



Preliminary Drainage Strategy

Project:

Proposed HQ for Ark ICT Ltd, Platts Close, Pinchbeck, Spalding

Client:

ARK ICT Ltd.

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Introduction

Jackson Consulting Engineers have been appointed by ARK ICT Solution Ltd, to undertake a drainage strategy, to form part of the supporting evidence of the planning submission for the proposed ARK ICT Headquarters development. The site is located off Platts Close, Pinchbeck, Spalding PE11 3UL. The following document is to assist the planners in demonstrating that the development is acceptable in terms of a suitable drainage strategy.

Existing Site

The site lies between Elsom Way and Platts Close. Access is to be off the south of Platts Close. The approximate centre of the site has a grid reference of 525911 east, 325388 north, with an approximate postcode of PE11 3UL. An aerial location plan is shown in figure 1.



Figure 1 - Site Location

The site currently is greenfield, with no impermeable areas present. There are very limited features on the site, but it is noted that the some below ground services have been identified.

A topographical survey has been undertaken, and has been produced on O&L's drawing A1412-02, which can be found in appendix A. The survey shows that the area of the site to be developed is approximately 0.63 hectares.

The site is generally flat, with levels ranging between approximately 3.50m and 2.90m AOD, although there are some levels higher than this to support the road surrounding road. The levels at the



proposed entrance onto Platts Close are between 3.862 and 3.776. Platts close appears to fall away from the site heading west. There is no true defined fall across the site, but a generalisation is that it nominally falls from east to west.

The topographical survey has highlighted that there is a small ditch present on site although no connections into or out of this area have been identified. This ditch appears to be informal and may be leftover as a result of the overall infrastructure construction.

A further survey has been carried out by Danial Charles Surveys Ltd, drawing number; 21-35-01, which can be found in appendix B. this identifies that there are substantially sized surface water sewers located in both Elsom Way and Platts Close. These pipes appear to head off in a northerly direction but are very flat (negative fall in places). This is not uncommon given the sizes of the pipes. The pipes appear to head off in the direction of and connect into the Blue Gowt drain.

The Blue Gowt drain is a substantial drain owned and maintained by the Welland and Deepings internal drainage board. This drain eventually reaches the River Welland before flowing towards the North Sea. Previous discussions with the IDB relating to the Blue Gowt (separate to this project) have established that the typical water levels in the drain are 1.50m AOD with the 1 in 100-year levels being 1.80m, identifying that these pipes are potentially regularly surcharged.

The road gullies along both of these roads connect into the main sewers, and this provides further evidence that the ditch on-site does not serve anything. The sewers for the site have several stubs connecting to the different parcels of land and the appear to be serviced plots, although as this parcel of land is being split up, it is not clear if it has a surface water stub connection. The foul for the site has been identified as a 225 dia. stub connection.

The Anglian Water wastewater asset map for the site shows that the sewers located in Platts Close, and Elsom Way are adopted and maintained by them, as shown in the figure below.



Figure 2 - Anglian Water Wastewater Asset Map

Development Proposals

The development of this site comprises of the creation of commercial headquarters. Although the size of the site is approximately 0.63 hectares, not all of it is being developed, in part because of the identified water main running through the site. The roof area of the proposed headquarters is approximately 630m², with approximately a further 1270m² of impermeable, positively drained hardstanding. The perimeter of the building is laid to impermeable paving (which will drain to soft landscaping), and there is an additional area of overflow hardstanding which will be constructed out of permeable materials, and not contribute to the flow from site, of approximately 560m².

Surface Water Drainage Strategy

Surface Water Disposal

Infiltration

Percolation testing was carried out for the site, with the results being presented in the figure below. It was noted that although the site did infiltrate, it was very, very slow. The results also show that the water dissipated slightly quicker toward the top of the testing, indicating this material has slightly better infiltration characteristics. Even though the infiltration appears better at a higher level, the result still indicate that infiltration is not viable for the site, although as the overflow parking is draining a like-for-like area it will be suitable for infiltration, as naturally occurring now. Additionally, the gravel will offer natural storage for any exceedance events and therefore will reduce the risk of flooding post development.



In summary, although infiltration for the like-for-like overflow car park is suitable, the remaining hardstanding areas will require a different form of drainage.

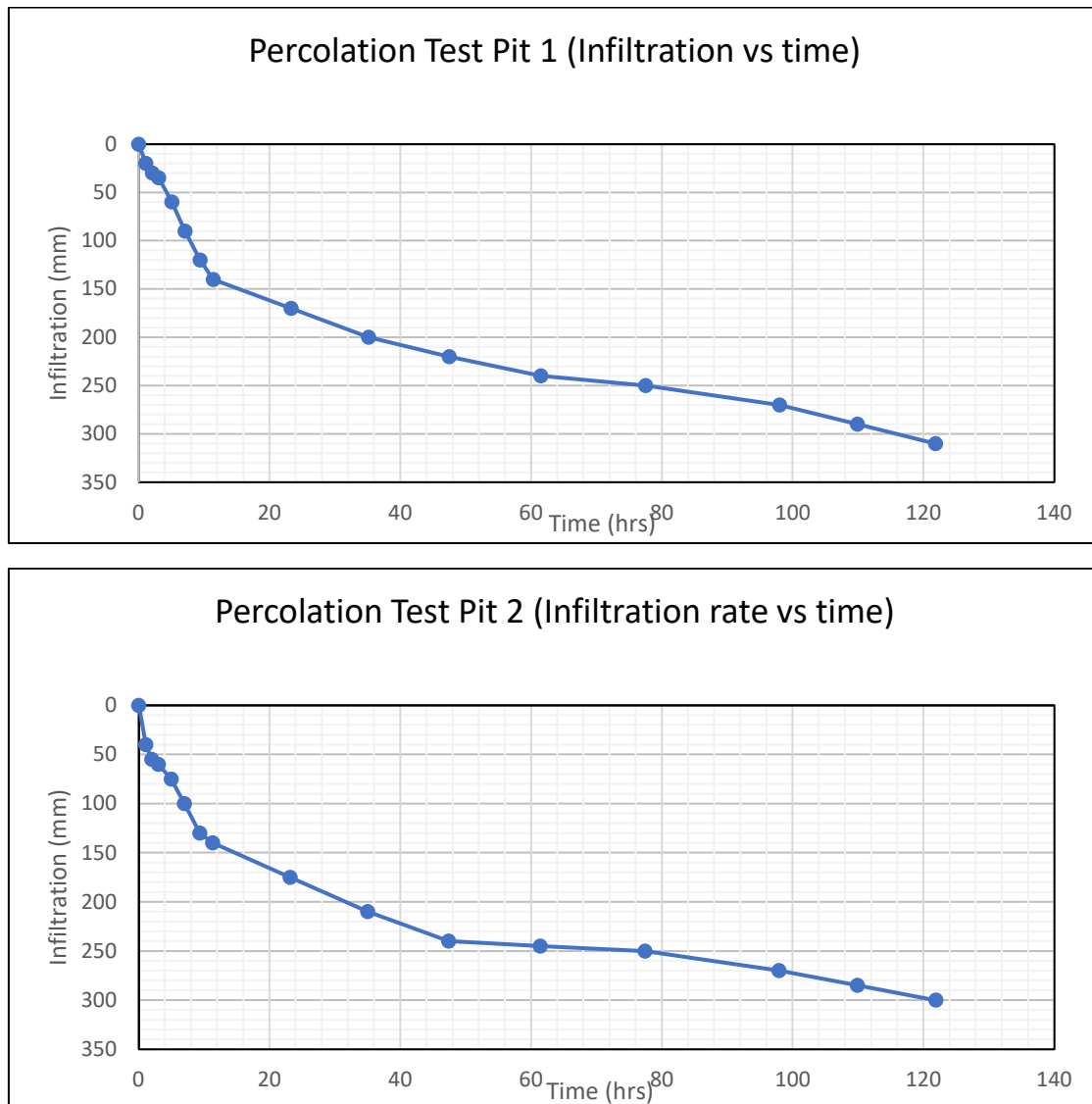


Figure 3 - Percolation Test Results

Watercourse

The closest watercourse is the Blue Gowt, located to the north of the site. It is known that the capacity of the Blue Gowt is good, and it is expected, subject to a formal application with the IDB, that a connection into this source is acceptable.

Surface Water Sewer

Ultimately the site discharges into an Anglian Water sewer, as shown in figure 2. It is highly likely that the original pipe sizes were sized to receive unrestricted discharge from the development plots, and it is expected that the surface water sewers will have capacity. Even though the site will connect into a sewer, in reality this is just conveyance and ultimately the site discharges into a watercourse.



Discharge Rates

On proposed sites, there is an expectation that the site should be restricted to a rate as close to greenfield run-off as far as practicable. Initial Greenfield run-off calculations have been undertaken with an extract shown in figure 3, and the full calculation shown in appendix C. For the purpose of the calculation, only the impermeable, positively drained areas, approximately 1900m², have been considered as the contributing greenfield runoff area.

Estimated site discharges

	My values	Map values
Q _{bar} (l/s) ⓘ	0.27	0.27

Greenfield runoff rates

1 in 1 year (l/s)	0.23	0.23
1 in 30 years (l/s)	0.65	0.65
1 in 100 years (l/s)	0.95	0.95
1 in 200 years (l/s)	1.12	1.12

Figure 4 - Existing Greenfield Run-off Rates

As the run-off rate for the Q_{Bar} event of 0.27l/s is so low, it is not feasible to restrict the development to this rate as the discharge is prohibited by the minimum device size and also a sensible opening size to ensure the risk of blockage is acceptable. Therefore, it is proposed, subject to Anglian Water and the IDB's agreement through a section 106/byelaw application that the flow from site is restricted to a maximum rate of 1.9l/s for all storms up to and including the 1 in 100 year + 40% climate change event. The discharge rate into the IDB drain will be subject to their confirmation and a surface water development contribution. The proposed discharge rate should place the sites actual discharge rate into the 5-10 l/s discharge rate band, subject to IDB confirmation.

It is noted that the presence of an extensive surface water network in the vicinity of the site naturally indicates that soakaways are not viable at a local level, and positive drainage connections have been offered. This is evident from the onsite percolation testing and likely higher water table that this area often has.

Lastly, as the development is so close to the Blue Gowt (a main watercourse), the river Welland (a main river), and the North Sea, the risk of flooding as a result of the development will not drastically increase as the site's water will be able to discharge quickly.

Surface Water Disposal

The site consists of roof area, access roads, parking, overflow parking and hardstanding around the buildings.



The roadway will be constructed out of an impermeable material, which will generally drain towards permeable paved parking bays. The entrance area of the site has an area which is too large to discharge into the porous paving – the maximum areas will be exceeded. At this area it is proposed that a gully will be offered which will drain into a voided stone area. This will help to slow the water down and achieve water quality requirements.

It is proposed that the overflow car parking will be provided via stabilised stone grids (bodpave or similar). This will be treated as a like for like area and will drain natural throughout into the natural subgrade. The purpose of the reinforced grass mat is to provide structural support for the vehicles, and to mimic natural drainage as far as possible. The build-up of these areas offers additional porous stone storage, and this will naturally provide attenuation for these areas.

In order to restrict the sites, flow to 1.9l/s, an attenuation tank will be required. Presently it is proposed that an offline attenuation tank will be provided at the flow control manhole, to store all storms up to and including the 1 in 100 year + 40% climate change events. It is proposed that the flow control will be a Hydrobrake device.

Once the water has been attenuated a new lateral connection will be provided running into the existing 1050 dia. pipe located in Platts Close, this is subject to a formal section 106 application and if an existing spur into the site is found. The proposed connection will be made just below soffit to soffit, this is to ensure the required depth of cover is met within the site and also to allow an easier connection onto the existing pipe. It is proposed that the lateral connection will be adopted by Anglian Water. Upon successful planning, an Anglian Water section 106 application will need to be applied for and Anglian Water will confirm if the system has capacity, or any further reductions in flow rates that may be required.

The modelling results show that there is some flooding in the 1 in 100-year + 40% climate change event. This is as a result of the low spot created around the entrance gully. This totals just under 7.5m³, and this will reach a maximum depth of 60mm before it discharges into the porous paving which has spare capacity. No flooding is present in the 1 in 30 year event, and this overall design ethos is in line with DEFRA's NTS.

The proposed drainage strategy can be found on JCE drawing: 0137-JCE-00-SI-DR-C-3000, and a copy of the calculations in appendix D, respectively, with a 3D representation of the drainage model shown below (the storage structures have been omitted for clarity).

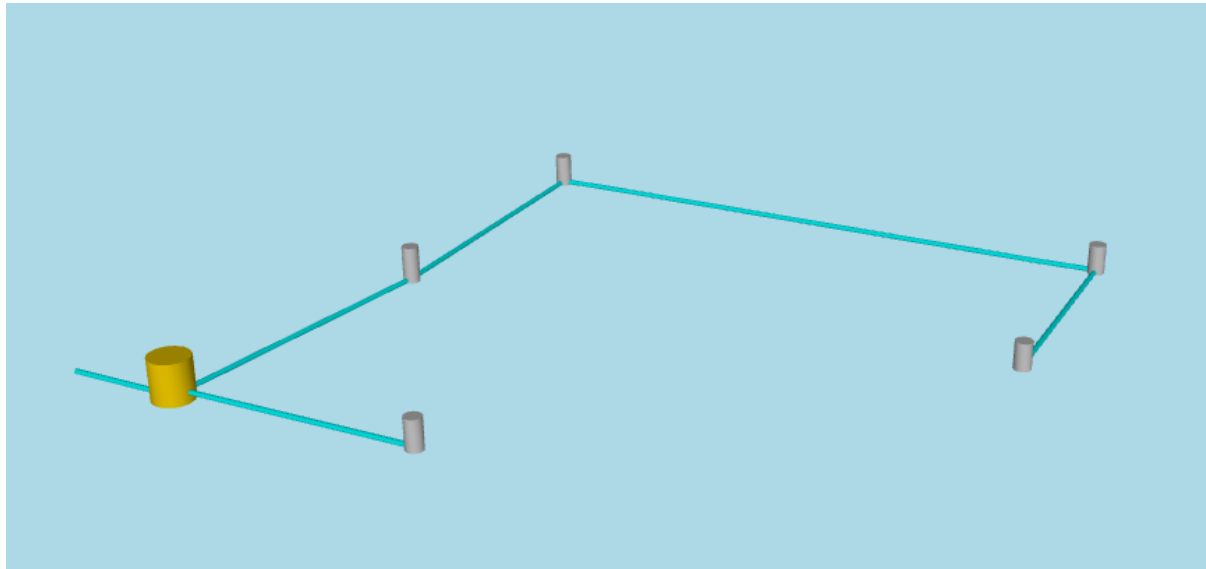


Figure 5 - 3D Schematic

Surcharged Outfall

During storm events, there is a potential for the outfall to become surcharge, affecting the flow from site. The chances of a surcharged outfall at the site's location have been assessed, and it is concluded that the outfall is unlikely to be surcharged and therefore has not been included in the calculation. The reasons for this being:

- The 1 in 100-year water level in the Blue Gowt will approximately be 1.800m AOD, the proposed connection onto the existing sewer is approximately 2.280m, significantly above this level.
- The connection onto the existing sewer is just downstream of a significant change in pipe size. It is therefore expected at this point there will naturally be spare capacity in the storm events.
- The existing surface water infrastructure for the site is substantial, and it would have been installed to serve the larger industrial development, with the pipes being designed to offer unrestricted flow. As the area is not fully developed, the maximum receiving impermeable area is not being used and any new sites being developed will be heavily reduced. Therefore, it is deduced that the maximum capacity of the existing surface water system is nowhere near being utilised.

Urban Creep

A factor that needs to be considered for new development is the potential for any future expansion, referred to as urban creep. For this element of the design the maximum impermeable area is being utilised. If any future development were to occur, then that would be subject to a separate sustainable drainage assessment. Therefore, urban creep does not need to be included.

Flood Routing

There is always the possibility that a device can become temporarily blocked or fail, and therefore the system will flood. 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. A preliminary sketch of the proposed flood routing in storms of exceedance or device failure can be found on JCE's drawing; 0137-JCE-00-SI-DR-C-3010, found in appendix E.



Water Quality

The water quality of the surface water run-off needs to be considered on new developments. For this site, there are 3 areas that need to be considered against water quality:

- Roof Area - Low
- Car Parking - Medium
- Access Road - Medium
- Overflow Parking - Medium
- To mitigate against 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 the figures below.

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 6 - Pollution hazard indices for different land use classifications



Type of SuDS component	Mitigation indices ¹		
	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 7 - Indicative SUDS mitigation indices for discharging surface water

CIRIA C753 outlines the level of mitigation indices that need to be provided for each element type. To deliver adequate treatment, the selected SUDS components should have a total pollution mitigation index (for each containment type) that equals or exceeds the pollution hazard index (for each contaminant type):

$$\text{Total SUDS mitigation index} \geq \text{pollution hazard index}$$

(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.

Roofs

0.3 0.2 0.05 = No mitigation

As the pollution generated from roofs is relatively low it is proposed that this will discharge directly into the surface water sewer. As the storm water is heavily attenuated the suspended solids will likely settle by the time it reaches the catchpit within the Hydrobrake. Additionally, the area is already built



up, and therefore it is unlikely that vegetation will readily find its way onto the roof (leaves for example).

Porous Paving

0.7 0.6 0.7 = Permeable Pavement 0.7 0.6 0.7

The mitigation provided by the permeable paving satisfies the mitigation index, therefore sufficient treatment has been provided.

Access Road

0.7 0.6 0.7 = Permeable Pavement 0.7 0.6 0.7

The mitigation provided to the water flowing off the impermeable access road into the porous parking bays provide the required mitigation.

Access Road - Gully

0.7 0.6 0.7 = Heavy sediment only.

There is only a small area of access road which does not receive water treatment. This is for the entrance way only and the water will be collected by a trapped gully. Heavy sediment will be collected, and as this is only a small section of road, it is deemed that sufficient water quality is being achieved, there will be no standing vehicles at this point, and vehicles will only be present for a very short period of time.

Overflow Parking

0.7 0.6 0.7 = Permeable Pavement 0.7 0.6 0.7

The overflow parking (gravel) will act in the same way as porous paving and therefore the appropriate level of mitigation has been provided.

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. Generally, the maintenance requirements are either from CIRIA 753, or manufacturer guidance. Generally, elements of the piped system are designed to not require maintenance as they will typically be designed to self-cleansing velocities.

The maintenance of these elements will be done by either the buildings maintenance team or a dedicated management company. This will be confirmed towards the end of the project.



Porous Paving Maintenance

Operation and maintenance requirements for pervious pavements		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually



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.

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.

Foul Water Drainage Strategy

The site benefits from an adopted Anglian Water foul sewer to the north of the site, just outside of the site's boundary. The below ground road survey has identified that there is an existing lateral into this manhole of 225 dia., it is proposed that the sites drainage will connect into this. Given the relatively small amount of flow entering the sewer it is not anticipated that there will be any capacity concerns, certainly given the size of this sewer. An extract of the AW asset map can be found in figure 2, towards the start of the document. For foul drainage, a positive surface water drainage solution is the preferred method of drainage.

It is expected that regardless of the proposals there will be an increase to the amount of foul water entering the system. It is not expected that this will have a detrimental impact to the capacity of the system, but as this is serving foul water, then any capacity issues will need to be addressed by Anglian Water. Once planning is granted, the developer will need to apply for a section 106 to Anglian Water in order to grant a direct connection for any additional flows.



Conclusion

- Infiltration testing has been undertaken for the site and it is not viable.
- There is a watercourse nearby, the Blue Gowt, where an existing Anglian Water sewer connects into, it is proposed the surface water will connect into the existing sewer.
- The sites surface water drainage is being restricted to 1.9l/s, subject to IDB approval.
- The proposed surface water drainage strategy can be found on JCE drawing: 0137-JCE-00-SI-DR-C-3000.
- Exceedance flows have been demonstrated on JCE drawing: 0137-JCE-00-SI-DR-C-3010.
- The sites drainage proposal will ensure that no flooding, for the entire site will occur in the 1 in 100 year + 40% climate change event.
- There is no flood risk increase to offsite properties as a result of the development, with the calculations demonstrating that all storms up to and including the 1 in 100-year event will be contained onsite.
- There have been no identified foul water capacity issues.



Appendices

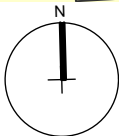
Appendix A – Topographical Survey

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Site Block Plan as existing
Scale 1:500 @ A3
Site of works proposal outlined in red.

SCALE 1 : 500
SCALE 1 : 1



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Date			Initial

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Client:
ARK ICT Ltd.

Project:
**Proposed HQ for Ark ICT Ltd
comprising offices, storage,
coffee bar & ancillary areas.**

Drawing Title:
Site Block Plan as existing

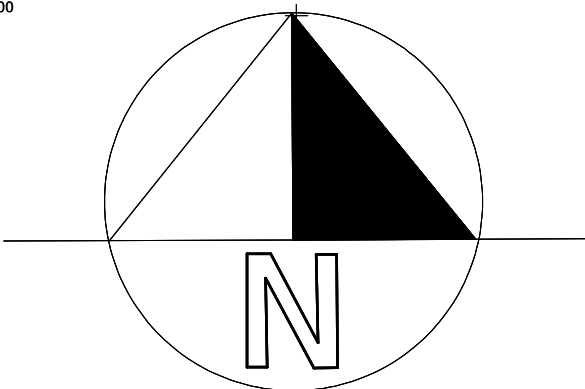
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Date:	March 2020	Scale:	as shown @ A3
Drawn by:	RDL	Checked by:	AJO

Drawing Number:	Rev:
A1412 - 02	-



Appendix B – Existing Road Below Ground Survey



GRID REF TF 25927 25497



SURVEY CONTROL POINT INFORMATION			
Point	Easting	Northing	Elevation
9000	525824.839	325402.251	3.915
9002	525906.516	325430.939	4.246
9003	525944.227	325430.777	4.099
9004	525927.295	325510.402	4.242
9005	525914.624	325551.617	4.073
9006	525882.016	325622.379	3.871
9007	525915.513	325553.490	4.097
9008	525925.801	325521.855	4.218
7500	525921.068	325424.697	4.183
7501	525861.416	325406.827	3.951
7502	525812.985	325375.612	4.052

- | ABBREVIATIONS & SYMBOLS | | NOTES: |
|--|----------------------|--|
| AV | AIR VALVE | QHC OVERHEAD CABLE |
| BR | BORE HOLE | PR POST |
| NO | NOISY | PM PUMP |
| CAV | CABLE TV | PI PITCH INVERT |
| CAV | CABLE TV MH | PO POST BOX |
| CCV | SECTIVEY CAM | PT POST |
| CH | CHANNEL | R/R POST AT RAMP LEVEL |
| CO | COLUMBIA | PW POST TO WIRE TENSE |
| DC | CABLE TV LID | RD EDGE OF ROADNO KERRB |
| CO | CROWN PIPE | RD ROODING EYE POINT |
| DR | DRRAIN | RL RIDGE LEVEL |
| E | EAGLE LEVEL | RP RISE POINT |
| EP | ELECTRIC POLE | RS ROAD SIGN |
| ES | EARTH RD | SLA STONE LVL |
| FL | FLOWER BED | SOF SOFT LEVEL |
| FR | FIRE PIT | SV VALVE |
| FFL | FINISHED FLOOR LEVEL | SW SURFACE WATER |
| PI | FLAG POLE | TAC TACTILE PAVING |
| FOU | FOUL WATER | TR TRUCK |
| GV | GAS | TL TRAFFIC LIGHTS |
| HE | HEADWATER | TRM TRIMMING LEVEL |
| IC | INSPECTION COVER | TOW TOP OF WALL LEVEL |
| IN | INVERT | TRM TRIMMING LEVEL |
| KB | KERR BOTTOM | TRK TRUCK |
| KT | KERR TOP | U/LT UNDER TO LIFT UP |
| KT | KERR TOP | VP VENT PIPE |
| LA | LAMP | WATER WATER METER |
| LC | LIGHT COLUMN | W/LW WATER LEVEL |
| MA | MANHOLE | W/P WATER PUMP |
| MP | MARKER POST | WO WASH OUT POINT |
|  FENCE
 HEDGE
 ELECTRIC
 BANK EDGE
 STORM LINE
 FOUL LINE
 TELESCOPE LINE
 GAS LINE
 LARSON PIPES
 CHANNEL
 WATER MAIN
 MANHOLE | |  TREE
 STATION
 TBM
 MANHOLE
 GULLY
 WATER LVL.
 GATE |
| THE POSITION OF THIS SURVEY IS BASED ON GPS OSN15N GRID. | | |
| ALL LEVELS RELATE TO GPS DATA ACQUIRED WITH TRIMBLE VRS. | | |
| TREES SPREADS ARE DRAWN TO SCALE AND SHOW THE GENERAL/AVERAGE CANOPIY SPREAD. | | |
| ALL BELOW GROUND LEVEL INFORMATION INCLUDING VOUNDS, DRAINAGE & SERVICES HAVE BEEN IDENTIFIED FROM THE BOUNDARY OF THIS SURVEY AND DRAWN TO SCALE. THE ESTIMATIONS ONLY! ALL CRITICAL DIMENSIONS SHOULD BE CHECKED PRIOR TO THE COMMENCEMENT OF ANY SITE WORKS. | | |
| EVERY EFFORT HAS BEEN MADE TO LOCATE AND SURVEY ALL VISIBLE FEATURES. IT SHOULD BE NOTED THAT SOME ITEMS MAY NOT BE IDENTIFIED DURING THE TIME OF THE SURVEY AND THEREFORE NOT SHOWN ON THIS DRAWING. | | |
| PHYSICAL BOUNDARY FEATURES SHOWN ON THIS DRAWING DO NOT NECESSARILY REPRESENT THE ACTUAL LEGAL BOUNDARY. THIS INFORMATION SHOULD BE CONFIRMED WITH THE RELEVANT DOCUMENTATION. | | |
| THE CONTRACTOR MUST CHECK AND VERIFY ALL SITE LEVELS, DIMENSIONS, SPREADS AND DRAINAGE PRIOR TO THE COMMENCEMENT OF ANY SITE WORKS. ANY DISCREPANCIES ARE NOTED TO THE CONTRACTOR'S ATTENTION. | | |
| ALL SURVEY STATION CONTROL POINTS MUST BE CHECKED BY THE CONTRACTOR PRIOR TO STARTING ANY SITE WORKS. | | |

SURVEY DATE	25/02/2021	INITIALS	CLR/MJW
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REV	AMENDMENTS	DRN	DATE

CJ & CA PENNEY CONSULTING Ltd

Project Title:

ELSOMS WAY
SPALDING - LINCS

Drawing Title:

AS-BUILT

Scale @ A1:	1:500	Date:	26/02/2021
Drawing No:	21 - 35 - 01		Rev:
C.A.D.Title:	c penney elsons way spalding/asbuilt master (21-35-01) mjo		
Drawn By:	MJW	Checked By:	SRW



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Appendix C – Greenfield Run Off

Calculated by:	Ben Jackson
Site name:	Platts Close
Site location:	Pinchbeck

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:	52.81127° N
Longitude:	0.13363° W
Reference:	2061378299
Date:	Aug 02 2021 17:28

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	0.19
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Methodology

Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	560	560
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 $SPR/SPRHOST \leq 0.3$?

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):	0.27	0.27
1 in 1 year (l/s):	0.23	0.23
1 in 30 years (l/s):	0.65	0.65
1 in 100 year (l/s):	0.95	0.95
1 in 200 years (l/s):	1.12	1.12

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.



Appendix D – Proposed Drainage Calculations

Results for 1 year Critical Storm Duration. Lowest mass balance: 96.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PS1	10	2.780	0.080	7.5	0.0156	0.0000	OK
15 minute winter	PS2	10	2.678	0.060	9.8	0.0118	0.0000	OK
180 minute winter	D1	140	2.645	0.070	4.9	12.9783	0.0000	OK
15 minute winter	D2	13	2.786	0.241	9.2	0.0000	0.0000	SURCHARGED
15 minute winter	PS3	13	2.796	0.268	9.7	0.0526	0.0000	SURCHARGED
15 minute winter	PS4	13	2.853	0.441	10.7	0.0864	0.0000	SURCHARGED
15 minute winter	PS5	13	2.893	0.493	4.8	0.0967	0.0000	SURCHARGED
15 minute winter	PS7	13	2.889	0.607	10.6	0.6862	0.0000	SURCHARGED
15 minute summer	Junction	1	2.237	0.000	1.6	0.0000	0.0000	OK
15 minute winter	PS6	13	2.893	0.343	5.4	0.0672	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)
15 minute winter	PS1	1.000	PS2	7.4	0.922	0.512	0.0988	
15 minute winter	PS2	1.001	D1	9.7	3.144	0.285	0.0043	
180 minute winter	D1	1.002	D2	-2.5	-0.301	-0.492	0.3443	
15 minute winter	D2	1.003	PS3	-9.2	-0.724	-0.634	0.0440	
15 minute winter	PS3	1.004	PS4	-9.7	-0.549	-0.668	0.3066	
15 minute winter	PS4	1.005	PS7	-7.7	-0.438	-0.533	0.3247	
15 minute winter	PS5	3.000	PS7	4.5	0.276	0.290	0.2659	
15 minute winter	PS7	Hydro-Brake®	Junction	1.6				8.3
15 minute winter	PS6	2.000	PS7	2.4	0.200	0.118	0.3667	

Results for 10 year Critical Storm Duration. Lowest mass balance: 96.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PS1	10	2.824	0.124	14.5	0.0243	0.0000	OK
180 minute winter	PS2	176	2.750	0.132	5.3	0.0258	0.0000	OK
180 minute winter	D1	176	2.750	0.175	10.2	32.5234	0.0000	SURCHARGED
15 minute winter	D2	12	2.871	0.326	12.9	0.0000	0.0000	SURCHARGED
15 minute winter	PS3	12	2.891	0.363	13.7	0.0712	0.0000	SURCHARGED
15 minute winter	PS4	12	3.004	0.592	16.2	0.1160	0.0000	SURCHARGED
15 minute winter	PS5	12	3.080	0.680	9.3	0.1332	0.0000	SURCHARGED
15 minute winter	PS7	14	3.067	0.785	19.2	2.4703	0.0000	SURCHARGED
15 minute summer	Junction	1	2.237	0.000	1.6	0.0000	0.0000	OK
15 minute winter	PS6	14	3.074	0.524	9.1	1.7945	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	PS1	1.000	PS2	14.3	1.092	0.990	0.1589	
180 minute winter	PS2	1.001	D1	4.4	1.515	0.129	0.0199	
180 minute winter	D1	1.002	D2	-5.8	-0.406	-1.123	0.5954	
15 minute winter	D2	1.003	PS3	-12.9	-0.733	-0.893	0.0440	
15 minute winter	PS3	1.004	PS4	-13.7	-0.778	-0.948	0.3066	
15 minute winter	PS4	1.005	PS7	-10.8	-0.613	-0.747	0.3247	
15 minute winter	PS5	3.000	PS7	8.6	0.486	0.546	0.2659	
15 minute winter	PS7	Hydro-Brake®	Junction	1.6				18.2
15 minute winter	PS6	2.000	PS7	9.1	0.518	0.452	0.3667	

Results for 30 year Critical Storm Duration. Lowest mass balance: 96.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PS1	10	2.891	0.191	18.3	0.0375	0.0000	SURCHARGED
240 minute winter	PS2	236	2.824	0.206	4.5	0.0404	0.0000	SURCHARGED
240 minute winter	D1	236	2.824	0.249	12.8	46.3404	0.0000	SURCHARGED
15 minute winter	D2	13	2.901	0.356	14.4	0.0000	0.0000	SURCHARGED
15 minute winter	PS3	13	2.927	0.399	14.4	0.0783	0.0000	SURCHARGED
15 minute winter	PS4	13	3.066	0.654	17.2	0.1282	0.0000	SURCHARGED
15 minute winter	PS5	12	3.165	0.765	11.8	0.1499	0.0000	SURCHARGED
15 minute winter	PS7	14	3.142	0.860	24.4	3.7667	0.0000	SURCHARGED
15 minute summer	Junction	1	2.237	0.000	1.6	0.0000	0.0000	OK
15 minute winter	PS6	14	3.151	0.601	12.4	3.0593	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	PS1	1.000	PS2	17.7	1.090	1.228	0.1831	
240 minute winter	PS2	1.001	D1	6.8	1.482	0.200	0.0207	
240 minute winter	D1	1.002	D2	-5.9	-0.364	-1.152	0.5954	
15 minute winter	D2	1.003	PS3	-14.4	-0.908	-0.995	0.0440	
15 minute winter	PS3	1.004	PS4	-14.4	-0.817	-0.995	0.3066	
15 minute winter	PS4	1.005	PS7	-12.0	-0.679	-0.827	0.3247	
15 minute winter	PS5	3.000	PS7	10.9	0.621	0.698	0.2659	
15 minute winter	PS7	Hydro-Brake®	Junction	1.6				22.9
15 minute winter	PS6	2.000	PS7	7.9	0.448	0.391	0.3667	

Results for 100 year Critical Storm Duration. Lowest mass balance: 96.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PS1	12	2.940	0.240	23.8	0.4477	0.0000	SURCHARGED
240 minute winter	PS2	236	2.930	0.312	5.9	0.0611	0.0000	SURCHARGED
240 minute winter	D1	236	2.930	0.355	15.1	66.0525	0.0000	SURCHARGED
60 minute winter	D2	43	2.972	0.427	14.4	0.0000	0.0000	SURCHARGED
30 minute winter	PS3	25	2.999	0.471	16.5	0.0923	0.0000	SURCHARGED
15 minute winter	PS4	13	3.163	0.751	16.7	0.1472	0.0000	SURCHARGED
15 minute winter	PS5	12	3.297	0.897	15.3	0.1759	0.0000	SURCHARGED
30 minute winter	PS7	23	3.268	0.986	24.7	5.9452	0.0000	SURCHARGED
15 minute summer	Junction	1	2.237	0.000	1.6	0.0000	0.0000	OK
30 minute winter	PS6	24	3.276	0.726	11.6	5.1132	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	PS1	1.000	PS2	20.3	1.195	1.402	0.1942	
240 minute winter	PS2	1.001	D1	7.6	1.578	0.223	0.0207	
240 minute winter	D1	1.002	D2	-8.1	-0.463	-1.583	0.5954	
60 minute winter	D2	1.003	PS3	-14.4	-0.820	-0.999	0.0440	
30 minute winter	PS3	1.004	PS4	-16.5	-0.938	-1.142	0.3066	
15 minute winter	PS4	1.005	PS7	-13.4	-0.760	-0.925	0.3247	
15 minute winter	PS5	3.000	PS7	14.0	0.795	0.894	0.2659	
30 minute winter	PS7	Hydro-Brake®	Junction	1.7				23.6
30 minute winter	PS6	2.000	PS7	6.6	0.372	0.325	0.3667	

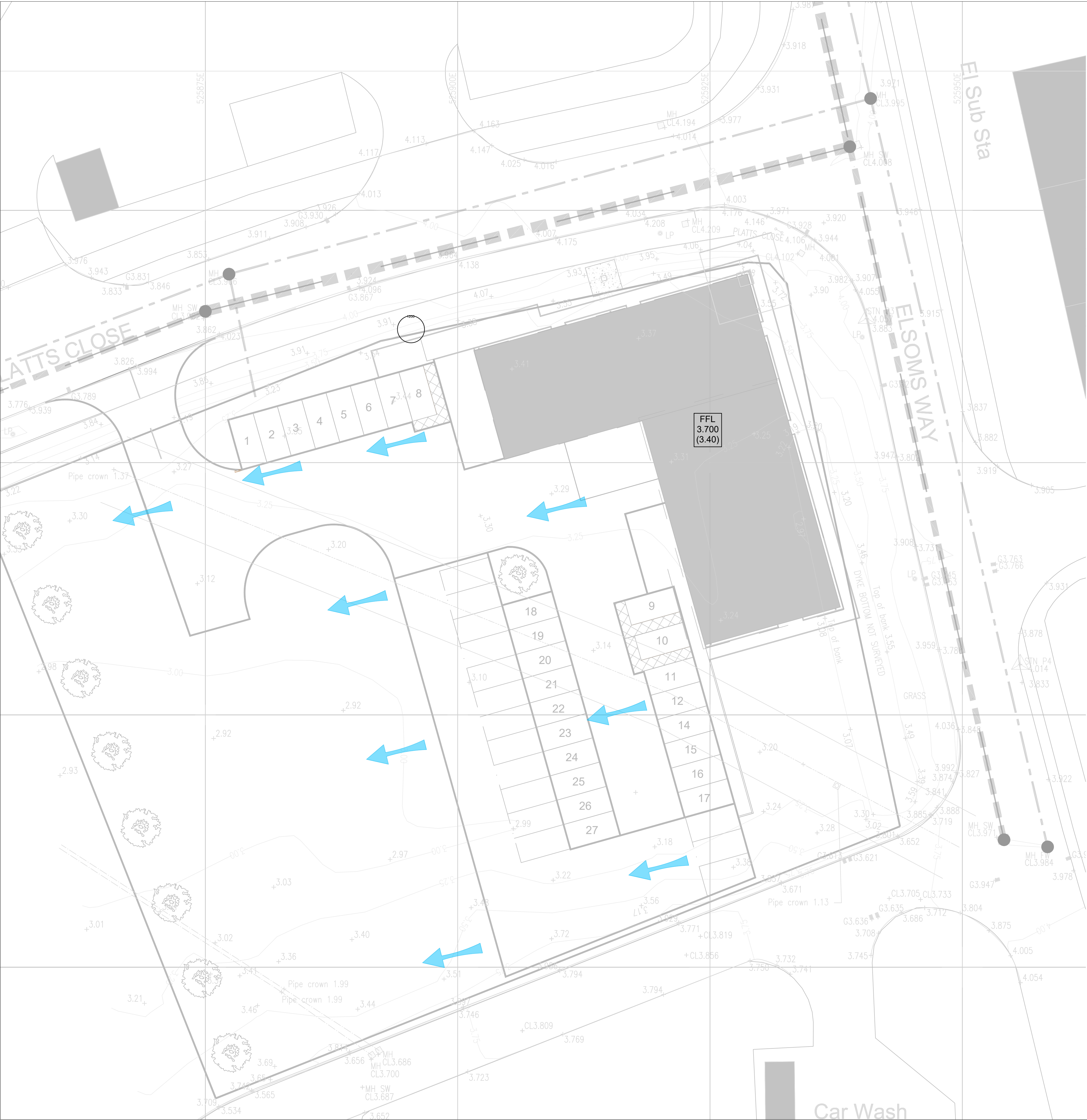
Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 96.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	PS1	352	3.197	0.497	6.8	19.0546	0.0000	SURCHARGED
360 minute winter	PS2	344	3.201	0.583	6.0	0.1142	0.0000	FLOOD RISK
360 minute winter	D1	352	3.196	0.621	16.1	74.5731	0.0000	SURCHARGED
360 minute winter	D2	352	3.193	0.648	8.1	0.0000	0.0000	SURCHARGED
360 minute winter	PS3	352	3.193	0.665	8.1	0.1303	0.0000	SURCHARGED
15 minute winter	PS4	12	3.512	1.100	27.3	0.2157	0.0000	FLOOD RISK
15 minute winter	PS5	12	3.700	1.300	21.4	0.2548	0.2591	FLOOD
15 minute winter	PS7	12	3.606	1.324	43.8	6.6981	0.0000	FLOOD RISK
15 minute summer	Junction	1	2.237	0.000	1.9	0.0000	0.0000	OK
30 minute winter	PS6	19	3.340	0.790	27.1	5.3550	7.1630	FLOOD

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	PS1	1.000	PS2	4.5	0.653	0.312	0.2164	
360 minute winter	PS2	1.001	D1	10.3	1.532	0.301	0.0207	
360 minute winter	D1	1.002	D2	-8.0	-0.453	-1.548	0.5954	
360 minute winter	D2	1.003	PS3	-8.1	-0.458	-0.557	0.0440	
360 minute winter	PS3	1.004	PS4	-8.1	-0.463	-0.564	0.3066	
15 minute winter	PS4	1.005	PS7	-13.7	-0.777	-0.946	0.3247	
15 minute winter	PS5	3.000	PS7	19.3	1.094	1.229	0.2659	
15 minute winter	PS7	Hydro-Brake®	Junction	1.9				22.6
30 minute winter	PS6	2.000	PS7	-17.0	-0.965	-0.842	0.3667	



Appendix E – Exceedance Route Plan



Flow Route Key



Proposed surface water flow routes

Disclaimer
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Any discrepancies must be reported back to the named office below.
Any works carried out without necessary written approvals is at the risk of the developer.
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Drawing must be printed in colour. This text will be red if a coloured drawing.

- Notes:
1. All drawings to be read in conjunction with Structural Engineers Drawings.
 2. If in doubt - ASK!
 3. Any discrepancies are to be reported back to the engineer immediately.
 4. All dimensions are in metres unless noted otherwise (pipe diameters are generally shown in millimetres, unless noted otherwise).
 5. Drawings marked Preliminary, Information or Tender are for guidance/ approval only, i.e. NOT for Construction.
 6. It is likely that existing services will be present within the existing site. Contractor to ensure all necessary precautions have been taken before any excavation takes place.
 7. It is the contractors responsibility to locate existing services where they may be affected by proposed works and protect them as necessary and agreed by the utility provider.
 8. Drawings to be read in conjunction with all relevant drawings.
 9. Setting out to be in accordance with the Architectural plans.

Preliminary
For discussion only

P01	Drawing generally updated to reflect revised site layout.	BJ	JCE	19/08/21
Rev	Description	Dwn	Ck'd	Date

Client:
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Project Title:
Proposed HQ for ARK ICT,
Platts Close, Pinchbeck, PE11 3UL

Drawing Title:
Exceedance Flow Routes

Drawing Status:
Preliminary

Scale: 1:200	Paper size: A1	Date: 24/07/2021
Drawn: BJ	Checked: JCE	Approved: JCE

Drawing Number: 0137-JCE-00-SI-DR-C-3010	Rev P01
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