



St. Peters Close, Rhosrobin

Drainage Strategy

August 2021

Project Information	
Project:	St. Peters Close, Rhosrobin
Report Title:	Drainage Strategy
Client:	S G Estates
Instruction:	The instruction to undertake this Drainage Strategy was received from Mr Steve Griffin of S G Estates.
File Ref:	12463-Drainage Strategy-02

Approval Record	
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Document History		
Revision	Date	Comment
01	06/11/2019	First issue
02	27/08/2021	Second issue – Updated with permeable paving removed due to DCWW requirements

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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 instructed to prepare a Drainage Strategy in respect of a proposed residential development at land off St. Peters Close / Llay New Road, Rhosrobin, Wrexham, LL11 2UB.

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 with consideration of the Welsh Government 'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems' (2018), hereby referred to as the 'Statutory Standards'.

This report has been prepared in consultation with the SAB and Dwr Cymru Welsh Water (DCWW).

This report should be read in conjunction with the Infiltration Test Report (ref: 12463-Infiltration Test Report-01) produced by Waterco, dated November 2019.

Existing Conditions

The site covers an area of approximately 5.05 hectares (ha) and is located at National Grid Reference; 333062, 352941. A location plan and an aerial image are included in Appendix A.

Online mapping (including Google Maps / Google Streetview imagery, accessed August 2021) shows that the site is greenfield and is bordered by Plas Acton Cemetery and agricultural land to the north, a residential property and Plas Acton Road to the north-east, a railway line to the south-east, residential properties to the south and Llay New Road to the west. Pedestrian access to the site is currently provided from Plas Acton Road to the east.

Local Topography

Topographical levels have been obtained from a previous 'Draft Surface Water Drainage Layout' undertaken by Kane Design in September 2014. The topographical information shows that the site slopes from 88.67 metres Above Ordnance Datum (m AOD) in the north-west to 84.55m AOD in the east. Land to the north-west of the site, within the Client ownership, is elevated above the site with a high of 90.94m AOD recorded.

Topographic levels to m AOD have also been derived from a 2m resolution NRW composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). The LiDAR data generally corroborates the topographical levels on the 'Draft Surface Water Drainage Layout' and shows that the site and surrounding area slopes from west to east.

Topographical information is provided as Appendix B.

Ground Conditions

Reference to the British Geological Survey (BGS) online mapping (1:50,000 scale) indicates that the western extent of the site is underlain by superficial deposits of Devensian Till generally comprising diamicton. The

eastern extent of the site is underlain by Devensian Glaciofluvial Sheet Deposits generally comprising sand and gravel. The superficial deposits are identified as being underlain by the Halesowen Formation consisting of mudstone, siltstone and sandstone.

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 NRW's Aquifer Designation data, obtained from MAGIC's online mapping [accessed August 2021], the Devensian Till is classified as a Secondary Undifferentiated Aquifer. Secondary Undifferentiated Aquifers are assigned in 'cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'. The Devensian Glaciofluvial Deposits are classified as a Secondary A Aquifer. Secondary A Aquifers are '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 Halesowen Formation is also classified as a Secondary A Aquifer.

A 'Surface Water Drainage Assessment' (ref: 1241SWA-4 Rev D) was produced by Kane Design in November 2014 and included infiltration testing. Infiltration testing was successful in the eastern extent of the site, with a rate of 1.43×10^{-5} m/s recorded at Trial Pit 1 and a rate of 1.69×10^{-5} m/s recorded at Trial Pit 2. However, the infiltration tests were not undertaken in accordance with BRE 365 specification. Therefore, further infiltration testing, in accordance with the BRE 365 specification, has been undertaken by Waterco in October 2019.

The Waterco 'Infiltration Test Report' confirms that infiltration was not feasible in the developable area of the site (corresponding to the western extent of the site shown to be underlain by Glacial Till). However, two trial pits in the eastern extent of the site (corresponding to the area shown to be underlain by sand and gravel) confirmed that infiltration was feasible in this area, with infiltration rates of 1.137×10^{-5} m/s and 1.451×10^{-5} m/s recorded.

The Cranfield University 'Soilscapes' map [accessed August 2021] indicates that the site is underlain by '*freely draining... loamy soils*'.

Local Drainage

Public sewer records have been obtained from DCWW and are included in Appendix C. The sewer records show that two 150mm public foul sewers flow onto site, one from the west, and one from residential properties to the south. The sewers converge on site and flow north, before orientating east along the northern boundary of the site, becoming 225mm in diameter. The 225mm public foul sewer flows east and to a public combined pumping station located approximately 100m north-east of the site.

The public combined pumping station receives inflow from a 225mm public foul sewer, a 600mm public foul sewer and a 300mm public foul sewer.

Development Proposals

The proposed development is for approximately 111No. dwellings, access roads, public open space and soft landscaping. A proposed development plan is included in Appendix D. All dwellings and access roads will be located in the western portion of the site. The eastern portion of the site will be designated for sustainable drainage features and public open space.

The proposed development will introduce hardstanding areas in the form of buildings and roads. Hardstanding will comprise approximately 1.74ha or 34% of the total site area. The remaining permeable, soft landscaped areas will occupy 3.31ha or 66% of the total site area. The measurements are based on a PDF copy of the proposed development plan (Appendix D) and are approximate.

Planning Policy

The Wrexham Unitary Development Plan 1996-2011 (adopted February 2005) contains the following policies relating to drainage;

'Policy EC13

Development which would result in an unacceptable adverse impact on the water environment due to additional surface water run-off will not be permitted.

Policy EC14

Development Which would have an unacceptable adverse impact upon the capacity, flow, quality or availability of controlled waters and associated land will not be permitted.

The 'Management of Surface Water Generated from New Development' (Updated March 2019) from the Wrexham County Borough Council local planning guidance portal contains the following guidance;

Surface Water Design Criteria

The Flood & Water Management Team will need to be satisfied that the criteria below are being met. This will normally apply to all major development, or where local site conditions dictate.

Wrexham County Borough Council advocates that surface water run-off should be controlled as near to its source as possible. Preferably sustainable drainage systems (SuDS) should be utilised. The variety of SuDS techniques available means that virtually any development should be able to include a scheme based around these principles. Surface water should be disposed of to the receptors listed in order of priority below:

- a) Infiltrated to ground;*
- b) To a watercourse*
- c) To a surface water sewer*

d) Other

Storage of Water on Site:

The drainage system should be designed so that flooding does not occur on any part of the development for the 3.33% (1 in 30 year) rainfall event other than in those areas/systems designated to store or convey water. It may be acceptable to allow some on-site flooding of roads etc. for rainfall events beyond this. However, flooding within the development site should not occur in any part of a building or utility plant susceptible to water during a 1% (1 in 100 year) + climate change rainfall event.

Practicable Minimum Limit of Discharge

A practicable minimum limit on the discharge rate from a flow of attenuation device is often a compromise between attenuating to a satisfactorily low flow rate while keeping the risk of blockage to an acceptable level. It is suggested that this is 5 litres per second, using an appropriate vortex flow control device or other technically acceptable flow control device. The minimum size of pipe discharging from a flow attenuation device should be 150mm laid at a gradient not flatter than 1 in 150, which meets the requirements of Sewers for Adoption 7th Edition.'

Consultation

A pre-application request was submitted to the SAB in September 2019. In their response, provided as Appendix E, the SAB have stated that; *'In response to your email, in principle the scheme as indicated [an infiltration basin in the east sized to accommodate the 1 in 100 + CC event, swales, permeable surfaces used for driveways and private roads and water butts for each property] would seem in the spirit of the Welsh ministers SuDS standards. Obviously full consideration would need to be given to how swale networks etc. would work with the proposed layout, that sufficient water quality enhancement can be achieved, future management and maintenance activities are clearly understood and any adoptable SuDS features are suitably located, accessible, maintainable and have a sustainable funding mechanism.*

I do note that the infiltration testing report submitted would not appear consistent with the normally required BRE 365 standard. Particularly with regards to the number of tests undertaken at each test. I would recommend this is investigated more fully to minimise potential problems at a later date.

With regards to climate change – we would accept a 20% increase in storm intensity, and as per Welsh Ministers Standards would expect consideration be given to urban creep'.

A request was submitted to the SAB in August 2021 to confirm the acceptability of the infiltration testing to inform detailed drainage design. A response is awaited.

A pre-development enquiry request was submitted to DCWW in September 2019. In their response (Appendix C), DCWW have stated that:

'We have considered the impact of the foul flows generated by the proposed development upon the local public sewerage system and concluded that it is unlikely that sufficient capacity exists to accommodate your development without causing detriment to the existing services we provide to our customers, or in regard to the protection of the environment. Accordingly, we are unable at this stage to provide you with a point of adequacy on the network.'

In light of the above our recommendation is that you instruct us to undertake a Hydraulic Modelling Assessment of the local public sewerage network. This Assessment will examine the existing network and consider the impact of the introduction of flows from your development upon its performance. Where required and appropriate, the Assessment will then identify solutions and points of communication to ensure that your site can be accommodated within the system.

Please note that we will seek to control the outcomes of the Hydraulic Modelling Assessment via appropriate planning conditions. However in the absence of known solutions to accommodate your site we not be able to support your development through the planning process. We therefore recommend that the Assessment is undertaken in advance of the planning application being submitted in order to avoid any subsequent delays. Further information on Hydraulic Modelling Assessments as well as any implications on the planning process is provided in the attached Advice & Guidance notes...

No problems are envisaged with the Waste Water Treatment Works for the treatment of domestic discharges from this site'.

Surface Water Management

The site is not formally drained and is therefore considered to be 100% permeable.

The proposed development will introduce 1.74ha of hardstanding in the form of buildings, driveways and roads.

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 managed and sustainable drainage systems used.

In accordance with TAN15, new development should not create additional runoff when compared with the undeveloped situation.

Discharge Method

The Statutory Standards set out the following hierarchy of drainage options:

S1 – Surface water runoff destination

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 accordance with G1.4 of the Statutory 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.

With regards to the second point above, the costs associated with rainwater harvesting systems (unit costs, installation costs, running costs and maintenance costs) outweigh the water saving costs. Furthermore, section G1.6 of the 'Statutory standards for sustainable drainage systems' 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 such, rainwater harvesting systems are not considered a cost-effective solution for managing surface water and a lower priority runoff destination is required.

Water butts will be installed at each property to encourage external water re-use. A water butt is a small-scale water storage device that collects rainwater from the roof, via the downpipe. A water butt should be connected to an appropriate overflow (lower priority runoff destination).

Priority Level 2: Surface water runoff is infiltrated to ground

Infiltration tests in accordance with the BRE365 specification have been undertaken by Waterco in October 2019 to determine the suitability of infiltration. The infiltration report confirmed that infiltration is feasible in the eastern extent of the site. Infiltration is not suitable in the western portion of the site where all properties will be located.

It is therefore proposed to discharge surface water to a shared infiltration basin in the eastern extent of the site.

The infiltration basin should be situated a minimum of 5m from habitable dwellings and a minimum of 20m from the adjacent railway embankment (measured from the top of the embankment).

As infiltration is proposed, the discharge from rainfall events of less than 5mm will be prevented from leaving the site. The infiltration basin will be designed to accommodate the 1 in 100 year plus 20% CC event.

Infiltration Device Sizing

The infiltration basin has been sized using MicroDrainage software. The MicroDrainage outputs are included in Appendix F. An estimated storage volume of 1,353m³ will be required to accommodate the 1 in 100 year plus 20% Climate Change (CC) event. The storage estimate is based on an infiltration rate of 1.137 x10⁻⁵m/s (the slowest rate recorded), an impermeable drainage area of 1.914ha (including a 10% factor for urban creep) and a 1.2m deep infiltration basin with a base (invert) area of 930m², 1 in 3 side slopes and a top bank area of 1,360m².

In addition to an infiltration basin, swales will be used where practical, for example, swales will convey flow between the most downstream point of the piped drainage system within roads and the infiltration basin.

A 'Concept Drainage Plan' is included in Appendix G.

It is noted that site levels are generally lowest in the position of the proposed infiltration basin (eastern extent of the site), however, some limited land level raising may be required in the lower eastern extent of the developable site area to achieve gravity drainage.

It is noted that permeable paving has been considered for non-adoptable shared access roads, however DCWW have advised that they would not allow the use of permeable paving over their assets, for example, the proposed foul sewer which will serve the development and will be put forward to DCWW for adoption.

Exceedance Event

Storage will be provided for the 1 in 100 year plus 20% CC event. Storm events in excess of the 1 in 100 year plus 20% CC event should be permitted to produce temporary shallow depth flooding within the access roads and landscaped areas. Finished floor levels should be set at a minimum of 150mm above surrounding ground levels ensuring exceedance flooding will not affect the buildings.

Surface Water Treatment

The Statutory Standards contain the following guidance in relation to Standard S3 – Surface water quality management:

'Treatment for surface water runoff should be provided to prevent negative impacts on the receiving water quality and / or protect downstream drainage systems, including sewers.'

In accordance with the CIRIA C753 publication 'The SuDS Manual' (2015), residential roofs have a 'very low' pollution hazard level. Roads (with greater than 300 traffic movements per day) are classified as having a 'medium' pollution hazard level. Individual property driveways and low traffic roads i.e. cul-de-sacs, homezones and access roads with less than 300 traffic movements per day, are 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
Roads (>300 traffic movements per day)	Medium	0.7	0.6	0.7
Individual Property Driveways and Roads (<300 traffic movements per day)	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, roads and driveways will be directed to a swale which will convey flow to an infiltration basin. Table 2 below demonstrates the pollution hazard indices associated with swales and basins.

Table 2 – SuDS Mitigation Indices

Type of SuDS	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Swale	0.5	0.6	0.6
Basin	0.5	0.5	0.6

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

As shown in Table 2, a swale or an infiltration basin will provide sufficient treatment for runoff from roofs.

The pollution mitigation offered by a swale or basin in isolation is not sufficient to provide treatment for runoff from adopted access roads with greater than 300 traffic movements per day. However, swales in conjunction with a basin will provide sufficient treatment. Table 3 shows the combined pollution mitigation indices of a basin in conjunction with swales.

Table 3 – SuDS Mitigation Indices – Treatment Train

Type of SuDS	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Basin and swale system total index	$0.5 + 0.5 + 0.5(\times 0.5) =$ 1.25	$0.5 + 0.6 + 0.6(\times 0.5) =$ 1.4	$0.6 + 0.6 + 0.6(\times 0.5) =$ 1.2

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

Amenity

The Statutory Standards 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 swale and an infiltration basin which will maximise the amenity value of the proposed drainage system.

Biodiversity

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

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

The proposed swale and infiltration basin and associated vegetation will maximise the biodiversity value of the proposed drainage system.

Construction, Operation and Maintenance

Standard S6 of the Statutory Standards 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. An access road (for maintenance vehicles) should be provided up to the proposed infiltration basin for maintenance access.

Maintenance of private drainage features such as water butts will be the responsibility of individual property owners.

Communal drainage features such as a swale and an infiltration basin will be adopted by the SAB who will then be responsible for maintenance.

Maintenance schedules for a swale and basin are included in Appendix H.

Other Considerations

A 3m clearance either side of the 150mm public foul sewers crossing the site should be provided.

A 20m standoff from the railway cutting to the infiltration basin is required.

Foul Drainage

Correspondence from DCWW (Appendix C) states that; *'We have considered the impact of the foul flows generated by the proposed development upon the local public sewerage system and concluded that it is unlikely that sufficient capacity exists to accommodate your development without causing detriment to the existing services we provide to our customers, or in regard to the protection of the environment. Accordingly, we are unable at this stage to provide you with a point of adequacy on the network'*.

Based on the DCWW response, it is recommended that Hydraulic Modelling of the public sewerage network is undertaken at the earliest opportunity within the planning process.

Where hydraulic modelling establishes that there is capacity for foul flows from the site, foul flows should be discharged to the 150mm public foul sewer onsite or at its downstream extent in the north-eastern corner of the site. Based on topographical levels, a gravity connection appears feasible.

Conclusions

The proposed development is for approximately 111No. dwellings, access roads, public open space and soft landscaping.

The proposed development will introduce impermeable drainage area in the form of buildings, driveways and access roads. 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, sustainable drainage systems will be used to accommodate storm events up to and including the 1 in 100 year plus 20% climate change event.

Infiltration testing has been undertaken in accordance with the BRE 365 guidance. The infiltration testing found that suitable infiltration characteristics were evidenced in the eastern extent of the site. Infiltration is not considered suitable in the western extent of the site (in the location of buildings and roads).

It is proposed to accommodate the 1 in 100 year plus 20% climate change event in an infiltration basin located in the eastern extent of the site where adequate infiltration was witnessed. Additional sustainable drainage systems will also be used including swales and water butts.

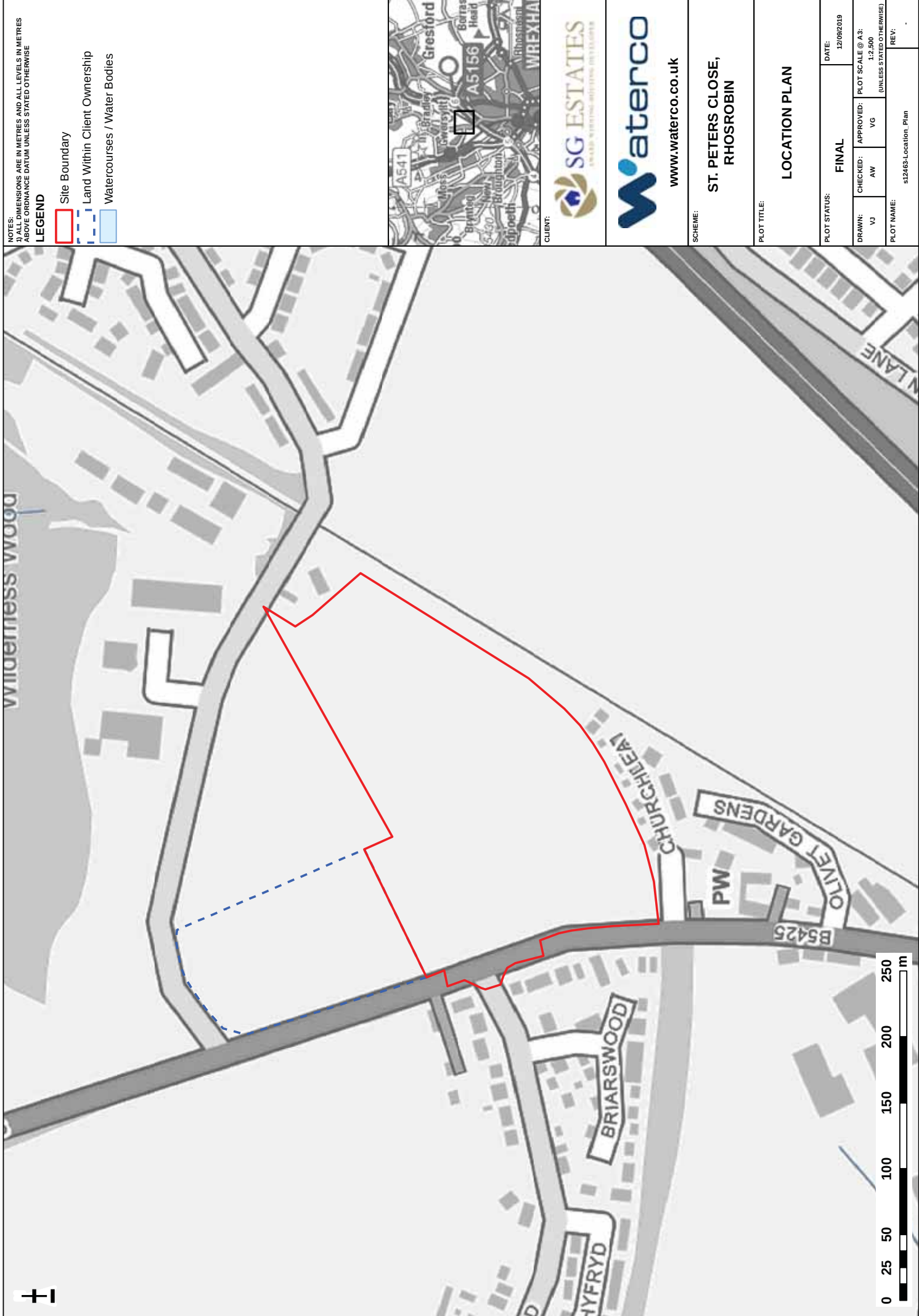
Provision of swales and an infiltration basin will ensure the development is compliant with Standards S3, S4 and S5 of the Statutory Standards.

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 I.

Recommendations

1. Make provision for an infiltration basin and a swale in the eastern extent of the site;
2. Undertake hydraulic modelling of the public sewerage network to establish whether there is sufficient capacity for foul flows from the site.

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

Land Within Client Ownership

Watercourses / Water Bodies



CLIENT:

SG ESTATES

AN ALTRA PROPERTY HOLDINGS LIMITED

www.waterco.co.uk

SCHEME:

ST. PETERS CLOSE,
RHOSROBIN

PLOT TITLE:

LOCATION PLAN

PLOT STATUS:

FINAL

DATE: 12/09/2019

DRAWN: VJ

CHECKED: AW

APPROVED: VG

PLOT SCALE @ A3: 1:2,500 (UNLESS STATED OTHERWISE)

PLOT NAME: s124631-Location_Plan

REV: .



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

Site Boundary

Land Within Client Ownership

CLIENT:

SG ESTATES
SARAH'S ESTATE AGENTS LTD

waterco
www.waterco.co.uk

SCHEME:

**ST. PETERS CLOSE,
RHOSROBIN**

PLOT TITLE:

AERIAL PLAN

PLOT STATUS:		FINAL		DATE:	12/09/2019
DRAWN:	VJ	CHECKED:	AW	APPROVED:	VG
				PLOT SCALE @ A3: 1:2,500 (UNLESS STATED OTHERWISE)	
PLOT NAME:				s12463-Aerial_Plan	
				REV:	

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, AeroGRID, IGN, and the GIS User Community

Appendix B Topographical Data

1. Survey taken from liver flapping surveys
drawing number D1029-8, 2 February 2014
Planning Layout Information taken from
AXIS ARCHITECTURAL SERVICES drawing number COL/7141-01
Revision C NOVEMBER 2014

[illegible]

FOR DISCUSSION PURPOSES ONLY

C	111 NUMBER PLATE	201104	AE	AE
B	BATCHING ADDED	200604	AE	AE
A	ARCHITECT LAYOUT REFINED TO MEET C	200604	AE	AE
Rev	Revisions	Date	Drawn	Checked

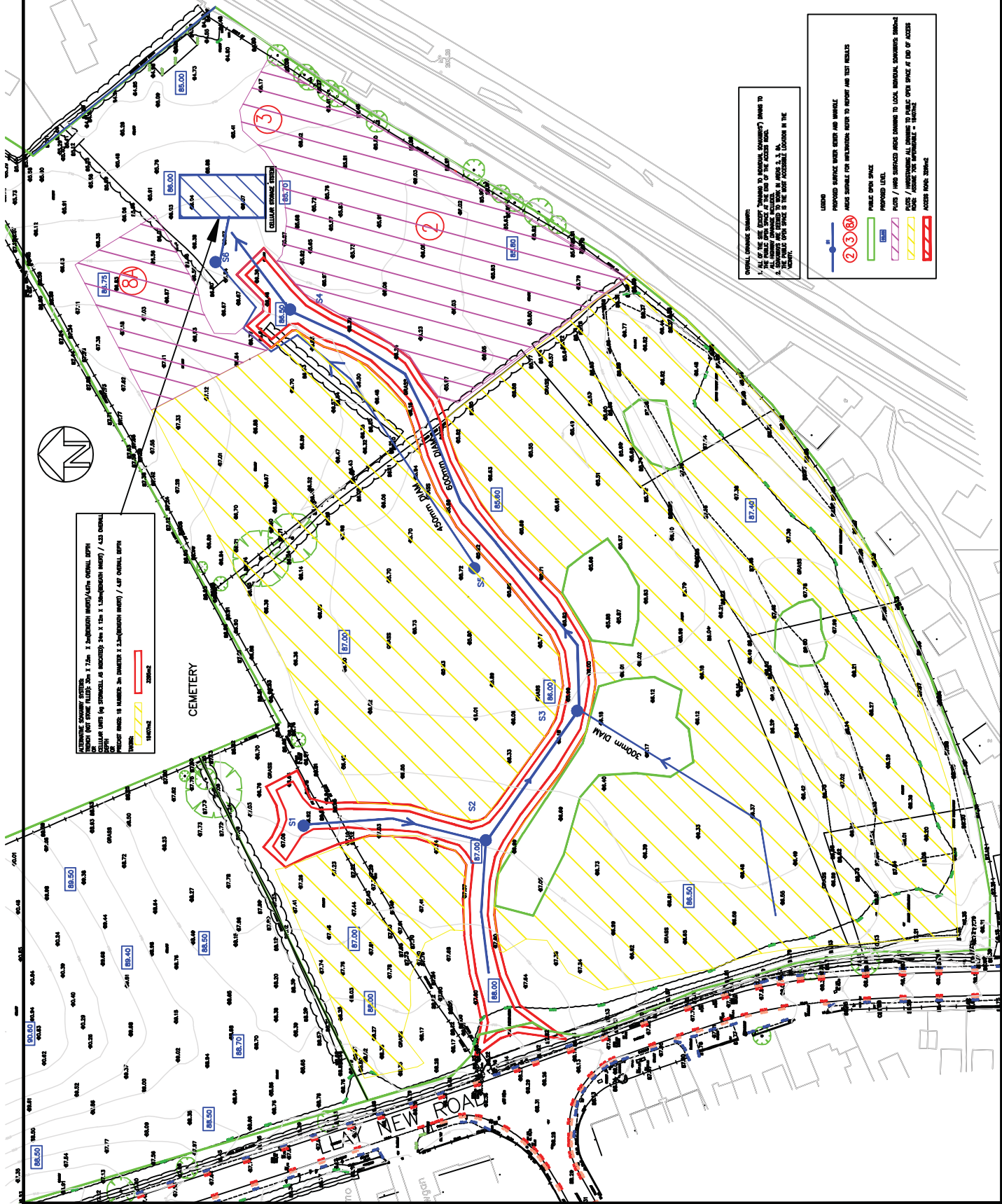
KANE DESIGN
Civil Engineering Design
15 Winchester Road

CASTLEMEAD GROUP LTD

**PROPOSED DEVELOPMENT at
LLAY NEW ROAD, RHOSGOMEN, WREKHAM**

DRAFT SURFACE WATER DRAINAGE LAYOUT

1241/101	SCHEDULE NUMBER		C
	SCALE	1:500	
	DATE	10-01-14	
	REVISION	ALL	
	COMPILED	ALL	

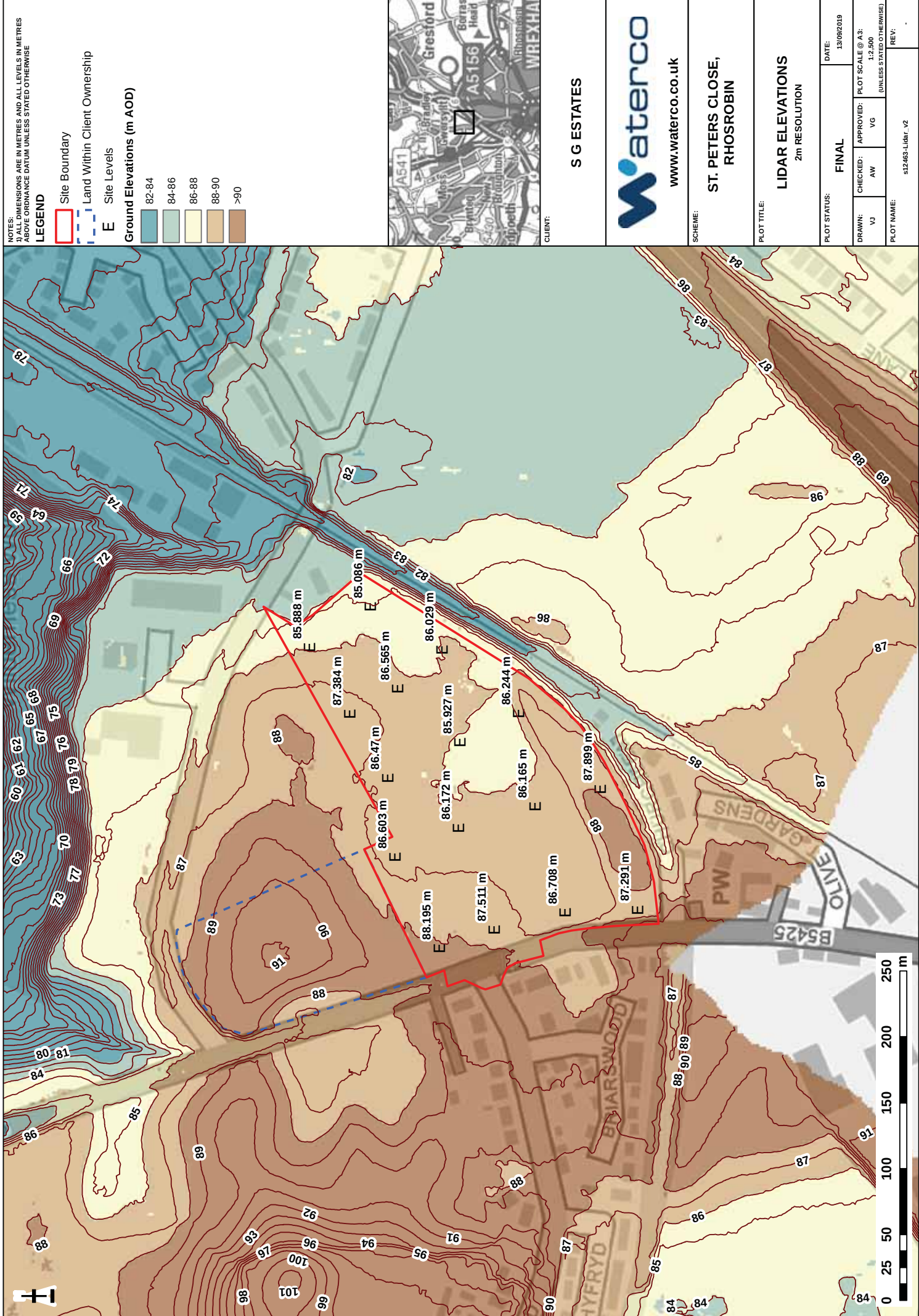


OVERALL DRAINAGE SUMMARY:

1. ALL OF THE SITE (EXCEPT "TRAINING TO REMEDIAL DOCUMENTS") DRAINS TO THE PUBLIC OPEN SPACE AT THE END OF THE ACCESS ROAD.
2. ALL "TRAINING TO REMEDIAL DOCUMENTS" DRAINS TO SEWER IN AREAS 2, 3, & 4.
3. ALL "TRAINING TO REMEDIAL DOCUMENTS" DRAINS TO SEWER IN AREAS 2, 3, & 4.

THE PUBLIC OPEN SPACE IS THE MOST ACCESSIBLE LOCATION IN THE VICINITY.

[illegible]



Appendix C DCWW Sewer Plans and Correspondence



LEGEND (Representative of most common features)



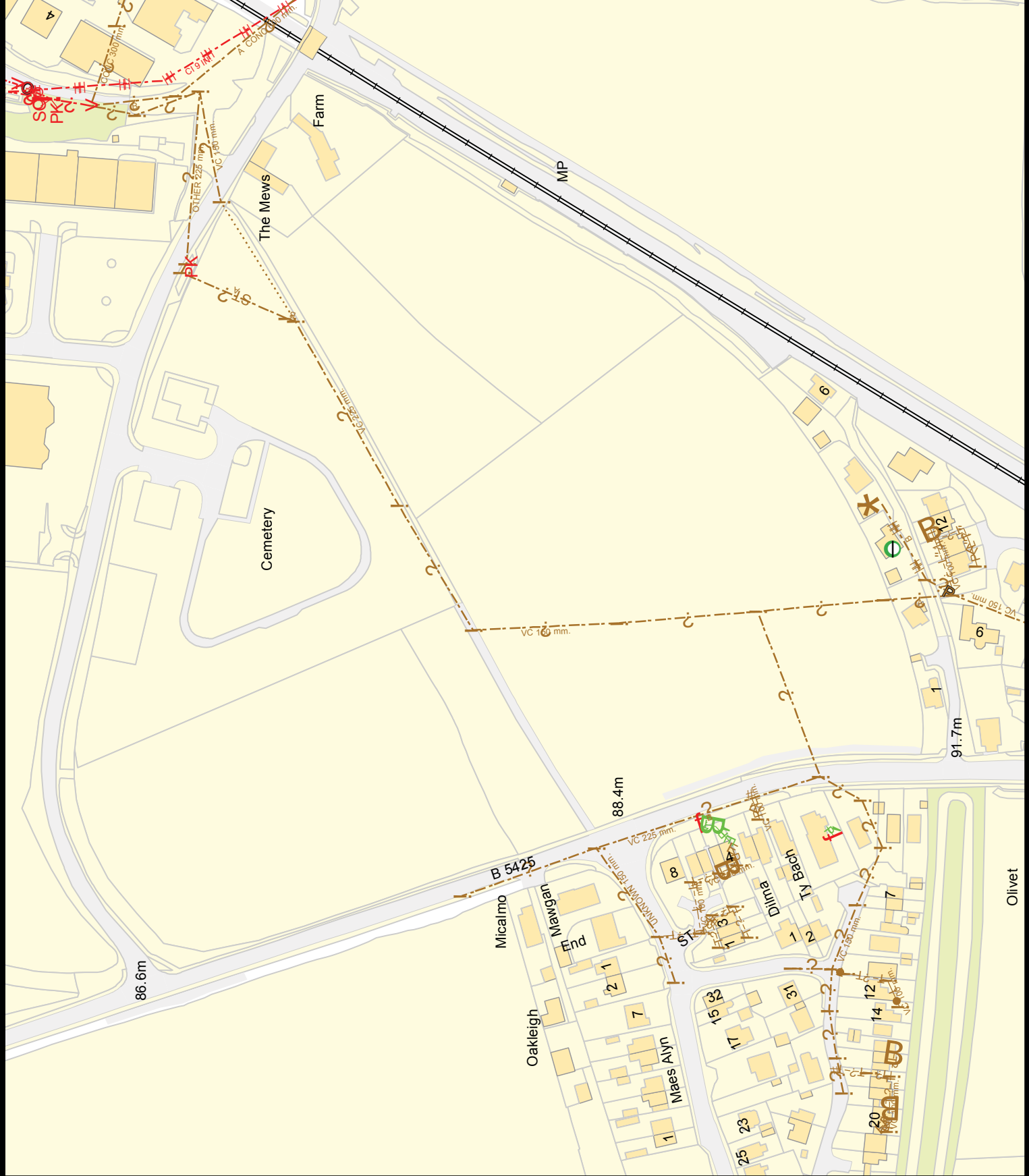
Notes:

While every care has been taken to ensure the accuracy of the information shown on this map, the user of the map should be aware that the information is provided for general guidance only and is not intended to be used for any other purpose. The user should consult the relevant authorities for more detailed information.

Exact locations of all apparatus to be determined on site. Reproduced by permission of the Ordnance Survey on behalf of HMSO. © Crown copyright and database right 2017. All rights reserved. Ordnance Survey Licence number: 100019534

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref: 333056.353009
Map scale: 1:2200
Printed by: Jenkins Tegan
Printed on: 16 Sep 2019





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CF30 0EH

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E.bost: developer.services@dwrcymru.com

Mrs Johanne Williams
Waterco
Lon Parcwr
Ruthin
Denbighshire
LL15 1NJ

Date: 13/09/2019
Our Ref: PPA0004297

Dear Mrs Williams,

Grid Ref: 333052 352947
Site Address: New Llay Road, Wrexham
Development: Rhosrobin, Wrexham

I refer to your pre-planning enquiry received relating to the above site, seeking our views on the capacity of our network of assets and infrastructure to accommodate your proposed development. Having reviewed the details submitted I can provide the following comments which should be taken into account within any future planning application for the development.

SEWERAGE

We have considered the impact of the foul flows generated by the proposed development upon the local public sewerage system and concluded that it is unlikely that sufficient capacity exists to accommodate your development without causing detriment to the existing services we provide to our customers, or in regard to the protection of the environment. Accordingly, we are unable at this stage to provide you with a point of adequacy on the network.

In light of the above our recommendation is that you instruct us to undertake a Hydraulic Modelling Assessment of the local public sewerage network. This Assessment will examine the existing network and consider the impact of the introduction of flows from your development upon its performance. Where required and appropriate, the Assessment will then identify solutions and points of communication to ensure that your site can be accommodated within the system.

Please note that we will seek to control the outcomes of the Hydraulic Modelling Assessment via appropriate planning conditions. However in the absence of known solutions to accommodate your site we not be able to support your development through the planning process. We therefore recommend that the Assessment is undertaken in advance of the planning application being submitted in order to



Welsh Water is owned by Glas Cymru – a 'not-for-profit' company.
Mae Dŵr Cymru yn eiddo i Glas Cymru – cwmni 'nid-er-elw'.

We welcome correspondence in
Welsh and English

Dŵr Cymru Cyf, a limited company registered in
Wales no 2366777. Registered office: Pentwyn Road,
Nelson, Treharris, Mid Glamorgan CF46 6LY

Rydym yn croesawu gohebiaeth yn y
Gymraeg neu yn Saesneg

Dŵr Cymru Cyf, cwmni cyfyngedig wedi'i gofrestru yng
Nghymru rhif 2366777. Swyddfa gofrestredig: Heol Pentwyn
Nelson, Treharris, Morgannwg Ganol CF46 6LY.

avoid any subsequent delays. Further information on Hydraulic Modelling Assessments as well as any implications on the planning process is provided in the attached Advice & Guidance notes.

SEWERAGE TREATMENT

No problems are envisaged with the Waste Water Treatment Works for the treatment of domestic discharges from this site.

I trust the above information is helpful and will assist you in forming water and drainage strategies that should accompany any future planning application. I also attach copies of our water and sewer extract plans for the area, and a copy of our Planning Guidance Note which provides further information on our approach to the planning process, making connections to our systems and ensuring any existing public assets or infrastructure located within new development sites are protected.

Please note that our response is based on the information provided in your enquiry and should the information change we reserve the right to make a new representation. Should you have any queries or wish to discuss any aspect of our response please do not hesitate to contact our dedicated team of planning officers, either on 0800 917 2652 or via email at developer.services@dwrcymru.com

Please quote our reference number in all communications and correspondence.

Yours faithfully,



Owain George
Planning Liaison Manager
Developer Services

Please Note that demands upon the water and sewerage systems change continually; consequently the information given above should be regarded as reliable for a maximum period of 12 months from the date of this letter.



Welsh Water is owned by Glas Cymru – a 'not-for-profit' company.
Mae Dŵr Cymru yn eiddo i Glas Cymru – cwmni 'nid-er-elw'.

We welcome correspondence in
Welsh and English

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Developer Services
PO Box 3146
Cardiff
CF30 0EH

Tel: +44 (0)800 917 2652
Fax: +44 (0)2920 740472
E.mail: developer.services@dwrcymru.com

Gwasanaethau Datblygu
Blwch Post 3146
Caerdydd
CF30 0EH

Ffôn: +44 (0)800 917 2652
Ffacs: +44 (0)2920 740472
E.bost: developer.services@dwrcymru.com

Mrs Johanne Williams
Waterco
Lon Parcwr
Ruthin
Denbighshire
LL15 1NJ

Date: 18/09/2019
Our Ref: PPA0004297

Dear Mrs Williams,

Grid Ref: SJ3305252947 333052 352947
Site: New Llay Road, Wrexham
Development: Rhosrobin, Wrexham

We refer to the pre-planning enquiry received on 30/08/2019 relating to the above site, and we can provide the following comments in respect to the proposed development.

We trust the above information is helpful. Our response is based on the information provided in your enquiry and should the information change we reserve the right to make a new representation.

If you have any queries please contact Developer Services on 0800 917 2652 or via email at developer.services@dwrcymru.com

Please quote our reference number in all communications and correspondence.

Yours faithfully,

Owain George



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Appendix D Development Plans



Rhesobin Scheme 8 - Revision 1 - K/L11/08/2013 - OPTION 3

House No. Schedule of Accommodation - Phase 1a to 1d inclusive.

House No.	House Type	Area (sq. ft.)	Area (sq. m.)
1	Three Bed Semi-Detached House Type	880	81.00
2	Three Bed Semi-Detached House Type	880	81.00
3	Three Bed Semi-Detached House Type	880	81.00
4	Three Bed Semi-Detached House Type	880	81.00
5	Three Bed Semi-Detached House Type	880	81.00
6	Three Bed Semi-Detached House Type	880	81.00
7	Three Bed Semi-Detached House Type	880	81.00
8	Three Bed Semi-Detached House Type	880	81.00
9	Three Bed Semi-Detached House Type	880	81.00
10	Three Bed Semi-Detached House Type	880	81.00
11	Three Bed Semi-Detached House Type	880	81.00
12	Three Bed Semi-Detached House Type	880	81.00
13	Three Bed Semi-Detached House Type	880	81.00
14	Three Bed Semi-Detached House Type	880	81.00
15	Three Bed Semi-Detached House Type	880	81.00
16	Three Bed Semi-Detached House Type	880	81.00
17	Three Bed Semi-Detached House Type	880	81.00
18	Three Bed Semi-Detached House Type	880	81.00
19	Three Bed Semi-Detached House Type	880	81.00
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Axis Architectural Services Ltd.
Riverside, Severn Lane, Welshpool, Powys, SY21 7BB
T: 01938 555318 H: 07790 506633 E: info@axis-architects.co.uk
L: www.axis-architects.co.uk
Land at: Lay New Road, Rhesobin, Wrexham, LL11 2UB.
Proposed Residential Development.
Client: Castlemead Group Limited.
Drawing Title: Master Plan as Proposed - Scheme No. 8 - OPTION 3
Scale: 1:1500 (A0 size) CGL1/TN1-05 K/Aug 15 T.M.J.
Date: June 2014.

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Appendix E SAB Correspondence

Johanne Williams

From: SAB <SAB@wrexham.gov.uk>
Sent: 11 September 2019 13:45
To: Johanne Williams; SAB
Subject: RE: 12463-SAB enquiry

Categories: Information received

Hi Johanne,

In response to your email, in principle the scheme as indicated would seem in the spirit of the Welsh ministers SuDs standards. Obviously full consideration would need to be given to how swale networks etc. would work with the proposed layout, that sufficient water quality enhancement can be achieved, future management and maintenance activities are clearly understood and any adoptable SuDS features are suitably located, accessible, maintainable and have a sustainable funding mechanism.

I do note that the infiltration testing report submitted would not appear consistent with the normally required BRE 365 standard. Particularly with regards to the number of tests undertaken at each test. I would recommend this is investigated more fully to minimise potential problems at a later date.

With regards to climate change – we would accept a 20% increase in storm intensity, and as per Welsh Ministers Standards would expect consideration be given to urban creep.

Happy to discuss options further if required, but would recommend consideration of our Pre application advice service prior to progressing with any full SAB application.

Regards

Neil

From: Johanne Williams [mailto:Johanne.Williams@waterco.co.uk]
Sent: 30 August 2019 09:04
To: SAB
Subject: 12463-SAB enquiry

Proposed residential development at Llay New Road, Rhosrobin, Wrexham, LL11 2UB, National Grid Reference: 333062, 352941

Dear Sir / Madam,

We have been instructed to prepare an FCA and Drainage Strategy for a proposed residential development at the above address. A site plan is attached for reference.

The proposal is for approximately 79 dwellings, access roads and soft landscaping.

Infiltration tests have been undertaken onsite, results attached. Infiltration has been successful on land to the east, within the client ownership and outside of the developable area. Trial Pit 2 (June 2014) had a rate of 1.69⁻⁵m/s. Infiltration was not successful for the trial pits on site.

It is therefore proposed to create an infiltration basin(s) in the land to the east, sized to accommodate the 1 in 100 plus 30% CC event (please confirm CC allowance – 20% or 30%?), with an approximate depth of 1m and 1 in 3

slopes. We will also aim to use swales rather than a traditional piped inflow into the basin. It is also proposed to use permeable surfaces for all driveways and shared private roads and each property will have a water butt.

Please could you advise if the above proposals are acceptable in principle to the SAB. If you would prefer a meeting to discuss options for the site please let me know.

I look forward to hearing from you.

Kind regards,

Johanne Williams LLB (Hons) PgDip MCIWEM
Environmental Consultant

Office: 01824 702220

Teams: Johanne.Williams@waterco.co.uk



Assessment, Modelling, Design

Ruthin - Chester - Manchester - London

Shortlisted for awards in the following categories;
'Innovation in Project Management' & 'Impact in Water'



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Ewch i weld - mi fedrwch chi dalu, rhoi gwybod, gwneud cais, dweud eich dweud, a dod o hyd i wybodaeth ar-lein yn www.wrecsam.gov.uk. Arbedwch bapur - meddyliwch cyn argraffu!

Mae'r neges e-bost hon ac unrhyw atodiadau wedi eu bwriadu ar gyfer yr unigolyn neu'r sefydliad y?i cyfeirir atynt yn unig. Am yr amodau llawn yngl?n ? chynnwys a defnyddio'r neges e-bost hon, ac unrhyw atodiadau, cyfeiriwch at www.wrecsam.gov.uk/top_navigation/disclaimersw.htm

We welcome correspondence in Welsh. We will respond to any correspondence in Welsh and this will not lead to any delay.

Take a look - you can pay, report, request, have your say and find information online at www.wrexham.gov.uk. Save paper - think before you print!

This e-mail message and any attachments are intended solely for the individual or organisation to whom it is addressed. For full conditions in relation to content and use of this e-mail message and any attachments, please refer to www.wrexham.gov.uk/top_navigation/disclaimers.htm

Appendix F MicroDrainage Simulations

Waterco Ltd			Page 1		
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ		12463 - St Peters Close Rhosrobin - Infiltration Basin 1 in 100 year plus 20% CC			
Date 29/10/2019 12:54 File 12463-MICRODRAINAGE.SRCX		Designed by JW Checked by AW			
XP Solutions		Source Control 2019.1			
Summary of Results for 100 year Return Period (+20%)					
Half Drain Time : 1248 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.272	0.472	7.2	475.8	0 K
30 min Summer	9.421	0.621	7.8	642.1	0 K
60 min Summer	9.577	0.777	8.5	825.4	0 K
120 min Summer	9.697	0.897	9.0	971.7	0 K
180 min Summer	9.759	0.959	9.3	1048.9	Flood Risk
240 min Summer	9.797	0.997	9.4	1097.3	Flood Risk
360 min Summer	9.839	1.039	9.6	1151.5	Flood Risk
480 min Summer	9.857	1.057	9.7	1175.1	Flood Risk
600 min Summer	9.862	1.062	9.7	1181.4	Flood Risk
720 min Summer	9.858	1.058	9.7	1177.0	Flood Risk
960 min Summer	9.838	1.038	9.6	1150.4	Flood Risk
1440 min Summer	9.790	0.990	9.4	1088.7	Flood Risk
2160 min Summer	9.718	0.918	9.1	997.8	Flood Risk
2880 min Summer	9.656	0.856	8.8	920.9	0 K
4320 min Summer	9.553	0.753	8.4	796.1	0 K
5760 min Summer	9.473	0.673	8.0	702.2	0 K
7200 min Summer	9.420	0.620	7.8	641.4	0 K
8640 min Summer	9.383	0.583	7.7	599.3	0 K
10080 min Summer	9.360	0.560	7.6	573.0	0 K
15 min Winter	9.324	0.524	7.4	533.4	0 K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	134.091	0.0	17		
30 min Summer	91.046	0.0	32		
60 min Summer	59.160	0.0	62		
120 min Summer	35.576	0.0	122		
180 min Summer	26.126	0.0	182		
240 min Summer	20.902	0.0	242		
360 min Summer	15.191	0.0	362		
480 min Summer	12.066	0.0	480		
600 min Summer	10.070	0.0	600		
720 min Summer	8.674	0.0	720		
960 min Summer	6.837	0.0	894		
1440 min Summer	4.857	0.0	1124		
2160 min Summer	3.429	0.0	1512		
2880 min Summer	2.676	0.0	1928		
4320 min Summer	1.885	0.0	2728		
5760 min Summer	1.483	0.0	3528		
7200 min Summer	1.256	0.0	4328		
8640 min Summer	1.112	0.0	5104		
10080 min Summer	1.018	0.0	5944		
15 min Winter	134.091	0.0	17		
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Waterco Ltd		Page 2
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	12463 - St Peters Close Rhosrobin - Infiltration Basin 1 in 100 year plus 20% CC	
Date 29/10/2019 12:54 File 12463-MICRODRAINAGE.SRCX	Designed by JW Checked by AW	
XP Solutions	Source Control 2019.1	

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	9.489	0.689	8.1	720.3	0 K
60 min Winter	9.661	0.861	8.8	926.6	0 K
120 min Winter	9.794	0.994	9.4	1093.4	Flood Risk
180 min Winter	9.863	1.063	9.7	1182.7	Flood Risk
240 min Winter	9.906	1.106	9.9	1239.7	Flood Risk
360 min Winter	9.956	1.156	10.1	1306.1	Flood Risk
480 min Winter	9.980	1.180	10.2	1338.2	Flood Risk
600 min Winter	9.989	1.189	10.3	1351.3	Flood Risk
720 min Winter	9.990	1.190	10.3	1352.5	Flood Risk
960 min Winter	9.977	1.177	10.2	1333.9	Flood Risk
1440 min Winter	9.920	1.120	10.0	1258.9	Flood Risk
2160 min Winter	9.839	1.039	9.6	1151.6	Flood Risk
2880 min Winter	9.759	0.959	9.3	1049.4	Flood Risk
4320 min Winter	9.619	0.819	8.7	875.9	0 K
5760 min Winter	9.507	0.707	8.2	741.7	0 K
7200 min Winter	9.427	0.627	7.8	649.2	0 K
8640 min Winter	9.368	0.568	7.6	582.3	0 K
10080 min Winter	9.327	0.527	7.4	536.0	0 K

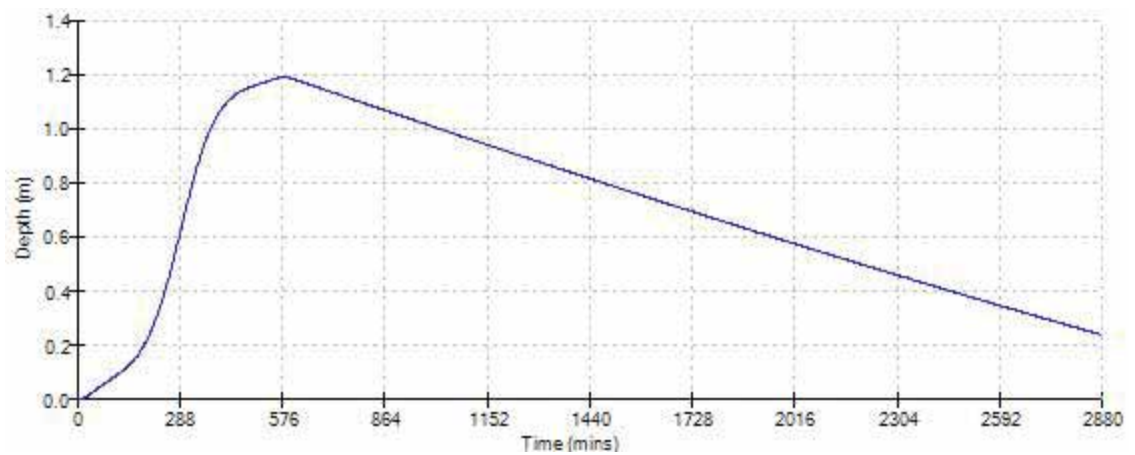
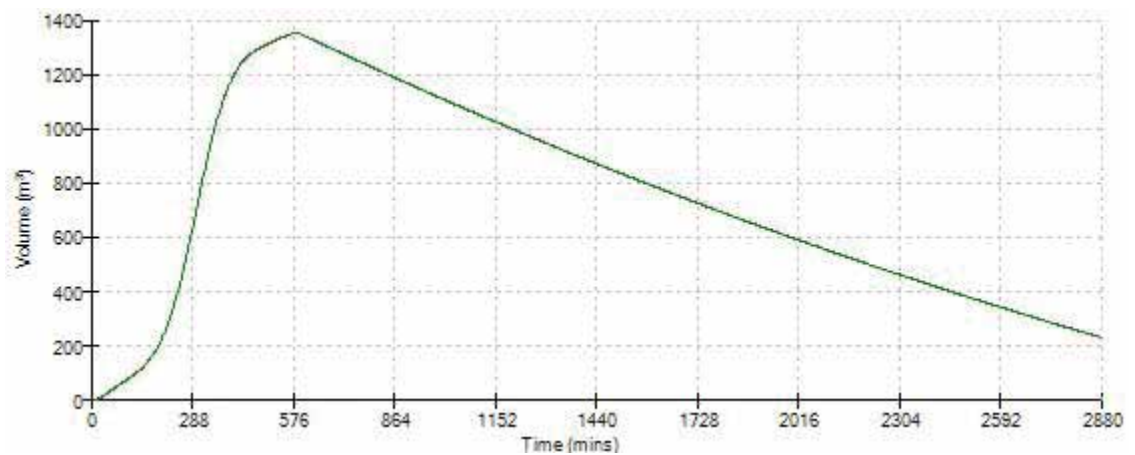
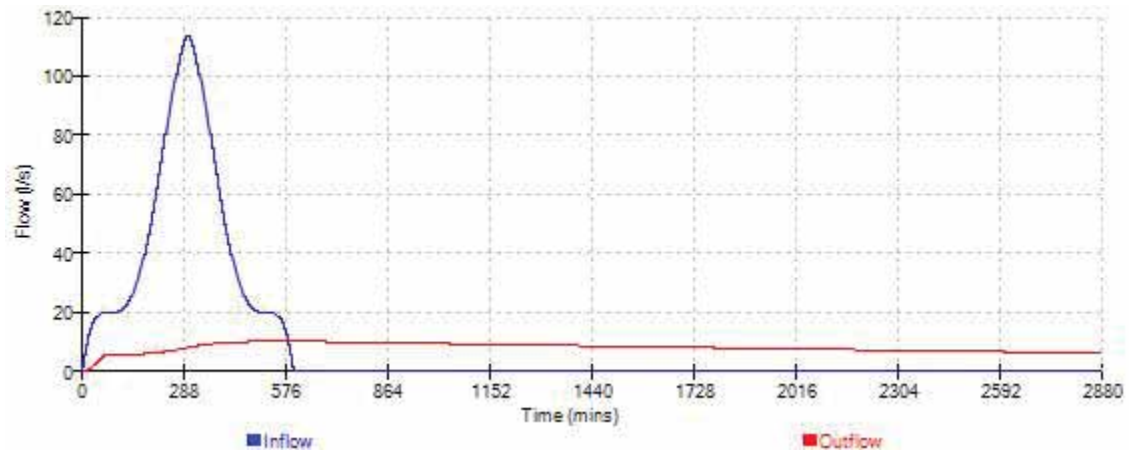
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240 min Winter	20.902	0.0	238
360 min Winter	15.191	0.0	354
480 min Winter	12.066	0.0	470
600 min Winter	10.070	0.0	584
720 min Winter	8.674	0.0	698
960 min Winter	6.837	0.0	914
1440 min Winter	4.857	0.0	1180
2160 min Winter	3.429	0.0	1620
2880 min Winter	2.676	0.0	2076
4320 min Winter	1.885	0.0	2980
5760 min Winter	1.483	0.0	3808
7200 min Winter	1.256	0.0	4616
8640 min Winter	1.112	0.0	5448
10080 min Winter	1.018	0.0	6256

Waterco Ltd		Page 3																																	
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	12463 - St Peters Close Rhosrobin - Infiltration Basin 1 in 100 year plus 20% CC																																		
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 333062 352948 SJ 33062 52948</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+20</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 1.914 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>2</td> <td>1.914</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 333062 352948 SJ 33062 52948	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+20	Time (mins)		Area	From:	To:	(ha)	0	2	1.914
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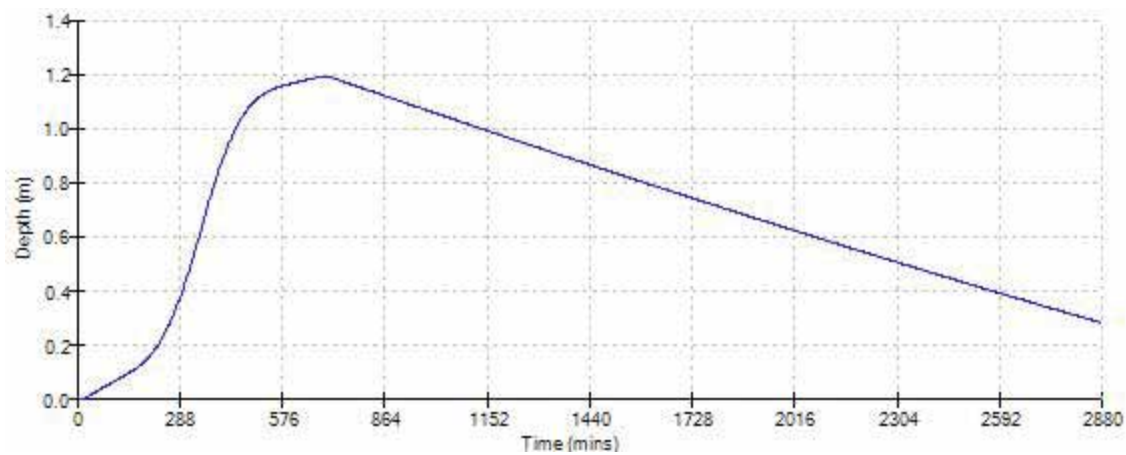
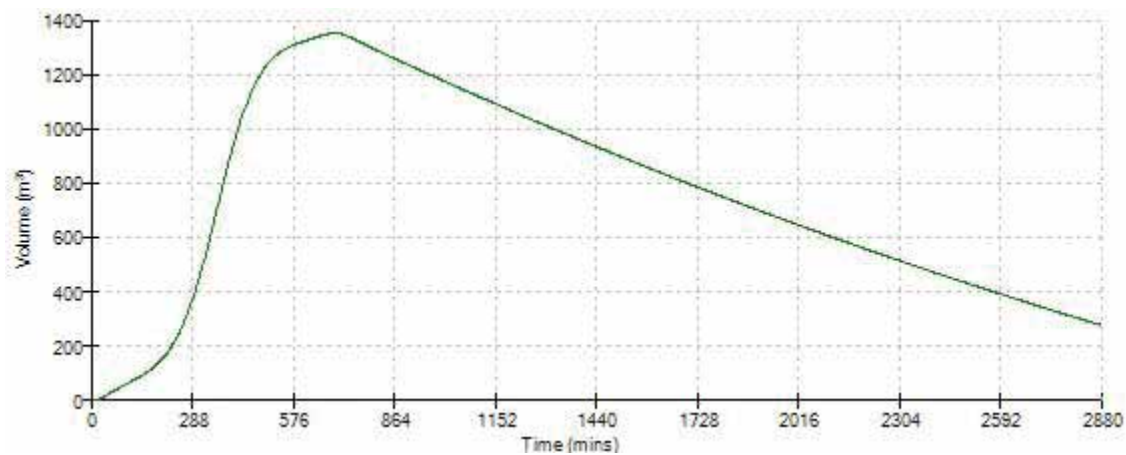
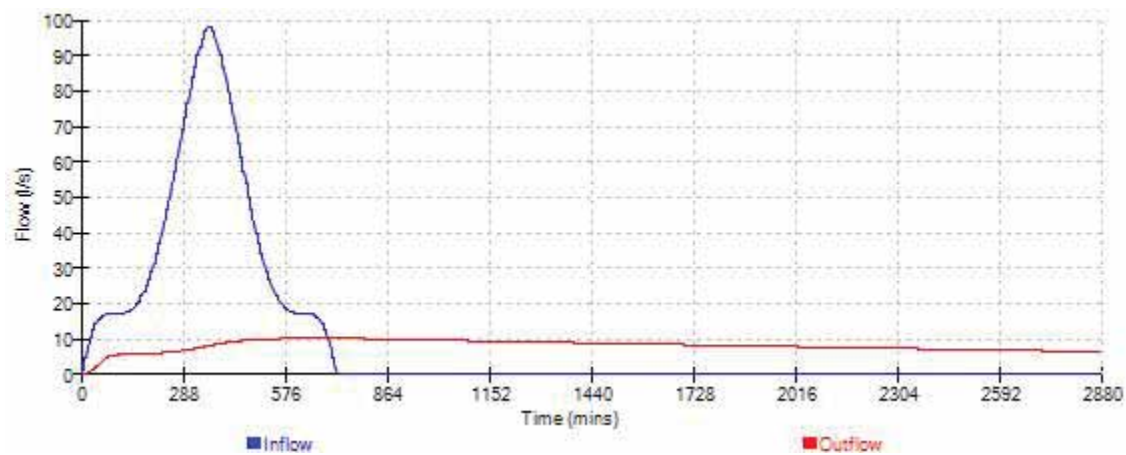
Waterco Ltd		Page 4								
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XP Solutions										
Source Control 2019.1										
Model Details Storage is Online Cover Level (m) 10.000 Infiltration Basin Structure Invert Level (m) 8.800 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.04093 Porosity 1.00 Infiltration Coefficient Side (m/hr) 0.04093 <table><thead><tr><th colspan="2">Depth (m) Area (m²)</th><th colspan="2">Depth (m) Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>930.0</td><td>1.200</td><td>1359.9</td></tr></tbody></table>			Depth (m) Area (m²)		Depth (m) Area (m²)		0.000	930.0	1.200	1359.9
Depth (m) Area (m²)		Depth (m) Area (m²)								
0.000	930.0	1.200	1359.9							
©1982-2019 Innovyze										

Waterco Ltd		Page 5
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	12463 - St Peters Close Rhosrobin - Infiltration Basin 1 in 100 year plus 20% CC	
Date 29/10/2019 12:54 File 12463-MICRODRAINAGE.SRCX	Designed by JW Checked by AW	
XP Solutions	Source Control 2019.1	

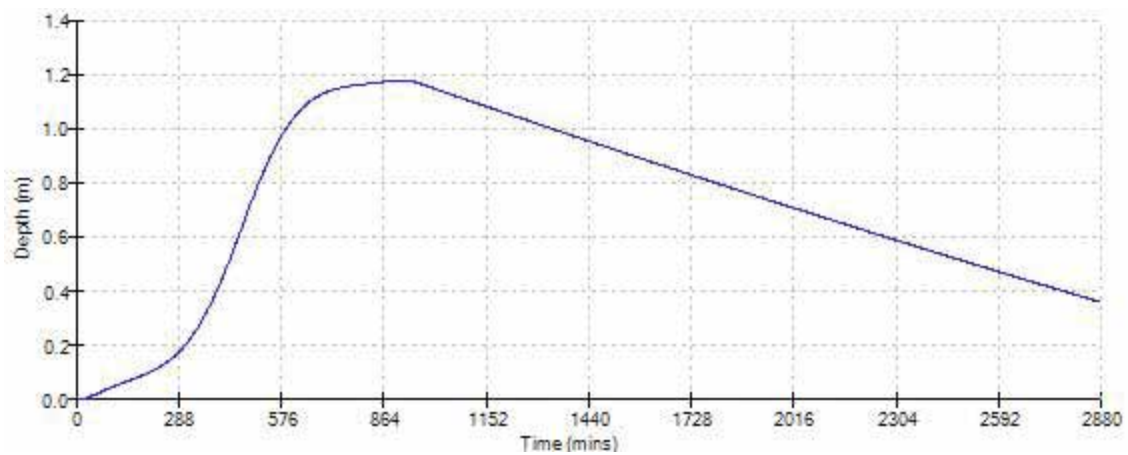
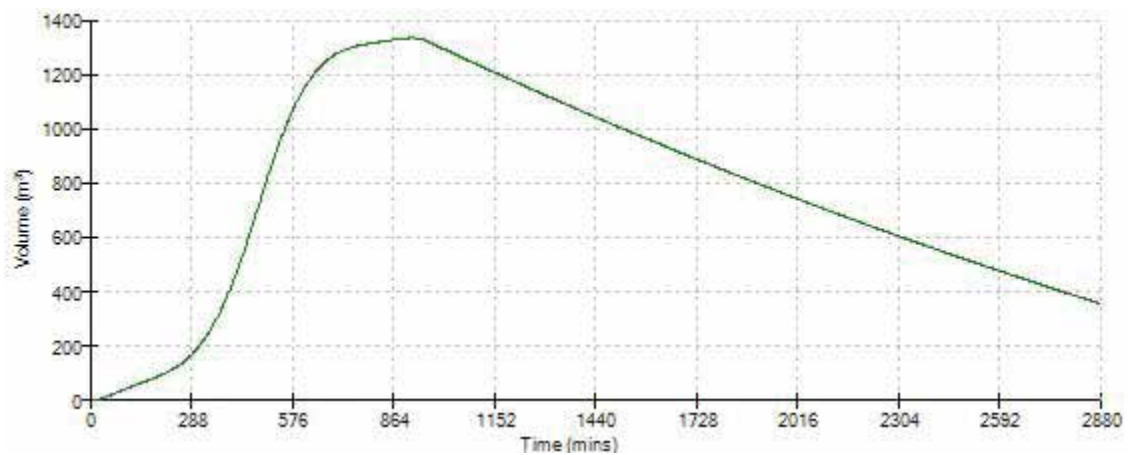
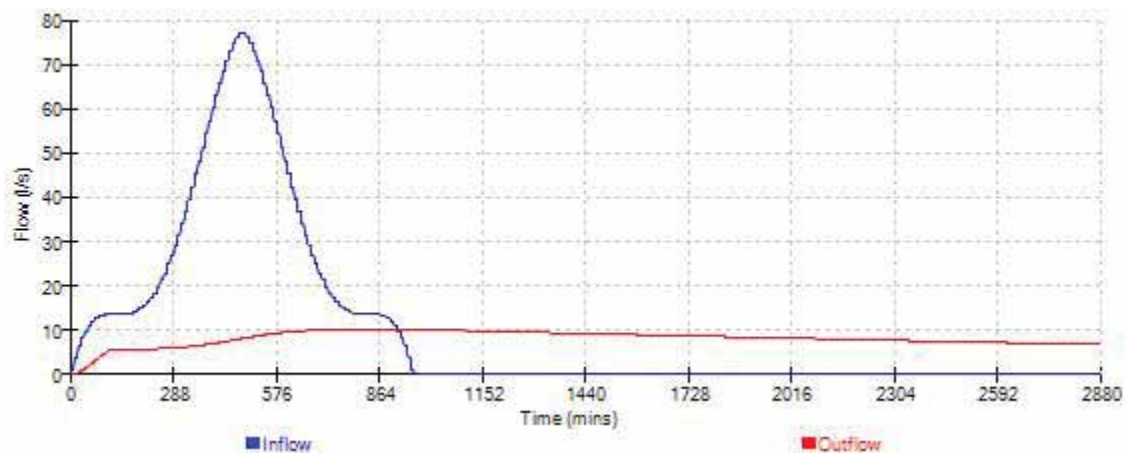
Event: 600 min Winter



Event: 720 min Winter



Event: 960 min Winter



Appendix G Concept Drainage Sketch

Concept Drainage Plan



Rhesobin Scheme 8 - Revision 1 - K111/06/20151 - OPTION 3

House No. Schedule of Accommodation - Phase 1, Lots 12 inclusive.

House No.	House Type	Area (sq.m)	Area (sq.ft)
1201	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1202	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1203	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1204	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1205	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1206	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1207	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1208	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1209	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1210	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1211	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1212	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1213	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1214	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1215	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1216	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1217	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1218	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1219	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1220	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1221	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1222	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1223	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1224	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1225	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1226	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1227	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1228	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1229	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1230	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1231	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1232	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1233	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1234	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1235	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1236	Three Bed Semi-Attached House Type	880	9,484 sq.ft
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1240	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1241	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1242	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1243	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1244	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1245	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1246	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1247	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1248	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1249	Three Bed Semi-Attached House Type	880	9,484 sq.ft
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1274	Three Bed Semi-Attached House Type	880	9,484 sq.ft
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1276	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1277	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1278	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1279	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1280	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1281	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1282	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1283	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1284	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1285	Three Bed Semi-Attached House Type	880	9,484 sq.ft
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1289	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1290	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1291	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1292	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1293	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1294	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1295	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1296	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1297	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1298	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1299	Three Bed Semi-Attached House Type	880	9,484 sq.ft
1300	Three Bed Semi-Attached House Type	880	9,484 sq.ft

Axis Architectural Services Ltd.
 Riverside, Severn Lane, Welshpool, Powys, SY21 7BB.
 T: 01938 555318 H: 07790 506633 E: info@axispost.com
 Location:
 Land at: Lay New Road, Rhesobin, Wrexham, LL11 2UB.
 Proposed Residential Development.
 Client:
 Castlemead Group Limited.
 Drawing Title:
 Drainage Plan as Proposed - Scheme No. 8 - OPTION 3
 Scale:
 1:500 (A0 size) CGL1/TN1-05 'K' Aug 15 T.M.J.
 Date:
 June 2014.

This drawing is the property of Axis Architectural Services Ltd. It is to be used for the purpose for which it was prepared and no other use without the written consent of Axis Architectural Services Ltd.

Appendix H Maintenance Schedules

Operation and Maintenance Requirements for Infiltration Basins

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass-for landscaped areas and access routes	Monthly (during growing season), or as required
	Cut grass - meadow grass in and around basin	Half yearly (spring - before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
Occasional maintenance	Reseed- areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	As required
	Remove sediment from pre-treatment system when 50% full	As required
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	As required
	Relevel uneven surfaces and reinstate design levels	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies	Half yearly
	Inspect infiltration surfaces for compaction and ponding	Monthly

Ref. Table 13.2 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 reseedling	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 I Concept Designers Risk Assessment



CONCEPT DESIGNER'S RISK ASSESSMENT

Project:

Client:

Report Reference:

St Peters Close, Rhosrobin

S G Estates

12463-Drainage Strategy-02

Project No: 12463

Prepared by:

Checked by:

Reviewed by:

Anthony Jones

Aled Williams

Victoria Griffin

Date:

Date:

Date:

24/08/2021

27/08/2021

27/08/2021

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	
2	Hazardous Environment	Unknown	
3	Existing Working Environment	Unknown	
4	Existing Services	Yes	Public foul sewer crosses site
5	Proximity to Other Structure(s)	Yes	Railway embankment adjacent to the site
6	Near Waterbody / flood risk	Unknown	
7	Proximity to Other Activities	Unknown	
8	Sequence of Construction	Unknown	
9	Access	Unknown	
10	Interfaces	Unknown	
11	Confined Space Working	Unknown	
12	Maintenance Considerations	Unknown	
13	Working at Height	Unknown	
14	Steep Slopes	Unknown	Railway embankment adjacent to the site
15	Demolition / Refurbishment / Repair	Unknown	
16	Welfare	Unknown	
17	Occupational Health	Unknown	
18	Environmental Issues	Unknown	
19	Other Significant Hazards not Identified Above	Unknown	
20	Residual Risk to Future Users	Unknown	