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Dragon Packaging
47-48 Clywedog Road North
Wrexham Industrial Estate
Wrexham
LL13 9XN

Proposed Commercial Extension

SuDS Strategy

For: FI Real Estate



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CONTENTS

1.0	INTRODUCTION.....	1
1.1	BACKGROUND.....	1
1.2	STANDARDS	1
1.3	WHAT ARE SUDS?	1
1.4	CLIMATE CHANGE	2
1.5	SUDS PROPOSAL	2
1.6	REPORT STRUCTURE	3
1.7	NOTE ON FOUL DRAINAGE MATTERS.....	3
2.0	SITE LOCATION & DEVELOPMENT DESCRIPTION.....	4
2.1	SITE LOCATION.....	4
2.2	EXISTING DEVELOPMENT.....	4
2.3	PROPOSED DEVELOPMENT.....	4
2.4	GROUND LEVELS	4
2.5	CATCHMENT HYDROLOGY / DRAINAGE	4
2.6	GROUND CONDITIONS.....	4
2.7	CONTAMINATED LAND	4
2.8	GROUND STABILITY.....	4
3.0	S1: SURFACE WATER DRAINAGE.....	5
3.1	OPPORTUNITIES FOR DISCHARGE OF SURFACE WATER.....	5
3.2	COLLECT FOR RE-USE	5
3.3	DISCHARGE TO GROUND	6
3.4	DISCHARGE TO SURFACE WATER BODY	6
3.5	DISCHARGE TO SURFACE WATER SEWER	6
3.6	DISCHARGE TO A COMBINED SEWER	6
4.0	S2: SURFACE WATER RUNOFF HYDRAULIC CONTROL	7
4.1	SUDS.....	7
4.2	SUDS STRATEGY	8
4.3	INTERCEPTION STORAGE	10
4.4	MORPHOLOGICAL PROTECTION / FLOOD RISK MITIGATION OF RECEIVING SURFACE WATER BODIES	10
4.5	DESIGNING FOR LOCAL DRAINAGE SYSTEM FAILURE/EXCEEDANCE.....	11
5.0	S3: WATER QUALITY	12
5.1	SUDS AND WATER QUALITY	12
6.0	S4: AMENITY	15
6.1	AMENITY BENEFITS.....	15
7.0	S5: BIODIVERSITY	16
7.1	BIODIVERSITY BENEFITS.....	16
7.2	SCRUB AND TREES	16
7.3	FEATURES.....	16
8.0	S6: DESIGNING DRAINAGE FOR CONSTRUCTION, OPERATION, MAINTENANCE & STRUCTURAL INTEGRITY	17
8.1	MAINTENANCE RESPONSIBILITY	17
8.2	PHASING	17
8.3	CONSTRUCTION PHASE SURFACE WATER IMPACTS.....	17
8.4	CONSTRUCTION PHASE SURFACE WATER MANAGEMENT PLAN	17
8.5	OPERATION / MAINTENANCE AND STRUCTURAL INTEGRITY.....	19
9.0	NOTES ON LIMITATIONS.....	15

APPENDICES 27

APPENDIX 1 - SITE LOCATION PLAN..... 28

APPENDIX 2 – TOPOGRAPHICAL SURVEY..... 29

APPENDIX 3 - PROPOSED SITE LAYOUT 30

APPENDIX 4 - EXISTING DRAINAGE SURVEY31

APPENDIX 5 - WELSH WATER SEWER PLAN32

APPENDIX 6 – SUDS STRATEGY33

APPENDIX 7 – MICRODRAINAGE ANALYSIS34

APPENDIX 8 - SPEL PURCEPTOR CLASS 1 FULL RETENTION SEPARATOR35

APPENDIX 9 - OVERLAND FLOOD ROUTES.....36

TABLES & FIGURES

Table 1 - Sustainability Hierarchy 8

Table 2 - Level of Hazard 12

Table 3 - Pollution Hazard Indices 12

Table 4 - Maintenance Schedule - Cellular Storage Structure 20

Table 5 - Maintenance Schedule - Flow Cotrol 21

Table 6 - Maintenance Schedule - Bioretention System 22

Table 7 - Maintenance Schedule - Filter Strip System 23

Table 8 - Maintenance Schedule - SPEL Puraceptor Full Retention Interceptor 24

1 INTRODUCTION

1.1 Background

This SuDS Strategy has been prepared to support a planning application at Dragon Packaging, 47-48 Clywedog Road North, Wrexham Industrial Estate, Wrexham LL13 9XN. It is recognised that consideration of flood issues should not be confined to the floodplain. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. For example, replacing vegetated areas with roofs, roads and other paved areas can increase both the total and the peak flow of surface water runoff from the development site. Changes of land use on previously developed land can also have significant downstream impacts where the existing drainage system may not have sufficient capacity for the additional drainage.

1.2 Standards

This SuDS Strategy complies with the principles of SuDS presented in the 'Statutory Standards for Sustainable Drainage Systems – Designing, constructing, operating and maintaining surface water drainage systems'. The six standards are as follows:

- S1 - Surface Water Runoff Destination
- S2 - Surface Water Runoff Hydraulic Control
- S3 - Water Quality
- S4 - Amenity
- S5 - Biodiversity
- S6 - Designing Drainage for Construction, Operation, Maintenance and Structural Integrity

The report findings are based upon professional judgement and are summarised below with detailed recommendations provided at the end of the report. The report includes geological information from the British Geological Survey (BGS) and the assessment will summarise and refer to this dataset in the text.

Wrexham Council is a statutory consultee for major planning applications in relation to surface water drainage, requiring that all planning applications are accompanied by a SuDS Strategy. The aim of the SuDS Strategy is to identify water management measures, including SuDS, to provide surface water runoff reduction and treatment. A SuDS approach has been adopted to the management of surface water runoff from the site.

1.3 What are SuDS?

A Sustainable Drainage System (SuDS) is designed to replicate, as closely as possible, the natural drainage from the site (before development) to ensure that the flood risk downstream of the site does not increase as a result of the land being developed. SuDS can also significantly improve the quality of water leaving the site and can enhance the amenity and biodiversity that a site has to offer.

There are a range of SuDS options available to provide effective surface water management that intercept and store excess runoff. The standards set out appropriate design criteria based on four main parameters:

1. Runoff Destination (in order of preference)
 - a. Re-use;
 - b. To ground;
 - c. To surface water body;
 - d. To road drain or surface water sewer;
 - e. To combined sewer
2. Peak flow rate and volume (pre-and post-development)
3. Water Quality (based on potential hazards arising from development and sensitivity of the runoff destination)
4. Function (design; flood risk; operation and maintenance)

These parameters are then used to develop a drainage strategy based on the following six principles:

1. Manage surface runoff at source
2. Manage on the surface
3. Utilise public space and integrate into the drainage design
4. Effective operation and maintenance
5. Account for climate change and changes in impermeable area
6. Affordability

This report aims identify the most practicable runoff destination and drainage parameters for each site. A surface water drainage assessment is presented with reference to the hydrological and hydrogeological context of the development.

1.4 Climate Change

Projections of future climate change, in the UK, indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Residential development is assumed to have a lifetime of 100 years while a lifetime of 75 years is assumed for non-residential developments. The recommended national precautionary climate change allowance for peak rainfall intensity is 40%.

1.5 SuDS Proposal

The SuDS Strategy at the development comprises:

- **Discharge to Surface Water Sewer:**
 - Attenuation in the form of underground crate storage from the new building roof areas together with the existing and proposed service yard and car parking areas then discharge to the Welsh Water adopted surface water sewerage system at a restricted discharge rate of 5.0l/s which is in excess of the greenfield run off rate but is the pragmatic minimum that can be achieved at this site. The adopted surface water sewer then discharges to open watercourse circa 270m south east of the site.

- Whilst the application is for an extension to the building and yard area, we propose to redirect the existing hardstanding areas into the new drainage system. Accordingly, we are not only providing water quality and quantity improvements to the new areas of roof and yard, but existing hardstanding areas also. The existing roofs will remain on the existing drainage network.
- We have incorporated SuDS where possible within the constraints of the site. The nature of the proposed extension means that the significant majority of the site will be hardstanding with the only soft landscaping being around the site perimeter. A significant portion of this area has well established vegetation including trees and hedging with root protection areas. Taking the above into account, we would propose the following SuDS measures at the site:
 - i) Bioretention strip along the western boundary of the development platform adjacent to the proposed parking bays which drains 20% of the yard area
 - ii) Given the constraints of the site, a sufficient SuDS treatment train is provided through the above noted SuDS elements together with a SuDS rated interceptor to treat the remainder of the external yard area.
 - iii) New building roofs and perimeter paths to drain into a new filter drain arrangement

A 40% increase in rainfall intensity due to climate change during the lifetime of the development has been used within the calculations. The surface water runoff from the site will be restricted to a pragmatic minimum flow rate of 5.0 litres per second. The system will be maintained by the owner of the site and will not be adopted by the SAB.

1.6 Report Structure

This SuDS Strategy has the following report structure:

- Section 2 details the location & development description;
- Section 3 details surface water runoff destination;
- Section 4 outlines surface water runoff hydraulic control;
- Section 5 discusses water quality;
- Section 6 outlines amenity;
- Section 7 outlines biodiversity; and
- Section 8 discusses designing drainage for construction, operation, maintenance and structural integrity.

1.7 Note on Foul Drainage Matters

Although this report is evidently produced to address the SuDS Strategy for the post-development site, it is also noted that Welsh Water has confirmed that the proposed building extensions can be accommodated within the revised environmental permit to Five Fords WwTW relating to phosphates.

2 SITE LOCATION & DEVELOPMENT DESCRIPTION

2.1 Site Location

The site is located at 47-48 Clywedog Road North, Wrexham Industrial Estate, Wrexham, LL13 9XN. The National Grid Reference (NGR) of the site is 337255, 349699 (refer to Appendix 1 for details).

2.2 Existing Development

The site currently consists of existing industrial buildings and an associated service yard / parking area.

2.3 Proposed Development

The proposals are for an extension on either side of the existing commercial units (refer to Appendix 3 for details). Further details with regard to the proposed development can be found in the accompanying information submitted with the planning application.

2.4 Ground Levels

Topographically, the site slopes gently from north west to south east with ground levels ranging between 37.4 metres Above Ordnance Datum (mAOD) and circa 35.1mAOD (refer to Appendix 2 for details).

2.5 Catchment Hydrology / Drainage

Redwither Brook is located approximately 160m to the north of the site / 400m south east of the site and the River Clywedog is located approximately 1.25km to the south of the site.

The site is located within an area of average rainfall. The 1961-1990 Standard Average Annual Rainfall (SAAR) for the site as recorded in the FEH Webservice is 692 mm per annum. The UK national average is 832mm per annum.

2.6 Ground Conditions

The British Geological Survey (BGS) Geological Map of the area indicates that the bedrock underlying the site consists of the Salop Formation - mudstone, sandstone and conglomerate which is a sedimentary bedrock formed between 309.5 and 272.3 million years ago during the Carboniferous and Permian periods. The superficial deposits consist of Till, Devensian - diamicton. These sedimentary superficial deposits were formed between 116 and 11.8 thousand years ago during the Quaternary period.

2.7 Contaminated Land

There is no evidence of historical industrial land use prior to 1938 following which the site formed part of a large munitions manufacturing factory. Following closure of the plant in the late 1940's, the site was re-developed for commercial uses. The above site history indicates that low levels of contamination may be present on site and a Phase 2 ground investigation is therefore recommended.

2.8 Ground Stability

Dissolution, sand liquefaction and landslides could be enhanced by SuDS infiltration and lead to unstable ground. Dissolution risk is low since the site does not appear to be directly underlain by chalk or other soluble rocks. Sand liquefaction risk is low since the site is not located on unconsolidated superficial sand deposits. Landslide risk is low since there are no records of landslides close to the site according to the BGS.

3 S1: SURFACE WATER DRAINAGE

3.1 Opportunities for Discharge of Surface Water

As part of the SuDS Standards the management of runoff from developments should be prioritised as to the choice of discharge destination. The priority hierarchy is listed below:

- 1) Collect for re-use;
- 2) Infiltrate to ground;
- 3) Discharge to a surface water body;
- 4) Discharge to a surface water sewer / highway drain; and
- 5) Discharge to a combined sewer.

It is necessary to identify the most appropriate method of controlling and discharging surface water. The design should seek to improve the local runoff profile by using systems that can either attenuate runoff and reduce peak flow rates or positively impact on the existing surface water runoff.

3.2 Collect for Re-use

The reuse of water from roofed areas to provide grey (non-potable) water for flushing WCs within buildings can reduce storm runoff without the need for treatment or oil separators since the risk of spillage or contamination is low.

Such a system would require one or more tanks at roof level and under optimum conditions these would be kept as near as full as possible to ensure a reliable water supply. For the purposes of a worst-case design scenario, it is assumed that the tanks would be full at the start of an extreme rainfall event and hence all storm rainfall would enter the surface water drainage system rather than grey water storage.

Whilst the first priority is to collect rainwater for re-use, rainwater harvesting was considered and deemed not suitable. From a cost/benefit approach, individual single property systems are considered to be unsuitable. The daily water requirement per person is minimal.

These types of units are typically used for storage/warehousing uses, together with some light production. There are no actual processes taking place and it is highly unlikely that there ever will be, as the unit are not designed for it and only have light electrical supplies. The proposed site layout in Appendix 3 shows that there is no foreseeable non-potable water demand at the site.

In accordance with G1.4 of the SuDS standards, rainwater harvesting is not proposed for the 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.
3. The rainfall yield exceeds demand, rainwater harvesting is not feasible for storm water control under BS8515:2009+A1:2013 detailed design approach.

With regard to the second point above, the costs of rainwater harvesting systems (unit costs, installation costs, running costs and maintenance costs) outweigh the water saving costs. Furthermore, section G1.6 of the SuDS Standards 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.'*

The use of large scale rainwater harvesting is not a viable / cost effective approach for the management of surface water runoff at the site taking into account the potential water supply benefits of such systems.

3.3 Discharge to Ground

In determining the future surface runoff from the site, the potential of using infiltration has been considered. An overview of the general ground conditions may be used to gauge if there is potential for their application. As detailed previously, information from the British Geological Survey (BGS) Geological Map of the area indicates that the bedrock underlying the site consists of the Salop Formation - mudstone, sandstone and conglomerate with superficial deposits consisting of Till, Devensian - diamicton. Furthermore, a review of adjacent BGS borehole data indicates circa 15m depth of boulder clay in a borehole located circa 15m from the development site.

Whilst the permeability and infiltration rate of the site would be confirmed by a site investigation into the hydrogeology prior to construction, the ground conditions suggest that surface water discharge to the ground would not be a viable option. Therefore, disposal of significant volumes of surface water runoff to infiltration devices is not considered likely to be appropriate.

3.4 Discharge to Surface Water Body

Should infiltration be found to be unsuitable, the next option is discharge to a water body. Redwither Brook is located in open channel circa 160m north of the site through multiple third party land ownerships and therefore discharge of surface water runoff from the site directly into a watercourse is not considered to be a practicable option.

3.5 Discharge to Surface Water Sewer

Existing site surface water discharges freely to the adjacent Welsh Water surface water sewerage system located at the eastern corner of the site (refer to Appendices 4 and 5 for details). It is therefore proposed to discharge post-development site surface water to the existing adopted surface water sewerage network in the same location.

In order to provide a significant level of betterment in relation to water quantity, it is proposed to provide attenuation in the form of underground crate storage from the new building roof areas together with the existing and proposed service yard and car parking areas then discharge to the Welsh Water adopted surface water sewerage system at a pragmatic minimum restricted discharge rate of 5.0l/s. By doing this, pressure on existing infrastructure will be reduced and risk of flooding will not be increased. Therefore, it would evidently be possible to discharge surface water runoff from the site into the adopted surface water sewerage system.

3.6 Discharge to a Combined Sewer

This option is not required.

4 S2: SURFACE WATER RUNOFF HYDRAULIC CONTROL

4.1 SuDS

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

One of the aims of the SuDS Standards is to provide not only flood risk mitigation but also to maximise additional gains such as improvements in runoff quality and provision of amenity and biodiversity. Systems incorporating these features are often termed SuDS and it is the requirement of the SuDS Standards that these are considered as the primary means of collection, control and disposal for storm water as close to source as possible. A hierarchy of techniques is identified:

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

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

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

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

The application of the SuDS Manual requires that SuDS systems are utilised to improve the quality of the runoff prior to outfall to watercourses. The SuDS Manual and the SuDS Standards guidance applies a sustainability hierarchy to the various types of SuDS systems, this is summarised in Table 1.

Systems at the top of the hierarchy provide a combination of attenuation, treatment and ecology and are deemed the most sustainable options. The usual approach is to consider the 'SuDS train' where each of the above options are considered in turn until a suitable solution is found.

Table 1 - Sustainability Hierarchy

Most Sustainable	SuDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife	Proposed for Use on Site
	Rainwater Harvesting	✓	✓	✓	
	Green / Living Roofs	✓	✓	✓	
	Basins and Ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓	
	Filter Strips and Swales	✓	✓	✓	
	Infiltration Devices - Soakaways	✓	✓	✓	
	Permeable Surfaces and Filter Drains - Gravelled areas - Solid paving blocks - Permeable paving	✓	✓		
	Tanked Systems - Over-sized pipes / tanks - Cellular storage	✓			✓
Least Sustainable					

4.2 SuDS Strategy

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

- No increase in the volume or runoff rate of surface water runoff from the site.
- No increase in flooding to people or property off-site as a result of the development.
- No surface water flooding of the site.
- A 40% increase in rainfall intensity due to climate change during the lifetime of the development.
- Maintain / improve surface water quality.
- Provide amenity and biodiversity benefits.

In line with adopting a 'management train' it is recommended that water is managed as close to source as possible. A hierarchical approach to surface water management has been adopted within this SuDS Design. This will reduce the size and cost of infrastructure further downstream and also shares the

maintenance burden more equitably. A hierarchical approach to surface water management has been adopted within this SuDS Strategy.

The SuDS Strategy at the development comprises:

- **Discharge to Surface Water Sewer:**
 - Attenuation in the form of underground crate storage from the new building roof areas together with the existing and proposed service yard and car parking areas then discharge to the Welsh Water adopted surface water sewerage system at a restricted discharge rate of 5.0l/s. The adopted surface water sewer then discharges to open watercourse circa 270m south east of the site.
 - Whilst the application is for an extension to the building and yard area, we have proposed to redirect the existing hardstanding areas into the new drainage system. Accordingly, we are not only providing water quality and quantity improvements to the new areas of roof and yard, but existing areas also. The existing roofs will remain on the existing drainage network.
 - We have incorporated SuDS where possible within the constraints of the site. The nature of the proposed extension means that the significant majority of the site will be hardstanding with the only soft landscaping being around the site perimeter. A significant portion of this area has well established vegetation including trees and hedging with root protection areas. Taking the above into account, we would propose the following SuDS measures at the site:
 - i) Bioretention strip along the western boundary of the development platform adjacent to the proposed parking bays which drains 20% of the yard area
 - ii) Given the constraints of the site, a sufficient SuDS treatment train is provided through the above noted SuDS elements together with a SuDS rated interceptor to treat the remainder of the external yard area.
 - iii) New building roofs and perimeter paths to drain into a filter drain

A 40% increase in rainfall intensity due to climate change during the lifetime of the development has been used within the calculations. The surface water runoff from the site will be restricted to a pragmatic minimum flow rate of 5.0 litres per second given the constraints of the site. The system will be maintained by the owner of the site and will not be adopted by the SAB.

The SuDS Strategy is shown in Appendix 6 and the Micro Drainage calculations for the proposed site drainage system are shown in Appendix 7.

These methods will reduce peak flows, the volume of runoff, and will slow down flows and will therefore provide a suitable SuDS solution for this site. The SuDS features for the site represents a significant enhancement from the current conditions as the current surface water runoff from the site is uncontrolled, untreated, unmanaged and unmitigated. The SuDS features will reduce the risk of flooding to the site and off-site locations.

In adopting these principles, it has been demonstrated that a scheme can be developed that does not increase the risk of flooding to adjacent properties and development further downstream.

4.3 Interception Storage

The underground crate storage and landscaped areas will provide interception storage as per Table G2.1 of the SuDS Standards.

4.4 Morphological Protection / Flood Risk Mitigation of Receiving S/Water Bodies

The provision of suitable storage on site to mitigate the flood risk resulting from the development of the site will be a key factor in the evolution of the site development layout. One of the aims of the SuDS Standards is to provide not only flood risk mitigation but also to maximise additional gains such as improvements in runoff quality and provision of amenity and biodiversity.

It is therefore proposed that attenuation storage with a restricted outfall to the adjacent adopted surface water sewer system to the east of the site will be used – it is noted that the surface water sewer system outfalls into Redwither Brook to the south east of the site. By restricting the runoff rate from the new building roofs, extended service yard / car parking areas and existing service yard areas to 5.0 litres per second, the receiving watercourse will be protected from erosion and the resulting morphological, ecological damage and increasing flood risk.

Runoff Rate Control

A value of 5.0 litres/second has been used as a pragmatic post-development discharge rate to the adjacent adopted surface water sewerage system, for all events up to and including the 1 in 100 year (+40%) event.

Runoff Volume Control

The size of the attenuation storage has been calculated such that the development has the capacity to accommodate the 1 in 100 year rainfall event including a 40% increase in rainfall intensity that is predicted to occur as a result of climate change. Consequently, all drained areas have been designed to accommodate the 1 in 100 year +40% climate change event.

Please refer to Appendix 7 for details of the volume of storage required for the proposed impermeable surfaces estimated using the Micro Drainage Software for the critical 1 in 100 year event with a 40% allowance for climate change (increase in peak rainfall).

The Micro Drainage calculations demonstrate that the proposed surface water runoff volumes from the new building roofs and all existing/proposed external hard surfaced areas can be viably accommodated on site within the underground crate storage system during the 1 in 100 year with a 40% allowance for climate change (see Appendix 7). This is based on a restricted discharge of 5.0l/s to the adopted surface water sewerage system.

The additional site building areas and the existing / proposed external hardstanding areas are to discharge from the site at a rate of 5.0 litres per second – given that surface water from the existing service yard slab currently discharges freely to the adjacent adopted surface water sewerage system (refer to Appendix 4 for existing drainage survey), it is evident that the surface water runoff from the developed site will be significantly less than existing.

The remainder of the site that is not formally drained i.e. landscaped areas, will be permeable (grass). The majority of rainwater falling on these areas will soak into the ground. Surface water runoff would be directed to the drainage system through guttering and lateral drains located around the perimeter of the buildings and through contouring of the hardstanding areas.

4.5 Designing for Local Drainage System Failure/Exceedance

When considering residual risk, it is necessary to make predictions as to the impacts of a storm event that exceeds the design event or potential failure of the drainage system through the blockage of pipes, blockage of outlet structures and risk of impediments across flood routing paths.

The SuDS Design applies a safe and sustainable approach to discharging rainfall runoff from the site and this reduces the risk of flooding however, it is not possible to completely remove the risk. This section is therefore associated with the way the residual risk is managed.

As part of the SuDS Strategy, it must be demonstrated that the flooding of property would not occur in the event of design exceedance or local drainage system failure. It is not economically viable or sustainable to build a drainage system that can accommodate the most extreme events. It is also very unlikely that a catastrophic failure would occur.

The SuDS features have been designed to accommodate the 1 in 100 year event plus climate change (+40%). It should also be noted that additional storage is provided within the manholes and lateral drains which will provide betterment over and above the 1 in 100 year (+40%) event. Flow resulting from a rainfall event in excess of the 1 in 100 year +40% event (exceedance event) will be managed to minimise the risks to people and property. There will not be an extensive sewerage network on the proposed development site and therefore any potential exceedance flooding would be from the sewers and lateral drains connecting the buildings to the underground storage areas. It is very unlikely that a catastrophic failure would occur.

The site slopes gently from north west to south east; the proposed units will be located above the attenuation storage crates and lateral drains so that any flows will not enter the proposed units ensuring any exceedance flooding would not affect the units. Boundary planting will also retard and allow infiltration of any surface water runoff. It is not considered that there is an increased risk to the properties on the site or located on third party land adjacent to the site.

As the site is existing, the new building extensions are proposed to follow the same finished floor level as the existing building. Existing buildings are raised above external areas with a typical 150mm drop around the perimeter. At the front of the buildings, level access is provided with external levels sloped away from the building towards a new drainage channel that is located 27m away from the building. Surface runoff is therefore directed away from the building towards the drainage channel where localised pooling occurs at the low points before overtopping and exiting the site as overland flow onto Clywedog Road South (refer to Appendix 9 for details). Maximum water level of the pooled area is 36.0m AOD which is 450mm below the building FFL's.

Consequently, the impact of an exceedance event or local drainage system is not considered to represent any significant flood hazard. The above noted design measures manage and mitigate the flood risk from surface water runoff to the proposed properties from surface water runoff generated by the site development and to offsite locations as well the risk from surface water runoff generated offsite.

5 S3: WATER QUALITY

5.1 SuDS and Water Quality

According to the SuDS Standards (see Table 2), the proposed development is a combination of low (roof water) to medium hazard (runoff from car parking and roads).

Table 2 - Level of Hazard

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

The proposed development has a 'low to medium' pollution hazard level (see Table 3), as per Table 26.2 of the SuDS Manual.

Table 3 - Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.70	0.60	0.70

* Indices values range from 0-1.

To deliver adequate treatment, the SuDS features should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type). Water treatment will be provided via the SuDS components included through the drainage network.

In line with the requirements stipulated in Table 26.2 and Table 26.3 of the SuDS Manual, it is proposed to utilise the following measures:

- i) A bioretention strip to extend along the western site boundary adjacent to the yard area
- ii) Filter drains to the west and south of new Warehouse Space 3 and to the east and south of Warehouse Space 4
- iii) 1 No proprietary water treatment system at the site in the form of the SuDS rated SPEL Puraceptor full retention interceptor PO65/1C/ESR (refer to Appendix 8 for details)

It is proposed that the SPEL Puraceptor unit is located immediately downstream of the surface water attenuation crate storage. The unit itself has sufficient capacity to accommodate the design flows directly downstream of the attenuation crate storage and hydrobrake system.

The simple index approach in line with the requirements of The SuDS Manual has been followed in order to verify that the SuDS treatment train provided by the combination of the filter drains, the bioretention strip and the SPEL Puraceptor full retention interceptor (ref: PO65/1C/ESR) provides a suitable level of water treatment at the subject site:

Determination of SuDS pollution mitigation indices

Filter Drain System:

Sediment or Total Suspended Solids (TSS):

SuDS Pollution Mitigation Index = 0.4

Sediment Bound Heavy Metals and Nutrients:

SuDS Pollution Mitigation Index = 0.4

Liquid Hydrocarbons:

SuDS Pollution Mitigation Index = 0.4

Bioretention Strip:

Sediment or Total Suspended Solids (TSS):

SuDS Pollution Mitigation Index = 0.8

Sediment Bound Heavy Metals and Nutrients:

SuDS Pollution Mitigation Index = 0.8

Liquid Hydrocarbons:

SuDS Pollution Mitigation Index = 0.8

SPEL Puracell Full Retention Interceptor:

In terms of the relevant SuDS mitigation indices, the attached data sheet information (refer to Appendix 8) shows that the SPEL Puracell full retention interceptor (ref: PO65/1C/ESR) delivers high removal of a variety of pollutants including:

Sediment or Total Suspended Solids (TSS):

SuDS Pollution Mitigation Index = 0.8

Sediment Bound Heavy Metals and Nutrients:

SuDS Pollution Mitigation Index = 0.6

Liquid Hydrocarbons:

SuDS Pollution Mitigation Index = 0.9*

* H R Wallingford test results to BS EN 858: tested to its maximum designed flow rate

Utilising the Simple Index Approach in line with Chapter 26 of CIRIA C753 The SuDS Manual, the aggregated Surface Water Mitigation Index is as set out below:

Sediment or Total Suspended Solids (TSS):

SuDS Pollution Mitigation Index = $0.4 + (0.5 \times 0.8) + (0.5 \times 0.8) = 1.2$

Sediment Bound Heavy Metals and Nutrients:

SuDS Pollution Mitigation Index = $0.4 + (0.5 \times 0.8) + (0.5 \times 0.6) = 1.1$

Liquid Hydrocarbons:

SuDS Pollution Mitigation Index = $0.4 + (0.5 \times 0.8) + (0.5 \times 0.9) = 1.25$

In combination, the above SuDS Mitigation Indices for the filter strip system, the bioretention strip and the SPEL Puraceptor full retention interceptor (ref: PO65/1C/ESR) demonstrate that this proposed SuDS treatment system significantly exceeds the relevant pollution hazard indices in relation to the proposed land use for total suspended solids, heavy metals and hydrocarbons.

Accordingly, the proposed use of the filter strip system, the bioretention strip and the SPEL Puraceptor full retention interceptor (ref: PO65/1C/ESR) is deemed to provide a sufficient SuDS treatment train without the need for any further measures to be employed on the site.

6 S4: AMENITY

6.1 Amenity Benefits

In accordance with the SuDS Manual, tree planting and landscape / grass zones within the development will provide air quality improvements. The tree planting and landscaped / grassed zones will help support flora and fauna for the benefit of the development community.

In accordance with the SuDS Manual, the SuDS features will provide an indirect amenity value by supporting the resilience of the development and the adjacent landscape to changes in climate and will deliver health and wellbeing benefits by providing areas for recreation and relaxation.

7 S5: BIODIVERSITY

7.1 Biodiversity Benefits

Planting will use a variety of native species of local provenance to ensure opportunities for biodiversity and sustaining habitat within the development. The majority of trees are to be retained. Carrying out grass cuts and removing from site will also improve biodiversity of landscaped areas.

7.2 Scrub and Trees

Scrub and trees will provide important terrestrial habitat cover and act as a windbreak. Trees and scrub will attract a greater variety of insects and birds to the site and will provide terrestrial habitat for amphibians. Species should be native and of local provenance.

7.3 Features

The surrounding land will include features beneficial to wildlife. This will include log / deadwood piles, embankments and hibernacula. Hibernacula generally comprise mounds of timber or other material covered by turf to provide damp, sheltered habitat. If available, inert discarded bricks or rubble from the site can be used. This will create habitat for reptile basking.

Arising from trees or bushes that have been cut down could be used to create log / deadwood piles, which are beneficial to a range of species, particularly insects. Using recovered material is always preferential to importing material to the site for the construction of such features, as this increases the risk of spreading invasive non-native species and diseases.

8 S6: DESIGNING DRAINAGE FOR CONSTRUCTION, OPERATION, MAINTENANCE AND STRUCTURAL INTEGRITY

8.1 Maintenance Responsibility

The system will be maintained by the owner of the site. An Operation and Maintenance Manual will be developed and this manual shall be passed on to subsequent future owners. The maintenance will be the responsibility of the property owner as the SuDS features will serve a single private site.

8.2 Phasing

The surface water drainage scheme will be installed and fully operational before occupation of the site occurs.

8.3 Construction Phase Surface Water Impacts

The proposed development has the potential to introduce contaminants from the associated machinery, infrastructure, transportation, importation of construction materials and maintenance and storage of plant equipment as discussed below:

Excavated Ground and Exposed Ground

Recently disturbed and vegetation free ground allows for relatively low velocity runoff to erode the surface. This leads to increased runoff and sedimentation of receiving waters, thereby increasing flood risk / potential impacts on water quality.

Stockpiles

Rainfall could lead to erosion of material should a stockpile be uncovered. This could lead to siltation of drainage or receiving watercourses and therefore an increase in flood risk / potential impact on water quality.

Oils and Hydrocarbons

The use of oils and hydrocarbons on construction sites provide a risk of leakages and spillages, leading to pollution incidents. This could affect the water quality in drainage / receiving watercourses and aquifers.

8.4 Construction Phase Surface Water Management Plan

The following section provides detail on site drainage during the Construction Phase, this will reduce the potential for vehicle movement on wet ground, which can increase the potential for compaction. In summary, the withdrawn Pollution Prevention Guidance¹ (PPG) and Government guidance² states

¹ Pollution Prevention Guidelines PPG1: Understanding Your Environmental Responsibilities (July 2013).

Pollution Prevention Guidelines PPG6: Working at construction and demolition sites (March 2012).

Pollution Prevention Guidelines PPG7: The safe operation of refuelling facilities (July 2011).

Pollution Prevention Guidelines PPG8: Safe storage and disposal of used oils (February 2004).

Pollution Prevention Guidelines PPG13: Vehicle washing and cleaning (July 2007).

Pollution Prevention Guidelines PPG21: Incident Response Planning (March 2009).

Pollution Prevention Guidelines PPG22: Dealing with spills (April 2011).

² <https://www.gov.uk/guidance/storing-oil-at-a-home-or-business>, May 2015.

<https://www.gov.uk/guidance/manage-waste-on-land-guidance-for-land-managers>, May 2014.

Guidance for Pollution Prevention GPP2: Above ground oil storage tanks (January 2018).

Guidance for Pollution Prevention GPP5: Works and maintenance in or near water (January 2017).

Guidance for Pollution Prevention GPP8: Safe storage and disposal of used oils (July 2017).

that the following methods of surface water management should be put in place during the construction phase to ensure pollution, sediment and erosion control.

Excavated Ground and Exposed Ground

To limit the volume of runoff reaching the exposed ground, runoff diversion or interception devices / bunds can be placed upstream of exposed ground. To help control sediment in runoff from leaving the site or entering drainage, silt fences, bunds, hay bales or ditches can be placed downstream of exposed ground to intercept runoff.

Stockpiles

Soil stockpiles will be located away from any site drainage systems and measures to intercept runoff will be incorporated, such as a silt fence or small perimeter bunds around the base of the stockpiles. Concrete should also be stored to prevent release into drains.

Oils and Hydrocarbons

Simple measures can be taken to prevent oil and hydrocarbons becoming pollutants, such as:

- Maintenance of machinery and plant.
- Drip trays.
- Regular checking of machinery and plant for oil leaks.
- Correct storage facilities.
- Check for signs of wear and tear on tanks.
- Care with specific procedures when refuelling.
- Designated areas for refuelling.
- Emergency spill kit located near refuelling area.
- Regular emptying of bunds.

Ground Compaction

In order to minimise ground compaction, the following measures will be implemented:

- A temporary hardcore surface will be placed as the construction site access road (to be removed at the end of the Construction Phase).
- Vehicle movements on bare soil will be minimised.
- Vehicle movements on wet ground will be minimised.

The pollution, sediment and erosion control mitigation measures as detailed above will ensure that the effects on receptors during the construction phase are negligible.

Guidance for Pollution Prevention GPP13: Vehicle washing and cleaning (April 2017).

Guidance for Pollution Prevention GPP21: Incident Response Planning (July 2017).

Guidance for Pollution Prevention GPP22: Dealing with spills (October 2018).

Guidance for Pollution Prevention GPP23: Safe storage - drums and intermediate bulk containers (February 2019).

8.5 Operation / Maintenance and Structural Integrity

The SuDS have been designed for easy maintenance to comprise:

- Regular day to day care – litter collection, regular gardening to control vegetation growth and checking inlets where water enters the SuDS features.
- Occasional tasks – checking the SuDS feature and removing any silt that builds up in the SuDS features.
- Remedial Work – repairing damage where necessary.

As far as is reasonably practicable the surface water drainage system has been designed so that the SuDS features can be constructed easily, safely, cost effectively and in a timely manner. The surface water drainage scheme will be regularly maintained. The key maintenance requirements are regular inspection of silt traps, manholes, pipework and pre-treatment devices, with removal of sediment and debris as required.

The structural integrity of the drainage components will be designed to withstand the anticipated loading conditions over the design life of the development, accounting for reasonable levels of maintenance. The maintenance will be the responsibility of the property owner as the SuDS features will serve a single property.

The management and maintenance of the above noted SuDS measures to serve the proposed development will be undertaken by a maintenance management company to be appointed for the project. The appointment of the maintenance management company is to be confirmed at the completion of the build phase. All parts of the drainage network are to be accessible and are to be constructed from materials that are suitable and robust for the lifetime of the development.

The maintenance activities required for the drainage network are as follows:

8.5.1 Cellular Storage Structure

The maintenance for the cellular storage structure is as follows:

Table 4 Maintenance Schedule – Cellular Storage Structure

Operation	Frequency
Inspect and identify any areas that are not operating correctly and if required take remedial actions	Monthly for three months then six monthly intervals
Debris caused from catchment surface (where it may cause risk to performance)	Monthly
Where rainfall infiltration into cellular storage from above, check surface or filter for blockage or silt, algae or other matter by jetting	As required but at least twice a year
Remove sediment from upstream surface water network by jetting	Annually or as required
Repair / check all inlets, outlets, overflows and vents	As required
Inspect / check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually and after severe storms

8.5.2 Flow Control

The maintenance for the flow control is as follows:

Table 5 Maintenance Schedule – Flow Control

Operation	Frequency
Inspect and identify any areas that are not operating correctly, if required take remedial actions	Monthly for three months then at six monthly intervals
Debris removal from catchment surface (where it may cause risk to performance)	Monthly
Check control chamber for blockage or silt, algae or other matter by jetting	As required, but at least four times a year
Remove sediment from upstream drainage network and sediment from within manhole by jetting	As required, but at least twice a year
Repair / check all inlets and control mechanics	As required
Inspect / check all inlets and control mechanics to ensure that they are operating as designed	Twice a year as a minimum and after severe storm events

8.5.3 Flow Control Chamber Design Criteria

In addition to the above maintenance methods, the flow control chamber will be designed so it works effectively throughout the lifespan of the development and will have precautionary features to ensure maintenance work can be carried out promptly and efficiently to ensure no control failure which may otherwise subsequently lead to flooding.

Details of the flow control chamber are as follows:

- High Water Level Alarm: Alarm installed and directed to site maintenance team
- Spares: Control spares to be kept on site for efficient maintenance

8.5.4 Bioretention System

The maintenance for the bioretention system is as follows:

Table 6 Maintenance Schedule – Bioretention System

Maintenance schedule	Required action	Frequency
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary.	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plant for disease, infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockages	Quarterly
Regular maintenance	Remove litter, surface debris and weeds	Quarterly
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets	Quarterly to bi-annually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

8.5.5 Filter Strip System

The maintenance for the filter strip system is as follows:

Table 7 Maintenance Schedule – Filter Strip System

Maintenance schedule	Required action	Frequency
Regular inspections	Check operation of underdrains by inspection of flows after rainfall	Annually
	Inspect inlets and outlets for blockages	Quarterly
Regular maintenance	Remove litter, surface debris and weeds	Quarterly
	Remove sediment, litter and debris build-up from around inlets	Quarterly
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt	As required
Remedial actions	Remove and replace filter medium	As required

8.5.6 SPEL Puraceptor Full Retention Interceptor

The maintenance for the SPEL Puraceptor Full Retention Interceptor (ref: PO65/1C/ESR) is as follows – it is noted that, for most cleanouts, routine maintenance would include removing a light liquid intercepted within the Puraceptor. If a SPEL automatic alarm/monitoring system is incorporated, it will automatically indicate when the Puraceptor should be emptied. Only in an emergency will the Puraceptor fill to its maximum and activate the Automatic Closure Device (ACD) – in such an event, the Puraceptor should be completely sucked out and the ACD lifted out (refer to Appendix 8 for details):

Table 8 Maintenance Schedule – SPEL Puraceptor Full Retention Interceptor

Maintenance schedule	Required action	Frequency
Regular inspections	Inspect regularly in order to determine the site-specific rate of pollutant accumulation.	Quarterly
Regular maintenance	Remove light liquid intercepted within the Puraceptor	Quarterly or as required
	Remove Automatic Closure Device (ACD) periodically – take care not to raise it too quickly and damage the plastic/copper float. Clean it from debris/silt to prevent premature closing. Check the seating in the base unit is free of debris/silt that could prevent proper closing in an emergency.	Bi-annually
Remedial actions	Puraceptor to be completely sucked out/emptied and the ACD lifted out in an emergency situation where the Puraceptor fills to its maximum and activates the ACD.	As required

8.5.7 Flood Routes

A visual monthly inspection of flood routes should be made in order to check that routes are not blocked by new fences, walls, soil or other rubbish with removal undertaken as necessary.

8.5.8 Spillage – Emergency Action

Most spillages on development sites are of compounds that do not pose a serious risk to the environment as they enter the drainage system in a slow and controlled manner with time available for natural breakdown in a treatment system. Therefore, small spillages of oil, milk or other known organic substances should be removed where possible using soak mats as recommend by Natural Resources Wales with residual spillage allowed to bio-remediate in the drainage system.

In the event of a serious spillage, either by volume or of unknown or toxic compounds, then the spillage should be isolated using soil, turf or fabric and outlet pipes from chambers downstream of the spillage blocked with bungs. Bungs for blocking pipes may be made by wrapping soil or turf in a plastic sheet or close woven fabric. Natural Resources Wales should be contacted immediately.

Contact Natural Resources Wales immediately. Tel: 0300 065 3000.

8.5.9 Linked and Further Maintenance

The maintenance of the drainage network and SuDS features is to be linked with the landscape maintenance plan for the proposed development.

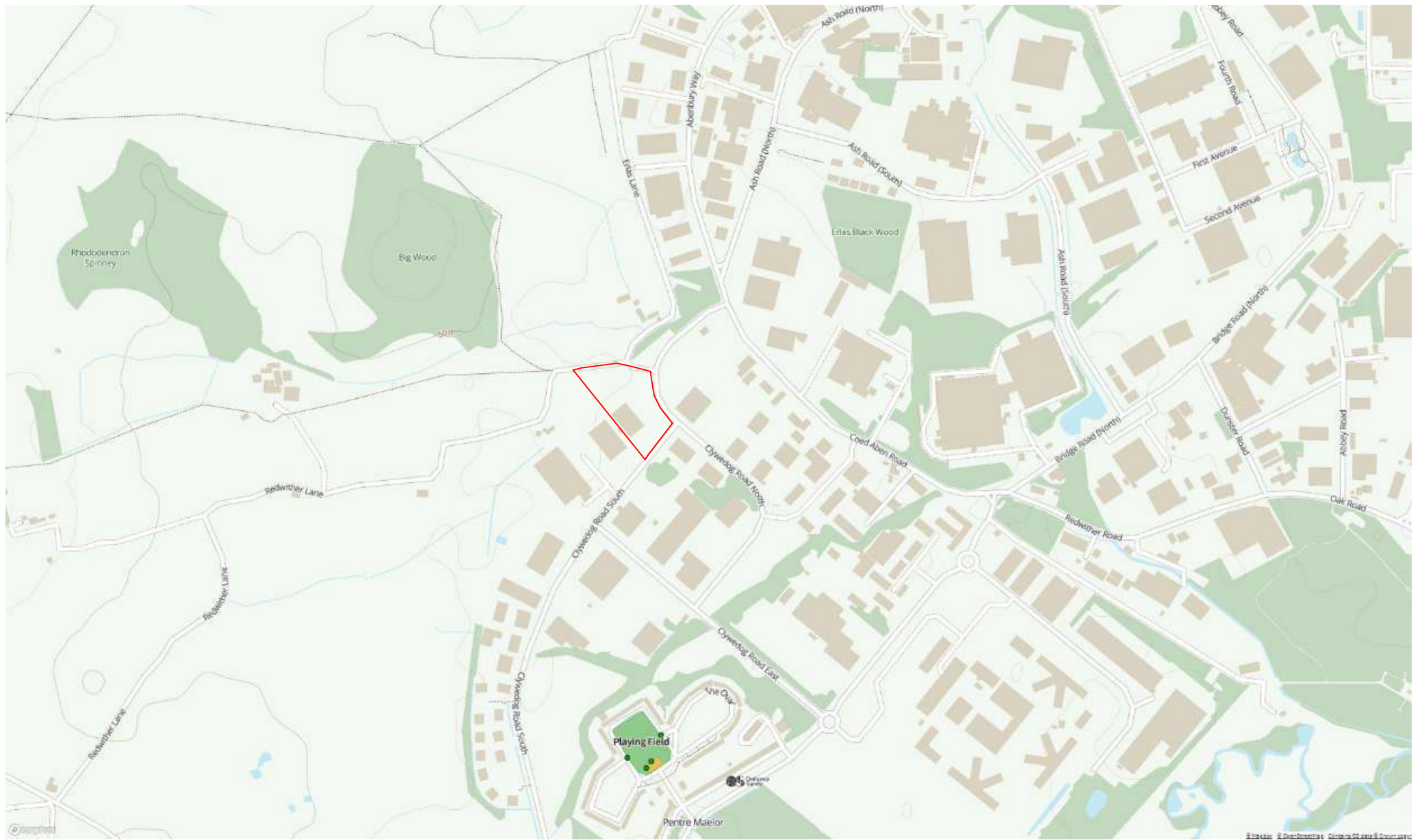
8.5.10 Maintenance Activities

A log of all maintenance activities is to be kept and made available to the Local Planning Authority (LPA) and / or the Lead Local Flood Authority (LLFA) on request.

9 NOTES ON LIMITATIONS

- 9.1 Shaw Stephens Consulting has prepared this report solely for the use of FI Real Estate.
- 9.2 Should any third party wish to use or rely on the contents of the report, written approval must be sought from Shaw Stephens Consulting and a charge may be levied against such approval.
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- i) The consequences of this report being used for any purpose or project other than for which it was commissioned and/or
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- 9.4 The information and views cited in the report are based on data derived from numerous sources. Shaw Stephens Consulting do not accept any liability for the correctness or otherwise of any information provided by third parties.
- 9.5 It should be noted that some of the elements covered in this report may be subject to change over time. Therefore, if the development is delayed or postponed, it may be necessary to consider reviewing such matters to verify that there have been no changes either at the subject site or in relation to pertinent legislation.
- 9.6 Further consultations with statutory bodies will evidently be required as the project progresses. Where responses have been received from Regulators, it is noted that the nature of these responses could be subject to change in the future.

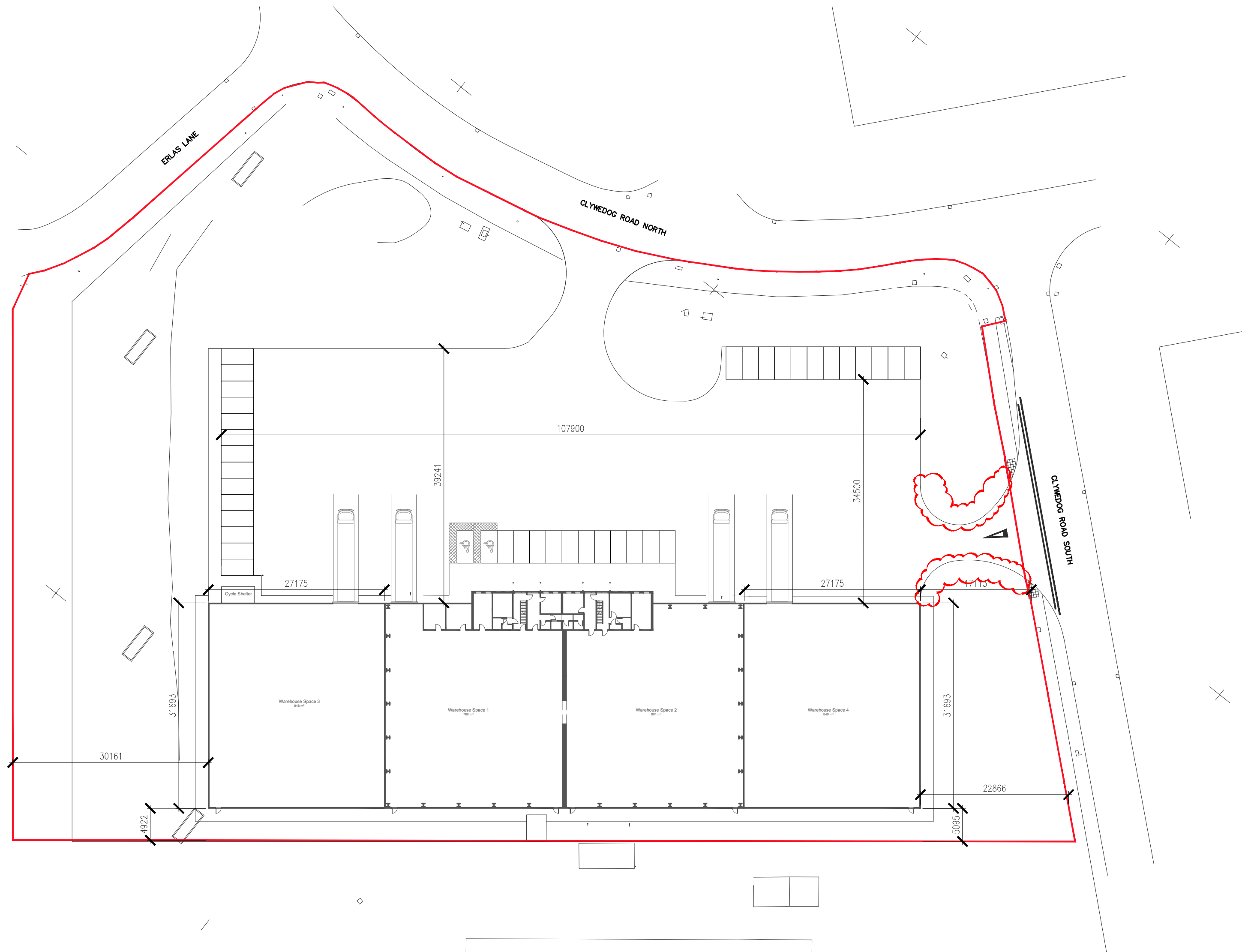
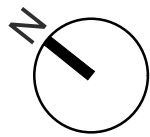
APPENDIX 1 – Site Location Plan





APPENDIX 2 – Topographical Survey

APPENDIX 3 – Proposed Site Layout



Proposed Site Plan

A	Initial Issue	PJ	01.08.22
B	Updated to reflect tree constraints plan	PJ	09.08.22
C	HGV egress updated, Cycle store added	PJ	18.08.22
D	Main access updated	PJ	24.08.22
E	Dimensions added	MM	15.12..22
F	Parking & yard area amended	PJ	19.04.23
G	Parking & yard area amended	MA	28.04.23
H	New entrance footway returns removed	JT	23.04.24

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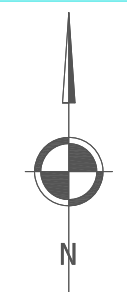
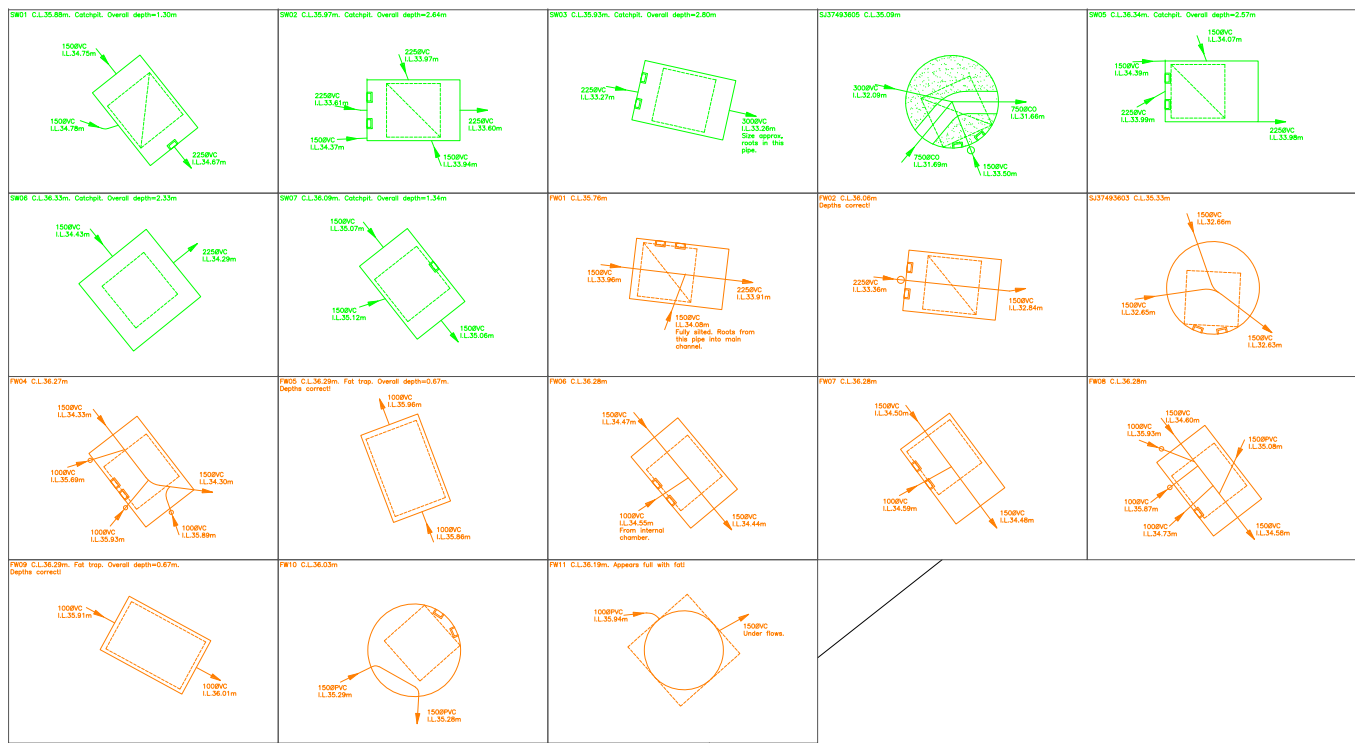
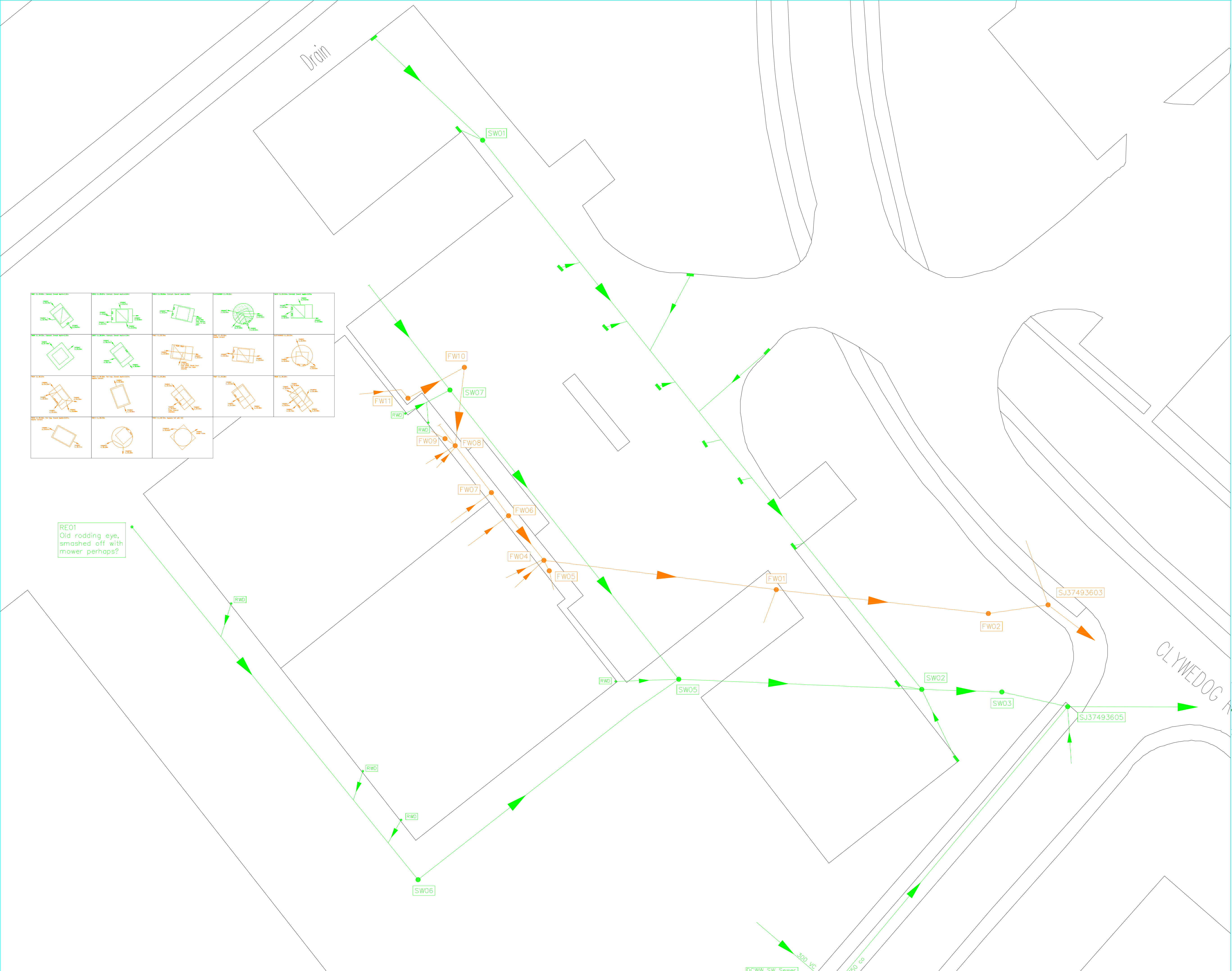
Client
F.I.Real Estate Management

Project
**Dragon Packaging
Wrexham**

Description
Proposed Site Plan

Status Information		
Scale	Drawn By	Date
1:500@A2	PJ	Jul22
Job Number	Drawing Number	Revision
1211	02-002	H

APPENDIX 4 – Existing Drainage Survey



Legend/Notes:

- Combined Sewer
- Foul Sewer
- SW Sewer
- Assumed Sewer (Not Proven)
- Rising Main
- Highway Drainage
- Culvert Sewer
- Open Water Course
- Overflow Line
- Treated Line
- RWD Rain Water Down Pipe
- FDP Foul Down Pipe
- CDP Combined Down Pipe
- GWP Grey Water Down Pipe
- Highway Gully
- Septic Tanks

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CHAS

Builder's

Profile

INVEK

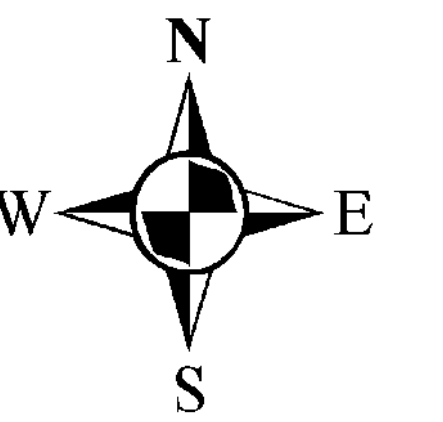
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Tel: 01925 244376 Fax: 01925 241517

Email: kevin@invek.com - www.invek.com

Client		Integra Consulting	
Drawing Title		U47/48 Dragon Packaging Site Drainage Layout	
Scale(s)	N.T.S	Drawn	PW
Date	04.04.22	Checked	RD
Job Number	1939	Approved	KN
Sheet Size, Drawing Number & Revision			
A1_1939/01_Rev_00			



LEGEND(Representative of most common features)

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

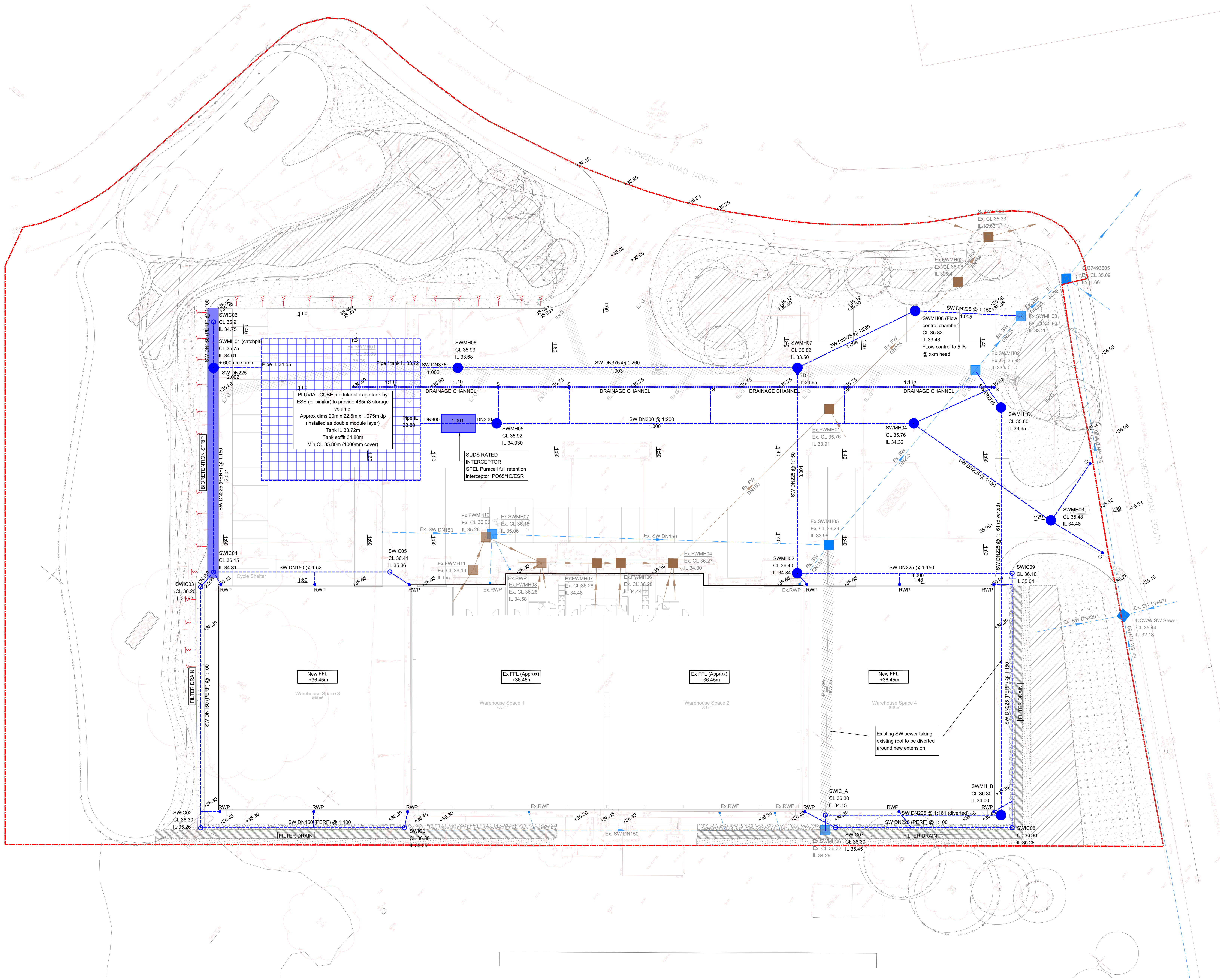
Dŵr Cymru Cyl gives this information as to the position of its underground apparatus by way of general guidance only on the basis of the information available to it and does not warrant its correctness. It is intended for use in the vicinity of the Company's apparatus and any use of the information for other purposes is at the user's risk. It must be understood that the turning of the information is entirely without prejudice to the provisions of the New Roads and Street Works Act 1991 and of the Company's rights to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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Map Ref: 337494,349462
Map scale: 1:1250
Printed by: Twidle David
Printed on: 31 Aug 2017



Key

- G - New gully
- Ex G - Existing gully
- RWP - New rainwater pipe
- Ex RWP - Existing rainwater pipe
- S - New sump
- SWIC - New surface water inspection chamber
- SWMH - New surface water manhole
- Ex SWMH - Existing surface water manhole
- Ex FWMH - Existing foul water manhole
- New surface water drain
- Existing surface water drain
- New drainage channel
- Existing foul water drain
- Existing drainage to be removed/grubbed up
- P1 Petrol Interceptor
- Existing site boundary levels
- Proposed levels
- Proposed fall direction
- Application boundary

- Notes.**
- All dimensions are in millimetres unless noted otherwise
 - All levels are in metres unless noted otherwise.
 - Do not scale from this drawing - use dimensions provided only. If additional dimensions are required, ask the engineer
 - Rainwater downpipes are indicative only and subject to receipt of further detailed design information.
 - Drainage design is indicative only for the purpose of demonstrating a viable surface water drainage solution / strategy for planning purposes. This drawing should not be used for construction
 - Surface Water inspection chambers to typically be 450dia and with a min 300mm sump depth to act as a catchpit in SUDS areas.
 - The scheme opposite is designed for all rainfall events up to the 1 in 100 year + 40% climate change event, with all storage provided below ground.
 - Off site flow from new areas of development to be restricted to SIs. Refer to the accompanying calculations.
 - SuDS measures are provided as follows:
 - New roofs & perimeter footpath - discharge into a perimeter filter drain
 - Bioretention strip provided to treat external areas where possible (circa 20% of external areas)
 - Remaining external areas unable to discharge to bioretention strip to pass through a SuDS rated interceptor.
 - Note: It is proposed to redirect existing handstanding areas into the new Drainage system, thus providing a significant restriction of flow and water quality improvements in comparison to the current drainage scenario.
 - It is assumed that the existing foul water drain will be reused and therefore no new FW drainage is required.
 - Drainage proposals shown opposite are subject to review and approval from the SAB.

Rev	Date	Description	By

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Status
PRELIMINARY

Project
DRAGON PACKAGING LTD WREXHAM

Title
SCHEMATIC DRAINAGE STRATEGY GA

Scale	1:200 @ A0	Date	Sept 24		
Project No	0133	By	ED	Appr	NS
Drawing No	0001	Rev	P01		

Shaw Stephens Consulting						Page 1																																																																																																																																																																																																																																						
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<u>Existing Network Details for Storm</u> <table><tr><th>PN</th><th>Length (m)</th><th>Fall (m)</th><th>Slope (1:X)</th><th>I.Area (ha)</th><th>T.E. (mins)</th><th>k (mm)</th><th>HYD SECT</th><th>DIA (mm)</th></tr><tr><td>1.000</td><td>58.859</td><td>0.294</td><td>200.2</td><td>0.205</td><td>10.00</td><td>0.600</td><td>o</td><td>300</td></tr><tr><td>1.001</td><td>22.268</td><td>0.231</td><td>96.5</td><td>0.159</td><td>0.00</td><td>0.600</td><td>o</td><td>300</td></tr><tr><td>2.000</td><td>2.826</td><td>0.035</td><td>80.7</td><td>0.060</td><td>10.00</td><td>0.600</td><td>o</td><td>150</td></tr><tr><td>2.001</td><td>28.883</td><td>0.200</td><td>144.5</td><td>0.088</td><td>0.00</td><td>0.600</td><td>o</td><td>225</td></tr><tr><td>2.002</td><td>18.726</td><td>0.112</td><td>167.9</td><td>0.026</td><td>0.00</td><td>0.600</td><td>o</td><td>225</td></tr><tr><td>1.002</td><td>16.901</td><td>0.042</td><td>400.0</td><td>0.000</td><td>0.00</td><td>0.600</td><td>o</td><td>375</td></tr><tr><td>1.003</td><td>48.112</td><td>0.185</td><td>260.0</td><td>0.000</td><td>0.00</td><td>0.600</td><td>o</td><td>375</td></tr><tr><td>3.000</td><td>30.342</td><td>0.202</td><td>150.2</td><td>0.065</td><td>10.00</td><td>0.600</td><td>o</td><td>225</td></tr><tr><td>3.001</td><td>29.065</td><td>0.194</td><td>150.0</td><td>0.035</td><td>0.00</td><td>0.600</td><td>o</td><td>225</td></tr><tr><td>1.004</td><td>18.505</td><td>0.071</td><td>260.0</td><td>0.000</td><td>0.00</td><td>0.600</td><td>o</td><td>375</td></tr><tr><td>1.005</td><td>15.008</td><td>0.051</td><td>294.3</td><td>0.000</td><td>0.00</td><td>0.600</td><td>o</td><td>375</td></tr></table> <table><tr><th>PN</th><th>US/MH Name</th><th>US/CL (m)</th><th>US/IL (m)</th><th>US C.Depth (m)</th><th>DS/CL (m)</th><th>DS/IL (m)</th><th>DS C.Depth (m)</th><th>Ctrl</th><th>US/MH (mm)</th></tr><tr><td>1.000</td><td>SWMH04</td><td>35.760</td><td>34.320</td><td>1.140</td><td>35.920</td><td>34.026</td><td>1.594</td><td></td><td>1050</td></tr><tr><td>1.001</td><td>SWMH05</td><td>35.920</td><td>34.026</td><td>1.594</td><td>35.800</td><td>33.795</td><td>1.705</td><td></td><td>1200</td></tr><tr><td>2.000</td><td>SWIC03</td><td>36.200</td><td>34.920</td><td>1.130</td><td>36.150</td><td>34.885</td><td>1.115</td><td></td><td>450</td></tr><tr><td>2.001</td><td>SWIC04</td><td>36.150</td><td>34.810</td><td>1.115</td><td>35.750</td><td>34.610</td><td>0.915</td><td></td><td>450</td></tr><tr><td>2.002</td><td>SWMH01</td><td>35.750</td><td>34.610</td><td>0.915</td><td>35.800</td><td>34.499</td><td>1.076</td><td></td><td>1200</td></tr><tr><td>1.002</td><td>TANK</td><td>35.800</td><td>33.720</td><td>1.705</td><td>35.930</td><td>33.678</td><td>1.877</td><td></td><td>1200</td></tr><tr><td>1.003</td><td>SWMH06</td><td>35.930</td><td>33.678</td><td>1.877</td><td>35.820</td><td>33.493</td><td>1.952</td><td></td><td>1200</td></tr><tr><td>3.000</td><td>SWIC09</td><td>36.100</td><td>35.040</td><td>0.835</td><td>36.400</td><td>34.838</td><td>1.337</td><td></td><td>450</td></tr><tr><td>3.001</td><td>SWMH02</td><td>36.400</td><td>34.838</td><td>1.337</td><td>35.820</td><td>34.644</td><td>0.951</td><td></td><td>1200</td></tr><tr><td>1.004</td><td>SWMH07</td><td>35.820</td><td>33.493</td><td>1.952</td><td>35.820</td><td>33.422</td><td>2.023</td><td></td><td>1200</td></tr><tr><td>1.005</td><td>SWMH08</td><td>35.820</td><td>33.422</td><td>2.023</td><td>35.930</td><td>33.371</td><td>2.184</td><td>Hydro-Brake®</td><td>1200</td></tr></table>									PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	1.000	58.859	0.294	200.2	0.205	10.00	0.600	o	300	1.001	22.268	0.231	96.5	0.159	0.00	0.600	o	300	2.000	2.826	0.035	80.7	0.060	10.00	0.600	o	150	2.001	28.883	0.200	144.5	0.088	0.00	0.600	o	225	2.002	18.726	0.112	167.9	0.026	0.00	0.600	o	225	1.002	16.901	0.042	400.0	0.000	0.00	0.600	o	375	1.003	48.112	0.185	260.0	0.000	0.00	0.600	o	375	3.000	30.342	0.202	150.2	0.065	10.00	0.600	o	225	3.001	29.065	0.194	150.0	0.035	0.00	0.600	o	225	1.004	18.505	0.071	260.0	0.000	0.00	0.600	o	375	1.005	15.008	0.051	294.3	0.000	0.00	0.600	o	375	PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)	1.000	SWMH04	35.760	34.320	1.140	35.920	34.026	1.594		1050	1.001	SWMH05	35.920	34.026	1.594	35.800	33.795	1.705		1200	2.000	SWIC03	36.200	34.920	1.130	36.150	34.885	1.115		450	2.001	SWIC04	36.150	34.810	1.115	35.750	34.610	0.915		450	2.002	SWMH01	35.750	34.610	0.915	35.800	34.499	1.076		1200	1.002	TANK	35.800	33.720	1.705	35.930	33.678	1.877		1200	1.003	SWMH06	35.930	33.678	1.877	35.820	33.493	1.952		1200	3.000	SWIC09	36.100	35.040	0.835	36.400	34.838	1.337		450	3.001	SWMH02	36.400	34.838	1.337	35.820	34.644	0.951		1200	1.004	SWMH07	35.820	33.493	1.952	35.820	33.422	2.023		1200	1.005	SWMH08	35.820	33.422	2.023	35.930	33.371	2.184	Hydro-Brake®	1200
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Manhole Schedules for Storm											
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SWMH04	35.760	1.440	Open Manhole	1050	1.000	34.320	300				
SWMH05	35.920	1.894	Open Manhole	1200	1.001	34.026	300	1.000	34.026	300	
SWIC03	36.200	1.280	Open Manhole	450	2.000	34.920	150				
SWIC04	36.150	1.340	Open Manhole	450	2.001	34.810	225	2.000	34.885	150	
SWMH01	35.750	1.140	Open Manhole	1200	2.002	34.610	225	2.001	34.610	225	
TANK	35.800	2.080	Open Manhole	1200	1.002	33.720	375	1.001	33.795	300	
								2.002	34.499	225	628
SWMH06	35.930	2.252	Open Manhole	1200	1.003	33.678	375	1.002	33.678	375	
SWIC09	36.100	1.060	Open Manhole	450	3.000	35.040	225				
SWMH02	36.400	1.562	Open Manhole	1200	3.001	34.838	225	3.000	34.838	225	
SWMH07	35.820	2.327	Open Manhole	1200	1.004	33.493	375	1.003	33.493	375	
								3.001	34.644	225	1001
SWMH08	35.820	2.398	Open Manhole	1200	1.005	33.422	375	1.004	33.422	375	
	35.930	2.559	Open Manhole	0		OUTFALL		1.005	33.371	375	

Shaw Stephens Consulting		Page 3
6 Hewitt Street Manchester, M15 4GB		
Date 12/09/2024 18:49 File Dragon MD.MDX	Designed by ED Checked by	
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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	300	SWMH04	35.760	34.320	1.140	Open Manhole	1050
1.001	o	300	SWMH05	35.920	34.026	1.594	Open Manhole	1200
2.000	o	150	SWIC03	36.200	34.920	1.130	Open Manhole	450
2.001	o	225	SWIC04	36.150	34.810	1.115	Open Manhole	450
2.002	o	225	SWMH01	35.750	34.610	0.915	Open Manhole	1200
1.002	o	375	TANK	35.800	33.720	1.705	Open Manhole	1200
1.003	o	375	SWMH06	35.930	33.678	1.877	Open Manhole	1200
3.000	o	225	SWIC09	36.100	35.040	0.835	Open Manhole	450
3.001	o	225	SWMH02	36.400	34.838	1.337	Open Manhole	1200
1.004	o	375	SWMH07	35.820	33.493	1.952	Open Manhole	1200
1.005	o	375	SWMH08	35.820	33.422	2.023	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	58.859	200.2	SWMH05	35.920	34.026	1.594	Open Manhole	1200
1.001	22.268	96.5	TANK	35.800	33.795	1.705	Open Manhole	1200
2.000	2.826	80.7	SWIC04	36.150	34.885	1.115	Open Manhole	450
2.001	28.883	144.5	SWMH01	35.750	34.610	0.915	Open Manhole	1200
2.002	18.726	167.9	TANK	35.800	34.499	1.076	Open Manhole	1200
1.002	16.901	400.0	SWMH06	35.930	33.678	1.877	Open Manhole	1200
1.003	48.112	260.0	SWMH07	35.820	33.493	1.952	Open Manhole	1200
3.000	30.342	150.2	SWMH02	36.400	34.838	1.337	Open Manhole	1200
3.001	29.065	150.0	SWMH07	35.820	34.644	0.951	Open Manhole	1200
1.004	18.505	260.0	SWMH08	35.820	33.422	2.023	Open Manhole	1200
1.005	15.008	294.3		35.930	33.371	2.184	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.005		35.930	33.371	33.335	0	0

Shaw Stephens Consulting		Page 4
6 Hewitt Street Manchester, M15 4GB		
Date 12/09/2024 18:49 File Dragon MD.MDX	Designed by ED Checked by	
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Simulation Criteria for Storm Volumetric Runoff Coeff 1.000 Additional Flow - % of Total Flow 0.000 Areal Reduction Factor 1.000 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Inlet Coefficient 0.800 Hot Start Level (mm) 0 Flow per Person per Day (l/per/day) 0.000 Manhole Headloss Coeff (Global) 0.500 Run Time (mins) 60 Foul Sewage per hectare (l/s) 0.000 Output Interval (mins) 1 Number of Input Hydrographs 0 Number of Storage Structures 1 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 Synthetic Rainfall Details Rainfall Model FSR Profile Type Winter Return Period (years) 2 Cv (Summer) 1.000 Region England and Wales Cv (Winter) 1.000 M5-60 (mm) 18.000 Storm Duration (mins) 30 Ratio R 0.338		
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Shaw Stephens Consulting		Page 5
6 Hewitt Street		
Manchester, M15 4GB		
Date 12/09/2024 18:49	Designed by ED	
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Innovyze	Network W.16.1	

Online Controls for Storm

Hydro-Brake® Manhole: SWMH08, DS/PN: 1.005, Volume (m³): 4.6

Design Head (m) 1.400 Hydro-Brake® Type Md4 Invert Level (m) 33.422
Design Flow (l/s) 5.0 Diameter (mm) 73

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	1.200	4.5	3.000	7.2	7.000	11.0
0.200	2.6	1.400	4.9	3.500	7.8	7.500	11.4
0.300	2.4	1.600	5.3	4.000	8.3	8.000	11.7
0.400	2.6	1.800	5.6	4.500	8.8	8.500	12.1
0.500	2.9	2.000	5.9	5.000	9.3	9.000	12.5
0.600	3.2	2.200	6.2	5.500	9.7	9.500	12.8
0.800	3.7	2.400	6.4	6.000	10.2		
1.000	4.2	2.600	6.7	6.500	10.6		

Shaw Stephens Consulting		Page 6
6 Hewitt Street		
Manchester, M15 4GB		
Date 12/09/2024 18:49	Designed by ED	
File Dragon MD.MDX	Checked by	
Innovyze	Network W.16.1	

Storage Structures for Storm

Cellular Storage Manhole: TANK, DS/PN: 1.002

Invert Level (m) 33.720 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.99
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	485.0	0.0	1.001	0.0	0.0
1.000	485.0	0.0			

Micro Drainage®

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

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

		Return	Climate	First X		First Y	First Z	O/F	Lvl
PN	Storm	Period	Change	Surcharge		Flood	Overflow	Act.	Exc.
1.000	30	Summer	100	+40%	100/15	Summer			
1.001	15	Summer	100	+40%	100/15	Summer			
2.000	15	Summer	100	+40%	30/15	Summer	100/15	Summer	2
2.001	15	Summer	100	+40%	30/15	Summer			
2.002	15	Summer	100	+40%	30/15	Summer			
1.002	720	Winter	100	+40%	30/120	Summer			
1.003	180	Summer	100	+40%	30/120	Summer			
3.000	30	Summer	100	+40%					
3.001	15	Summer	100	+40%	100/15	Summer			
1.004	180	Summer	100	+40%	1/180	Summer			
1.005	240	Summer	100	+40%	1/30	Summer			

PN	US/MH Name	Water	Surch'd Depth (m)	Flooded	Flow / Cap.	O'flow	Pipe	Status
		Level (m)		Volume (m³)		(l/s)	Flow (l/s)	
1.000	SWMH04	35.138	0.518	0.000	1.29	0.0	95.6	SURCHARGED
1.001	SWMH05	34.793	0.467	0.000	1.71	0.0	170.6	SURCHARGED
2.000	SWIC03	36.200	1.130	0.459	3.08	0.0	36.1	FLOOD
2.001	SWIC04	36.144	1.109	0.000	1.86	0.0	74.6	FLOOD RISK
2.002	SWMH01	35.416	0.580	0.000	2.49	0.0	89.7	SURCHARGED
1.002	TANK	34.746	0.651	0.000	0.87	0.0	65.3	SURCHARGED
1.003	SWMH06	34.789	0.736	0.000	0.58	0.0	66.7	SURCHARGED
3.000	SWIC09	35.234	-0.031	0.000	0.76	0.0	30.0	OK
3.001	SWMH02	35.139	0.076	0.000	1.19	0.0	46.8	SURCHARGED
1.004	SWMH07	35.151	1.283	0.000	0.26	0.0	26.3	SURCHARGED
1.005	SWMH08	35.089	1.293	0.000	0.05	0.0	5.0	SURCHARGED

**APPENDIX 8 – SuDS Treatment Train – SPEL Puraceptor Full
Retention Interceptor**

SPEL Puraceptor®

Class 1 Full Retention Separators

Overview

SPEL Puraceptor® oil separators treat 100% of the flow and have been designed and tested to meet the stringent British/European Standard BS EN 858-1. For peace of mind, install SPEL Puraceptors in high risk areas where the maximum hydrocarbon concentration in the outlet must not exceed 5mg/l.

All SPEL Puraceptors (Full Retention Separators) are fitted with a special automatic closure device (ACD) which shuts the separator down when the contained oil exceeds the maximum oil spill capacity.

The 'heart' of SPEL Separators is the unique long life, low maintenance coalescer unit which 'polishes' the final effluent after 90% of hydrocarbons and silt have been separated out.

Product Range

Series 200

(1.2m inside diameter):

NS 4 - NS 10

Catchment area: 222m² - 556m²

Series 300

(1.8m inside diameter):

NS 15 - NS 50

Catchment area: 833m² - 2,778m²

Series 400

(2.6m inside diameter):

NS 65 - NS 280

Catchment area: 3,611m² - 15,555m²

Series 500

(3.5m inside diameter):

NS 300 - NS 500

Catchment area: 16,665m² - 27,775m²

Series 600

(4m inside diameter):

NS 500 - NS 1,000

Catchment area: 27,775m² - 55,550m²

Note: NS 1,000 unit does not have silt capacity

Applications

Fuel storage/handling areas

Refuelling facilities

Vehicle maintenance yards

Heavy industrial areas

Distribution centres

Power/sub stations

Fire training grounds

Shell Design

Designed with reference to BS EN 13121. All tank shells carry the SPEL 25 Year Warranty and life expectancy in excess of 50 years.

Shell Specifications

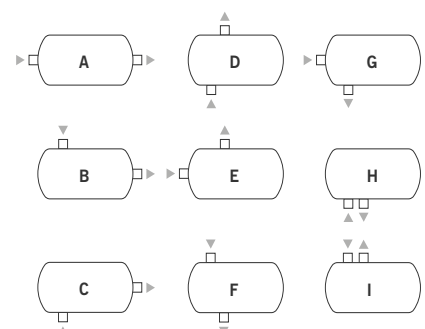
Different tank shell specifications are available dependent upon tank invert levels, ground conditions and ground water levels.

Inlet/Outlet Connections

160/225/300mm diameter PVCU socket/spigot.

450, 600, 750, 900 and 1200mm diameter GRP spigot available, for connecting to site pipework via Flex-Seal/Band-Seal or similar flexible couplings.

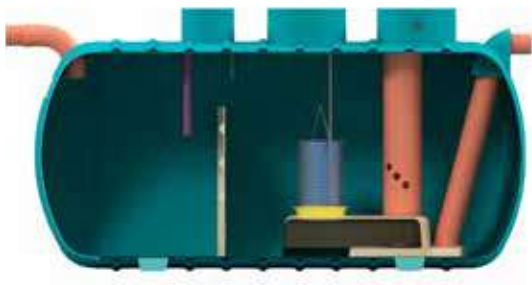
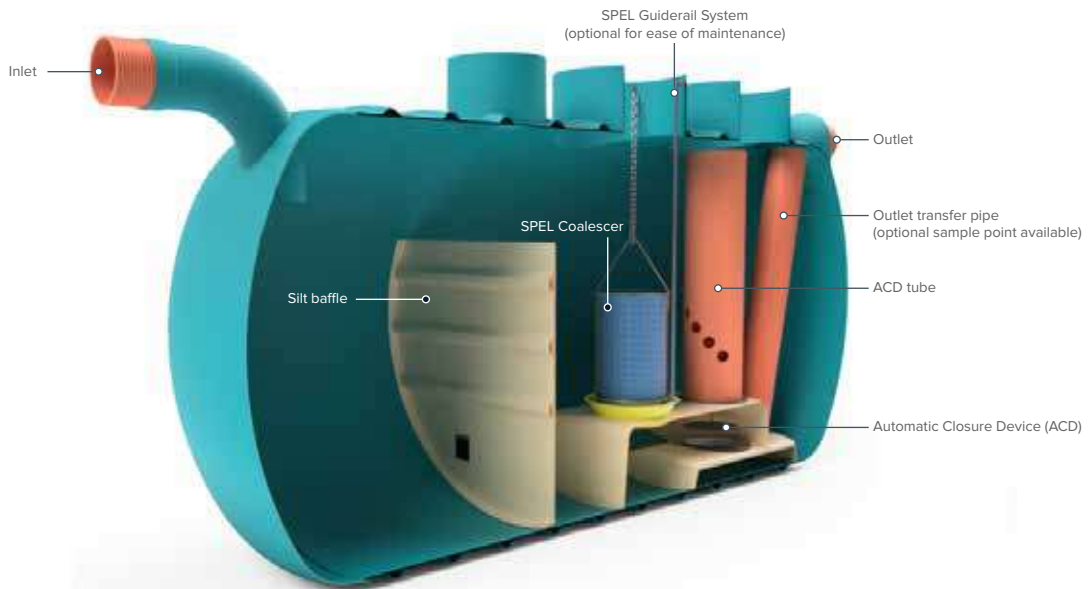
The nine inlet/outlet options below are available to assist with design and installation.



SPEL Puraceptor® Class 1 Single & Two Chamber Separators

Introduction

The SPEL Puraceptor® is a full retention model treating all the flow from the connected catchment area, it is available in two versions, single or two chamber, dependent upon the site application and requirements. See specification detail below. This system benefits from **BS EN 858 testing conducted by HR Wallingford** and the inclusion of the unique SPEL coalescer, ensuring the **highest performance and simple maintenance**.



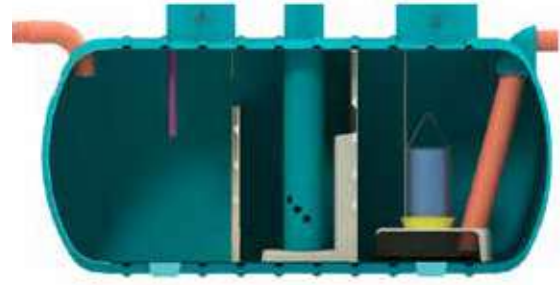
Class 1 Single Chamber Separator

Operation:

Flow enters the chamber from the inlet pipe, and the separation process begins as the flow moves towards the coalescer. Oil rises to the surface, silt settles out and the cleanest water then enters the coalescer which polishes the flow to a higher level prior to discharge.

The SPEL Puraceptor® benefits from the unique SPEL coalescer which is the heart of all SPEL separation systems. The foam insert is located in a stainless steel basket and delivers high quality water, long life, and ease of maintenance.

The other key component is the fail safe Automatic Closure Device (ACD) which will shut the system down in the event of a catastrophic oil spill.



Class 1 Two Chamber Separator

Operation:

The SPEL Two Chamber Separator is the result of long development with National Grid and has resulted in a system that can substantially reduce maintenance costs.

The Two Chamber unit has all the benefits of the Class 1 Puraceptor® but the addition of a strategically located full height baffle wall protects the unique coalescer from the bulk of the silt load.

The coalescer is mounted in the second chamber (clean zone) where it is more effective as well as being protected. The result is that it will not clog as quickly and this can equate to longer periods between maintenance.

SPEL Automatic Closure Device (ACD)

Overview

The purpose of the Automatic Closure Device (ACD) is to close the separator off automatically when the maximum capacity of light liquid/oil is reached.

The ACD ensures that in the event of a major spillage, pollutants do not pass into the drainage system; it should not be regarded as a substitute for an automatic alarm/monitoring system. The oil alarm and ACD are both required to comply with BS EN 858.

If the tank should fill with light liquid/oil the ACD, which is calibrated for a specific gravity of 0.85, will automatically sink and close off the SPEL Puraceptor®.

Normally routine maintenance would include removing light liquid intercepted within the Puraceptor®. If a SPEL automatic alarm/monitoring system is incorporated, it will automatically indicate when the Puraceptor® should be emptied. Only in an emergency will the Puraceptor® fill to its maximum and activate the ACD.

In such an event the Puraceptor® should be completely sucked out/emptied and the ACD lifted out.

Prior to installation

Prior to installation the ACD retaining tube should be covered with polythene to prevent ingress of concrete etc., which would fall onto the ACD and cause a malfunction.

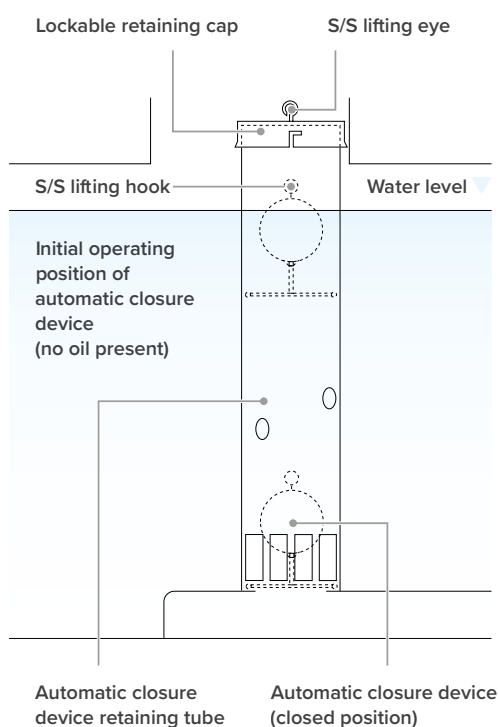
Maintenance

Dependent upon site conditions it is advisable to remove the ACD periodically taking care not to raise it too quickly and damage the plastic/copper float. Clean it from debris/silt to prevent premature closing. Check the seating in the base unit is free of debris/silt that could prevent proper closing in an emergency.

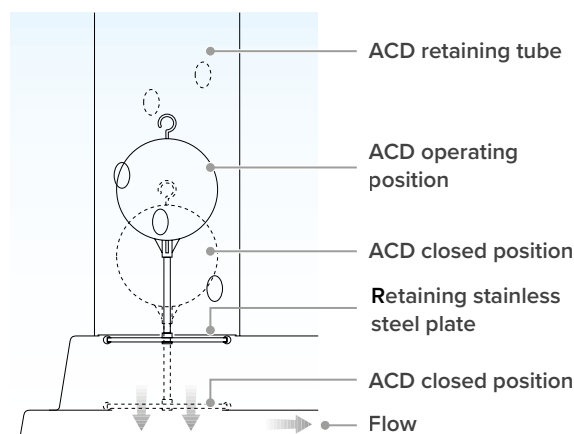
For Installation/Commissioning
get in touch with our team:
engineers@spelproducts.co.uk

'Companies who pollute the environment can be hit with unlimited financial penalties from the Environment Agency from today (11 December 2023).' *gov.uk, 'Unlimited penalties introduced for those who pollute environment' (11 December 2023)*

Automatic closure device **Type F** (Floating)
SPEL Puraceptor® class 1 separators
(two chamber) & full retention class 2 separators.



Automatic closure device **Type R** (Retained)
SPEL Puraceptor® class 1 separator
(single chamber).



SPEL Puraceptor® Class 1 Full Retention Separators

Single Chamber

Model	Series	Nominal Size (NS)	Catchment Area (m²)	Oil Storage (litres)	Silt Capacity (litres)	Overall Length* (mm)	Overall Diameter (mm)	Inlet Invert (mm)	Base to Inlet (mm)	Base to Outlet (mm)	Optimum In/Out Pipe Diameter** (mm)	Number of Access Shafts (dia. mm)				
		Flow (l/s)				L		A	B	C		450	600	750	900	1200
P004 1C/SC	200	4	222	40	400	1,720	1,225	630	1,110	1,050	160	-	-	1	-	-
P006 1C/SC	200	6	333	60	600	2,310	1,225	630	1,110	1,050	160	-	-	1	-	-
P010 1C/SC	200	10	556	100	1,000	3,410	1,225	630	1,110	1,050	160	-	-	1	-	-
P015 1C/SC	300	15	833	150	1,500	3,200	1,875	350	1,800	1,740	225	1	-	1	-	-
P020 1C/SC	300	20	1,111	200	2,000	3,540	1,875	350	1,800	1,740	225	-	1	1	-	-
FP 1C/SC	300	20	1,111	200	2,000	4,290	1,875	350	1,800	1,740	225	-	-	1	-	-
P030 1C/SC	300	30	1,667	300	3,000	4,420	1,875	390	1,760	1,700	300	-	1	-	1	-
P040 1C/SC	300	40	2,222	400	4,000	5,760	1,875	390	1,760	1,700	300	-	1	-	1	-
P050 1C/SC	300	50	2,778	500	5,000	7,060	1,875	390	1,760	1,700	300	-	1	-	1	-
P065 1C/SC	400	65	3,611	650	6,500	4,860	2,700	425	2,625	2,525	300	-	1	-	2	-
P080 1C/SC	400	80	4,444	800	8,000	5,700	2,700	425	2,625	2,525	300	-	1	-	2	-
P100 1C/SC	400	100	5,555	1,000	10,000	7,400	2,700	475	2,575	2,475	450	-	1	-	2	-
P125 1C/SC	400	125	6,944	1,250	12,500	8,580	2,700	475	2,575	2,475	450	-	-	1	2	-
P150 1C/SC	400	150	8,333	1,500	15,000	10,180	2,700	475	2,575	2,475	450	-	-	1	2	-
P165 1C/SC	400	165	9,166	1,650	16,500	11,200	2,700	500	2,550	2,450	450	-	2	1	1	-
P200 1C/SC	400	200	11,110	2,000	20,000	13,710	2,700	660	2,390	2,290	600	-	2	1	1	-
P250 1C/SC	400	250	13,888	2,500	25,000	16,750	2,700	660	2,390	2,290	600	-	2	1	2	-
P280 1C/SC	400	280	15,555	2,800	28,000	18,800	2,700	660	2,390	2,290	600	-	1	2	2	-
P300 1C/SC	500	300	16,665	3,000	30,000	12,410	3,650	805	3,070	2,970	750	-	1	2	2	-
P400 1C/SC	500	400	22,220	4,000	40,000	15,760	3,650	805	3,070	2,970	750	-	2	2	2	-
P500 1C/SC	500	500	27,775	5,000	50,000	20,530	3,650	955	2,920	2,820	900	-	2	2	1	1
P500 1C/SC	600	500	27,775	5,000	50,000	16,040	4,150	925	3,250	3,150	900	-	2	2	1	1
P600 1C/SC	600	600	33,330	6,000	60,000	19,080	4,150	925	3,250	3,150	900	-	2	2	-	2
P700 1C/SC	600	700	38,888	7,000	70,000	21,460	4,150	925	3,250	3,150	900	-	3	2	3	-
P800 1C/SC	600	800	44,440	8,000	80,000	23,020	4,150	925	3,250	3,150	900	-	3	2	2	1
P900 1C/SC	600	900	49,846	9,000	90,000	24,658	4,150	925	3,250	3,150	900	-	3	2	-	3

All of the above models are available without silt capacity, below are selected models for size comparison.
The P1000 model is only available in non silt format.

P050 1C	300	50	2,778	500	-	5,070	1875	390	1,760	1,700	300	-	-	-	1	-
P065 1C	400	65	3,611	650	-	3,710	2,700	425	2,625	2,525	300	-	-	-	2	-
P100 1C	400	100	5,555	1,000	-	5,250	2,700	475	2,575	2,475	450	-	-	-	2	-
P125 1C	400	125	6,944	1,250	-	6,090	2,700	475	2,575	2,475	450	-	-	-	2	-
P165 1C	400	165	9,166	1,650	-	7,960	2,700	500	2,550	2,450	450	-	2	-	1	-
P250 1C	400	250	13,888	2,500	-	11,830	2,700	660	2,390	2,290	600	-	2	-	2	-
P300 1C	400	300	16,665	3,000	-	14,120	2,700	660	2,390	2,290	600	-	2	-	2	-
P500 1C	500	500	27,775	5,000	-	14,340	3,650	955	2,920	2,820	900	-	2	2	1	1
P500 1C	600	500	27,775	5,000	-	11,470	4,150	925	3,250	3,150	900	-	2	2	1	1
P700 1C	600	700	38,888	7,000	-	15,880	4,150	925	3,250	3,150	900	-	3	2	3	-
P1000 1C	600	1,000	55,550	10,000	-	21,407	4,150	925	3,250	3,150	900	-	3	2	1	3

*Overall length subject to inlet/outlet and orientation.

**SPEL Separators are designed for a maximum flow (NS/NSB) but can be fitted with larger than the recommended maximum connection size IN/OUT or with the addition of adapters providing the maximum flow (NS/NSB) cannot be exceeded or any increase in the operating level in the SPEL Separator to cause the captured pollutants to escape into the vent connections or through access shaft connections. Any overriding of the above criteria could jeopardise performance to the European Standard BS EN 858-1.

Note: Model FP1C/SC is a special Forecourt separator with 7600 litre spillage holding capacity. See Forecourt separator detail on Page 3.14

SPEL Puraceptor® Class 1 Full Retention Separators

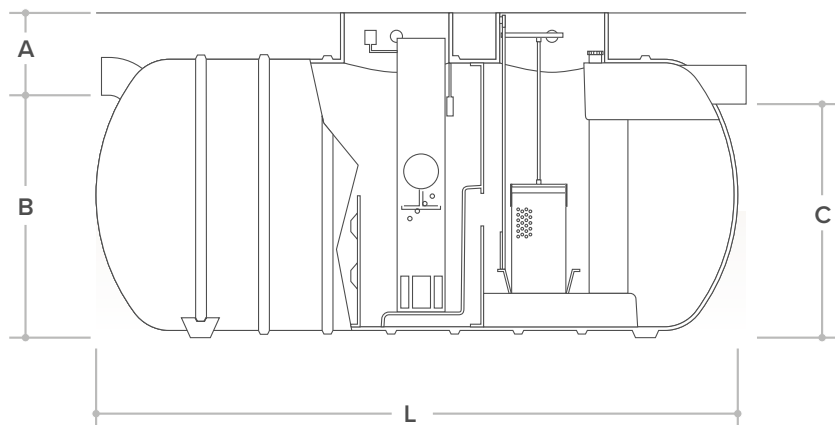
Two Chamber

Model	Series	Nominal Size (NS)	Catchment area (m ²)	Oil storage (litres)	Silt capacity (litres)	Overall length* (mm)	Overall diameter (mm)	Inlet Invert (mm)	Base to inlet (mm)	Base to outlet (mm)	Optimum in/out pipe diameter** (mm)	Number of access shafts (dia. mm)				
		Flow (l/s)										450	600	750	900	1200
P006 2C/SC	200	6	333	60	600	3,050	1,225	340	1,200	1,140	160	-	1	1	-	-
P010 2C/SC	200	10	556	100	1,000	3,820	1,225	340	1,200	1,140	160	-	1	1	-	-
P015 2C/SC	300	15	833	150	1,500	4,015	1,875	350	1,800	1,740	225	-	-	2	-	-
P020 2C/SC	300	20	1,111	200	2,000	4,015	1,875	350	1,800	1,740	225	-	-	2	-	-
FP 2C/SC***	300	20	1,111	200	2,000	5,500	1,875	350	1,800	1,740	225	-	-	2	-	-
P025 2C/SC	300	25	1,389	250	2,500	4,290	1,875	350	1,800	1,740	225	-	-	2	-	-
P030 2C/SC	300	30	1,667	300	3,000	4,420	1,875	390	1,760	1,700	300	-	1	2	-	-
P035 2C/SC	300	35	1,944	350	3,500	5,070	1,875	390	1,760	1,700	300	-	1	2	-	-
P040 2C/SC	300	40	2,222	400	4,000	5,760	1,875	390	1,760	1,700	300	-	1	2	-	-
P050 2C/SC	300	50	2,778	500	5,000	7,060	1,875	390	1,760	1,700	300	-	1	2	-	-
P065 2C/SC	300	65	3,611	650	6,500	9,180	1,875	390	1,760	1,700	300	1	-	2	-	-
P080 2C/SC	400	80	4,444	800	8,000	5,700	2,700	425	2,625	2,525	300	-	-	1	1	-
P100 2C/SC	400	100	5,555	1,000	10,000	7,400	2,700	475	2,575	2,475	450	-	-	1	1	-
P125 2C/SC	400	125	6,944	1,250	12,500	8,580	2,700	475	2,575	2,475	450	-	-	2	1	-
P150 2C/SC	400	150	8,333	1,500	15,000	10,180	2,700	500	2,550	2,450	450	-	-	2	1	-
P200 2C/SC	400	200	11,110	2,000	20,000	13,710	2,700	660	2,390	2,290	600	-	1	2	1	-
P250 2C/SC	400	250	13,888	2,500	25,000	16,752	2,700	660	2,390	2,290	600	-	2	1	2	-
P300 2C/SC	500	300	16,665	3,000	30,000	12,530	3,650	675	3,200	3,100	600	-	1	2	-	1
P400 2C/SC	500	400	22,220	4,000	40,000	15,980	3,650	675	3,200	3,100	600	-	2	2	2	-
P500 2C/SC	500	500	27,775	5,000	50,000	20,530	3,650	955	2,920	2,820	900	-	2	2	1	1
P500 2C/SC	600	500	27,775	5,000	50,000	16,260	4,150	925	3,250	3,150	900	-	2	1	1	1
P600 2C/SC	600	600	33,330	6,000	60,000	19,080	4,150	925	3,250	3,150	900	-	2	2	3	-
P700 2C/SC	600	700	38,888	7,000	70,000	22,270	4,150	925	3,250	3,150	900	-	3	2	3	-
P800 2C/SC	600	800	44,440	8,000	80,000	23,020	4,150	925	3,250	3,150	900	-	3	2	2	1
P900 2C/SC	600	900	50,000	9,000	90,000	24,658	4,150	925	3,250	3,150	900	-	3	2	1	2

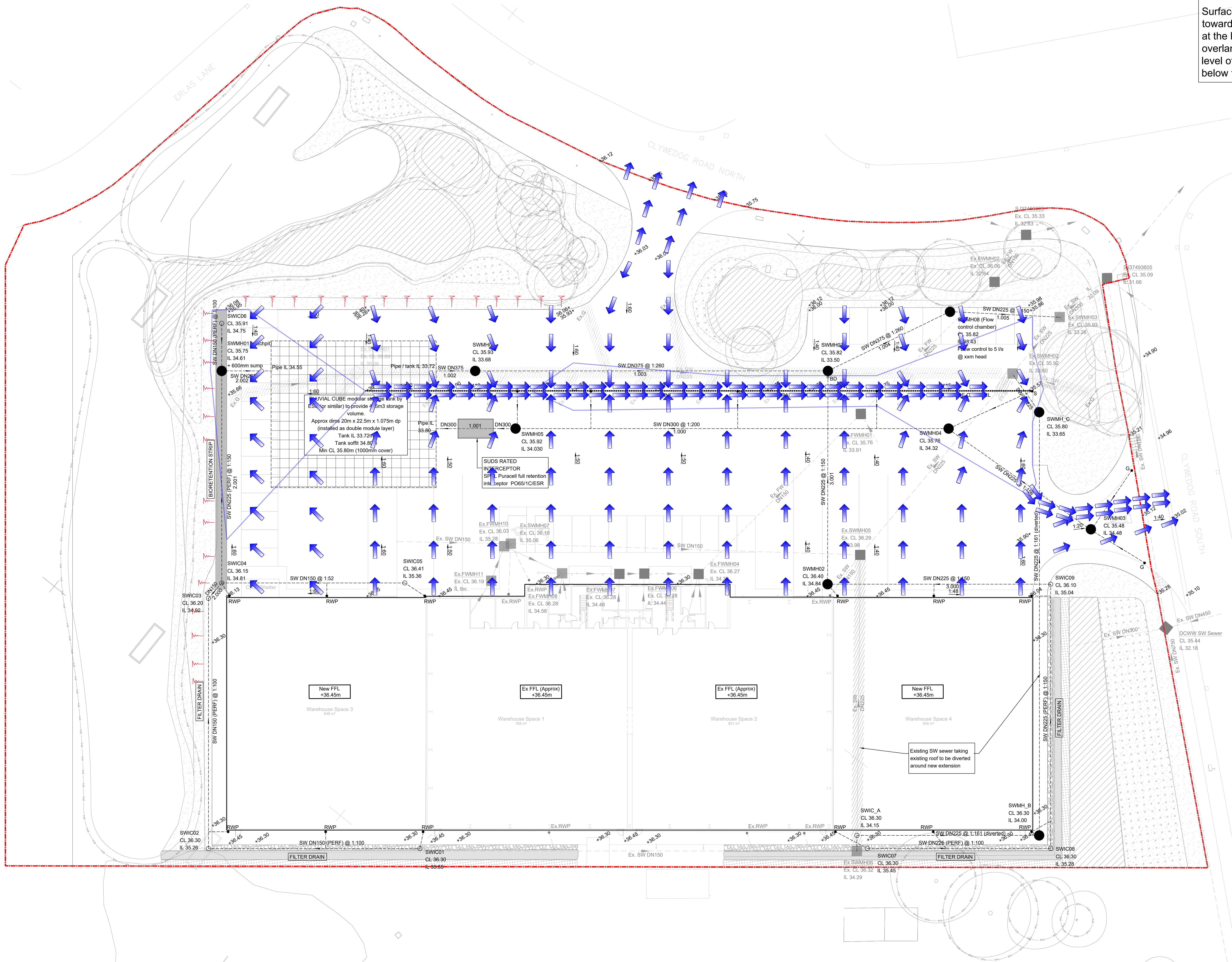
*Overall length subject to inlet/outlet and orientation.

**SPEL Separators are designed for a maximum flow (NS/NSB) but can be fitted with larger than the recommended maximum connection size IN/OUT or with the addition of adapters providing the maximum flow (NS/NSB) cannot be exceeded or any increase in the operating level in the SPEL Separator to cause the captured pollutants to escape into the vent connections or through access shaft connections. Any overriding of the above criteria could jeopardise performance to the European Standard BS EN 858-1.

***Note: Model FP2C/SC is a special Forecourt separator with 7600 litre spillage holding capacity. See Forecourt separator detail on Page 3.14



APPENDIX 9 – Overland Flood Routes



OVERLAND FLOODING:

As the site is existing, the new building extensions are proposed to follow the same FFL as the existing building FFL's. Existing buildings are raised above external areas, with generally a 150mm drop around the perimeter. At the front of the building level access is provided, with external levels sloped away from the building towards a new drainage channel 27m away from the building.

Surface runoff is therefore directed away from the building towards the drainage channel, where localised pooling occurs at the low points, before overtopping and exiting the site as overland flow onto Clywedog Road South. Maximum water level of the pooled area is 36.00m AODD, which is 450mm below the building levels.

Notes.

1. All dimensions are in millimetres unless noted otherwise
2. All levels are in metres unless noted otherwise.
3. Do not scale from this drawing - use dimensions provided only. If additional dimensions are required, ask the engineer

Rev	Date	Description	By

Shaw Stephens Consulting

6 Hewitt Street
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Tel : +44 7471 877 617
Email: neville.shaw@shaw-stephens.com

Status
PRELIMINARY

Project
DRAGON PACKAGING LTD WREXHAM

Title
OVERLAND FLOODING (EXTREME EVENTS)

Scale	1:200 @ A0	Date	Sept 24
Project No	0133	By	RH
Drawing No	0002	Rev	NS
			P01