PROJECT:

Wren Kitchens, Barton-Upon-Humber

DOCUMENT TITLE:

Drainage Design Philosophy

PREPARED FOR:

Wren Kitchens Ltd

BUILT ENVIRONMENT DESIGN PARTNERSHIP

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Revision	Date	By	Description
P01	**24/11/21**	**DE**	**First Issue**
P02	**08/04/22**	**DE**	**Updated to suit LLFA correspondence regards SuDS features & Existing site ditches**

Contents

1 Introduction

The site is located on the north of Falkland Way adjacent to the existing Wren Kitchens facility to the East of Barton-Upon-Humber, DN18 5RL.

The site is roughly centred at National Grid Reference TA039226, bounded by open farmland to the north and factories to the east and west, and the existing Wren Kitchen facility to the south, being adjacent to the existing premises of Wren Kitchens is key for the development.

The application site is approximately 2.55ha, with the proposed development impermeable area being approximately 2.085ha.

The site is approx. 600m from the entrance to Wrens Nest Facility. The site is flat in nature and has historically been undeveloped.

North East Lindsay Internal Drainage Board ditch 16D runs east to west is located to the east of the site boundary.

Desktop studies indicate the site ground conditions consist of clay/ silts underlain by the Chalk and not suited to infiltration drainage.

The site is located within Environment Agency Flood Zone 3. A flood risk assessment has been undertaken by Weetwood and will accompany the planning application.

Given the nature of the development the raising of ground levels above the flooding datum are not proposed.

The development will comprise the following:

- 156 Space Lorry Park
- 51 Space Car park
- Access road

2 Surface Water Drainage

2.1 Proposed Site Surface Water Drainage

The development area is currently vacant and undeveloped. There is no formal drainage system, therefore the surface water currently either infiltrates into the ground or follows the natural topography of the site and discharges to the surrounding areas, namely North East Lindsay IDB ditch 16D to the East of the site. As such, it is pertinent to treat the development area as a greenfield land and ensure that the surface water run-off from the proposed development will not exceed the existing surface water run-off.

The drainage design philosophy for the site is based on implementing sustainable drainage systems (SuDS) techniques. The philosophy of SuDS is to replicate as closely as possible the natural drainage from the site before development and to treat run-off to remove pollutants, therefore reducing the impact on the receiving watercourses.

The proposed development involves the construction of a parking facility which will generate approximately 2.085 ha of impermeable area. The proposed drainage layout is contained in Appendix B. The allowable discharge rate from the site is to be restricted to Greenfield QBAR rate of 2.57 l/s/ha. The principle of the design are based on those used for new Wren facility off Barrow Road, on that basis a 30% allowance will be made for climate change.

The proposed surface water drainage system is a gravity system discharging into a below ground attenuation tank under the development.

The flow from the attenuation storage will then discharge at a restricted flow rate to the ditch to the north of the development.

This ditch is believed to currently accept the surface water runoff from the site and connects to the IDB drainage network ditch 16D at Grid reference TA 04269 22698. (See Appendix F)

Water entering the Anglian Water surface water sewer network within Victory Way also discharges via this location, see Appendix E.

A Hydrobrake flow control has been utilized to optimise the attenuation volume and is positioned just downstream of the attenuation storage. The maximum flow rate from the attenuation storage has been determined as below.

- Proposed development = Impermeable area x Qbar = 2.085 ha x 2.570 l/s/ha = 5.4 l/s
- The below ground attenuation will be sized based on the proposed drainage network discharging at 5.4 l/s. This equates to a proposed attenuation volume of between 1180m³ & 1579m³

  See Appendix D for a quick storage estimate indicated for and impermeable area of 2.085 ha and a maximum flow rate of 5.4 l/s between 1180m³ & 1579m³ of attenuation is required. All attenuation sizing will be confirmed by detail design.

There are two separate proposed networks out-falling into the attenuation tank.

One network will take the car park run-off and this will enter the attenuation via SuDS features.

The second network will drain the lorry parking areas and access road, and this will enter the attenuation via SuDS features and a full retention separator.

The separators are to be Class 1 full retention separators (with integral level alarms) to ensure compliance with BS EN 858-1:2002, in accordance with Pollution Prevention Guideline document PPG3 *'Use and design of Oil Separators in Surface Water Drainage Systems'*.

External car park areas and lorry parking areas will be drained via linear drainage and/or local gullies.

The proposed drainage drawings are located in Appendix B.

Infiltration drainage is not feasible due to the geotechnical nature of the site.

2.2 Water Treatment

To protect the water quality of the receiving surface water bodies and groundwaters the run off discharged from the site will be treated using a by SuDS features and a proprietary oil interceptor. Surface water run off from the car parks will pass through SuDS features and concrete hardstanding for the lorry parking will pass through SuDS features including a retention oil interceptors, these are designed to remove the hydrocarbons.

2.3 SuDS Features

Source Control

Rainwater harvesting:

Not feasible as no usage for the collected water.

Soakaways:

Not compatible with ground conditions

Permeable Paving:

Due to the site usage this would only be suitable within the car park area.

This has been discounted as would require additional excavated materials to be exported form site and an increase import of stone and is therefore a less sustainable solution.

For the car park filter strip and filter drains will be utilised and connected to the Pond/ Wetland.

Green Roofs:

No structure on site.

Trees:

Trees are being provided to assist with ecology and water management in landscaped areas but will not be able to assist with the large volumes of water generated by the hard surfacing.

Filter Strips & Filter Drains:

Filter strip are to be utilised for the car park, this would connect to a filter drain carrying water to the pond/ wetland.

It will not be possible to use filter strips within the lorry parking area as the trailer boxes being stored have support legs at the rear (Not an overhang like HGV trailers) meaning limit space would be available for a meaningful strip given the large flow volumes surface flow from the parking area.

Filter drains are to be utilised for the lorry parking area and connected to the attenuation via an oil separator to provide a sufficient level of water quality management.

Site Control

Swales:

Not feasible due to land take requirements and boundary tie in levels.

Attenuation Tanks:

Being utilised with a controlled discharge rate.

Regional Control

Detention Basin:

Not feasible due to land take requirements.

Pond/ Wetland:

Being utilised for the car parking area. Not feasible for the lorry parking due to land take.

2.4 Drainage Design Parameters and Criteria

The new surface water drainage system will be modelled using current design software, ensuring planning conditions and Environment Agency (EA) guidelines are satisfied to prevent uncontrolled flooding of the site and surrounding areas. The design parameters used and applicable to the site are:

- **Rainfall:** Flood Studies Report (FSR)
- **M5-60 (mm):** 19.000
- **Ratio R:** 0.400
- **Global Time of Entry:** 5min
- **Volumetric Run-off Coefficient:** 0.75 (summer), 0.84 (winter)

The drainage system has been check against the following storm return periods and durations:

- 1 in 2 year storm + 30% climate change – 15mins to 1440mins storm duration
- 1 in 30 year storm + 30% climate change – 15mins to 1440mins storm duration
- 1 in 100 year storm + 30% climate change – 15mins to 1440mins storm duration

The drainage system has been modelled with adequate attenuation capacity to ensure that the following criteria are met:

- 1 in 2 year storm + 30% climate change – No Surcharge
- 1 in 30 year storm + 30% climate change – No Flooding
- 1 in 100 year storm + 30% climate change – No Flooding off site.

2.5 Surface Water Design Summary

The Design input and output summary will included:

- Design Criteria for Storm
- Time Area Diagram for Storm
- Network Design Table for Storm
- Online Controls for Storm
- Storage Structures for Storm (Tank)
- 1 year Return Period Summary of Critical Results by Maximum Level
- 2 year Return Period Summary of Critical Results by Maximum Level
- 30 year Return Period Summary of Critical Results by Maximum Level
- 100 year Return Period Summary of Critical Results by Maximum Level

It will be conclusive from the simulation output that the proposed surface water drainage system will be satisfactory with sufficient attenuation volume.

The Causeway Flow Storage estimate tool predicts an attention volume requirement of 1180m³ & 1579m³. This will be confirmed and quantified in the detailed design.

Full design calculations can be found in Appendix G.

3 Foul Water Drainage

3.1 Proposed Foul Water Drainage

The proposal is for the foul water from the new development to drain via gravity to an existing stub within the site boundary with connects to the Anglian Water sewer network at manhole 9601.

At this time this connection is to future proof the for the installation of an accommodation pod of up to 150m² which would be located on an island adjacent to the site entrance.

4 Existing Watercourse Features

4.1 Proposed treatment for Existing Watercourse

It is noted recent mapping indicated 4No ditch features within the development plot.

From historic mapping/ aerial photos these appear to have been created between 2007 and 2014. See Appendix H.

This time frame corresponds with an historic planning application. It is believed these features are investigation trenches excavated at this point and not backfilled as no other development occurred on the plot during this period of time.

In addition to the above, site clearance is also apparent on the aerial photos during this period, supporting the fact some works were undertaken.

Historic mapping back to the 1900 century shows the site as undeveloped (with no water courses) and given the lack of connectivity of the features, there random nature and lack of further development, it is not believed they are, or ever have been water courses/ drains.

Recent topo surveys and site walk overs show no sign of the trenches.

As part of the site development works these features would be located, and, if required, the soil would be reengineered to prevent future settlements, but it is not believed they were ever part of a wider drainage network.

5 Drainage Maintenance Schedule

The following table indicates the maintenance regime that will need to be followed by the landlord.

Element	Access Method	Method of Maintenance	Frequency Required
Channel/ Kerb Drains	In accordance with health and safety regulations	Monitored to ensure no blockages develop. Jet cleaning where required.	Bi-annual jet cleaning of channel drains.
Silt-traps and Gullies	In accordance with health and safety regulations	Monitored to ensure no blockages develop. Removal of rubbish and debris where required.	Bi-annual inspection and clearance of all silt traps and gullies.

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

21.14 REFERENCES

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TABLE 23.1 Operation and maintenance requirements for ponds and wetlands

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

TABLE 14.2 An example of operation and maintenance requirements for a proprietary treatment system

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	Six monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six monthly
	Inspect filter media and establish appropriate replacement frequencies	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every six months

should be undertaken whenever access for maintenance is required. Removal of oil, silt and other pollutants must be in accordance with the appropriate waste management legislation.

Maintenance responsibility for all systems should be placed with an appropriate organisation, and Maintenance Plans and schedules should be developed during the design phase.

▶ Further detail on the preparation of maintenance specifications and schedules of work is given in **Chapter 32**.

Table 14.2 provides guidance on the type of operation and maintenance schedule that may be appropriate for a proprietary treatment system. The list of actions is not exhaustive and some actions may not always be required.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

▶ Generic health and safety guidance is presented in **Chapter 36**.

14.12.2 Oil water separators

Specific requirements for oil/water separators are provided in PPG3 (EA/SEPA/EHSNI, 2006). The following items should be undertaken every six months as a minimum:

- check volume of sludge
- check thickness of light liquid
- check function of automatic closure device
- empty the separator, if required
- check the coalescing material and clean or change if necessary (class 1 only)
- check the function of the warning device (if fitted)

General inspection of the integrity of oil/water separators should occur at a maximum frequency of five years, and should cover the following:

- watertightness of system

TABLE 15.1 Operation and maintenance requirements for filter strips

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 filter strip surface to identify evidence of erosion, poor vegetation growth, compaction, ponding, sedimentation and contamination (eg oils)	Monthly (at start, then half yearly)
	Check flow spreader and filter strip surface for even gradients	Monthly (at start, then half yearly)
	Inspect gravel flow spreader upstream of filter strip for clogging	Monthly (at start, then half yearly)
	Inspect silt accumulation rates and establish appropriate removal frequencies	Monthly (at start, then 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% of the filter strip area.
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Maintenance Plans and schedules should be developed during the design phase. Specific maintenance needs of the filter strip should be monitored, and maintenance schedules adjusted to suit requirements.

▶ Further detail on the preparation of maintenance specifications and schedules of work is given in **Chapter 32**.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

▶ Generic health and safety guidance is presented in **Chapter 36**.

TABLE 16.1 Operation and maintenance requirements for filter drains

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

Sediments excavated from upstream pre-treatment devices that receive runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can therefore be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate waste management protocols and compliance with legislation. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For industrial site runoff, sediment testing will be essential. In the majority of cases, it will be acceptable to distribute the sediment on site, if there is an appropriate safe and acceptable location to do so. Any damage due to sediment removal or erosion should be repaired and immediately reseeded or planted.

▶ Further detail on waste management is provided in **Chapter 32**.

Maintenance Plans and schedules should be developed during the design phase. Specific maintenance needs of the filter drain should be monitored and maintenance schedules adjusted to suit requirements.

▶ Further detail on the preparation of maintenance specifications and schedules of work is given in **Chapter 32**.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

▶ Generic health and safety guidance is presented in **Chapter 36**.

▶ Further detail on construction activities and the programming of construction activities is provided in **Chapter 31**.

A construction phase health and safety plan is required under the Construction (Design and Management) Regulations 2015. This should ensure that all construction risks have been identified, eliminated, reduced and/or controlled where appropriate.

▶ Generic health and safety guidance is provided in **Chapter 36**.

19.12 OPERATION AND MAINTENANCE REQUIREMENTS

Maintenance requirements of trees will be greatest during the first few years, when the tree is becoming established. Early maintenance should involve regular inspection, removal of invasive vegetation and possibly irrigation during long dry periods, particularly in soils with high void ratios. Tree roots need to establish good root–soil contact before they can efficiently extract water from the soil. The expertise of a arboriculturist/landscape architect with local knowledge should be sought regarding appropriate irrigation schedules. Maintenance responsibility for a tree pit or planter should always be placed with an appropriate organisation.

Table 19.3 provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

TABLE 19.3 Operation and maintenance requirements for trees (after CRWA, 2009)

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets and outlets	Inspect monthly
Occasional maintenance	Check tree health and manage tree appropriately	Annually
	Remove silt build-up from inlets and surface and replace mulch as necessary	Annually, or as required
	Water	As required (in periods of drought)
Monitoring	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

Sediments excavated from a tree pit or planter that receive runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can therefore be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For runoff, from busy streets with high vehicle traffic sediment testing will be essential.

▶ Further detail on waste management is provided in **Chapter 33**.

Maintenance Plans and schedules should be developed during the design phase. Specific maintenance needs of the tree pits/planters should be monitored and maintenance schedules adjusted to suit requirements.

▶ Further detail on the preparation of maintenance specifications and schedules of work is given in **Chapter 31**.

Appendix A: Topographical Survey

A0

NOTES

1. SURVEY CONTROL

   A) SURVEY GRID (HORIZONTAL):

   THIS SURVEY IS ORIENTATED TO ORDNANCE SURVEY GRID NORTH. THE SURVEY IS TO A PLANE GRID. HORIZONTAL MEASUREMENTS TAKEN FROM THIS SURVEY WILL BE GROUND DISTANCE.

   FULL ORDNANCE SURVEY CO-ORDINATES CAN BE CALCULATED BY SCALING THE SURVEY ABOUT THE SURVEY STATION NAMED STN1, WITH CO-ORDINATES E 503969.73 N 422677.27 AS FOLLOWS:

   SHIFT: NOT REQUIRED
   SCALE: LSF = 0.99973
   ROTATION: NOT REQUIRED.

   THE LOCAL SCALE FACTOR (LSF) APPLICABLE TO THIS SITE IS 0.99973, CALCULATED USING STANDARD TABULATED DATA.

   THE CONTROL HAS BEEN ESTABLISHED BY TYING INTO THE ACTIVE ORDNANCE SURVEY CONTROL NETWORK. SEE NOTE C. BELOW.

   (FOR THIS RELATIVELY LOW LEVEL SITE, MEAN SEA LEVEL CORRECTIONS (MSL) ARE DEEMED TO BE INSIGNIFICANT AND HAVE THEREFORE NOT BEEN APPLIED.)

   B) VERTICAL DATUM:

   ALTITUDES FOR THE CONTROL HAVE BEEN CALCULATED FROM GNSS DERIVED HEIGHTS AND CONVERTED TO ORTHOMETRIC HEIGHTS (ORDNANCE DATUM NEWLYN - ODN) USING OSGM15 TRANSFORMATION PARAMETERS.

   C) GNSS CONTROL:

   THE CO-ORDINATE SYSTEM USED FOR THE PRIMARY CONTROL IS OSGB36; THIS HAS BEEN CALCULATED FROM ETRS89 USING OSTN15 TRANSFORMATION PARAMETERS.

   METHOD: FOR THIS PARTICULAR PROJECT, THE "TRIMBLE VRS NOW" NETWORK RTK SYSTEM HAS BEEN USED. OBSERVATIONS HAVE BEEN TAKEN ON THE FOLLOWING DATE (S): 15/11/2021

   MANUFACTURERS QUOTED ACCURACY IS RMSE 10 – 20 mm IN PLAN AND 20 – 30 mm IN HEIGHT. HOWEVER, RESULTS MAY VARY DURING THE DAY AND CERTAIN CONDITIONS COULD CAUSE DEGRADATION TO THE FINAL SOLUTIONS. FOR SALIENT CONTROL AND WHEREVER POSSIBLE AND PRACTICAL, TOWER SURVEYORS HAVE USED AN OPEN SKY WITH GOOD SATELLITE GEOMETRY SO AS TO MAINTAIN THE HIGHEST ACCURACY POSSIBLE.

2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS/DOCUMENTATION.
   NAMELY: J-00326_201 - TOPOGRAPHICAL SURVEY
   J-00326_101 - UTILITIES SURVEY
3. CHECK SCALE BAR AND GRID BEFORE TAKING NON-FIGURED DIMENSIONS FROM THIS DRAWING.
4. IF IN DOUBT ASK.
5. DRAWING PRESENTED AS 2D, WITH 3D VERSION IN FROZEN LAYERS.
6.

LEGEND

30.29 SPOT LEVEL
STN/4 SURVEY STATION
SAPLING
BUSHES/SHRUB
HEDGE/AREA OF UNDERGROWTH
TREE (INDICATIVE ONLY)
BUILDING
99.90 CONTOUR
R/W RETAINING WALL
BANKING
OVERHEAD CABLE
FENCE WITH DESCRIPTION

C/P	CHESTNUT PALING	Iwn	INTERWOVEN
C/B	CLOSE BOARDED	O/L	OVERLAP
C/I	CORRUGATED IRON	Pal	PALLING
C/L	CHAIN LINK	P/W	POST AND WIRE
CBr	CRASH BARRIER	P/R	POST AND RAIL
Con/P	CONCRETE PANEL	P/C	POST AND CHAIN
Elc	ELECTRIC	P/Bw	POST AND BARBED WIRE
Hrd	HOARDING	P/S	POST AND STRING
H/M	HIT AND MISS	W/M	WIRE MESH
I/R	IRON RAILING		

ABBREVIATIONS

AC	AIRCON		
B	BOLLARD	LB	LITTER BIN
BB	BELISHA BEACON	LP	LAMP POST
BL	BED LEVEL	L/W	LIGHTWELL
BOP	BACK OF PATH	MKR	MARKER POST
BP	BOUNDARY POST	MH	MANHOLE
BS	BUS STOP	PB	PILLAR BOX
BT	BRITISH TELECOM IC	PI	PIPE
CATV	CABLE TELEVISION IC	PM	PARKING METER
CC	CONTROL CABINET	P	POST
CL	COVER LEVEL	RE	RODDING EYE
COL	COLUMN	RF/RG	ROOF/RIDGE LEVEL
CTV	CABLE TELEVISION POINT	RNP	ROAD NAME PLATE
DK	DROP KERB	RS	ROAD SIGN
DRN	DRAIN	RWP	RAINWATER PIPE
DWP	DOWN WATER PIPE	SC	STOP COCK
DP	DOWN PIPE	SOF	SOFFIT LEVEL
EV	EAVES LEVEL	SGY	STRIP GULLY
EP	ELECTRICITY POLE	SP/B	SIGN POST/BOARD
ER	EARTH ROD	ST	STOP TAP
FFL	FINISHED FLOOR LEVEL	SV	STOP VALVE
FH	FIRE HYDRANT	SW	STORM WATER
FL	FLOOD LIGHT	TAP	WATER TAP
FW	FOUL WATER	TCB	TELEPHONE CALL BOX
G	GULLY	THL	THRESHOLD LEVEL
GV	GAS VALVE	TL	TRAFFIC LIGHT
GP	GATE POST	TOF	TOP OF FENCE
GUT	GUTTER LEVEL	TP	TELEPHONE POLE
Hlev	TOP OF HEDGE LEVEL	TWL	TOP OF WALL
IC	INSPECTION COVER	US	UNDERSIDE LEVEL
IL	INVERT LEVEL	VP	VENT PIPE
KB	KERB	WLV	WATER LEVEL
KO	KERB OUTLET GULLY	WM	WATER METER
		WO	WASH OUT

TREE NOTES

A) MB "X" NO – MULTIPLE BOLES FOLLOWED BY NUMBER OF.
B) DIA – TRUNK DIAMETER MEASURED AT APPROX 1.5M ABOVE GROUND LEVEL.
C) SPREAD – DIAMETER OF CANOPY. (TREE SPREADS ARE INDICATIVE ONLY AND ARE REPRESENTATIVE OF THE GENERALISED CANOPY SIZE, AND MAY NOT REPRESENT THE TRUE CANOPY POSITION AS OUTLINED ON SITE – TREE BOLES MAY NOT SIT CENTRALLY TO THE CANOPY).
D) HEIGHT – APPROXIMATE HEIGHT TO TOP OF CANOPY – ESTIMATED FROM GROUND LEVEL.
E) ATTENTION SHOULD BE PAID TO THE ORIGINAL TOPOGRAPHICAL BRIEF AS TO WHAT TREES HAVE ACTUALLY BEEN SCHEDULED; I.E. THOSE "TREES LARGER THAN DIAMETER "X" OR "ONLY TREES WITHIN THE IMMEDIATE SURVEY LIMITS". (THIS IS NORMALLY THE CASE UNLESS OTHERWISE SPECIFIED AS INCLUDING "OFF SITE" TREES).

STATION CO-ORDINATES

STATION	EASTING	NORTHING	LEVEL	DESCRIPTION
STN1	503969.73	422677.27	3.02	PEG & NAIL
STN2	503951.50	422570.80	3.39	SURVEY NAIL
STN3	503904.77	422602.23	3.33	SURVEY NAIL
STN4	503988.69	422579.93	2.99	PEG & NAIL

UNLESS OTHERWISE STATED THE SURVEY STATIONS LISTED ABOVE ARE ONLY INTENDED TO BE USED FOR TOPOGRAPHICAL SURVEYS AT THE STATED SCALE.
DUE CONSIDERATION SHOULD BE GIVEN TO LONG-TERM STABILITY OF SURVEY STATION MARKERS.

GENERAL

- NO ALLOWANCE HAS BEEN MADE FOR SUB SURFACE ENTRY INTO MANHOLES OR OTHER CHAMBERS OR VOIDS BELOW GROUND LEVEL. THEREFORE ANY DETAILS RELATING TO DEPTHS, SIZES ETC. ARE TAKEN FROM ABOVE GROUND AND AS SUCH WILL BE APPROXIMATE ONLY.
- THE CONTRACTOR IS TO CHECK AND VERIFY ALL CRITICAL DIMENSIONS AND LEVELS BEFORE WORK STARTS.
- BURIED SERVICES SHOWN ON THIS DRAWING MAY BE ASSUMED ROUTES AND WILL NORMALLY BE OF UNKNOWN CONDITION, CONTRACTORS SHOULD UNDERTAKE SUITABLE VALIDATION WORK AND TAKE PARTICULAR CARE DURING EXCAVATION WORK; SAFE DIGGING PRACTICES SHOULD BE FOLLOWED.
- SHOULD THERE BE ANY CONFLICT BETWEEN THE DETAILS INDICATED ON THIS DRAWING AND THOSE INDICATED ON OTHER DRAWINGS, THEN TOWER SURVEYORS SHOULD BE INFORMED PRIOR TO CONSTRUCTION ON SITE.
- IT IS IMPORTANT TO NOTE THAT THE SAME ACCURACIES IMPLIED BY THE PLOTTING SCALE ARE EQUALLY APPLICABLE TO DIGITAL DATA SUPPLIED FOR CAD.
- EVERY EFFORT IS MADE TO IDENTIFY ALL VISIBLE ABOVE GROUND FEATURES. HOWEVER, IT SHOULD BE BORNE IN MIND THAT THERE MAY BE ITEMS OBSCURED AT THE TIME OF SURVEY.
- VISIBLE FEATURES IN THE VICINITY OF THE BOUNDARIES, AS SHOWN ON THIS SURVEY, MAY NOT REPRESENT THE EXTENT OF LEGALLY CONVEYED OWNERSHIP.
- UNLESS OTHERWISE SPECIFIED FEATURES SHOWN USING LINE STYLES OR HATCHING ARE INDICATIVE ONLY, SUCH AS; ROAD MARKINGS, HEDGE CENTRELINES, BRICK HATCHING AND GLAZING DETAIL.

DESCRIPTION	REV	DATE	DRWN	CHKD	APPR

DRAWING STATUS

INFORMATION

Tower Surveys
Chartered Surveyors
Geomatics - Land, Utilities, Engineering & Building
RICS
SUITE 1826, 109 VERNON HOUSE,
FRIAR LANE, NOTTINGHAM, NG1 6DQ
TEL: +44 (0)7786560451 / 01158088224
info@towersurveyors.co.uk
https://towersurveys.associates/associates/
Regulated by RICS

CLIENT
WREN KITCHENS
(CONSULTANT: BUILT ENVIRONMENT DESIGN PARTNERSHIP LIMITED)

PROJECT TITLE what3words ///tender.corals.lighters
PROPOSED LORRY PARK, FALKLAND WAY / VICTORY WAY, BARTON-UPON-HUMBER, DN18 5XY

DRAWING DETAIL
TOPOGRAPHICAL SURVEY AS OF 15/11/21

DRAWN	EPB	DATE	NOVEMBER 2021
PROJECT ENGINEER	ATM		
CHECKED	NJR	SCALE	1:250 (WHEN PLOTTED @ A0)
APPROVED	ATM		

DRAWING NUMBER J-00326 / 201
REVISION

CAD REFERENCE
\\2021Projects\J-00326\J-00326_201_Issue01

CTB REFERENCE
\\CTB-files\TS-Topo-v01.ctb

Tower Surveyors Ltd

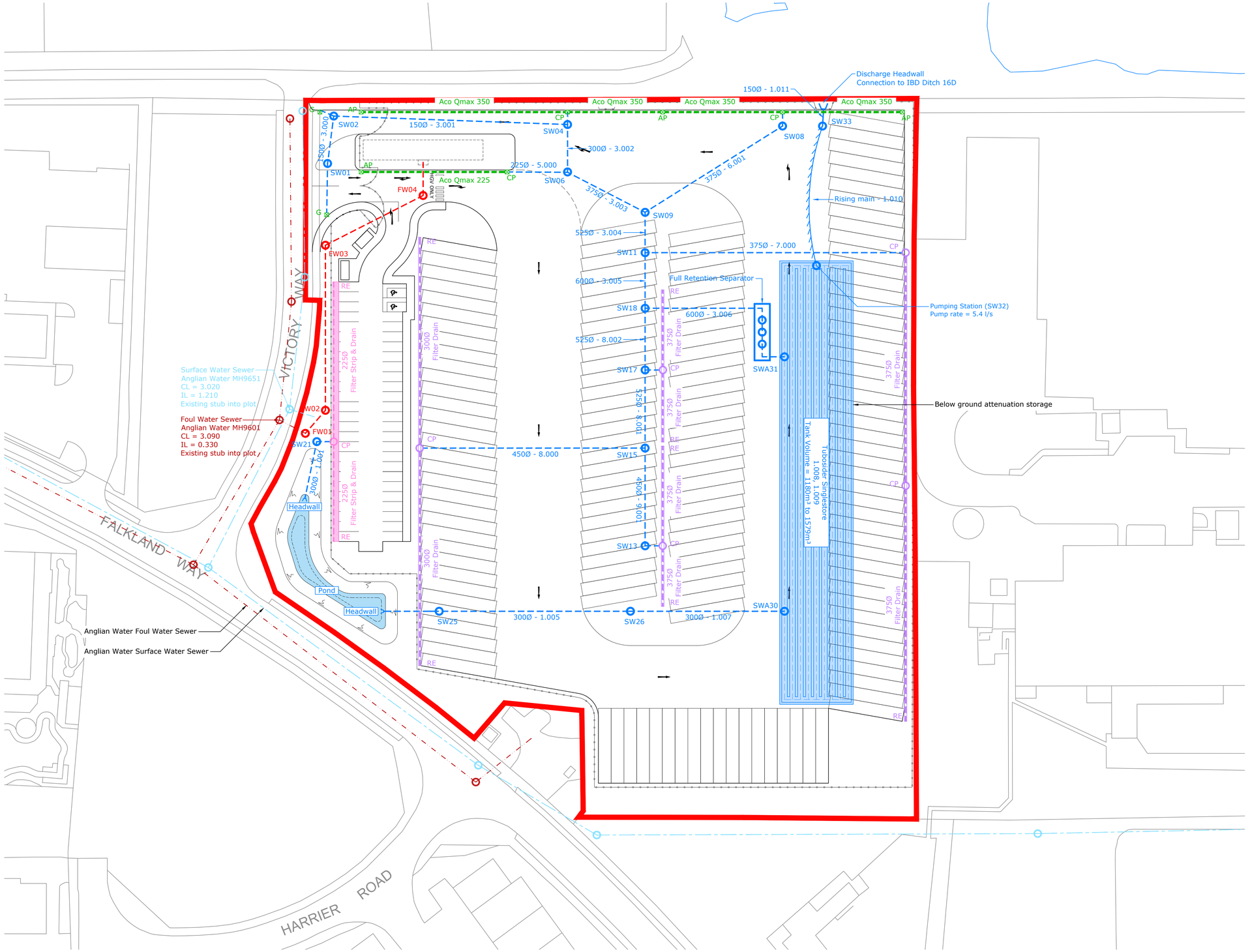
Appendix B: Proposed Drainage Layouts

BUILT ENVIRONMENT DESIGN PARTNERSHIP
Fernwood business park, 14 Halifax Court, Newark, Nottinghamshire, NG24 3JP
t: +44 (0) 1636 850500 www.bedesign.co.uk

NOTES:

1. If this drawing has been received electronically it is the recipients responsibility to print the document to the correct scale.
2. All dimensions are in millimetres unless stated otherwise. It is recommended that information is not scaled off this drawing.
3. This drawing should be read in conjunction with all other relevant drawings and specifications.

N



Drainage Layout
(Scale 1:500)

Planning

10m SCALE 1:500

Rev				
P04	DE	AT	AT	07/04/2022
	Filter Drain & Filter Strip added.			
P03	DE	AT	AT	14/12/2021
	Drainage layout updated. Levels moved to separate plan.			
P02	DE	AT	AT	17/11/2021
	Drainage layout updated.			
P01	DE	AT	AT	03/11/2021
	First Issue			

Rev	Drawn By:	Checked By:	Approved By:	Date:
	Amendments			

Project: Falklands Way Logistics Park

Title: Drainage Layout

Drawing Number:

Identification / Location:				Sheet Number:		
Project Code:	Originator Code:	Vol / Zone:	Level:	Type:	Role:	Number:
WREN2	BED	ST	ZZ	DR	C	0150

Rev Description:	Status Code:	Model Ref:	Rev No:
Preliminary	S0	ACAD	P04

Scale:	Sheet:	Discipline:	BED Project Number:
1:500	A1	Civil	NWK 210085

Client: WREN KITCHENS

Appendix C: Greenfield Run-Off Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	daniel edwards
Site name:	6 Acres
Site location:	Falkland Way

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:	53.69010° N
Longitude:	0.42698° W
Reference:	3094881297
Date:	Dec 14 2021 11:54

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 2.085

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

Hydrological characteristics	Default	Edited
SAAR (mm):	637	637
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

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.

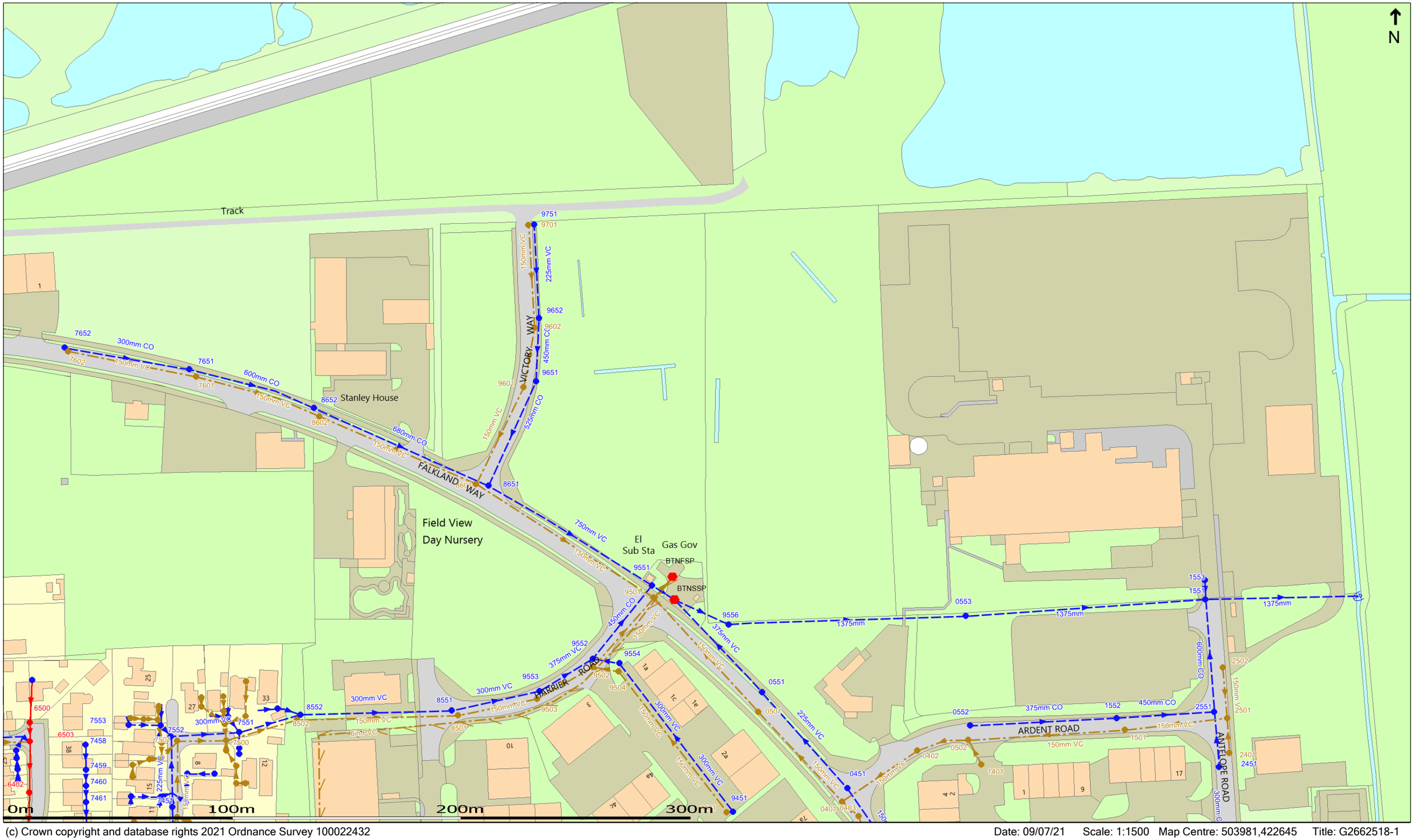
Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	5.36	5.36
1 in 1 year (l/s):	4.67	4.67
1 in 30 years (l/s):	13.14	13.14
1 in 100 year (l/s):	19.1	19.1
1 in 200 years (l/s):	22.58	22.58

Appendix D: Surface Water Storage Estimate

Storage Estimate

Return Period (years)	100		OK
Climate Change (%)	30		Cancel
Impermeable Area (ha)	2.085	Update	
Peak Discharge (l/s)	5.400		
Infiltration Coefficient (m/hr) (leave blank if no infiltration)		Calc	
Required Storage (m³)	Calc		
from	1180		
to	1579		
With infiltration (m³)			
from			
to			

Appendix E: Anglian Water Sewer Network Layout



Date: 09/07/21 Scale: 1:1500 Map Centre: 503981,422645 Title: G2662518-1

COMMERCIALDW
DRAINAGE AND WATER ENQUIRY

- Foul Sewer
- Surface Sewer
- Combined Sewer
- Final Effluent
- Decommissioned Sewer (colour denotes effluent type)
- Private Sewer (colour denotes effluent type)
- Rising Main (colour denotes effluent type)
- Manhole (colour denotes effluent type)
- Public Pumping Station
- Private Pumping Station
- Decommissioned Pumping Station
- Public Sewage Treatment Works
- Private Sewage Treatment Works
- Outfall
- Inlet

GEODESYS
Land and property information

Appendix F: IBD Ditch Layout


Legend
NEL Drains
EA Main River
North_East_Lindsey_IDB_Boundary
Barton Drain Branch 1
Existing culvert
Proposed new cut
GAS PIPE
Barton Drain Branch 2
Barrow Haven Branch 3
Barrow Haven Branch 2
Contains OS data © Crown Copyright and database right 2019

Appendix G: Drainage Design Calculation

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Attenuation29		5.00	3.400		504029.112	422583.143	2.660
CP20	0.130	5.00	2.810	1200	503915.106	422651.386	0.975
26			3.240	1200	503979.633	422604.255	1.865
Atenuation30			3.400		504028.075	422606.414	2.705
CP14	0.320	5.00	3.010	1350	503936.121	422643.196	1.200
CP12	0.490	5.00	3.010	1350	503997.115	422621.430	1.200
13			3.060	1350	503992.720	422621.235	1.265
15			3.060	1500	503991.631	422645.672	1.465
CP16	0.260	5.00	3.010	1200	503995.154	422665.400	1.025
17			3.060	1500	503990.760	422665.204	1.505
CP10	0.340	5.00	3.100	1350	504053.813	422697.411	1.290
CP07	0.240	5.00	2.710	1350	504025.998	422731.396	1.200
08			2.750	1350	504026.154	422727.900	1.255
CP05	0.075	5.00	2.900	1200	503954.046	422713.181	0.990
CP03	0.230	5.00	2.710	1200	503968.491	422728.833	1.200
01		5.00	3.170	1200	503909.044	422713.299	0.940
02			3.030	1200	503910.055	422725.227	0.920
04			2.750	1200	503968.630	422725.714	1.375
06			2.900	1350	503969.158	422713.855	1.650
09			3.030	1500	503989.002	422704.643	2.000
11			3.140	1500	503989.454	422694.521	2.210
18			3.060	1500	503990.072	422680.637	2.160
Attenuation31			3.400		504025.239	422670.053	2.830
PS32			3.240		504024.170	422694.035	2.720
33			2.750	1200	504032.856	422728.187	2.635
HW34			2.750	1200	504032.633	422733.182	2.685
Pond			3.000	1350	503909.218	422609.544	1.320
FRS19			3.330	1500	504019.895	422669.804	2.675
BPS25			3.300	1200	503960.238	422603.439	1.845
24			3.030	1200	503939.864	422602.718	1.440
HW22			3.000	1350	503907.401	422629.477	1.280
21			2.910	1200	503910.293	422650.949	1.095
HW23			3.000	1350	503928.025	422601.937	1.360

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.011	33	HW34	5.000	0.600	0.115	0.065	0.050	100.0	150	9.16	1.0
1.010	PS32	33	35.239	0.600	0.520	0.165	0.355	99.3	100	9.08	1.0
1.009	Attenuation31	PS32	24.006	0.600	0.570	0.520	0.050	480.1	1400	8.31	75.0
1.008	Atenuation30	Attenuation31	63.702	0.600	0.695	0.570	0.125	509.6	1400	8.21	75.0
3.007	FRS19	Attenuation31	5.350	0.600	0.655	0.635	0.020	267.5	600	7.51	75.0
3.006	18	FRS19	31.730	0.600	0.900	0.790	0.110	288.5	600	7.45	75.0
8.002	17	18	15.448	0.600	1.555	1.520	0.035	441.4	525	6.48	75.0
3.005	11	18	13.898	0.600	0.930	0.900	0.030	463.3	600	7.08	75.0
7.000	CP10	11	64.424	0.600	1.810	1.610	0.200	322.1	375	6.07	75.0
3.004	09	11	10.132	0.600	1.030	1.005	0.025	405.3	525	6.88	75.0
6.001	08	09	43.831	0.600	1.495	1.355	0.140	313.1	375	5.77	75.0
3.003	06	09	21.884	0.600	1.250	1.180	0.070	312.6	375	6.72	75.0
5.000	CP05	06	15.134	0.600	1.910	1.820	0.090	168.2	225	5.25	75.0
3.002	04	06	11.871	0.600	1.375	1.325	0.050	237.4	300	6.37	75.0
4.000	CP03	04	3.122	0.600	1.510	1.495	0.015	208.1	300	5.05	75.0
3.001	02	04	58.577	0.600	2.110	1.525	0.585	100.1	150	6.17	75.0
3.000	01	02	11.971	0.600	2.230	2.110	0.120	99.8	150	5.20	75.0
6.000	CP07	08	3.499	0.600	1.510	1.495	0.015	233.3	375	5.05	75.0
8.001	15	17	19.551	0.600	1.595	1.555	0.040	488.8	525	6.24	75.0
10.000	CP16	17	4.398	0.600	1.985	1.965	0.020	219.9	300	5.07	75.0
8.000	CP14	15	55.565	0.600	1.810	1.670	0.140	396.9	450	5.91	75.0
9.001	13	15	24.461	0.600	1.795	1.735	0.060	407.7	450	5.47	75.0
9.000	CP12	13	4.399	0.600	1.810	1.795	0.015	293.3	450	5.06	75.0
2.000	Attenuation29	Atenuation30	23.294	0.600	0.740	0.695	0.045	517.6	1400	5.10	75.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.011	1.005	17.8	5.7	2.485	2.535	2.085	0.0	58	0.895
1.010	0.772	6.1	5.7	2.620	2.485	2.085	0.0	76	0.876
1.009	3.841	68300.5	423.9	1.430	1.320	2.085	0.0	56	0.588
1.008	3.728	66287.4	26.4	1.305	1.430	0.130	0.0	11	0.192
3.007	1.484	419.5	397.4	2.075	2.165	1.955	0.0	469	1.676
3.006	1.428	403.9	397.4	1.560	1.940	1.955	0.0	487	1.615
8.002	1.059	229.3	217.5	0.980	1.015	1.070	0.0	411	1.197
3.005	1.125	318.0	179.9	1.610	1.560	0.885	0.0	323	1.157
7.000	1.004	110.9	69.1	0.915	1.155	0.340	0.0	215	1.057
3.004	1.106	239.5	110.8	1.475	1.610	0.545	0.0	251	1.086
6.001	1.018	112.5	48.8	0.880	1.300	0.240	0.0	172	0.983
3.003	1.019	112.6	62.0	1.275	1.475	0.305	0.0	199	1.043
5.000	1.005	40.0	15.2	0.765	0.855	0.075	0.0	96	0.939
3.002	1.016	71.8	46.8	1.075	1.275	0.230	0.0	177	1.080
4.000	1.086	76.7	46.8	0.900	0.955	0.230	0.0	169	1.137
3.001	1.004	17.7	0.0	0.770	1.075	0.000	0.0	0	0.000
3.000	1.006	17.8	0.0	0.790	0.770	0.000	0.0	0	0.000
6.000	1.182	130.5	48.8	0.825	0.880	0.240	0.0	159	1.099
8.001	1.006	217.8	164.7	0.940	0.980	0.810	0.0	342	1.101
10.000	1.056	74.6	52.9	0.725	0.795	0.260	0.0	187	1.142
8.000	1.014	161.3	65.1	0.750	0.940	0.320	0.0	198	0.961
9.001	1.000	159.1	99.6	0.815	0.875	0.490	0.0	259	1.054
9.000	1.182	187.9	99.6	0.750	0.815	0.490	0.0	233	1.199
2.000	3.699	65769.5	0.0	1.260	1.305	0.000	0.0	0	0.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.007	26	Atenuation30	48.490	0.600	1.375	1.170	0.205	236.5	300	7.93	75.0
1.006	BPS25	26	19.422	0.600	1.455	1.375	0.080	242.8	300	7.13	75.0
1.005	24	BPS25	20.394	0.600	1.590	1.505	0.085	239.9	300	6.81	75.0
1.004	HW23	24	11.867	0.600	1.640	1.590	0.050	237.3	300	6.47	75.0
1.003	Pond	HW23	20.306	0.600	1.680	1.640	0.040	507.6	375	6.28	75.0
1.002	HW22	Pond	20.030	0.600	1.720	1.680	0.040	500.8	375	5.85	75.0
1.001	21	HW22	21.666	0.600	1.815	1.725	0.090	240.7	300	5.44	75.0
1.000	CP20	21	4.833	0.600	1.835	1.815	0.020	241.6	300	5.08	75.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.007	1.018	71.9	26.4	1.565	1.930	0.130	0.0	126	0.942
1.006	1.004	71.0	26.4	1.545	1.565	0.130	0.0	126	0.932
1.005	1.010	71.4	26.4	1.140	1.495	0.130	0.0	126	0.937
1.004	1.016	71.8	26.4	1.060	1.140	0.130	0.0	126	0.940
1.003	0.797	88.0	26.4	0.945	0.985	0.130	0.0	140	0.699
1.002	0.803	88.7	26.4	0.905	0.945	0.130	0.0	140	0.704
1.001	1.009	71.3	26.4	0.795	0.975	0.130	0.0	126	0.936
1.000	1.007	71.2	26.4	0.675	0.795	0.130	0.0	126	0.934

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.011	5.000	100.0	150	Circular	2.750	0.115	2.485	2.750	0.065	2.535
1.010	35.239	99.3	100	Circular	3.240	0.520	2.620	2.750	0.165	2.485
1.009	24.006	480.1	1400	Tubosider	3.400	0.570	1.430	3.240	0.520	1.320
1.008	63.702	509.6	1400	Tubosider	3.400	0.695	1.305	3.400	0.570	1.430
3.007	5.350	267.5	600	Circular	3.330	0.655	2.075	3.400	0.635	2.165
3.006	31.730	288.5	600	Circular	3.060	0.900	1.560	3.330	0.790	1.940
8.002	15.448	441.4	525	Circular	3.060	1.555	0.980	3.060	1.520	1.015
3.005	13.898	463.3	600	Circular	3.140	0.930	1.610	3.060	0.900	1.560
7.000	64.424	322.1	375	Circular	3.100	1.810	0.915	3.140	1.610	1.155
3.004	10.132	405.3	525	Circular	3.030	1.030	1.475	3.140	1.005	1.610
6.001	43.831	313.1	375	Circular	2.750	1.495	0.880	3.030	1.355	1.300
3.003	21.884	312.6	375	Circular	2.900	1.250	1.275	3.030	1.180	1.475

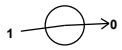
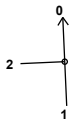
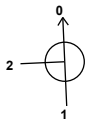
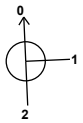
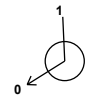
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.011	33	1200	Manhole	Adoptable	HW34	1200	Manhole	Adoptable
1.010	PS32		Junction		33	1200	Manhole	Adoptable
1.009	Attenuation31		Junction		PS32		Junction	
1.008	Atenuation30		Junction		Attenuation31		Junction	
3.007	FRS19	1500	Manhole	Adoptable	Attenuation31		Junction	
3.006	18	1500	Manhole	Adoptable	FRS19	1500	Manhole	Adoptable
8.002	17	1500	Manhole	Adoptable	18	1500	Manhole	Adoptable
3.005	11	1500	Manhole	Adoptable	18	1500	Manhole	Adoptable
7.000	CP10	1350	Manhole	Adoptable	11	1500	Manhole	Adoptable
3.004	09	1500	Manhole	Adoptable	11	1500	Manhole	Adoptable
6.001	08	1350	Manhole	Adoptable	09	1500	Manhole	Adoptable
3.003	06	1350	Manhole	Adoptable	09	1500	Manhole	Adoptable

Pipeline Schedule

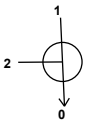
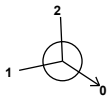
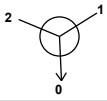
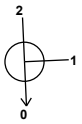
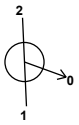
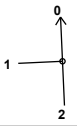
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.000	15.134	168.2	225	Circular	2.900	1.910	0.765	2.900	1.820	0.855
3.002	11.871	237.4	300	Circular	2.750	1.375	1.075	2.900	1.325	1.275
4.000	3.122	208.1	300	Circular	2.710	1.510	0.900	2.750	1.495	0.955
3.001	58.577	100.1	150	Circular	3.030	2.110	0.770	2.750	1.525	1.075
3.000	11.971	99.8	150	Circular	3.170	2.230	0.790	3.030	2.110	0.770
6.000	3.499	233.3	375	Circular	2.710	1.510	0.825	2.750	1.495	0.880
8.001	19.551	488.8	525	Circular	3.060	1.595	0.940	3.060	1.555	0.980
10.000	4.398	219.9	300	Circular	3.010	1.985	0.725	3.060	1.965	0.795
8.000	55.565	396.9	450	Circular	3.010	1.810	0.750	3.060	1.670	0.940
9.001	24.461	407.7	450	Circular	3.060	1.795	0.815	3.060	1.735	0.875
9.000	4.399	293.3	450	Circular	3.010	1.810	0.750	3.060	1.795	0.815
2.000	23.294	517.6	1400	Tubosider	3.400	0.740	1.260	3.400	0.695	1.305
1.007	48.490	236.5	300	Circular	3.240	1.375	1.565	3.400	1.170	1.930
1.006	19.422	242.8	300	Circular	3.300	1.455	1.545	3.240	1.375	1.565
1.005	20.394	239.9	300	Circular	3.030	1.590	1.140	3.300	1.505	1.495
1.004	11.867	237.3	300	Circular	3.000	1.640	1.060	3.030	1.590	1.140
1.003	20.306	507.6	375	Circular	3.000	1.680	0.945	3.000	1.640	0.985
1.002	20.030	500.8	375	Circular	3.000	1.720	0.905	3.000	1.680	0.945
1.001	21.666	240.7	300	Circular	2.910	1.815	0.795	3.000	1.725	0.975
1.000	4.833	241.6	300	Circular	2.810	1.835	0.675	2.910	1.815	0.795

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.000	CP05	1200	Manhole	Adoptable	06	1350	Manhole	Adoptable
3.002	04	1200	Manhole	Adoptable	06	1350	Manhole	Adoptable
4.000	CP03	1200	Manhole	Adoptable	04	1200	Manhole	Adoptable
3.001	02	1200	Manhole	Adoptable	04	1200	Manhole	Adoptable
3.000	01	1200	Manhole	Adoptable	02	1200	Manhole	Adoptable
6.000	CP07	1350	Manhole	Adoptable	08	1350	Manhole	Adoptable
8.001	15	1500	Manhole	Adoptable	17	1500	Manhole	Adoptable
10.000	CP16	1200	Manhole	Adoptable	17	1500	Manhole	Adoptable
8.000	CP14	1350	Manhole	Adoptable	15	1500	Manhole	Adoptable
9.001	13	1350	Manhole	Adoptable	15	1500	Manhole	Adoptable
9.000	CP12	1350	Manhole	Adoptable	13	1350	Manhole	Adoptable
2.000	Attenuation29		Junction		Atenuation30		Junction	
1.007	26	1200	Manhole	Adoptable	Atenuation30		Junction	
1.006	BPS25	1200	Manhole	Adoptable	26	1200	Manhole	Adoptable
1.005	24	1200	Manhole	Adoptable	BPS25	1200	Manhole	Adoptable
1.004	HW23	1350	Manhole	Adoptable	24	1200	Manhole	Adoptable
1.003	Pond	1350	Manhole	Adoptable	HW23	1350	Manhole	Adoptable
1.002	HW22	1350	Manhole	Adoptable	Pond	1350	Manhole	Adoptable
1.001	21	1200	Manhole	Adoptable	HW22	1350	Manhole	Adoptable
1.000	CP20	1200	Manhole	Adoptable	21	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Attenuation29	504029.112	422583.143	3.400	2.660					
						0	2.000	0.740	1400
CP20	503915.106	422651.386	2.810	0.975	1200				
						0	1.000	1.835	300
26	503979.633	422604.255	3.240	1.865	1200	1	1.006	1.375	300
									
						0	1.007	1.375	300
Atenuation30	504028.075	422606.414	3.400	2.705			1	2.000	0.695	1400
							2	1.007	1.170	300
							0	1.008	0.695	1400
CP14	503936.121	422643.196	3.010	1.200	1350				
						0	8.000	1.810	450
CP12	503997.115	422621.430	3.010	1.200	1350				
						0	9.000	1.810	450
13	503992.720	422621.235	3.060	1.265	1350		1	9.000	1.795	450
							0	9.001	1.795	450
15	503991.631	422645.672	3.060	1.465	1500		1	9.001	1.735	450
							2	8.000	1.670	450
							0	8.001	1.595	525
CP16	503995.154	422665.400	3.010	1.025	1200				
						0	10.000	1.985	300
17	503990.760	422665.204	3.060	1.505	1500		1	10.000	1.965	300
							2	8.001	1.555	525
							0	8.002	1.555	525
CP10	504053.813	422697.411	3.100	1.290	1350				
						0	7.000	1.810	375
CP07	504025.998	422731.396	2.710	1.200	1350				
						0	6.000	1.510	375
08	504026.154	422727.900	2.750	1.255	1350		1	6.000	1.495	375
							0	6.001	1.495	375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
CP05	503954.046	422713.181	2.900	0.990	1200				
						0	5.000	1.910	225
CP03	503968.491	422728.833	2.710	1.200	1200				
						0	4.000	1.510	300
01	503909.044	422713.299	3.170	0.940	1200				
						0	3.000	2.230	150
02	503910.055	422725.227	3.030	0.920	1200	1	3.000	2.110	150
									
						0	3.001	2.110	150
04	503968.630	422725.714	2.750	1.375	1200	1	4.000	1.495	300
						2	3.001	1.525	150
									
						0	3.002	1.375	300
06	503969.158	422713.855	2.900	1.650	1350	1	5.000	1.820	225
						2	3.002	1.325	300
									
						0	3.003	1.250	375
09	503989.002	422704.643	3.030	2.000	1500	1	6.001	1.355	375
						2	3.003	1.180	375
									
						0	3.004	1.030	525
11	503989.454	422694.521	3.140	2.210	1500	1	7.000	1.610	375
						2	3.004	1.005	525
									
						0	3.005	0.930	600
18	503990.072	422680.637	3.060	2.160	1500	1	8.002	1.520	525
						2	3.005	0.900	600
									
						0	3.006	0.900	600
Attenuation31	504025.239	422670.053	3.400	2.830		1	3.007	0.635	600
						2	1.008	0.570	1400
									
						0	1.009	0.570	1400
PS32	504024.170	422694.035	3.240	2.720		1	1.009	0.520	1400
									
						0	1.010	0.520	100
33	504032.856	422728.187	2.750	2.635	1200	1	1.010	0.165	100
									
						0	1.011	0.115	150
HW34	504032.633	422733.182	2.750	2.685	1200	1	1.011	0.065	150
									

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Pond	503909.218	422609.544	3.000	1.320	1350	1	1.002	1.680	375
						0	1.003	1.680	375
FRS19	504019.895	422669.804	3.330	2.675	1500	1	3.006	0.790	600
						0	3.007	0.655	600
BPS25	503960.238	422603.439	3.300	1.845	1200	1	1.005	1.505	300
						0	1.006	1.455	300
24	503939.864	422602.718	3.030	1.440	1200	1	1.004	1.590	300
						0	1.005	1.590	300
HW22	503907.401	422629.477	3.000	1.280	1350	1	1.001	1.725	300
						0	1.002	1.720	375
21	503910.293	422650.949	2.910	1.095	1200	1	1.000	1.815	300
						0	1.001	1.815	300
HW23	503928.025	422601.937	3.000	1.360	1350	1	1.003	1.640	375
						0	1.004	1.640	300

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	19.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.400	Check Discharge Rate(s)	x
Summer CV	0.750	Check Discharge Volume	x
Analysis Speed	Normal		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
2	30	0	0
30	30	0	0
100	30	0	0

Node PS32 Online Depth/Flow Control

Flap Valve	x	Invert Level (m)	0.520	Design Flow (l/s)	5.4
Replaces Downstream Link	✓	Design Depth (m)	2.500		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	5.400	2.500	5.400

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.08%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute summer	Attenuation29	248	0.781	0.041	4.6	0.0000	0.0000	OK
15 minute summer	CP20	10	1.945	0.110	16.5	0.4165	0.0000	OK
15 minute summer	26	14	1.468	0.093	15.7	0.1052	0.0000	OK
240 minute summer	Atenuation30	248	0.781	0.086	52.2	0.0000	0.0000	OK
15 minute summer	CP14	10	1.959	0.149	40.7	1.0111	0.0000	OK
15 minute summer	CP12	10	2.023	0.213	62.3	2.0437	0.0000	OK
15 minute summer	13	11	1.993	0.198	60.8	0.2826	0.0000	OK
15 minute summer	15	11	1.882	0.287	100.5	0.5069	0.0000	OK
15 minute summer	CP16	10	2.141	0.156	33.1	0.9659	0.0000	OK
15 minute summer	17	11	1.842	0.287	131.3	0.5063	0.0000	OK
15 minute summer	CP10	11	1.971	0.161	43.2	1.0811	0.0000	OK
15 minute summer	CP07	11	1.655	0.145	30.5	0.7858	0.0000	OK
15 minute summer	08	11	1.629	0.134	29.8	0.1916	0.0000	OK
15 minute summer	CP05	10	1.987	0.077	9.5	0.2038	0.0000	OK
15 minute summer	CP03	10	1.654	0.144	29.3	0.7169	0.0000	OK
15 minute summer	01	1	2.230	0.000	0.0	0.0000	0.0000	OK
15 minute summer	02	1	2.110	0.000	0.0	0.0000	0.0000	OK
15 minute summer	04	10	1.517	0.142	28.9	0.1606	0.0000	OK
15 minute summer	06	11	1.407	0.157	37.9	0.2244	0.0000	OK
15 minute summer	09	12	1.282	0.252	67.8	0.4457	0.0000	OK
15 minute summer	11	12	1.268	0.338	107.7	0.5972	0.0000	OK
15 minute summer	18	12	1.253	0.353	235.4	0.6234	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute summer	Attenuation29	2.000	Atenuation30	-4.6	0.011	0.000	18.8139	
15 minute summer	CP20	1.000	21	16.3	0.739	0.229	0.1065	
15 minute summer	26	1.007	Atenuation30	15.1	0.817	0.210	0.8956	
240 minute summer	Atenuation30	1.008	Attenuation31	-47.6	-0.052	-0.001	119.9678	
15 minute summer	CP14	8.000	15	39.9	0.742	0.247	3.3078	
15 minute summer	CP12	9.000	13	60.8	0.868	0.324	0.3094	
15 minute summer	13	9.001	15	60.9	1.003	0.383	1.4877	
15 minute summer	15	8.001	17	99.2	0.823	0.456	2.3575	
15 minute summer	CP16	10.000	17	32.5	0.954	0.435	0.1497	
15 minute summer	17	8.002	18	130.1	1.201	0.567	1.6756	
15 minute summer	CP10	7.000	11	40.9	0.966	0.369	2.7349	
15 minute summer	CP07	6.000	08	29.8	0.860	0.228	0.1303	
15 minute summer	08	6.001	09	29.5	0.885	0.262	1.4609	
15 minute summer	CP05	5.000	06	9.3	0.804	0.233	0.1755	
15 minute summer	CP03	4.000	04	28.9	0.938	0.376	0.0961	
15 minute summer	01	3.000	02	0.0	0.000	0.000	0.0000	
15 minute summer	02	3.001	04	0.0	0.000	0.000	0.0000	
15 minute summer	04	3.002	06	28.6	0.928	0.398	0.3673	
15 minute summer	06	3.003	09	38.3	0.942	0.341	0.8909	
15 minute summer	09	3.004	11	66.7	0.789	0.279	1.0674	
15 minute summer	11	3.005	18	105.7	0.634	0.333	2.3335	
15 minute summer	18	3.006	FRS19	237.9	1.472	0.589	5.1293	

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.08%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute summer	Attenuation31	244	0.781	0.211	71.3	0.0000	0.0000	OK
360 minute summer	PS32	352	0.781	0.261	20.2	0.0000	0.0000	SURCHARGED
60 minute summer	33	13	0.177	0.062	5.4	0.0700	0.0000	OK
60 minute summer	HW34	13	0.122	0.057	5.4	0.0000	0.0000	OK
15 minute summer	Pond	12	1.791	0.111	16.2	0.1589	0.0000	OK
15 minute summer	FRS19	12	0.995	0.340	237.9	0.6010	0.0000	OK
15 minute summer	BPS25	13	1.554	0.099	15.6	0.1119	0.0000	OK
15 minute summer	24	12	1.689	0.099	15.9	0.1119	0.0000	OK
15 minute summer	HW22	11	1.833	0.113	16.2	0.1615	0.0000	OK
15 minute summer	21	10	1.916	0.101	16.3	0.1140	0.0000	OK
15 minute summer	HW23	12	1.742	0.102	15.9	0.1466	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute summer	Attenuation31	1.009	PS32	23.5	0.129	0.000	71.7684	
360 minute summer	PS32	Depth/Flow	33	5.4				
60 minute summer	33	1.011	HW34	5.4	0.837	0.305	0.0323	93.4
15 minute summer	Pond	1.003	HW23	15.9	0.624	0.181	0.5241	
15 minute summer	FRS19	3.007	Attenuation31	238.3	1.516	0.568	0.8409	
15 minute summer	BPS25	1.006	26	15.7	0.894	0.221	0.3742	
15 minute summer	24	1.005	BPS25	15.6	0.801	0.219	0.3983	
15 minute summer	HW22	1.002	Pond	16.2	0.591	0.182	0.5507	
15 minute summer	21	1.001	HW22	16.2	0.755	0.227	0.4704	
15 minute summer	HW23	1.004	24	15.9	0.770	0.221	0.2460	

Results for 2 year +30% CC Critical Storm Duration. Lowest mass balance: 99.08%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	Attenuation29	480	0.912	0.172	8.0	0.0000	0.0000	OK
15 minute summer	CP20	10	1.984	0.149	27.8	0.5676	0.0000	OK
15 minute summer	26	13	1.500	0.125	26.3	0.1413	0.0000	OK
480 minute summer	Atenuation30	480	0.912	0.217	33.6	0.0000	0.0000	OK
15 minute summer	CP14	11	2.024	0.214	68.4	1.4498	0.0000	OK
15 minute summer	CP12	11	2.108	0.298	104.8	2.8584	0.0000	OK
15 minute summer	13	11	2.073	0.278	101.9	0.3973	0.0000	OK
15 minute summer	15	11	1.991	0.396	163.4	0.6991	0.0000	OK
15 minute summer	CP16	10	2.199	0.214	55.6	1.3297	0.0000	OK
15 minute summer	17	11	1.941	0.386	215.9	0.6815	0.0000	OK
15 minute summer	CP10	11	2.032	0.222	72.7	1.4874	0.0000	OK
15 minute summer	CP07	11	1.707	0.197	51.3	1.0681	0.0000	OK
15 minute summer	08	11	1.675	0.180	50.4	0.2575	0.0000	OK
15 minute summer	CP05	10	2.014	0.104	16.0	0.2740	0.0000	OK
15 minute summer	CP03	10	1.709	0.199	49.2	0.9902	0.0000	OK
15 minute summer	01	1	2.230	0.000	0.0	0.0000	0.0000	OK
15 minute summer	02	1	2.110	0.000	0.0	0.0000	0.0000	OK
15 minute summer	04	11	1.569	0.194	48.6	0.2194	0.0000	OK
15 minute summer	06	11	1.479	0.229	63.8	0.3277	0.0000	OK
15 minute summer	09	11	1.431	0.401	113.1	0.7088	0.0000	OK
15 minute summer	11	11	1.417	0.487	179.9	0.8610	0.0000	OK
15 minute summer	18	12	1.397	0.497	393.6	0.8778	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute summer	Attenuation29	2.000	Atenuation30	-8.0	-0.009	0.000	57.4620	
15 minute summer	CP20	1.000	21	27.5	0.830	0.386	0.1599	
15 minute summer	26	1.007	Atenuation30	25.8	0.944	0.358	1.3283	
480 minute summer	Atenuation30	1.008	Attenuation31	-29.8	-0.028	0.000	225.8816	
15 minute summer	CP14	8.000	15	64.0	0.769	0.397	5.4247	
15 minute summer	CP12	9.000	13	101.9	0.988	0.542	0.4706	
15 minute summer	13	9.001	15	100.9	1.088	0.634	2.3918	
15 minute summer	15	8.001	17	162.2	0.946	0.745	3.3688	
15 minute summer	CP16	10.000	17	54.8	1.110	0.734	0.2167	
15 minute summer	17	8.002	18	215.8	1.413	0.941	2.3523	
15 minute summer	CP10	7.000	11	69.8	1.117	0.629	4.0221	
15 minute summer	CP07	6.000	08	50.4	0.953	0.386	0.1937	
15 minute summer	08	6.001	09	50.0	1.023	0.444	2.1417	
15 minute summer	CP05	5.000	06	15.7	0.920	0.393	0.2589	
15 minute summer	CP03	4.000	04	48.6	1.065	0.633	0.1422	
15 minute summer	01	3.000	02	0.0	0.000	0.000	0.0000	
15 minute summer	02	3.001	04	0.0	0.000	0.000	0.1259	
15 minute summer	04	3.002	06	48.2	1.077	0.671	0.5307	
15 minute summer	06	3.003	09	63.1	1.006	0.561	1.6297	
15 minute summer	09	3.004	11	110.2	0.793	0.460	1.8186	
15 minute summer	11	3.005	18	177.7	0.719	0.559	3.4361	
15 minute summer	18	3.006	FRS19	394.1	1.722	0.976	7.2303	

Results for 2 year +30% CC Critical Storm Duration. Lowest mass balance: 99.08%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	Attenuation31	488	0.912	0.342	67.9	0.0000	0.0000	OK
480 minute summer	PS32	488	0.912	0.392	19.1	0.0000	0.0000	SURCHARGED
120 minute summer	33	14	0.177	0.062	5.4	0.0699	0.0000	OK
120 minute summer	HW34	14	0.122	0.057	5.4	0.0000	0.0000	OK
15 minute summer	Pond	11	1.827	0.147	27.2	0.2111	0.0000	OK
15 minute summer	FRS19	12	1.111	0.456	394.1	0.8066	0.0000	OK
15 minute summer	BPS25	13	1.587	0.132	26.6	0.1492	0.0000	OK
15 minute summer	24	12	1.723	0.133	26.7	0.1507	0.0000	OK
15 minute summer	HW22	11	1.871	0.151	27.1	0.2155	0.0000	OK
15 minute summer	21	10	1.951	0.136	27.5	0.1541	0.0000	OK
15 minute summer	HW23	12	1.779	0.139	26.7	0.1982	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute summer	Attenuation31	1.009	PS32	19.1	0.131	0.000	111.8003	
480 minute summer	PS32	Depth/Flow	33	5.4				
120 minute summer	33	1.011	HW34	5.4	0.837	0.305	0.0323	112.6
15 minute summer	Pond	1.003	HW23	26.7	0.700	0.303	0.7806	
15 minute summer	FRS19	3.007	Attenuation31	394.8	1.807	0.941	1.1676	
15 minute summer	BPS25	1.006	26	26.3	0.971	0.370	0.5592	
15 minute summer	24	1.005	BPS25	26.6	0.919	0.372	0.5898	
15 minute summer	HW22	1.002	Pond	27.2	0.673	0.307	0.8167	
15 minute summer	21	1.001	HW22	27.1	0.849	0.380	0.7018	
15 minute summer	HW23	1.004	24	26.7	0.865	0.371	0.3678	

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.08%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute summer	Attenuation29	735	1.229	0.489	9.0	0.0000	0.0000	OK
15 minute summer	CP20	10	2.065	0.230	52.7	0.8728	0.0000	OK
15 minute summer	26	13	1.558	0.183	49.8	0.2074	0.0000	OK
720 minute summer	Atenuation30	735	1.229	0.534	48.6	0.0000	0.0000	OK
15 minute summer	CP14	11	2.409	0.599	129.7	4.0525	0.0000	SURCHARGED
15 minute summer	CP12	11	2.489	0.679	198.6	6.5158	0.0000	SURCHARGED
15 minute summer	13	11	2.438	0.643	187.4	0.9198	0.0000	SURCHARGED
15 minute summer	15	11	2.316	0.721	309.8	1.2734	0.0000	SURCHARGED
15 minute summer	CP16	10	2.329	0.344	105.4	2.1336	0.0000	SURCHARGED
15 minute summer	17	11	2.182	0.627	411.4	1.1083	0.0000	SURCHARGED
15 minute summer	CP10	11	2.194	0.384	137.8	2.5745	0.0000	SURCHARGED
15 minute summer	CP07	11	2.050	0.540	97.3	2.9323	0.0000	SURCHARGED
15 minute summer	08	12	2.030	0.535	87.9	0.7652	0.0000	SURCHARGED
15 minute summer	CP05	10	2.067	0.157	30.4	0.4158	0.0000	OK
15 minute summer	CP03	12	2.165	0.655	93.2	3.2534	0.0000	SURCHARGED
15 minute summer	01	1	2.230	0.000	0.0	0.0000	0.0000	OK
15 minute summer	02	13	2.114	0.004	0.4	0.0049	0.0000	OK
15 minute summer	04	12	2.120	0.745	85.1	0.8423	0.0000	SURCHARGED
15 minute summer	06	12	2.025	0.775	104.3	1.1084	0.0000	SURCHARGED
15 minute summer	09	12	1.935	0.905	190.5	1.6000	0.0000	SURCHARGED
15 minute summer	11	12	1.898	0.968	311.3	1.7113	0.0000	SURCHARGED
15 minute summer	18	12	1.835	0.935	710.1	1.6515	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute summer	Attenuation29	2.000	Atenuation30	-9.0	-0.014	0.000	151.3016	
15 minute summer	CP20	1.000	21	52.0	0.943	0.730	0.2661	
15 minute summer	26	1.007	Atenuation30	49.3	1.133	0.685	2.1080	
720 minute summer	Atenuation30	1.008	Attenuation31	-42.7	0.013	-0.001	482.5364	
15 minute summer	CP14	8.000	15	122.6	0.780	0.760	8.8039	
15 minute summer	CP12	9.000	13	187.4	1.183	0.997	0.6970	
15 minute summer	13	9.001	15	187.2	1.181	1.176	3.8757	
15 minute summer	15	8.001	17	309.6	1.433	1.421	4.2237	
15 minute summer	CP16	10.000	17	104.0	1.492	1.394	0.2926	
15 minute summer	17	8.002	18	411.2	1.928	1.793	3.1367	
15 minute summer	CP10	7.000	11	129.9	1.267	1.172	6.3676	
15 minute summer	CP07	6.000	08	87.9	1.089	0.673	0.3859	
15 minute summer	08	6.001	09	84.0	1.086	0.747	4.8344	
15 minute summer	CP05	5.000	06	29.8	1.060	0.747	0.5064	
15 minute summer	CP03	4.000	04	85.1	1.318	1.109	0.2198	
15 minute summer	01	3.000	02	0.0	0.000	0.000	0.0008	
15 minute summer	02	3.001	04	-0.4	-0.044	-0.025	0.5196	
15 minute summer	04	3.002	06	85.3	1.211	1.187	0.8359	
15 minute summer	06	3.003	09	108.4	1.054	0.963	2.4137	
15 minute summer	09	3.004	11	194.6	0.901	0.812	2.1888	
15 minute summer	11	3.005	18	320.6	1.138	1.008	3.9148	
15 minute summer	18	3.006	FRS19	712.4	2.530	1.764	8.7572	

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.08%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute summer	Attenuation31	735	1.229	0.659	88.5	0.0000	0.0000	OK
720 minute summer	PS32	735	1.229	0.709	22.4	0.0000	0.0000	SURCHARGED
240 minute summer	33	16	0.177	0.062	5.4	0.0699	0.0000	OK
240 minute summer	HW34	16	0.122	0.057	5.4	0.0000	0.0000	OK
15 minute summer	Pond	11	1.897	0.217	51.1	0.3107	0.0000	OK
15 minute summer	FRS19	12	1.339	0.684	712.4	1.2090	0.0000	SURCHARGED
15 minute summer	BPS25	12	1.654	0.199	50.1	0.2253	0.0000	OK
15 minute summer	24	12	1.787	0.197	49.9	0.2223	0.0000	OK
15 minute summer	HW22	11	1.942	0.222	51.2	0.3175	0.0000	OK
15 minute summer	21	11	2.023	0.208	52.0	0.2357	0.0000	OK
15 minute summer	HW23	12	1.849	0.209	50.3	0.2991	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute summer	Attenuation31	1.009	PS32	22.4	0.065	0.000	208.5221	
720 minute summer	PS32	Depth/Flow	33	5.4				
240 minute summer	33	1.011	HW34	5.4	0.836	0.304	0.0323	151.1
15 minute summer	Pond	1.003	HW23	50.3	0.795	0.572	1.3055	
15 minute summer	FRS19	3.007	Attenuation31	713.4	2.535	1.700	1.4651	
15 minute summer	BPS25	1.006	26	49.8	1.099	0.702	0.9104	
15 minute summer	24	1.005	BPS25	50.1	1.098	0.701	0.9296	
15 minute summer	HW22	1.002	Pond	51.1	0.780	0.576	1.3419	
15 minute summer	21	1.001	HW22	51.2	0.977	0.718	1.1568	
15 minute summer	HW23	1.004	24	49.9	0.991	0.694	0.6012	

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.08%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	Attenuation29	975	1.448	0.708	12.4	0.0000	0.0000	OK
15 minute summer	CP20	11	2.121	0.286	68.2	1.0854	0.0000	OK
15 minute summer	26	13	1.593	0.218	63.6	0.2469	0.0000	OK
960 minute summer	Atenuation30	975	1.448	0.753	45.0	0.0000	0.0000	OK
15 minute summer	CP14	11	2.778	0.968	167.9	6.5483	0.0000	FLOOD RISK
15 minute summer	CP12	11	2.889	1.079	257.1	10.3532	0.0000	FLOOD RISK
15 minute summer	13	11	2.812	1.017	230.7	1.4554	0.0000	FLOOD RISK
15 minute summer	15	12	2.638	1.043	377.4	1.8424	0.0000	SURCHARGED
15 minute summer	CP16	11	2.570	0.585	136.4	3.6308	0.0000	SURCHARGED
15 minute summer	17	12	2.452	0.897	495.1	1.5853	0.0000	SURCHARGED
15 minute summer	CP10	11	2.695	0.885	178.4	5.9343	0.0000	SURCHARGED
15 minute summer	CP07	12	2.493	0.983	125.9	5.3378	0.0000	FLOOD RISK
15 minute summer	08	12	2.460	0.965	109.8	1.3815	0.0000	FLOOD RISK
15 minute summer	CP05	12	2.512	0.602	39.4	1.5921	0.0000	SURCHARGED
15 minute summer	CP03	12	2.631	1.121	120.6	5.5637	0.0000	FLOOD RISK
15 minute summer	01	13	2.525	0.295	9.1	0.3337	0.0000	SURCHARGED
15 minute summer	02	13	2.517	0.407	11.9	0.4599	0.0000	SURCHARGED
15 minute summer	04	12	2.555	1.180	103.2	1.3350	0.0000	FLOOD RISK
15 minute summer	06	12	2.432	1.182	122.5	1.6916	0.0000	SURCHARGED
15 minute summer	09	12	2.313	1.283	229.9	2.2669	0.0000	SURCHARGED
15 minute summer	11	12	2.260	1.330	384.6	2.3504	0.0000	SURCHARGED
15 minute summer	18	12	2.169	1.269	873.2	2.2422	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute summer	Attenuation29	2.000	Atenuation30	-12.4	-0.005	0.000	215.9960	
15 minute summer	CP20	1.000	21	67.0	0.998	0.941	0.3251	
15 minute summer	26	1.007	Atenuation30	62.9	1.213	0.874	2.5099	
960 minute summer	Atenuation30	1.008	Attenuation31	-38.9	0.013	-0.001	659.4559	
15 minute summer	CP14	8.000	15	153.0	0.966	0.949	8.8039	
15 minute summer	CP12	9.000	13	230.7	1.456	1.227	0.6970	
15 minute summer	13	9.001	15	228.4	1.442	1.436	3.8757	
15 minute summer	15	8.001	17	374.6	1.734	1.720	4.2237	
15 minute summer	CP16	10.000	17	123.9	1.759	1.659	0.3097	
15 minute summer	17	8.002	18	492.3	2.279	2.147	3.3373	
15 minute summer	CP10	7.000	11	155.8	1.412	1.405	7.1058	
15 minute summer	CP07	6.000	08	109.8	1.152	0.841	0.3859	
15 minute summer	08	6.001	09	107.1	1.073	0.953	4.8344	
15 minute summer	CP05	5.000	06	35.0	1.096	0.875	0.6019	
15 minute summer	CP03	4.000	04	103.2	1.465	1.344	0.2198	
15 minute summer	01	3.000	02	-9.1	-0.519	-0.513	0.2107	
15 minute summer	02	3.001	04	-11.9	-0.743	-0.671	1.0312	
15 minute summer	04	3.002	06	90.0	1.279	1.254	0.8359	
15 minute summer	06	3.003	09	125.5	1.138	1.115	2.4137	
15 minute summer	09	3.004	11	231.3	1.071	0.966	2.1888	
15 minute summer	11	3.005	18	386.1	1.371	1.214	3.9148	
15 minute summer	18	3.006	FRS19	874.6	3.105	2.166	8.9376	

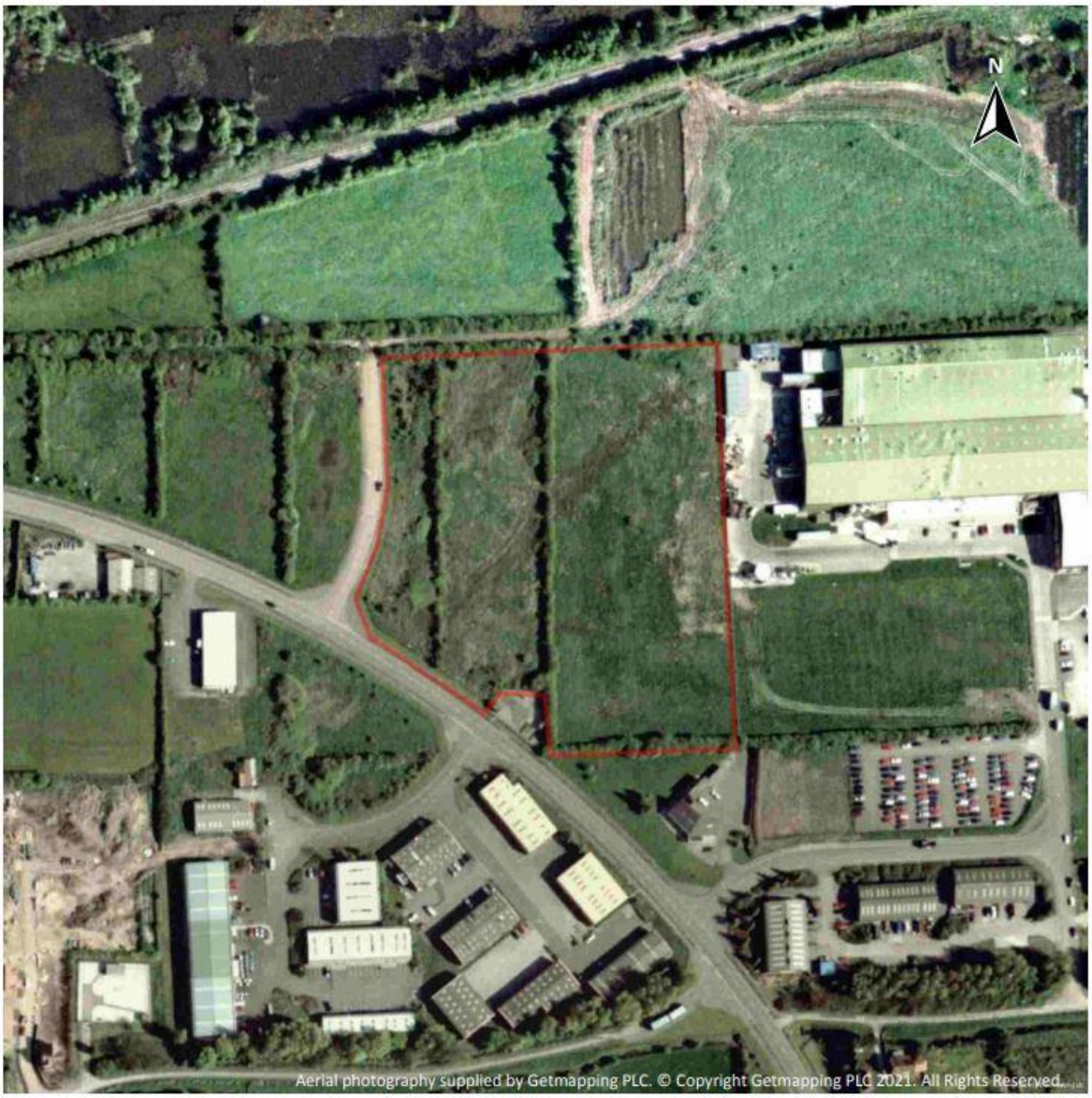
Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.08%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	Attenuation31	975	1.448	0.878	90.8	0.0000	0.0000	OK
960 minute summer	PS32	975	1.448	0.928	19.3	0.0000	0.0000	SURCHARGED
15 minute summer	33	6	0.177	0.062	5.4	0.0701	0.0000	OK
15 minute summer	HW34	6	0.122	0.057	5.4	0.0000	0.0000	OK
15 minute summer	Pond	11	1.939	0.259	65.5	0.3712	0.0000	OK
960 minute summer	FRS19	975	1.448	0.793	91.9	1.4004	0.0000	SURCHARGED
15 minute summer	BPS25	12	1.696	0.241	63.9	0.2730	0.0000	OK
15 minute summer	24	12	1.824	0.234	63.7	0.2650	0.0000	OK
15 minute summer	HW22	11	1.985	0.265	65.9	0.3791	0.0000	OK
15 minute summer	21	11	2.077	0.262	67.0	0.2964	0.0000	OK
15 minute summer	HW23	12	1.894	0.254	64.4	0.3639	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute summer	Attenuation31	1.009	PS32	19.3	0.063	0.000	275.1941	
960 minute summer	PS32	Depth/Flow	33	5.4				
15 minute summer	33	1.011	HW34	5.4	0.838	0.306	0.0324	80.9
15 minute summer	Pond	1.003	HW23	64.4	0.826	0.731	1.6306	
960 minute summer	FRS19	3.007	Attenuation31	90.8	0.783	0.216	1.5070	
15 minute summer	BPS25	1.006	26	63.6	1.150	0.896	1.1130	
15 minute summer	24	1.005	BPS25	63.9	1.179	0.895	1.1027	
15 minute summer	HW22	1.002	Pond	65.5	0.821	0.739	1.6481	
15 minute summer	21	1.001	HW22	65.9	1.036	0.924	1.4097	
15 minute summer	HW23	1.004	24	63.7	1.045	0.887	0.7281	

Appendix H: Site Aerial Photos

Recent site history - 1999 aerial photograph



Recent site history - 2007 aerial photograph

Capture Date: 17/04/2007

Recent site history - 2014 aerial photograph

Capture Date: 27/09/2014

Site Area: 2.54ha