JACKSON
CONSULTING ENGINEERS

Preliminary Drainage Strategy

Project:

Plant Based Protein Extraction Facility, Rangell Gate, Spalding, Lincolnshire

Client:

Naylor Farms

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Contents

Introduction

Jackson consulting engineers have been appointed by Naylor Farms, to undertake a drainage strategy, forming part of the supporting evidence of the planning submission for the proposed plant based protein extraction facility, to land south of west of Rangal Gate, Spalding, near PE12 6FA. The following document is to assist the planners and Lead Local Flood Authority (LLFA) in demonstrating that the development is acceptable in terms of sustainable drainage strategy and flood risk as a result of the development.

Existing Site

The site lies to the west of Rangell Gate. An aerial location plan is shown in figure 1, please note that the red line is indicative and does not indicate the planning boundary.

Figure 1 - Site Location

Site Topography

A site survey has been carried, and can be found in the background of the site layout, which will be supplied as part of the overall planning submission pack for this scheme. The total site area is 5.7 hectares.

The development sits just south of Low Road (B1165), to the west of Rangell Gate and east of the A16. The current site has no access available to it. The field is currently used for crops, and has no buildings located on it.

The overall field, is bounded by ditches. The ditch to the western boundary is off the edge of the A16, and presumably serves as the drainage for that road. From the topographical survey levels, the ditch to the north boundary falls from west to east, with the eastern boundary having a very subtle fall heading south. The southern ditch falls east to west, towards the A16, although the A16 ditch was not surveyed, it appears that ditch is deeper than the field ditches. The ditches to the field is typically 0.7-0.9m deep. During a site walkover it was noted that the ditches contained well established reeds, and it was difficult to locate any culvert locations. One culvert location was noted to the southern ditch at the vehicle access point.

At present it is assumed that all ditches bounding the field (north, east, and south) are owned by the landowner serving the field and the ditches to the east and part of the north also serve the existing highway. It is assumed that the ditch to the west is outside of the site's boundary, serving the A16 and is owned and maintained by LCC, and the site walkover demonstrated that the fields ditches connect into this via. an open connection. It is reasonable to assume that the LCC ditch will have overall connectivity into either the main river or into the IDB ditches, and this has been tentatively confirmed by LCC.

The proposed site is to be accessed from a new entrance off Rangal Gate. The levels along the edge of Low Road at the existing junction, is approximately 3.00m AOD. A culvert will be required to the existing ditch – this will require byelaw consent.

The existing field levels are generally flat, with typically range from 2.65m and 2.75m AOD.

Ground Conditions

A phase 1 or 2 ground investigation report is not available for this site currently, and the findings of this section are based on publicly available information. A full ground investigation will be undertaken prior to detailed design and assessed by the appointed engineer.

The bedrock geology of the site is described as 'Oxford Clay Formation'. This generally indicates that deeper infiltration devices are not viable for the site to understand the full viability of infiltration.

The superficial deposits are described as 'Tidal Flat Deposits', consisting of clays and silts. This type of strata can offer some limited infiltration but is generally restricted by the underlying clay. Additionally, the soaked CBR's of the silty clay are likely to be poor and not allow the use of items such as unlined porous paving.

There is limited borehole information in close proximity of the site. Any ground water levels will need to be assessed at detailed design stage.

Both British Geological Survey definitions can be found respectively in figures 2 and 3 below.

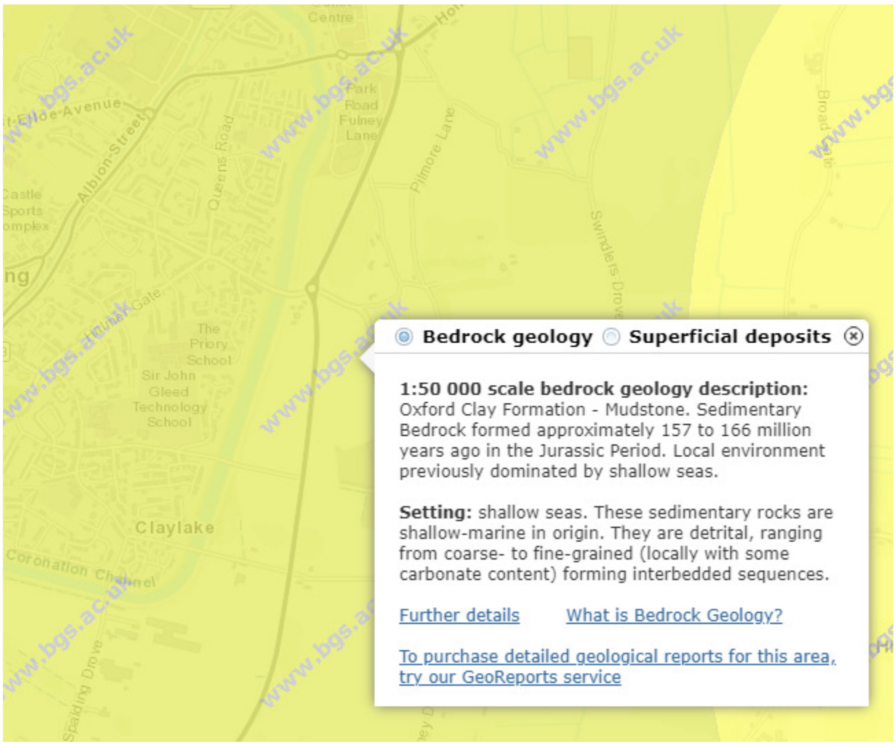


Figure 2 - BGS Bedrock Geology

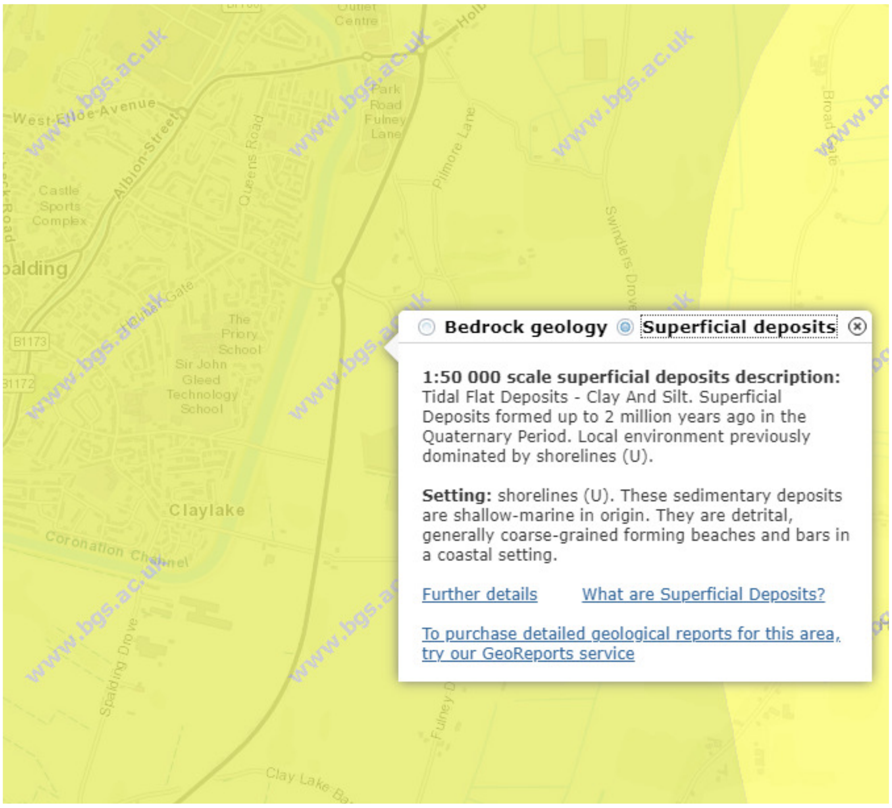


Figure 3 - BGS Superficial Deposits

Surrounding Drainage

The existing drainage for the site have already been described earlier in this document. No surface water sewers have been identified in close proximity of the site.

Overall, the development sits within South Holland Internal Drainage Boards district, specifically into Wisemans Catchment. The figure below shows the local assets in relation to the site. DRN193P1804 and 5 lie almost due east of the existing southern ditch within the landowners field. No evidence has been seen of a direct connection into this IDB ditch, and as the field ditch then proceeds to fall to the west it is unlikely that the site connects into the IDB ditch at this location.

Local to the A16, it is unclear where the A16 ditch flows into an IDB ditch, although it is assumed it does. There is an existing IDB drain to the west of the A16 (south west of the development) – DRN193P3402 which appears to connect into the A16 ditch which then flows east. It is unlikely that the drainage will have any direct connections into the Coronation Channel as the majority of the IDB drains are pumped.

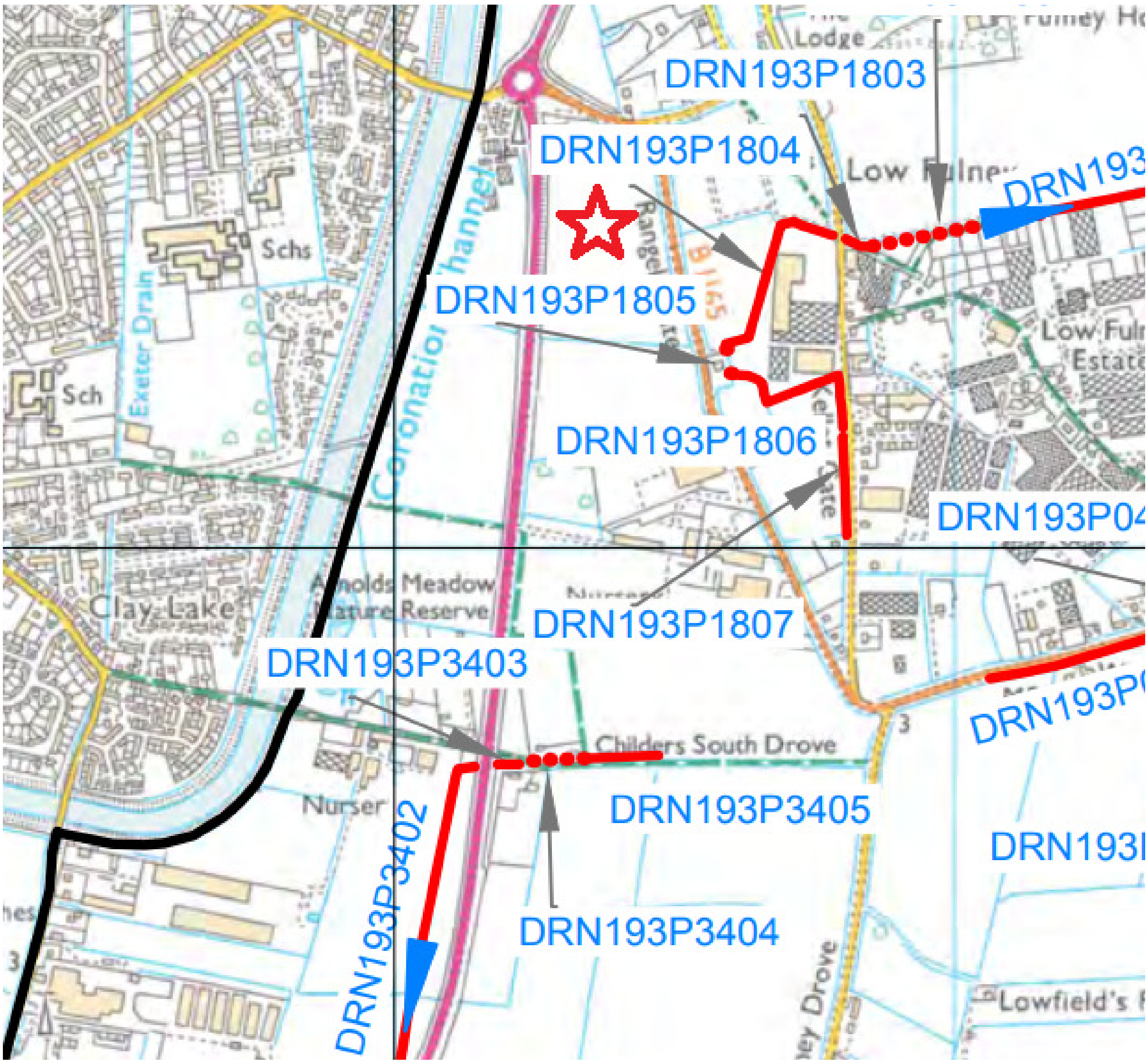


Figure 4 - IDB Assets Local to Site

In summary, the site and general area is served by land drainage, being a mixture of private and LCC ditches before ultimately discharging into IDB drainage, although this will need to be fully determined at detailed design stage. The site will benefit from natural riparian rights, but any increase to greenfield discharge needs to be established with the LLFA and IDB. Improvements to the field ditches can readily be made as they are owned by the landowner.

The final discharge rates will need to be agreed with LCC/LLFA and SHIDB/WLMA, and a development contribution will need to be made for any discharge.

Surface Water Flood Risk

The existing flood risk for the site has been assessed by a different consultant and can be found within report: ECL0563-2/P&R. The FRA has recommendations for the finished floor levels and construction and should be fully referenced to develop the detailed drainage strategy.

The FRA should be fully referred to, but the general consensus is that there is no recommended minimum FFL as the building will be built with refuse points and flood resilient construction. Given the limited depth to the existing ditch it is proposed that the floors are to be raised a minimum level too ensure that a surface water gravity solution is feasible, this is not a recommendation for flood risk, just for ease of constructing drainage elements.

Development Proposals

The development consists of the construction of a new plant based protein extraction facility and ancillary office space together with landscaping, SuDS features, car park and associated infrastructure

Drainage Strategy

The following section provides narrative on the principles behind the drainage strategy and has been carried out in general accordance with Lincolnshire County Council's "Sustainable Drainage Design and Evaluation Guide" (SDDEG), and "CIRIA's C753 – the SUDS Manual", where appropriate.

Surface Water Drainage

For new developments there is a requirement to apply sustainable drainage principles (SuDS) to the disposal of surface water from the site where practicable. As required by Building Regulations and Defra's "Non-statutory Technical Standards for Sustainable Drainage Systems" (NTS), surface water must discharge to the following, listed in priority.

1. To ground – in an adequate soakaway or some other adequate infiltration system.
2. To a watercourse.
3. To a surface water sewer, highway drain or other drainage system.
4. To a combined sewer.

Infiltration

During phase 1 of the development, basic infiltration testing has been undertaken to establish the general viability of infiltration. It is expected at detailed design, further testing will be completed.

Two different sets of testing was undertaken, the first test was to establish the viability of a drainage field for foul water – carried out in general accordance with building regulations and the second test to establish surface water drainage soakaway rates in general accordance with BRE365.

Foul Infiltration

The foul test, although undertaken in general accordance with building regulations, had a slightly different pit size, in this case being 400mm deep rather than 300mm deep. The recordings were still taken between 25 and 75% - when the water depth was between 300mm and 100mm depth. The top of test pit was taken at 500mm below ground levels. Due to access to the field, the testing was only undertaken once, and the purpose is to demonstrate overall viability of infiltration. As the total depth of water was 400mm rather than 300mm the equation is modified to represent a 200mm drop of water. The equation used for this exercise is;

V_p = Time/200

A summary of the results and infiltration rates are shown in the table below.

Trial Pit	Time taken to drop between 75% and 25%, seconds (minutes)	Time/200 = V_p
1	1140 (19)	5.7
2	3240 (54)	16.2
3	9480 (158)	47.4
4	1080 (18)	5.4
5	1320 (22)	6.6

For infiltration to a drainage field to be viable then the VP rate should fall between 12 and 100. Although several of these results were below 12, it is likely that over the subsequent 2 tests at each hole location, this result would slow down. Additionally, test location 3 had a slow V_p rate, although given that all other test locations had a good rate of drop, it would be unreasonable to use the slowest rate for the entire area.

It should be noted that these infiltration rates are preliminary, and a full set of testing is required to establish the design rates and determine if all other ground conditions are suitable. Given the amount of water required to drain, it is unlikely that a drainage field is sufficient, and these results are just for viability.

Surface Water Infiltration

Two tests were undertaken for surface water disposal, in general accordance with BRE 365. Both pits were 1.5m long x 0.6m wide x 0.9m deep, each were filled with 0.9m of water and the time taken to drop 25% and 75% were recorded. Again, due to access to the field, the tests were only undertaken once for each pit. A summary of the results is shown in the table below.

Test Location	Time taken to drop between 75% and 25%, seconds minutes	f
1	257	$9.4x10^{-6}$ m/s
2	350	$6.9x10^{-6}$ m.s

The infiltration rates show that the site has some infiltration potential, although the infiltration rates are slow, and are only likely to be slower for the 2nd and 3rd tests.

It should be noted that these infiltration rates are preliminary and a full set of testing is required to establish the design rates and determine if all other ground conditions are suitable.

Infiltration Summary

Subject to other factors stated in the foul drainage proposals section, there is potential that foul drainage can be discharge via. a drainage field, although the final design will be subject to complete testing, available space and most importantly, approval from the EA – given the volumes encountered.

The BRE 365 testing returned slow infiltration rates, and although the ground does infiltrate, as the results are slow it is likely that the entire site cannot be catered for through infiltration and will be subject to further testing. Parts of the storage features a likely to be unlined once they are out of there permeant water levels and these areas could partly infiltrate subject to full results becoming available and depth of the water table.

Although some limited infiltration can be achieved, the preliminary results are not high enough to allow infiltration to be solely used on site, but it will offer some benefit to allow low return period storm to be retained on the site.

Watercourse

As previously described, the site benefits from land drainage to the perimeter of the field, which currently serves the existing field and adopted highway. This ditch then connects into an assumed LCC ditch running alongside the A16, before assuming to connect into an IDB drain.

A connection into a watercourse is the most likely definitive connection, although the overall connection into the IDB system needs to be proven through detailed design, and rates will need to be agreed by LCC/LLFA and the IDB. Similar with the foul drainage discharge, the watercourse has potential to receive the treated water, subject to agreement with the IDB, LCC/LLFA and the EA.

Surface Water Sewer

There are no identified surface water sewers in the vicinity of the site. As a watercourse connection is viable, then there is no need for a surface water sewer to be considered.

Run-off Rates

Existing Drainage Arrangements

As the site is greenfield it has no current surface water drainage. The natural topography of the site directs surface runoff into the existing watercourses to the north, east and south of the site and will either flow directly overland or laterally within the strata layers, certainly as the underlying strata, would be considered as being very slow draining to impermeable once saturated.

Existing greenfield run-off

The greenfield run-off for the site is summarised in the figure below.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	6.72	6.72
1 in 1 year (l/s):	5.84	5.84
1 in 30 years (l/s):	16.46	16.46
1 in 100 year (l/s):	23.91	23.91
1 in 200 years (l/s):	28.28	28.28

Figure 5 - Existing Greenfield Runoff Rates

The Q_{BAR} greenfield run-off for the site is calculated at 6.7 l/s, and ideally the proposed discharge from the site should be restricted as close as practical to this rate.

The IDB also has a pumpable catchment rate of 1.4l/s. The total impermeable area of this scheme 34250m^2 – this includes the swale and basin areas, and this results in a discharge rate of 4.8l/s.

The HR Wallingford Greenfield runoff rate estimation for sites is an industry standard way to determine the greenfield run-off. The above calculation uses the IH124 method to determine the runoff.

Proposed Run-off

The greenfield run-off from the site should, as far as reasonably practical, not exceed the greenfield runoff rate for the Q_{BAR} event, which in this instance is 4.8 l/s. Therefore, the proposed discharge from the site will have a maximum runoff of 4.8 l/s, for all storms up to and including the 1 in 100 year + 40% climate change event. The post development run-off values are summarised in the table below. These figures represent the non-surcharged event. The full calculations can be found in appendix A.

Storm	Critical Flow
1 Year	4.8 l/s
2 Year	4.8 l/s
30 Year	4.8 l/s
100 Year	4.8 l/s
100 Year + 40% CC	4.8 l/s

The figures above demonstrate that the risk of flooding as a result of the development will actually lower the existing flood risk as it is being reduced below the natural QBAR discharge rates for the site. For the longer storm durations, the discharge from site has been significantly reduced, and this generally provides a good betterment for the scheme. As a result, the flood risk for the site is being reduced as a result of the development. At detailed design, and through negotiation with the IDB, it would be reasonable to increase the discharge rate to 6.7l/s, but this would incur an additional development contribution. It is recommended that due to the size of the flow control and the available areas for SUDS features, that this lower rate is adhered to.

Drainage Proposals

The ethos for the drainage design is to try and mimic natural drainage as far as possible, and to ensure that as a result of the development, flood risk offsite is not increased. The following section demonstrates how this will be achieved and outline the general drainage strategy.

The proposed drainage strategy can be found on drawing 0371-JCE-00-SI-DR-C-3000.

Infiltration

The site is somewhat unique in its layout, in the fact that large areas of open space is being provided. These spaces feature tree planting, and a pond. As a result of this, there is an opportunity to offer infiltration areas over large areas such as infiltration blankets, with any planting in these areas being specified to allow for periods of saturated ground. This option is subject to further infiltration testing and therefore is not being fully explored at this stage, although the proposed drainage layout could be easily modified to accommodate infiltration. Notes on this potential can be found on the preliminary drainage strategy. The use of infiltration will be dependent on the foul drainage solution as infiltration features for surface water shall not be located in these areas. Regardless, it is not expected that infiltration will be able to fully accommodate the site, but could be used to help enhancements to the bio-diversity for example.

Watercourses

Although the final connectivity of the ditches is not known, it is reasonable to assume that the existing ditch on the site connects into an LCC ditch which then connects into the IDB network. Subject to final agreed run-off rates, and ruling out infiltration, it is proposed that the sites surface water drainage will connect into the existing field drain.

One of the main constraints of the site is the limited fall between the proposed/existing levels and invert level of the ditch, this is exacerbated by the scale of the development. The drainage proposals put forward bear these site constraints in mind.

The north of the site is occupied by staff carparking space and an access road. It is proposed that this area will flow overland into perimeter swales which then flow into the attenuation pond/basin.

The main concrete hardstanding serving the facility will discharge to a perimeter swale – to keep the internal drainage shallow it is proposed that surface conveyance channels will be used within the concrete itself. As the site is very flat, and the outfall depth shallow, it is proposed that the swale will be designed as wet swales, which reduces the need for a longitudinal fall.

The roof water will enter a piped network before discharging into the swales.

Where the storage tanks sit, they have been designed to sit in a bunded/sump area, this means that in the even that the tank splits, the spillage will be retained before an emergency clean up can be instigated. Minor spillages will be returned back into the tanks. The sump means that gravity drainage will not be feasible, unless significant raising of the building and remaining slab levels is undertaken (it is unlikely this is feasible). At present it is proposed that the pump will discharge into the attenuation pond/basin, although a storage tank will be required to allow the pump to discharge.

Some indicative figures have been provided on the drawing, but these will be subject to change at detailed design.

To ensure that contaminated water is not inadvertently pumped offsite, telemetry will be provided and on the presence of a spillage the pumps will be turned off, and the site management/emergency plan will be activated.

All of the site's surface water will ultimately discharge into the attenuation pond/basin, which will have a flow restriction before discharging into the fields ditch. The current proposal is for the pond to have a wet bed to provide amenity value for the site. This will create a permanent water level, and the water level will rise during storm events, helping to cycle the water.

The site has been designed to incorporate source control as far as reasonably practical, and it is our opinion that SUDS has been fully considered for this type of development, meeting all of the appropriate standards. All of the water from these sources will pass through at least two treatment devices.

The site utilises a Hydrobrake, which has a provisional opening size of 109mm to control the discharge to greenfield run-off rates. The surface water will pass through features such as reeds within the swale, filter strips and the pond, and therefore the risk of blockage is low as debris will be filtered before entering the Hydrobrake. If the Hydrobrake was to become blocked, or a higher storm period encountered then there would be more flooding than currently modelled. A provisional flood route is shown on the proposed drainage plans, but to summarise, flood water would flow towards the attenuation basin, utilise the freeboard, then overtop into the existing watercourse, away from any buildings.

The system has been designed so that there is no above ground flooding for the 1 in 30-year event and all flooding up to and including the 1 in 100 year + 40% climate change event is contained within the site. The calculations demonstrate that the 1 in 30-year storm event is stored below ground. For the 1 in 100-year + 40% climate change event, there is some minor flooding – a total of approximately 55m^3 located in the channels of the concrete hardstanding – this would easily dissipate into the surrounding area (typically towards swales. A 3D schematic of the drainage model is shown in the figure below.

The proposed drainage layout is shown on JCE drawing 0371-JCE-00-SI-DR-C-3000 which has been provided in the overall planning submission related to this application.

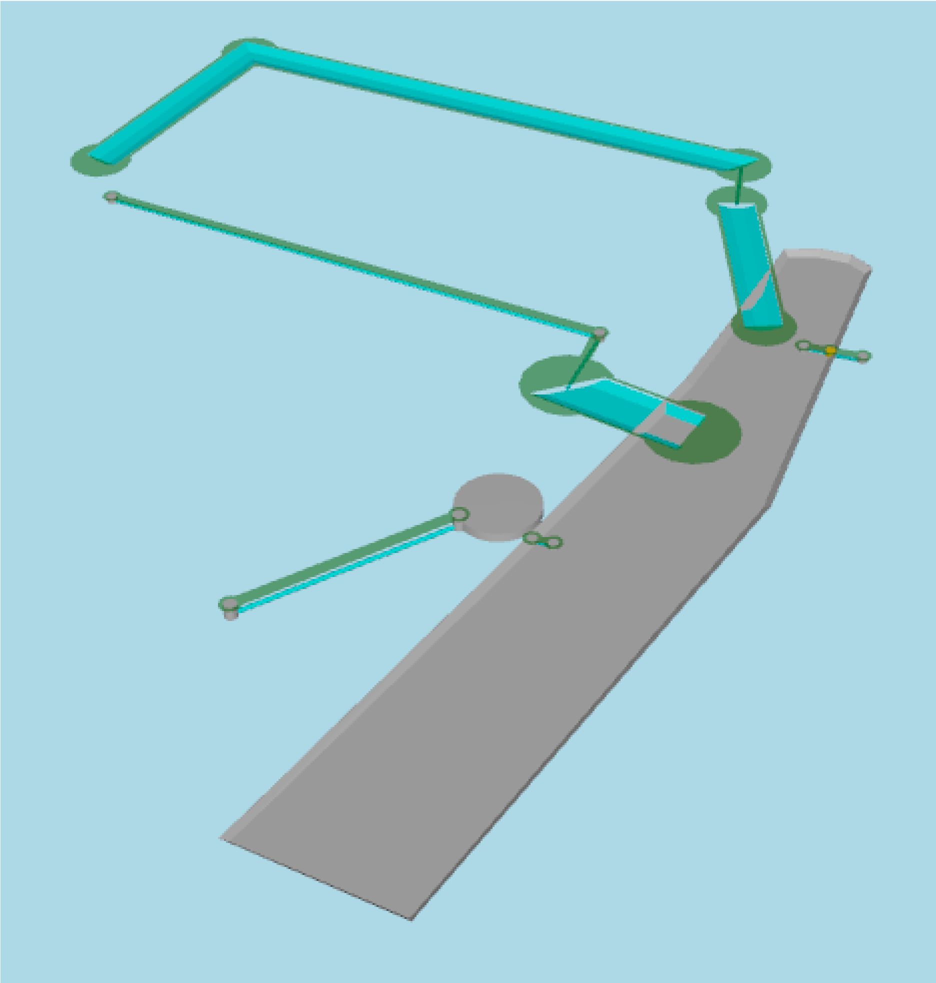


Figure 6 - 3D View of Drainage Model

Surcharged Outfall

During storm events, it is unknown if the water in the existing watercourse network will surcharge the outfall device, which needs to be considered. As this cannot be determined, the model has included a surcharged outfall for the worst case storms, the 1 in 100 year + 40% CC event. As the water levels are not known a surcharge depth of 0.5m has been assumed. A flap valve is to be fitted downstream of the Hydrobrake to ensure offsite water does not enter the site.

Exceedance Flows

There is always the possibility that a device can become temporarily blocked or fail, resulting in the system flooding. Additionally, the site has been designed up to and including storms of 1 in 100 year + 40% climate change, any storms greater than this will cause above ground flooding. The proposed flood routing in storms of exceedance or device failure can be found on the drainage drawing. The top of bank for the pond is set at 2.80m AOD, which is slightly above the surrounding levels – but this will allow some of the arisings to be reused on site. The modelled water level in the pond during the critical 1 in 100 year + 40% storm event is 2.372m AOD, therefore more than 400mm of free board is being provided, which is appropriate for this type of scheme. Free board to the building's FFL is more than 900mm.

Water Quality

The methods of surface water disposal mentioned above have included provisions for water quality. In accordance with CIRIA C753, the pollution hazard features for the drainage areas are:

- Other roofs - Low
- Non-residential parking - Low
- Commercial yard and delivery areas - Medium

To remove the pollution risks, CIRA have developed 'Pollution hazard indices' and the 'mitigation indices' that the SuDS components provide, further details of these are found in figures 8 and 9 below. This simple approach is considered suitable for this type of development.

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Figure 7 - Pollution hazard indices for different land use classifications

	Mitigation indices[1]		
Type of SuDS component	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Figure 8 - Indicative SuDS mitigation indices for discharging to a surface water

To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type):

Total SuDS mitigation index ≥ pollution hazard index
(for each contaminant type) (for each contaminant type)

Where the mitigation index of an individual component is insufficient, two components (or more) in series will be required where:

$$\text{Total SuDS mitigation index} = \text{mitigation index}_1 + 0.5\,(\text{mitigation index}_2)$$

Where:

$$\text{Mitigation index}_n = \text{mitigation index for component } n$$

Provided the total SuDS mitigation index exceeds the pollution hazard indices, then sufficient water quality will be provided.

For the calculations below the hazards are represented by;

Total suspended solids = Red

Metals = Blue

Hydrocarbons = Green

The figures are presented to show the actual achieved in the right-hand side column. The right-hand side's total must be higher than the left-hand side.

Roof areas

The roof water enters the below ground pipework directly, before passing into a swale, before ultimately discharging into the attenuation pond. The mitigation for this area is:

0.3 0.8 0.05 = Swale 0.5 0.6 0.6 + ½ Detention Basin 0.7 0.7 0.5 – Total 0.85 0.95 0.85

The mitigation provided by the swale and detention pond creates enough water quality improvement for this aspect of the development.

Non-residential parking

The non-residential parking will pass overland into the swale before discharging into the detention basin. The mitigation for this area is:

0.5 0.4 0.4 = Swale 0.5 0.6 0.6 + ½ Detention Basin 0.7 0.7 0.5 – Total 0.85 0.95 0.85

The mitigation provided by the swale and detention pond creates enough water quality improvement for this aspect of the development.

Commercial Yard and Delivery Areas

The commercial yard and delivery area will drain into a swale, before discharging into the detention pond. The mitigation for this area is:

0.7 0.6 0.7 = Swale 0.5 0.6 0.6 + ½ Detention Basin 0.7 0.7 0.5 – Total 0.85 0.95 0.85

The mitigation provided by the swale and detention pond creates enough water quality improvement for this aspect of the development.

All the methods above provide enough water quality in accordance with CIRIA's C753 document or a suitable compared to the existing drainage arrangements. Further evidence will need to be provided at detailed design stage. In some instances the water will also pass over a filter strip which will improve the water quality further.

Flood Risk off-site

As the flow from site will be restricted to below greenfield runoff rates (the pumpable rate is lower than natural run-off rate), the flood risk offsite has not been increased as a result of the development, and for the higher storm durations it has been decreased.

Management/Maintenance

It is crucial that the elements mentioned in the drainage elements and water quality are maintained to a sufficient standard to ensure that the devices can still function as designed. Generally, the maintenance requirements are either from CIRIA 753, or manufacturer guidance. It is currently assumed that the building's management will maintain the SUDS devices.

The devices outlined below are preliminary only and subject to detailed design.

Filter Strip

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

Hydrobrake Maintenance

Maintenance

Normally, little maintenance is required as there are no moving parts within the Flow Control. Experience has shown that if blockages occur they do so at the intake, and the cause on such occasions has been due to a lack of attention to engineering detail such as approach velocities being too low, inadequate benching, or the use of units below the minimum recommended size. The Flow Control (where applicable) is fitted with a pivoting bypass door, which allows the manhole chamber to be drained down should blockage occur. The smaller conical units, below the minimum recommended size, are also supplied with rodding facilities or vortex suppressor pipes as standard.

Following installation of the Flow Control it is vitally important that any extraneous material i.e. building materials are removed from the unit and the chamber. After the system is made live, and assuming that the chamber design is satisfactory, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required. If problems are experienced, please do not hesitate to contact the company so that an investigation may be made.

All Flow Control units are typically manufactured from grade 304 Stainless Steel, and if required they can also be manufactured in grade 316 Stainless Steel. Both materials have an estimated life span in excess of the design life of drainage systems.

Detention Pond

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

Swales

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

Catchpits

Catchpits are utilised to help prevent the ingress of heavy sediment and other debris from entering the system. Maintenance requirements are low, and it is recommended that catchpits are inspected every six months and any build-up of sediment removed.

Pipework

If sediment in the catchpits are above the incoming pipes, or if performance of the site is hampered, then the pipes are to be inspect and jetted as necessary. The condition of the pipes shall generally be checked at the catchpit inspections.

Headwall

The headwall, and bed of the watercourse at that location is to be inspected every 12 months, and any signs of wear, or erosion are to be addressed.

Foul Proposals

Unlike surface water drainage, the preference for foul water disposal is to connect into a sewer, and only where this is not a viable option should other means of drainage be considered.

Connection to a Sewer

Extracts of the Anglian Water asset maps are shown in the figures below, with the full asset maps being provided in appendix D. The first figure shows a foul connection, reference 0801, in Low Road to the east of the entrance of the site. The length of this connection would be approximately 590m, and it would have to go through a busy roundabout and over a bridge. As a result of this, this connection point is not deemed suitable due to the cost, but more importantly the disruption of the works.

The second figure shows an existing riser main to the south of the site, with the majority of the line of riser main being within the landowners land. This connects into an existing pumping station in Matmore Gate. The length of connection to this point would be approximately 0.70km, and although this is significantly further than the other closest sewer, it would be easier to construct, although a limiting factor would be, similar to the first connection point, crossing the river and A16, and therefore this connection point is also not deemed suitable, again due to the cost, but more importantly the disruption of the works.

Figure 9 - Foul Connection into Low Road

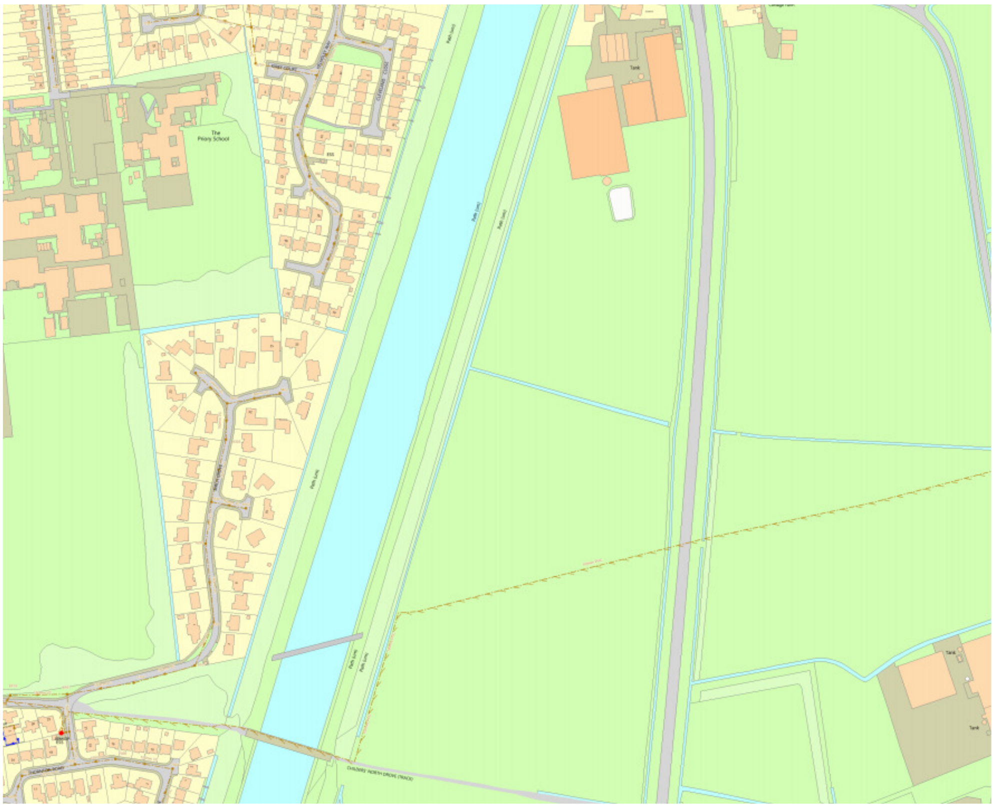


Figure 10 - Foul Connection into Matmore Gate

At present, the total number of people proposed to work in this development is 60. Under 'British Water Flows and Loads', an 'office/factory without canteen' should allow for 50 litres per person per day. This means that minimum storage of 3000 litres is required for a pumping station – this is to comply with building regulations.

Additionally, as part of the processes on site, there will be waste water from cabbage washing. As these sites are innovators in the field, it is proposed that a large amount of the water used in the process is either directly recycled into the system, evaporates into the air, or is turned into a 'gel' which is then used for other industries – this is converted, stored on site and the transported away.

Through all of the processes involved, the final discharge still amounts to 10m^3, with the domestic type waste generated from the workers, this amounts to a total of 13m^3 per day. Although in the scheme of things this is a modest amount, it exceeds the amount that the EA will allow without a permit. Permits should only be granted in exception circumstances, which is detailed further below.

One of the criteria for a reasonable connection is the length of the connection. The EA consider a connection be made to the public sewer if the distance of the closest sewer falls within the following condition.

> *Divide the maximum volume in cubic metres that you want to discharge from those other premises by 0.75 (1 cubic metre is 1000 litres). Multiply the result by 30 metres. This will give you a result in metres.*

The daily volume of discharge from the site will not exceed $13m^3$. With the EA's formula, this gives a distance of approximately 520m (($13m^3$/0.75)*30). This means that the current identified sewer is not within the limit of this.

The EA states '*If there is a good reason why you cannot connect to the public foul sewer (for example, if there is a river or a railway line in the way) then you must apply for a permit. You must provide evidence to justify this when you apply'*. In this sites case, either connection will need to cross the A16 or a river, with the southern connection having to cross through ditches and the northern connection having to pass through a roundabout. These constraints of the site would make the connection into the existing foul sewer unreasonable and alternative methods of foul drainage is to be considered. Both options will need to pass through a river regardless.

Additionally, this sewer only serves a handful of properties prior to being pumped elsewhere. This is likely to require upgrades to the system, and the disruption and cost this will cause should be a consideration as to why a connection here is not feasible.

The water will pass through wastewater treatment plants to ensure that the water quality reaches appropriate levels or treatment.

There will be seldom occasions where the site is cleaned – this is estimated to be once a month. During this process, more waste water will be generated and due to the presence of cleaning chemicals this water will not be suitable for recycling, re-use or distribution through the waste water treatment plants. On these days, the wastewater will be collected, and taken offsite for disposal – this ensures that the daily volume of water leaving the site is note exceeded and that the discharge is suitable to be cleaned to sufficient levels and discharge into the watercourse.

Another considered to be presented to the EA is the general location of this development. The waste water discharge flow would flow away from any residential areas before eventually being pumped out by the IDB. This will limit the impact of any nuisance smells.

Conclusion

- The above drainage strategy demonstrates that the site can be drained through the use of a Sustainable Drainage System at an appropriate level for the development, and although the final method has not been decided, viable options have been provided.
- The flow offsite will be restricted to a maximum of 4.8 l/s.
- Calculations have been included to assess a surcharged outfall.
- Maximum water depth in the basin is less than 0.5m.
- No flooding is currently anticipated for the 1 in 100 year + 40% climate change event.
- Existing greenfield offsite flow from the undeveloped site is reduced for all storms above the Q_{BAR} event – the discharge is in fact reduced to the pumpable catchment rate which is lower than the Q_{BAR} event.
- The proposed scheme does not increase the risk of flooding either on or off site as a result of the development.
- A full maintenance strategy will be developed at the detailed design stage.
- The total foul discharge from the site is slightly more than $13m^3$ per day.
- This is more than the EA allows in the general binding rules and an EA permit will be required.
- The length of connection to the foul sewer exceeds the EA's 'reasonable' length formula, and for the viability of the project can be ruled out.
- A preliminary drainage layout can be found on JCE's Preliminary Drainage Strategy drawing: 0371-JCE-00-SI-DR-C-3000.

Appendices

Appendix A – Proposed Drainage Calculations

Design Settings

Rainfall Methodology	FSR
Return Period (years)	1
Additional Flow (%)	0
FSR Region	England and Wales
M5-60 (mm)	20.000
Ratio-R	0.400
CV	0.750
Time of Entry (mins)	5.00

Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	1.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	0.200
Preferred Cover Depth (m)	1.200
Include Intermediate Ground	✓
Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
PS4	0.890	5.00	2.800	1500	526401.429	322395.919	1.800
S Pump			2.800	1500	526432.776	322441.668	1.892
PS5		5.00	2.800	1200	526450.623	322441.467	0.700
HW3			2.800	1200	526455.420	322442.057	0.738
HW2	0.792	5.00	2.800		526436.015	322493.000	0.750
SW5			2.800		526468.634	322489.365	0.751
HW4	0.840	5.00	2.800	1200	526480.772	322530.435	0.750
PS6			2.800	1200	526487.242	322531.406	0.794
HW5			2.800	1200	526494.885	322532.556	0.846
PS1		5.00	3.250	1350	526298.585	322513.581	0.800
PS2			3.250	1350	526435.172	322513.581	1.104
HW1			2.800		526444.834	322579.216	0.728
SW1		5.00	3.000		526286.532	322527.317	0.500
SW2			3.000		526295.272	322590.632	0.501
SW3			3.000		526439.848	322595.560	0.502
SW4			2.800		526469.493	322533.611	0.738

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)
3.000	PS4	S Pump	55.458	0.600	1.000	0.908	0.092	600.0	600	5.94	1.0
2.002	HW2	SW5	32.821	0.035	2.050	2.049	0.001	32820.9	4000	14.32	1.0
2.000	PS1	PS2	136.587	0.600	2.450	2.146	0.304	450.0	450	7.39	1.0
2.001	PS2	HW2	20.598	0.600	2.146	2.100	0.046	450.0	450	7.75	1.0
4.000	HW4	PS6	6.542	0.600	2.050	2.006	0.044	150.0	150	5.13	1.0
4.001	PS6	HW5	7.729	0.600	2.006	1.954	0.052	150.0	150	5.29	1.0

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)
3.000	0.987	279.0	2.4	1.200	1.292	0.890	0.0	39	0.309
2.002	0.083	229.1	3.1	0.250	0.251	1.160	0.0	42	0.018
2.000	0.952	151.4	1.0	0.350	0.654	0.368	0.0	26	0.272
2.001	0.952	151.4	1.0	0.654	0.250	0.368	0.0	26	0.272
4.000	0.818	14.5	2.3	0.600	0.644	0.840	0.0	40	0.597
4.001	0.818	14.5	2.3	0.644	0.696	0.840	0.0	40	0.597

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)
1.000	SW1	SW2	63.915	0.035	2.500	2.499	0.001	100000.0	1700	29.74	1.0
1.003	HW1	SW4	51.845	0.035	2.072	2.067	0.005	10000.0	1700	30.00	1.0
5.000	PS5	HW3	4.833	0.600	2.100	2.092	0.008	600.0	100	5.26	1.0
1.002	SW3	HW1	17.088	0.035	2.498	2.422	0.076	225.0	150	30.00	1.0
1.001	SW2	SW3	144.660	0.035	2.499	2.498	0.001	100000.0	1700	30.00	1.0

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)
1.000	0.043	68.9	0.1	0.000	0.001	0.048	0.0	14	0.005
1.003	0.136	217.9	1.7	0.228	0.233	0.632	0.0	34	0.029
5.000	0.307	2.4	0.0	0.600	0.608	0.000	0.0	0	0.000
1.002	0.213	3.8	1.7	0.352	0.228	0.632	0.0	71	0.209
1.001	0.043	68.9	1.7	0.001	0.002	0.632	0.0	66	0.014

Pipeline Schedule

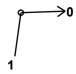
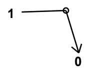
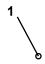
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
3.000	55.458	600.0	600	Circular	2.800	1.000	1.200	2.800	0.908	1.292
2.002	32.821	32820.9	4000	Swale	2.800	2.050	0.250	2.800	2.049	0.251
2.000	136.587	450.0	450	Circular	3.250	2.450	0.350	3.250	2.146	0.654
2.001	20.598	450.0	450	Circular	3.250	2.146	0.654	2.800	2.100	0.250
4.000	6.542	150.0	150	Circular	2.800	2.050	0.600	2.800	2.006	0.644
4.001	7.729	150.0	150	Circular	2.800	2.006	0.644	2.800	1.954	0.696
1.000	63.915	100000.0	1700	Swale	3.000	2.500	0.000	3.000	2.499	0.001
1.003	51.845	10000.0	1700	Swale	2.800	2.072	0.228	2.800	2.067	0.233
5.000	4.833	600.0	100	Circular	2.800	2.100	0.600	2.800	2.092	0.608
1.002	17.088	225.0	150	Circular	3.000	2.498	0.352	2.800	2.422	0.228
1.001	144.660	100000.0	1700	Swale	3.000	2.499	0.001	3.000	2.498	0.002

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
3.000	PS4	1500	Manhole	1 Adoptable	S Pump	1500	Manhole	1 Adoptable
2.002	HW2		Junction		SW5		Junction	
2.000	PS1	1350	Manhole	1 Adoptable	PS2	1350	Manhole	1 Adoptable
2.001	PS2	1350	Manhole	1 Adoptable	HW2		Junction	
4.000	HW4	1200	Manhole	1 Adoptable	PS6	1200	Manhole	1 Adoptable
4.001	PS6	1200	Manhole	1 Adoptable	HW5	1200	Manhole	1 Adoptable
1.000	SW1		Junction		SW2		Junction	
1.003	HW1		Junction		SW4		Junction	
5.000	PS5	1200	Manhole	1 Adoptable	HW3	1200	Manhole	1 Adoptable
1.002	SW3		Junction		HW1		Junction	
1.001	SW2		Junction		SW3		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
PS4	526401.429	322395.919	2.800	1.800	1500	0	3.000	1.000	600
S Pump	526432.776	322441.668	2.800	1.892	1500	1	3.000	0.908	600
PS5	526450.623	322441.467	2.800	0.700	1200	0	5.000	2.100	100
HW3	526455.420	322442.057	2.800	0.738	1200	1	5.000	2.092	100
HW2	526436.015	322493.000	2.800	0.750		1	2.001	2.100	450
						0	2.002	2.050	4000
SW5	526468.634	322489.365	2.800	0.751		1	2.002	2.049	4000
HW4	526480.772	322530.435	2.800	0.750	1200	0	4.000	2.050	150
PS6	526487.242	322531.406	2.800	0.794	1200	1	4.000	2.006	150
						0	4.001	2.006	150
HW5	526494.885	322532.556	2.800	0.846	1200	1	4.001	1.954	150
PS1	526298.585	322513.581	3.250	0.800	1350	0	2.000	2.450	450
PS2	526435.172	322513.581	3.250	1.104	1350	1	2.000	2.146	450
						0	2.001	2.146	450
HW1	526444.834	322579.216	2.800	0.728		1	1.002	2.422	150
						0	1.003	2.072	1700
SW1	526286.532	322527.317	3.000	0.500		0	1.000	2.500	1700

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW2	526295.272	322590.632	3.000	0.501		1	1.000	2.499	1700
						 0	1.001	2.499	1700
SW3	526439.848	322595.560	3.000	0.502		1	1.001	2.498	1700
						 0	1.002	2.498	150
SW4	526469.493	322533.611	2.800	0.738		 1	1.003	2.067	1700

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Node PS6 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	2.006	Product Number	CTL-SHE-0109-4800-0600-4800
Design Depth (m)	0.600	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.8	Min Node Diameter (mm)	1200

Node S Pump Offline Pump Control

Flap Valve	x	Invert Level (m)	0.908	Design Flow (l/s)	100.0	Switch off depth (m)	0.010
Loop to Node	HW3	Design Depth (m)	1.200	Switch on depth (m)	0.050		

Depth (m)	Flow (l/s)
1.200	100.000

Node HW4 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	120.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	2.050	Main Channel Slope (1:X)	10000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.035

Inlets

HW3 | SW5 | SW4

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	7352.0	0.0	0.700	8377.0	0.0

Node S Pump Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	0.908
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	39

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	250.0	0.0	1.200	250.0	0.0	1.210	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.35%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PS4	7	1.317	0.317	125.4	0.5594	0.0000	OK
60 minute winter	S Pump	46	1.154	0.246	64.8	58.8258	0.0000	OK
1440 minute winter	PS5	1350	2.121	0.021	0.0	0.0241	0.0000	OK
1440 minute winter	HW3	1260	2.121	0.059	0.1	0.0668	0.0000	OK
15 minute winter	HW2	14	2.294	0.244	151.7	0.0000	0.0000	OK
15 minute winter	SW5	14	2.293	0.244	108.4	0.0000	0.0000	OK
1440 minute winter	HW4	1320	2.121	0.071	10.6	0.0804	0.0000	OK
1440 minute winter	PS6	1320	2.117	0.111	4.2	0.1253	0.0000	OK
15 minute summer	HW5	1	1.954	0.000	0.7	0.0000	0.0000	OK
15 minute winter	PS1	12	2.479	0.029	2.3	0.0419	0.0000	OK
15 minute winter	2.000:50%	10	2.473	0.175	51.9	0.0000	0.0000	OK
15 minute winter	PS2	12	2.320	0.174	48.6	0.2494	0.0000	OK
480 minute winter	HW1	352	2.124	0.052	4.8	0.0000	0.0000	OK
360 minute winter	SW1	256	2.657	0.157	0.8	0.0000	0.0000	OK
360 minute winter	1.000:50%	256	2.656	0.157	2.6	1.2264	0.0000	OK
360 minute winter	SW2	256	2.657	0.158	4.2	0.0000	0.0000	OK
360 minute winter	1.001:50%	256	2.656	0.158	12.6	1.2368	0.0000	OK
360 minute winter	SW3	256	2.656	0.158	5.4	0.0000	0.0000	SURCHARGED
1440 minute winter	SW4	1290	2.121	0.059	3.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	PS4	3.000	S Pump	125.1	1.861	0.448	4.3021	
60 minute winter	S Pump	Pump	HW3	20.5				93.4
1440 minute winter	PS5	5.000	HW3	0.0	0.020	0.013	0.0075	
60 minute winter	HW3	Flow through pond	HW4	22.5	0.015	0.003	221.7094	
15 minute winter	HW2	2.002	SW5	108.4	0.175	0.473	37.9551	
60 minute winter	SW5	Flow through pond	HW4	22.5	0.015	0.003	221.7094	
1440 minute winter	HW4	4.000	PS6	4.2	0.406	0.289	0.0725	
1440 minute winter	PS6	Hydro-Brake®	HW5	4.2				243.8
15 minute winter	PS1	2.000	2.000:50%	-2.3	-0.088	-0.015	2.0345	
15 minute winter	PS1	2.000	PS2	48.6	0.882	0.321	3.7998	
15 minute winter	PS2	2.001	HW2	46.1	0.891	0.304	1.2359	
360 minute winter	HW1	1.003	SW4	4.9	0.057	0.022	4.6167	
30 minute winter	SW1	1.000	1.000:50%	-8.5	-0.085	-0.123	7.5468	
30 minute winter	SW1	1.000	SW2	-16.1	-0.105	-0.234	7.5661	
15 minute winter	SW2	1.001	1.001:50%	-29.0	-0.167	-0.420	13.7383	
15 minute winter	SW2	1.001	SW3	30.0	0.160	0.436	16.6932	
360 minute winter	SW3	1.002	HW1	4.9	0.351	1.301	0.2113	
60 minute winter	SW4	Flow through pond	HW4	22.5	0.015	0.003	221.7094	

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.35%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	PS4	46	1.480	0.480	157.0	0.8482	0.0000	OK
60 minute winter	S Pump	46	1.480	0.572	153.8	136.7635	0.0000	OK
1440 minute winter	PS5	1440	2.204	0.104	0.0	0.1172	0.0000	SURCHARGED
1440 minute winter	HW3	1440	2.204	0.142	0.1	0.1604	0.0000	OK
15 minute winter	HW2	13	2.515	0.465	363.1	0.0000	0.0000	OK
15 minute winter	SW5	13	2.511	0.462	269.3	0.0000	0.0000	OK
1440 minute winter	HW4	1440	2.204	0.154	20.7	0.1737	0.0000	SURCHARGED
1440 minute winter	PS6	1440	2.197	0.191	4.8	0.2157	0.0000	SURCHARGED
15 minute summer	HW5	1	1.954	0.000	2.9	0.0000	0.0000	OK
15 minute winter	PS1	11	2.609	0.159	14.1	0.2269	0.0000	OK
15 minute winter	2.000:50%	11	2.593	0.295	127.2	0.0000	0.0000	OK
15 minute winter	PS2	13	2.528	0.382	115.3	0.5468	0.0000	OK
1440 minute winter	HW1	1410	2.204	0.132	6.3	0.0000	0.0000	OK
240 minute winter	SW1	212	2.801	0.301	2.6	0.0000	0.0000	OK
240 minute winter	1.000:50%	212	2.800	0.301	8.7	4.5276	0.0000	OK
240 minute winter	SW2	212	2.801	0.302	13.8	0.0000	0.0000	OK
240 minute winter	1.001:50%	212	2.800	0.302	37.7	4.5398	0.0000	OK
240 minute winter	SW3	212	2.801	0.303	11.7	0.0000	0.0000	FLOOD RISK
1440 minute winter	SW4	1410	2.204	0.142	6.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	PS4	3.000	S Pump	301.9	2.088	1.082	11.4376	
60 minute winter	S Pump	Pump	HW3	47.6				228.0
600 minute summer	PS5	5.000	HW3	-0.1	-0.038	-0.030	0.0293	
30 minute winter	HW3	Flow through pond	HW4	63.6	0.023	0.009	426.8625	
15 minute winter	HW2	2.002	SW5	269.3	0.208	1.175	81.9532	
30 minute winter	SW5	Flow through pond	HW4	63.6	0.023	0.009	426.8625	
1440 minute winter	HW4	4.000	PS6	4.8	0.406	0.332	0.1152	
1440 minute winter	PS6	Hydro-Brake®	HW5	4.8				325.7
15 minute summer	PS1	2.000	2.000:50%	-14.5	-0.291	-0.096	5.1897	
15 minute winter	PS1	2.000	PS2	115.3	1.020	0.762	8.5061	
15 minute winter	PS2	2.001	HW2	106.3	0.942	0.702	3.0515	
180 minute winter	HW1	1.003	SW4	7.1	0.061	0.033	8.7878	
15 minute winter	SW1	1.000	1.000:50%	-26.7	-0.146	-0.387	14.5909	
15 minute winter	SW1	1.000	SW2	-54.0	-0.185	-0.783	14.5417	
15 minute winter	SW2	1.001	1.001:50%	-86.9	-0.254	-1.262	32.2635	
15 minute winter	SW2	1.001	SW3	82.8	0.236	1.202	34.9804	
240 minute winter	SW3	1.002	HW1	7.2	0.473	1.917	0.2295	
30 minute winter	SW4	Flow through pond	HW4	63.6	0.023	0.009	426.8625	

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.35%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	PS4	45	1.674	0.674	206.4	1.1908	0.0000	SURCHARGED
60 minute winter	S Pump	46	1.670	0.762	199.0	182.4006	0.0000	OK
1440 minute winter	PS5	1470	2.248	0.148	0.0	0.1673	0.0000	SURCHARGED
1440 minute winter	HW3	1470	2.248	0.186	0.1	0.2103	0.0000	OK
15 minute winter	HW2	13	2.608	0.558	468.4	0.0000	0.0000	FLOOD RISK
15 minute winter	SW5	13	2.605	0.556	358.9	0.0000	0.0000	OK
1440 minute winter	HW4	1470	2.248	0.198	25.2	0.2238	0.0000	SURCHARGED
1440 minute winter	PS6	1470	2.241	0.235	4.8	0.2657	0.0000	SURCHARGED
15 minute summer	HW5	1	1.954	0.000	3.6	0.0000	0.0000	OK
15 minute winter	PS1	13	2.693	0.243	19.2	0.3479	0.0000	OK
15 minute winter	2.000:50%	12	2.686	0.388	165.1	0.0000	0.0000	OK
15 minute winter	PS2	13	2.633	0.487	140.9	0.6974	0.0000	SURCHARGED
1440 minute winter	HW1	1440	2.248	0.176	7.1	0.0000	0.0000	OK
240 minute winter	SW1	228	2.872	0.372	3.4	0.0000	0.0000	OK
240 minute winter	1.000:50%	228	2.872	0.372	11.6	6.9308	0.0000	OK
240 minute winter	SW2	228	2.872	0.373	18.5	0.0000	0.0000	OK
240 minute winter	1.001:50%	228	2.872	0.373	49.1	6.9399	0.0000	OK
240 minute winter	SW3	228	2.872	0.374	14.2	0.0000	0.0000	FLOOD RISK
1440 minute winter	SW4	1470	2.248	0.186	6.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	PS4	3.000	S Pump	389.0	2.307	1.394	14.7952	
60 minute winter	S Pump	Pump	HW3	63.5				300.5
60 minute winter	PS5	5.000	HW3	-0.1	-0.121	-0.051	0.0211	
30 minute winter	HW3	Flow through pond	HW4	93.2	0.026	0.013	558.1957	
15 minute winter	HW2	2.002	SW5	358.9	0.212	1.567	103.6463	
30 minute winter	SW5	Flow through pond	HW4	93.2	0.026	0.013	558.1957	
960 minute winter	HW4	4.000	PS6	4.8	0.407	0.332	0.1152	
960 minute summer	PS6	Hydro-Brake®	HW5	4.8				237.7
15 minute summer	PS1	2.000	2.000:50%	-22.5	-0.324	-0.149	6.9542	
15 minute winter	PS1	2.000	PS2	140.9	1.057	0.931	10.3684	
15 minute winter	PS2	2.001	HW2	130.5	0.935	0.862	3.2636	
240 minute winter	HW1	1.003	SW4	8.1	0.060	0.037	13.1326	
15 minute winter	SW1	1.000	1.000:50%	-35.2	-0.160	-0.511	18.8112	
15 minute winter	SW1	1.000	SW2	-74.5	-0.207	-1.081	18.7516	
15 minute winter	SW2	1.001	1.001:50%	-125.0	-0.280	-1.815	41.8719	
15 minute summer	SW2	1.001	SW3	102.4	0.258	1.486	39.9904	
240 minute winter	SW3	1.002	HW1	8.2	0.523	2.162	0.2360	
30 minute winter	SW4	Flow through pond	HW4	93.2	0.026	0.013	558.1957	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.35%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	PS4	45	2.004	1.004	288.9	1.7740	0.0000	SURCHARGED
60 minute winter	S Pump	46	1.994	1.086	287.7	259.8574	0.0000	OK
1440 minute winter	PS5	1680	2.372	0.272	0.1	0.3080	0.0000	SURCHARGED
1440 minute winter	HW3	1680	2.372	0.310	0.1	0.3505	0.0000	OK
15 minute winter	HW2	14	2.796	0.746	692.8	0.0000	0.0000	FLOOD RISK
15 minute winter	SW5	14	2.796	0.747	543.2	0.0000	0.0000	OK
1440 minute winter	HW4	1680	2.372	0.322	31.0	0.3643	0.0000	SURCHARGED
1440 minute winter	PS6	1680	2.372	0.366	0.0	0.4143	0.0000	SURCHARGED
15 minute summer	HW5	1	2.454	0.500	0.0	0.0000	0.0000	OK
15 minute summer	PS1	11	3.184	0.734	33.8	1.0508	0.0000	FLOOD RISK
15 minute summer	2.000:50%	11	3.168	0.870	219.7	0.0000	0.0000	SURCHARGED
15 minute winter	PS2	12	2.841	0.695	224.5	0.9941	0.0000	SURCHARGED
1440 minute winter	HW1	1680	2.372	0.300	8.5	0.0000	0.0000	OK
240 minute winter	SW1	232	2.982	0.482	4.8	0.0000	0.0000	OK
240 minute winter	1.000:50%	232	2.982	0.482	16.8	11.6232	0.0000	OK
240 minute winter	SW2	232	2.982	0.483	26.6	0.0000	0.0000	OK
240 minute winter	1.001:50%	232	2.982	0.483	68.8	11.6245	0.0000	OK
240 minute winter	SW3	232	2.982	0.484	18.4	0.0000	0.0000	FLOOD RISK
1440 minute winter	SW4	1680	2.372	0.310	8.2	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	PS4	3.000	S Pump	553.9	2.252	1.985	15.6213	
60 minute winter	S Pump	Pump	HW3	90.5				421.5
30 minute winter	PS5	5.000	HW3	-0.3	-0.170	-0.110	0.0301	
15 minute winter	HW3	Flow through pond	HW4	147.5	0.037	0.021	658.0176	
15 minute winter	HW2	2.002	SW5	543.2	0.234	2.371	152.8583	
15 minute winter	SW5	Flow through pond	HW4	147.5	0.037	0.021	658.0176	
15 minute summer	HW4	4.000	PS6	1.3	0.328	0.088	0.0871	
15 minute summer	PS6	Hydro-Brake®	HW5	0.0				0.0
15 minute winter	PS1	2.000	2.000:50%	-56.9	-0.359	-0.376	10.8207	
15 minute winter	PS1	2.000	PS2	224.5	1.417	1.483	10.8207	
15 minute winter	PS2	2.001	HW2	224.9	1.420	1.486	3.2636	
240 minute winter	HW1	1.003	SW4	9.3	0.060	0.043	22.0644	
15 minute winter	SW1	1.000	1.000:50%	-46.6	-0.175	-0.677	25.9068	
15 minute winter	SW1	1.000	SW2	-105.4	-0.233	-1.529	25.8433	
15 minute winter	SW2	1.001	1.001:50%	-190.2	-0.319	-2.760	58.1740	
15 minute winter	SW2	1.001	SW3	139.6	0.282	2.026	59.2132	
240 minute winter	SW3	1.002	HW1	9.5	0.593	2.507	0.2444	
15 minute winter	SW4	Flow through pond	HW4	147.5	0.037	0.021	658.0176	

Appendix B – Anglian Water Asset Maps

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Date: 18/08/21

Scale: 1:1250

Map Centre: 526156,322824

Data updated: 31/07/21

Our Ref: 628099 - 1

Wastewater Plan A0

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2021 Ordnance Survey 100022432.This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer
Surface Sewer
Combined Sewer
Final Effluent
Rising Main*
Private Sewer*
Decommissioned Sewer*

Outfall*
Inlet*
Manhole*

Sewage Treatment Works
Public Pumping Station
Decommissioned Pumping Station

*(Colour denotes effluent type)

ben@j-ce.co.uk

Naylor

love every drop
anglianwater

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert
0001	526015	323032	F	-	-	-
0002	526054	323051	F	-	-	-
0003	526063	323047	F	-	-	-
0004	526069	323060	F	-	-	-
0005	526037	323058	F	-	-	-
0006	526012	323053	F	-	-	-
0007	526066	323038	F	-	-	-
0011	526049	323040	F	-	-	-
0012	526052	323038	F	-	-	-
0015	526003	323050	F	-	-	-
0016	526005	323054	F	-	-	-
0017	526014	323051	F	-	-	-
0018	526027	323011	F	-	-	-
0019	526012	323046	F	-	-	-
0020	526029	323016	F	-	-	-
0021	526025	323005	F	-	-	-
0022	526036	323001	F	-	-	-
0023	526016	323009	F	-	-	-
0024	526010	323023	F	-	-	-
0027	526035	323014	F	-	-	-
0028	526041	323010	F	-	-	-
0029	526044	323013	F	-	-	-
0030	526039	323018	F	-	-	-
0034	526036	323067	F	-	-	-
0040	526030	323054	F	-	-	-
0101	526095	323199	F	-	-	-
0102	526046	323198	F	-	-	-
0103	526051	323129	F	2.76	2.16	0.6
0104	526036	323136	F	2.84	2.1	0.74
0105	526010	323140	F	2.89	1.92	0.97
0106	526006	323125	F	2.85	1.96	0.89
0107	526022	323110	F	2.81	2.12	0.69
0108	526056	323123	F	-	-	-
0109	526056	323118	F	-	-	-
0110	526055	323114	F	-	-	-
0111	526055	323108	F	-	-	-
0112	526055	323101	F	-	-	-
0113	526041	323151	F	-	-	-
0114	526047	323149	F	-	-	-
0115	526035	323153	F	-	-	-
0201	526002	323275	F	-	-	-
0202	526026	323276	F	-	-	-
0203	526070	323260	F	-	-	-
0204	526098	323254	F	-	-	-
049B	525973	323029	F	-	-	-
0801	526030	322839	F	-	-	-
0901	526008	322999	F	-	-	-
4002	525475	323087	F	3.4	0.63	2.77
4101	525439	323102	F	3.45	0.79	2.66
4102	525452	323125	F	3.45	1.07	2.38
4103	525468	323182	F	3.24	1.17	2.07
4104	525467	323158	F	-	-	-
4105	525452	323163	F	-	-	-
4106	525447	323166	F	-	-	-
4205	525467	323225	F	3.255	1.775	1.48
4206	525489	323202	F	-	-	-
4401	525483	322400	F	2.76	1.89	0.87
4402	525474	322495	F	2.65	1.08	1.57
4501	525462	322598	F	2.824	1.234	1.59
4602	525444	322642	F	2.962	0.952	2.01
4603	525432	322663	F	-	-	-
4604	525437	322673	F	-	-	-
4702	525476	322795	F	3.62	2.99	0.63
4703	525489	322791	F	3.653	2.513	1.14
4801	525443	322849	F	-	-	-
4802	525487	322864	F	3.609	2.119	1.49
4803	525468	322883	F	3.609	1.049	2.56
4901	525451	322951	F	3.54	1.29	2.25
4902	525474	322963	F	3.39	0.99	2.4
4903	525493	322996	F	3.26	0.8	2.46
5001	525510	323022	F	3.39	0.28	3.11
5002	525515	323032	F	-	-	-
5004	525567	323044	F	-	-	-
5005	525599	323045	F	3.5	1.28	2.22
5006	525518	323071	F	3.488	0.368	3.12
5100	525543	323188	F	3.274	-	-
5101	525569	323167	F	2.881	0.811	2.07
5102	525537	323155	F	3	0.76	2.24
5103	525509	323194	F	3.342	-	-
5200	525503	323267	F	3.032	1.952	1.08
5201	525506	323223	F	3.223	1.663	1.56
5202	525535	323227	F	3.287	1.777	1.51
5203	525557	323217	F	-	-	-
5204	525526	323215	F	3.271	0.991	2.28
5205	525568	323241	F	2.86	1.69	1.17
5206	525522	323259	F	2.976	1.186	1.79
5207	525588	323266	F	-	-	-
5208	525591	323275	F	-	-	-
5209	525594	323281	F	-	-	-
5210	525596	323285	F	-	-	-
5601	525540	322629	F	-	-	-
5602	525502	322685	F	-	-	-
5701	525537	322701	F	3.33	2.18	1.15
5702	525561	322738	F	3.182	1.632	1.55
5703	525576	322734	F	-	-	-
5704	525583	322740	F	-	-	-
5705	525550	322737	F	-	-	-
5706	525555	322738	F	-	-	-
5707	525585	322724	F	-	-	-
5801	525529	322805	F	3.678	2.926	0.752
5802	525592	322890	F	3.384	1.944	1.44
5901	525506	322926	F	4.159	0.919	3.24
5902	525557	322959	F	3.547	0.497	3.05
5903	525581	322960	F	3.245	1.255	1.99
5904	525586	322987	F	3.334	1.944	1.39
6002	525693	323054	F	3.28	2.57	0.71
6003	525699	323095	F	3.047	1.392	1.655
6006	525611	323030	F	-	-	-
6007	525611	323024	F	-	-	-
6008	525610	323022	F	-	-	-
6100	525635	323167	F	-	-	-
6101	525687	323155	F	3.163	1.863	1.3
6200	525656	323238	F	3.245	1.495	1.75
6201	525626	323223	F	3.109	1.279	1.83
6202	525598	323236	F	3.006	1.126	1.88
6203	525627	323291	F	3.045	1.335	1.71
6204	525602	323259	F	-	-	-
6205	525625	323271	F	-	-	-
6206	525633	323268	F	-	-	-
6207	525633	323265	F	-	-	-
6601	525611	322643	F	-	-	-
6602	525678	322682	F	3.047	2.107	0.94
6701	525605	322725	F	3.23	2.06	1.17
6702	525671	322733	F	3.018	1.858	1.16
6703	525601	322767	F	3.3	1.97	1.33
6704	525665	322791	F	3.082	1.632	1.45
6801	525656	322814	F	3.139	1.579	1.56
6802	525606	322883	F	3.431	0.921	2.51
6803	525637	322840	F	-	-	-
6804	525664	322804	F	3.073	1.723	1.35
6901	525685	322920	F	3.355	1.715	1.64
6902	525605	322941	F	3.382	1.852	1.53
6903	525609	322961	F	3.461	1.601	1.86
7001	525768	323008	F	3.44	2.58	0.86
7002	525798	323028	F	3.35	1.94	1.41
7003	525770	323031	F	-	-	-
7004	525703	323034	F	3.24	2.49	0.75
7005	525771	323052	F	3.34	2.52	0.82
7006	525763	323088	F	3.413	1.603	1.81
7007	525705	323079	F	-	-	-
7008	525719	323070	F	-	-	-
7100	525767	323147	F	3.214	1.764	1.45
7200	525779	323229	F	-	-	-
7201	525704	323224	F	3.234	1.734	1.5
7202	525775	323289	F	3.144	1.944	1.2
7701	525759	322738	F	3.01	1.93	1.08
7703	525747	322785	F	2.92	-0.3	3.22
7801	525775	322818	F	2.9	-0.12	3.02
7802	525754	322846	F	3.02	1.89	1.13
7803	525713	322858	F	3.115	2.065	1.05
7804	525764	322879	F	-	-	0.991
7805	525781	322890	F	-	-	1.48
7901	525749	322952	F	3.587	2.857	0.73
7902	525767	322960	F	3.534	2.184	1.35
7903	525794	322960	F	-	-	-
8001	525802	323073	F	-	-	-
8002	525870	323088	F	-	-	-
8003	525885	323083	F	-	-	-
8009	525864	323036	F	-	-	-
8013	525853	323036	F	-	-	-
8014	525897	323018	F	-	-	-
8015	525891	323024	F	-	-	-
8016	525877	323016	F	-	-	-
8021	525882	323045	F	-	-	-
8024	525876	323031	F	-	-	-
8101	525806	323144	F	-	-	-
8102	525894	323170	F	3.17	1.84	1.33
8103	525841	323195	F	-	-	-
8104	525878	323115	F	-	-	-
8105	525866	323118	F	-	-	-
8106	525851	323124	F	-	-	-
8107	525825	323126	F	-	-	-
8108	525857	323100	F	-	-	-
8201	525811	323200	F	-	-	-
8202	525799	323285	F	-	-	-
8203	525826	323201	F	-	-	-
8303	525828	322368	F	2.5	1.223	1.277
8312	525817	323308	F	-	-	-
8401	525829	322400	F	2.5	1.39	1.11
8402	525876	322409	F	2.432	1.68	0.752
8403	525801	322427	F	2.5	1.612	0.888
8601	525892	322638	F	3.08	1.31	1.77
8701	525855	322702	F	2.78	0.84	1.94
8702	525851	322734	F	2.94	0.63	2.31
8703	525803	322745	F	2.9	0.21	2.69
8704	525801	322793	F	2.81	-	2.81
8801	525843	322795	F	2.998	0.728	2.27
8802	525837	322864	F	2.942	1.002	1.94
8901	525867	322929	F	2.992	1.442	1.55
8902	525862	322975	F	-	-	-
8903	525884	322992	F	-	-	-
8904	525846	322938	F	2.893	1.672	1.221
8911	525873	322968	F	-	-	-
8912	525867	322972	F	-	-	-
8913	525868	322956	F	-	-	-
8916	525888	322982	F	-	-	-
8918	525855	322991	F	-	-	-
8919	525856	322977	F	-	-	-
8920	525846	322967	F	-	-	-
9000	525907	323004	F	-	-	-
9001	525942	323033	F	-	-	-
9002	525948	323048	F	-	-	-
9003	525972	323077	F	-	-	-
9004	525963	323052	F	-	-	-
9005	525933	323020	F	-	-	-
9007	525917	323026	F	-	-	-
9008	525955	323100	F	-	-	-
9009	525986	323087	F	-	-	-
9017	525939	323005	F	-	-	-
9019	525984	323084	F	-	-	-
9020	525967	323084	F	-	-	-
9021	525974	323081	F	-	-	-
9022	525950	323087	F	-	-	-
9023	525941	323010	F	-	-	-
9025	525957	323004	F	-	-	-
9028	525953	323055	F	-	-	-
9029	525955	323059	F	-	-	-
9030	525953	323066	F	-	-	-
9031	525991	323025	F	-	-	-
9032	525993	323030	F	-	-	-
9036	525989	323020	F	-	-	-
9039	525994	323071	F	-	-	-
9045	525969	323032	F	-	-	-
9046	525972	323042	F	-	-	-
9047	525978	323040	F	-	-	-
9048	525943	323051	F	-	-	-
9101	525921	323159	F	3.17	1.64	1.53
9102	525991	323147	F	2.96	1.8	1.16
9103	525964	323158	F	3.04	1.65	1.39
9104	525995	323159	F	3.23	2.03	1.2
9105	525932	323174	F	3.195	1.475	1.72
9106	525901	323182	F	3.12	1.65	1.47
9107	525904	323107	F	-	-	-
9201	525940	323206	F	3.15	1.37	1.78
9202	525974	323224	F	-	-	-
9203	525951	323231	F	-	-	-
9204	525989	323275	F	-	-	-
9205	525925	323281	F	-	-	-
9501	525914	322516	F	2.932	2.082	0.85
9502	525924	322542	F	2.964	1.944	1.02
9503	525930	322567	F	2.994	1.824	1.17
9504	525904	322589	F	2.925	1.665	1.26
9601	525902	322602	F	2.791	1.531	1.26
9602	525909	322691	F	-	-	-
9701	525974	322714	F	2.775	1.515	1.26
9702	525925	322726	F	2.607	1.267	1.34
9703	525931	322788	F	2.754	1.614	1.14
9801	525962	322879	F	3.098	1.958	1.14
9901	525918	322901	F	3.033	1.783	1.25
9902	525983	322932	F	3.037	2.197	0.84
9904	525901	322975	F	-	-	-
9910	525935	322962	F	-	-	-
9914	525922	322967	F	-	-	-
9919	525925	322913	F	-	-	-
9920	525924	322909	F	-	-	-
9921	525915	322911	F	-	-	-
0051	526016	323030	S	-	-	-
0052	526072	323042	S	-	-	-
0053	526054	323049	S	-	-	-
0054	526067	323038	S	-	-	-
0055	526016	323051	S	-	-	-
0057	526041	323019	S	-	-	-
0058	526046	323013	S	-	-	-
0059	526050	323038	S	-	-	-
0060	526012	323024	S	-	-	-
0061	526038	323068	S	-	-	-
0062	526038	323055	S	-	-	-
0063	526030	323052	S	-	-	-
0950	526053	322999	S	-	-	-
0951	526043	322996	S	-	-	-
4952	525463	322952	S	-	-	-
4953	525481	322971	S	-	-	-
5051	525511	323020	S	-	-	-
8052	525839	323037	S	-	-	-
8053	525841	323040	S	-	-	-
8054	525854	323034	S	-	-	-
8055	525862	323035	S	-	-	-
8059	525890	323023	S	-	-	-
8060	525894	323019	S	-	-	-
8061	525877	323015	S	-	-	-
8062	525869	323010	S	-	-	-
8063	525883	323045	S	-	-	-
8064	525877	323028	S	-	-	-
8951	525867	322975	S	-	-	-
8952	525883	322990	S	-	-	-
8955	525839	322971	S	-	-	-
8956	525845	322969	S	-	-	-
8957	525854	322979	S	-	-	-
8960	525875	322955	S	-	-	-
8961	525871	322957	S	-	-	-
8962	525876	322968	S	-	-	-
8963	525869	322973	S	-	-	-
8964	525886	322981	S	-	-	-
9051	525906	323003	S	-	-	-
9052	525933	323018	S	-	-	-
9053	525943	323032	S	-	-	-
9054	525949	323046	S	-	-	-
9055	525964	323051	S	-	-	-
9056	525973	323075	S	-	-	-
9057	525922	323037	S	-	-	-
9058	525975	323080	S	-	-	-
9059	525918	323024	S	-	-	-
9060	525955	323004	S	-	-	-
9061	525939	323009	S	-	-	-
9062	525948	323087	S	-	-	-
9063	525956	323056	S	-	-	-
9064	525971	323060	S	-	-	-
9065	525993	323032	S	-	-	-
9066	525900	323025	S	-	-	-
9067	525939	323054	S	-	-	-
9068	525945	323051	S	-	-	-
9069	525974	323027	S	-	-	-
9070	525995	323068	S	-	-	-
9150	525954	323102	S	-	-	-
9950	525967	322995	S	-	-	-
9951	525954	323000	S	-	-	-
9954	525938	322957	S	-	-	-
9956	525932	322959	S	-	-	-
9957	525901	322973	S	-	-	-
9958	525923	322963	S	-	-	-

Date: 18/08/21 | Scale: 1:1250 | Map Centre: 526344,322274 | Data updated: 31/07/21 | Our Ref: 628100 - 1 | Wastewater Plan A0

Foul Sewer
Surface Sewer
Combined Sewer
Final Effluent
Rising Main*
Private Sewer*
Decommissioned Sewer*

Outfall*
Inlet*
Manhole*

Sewage Treatment Works
Public Pumping Station
Decommissioned Pumping Station

*(Colour denotes effluent type)

ben@j-ce.co.uk

Naylor 1

love every drop
anglianwater

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert
6001	525641	322052	F	2.804	-0.824	3.628
6002	525647	322070	F	2.715	-0.285	3
6003	525694	322080	F	2.77	-0.63	3.4
6101	525687	322142	F	3.3	-0.57	3.87
6102	525689	322109	F	2.911	-0.779	3.69
6103	525637	322141	F	3.5	0.847	2.653
6104	525632	322134	F	3.37	0.904	2.466
6602	525678	322682	F	3.047	2.107	0.94
6702	525671	322733	F	3.018	1.858	1.16
6801	525666	321873	F	2.782	0.322	2.46
6802	525671	321839	F	2.511	0.456	2.055
6804	525627	321844	F	2.655	0.9	1.755
6901	525652	321989	F	2.851	-0.029	2.88
6902	525654	321946	F	2.815	0.205	2.61
6903	525659	321918	F	2.803	0.253	2.55
7001	525723	322002	F	2.506	1.226	1.28
7002	525762	322015	F	2.525	1.395	1.13
7003	525768	322035	F	2.507	1.377	1.13
7004	525781	322076	F	2.453	1.078	1.375
7005	525730	322085	F	2.398	0.828	1.57
7101	525746	322153	F	2.5	-0.237	2.737
7701	525759	322738	F	3.01	1.93	1.08
7801	525707	321857	F	2.726	0.906	1.82
7802	525702	321837	F	2.636	0.706	1.93
7901	525754	321996	F	2.59	1.3	1.29
7902	525742	321959	F	2.625	1.435	1.19
7903	525700	321922	F	2.736	1.336	1.4
8101	525800	322168	F	2.5	0.102	2.398
8201	525817	322206	F	2.5	0.354	2.146
8202	525810	322276	F	2.5	0.726	1.774
8301	525815	322313	F	2.5	0.918	1.582
8302	525846	322307	F	2.377	1.48	0.897
8303	525828	322368	F	2.5	1.223	1.277
8401	525829	322400	F	2.5	1.39	1.11
8402	525876	322409	F	2.432	1.68	0.752
8403	525801	322427	F	2.5	1.612	0.888
8601	525892	322638	F	3.08	1.31	1.77
8701	525855	322702	F	2.78	0.84	1.94
8702	525851	322734	F	2.94	0.63	2.31
8703	525803	322745	F	2.9	0.21	2.69
9501	525914	322516	F	2.932	2.082	0.85
9502	525924	322542	F	2.964	1.944	1.02
9503	525930	322567	F	2.994	1.824	1.17
9504	525904	322589	F	2.925	1.665	1.26
9601	525902	322602	F	2.791	1.531	1.26
9602	525909	322691	F	-	-	-
9701	525974	322714	F	2.775	1.515	1.26
9702	525925	322726	F	2.607	1.267	1.34

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Easting	Northing	Liquid Type	Cover Level	Invert Level	Depth to Invert