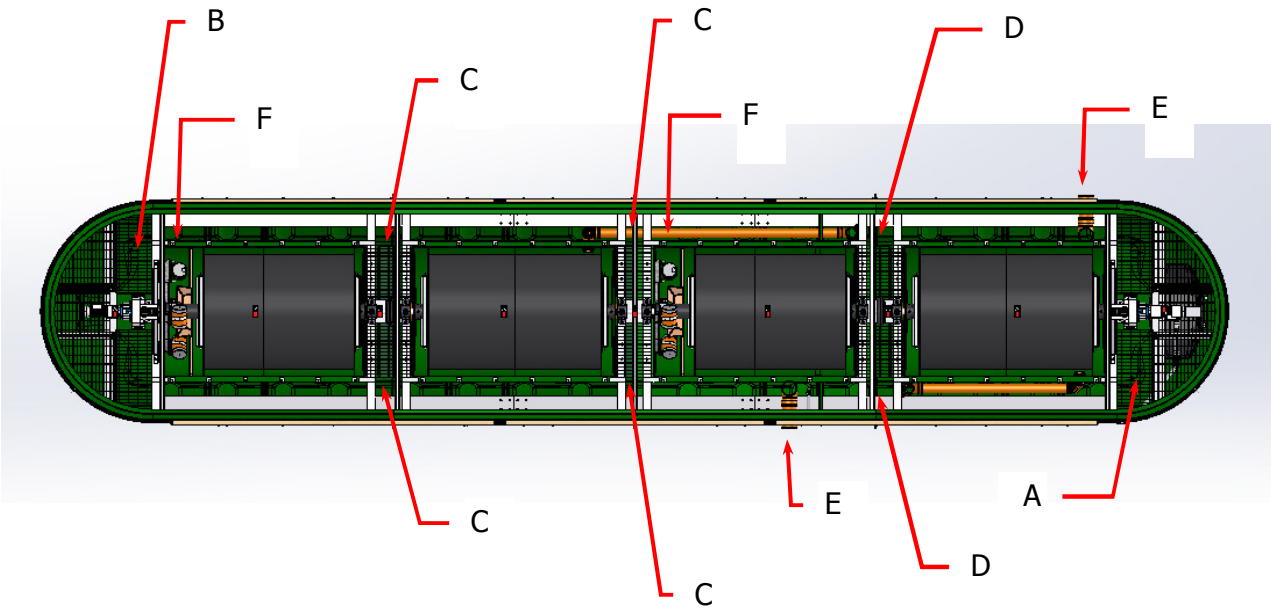
9.1.2 Mechanical and electrical maintenance must be performed by properly trained engineers, with reference to the appropriate Maintenance Manual. Kingspan offer a range of maintenance packages, details on request.

9.1.3 Kingspan BioDiscs are designed and engineered for the minimum possible maintenance requirements, consistent with proper performance. Nevertheless, it is important that routine preventive electro/mechanical maintenance and de-sludging are carried out at the appropriate intervals by suitably qualified persons.

9.1.4 Kingspan offer various levels of contract maintenance of all BioDisc Systems through Kingspan Environmental Services who can be contacted on 0844 846 0500.

9.2 Sludge Removal

9.2.1 Refer to the illustration below for recommended de-sludge positions. (Note: Illustration is typical; individual units may vary).



9.2.2 Isolate power to the BioDisc (and Pump Station if applicable) at the Control Panel(s).

9.2.3 Undo the BioDisc cover latches and fold back the hinged cover sections as required to gain access. Alternatively the covers can be completely removed if wished. Hinged sections should be folded back before lifting off.

9.2.4 Remove any surface scum from the Final Settlement Tank [A]. The steel mesh may be removed for access if required. Lower the hose to the bottom of the tank and remove any settled sludge. Also de-sludge at points [D] on either side of the rotors and along the length to prevent 'rat-holing'. The steel mesh over points [D] may be removed for access if required. Replace any removed steel mesh.

9.2.5 Remove surface scum from the BioDisc Primary Settlement Zone at point [B] and de-sludge at points [C] on either side of the rotors. De-sludge along the length of the rotors to prevent 'rat-holing'. The steel mesh over points [B] and [C] may be removed for access if required.

9.2.6 **Note:** While de-sludging ensure that there is never more than 250mm difference in water levels between points [A] and [C].

9.2.7 **DO NOT** attempt to remove any liquid from any Rotor Section.

9.2.8 **DO NOT** attempt to clean off the gelatinous growth on the rotors.

9.2.9 Ensure that the BioDisc inlet and outlet pipes [E] and the Forward Feed Buckets [F] are free of debris.

9.2.10 Ensure that all safety meshes are replaced, then close and lock the BioDisc covers.

9.2.11 Units with separate Primary Tank only - Remove the covers from Primary Settlement Tank. Remove any surface scum in the Primary Settlement Tank, then lower the hose into the bottom of the tank and completely remove settled sludge. It may be necessary to empty the tank completely to ensure full sludge removal. Ensure that the inlet and outlet pipes are clear of debris, and then replace the covers.

9.2.12 All units - Re-connect the power supply. Wait for two minutes. If the alarm on the control Panel does not activate, this indicates that the Rotor has successfully re-started. If the alarm activates, switch off the power at the Control Panel and immediately switch on again. If the alarm continues to activate, isolate the power supply and notify the plant owner so that the problem can be investigated.

9.3 Desludge Volumes

9.3.1 The minimum volumes shown here are those which can be anticipated under full loading at the de-sludge period indicated. If the system is not loaded to full capacity, the de-sludge period and volumes removed may be adjusted, but it is essential that a) sludge is not allowed to accumulate to the detriment of the process and b) all settled sludge and floating matter are removed at each de-sludge visit.

UNIT	De-sludge Period	BioDisc Primary Settlement Zone	BioDisc Final Settlement Zone
BN	Approx. 3 months	29,150 (6,412)	14,300 (3146)

Note: Volume is in litres (gallons below in brackets)

10 Warranty

Taken from 'Kingspan's Terms & Conditions of Sale'
The company will replace or, at its option, properly repair without charge any goods which are found to be defective and which cause failure in normal circumstances of use within a period of twelve months from the date of delivery.

This warranty is conditional upon:

(a) the Buyer notifying the Company of any claim within Seven days of the failure becoming discernible.
(b) the Company being allowed a reasonable opportunity to inspect the goods so as to confirm that they are defective.
(c) the goods not having been modified, mishandled or misused and being used strictly in accordance with any relevant instructions issued by the Company.

The Company's liability under this Clause is limited to the repair or replacement of the defective goods, and does not cover costs of transport, installation or associated site costs, if applicable.

The Company's liability to replace or repair the goods is in lieu of and excludes all other warranties and conditions, and in particular (but without limitation) the Company shall have no liability of any kind for consequential loss or damage.

For any further advice, please contact the Warranty department on 0844 225 2785.

A Warranty Form is included in this package, to register your unit for Warranty. Please complete ALL sections of the Form, and return it at your earliest convenience.

Also within this package is a Notice, describing the necessary maintenance of the plant in use. This should be fixed within the building.

Our service provider: Kingspan Environmental Services: 0844 846 0500

11 Notice

KINGSPAN BioDisc ®

The foul drainage from this property discharges into a package treatment works.

Maintenance is required, the frequency of which depends upon the model installed, its use and its application. Please consult your owners pack.

* BN BioDisc requires routine maintenance and Desludging at 3 month intervals.

Maintenance and Desludging should be carried out by the owner in accordance with the Manufactures instructions.

THE OWNER OF THE PROPERTY IS LEGALLY RESPONSIBLE FOR ENSURING THAT THE SYSTEM DOES NOT CAUSE POLLUTION, A HEALTH HAZARD OR A NUISANCE.

We recommend that a separate log is kept of all maintenance and service visits, the log should detail the date and any action taken, e.g. Regular maintenance service, breakdown visit, desludge volume removed, parts replaced.

This notice should be fixed by the owner within the building alerting current and future owners to the maintenance requirement. (Building regulation H2 (1.57)

Please contact Kingspan Environmental Services on +44 (0) 844 846 0500, to arrange a maintenance service or to request replacement operating instructions. It would be helpful if you provide your equipment serial number.

Certificate

353.02C02

Kingspan Water & Energy Ltd.
College Road North, Aston Clinton, Aylesbury, HP22 5EW, UK

EN 12566-3, Annex B
Small wastewater treatment systems for up to 50 PT

Small wastewater treatment system BioDisc +P
Rotating Biological Contactor (RBC) in a GRP tank with chemical dosing equipment

Test report PIA2019-353B47.02
This test certificate is a revised version of test certificate no. 353.02C01.

Nominal organic daily load (influent)	0.28 kg BOD_5/d		
Nominal hydraulic daily load	0.9 m^3/d		
Material	GRP		
Treatment efficiency		Efficiency	Effluent
(nominal sequences)	COD	95.9 %	31 mg/l
	BOD_5	98.0 %	6 mg/l
	N_{tot}*	71.1 %	17.9 mg/l
	NH_4-N*	92.1 %	3.0 mg/l
	P_{tot}	95.4 %	0.3 mg/l
	SS	95.6 %	15 mg/l
Electrical consumption	1.5 kWh/d		

**determined for temperatures ⩾ 12 ° C in the bioreactor*

Performance tested by:

PIA – Prüfinstitut für Abwassertechnik GmbH
Hergenrather Weg 30
52074 Aachen
Germany

This document replaces neither the declaration of performance nor the CE marking.

PIA - Sustainable Certification

geprüft - tested- testé

Notified Body No.: 1739

DAkkS Deutsche Akkreditierungsstelle D-PL-17712-01-00

Martina Wermter December 2020

Appendix N Concept Designers Risk Assessment

CONCEPT DESIGNER'S RISK ASSESSMENT

Project:	Llandegla Forest, Llandegla	**Project No:**	14648
Client:	OnePlanet Ltd		
Report Reference:	14648-Drainage Strategy-01		

Prepared by:	Megan Williams	**Date:**	22/06/2022
Checked by:	Aled Williams	**Date:**	30/06/2022
Reviewed by:	Mike Wellington	**Date:**	30/06/2022

Requirement:

The Construction (Design and Management) Regulations 2015 (CDM 2015) place an obligation on the Designer to take all reasonable steps to provide, with the design, sufficient information about the design, construction or maintenance of the structure, to adequately assist the client, other designers and contractors to comply with their duties under CDM. The Designer has undertaken this assessment to identify any extra-ordinary risks, or those that would not be expected on this particular project by an experienced and competent Contractor. The aim is to avoid needless paperwork and bureaucracy and ensure the assessment is project specific, relevant and proportionate to the risk.

DRA Summary

Each of the following risk areas has been considered using the question below. Is a risk present which is considered to be **extra-ordinary or unexpected** in this instance?

If **YES** - A detailed risk assessment is required at design stage
If **UNKNOWN** - Insufficient information has been provided at concept design stage and the risks are unknown. Further consideration must be given at design stage(s)
If **NO** - No further action is required.

Hazard Ref.	Risk Areas	YES, UNKNOWN or NO	Comments
1	Ground Conditions	Unknown	Uneven ground with uprooted trees
2	Hazardous Environment	Unknown	To be confirmed at detail design stage
3	Existing Working Environment	Unknown	To be confirmed at detail design stage
4	Existing Services	Unknown	To be confirmed at detail design stage
5	Proximity to Other Structure(s)	Unknown	Existing OnePlanet Adventure activities and water treatment works
6	Near Waterbody / flood risk	Yes	Ditches on site and watercourse on western boundary
7	Proximity to Other Activities	Yes	Existing OnePlanet Adventure activities and water treatment works
8	Sequence of Construction	Unknown	To be confirmed at detail design stage
9	Access	Unknown	To be confirmed at detail design stage
10	Interfaces	Unknown	To be confirmed at detail design stage
11	Confined Space Working	Unknown	To be confirmed at detail design stage
12	Maintenance Considerations	Yes	SuDS maintenace guidance in Appendix L
13	Working at Height	Unknown	To be confirmed at detail design stage
14	Steep Slopes	Yes	Steep slope to southern extent of the site
15	Demolition / Refurbishment / Repair	Unknown	To be confirmed at detail design stage
16	Welfare	Unknown	To be confirmed at detail design stage
17	Occupational Health	Unknown	To be confirmed at detail design stage
18	Environmental Issues	Yes	River Dee SAC downstream. SSSI within 1km.
19	Other Significant Hazards not Identified Above	Unknown	Potential for trees to fall in high winds
20	Residual Risk to Future Users	Unknown	Potential for trees to fall in high winds