19th July 2021

Castle Green
Unit 20
St Asaph Business Park
St Asaph
Denbighshire
LL17 0LJ

GWAENYNOG ROAD, DENBIGH
FLOOD RISK AND DRAINAGE SCOPING EXERCISE

This Flood Risk and Drainage Scoping Statement provides a summary of the primary sources of flood risk to the development site, which is located off Gaenynog Road in Denbigh. The purpose of this exercise was to identify the primary sources of flood risk both to and from the site and to provide a sustainable surface water and foul water management strategy to support pre-application discussions with Denbighshire County Council.

SITE CONTEXT & INITIAL CONSULTATIONS

The site is located on land off Gaenynog Road in Denbigh, the nearest Ordnance Survey National Grid Reference is E: 304256, N: 366101 and the nearest postcode is LL16 3RR. Gaenynog Road is located adjacent to the southern boundary of the site and to the east is Ysgol Pendref school. Undeveloped agricultural land is also located adjacent to the northern and western boundary of the site, as illustrated in **Figure 1**.

Figure 1: Site Location and Features (Betts Hydro, 2021)

Initial consultations have been undertaken with National Resources Wales (NRW), Welsh Water (WW) and Denbighshire County Council (DCC) to obtain their historical records of flooding at the site and the most up-to-date flood data. Some responses are still outstanding but those that have been received are included within **Appendix A**, **B** and **C**).

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Flintshire CH5 2LY
Telephone: 01244 289 041

A site-specific topographic survey has been carried out to support this assessment and identified the ground levels onsite to vary from 134.56mAOD along the western boundary of site, down to a level of 121.55mAOD within the northern corner and 120.74mAOD within the eastern corner of the development site. The full topographic survey is included within **Appendix D**.

DEVELOPMENT PROPOSALS

This scoping exercise has been prepared to support pre-application discussions with Denbighshire County Council, for residential development, on land to the north of Gaenynog Road in Denbigh. Based on the planning layout (below), the proposals will be complete with access, footpaths, car parking, external works, landscaping, external services, and drainage (see full plans in **Appendix E**).

Figure 2: Proposed Planning Layout (Castle Green, 2021)

FLOOD ZONE CLASSIFICATION

The site is located within Flood Zone A based on the Welsh Government Development Advice Map (see **Appendix A**). Flood Zone A is an area considered to be at little/no fluvial and/or tidal flood risk. The proposed development is residential in nature, and therefore considered to be highly vulnerable within TAN15, which is the key planning policy guidance for Wales in relation to flood risk matters. In accordance with TAN15 highly vulnerable development is considered acceptable within Flood Zone A, providing surface water is appropriately managed.

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FLOOD RISK SUMMARY

As part of this initial exercise, we have obtained and reviewed the most up to date flood data available. This flood mapping has identified the key development considerations relating to flood risk. **Table 1** summarises these key flood risks and the subsequent sections will consider how these risks might impact the development proposed.

Table 1: Key Flood Sources and Level of Risk (Betts Hydro, 2021)

SOURCE OF POTENTIAL FLOOD RISK		RISK RATING		COMMENT
Surface Water / Pluvial		🟢	Low	The online national flood mapping shows that the site is not at risk from surface water flooding. The potential flood risk to the site from this source is therefore considered to be low. Full mapping data has been included within **Appendix A**.
Groundwater		🟢	Low	The site is located within a low Groundwater Vulnerability Zone and no records of historic flooding at the site have been identified. The potential flood risk from groundwater is therefore anticipated to be low.
Artificial Sources	**Reservoirs**	🟢	Low	The national flood mapping shows that the site is not at risk from reservoir flooding should a breach or failure occur.
	Canals	🟢	Low	There are no canals located within proximity to site, the potential flood risk associated is therefore low.
	Sewers	🟢	Low	Welsh Water has not identified any historic sewer flooding within the vicinity of site. The potential risk associated is therefore low.
Fluvial • ***Main Rivers*** • ***Ordinary Watercourse*** • ***and Drainage Features***		🟢	Low	The nearest Main River is Afon Ystrad which is located 1km to the south of site. From the review of the mapping the fluvial flood risk from this source is understood to be low given the surrounding catchment topography and the distance from site. The mapping has however identified an unnamed Ordinary Watercourse 20m to the north of site. From the review of the mapping the fluvial flood risk from this source is also understood to be low given the existing topography onsite which falls towards the watercourse.
Tidal		🟢	Low	The North Wales coastline and the River Dee Estuary is located over 20km to the north of the site. Given the distance from site, the proposed tidal flood risk to the site is therefore also considered to be low, as shown within the mapping included within **Appendix A**.

Legend: 🟢 Very low / Low 🟡 Medium 🔴 High

Overall, the site is at 'low' flood risk from all of the flood sources reviewed including surface water flooding. Furthermore, consultation with Natural Resources Wales (NRW), Denbighshire County Council (DCC) and Welsh Water (WW) has been undertaken and has failed to identify any historic flooding directly to site, from any fluvial or tidal sources.

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SURFACE WATER MANAGEMENT

In order for the development proposals to be justified in line with the guidance set out in TAN15, development must not increase flood risk elsewhere within the catchment and were possible offer improvement on the pre-development situation.

Surface water management is therefore a key focus. The following section will briefly consider the potential methods for a sustainable drainage management regime to cater for the proposed residential dwellings on the site. This is not a detailed drainage design, but a strategic overview of the opportunities based on sustainable drainage hierarchy. The Welsh Government: 'Statutory standards for sustainable drainage systems' (2018) are aimed at ensuring that the most effective drainage scheme is delivered for protecting and enhancing both the natural and built environment.

Standard S1 comprises 5 Levels with the most preferred level represented by Level 1, and movement from Level 1 to lower levels determined by demonstration that the exception criteria apply. The Fixed Standards S2 to S6 do not have exception criteria and prioritised levels. They specify all the criteria that need to be met in order to show compliance to the Standards.

Standard 1 – Surface Water Run-Off Destination

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

Surface water re-use is applicable for residential properties. An external water butt will be provided for each dwelling to collect rainwater from roof tops, to promote domestic external water re-use. Internal rainwater harvesting systems are not proposed.

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

Any proposed impermeable areas that can drain to soakaway or an alternative method of infiltration would significantly improve the sustainability of any surface water systems and be justified in line with SuDS Standards for Wales. The published online datasets and FEH catchment data has identified that conditions would not support a full infiltration-based surface water management regime at the site due to the underlying strata.

This is further supported by a Site Investigation & BRE 365 Soakaway Assessment undertaken by e3p in March 2021 (ref: 14-810-L1). The report identified that all tests showed cohesive drift deposits to have minimum soakage potential and with consideration to the impermeable clay underlying the site, it is considered that soakaway drainage would not be suitable for the proposed development.

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

As infiltration is not able to offer a full surface water management solution for the proposals. It is proposed that the site has a formal connection into the unnamed Ordinary Watercourse located 20m to the north of the site, as shown within **Figure 3** (full plans in **Appendix F**). Formal consents and agreement will need to be obtained in due course from the LLFA and detailed design will need to refine the strategy, based on engineering constraints and final layout.

In terms of surface water proposals, policy states that new development should minimise the run-off generated by new impermeable areas. Restricting run-off from new development to mimic a pre-development greenfield equivalent where at all practical. Based on the total

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site area, the pre-development greenfield rate (QBar) is calculated to be 11.1l/s (3.9l/s/ha) using the FEH Statistical Method.

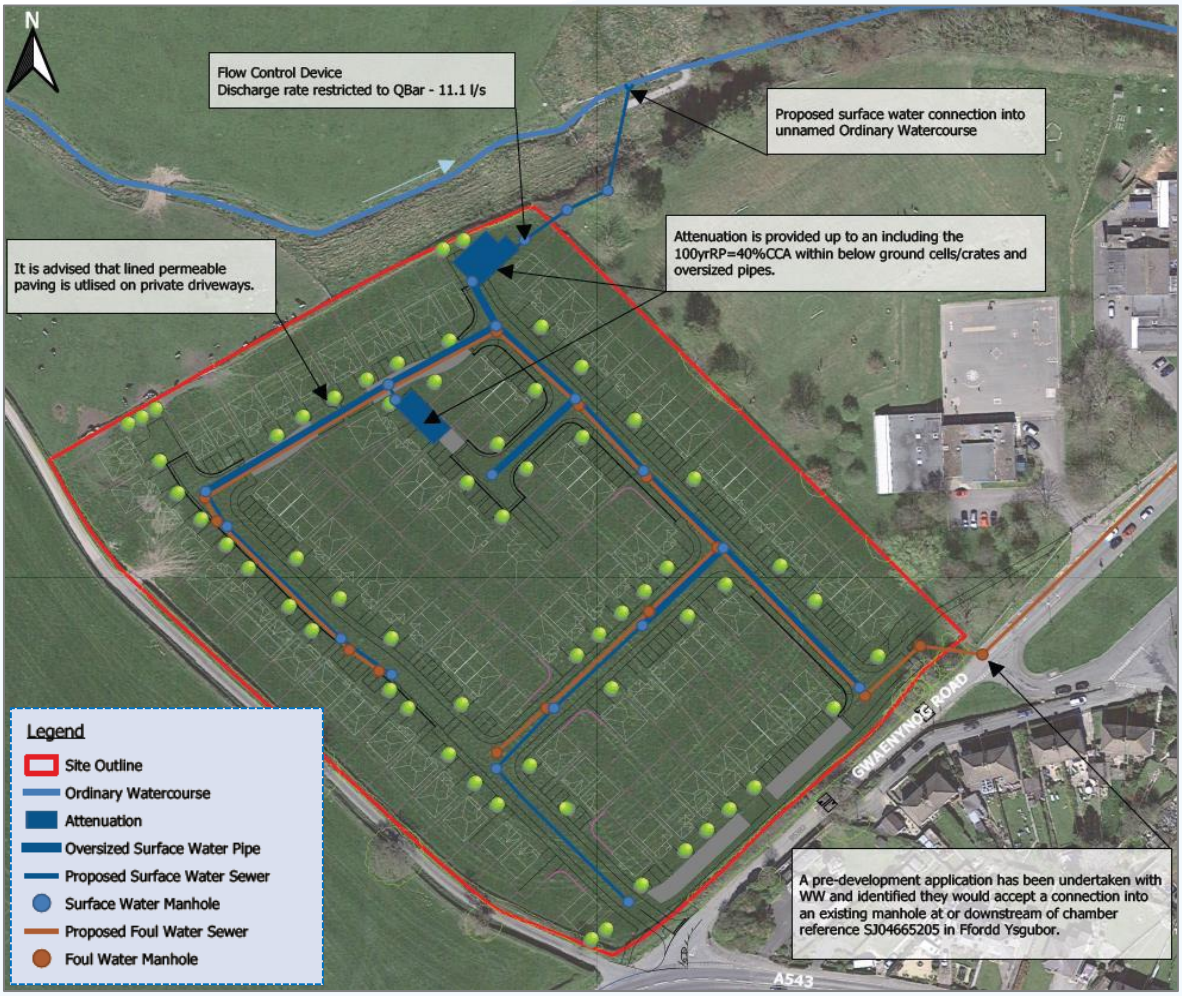

Figure 3: Preliminary Proposed Drainage Plan extract (Betts Hydro, 2021)
This drawing is not a drainage 'design' it is a preliminary drainage strategy. The location and sizes of proposed assets are not to scale or in fixed locations.

The proposals for future surface water management are therefore to restrict surface water run-off to mimic a pre-development greenfield situation. Restricting the rate of discharge will generate a requirement to provide onsite stormwater storage for the extreme rainfall events. The stormwater storage figures quoted in **Table 2** (**Appendix G**) are estimates only. Detailed design will determine with accuracy the attenuation requirements.

Imperm Area (1.87ha)	1 In 1 Year	1 In 30 Year	1 In 100 Year + 40% CC
Restricted Run-Off Rate	11.1l/s	11.1l/s	11.1l/s
Estimated Stormwater Storage Volume	229cu.m-408cu.m	645cu.m-947cu.m	1444cu.m-1917cu.m

Table 2: Estimated Stormwater Storage Requirements (Betts Hydro, 2021)

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

As infiltration is understood not to be feasible the proposals are to discharge surface water run-off from the proposed development site into the neighbouring watercourse. There are no proposals to discharge surface water run-off into a public surface water sewer, highway drain or any other drainage system.

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

As infiltration is understood not to be feasible, the proposals are to discharge surface water run-off from the proposed development site into the neighbouring watercourse. There are no proposals to discharge surface water run-off into a public combined sewer.

Standard 2 – Surface Water Run-Off Hydraulic Control

This Standard applies to discharges to surface water bodies, surface water sewers or combined sewerage systems. As the proposals are to discharge surface water run-off from the site to the Ordinary Watercourse located to the north, mimicking the existing pre-development greenfield regime, this ensures that there is no increased flood risk to others because of the development and through appropriate design will ensure no increased flood risks when climate changes are considered in the future.

The specific drainage infrastructure to be implemented will be confirmed during the detailed design stage following discussion with all relevant parties and confirmation of the ground conditions. The overall the surface water drainage regime will be designed to manage the run-off generated in the storm events up to and including the 1 in 100 year return period event with 40% allowance for climate change.

Standard 3 – Water Quality

The proposed drainage regime will look to address the design requirement associated with Water Quality in multiple ways. The key being the incorporation of multiple stages of water treatment prior to discharge from the site. Permeable private driveways are proposed throughout, although infiltration is not viable the benefits of filtration for water quality improvement can be obtained.

As infiltration is not viable attenuation is proposed; due to levels constraints and viability containing the space available to achieve surface solutions it is necessary to contain the stormwater below ground, this will be achieved using over-sized pipes and cellular/crate storage. Planting will also be considered where appropriate to provide additional benefits for any run-off entering the main drainage system.

Standard 4 – Amenity

The developer will consider the use of external rainwater butts in rear gardens of properties to encouraging residents to get involved with water and resource control at a domestic level. Rainwater butts would not be suitable to cater for all the run-off generated by the development which is why the wider site will look to include the use of lined permeable driveways.

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Standard 5 – Biodiversity

The proposed drainage regime will look to address the design requirements associated with biodiversity by encouraging residents to get involved with water and resource control at a domestic level through the use of rainwater butts in rear gardens of properties. Furthermore, the proposed permeable driveways, will be designed to promote the maximum benefits in terms of biodiversity. Any planting proposed will be native to the area and provide benefits to natural and local ecosystems, the specific design and criteria will be confirmed during detailed design, in conjunction with an appropriate ecologist.

Standard 6 - Design of Drainage for Construction, Operation and Maintenance

From January 2019, all new developments of at least 2 properties or over 100m² in Wales will be required to have Sustainable Drainage Systems (SuDS) to manage surface water run-off generated by the proposals. These SuDS must be designed and constructed in accordance with the Welsh Government SuDS standards for Wales guidance and Schedule 3 of the Flood and Water Management Act 2010 (FWMA), which establishes Denbighshire County Council as a SuDS Approval Board (SAB).

Further details regarding the construction operation and maintenance of the proposed SuDS onsite will be provided as part of a full Drainage Management Strategy as part of a full planning application.

FOUL WATER MANAGEMENT

At present there are no foul water flows generated by site and no existing foul water connections. Welsh Water sewer records show limited public sewer assets within the vicinity of site. A pre-development application has been undertaken with WW and identified they would accept a connection into an existing manhole at or downstream of chamber reference SJ04665205 in Ffordd Ysgubor (see correspondence in **Appendix C**)

The proposals are therefore to discharge foul water flows, via a new connection from site into existing manhole at or downstream of chamber reference SJ04665205 in Ffordd Ysgubor, subject to consent and agreement with WW (see Proposed Level and Drainage Plans included within **Appendix F**).

Any offsite asset routing works will also need to be considered in terms of consents with the relevant landowners (Highways Authority). Detailed design will be required to confirm feasibility of the strategy based on the topographic levels following further detailed investigations.

CONCLUSION

This Flood Risk and Drainage Scoping Statement has identified the key considerations in terms of flood risk and drainage at the site. The findings of this exercise are that the potential flood risks are either very low or can be sufficiently catered for through further detailed assessment and the implementation of mitigation measures. The incorporation of a sustainable and appropriate surface water and foul water management regime for any future development can also be achieved in accordance with planning policy.

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I trust that the above information summarises the flood risk and drainage scoping exercise and illustrates that the site can be developed providing appropriate design and mitigation is implemented to safeguard future proposals against the primary risks identified. If you have any further queries or require further information, please do not hesitate to contact us.

Yours sincerely

Megan Berry *BSc (Hons) MCIWEM*
Flood Risk Analyst

Attached:

Appendix A – NRW Consultation and Mapping Data
Appendix B – Denbighshire County Council Correspondence
Appendix C – Welsh Water Correspondence & Data
Appendix D – Topographic Survey
Appendix E – Proposed Planning Layout
Appendix F – Pre and Post Drainage Plans
Appendix G – Surface Water Calculations and Storage Estimates

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APPENDIX A – NRW CONSULTATION AND MAPPING DATA

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Megan Berry

From: Megan Berry
Sent: 14 May 2021 13:37
To: 'datadistribution@cyfoethnaturiolcymru.gov.uk'
Subject: PRODUCT 5 & 6
Attachments: LOCATION PLAN.pdf

To whom it may concern,

Gwaenynog Rd, Denbigh LL16 3RU

Please could you confirm whether you have any information that you feel would be valuable to a Flood Consequence Assessment and Drainage Management Strategy for the above site (location plan attached), including details of historical flooding and Specific Drainage Requirements; this would be greatly appreciated. If there are any other specific requirements that you require in a scope of works for this site please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards

Megan Berry BSc(Hons) MCIWEM
Flood Risk Analyst

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Consulting Engineers

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meganberry@betts-associates.co.uk
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SUDS | STRUCTURAL SURVEYS | PARTY WALL DUTIES | INFILTRATION | GEOTECHNICAL

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APPENDIX B – DENBIGHSHIRE COUNTY COUNCIL CORRESPONDENCE

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Megan Berry

From: Megan Berry
Sent: 14 May 2021 13:36
To: 'yourvoice@denbighshire.gov.uk'
Subject: FLOOD RISK INFORMATION
Attachments: LOCATION PLAN.pdf

To whom it may concern,

Gwaenynog Rd, Denbigh LL16 3RU

Please could you confirm whether you have any information that you feel would be valuable to a Flood Consequence Assessment and Drainage Management Strategy for the above site (location plan attached), including details of historical flooding and Specific Drainage Requirements; this would be greatly appreciated. If there are any other specific requirements that you require in a scope of works for this site please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

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Kind Regards

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Flood Risk Analyst

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APPENDIX C – WELSH WATER CORRESPONDENCE & DATA

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Megan Berry

From: Megan Berry
Sent: 14 May 2021 13:36
To: 'Sewerage.Services@dwrcymru.com'
Subject: SEWER FLOOD RISK INFORMATION
Attachments: LOCATION PLAN.pdf

To whom it may concern,

Gwaenynog Rd, Denbigh LL16 3RU

Please could you confirm whether you have any information that you feel would be valuable to a Flood Consequence Assessment and Drainage Management Strategy for the above site (location plan attached), including details of historical flooding and Specific Drainage Requirements; this would be greatly appreciated. If there are any other specific requirements that you require in a scope of works for this site please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards

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Flood Risk Analyst

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Maes
Haulfryn
Glasfryn
LLOYD AVENUE
TCB
El
Ysgol Pendref
Llwyn-On
LB
Recreation Ground
Play Area
Path
GWAENYNOG ROAD
B5382
BRYN GARTH
GORON
El Sub Sta
DRE
AVENUE
GP
125.7m
122.1m
117.9m
A 543
Lay-by
136.6m
143.7m
101.7m
100.3m
VC 225mm
VC 150mm
CONC 225mm
S104
PVC 150mm

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APPENDIX D – TOPOGRAPHIC SURVEY

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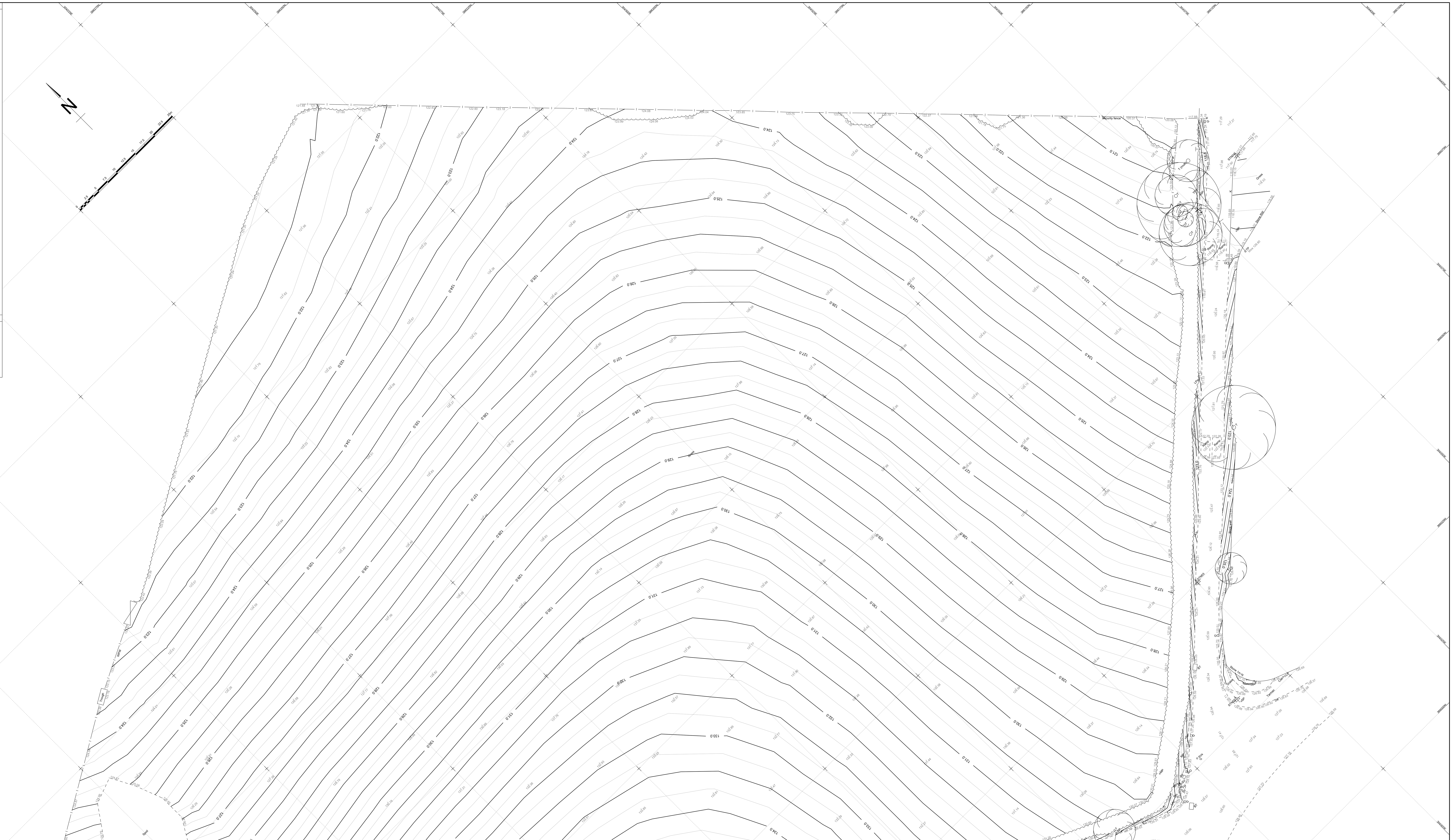
ANNOTATION LEGEND

AV	AIR VALVE
BH	BOREHOLE
Bin	LITTER BIN
BL	BED LEVEL
Bol	BOLLARD
BS	BUS STOP
BT	BRITISH TELECOM COVER
C/Rack	CABLE RACK
CATV	CABLE TELEVISION
Cab	CABINET
CCTV	CLOSED CIRCUIT TELEVISION
CL	COVER LEVEL
Clawdd	HEDGE/WALL MOUND
Col	COLUMN
Cover	COVER (OTHER)
Conc	CONCRETE
Cul	CULVERT
DC	DRAIN CHANNEL
Dia	DIAMETER
Dis	DISUSED
Dilap	DILAPIDATED
DK	DROP KERB
DP	DRAIN PIPE
DSW	DRY STONE WALL
EK	EDGING KERB
Elec	ELECTRICITY COVER
EL	EAVES LEVEL
EP	ELECTRICITY POLE
ER	EARTHING ROD
FFL	FINISHED FLOOR LEVEL
FH	FIRE HYDRANT
Fig	FEEDS INTO GROUND
FL	FLOODLIGHT
FP	FENCE POST
FS	FLAG STAFF
G	GULLY
Grav	GRAVEL
H/C	HARDCORE
IC	INSPECTION COVER
IL	INVERT LEVEL
K	KERB
LB	LETTER BOX
LP	LAMP POST
MH	MANHOLE
Mkr	MARKER
Mkrs	MARKERS
MP	MARKER POST
NB	NOTICE BOARD
NP	STREET NAME PLATE
P	POST
Pav	PAVED
PH	POST HOLE
PLP	PEDESTRIAN LAMP POST
RE	RODDING EYE
RL	RIDGE LEVEL
RS	ROAD SIGN
R/W	RETAINING WALL
RWP	RAIN WATER PIPE
Sap	SAPLING
SB	STAGGERED BARRIERS
SL	SOFFIT LEVEL
SP	SIGN POST
Stay	STAY WIRE
St	STUMP
ST	STOP TAP
STG	STOP TAP GAS
STW	STOP TAP WATER
Sub-Stn	SUB STATION
SV	STOP VALVE
SVG	STOP VALVE GAS
SVW	STOP VALVE WATER
T	TREE
Tac	TACTILE PAVING
TL	TRAFFIC LIGHT / THRESHOLD LEVEL
TP	TELEPHONE POLE
Trans	TRANSFORMER
UTL	UNABLE TO LIFT
VP	VENT PIPE
W	WATER
WL	WATER LEVEL
WO	WASH-OUT POINT
WM	WATER METER
WP	WASTE PIPE

FENCE TYPE ABBREVIATIONS

BW	BARBED WIRE
CB	CLOSE BOARDED
CI	CORRUGATED IRON
CL	CHAIN LINK
CP	CONCRETE POST
IR	IRON RAILING
MR	METAL RAILING
PAL	PALISADE
R	RAILING
SEC	SECURITY
SP	STOCK PROOF
WM	WIRE MESH
WP	WOODEN POST



All efforts have been made to identify all visible features above ground - it is possible that features may have been obscured at the time of survey due to parked vehicles, debris or vegetation.

No allowance has been made for sub-surface entry into manholes, other chambers or voids below ground level. Therefore, any details relating to depths, pipe sizes, flow directions etc were taken from above ground and as such will be approximate only. The routes of buried services shown on this drawing may be assumed and may require further work to validate their positions.

All critical measurements should be checked on site prior to design and no liability will be taken for this survey if passed on to third parties. If there is any conflict between the detail shown on this drawing and those shown on other drawings, Co-Surveys Ltd should be informed as soon as possible and prior to any design or construction works taking place.

Station	Easting	Northing	Level	Station description
STN01	304259.01	366015.45	129.46	Road nail
STN02	304289.68	366028.98	126.88	Road nail
STN03	304300.14	366050.02	124.74	Road nail
STN04	304362.81	366102.11	117.80	Road nail

PROJECT

TOPOGRAPHIC SURVEY
FIELD ADJACENT TO PENDREF SCHOOL
DENBIGH

CLIENT DENBIGHSHIRE COUNTY COUNCIL
CALEDFRYN
SMITHFIELD ROAD
DENBIGH
LL16 3RJ

ORIGINAL DRAWING BY

Co - Surveys Ltd
Survey House
Unit 7 Parc Caer Seion
CONWY
LL32 8FA
Tel (01492) 593367
mail@co-surv.com

ISO 9001 QUALITY ASSURANCE MANAGEMENT · ISO 14001 ENVIRONMENTAL MANAGEMENT · OHSAS 18001 OCCUPATIONAL HEALTH & SAFETY

THE SURVEY ASSOCIATION FULL MEMBER

8 January 2021

NOTES

GRID - Related to OSGB36 via GNSS and OSTN15 at STN03
Scale factor 1.0

LEVELS - Related to OS Newlyn Datum via OSGM15

SCALES

HORIZONTAL 1:250
VERTICAL N/A

DRAWING REFERENCE

10490 / 1 (sheet 1 of 1)

SURVEYED	PROCESSED	APPROVED
AJ/COH	TAL	AJ/COH

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APPENDIX E – PROPOSED PLANNING LAYOUT

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SCHEDULE OF ACCOMMODATION

HOUSETYPE	DESCRIPTION	SQFT	NUMBER	PERCENTAGE
2P1B (Affordable)	1 Bed, Walk up flat - Ground Floor	529 SQFT	2	1.82
2P1B (Affordable)	1 Bed, Walk up flat - First Floor	609 SQFT	2	1.82
4P2B (Affordable)	2 Bed, 2 Storey, End/Mid-Terrace	880 SQFT	14	12.73
5P3B (Affordable)	3 Bed, 2 Storey, End-Terrace	999 SQFT	2	1.82
6P4B (Affordable)	4 Bed, 2 Storey, Semi-Detached	1182 SQFT	2	1.82
Oakley	2 Bed, 2 Storey, Mid-Terrace	705 SQFT	14	12.73
Highfield	3 Bed, 2 Storey, End-Terrace	821 SQFT	14	12.73
Marlow Detached	3 Bed, 2 Storey	987 SQFT	14	12.73
Henley	3 Bed, 2 Storey	1040 SQFT	5	4.55
Stratford	3 Bed, 2 Storey	1055 SQFT	15	13.64
Broadway	4 Bed, 2 Storey	1170 SQFT	12	10.91
Beaumont	4 Bed, 2 Storey	1234 SQFT	9	8.18
Wentworth	4 Bed, 2 Storey	1344 SQFT	5	4.55
TOTAL		**107031 SQFT**	**110**	

Gross Site Area	7.01	Acres	2.84	Hectares
Existing Landscape/Buffers	0.16	Acres	0.06	Hectares
Undevelopable: Site Access, Drainage easements & SSR	0.15	Acres	0.06	Hectares
NETT SITE AREA:	**6.7**	**ACRES**	**2.71**	**HECTARES**
Gross Density:	15.69	Units/Acre	38.78	Units/Hectare
NETT DENSITY:	**16.42**	**UNITS/ACRE**	**40.57**	**UNITS/HECTARE**
Gross Footage:	15268.33	SQFT/Acre	3505.09	SQM/Hectare
NETT FOOTAGE:	**15974.78**	**SQFT/ACRE**	**3667.27**	**SQM/HECTARE**

Key:

- Site Boundary
- 1.8m high boundary fence
- 1.8m high screen wall / fence
- Private Drive
- Indicative Landscaping
- Number of parking spaces proposed to Semi-Detached and Detached Dwellings in accordance with Local Authority's Parking Standards
- Parking space allocation to Frontage Parking Dwellings
- Knee rails to parking bays to Terraced Housetypes
- Existing retained hedges/landscaping
- Proposed Surface Water Drainage Connection and 6.0m Easement
- Proposed Water main diversion and 6.0m Easement

Rev:	Description:	Date:
A	Plot numbers reduced, drainage basin shown.	10.03.21
B	Drainage basin removed.	26.03.21
C	Plots 28 - 35 repositioned.	07.04.21
D	Plots 8, 11, 13, 34, 35, 96 & 99 amended.	08.04.21
E	Internal design review	13.05.21
F	Access Amended & amended to suit drainage design	20.05.21
G	Access amended & housetypes updated	10.06.21
H	Numbers increased to 110	13.07.21

H:\DESIGN\03_ 2020 Housetype Range\CGSTACKED.png

Castle Green,
Unit 20,
St. Asaph Business Park,
Denbighshire. LL17 0LJ.
Tel. 01745 536677

Site: Land Adj. Pendref School, Denbigh

Title: Proposed Site Plan

Scale: 1:500@A1

Date: 23.02.21

Ref: PEN-DEN-SP01

Rev: H

BETTS HYDRO
CONSULTING ENGINEERS

APPENDIX F – PRE & POST DRAINAGE PLANS

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Old Marsh Farm Barns
Welsh Road, Sealand
Flintshire CH5 2LY
Telephone: 01244 289 041

DO NOT SCALE

Legend

- Site Outline
- Topographic Fall
- Ordinary Watercourse

Topographic Survey

REV	DATE	BY	DESCRIPTION	CHK
A	17/05/21	MB	PRELIMIANRY FOR ISSUE	RDN

DRAWING STATUS:

BETTS HYDRO
CONSULTING ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 enquiries@betts-associates.co.uk

Castle Green

PROJECT:

GWAENYNOG ROAD
DENBIGH

TITLE:

PRE-DEVELOPMENT
DRAINAGE PLAN

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
17/05/21	1000@A3	MB	RDN

PROJECT No:	DRAWING No:	REV:
HYD622	100	A

DO NOT SCALE

Legend

- Site Outline
- Ordinary Watercourse
- Attenuation
- Oversized Surface Water Pipe
- Proposed Surface Water Sewer
- Surface Water Manhole
- Proposed Foul Water Sewer
- Foul Water Manhole

REV	DATE	BY	DESCRIPTION	CHK
C	19/07/21	MB	PRELIMINARY FOR ISSUE	RDN
B	01/07/21	MB	PRELIMINARY FOR ISSUE	RDN

DRAWING STATUS:

BETTS HYDRO
CONSULTING ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 enquiries@betts-associates.co.uk

Castle Green

PROJECT:

GWAENYNOG ROAD
DENBIGH

TITLE:

POST-DEVELOPMENT
DRAINAGE PLAN

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
19/07/21	1000@A3	MB	RDN

PROJECT No:	DRAWING No:	REV:
HYD622	101	C

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BETTS HYDRO
CONSULTING ENGINEERS

APPENDIX G – SURFACE WATER CALCULATIONS AND STORAGE ESTIMATES

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Old Marsh Farm Barns
Welsh Road, Sealand
Flintshire CH5 2LY
Telephone: 01244 289 041

SURFACE WATER RUN-OFF CALCULATION SHEET

Development	Gwaenynog Road, Denbigh
Project No.	HYD622

Revision	A	**Completed by**	MB
Date	14/05/2021	**Checked by**	RDN

Areas

Total Site	2.840	ha	
Development Area[1]	2.840	ha	
Existing Impermeable	0.000	ha	
Existing Impermeable[2]	0.000	ha	
Existing Pervious	2.840	ha	
Existing Pervious[2]	0.000	ha	
Proposed total impermeable	1.870	ha	66%

Catchment Characteristics

SAAR	820	mm			
SPR	0.38				
BFI	0.539				
i_1	18.1	mm/hr	d_1	25.1	mm
i_{30}	36.6	mm/hr	d_{30}	55.9	mm
i_{100}	49.1	mm/hr	d_{100}	75.1	mm

Run-off Rates

Pre-development

Impermeable ------	1yr	0.0	l/s
	30yr	0.0	l/s
	100yr	0.0	l/s
	40mm/hr[3]	0.0	l/s
Pervious[4] ------	1yr	9.8	l/s
	30yr	19.8	l/s
	100yr	24.2	l/s
	QBar[5]	11.1	l/s
Total ------	1yr	9.8	l/s
	30yr	19.8	l/s
	100yr	24.2	l/s

Post-development (without control)

Impermeable[6] ------	1yr	94.0	l/s
	30yr	189.9	l/s
	100yr+40%CC	356.8	l/s

Volumes

Pre-development

Impermeable ------	1yr	0.0	cu.m
	30yr	0.0	cu.m
	100yr	0.0	cu.m
Pervious[4] ------	1yr	204.2	cu.m
	30yr	393.2	cu.m
	100yr	546.2	cu.m
Total ------	1yr	204.2	cu.m
	30yr	393.2	cu.m
	100yr	546.2	cu.m

Post-development

Impermeable[6] ------	1yr	47.0	cu.m
	30yr	104.6	cu.m
	100yr+40%CC	140.5	cu.m

Stormwater Storage Estimates

Based on Greenfield run-off QBar

Microdrainage Quick Storage Estimates (using FEH catchment data)

Return Period	Rate		lower	upper	mean	
1yr	11.1	l/s	229	408	318.5	cu.m
30yr	11.1	l/s	645	947	796	cu.m
100yr+40%CC	11.1	l/s	1444	1917	**1680.5**	**cu.m**

1/ The 'development area' removes areas of POS and/or landscaped areas of the wider site that are to remain as existing.
2/ On occasion the existing impermeable area cannot be evidenced to connect and a reduction is applied.
3/ 50mm/hr is used for BRegs calculations and often used by Water Companies when considering allowable post-development rates of discharge. (Rational Method)
4/ The Greenfield rates and of run-off have been calculated using the UK SUDS Calculator
5/ QBar is the estimated flood flow for the 2.33yr return period event and is often used as a post-development rate restriction.
6/ Post-development run-off is only considered from the impermeable area when the proposed post-development impermeable area >50% in accordance with the EA Guidance Preliminary rainfall runoff management for developments (W5-074/A/TR1/1 rev E (2012).

NB. The catchment characteristics are from the FEH catchment, the UK SUDS Calculator and Microdrainage.
NB. The rainfall intensities and depths are calculated for the 6hr duration rainfall event (peak summer intensity)

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Megan Berry
Site name:	Gwaenynog Road
Site location:	Denbigh

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.18336° N
Longitude:	3.43367° W
Reference:	703074134
Date:	May 14 2021 13:59

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha): 2.84

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.539
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.08

Hydrological characteristics

	Default	Edited
SAAR (mm):	802	802
Hydrological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 30 years:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Growth curve factor 200 years:	2.46	2.46

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):		11.12
1 in 1 year (l/s):		9.78
1 in 30 years (l/s):		19.79
1 in 100 year (l/s):		24.24
1 in 200 years (l/s):		27.35

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	18.000
Ratio R	0.351
Areal Reduction Factor	1.00
Area (ha)	2.840
SAAR (mm)	820
CWI	118.309
Urban	0.000
SPR	30.000

Results

Percentage Runoff (%)	32.00
Greenfield Runoff Volume (m^3)	546.169

Greenfield Runoff Volume

FSR Data

Return Period (years)	30
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	18.000
Ratio R	0.351
Areal Reduction Factor	1.00
Area (ha)	2.840
SAAR (mm)	820
CWI	118.309
Urban	0.000
SPR	30.000

Results

Percentage Runoff (%)	29.95
Greenfield Runoff Volume (m^3)	393.188

Greenfield Runoff Volume

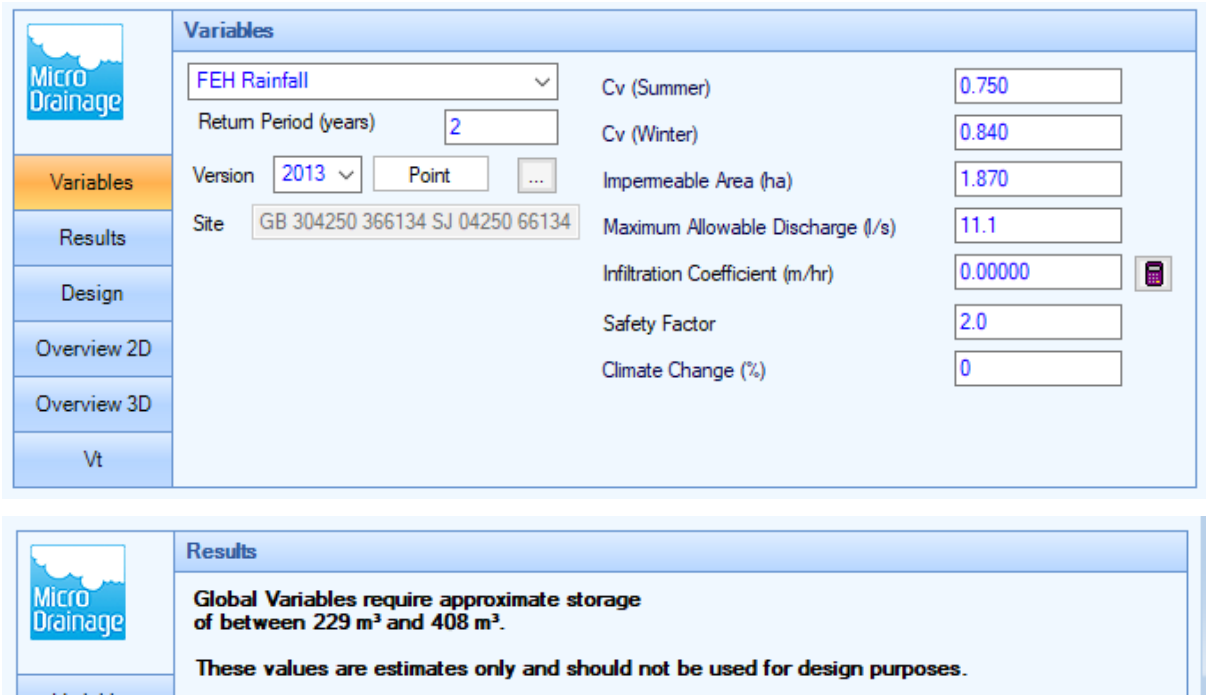
FSR Data

Return Period (years)	2
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	18.000
Ratio R	0.351
Areal Reduction Factor	1.00
Area (ha)	2.840
SAAR (mm)	820
CWI	118.309
Urban	0.000
SPR	30.000

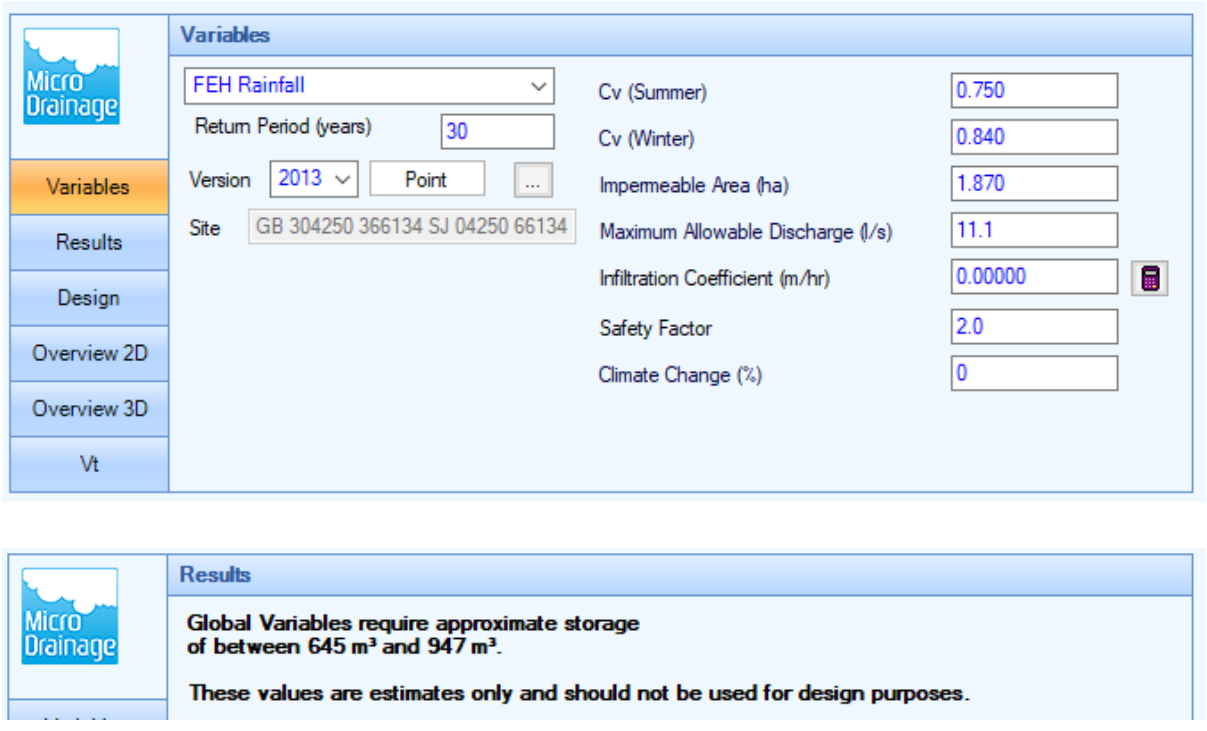
Results

Percentage Runoff (%)	28.33
Greenfield Runoff Volume (m^3)	204.165

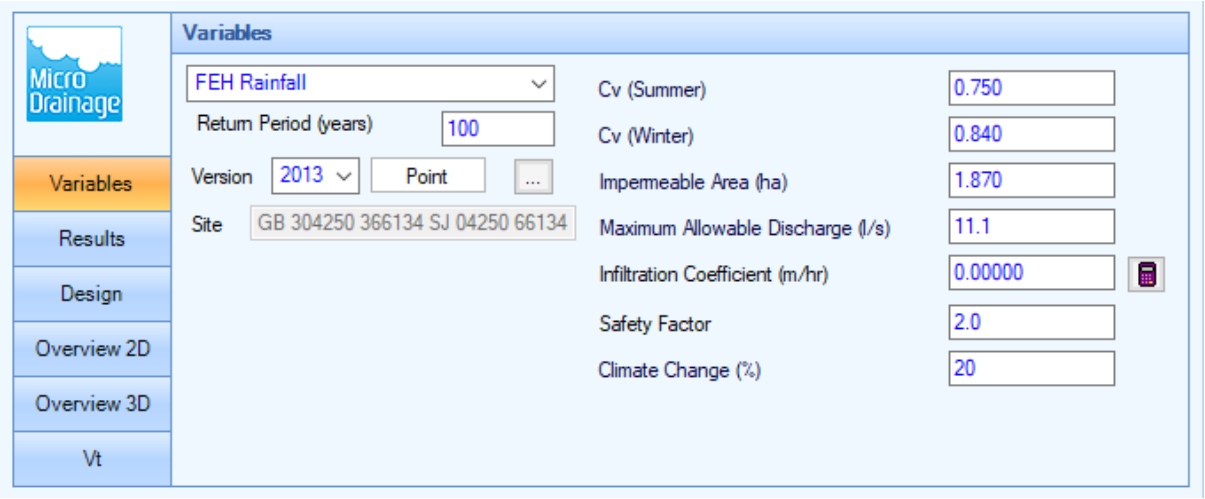
1 YEAR RETURN PERIOD STORM EVENT

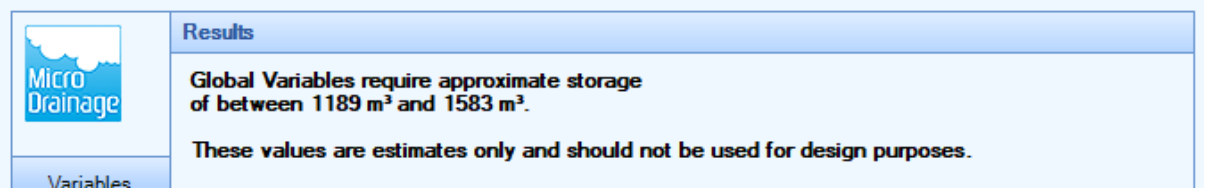


30 YEAR RETURN PERIOD STORM EVENT

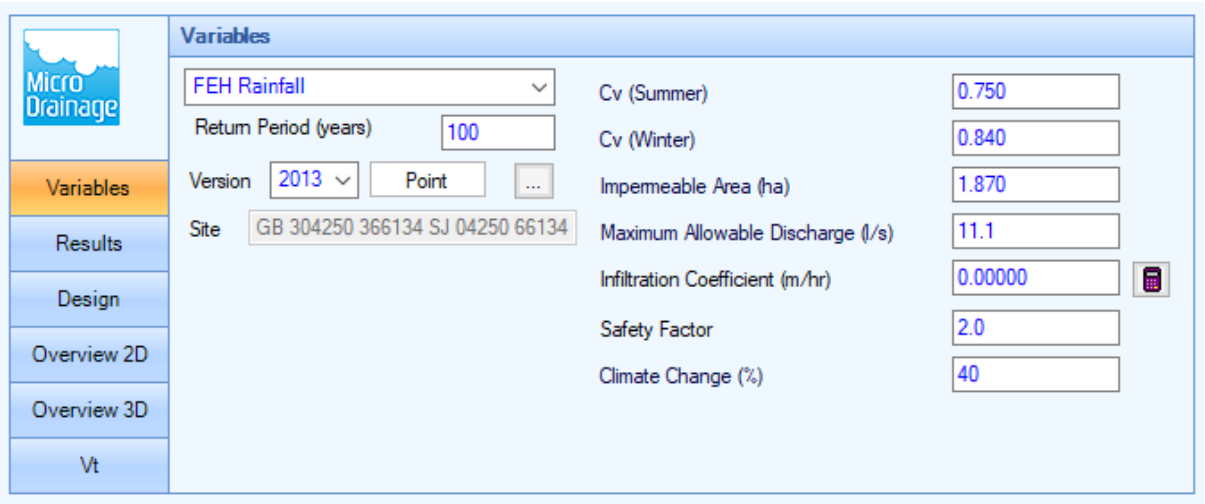


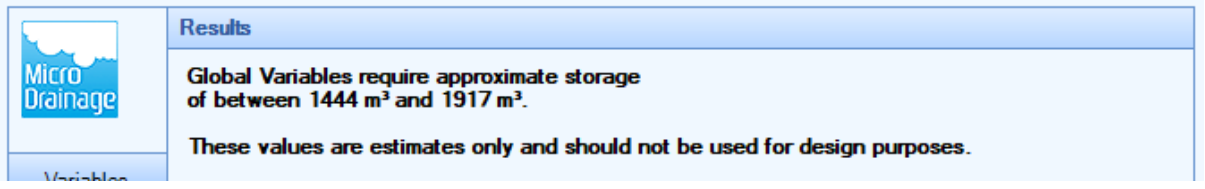
100 YEAR RETURN PERIOD STORM EVENT + 20% CLIMATE CHANGE





100 YEAR RETURN PERIOD STORM EVENT + 40% CLIMATE CHANGE



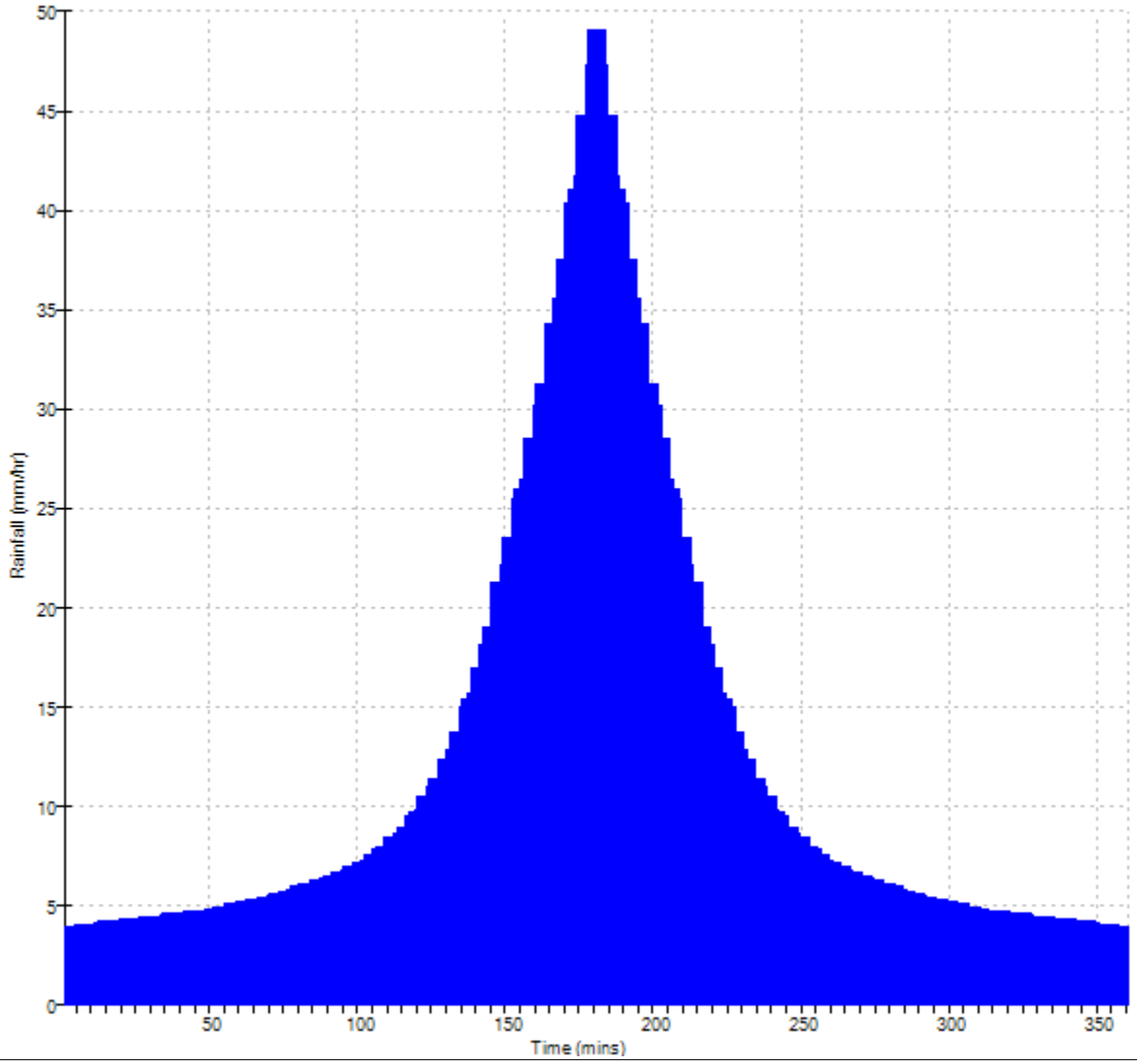


Rainfall profile

Storm duration (mins) 360

FEH Data

FEH Rainfall Version	2013
Site Location	GB 304250 366134 SJ 04250 66134
Data Type	Point
Peak Intensity (mm/hr)	49.075
Ave. Intensity (mm/hr)	12.519
Return Period (years)	100.0

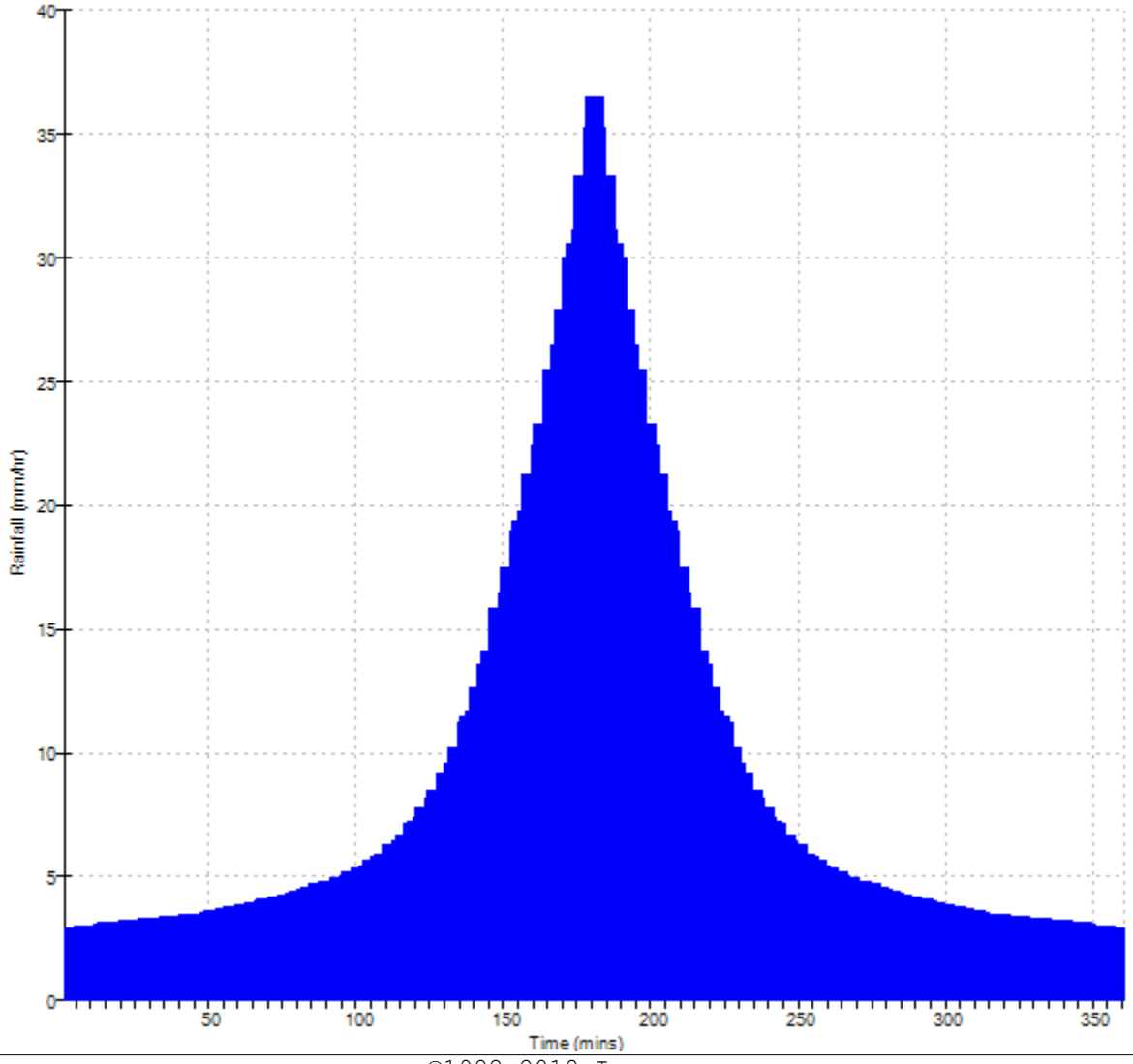


Rainfall profile

Storm duration (mins) 360

FEH Data

FEH Rainfall Version	2013
Site Location	GB 304250 366134 SJ 04250 66134
Data Type	Point
Peak Intensity (mm/hr)	36.550
Ave. Intensity (mm/hr)	9.324
Return Period (years)	30.0



Rainfall profile

Storm duration (mins) 360

FEH Data	
FEH Rainfall Version	2013
Site Location	GB 304250 366134 SJ 04250 66134
Data Type	Point
Peak Intensity (mm/hr)	18.103
Ave. Intensity (mm/hr)	4.618
Return Period (years)	2.0