FLOOD RISK ASSESSMENT

FOR

SCHOOL EXTENTION AT
PRINCE WILLIAM SCHOOL, HERNE ROAD, OUNDLE

FOR

MORGAN SINDALL CONSTRUCTION

Prepared by Couch Consulting Engineers

MARCH 2023

Rev. No.	Date	Revision	Rev. By
P01	27/03/2023	Initial Issue.	OJB
P02	19/07/2023	FRA amended to suit comments made by the LLFA.	OJB
P03	10/11/2023	FRA amended to include updated drainage drawings and calculations	SN

TABLE OF CONTENTS

1. DEVELOPMENT DESCRIPTION AND LOCATION

This Flood Risk Assessment report has been commissioned to support a planning application for an extension to an existing school building to accommodate a new sports hall, as well as associated soft landscaping and hardstanding areas, on land that is currently within the school grounds located off Herne Road, Oundle, Peterborough.

The purpose of this report is to assess flood risk at the site in relation to the proposed development and provide a suitable surface water scheme for the site which does not increase flood risk on the site or to adjacent land.

For the purposes of this study, the following have been considered:-

- Environment Agency Flood Mapping
- British Geological Survey Mapping
- Ground Investigation provided by Geosphere Environmental in January 2022.
- Topographical Survey undertaken by Plowman Craven Ltd in October 2021.
- Proposed site layout prepared by Wynne-Williams Associates in August 2022.

1.1. Existing Site

The 1.236 ha site is within the Prince William School grounds. The site is bounded by the Herne Road to the south, existing residential buildings to the north and western boundaries, and fields to the east. The site is located off the Herne Road, Oundle, Peterborough.

The location of the site is shown in Figure 1.1.

Figure 1.1: Development Location

The site generally falls from a high spot in the west, towards the low spot located to the south-east corner of the site. A majority of the site is comprised of an existing building, with areas of soft and hard landscaped areas. A car park and school entrance are situated to the south, and a playing field as well as astroturf courts are located to the south-east.

A copy of the topographical survey undertaken by Plowman Craven Ltd in October 2021 is included in Appendix A.

1.2. Site Geology

A geo-environmental report, undertaken by Geosphere Environmental Ltd in January 2022, includes both a desktop study and an intrusive ground investigation.

The desktop study includes a review of the history of the site, based on available old Ordnance Survey Maps, a review of the site geology, and a search for records of any licensed landfill sites, pollution incidents etc., within the vicinity of the site. Fieldwork testing was carried out on-site, and Laboratory testing was carried out on soil samples collected during the ground investigation.

The site area is described on maps, published by the British Geological Survey, as having a majority of the site underlain by superficial River Terrace deposits, comprising of sands and gravels. The maps also show at these superficial deposits are underlaid by sandstone and limestone bedrock of the Rutland Formation.

The Rutland Formation comprises of materials from mudstone to sandstone and limestone depending on the location. The EA records the Rutland Formation as a Secondary B Aquifer of Medium - High Vulnerability with Soluble Rock Risk. The BGS classifies Limestone as a moderately soluble risk and is removed over long-time scales.

The closet surface water features to the site include, the River Nene which wraps round the site, with its closest points located 200m to the south of the site, and 580m to the east of the site. The river flows in an easterly direction towards the site, then meanders south before heading in a northern direction. A marina and lakes are located 650-1000m to the east, which forms part of the Barnwell Country Park and Oundle Marina Village.

The site has a fall across the carparking area, which begins as a high spot located in the west and falls towards the south-east corner of the site.

The Desk Study identified that from the early records (1884) the area consisted of arable farmland, which was later developed on between 1978-1979 when the school was build. Since then, the school had undertaken various small extensions. The Desk Study then confirmed that there could be a few contaminants of concern, due to the made ground associated with the school's previous development.

During the intrusive site investigation soil sample were obtained which confirm that the results for; Metals, Metalloids, Non-metals; Polycyclic Aromatic Hydrocarbons; Total Petroleum Hydrocarbons; Gas Monitoring, and Asbestos were no present, or did not exceed the relevant testing criteria as discussed in the GI Report.

From the information available, due to the cohesive nature of the local sub-soil deposits traditional foundation may be used as stated in the Ground Investigation Report. However, the foundations will need to be a minimum depth of 1m below ground level to avoid the underlying made ground.

Made ground will be present across the whole site at various depths.

2. FLOOD HAZARD AND PROBABILITY

2.1 Possible Flooding Mechanisms

Table 1: Possible Flooding Mechanisms

Source/Pathway	Level of Risk	Comment/Reason
Fluvial	Low	The site is shown to lie within Flood Zone 1, outside of both the 1 in 100 year and 1 in 1000 year floodplain extents.
Tidal/Coastal	N/A	The site does not lie within close proximity to the sea.
Canals	N/A	The site does not lie within close proximity to any canals.
Reservoirs and Waterbodies	Low	The site is not shown to be affected by flooding from reservoirs. A few small ponds lie within relatively close proximity to the site but any risk to the site would be negligible.
Pluvial (surface water)	Low / Very Low	EA Surface Water Flood Maps has highlighted that the site lies within an area at risk of low to very low flood risk during high rainfall events.
Groundwater	Low	Groundwater was not encountered during the Ground Investigation.
Overland flow	Low	The ground falls from the west towards the south-east corner of the site.

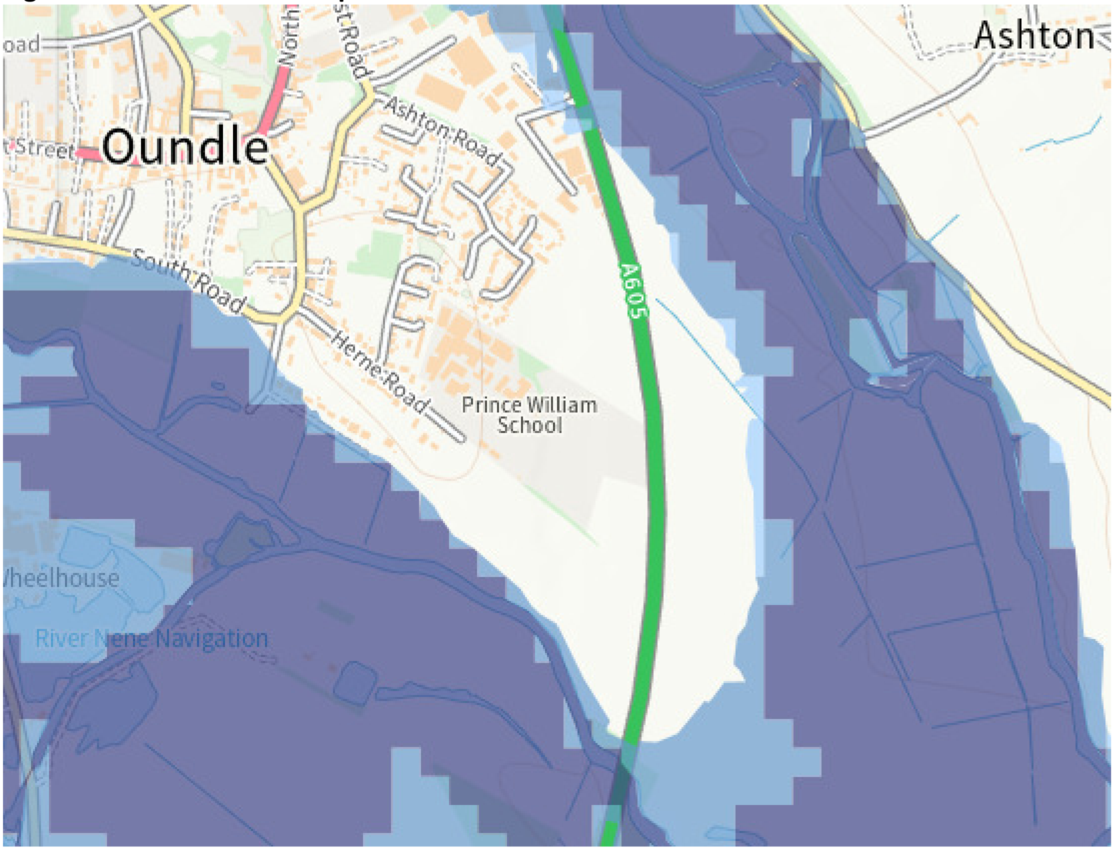
The main potential source of flood risk is considered to be surface water runoff from the site towards the boundary.

According to the Environment Agency Flood Maps the site lies within Flood Zone 1 (outside of both the 1 in 100 year and 1 in 1000 year floodplain).

2.2 Fluvial Flooding Risk

The annual probability of a flood event occurring at a site can be defined from the Environment Agency's Flood Zone map (Figure 2.2).

Figure 2.2: Fluvial Flood Map



Source: watermaps.environment-agency.gov.uk/

The proposed development site lies in **Flood Zone 1 (FZ1)**. According to 'Guidance – Flood Risk and Coastal Change', this zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%). This assigns the probability as defined on the government web site 'Guidance – Flood Risk and Coastal Change', Table 1: Flood Zones (https://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones).

2.2.1 Suitability of the Site for Educational Development

The probability of flooding at a location area defined on the government web site 'Guidance – Flood Risk and Coastal Change', Table 3: Flood risk vulnerability and flood zone 'compatibility' (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/575184/Table_3_-_Flood_risk_vulnerability_and_flood_zone__compatibility_.pdf). Any developments are appropriate in this Flood Zone. as shown in Table 3.1.

Table 3.1 Flood Risk Vulnerability and Flood Zone 'Compatibility' (Guidance on Flood Risk and Coast Change, Table 3)

Flood Risk Vulnerability		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✔	✔	✔	✔	✔
	Zone 2	✔	✔	Exception test required	✔	✔
	Zone 3a	Exception test required	✔	✕	Exception test required	✔
	Zone 3b	Exception test required	✔	✕	✕	✕

✔ - Development is appropriate ✕ – Development should not be permitted

The Indicative Flood Plain Map contained within Figure 2.2 confirms that the whole site is within Flood Zone 1 'low probability'. NPPF Technical Guidance Table 2 shows the commercial site is within the Flood Risk Vulnerability classification of "more vulnerable" (this includes buildings used for; hospitals, residential institutions, buildings used for dwelling houses, non-residential uses for health services and educational establishments). Therefore, based on the EA flood zone classification of the development, Table 3 in NPPF 'Technical Guidance' (see Table 3.1 above), indicates that development is 'appropriate'.

The risk of fluvial flooding is Low.

2.3 Reservoir and Waterbodies Flood Risk

Figure 2.3: Reservoir Flood Map

Source: watermaps.environment-agency.gov.uk/

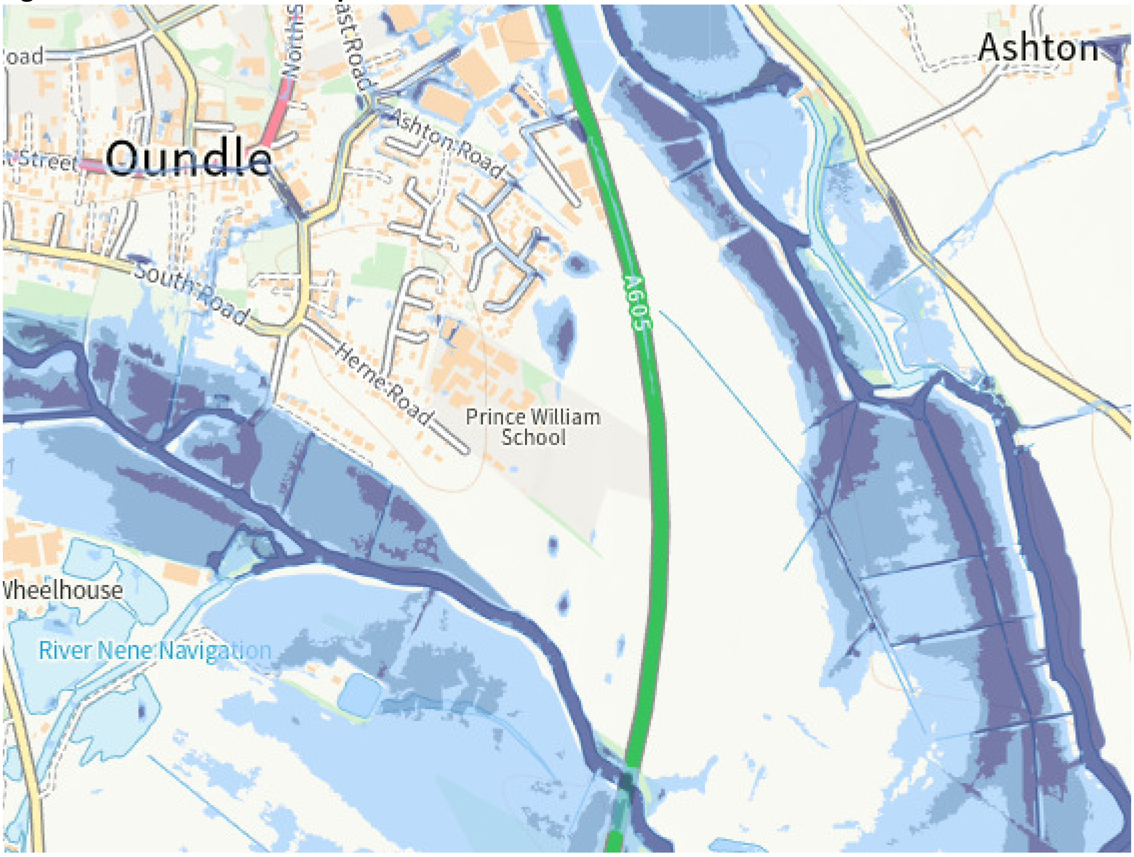
The development location is shown to be not at risk of flooding from reservoirs and other waterbodies.

The risk of flooding from reservoirs and other waterbodies is Low.

2.4 Pluvial / Surface Water Flooding

According to the Surface Water Flood Map from the Environment Agency's website (see Figure 2.4) The site is shown to be at low to very low risk of surface water flooding.

Figure 2.4: Pluvial Flood Map



Source: watermaps.environment-agency.gov.uk/

The map shows that the development will be at low risk from pluvial flooding. Pluvial flooding occurs at the edge of the car park to the south of the site.

The risk of flooding from pluvial flooding is Low.

2.5 Overland Flow

As previously stated in the Site Geology section, the site is relatively flat with an embankment located along the northern boundary, shown by the topographical survey, and as shown in Figure 2.5 below.

Figure 2.5: Overland Flow Route

At present any overland flows fall from the high point located at the western end of the car park and falls towards the south-east corners of the car park. During extreme rainfall events, any flood water will make its way onto the playing field and into the River Nene.

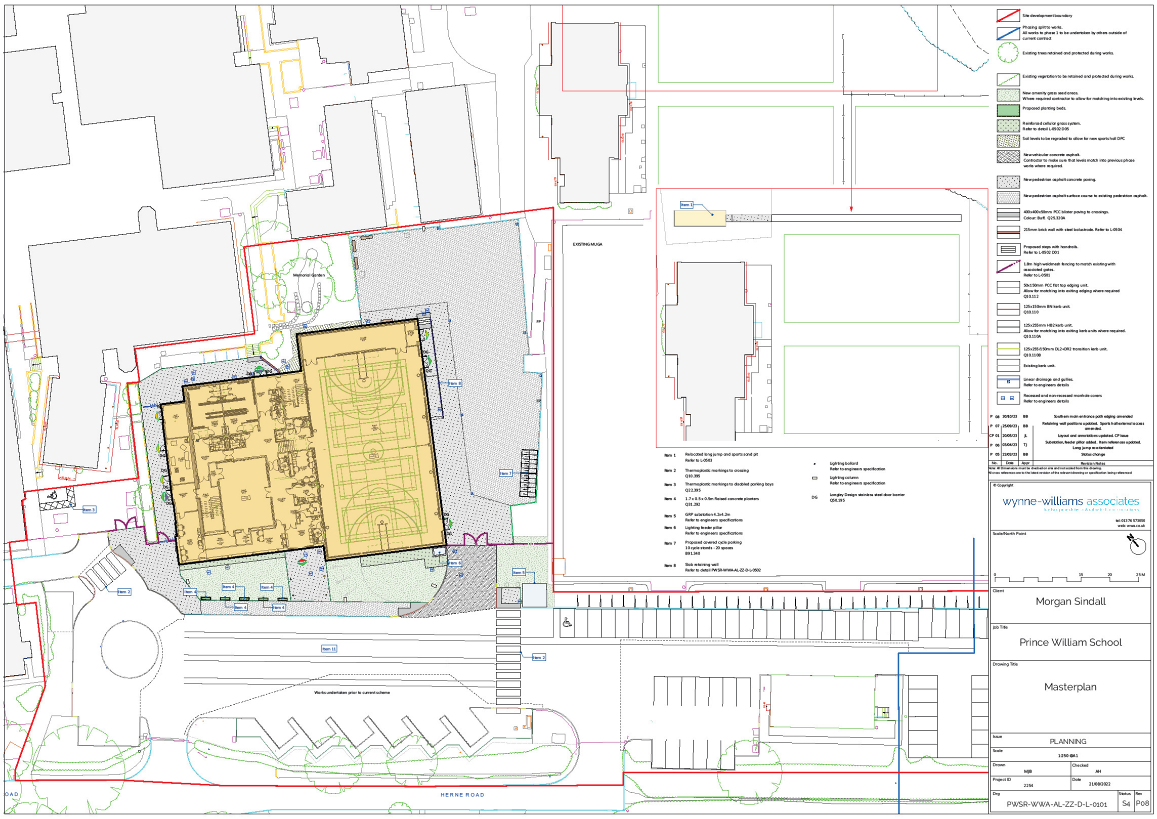
3. DEVELOPMENT PROPOSALS, FLOOD RISK MANAGEMENT & OFF-SITE IMPACTS

3.1. Development Location and Proposals

The proposal includes the extension of an existing building to accommodate a new sports hall, and hardstanding communal areas. On the south-west boundary, along Herne Road , two existing bellmouths are used for access to the existing car park.

A copy of the proposed site layout produced by Wynne-Williams Associates is included in Figure 3.1 below with a larger scale plan provided in Appendix B.

Figure 3.1: Proposed Site Layout



Source: Wynne-Williams Associates

The development site has been shown to lie outside the fluvial floodplain, as well as low to very low risk of flooding from other sources, being surface water runoff and overland flow.

In terms of the risk from flooding due to overland flow post-development, the existing building has FFL of 32.150mAOD, with the Sports Hall extension's FFL of 30.650mAOD. Surrounding hardstanding surfaces have been designed to fall away from the building to force the pluvial flooding around the property during extreme rainfall events. The large areas of paving associated with the building will require a drainage solution to intercept any overland flows and avoid unnecessary ponding.

3.2. Access / Egress

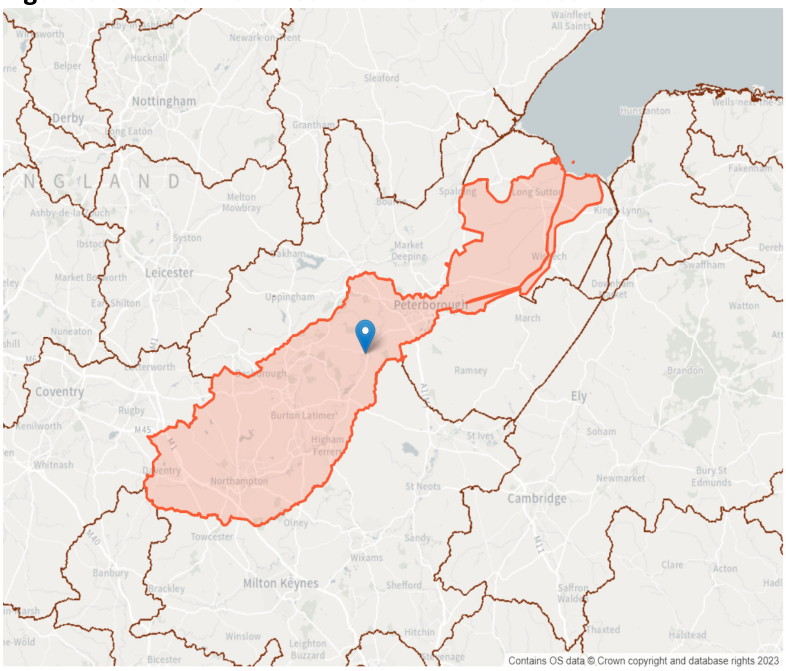
The main access in and out of the site will have no flooding, as indicated on the EA's pluvial flood mapping (see section 2.4 Pluvial / Surface Water Flooding). In the event that the route is not passable the immediate area around the property will be out of the path of the overland flow.

3.3. Surface Water Drainage & Foul Water Drainage

The proposal for the site shows the amount of impermeable area will increase, from an area of 0.130 ha, with an increase in area of 0.020 ha to 0.150 ha. Therefore, the amount and rate of surface water runoff will also increase.

It should be noted that a Climate Change allowance of 25% has been used when designing the surface water drainage system. This Climate Change figure has been obtained from the governments website on FRA Climate Change Allowances (https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances). The proposed design life of the development is 50 years i.e., between 2061 and 2100. The guidance recommends the central allowance (50th percentile) is used for flood risk assessments i.e., 25% (see figure 3.3 below).

Figure 3.3: Catchment Peak Rainfall Allowances



Nene Management Catchment peak rainfall allowances

3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	35%
2070s	25%	35%

1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	40%
2070s	25%	40%

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

Source: https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall?mgmtcatid=3059

A drainage strategy has been prepared based on FEH Rainfall data which proposes to pipe the surface water runoff from the roof area and associated hardstanding areas, into a soakaway storage tank located under a soft landscaped area to the south-east of the site. The surface water within the storm drainage network is then discharged into a soakaway tank at an infiltration rate of 0.031464 m/hr.

An assessment for an appropriate storm water outfall base on the 'Surface Water Discharge Hierarchy' has been undertaken in line with the Planning Practice Guidance (PPG), Paragraph 056.

1. **Infiltration**
   As stated in a supplementary Ground Investigation Report undertaken by Geosphere Environmental (infiltration testing was performed to comply with BRE 365) in January 2022, where soakaways are shown to work outside the development area, but within school grounds to the south of the proposed development, at the end of the school car park (see Appendix D). Although the area within the development area has no potential to soakaway, due to the cohesive nature on site, the drainage will be diverted towards the end of the school's carpark to take advantage of the infiltration rates (see Appendix E).
2. **Water course / body**
   The site does not have direct access / riparian rights to a local water course / body. The nearest water course is the River Nene which encloses the site; located 330m to the south at its closest approach. This method of outfall has not been considered due to surface water system discharge via infiltration.
3. **Surface water sewer**
   A developer enquiry from Anglian Water has been obtain, however it is only commenting on the foul water connection, as surface water will be discharged via infiltration. This method of outfall has not been considered due to surface water system discharge via infiltration.
4. **Combined water sewer**
   This method of outfall has not been considered due to the surface water system discharging via infiltration.

As stated in the geo-environmental report undertaken by Geosphere Environmental in January 2022, soakaways are shown to work within the site (see Appendix E).

In terms of site foul water drainage, an existing foul water drainage system is located running through the site. Further exploratory investigative works will be undertaken to establish is this drainage is in satisfactory order. The existing private foul water network currently passes under the proposed Sports Hall extension; therefore, the foul drainage will need to be diverted around the extension.

A copy of the drainage strategy and construction details is provided in Appendix C.

3.3.1. Potential SUDS Option on Site

The following represents considerations on suitable SUDS options appropriate to this site. CIRIA C753 The SUDS manual was consulted to examine the use of SUDS on this site. Our conclusions are based on the assessment of the site and the evaluation of the relevant design requirements.

Infiltration System

There are many different types of drainage component that can be used to facilitate infiltration. These include soakaways, infiltration trenches, infiltration blankets and infiltration basins. Infiltration can contribute to reducing runoff rates and volumes while supporting baseflow and groundwater recharge processes. Soakaways are excavations that are filled with a void-forming material that allows the temporary storage of water before it soaks into the ground. Many small soakaways are now constructed with geocellular units available from builders' merchants pre-wrapped in geotextile. The geocellular units provide good overall storage capacity compared to rubble fill, and they allow the size of the structure required for any application to be minimised.

Soakaway Storage Tank is proposed.

Proprietary Treatment Systems

Proprietary treatment systems are manufactured products that remove specified pollutants from surface water runoff. They are especially useful where site constraints preclude the use of other methods or where they offer specific benefits in facilitating the delivery of SuDS design criteria for a site. They are often (but not always) subsurface structures and can often be complementary to landscaped features, reducing pollutant levels in the run-off, and protecting the amenity and/or biodiversity functionality of downstream SuDS components.

Full Retention Separator is proposed.

Rainwater Harvesting Systems

Rainwater harvesting is the collection of rainwater runoff for use. Runoff can be collected from roofs and other impermeable areas, stored, treated (where required) and then used as a supply of water for domestic, commercial industrial and/or institutional properties.

Rainwater Harvesting is not recommended.

Green Roofs

Green roofs comprise a multi-layered system that covers the roof of a building or podium structure with vegetation cover, over a drainage layer. They are designed to intercept and retain precipitation, reducing the volume of run-off and attenuating peak flows. Cost to the structure can be considerable and poor maintenance will leave it looking unsightly. The development proposals comprise of incorporating PV solar panels and plant onto the roof, therefore there won't be sufficient space to incorporate a green roof.

Green roof is not recommended.

Tree Pits

Tree Pits are an effective and environmentally robust means of managing surface water run-off. Surface water is discharged into surrounding subsoil, absorbed by roots, flowing into the tree pits control chamber. Tree pits reduce velocity & flow rate of surface water runoff as well as trap silt and other organic matter such as leaves filtering out harmful pollutants.

Due to the lack of available space on site, tree pits are unlikely to work and therefore will not be proposed as part of this development.

Tree Pits are not recommended.

Soakaways

Soakaways are square or circular excavations either filled with rubble or lined with brickwork, precast concrete or polyethylene rings/perforated storage structures surrounded by granular backfill. They can be grouped and linked together to drain large areas including highways. The supporting structure and backfill can be substituted by modular geocellular units. Soakaways provide storm water attenuation, storm water treatment and groundwater recharge.

Although soakaways are not viable around the proposed development, soakaways have been proved to work at the bottom of the school's car park. Therefore, it is proposed to divert the surface water drainage into soakaway tanks sited at suggested location.

Soakaways are proposed.

Swales

Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate. They should promote low flow velocities to allow much of the suspended particulate load in the storm water runoff to settle out, thus providing effective pollutant removal. Roadside swales can replace conventional gullies and drainage pipes. Swales are easy to incorporate into landscape design and it can reduce the run-off rates and volumes.

Due to a lack of available space on site, swales are unlikely to work within compact urban development, therefore swales are not proposed as part of the development.

Swales are not recommended.

Porous Pavements

Porous pavements provide a pavement suitable for pedestrian and/or vehicle traffic, whilst allowing rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored between infiltration to the ground, reuse or discharge to a watercourse or other drainage system. Pavements with aggregate sub-bases can provide good water quality treatment. The use of permeable paving for parking bays can be used as a stone sub-base not only stores and slows down the rate of discharge, but also raises the water quality.

Due to the lack of available space on site, porous paving is unlikely to work and therefore will not be proposed as part of this development.

Porous Paving is not recommended.

Ponds

Ponds can provide both storm water attenuation and treatment. They are designed to support emergent and submerged aquatic vegetation along their shoreline. Run off from each rain event is detained and treated in the pool. The retention time promotes removal through sedimentation and the opportunity for biological uptake mechanisms to reduce nutrient concentrations.

Attenuation ponds are unlikely to work within compact urban development's due to a lack of available space on site. Therefore, it is not proposed to incorporate any ponds as part of the development proposals.

Ponds are not recommended.

3.4. Overland Flow

As stated on the EA's pluvial flood mapping, the site is in an area of low flood risk. In order to protect the proposed building from overland flow during extreme rainfall events, the proposed building extension will have a FFL of 30.650mAOD, with surrounding ground levels directed away from the building.

The surface water drainage system has taken into consideration the potential for exceedance flow. The proposed network has been modelled for storm events up to and including the 1 in 100 year + 25% climate change allowance event. The hydraulic modelling shows there is some minor flooding of the system. This is indicated on the drainage layout plan included in Appendix C along with overland flow route arrows.

The nominal amount of flooding at node S5 will flow away from the building towards a vegetated garden area. At node S6 the volume of flooding is greater, however the levels fall away from the new sports hall and the overland flow route is in the direction of a gully located at a low point. This existing gully will be cleaned and jetted to ensure it performs effectively.

3.5. SUDS Maintenance & Management Plans

The scope/nature of inspection and maintenance is such that various facilities and structures are inspected and maintained at regular intervals, as well as after or during heavy storms, in order to ensure that these perform effectively. This shall include the storage and pipework so that the system fully maintains its functionality throughout.

A suitably appointed private management company will be responsible for maintaining the private site entities such as the manholes, gullies, and the respective SUDS facilities etc.

It is anticipated that the maintenance schedule will generally comprise the following activities in accordance with the CIRIA publication C753 (The SuDS Manual).

Refer to the following tables for proposed site maintenance & management strategies.

INFILTRATION SYSTEMS (SOAKAWAYS)		
Maintenance Schedule	**Required Action**	**Typical Frequency**
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings.	Annually
	Cleaning of gutters and any filters on downpipes.	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages.	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings.	As required, based on inspections
Remedial Actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs.	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway).	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation.	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring.	Annually

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

4. RESIDUAL RISKS

The assessment has shown the site to be located within Flood Zone 1, and at low to very low risk of flooding from all other sources.

To ensure the development does not pose a flood risk to the surrounding area, overland flows should be directed away from the proposed and existing buildings as much as reasonability feasible.

5. CONCLUSIONS

This report has been written in accordance with the requirements set out in the National Planning Policy Framework for a proposed extension to an existing school building and extension to the existing car park on land currently within the school grounds at Prince William School, Herne Road, Oundle.

Based on the information obtained from the Environment Agency, the site has been shown to lie within Flood Zone 1 and therefore at low risk of flooding from fluvial sources. The site has also been shown to lie at low to very low risk of flooding from other sources.

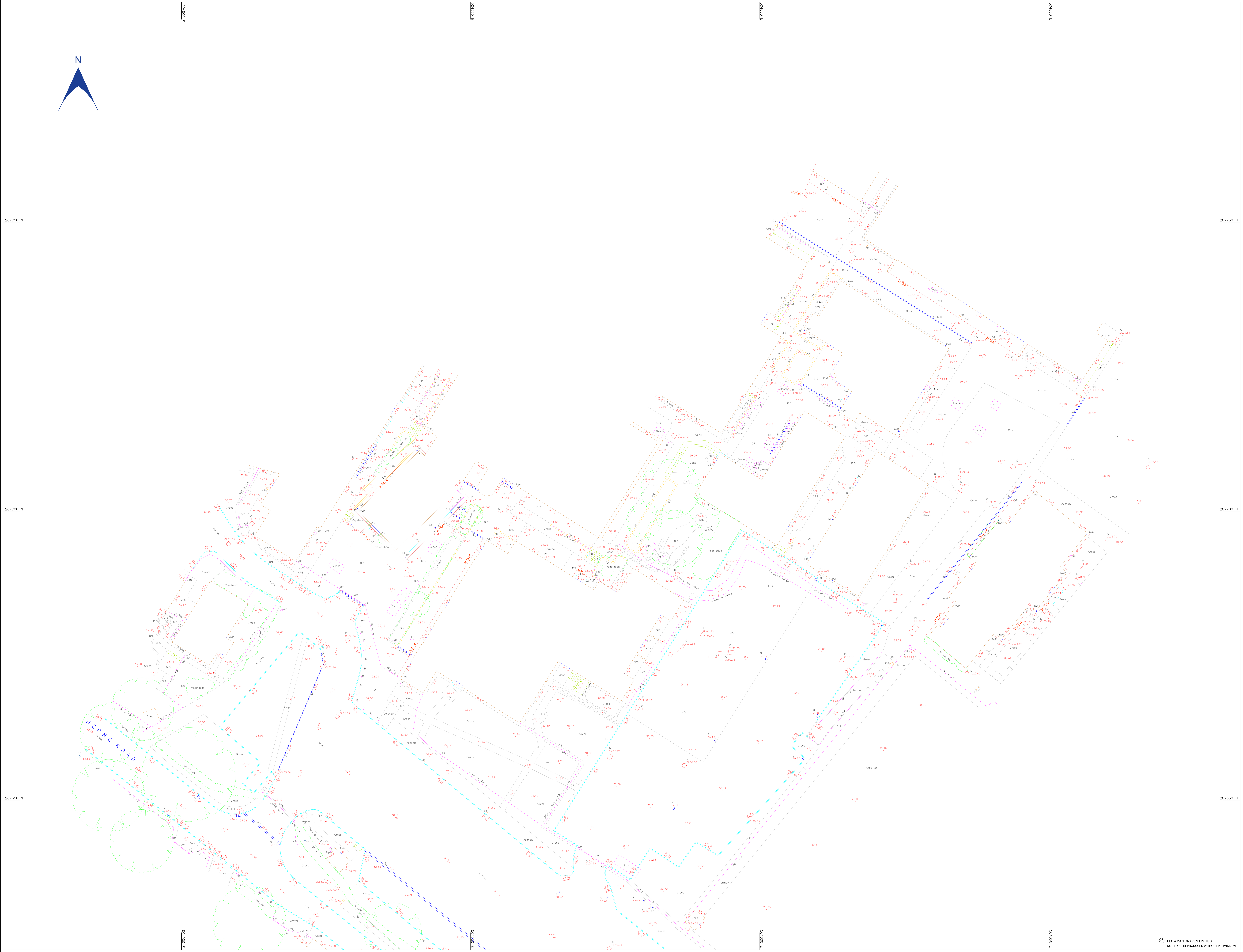
- The proposed site layout shows the building extension will have a split finished floor level, with the existing building at a FFL of 32.150mAOD, and the proposed building extension FFL to be 30.650mAOD. Surrounding ground levels to be set at least 150mmm lower to mitigate against any possible overland flows flooding the new building. Site levels should also be designed to fall away from the building.

- During heavy rainfall events, the Environment Agency's flood mapping shows no flooding around the buildings and access to the school, making dry access / egress from the building possible at all times.

- In terms of the risk of flooding from pluvial sources from the site a surface water drainage strategy has been prepared which intercepts the runoff from the roof and paved areas of the proposed building, via a piped storm water network. The surface water is then drained into a Soakaway Attenuation Tank located under an area of soft landscaping, which has sufficient storage for all storm events up to and including the 1:100 year event plus 25% for climate change.

Providing the mitigation measures discussed in this report or similar measures are implemented it is considered that the risk of flooding to the site and adjacent land will be greatly reduced.

APPENDIX A – TOPOGRAPHICAL SURVEY



STANDARD ABBREVIATIONS

A/C	Air Conditioner	LB	Litter Bin
ATM	Automated Telling Machine	LP	Lamp Post
B	Bollard	Max	Maximum
BB	Belisha Beacon	Mb	Multibole
Bh	Borehole	MH	Manhole
Br	Brick	Min	Minimum
BrS	Brick Setts	Mkr	Marker
BRW	Brick Retaining Wall	NB	Notice Board
BS	Bus Stop	NP	Name Plate
BT	British Telecom	OBF	Open Boarded Fence
BW	Brick Wall	O/H	Overhead
BWF	Barbed Wire Fence	OSBM	Ordnance Survey Bench Mark
CBF	Close Boarded Fence	P	Post
CCTV	Closed Circuit Television	PB	Pillar Box
CIF	Corrugated Iron Fence	PGM	Permanent Ground Marker
CL	Cover Level	PLt	Pavement Light
CLF	Chain Link Fence	PM	Parking Meter
Col	Column	PRF	Post and Rail Fence
Conc	Concrete	PS	Paving Stones
CoW	Cable on Wall	PWF	Post and Wire Fence
CPS	Concrete Paving Slabs	RE	Rodding Eye
CTV	Cable Television IC	RG	Road Gully
d	depth	RS	Road Sign
DC	Duct Cover	RSJ	Rolled Steel Joist
DH	Duct Height	RWP	Rain Water Pipe
DP	Down Pipe	s	spread
DrC	Drainage Channel	SB	Sign Board
EIC	Electrical Inspection Cover	SBM	Site Bench Mark
EJB	Electrical Junction Box	SC	Stop Cock
EP	Electricity Pole	SF	Security Fence
ER	Earthing Rod	ShB	Shrub Bed
ESG	Electrical Switchgear	SL	Sump Level
FB	Flower Bed	SO	Smoke Outlet
FH	Fire Hydrant	SP	Sign Post
FL	Floor Level	SV	Stop Valve
Flt	Floodlight	T	Telephone
g	girth	Tac	Tactile Paving
G	Gully	TBM	Temporary Bench Mark
GC	Gas Cock	TCB	Telephone Call Box
GM	Gas Meter	TCP	Traffic Control Post
GP	Gate Post	TIC	Telephone Inspection Cover
GV	Gas Valve	TJB	Telephone Junction Box
h	height	TL	Traffic Light
HR	Handrail	TLCB	Traffic Light Control Box
IB	Illuminated Bollard	TLIC	Traffic Light Inspection Cover
IC	Inspection Cover	TP	Telephone Pole
IL	Invert Level	Typ	Typical
IRF	Iron Railing Fence	V	Vent
IRS	Illuminated Road Sign	VP	Vent Pipe
JB	Junction Box	W	Window
KO	Kerb Outlet	WM	Water Meter
L	Light	WV	Water Valve

LEGEND

Stair/step arrows point up

Assumed detail

Due to the inherent instability of paper materials, drawings plotted on paper may be stretched and distorted - dimensions scaled from paper plots should therefore be treated with caution

SHEET LAYOUT

46970T-01-1

46970T-01-2

ISSUES & REVISIONS

Issue	Details	By	Date
A	Original Issue	PCL	30/11/21

This survey is commensurate with band F accuracy, as outlined in the RICS survey detail accuracy banding table

All levels are in metres and are above Ordnance Survey Newlyn Datum derived by multiple network RTK GPS observations

The survey grid shown on this drawing is only referenced to Ordnance Survey (OS) National Grid at the following point: 504627.508, 287644.554, obtained by multiple network RTK GPS observations

Unless otherwise stated, levels have been taken to finished floor surface

All quoted dimensions are in metres

Drawing units are metres

CLIENT

PEP Group

PEP House,
Stoney Lane, Bourne End,
Hemel Hempstead,
Herts, HP1 2SB

PROJECT TITLE

Prince William School Oundle

3D Topographical Survey

PRESENTATION SCALE 1:200 @ A0

DATE OF ORIGINAL SURVEY October 2021

PC PROJECT No. 46970 CHECKED GH

DRAWING No. 46970T-01-1 ISSUE A

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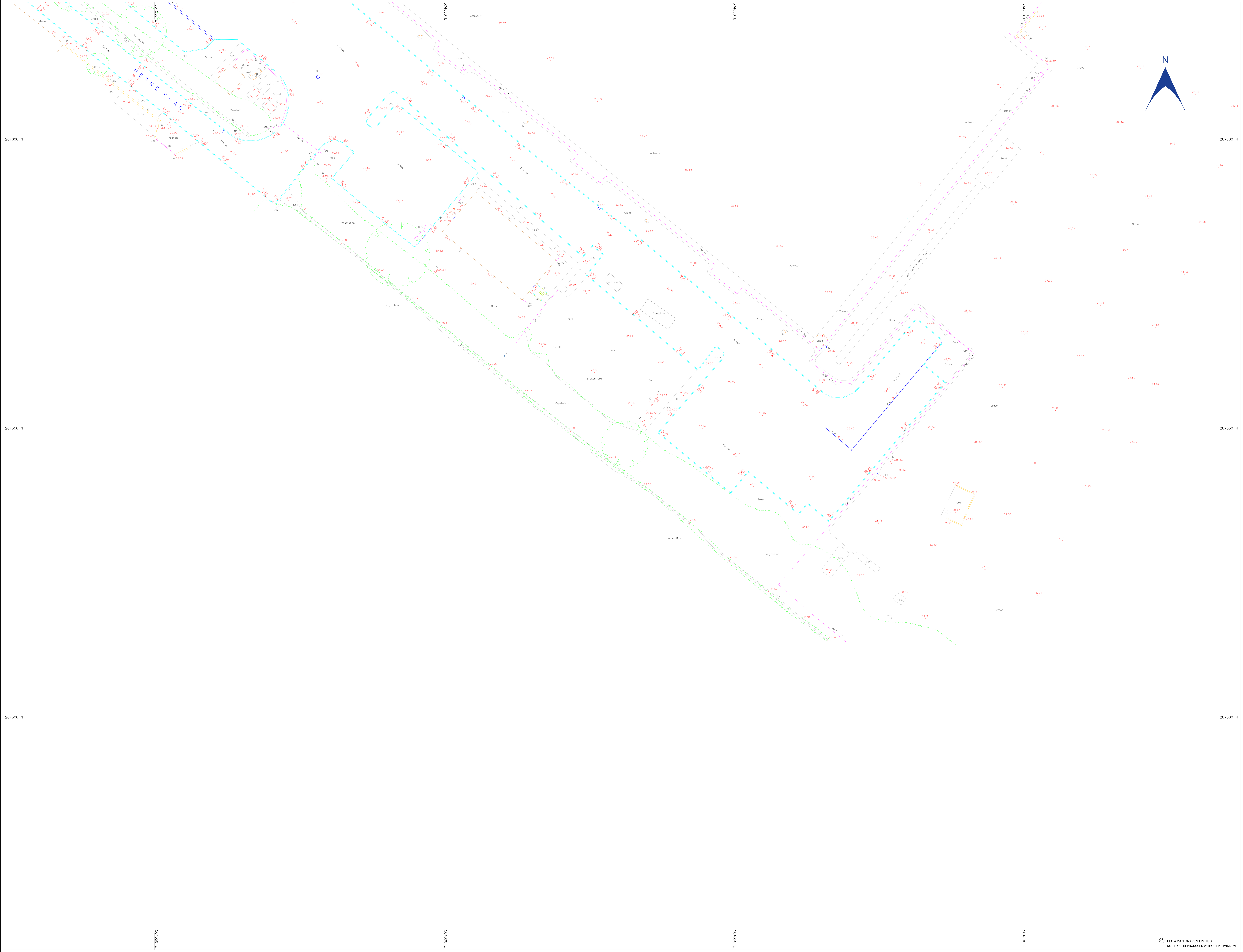

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A/C	Air Conditioner	LB	Litter Bin
ATM	Automated Telling Machine	LP	Lamp Post
B	Bollard	Max	Maximum
BB	Belisha Beacon	Mb	Multibole
Bh	Borehole	MH	Manhole
Br	Brick	Min	Minimum
BrS	Brick Setts	Mkr	Marker
BRW	Brick Retaining Wall	NB	Notice Board
BS	Bus Stop	NP	Name Plate
BT	British Telecom	OBF	Open Boarded Fence
BW	Brick Wall	O/H	Overhead
BWF	Barbed Wire Fence	OSBM	Ordnance Survey Bench Mark
CBF	Close Boarded Fence	P	Post
CCTV	Closed Circuit Television	PB	Pillar Box
CIF	Corrugated Iron Fence	PGM	Permanent Ground Marker
CL	Cover Level	PLt	Pavement Light
CLF	Chain Link Fence	PM	Parking Meter
Col	Column	PRF	Post and Rail Fence
Conc	Concrete	PS	Paving Stones
CoW	Cable on Wall	PWF	Post and Wire Fence
CPS	Concrete Paving Slabs	RE	Rodding Eye
CTV	Cable Television IC	RG	Road Gully
d	depth	RS	Road Sign
DC	Duct Cover	RSJ	Rolled Steel Joist
DH	Duct Height	RWP	Rain Water Pipe
DP	Down Pipe	s	spread
DrC	Drainage Channel	SB	Sign Board
EIC	Electrical Inspection Cover	SBM	Site Bench Mark
EJB	Electrical Junction Box	SC	Stop Cock
EP	Electricity Pole	SF	Security Fence
ER	Earthing Rod	ShB	Shrub Bed
ESG	Electrical Switchgear	SL	Sump Level
FB	Flower Bed	SO	Smoke Outlet
FH	Fire Hydrant	SP	Sign Post
FL	Floor Level	SV	Stop Valve
Flt	Floodlight	T	Telephone
g	girth	Tac	Tactile Paving
G	Gully	TBM	Temporary Bench Mark
GC	Gas Cock	TCB	Telephone Call Box
GM	Gas Meter	TCP	Traffic Control Post
GP	Gate Post	TIC	Telephone Inspection Cover
GV	Gas Valve	TJB	Telephone Junction Box
h	height	TL	Traffic Light
HR	Handrail	TLCB	Traffic Light Control Box
IB	Illuminated Bollard	TLIC	Traffic Light Inspection Cover
IC	Inspection Cover	TP	Telephone Pole
IL	Invert Level	Typ	Typical
IRF	Iron Railing Fence	V	Vent
IRS	Illuminated Road Sign	VP	Vent Pipe
JB	Junction Box	W	Window
KO	Kerb Outlet	WM	Water Meter
L	Light	WV	Water Valve

LEGEND

Stair/step arrows point up

Assumed detail

Due to the inherent instability of paper materials, drawings plotted on paper may be stretched and distorted - dimensions scaled from paper plots should therefore be treated with caution

This drawing has been produced for the purpose of the original commissioning agent. Plowman Craven Limited will accept no responsibility for details that are subsequently found to be the consequence of undisclosed facts or that were obscured from view at the time of survey or that have been altered since the survey.

See www.plowmancraven.co.uk for full terms and conditions of contract.

SHEET LAYOUT

46970T-01-1

46970T-01-2

ISSUES & REVISIONS

Issue	Details	By	Date
A	Original Issue	PCL	30/11/21

This survey is commensurate with band F accuracy, as outlined in the RICS survey detail accuracy banding table

All levels are in metres and are above Ordnance Survey Newlyn Datum derived by multiple network RTK GPS observations

The survey grid shown on this drawing is only referenced to Ordnance Survey (OS) National Grid at the following point: 504627.508, 287644.554, obtained by multiple network RTK GPS observations

Unless otherwise stated, levels have been taken to finished floor surface

All quoted dimensions are in metres

Drawing units are metres

CLIENT

PEP Group

PEP House,
Stoney Lane, Bourne End,
Hemel Hempstead,
Herts, HP1 2SB

PROJECT TITLE

Prince William School Oundle

3D Topographical Survey

PRESENTATION SCALE 1:200 @ A0

DATE OF ORIGINAL SURVEY October 2021

PC PROJECT No. 46970 CHECKED GH

DRAWING No. 46970T-01-2 ISSUE A

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Email: post@plowmancraven.co.uk
Web: www.plowmancraven.co.uk

APPENDIX B – PROPOSED SITE LAYOUT

Item 1	Relocated long jump and sports sand pit Refer to L-0503
Item 2	Thermoplastic markings to crossing Q10.395
Item 3	Thermoplastic markings to disabled parking bays Q22.395
Item 4	1.7 x 0.5 x 0.5m Raised concrete planters Q31.292
Item 5	GRP substation 4.2x4.2m Refer to engineers specifications
Item 6	Lighting feeder pillar Refer to engineers specifications
Item 7	Proposed covered cycle parking 10 cycle stands - 20 spaces B91.340
Item 8	Slab retaining wall Refer to detail PWSR-WWA-AL-ZZ-D-L-0502

Lighting bollard
Refer to engineers specification

Lighting column
Refer to engineers specification

DG Langley Design stainless steel door barrier
Q50.195

Site development boundary

Phasing split to works.
All works to phase 1 to be undertaken by others outside of current contract

Existing trees retained and protected during works.

Existing vegetation to be retained and protected during works.

New amenity grass seed areas.
Where required contractor to allow for matching into existing levels.

Proposed planting beds.

Reinforced cellular grass system.
Refer to detail L-0502 D05

Soil levels to be regraded to allow for new sports hall DPC

New vehicular concrete asphalt.
Contractor to make sure that levels match into previous phase works where required.

New pedestrian asphalt concrete paving.

New pedestrian asphalt surface course to existing pedestrian asphalt.

400x400x50mm PCC blister paving to crossings.
Colour: Buff. Q25.320A

215mm brick wall with steel balustrade. Refer to L-0504

Proposed steps with handrails.
Refer to L-0502 D01

1.8m high weldmesh fencing to match existing with associated gates.
Refer to L-0501

50x150mm PCC flat top edging unit.
Allow for matching into exiting edging where required
Q10.112

125x150mm BN kerb unit.
Q10.110

125x255mm HB2 kerb unit.
Allow for matching into exiting kerb units where required.
Q10.110A

125x255/150mm DL2+DR2 transition kerb unit.
Q10.110B

Existing kerb unit.

Linear drainage and gullies.
Refer to engineers details

Recessed and non-recessed manhole covers
Refer to engineers details

No.	Date	Appr	Revision Notes
P 08	30/10/23	BB	Southern main entrance path edging amended
P 07	25/09/23	BB	Retaining wall positions updated. Sports hall external access amended.
CP 01	20/05/23	JL	Layout and annotations updated. CP issue
P 06	03/04/23	TJ	Substation, feeder pillar added. Item references updated. Long jump re-orientated
P 05	23/03/23	BB	Status change

Note: All Dimensions must be checked on site and not scaled from this drawing.
All cross references are to the latest revision of the relevant drawing or specification being referenced

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Scale/North Point
0 15 20 25 M

Client
Morgan Sindall

Job Title
Prince William School

Drawing Title
Masterplan

Issue
PLANNING

Scale
1:250 @A1

Drawn
MJB

Checked
AH

Project ID
2254

Date
21/08/2022

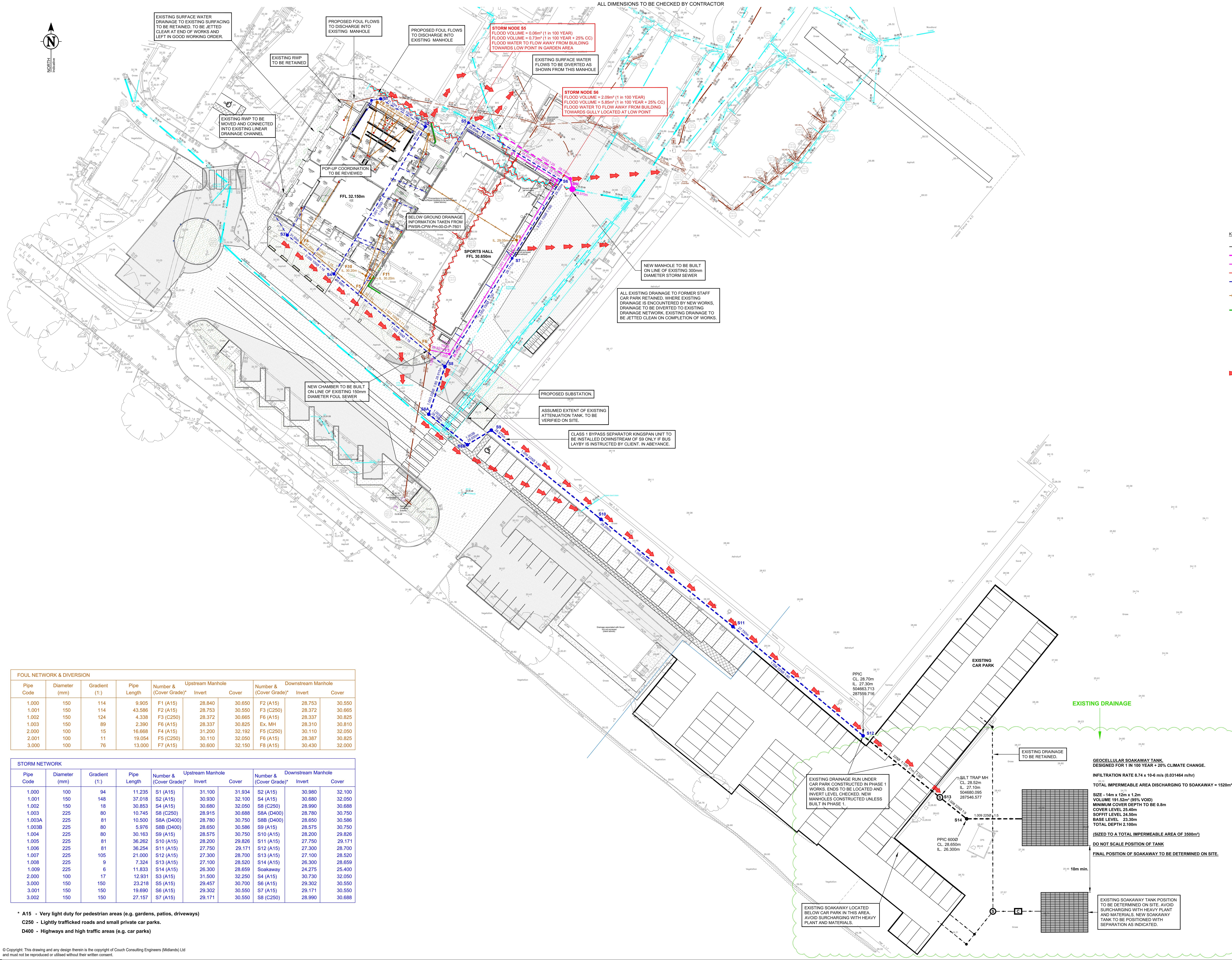
Drg
PWSR-WWA-AL-ZZ-D-L-0101

Status
S4

Rev
P08

APPENDIX C – SITE DRAINAGE STRATEGY

ALL DIMENSIONS TO BE CHECKED BY CONTRACTOR



GEOCELLULAR SOAKAWAY TANK.
DESIGNED FOR 1 IN 100 YEAR + 20% CLIMATE CHANGE.

INFILTRATION RATE 8.74 x 10-6 m/s (0.031464 m/hr)

TOTAL IMPERMEABLE AREA DISCHARGING TO SOAKAWAY = 1520m²

SIZE - 14m x 12m x 1.2m
VOLUME 191.52m³ (95% VOID)
MINIMUM COVER DEPTH TO BE 0.8m
COVER LEVEL 25.40m
SOFFIT LEVEL 24.50m
BASE LEVEL 23.30m
TOTAL DEPTH 2.100m

(SIZED TO A TOTAL IMPERMEABLE AREA OF 3500m²)

DO NOT SCALE POSITION OF TANK

FINAL POSITION OF SOAKAWAY TO BE DETERMINED ON SITE.

FOUL NETWORK & DIVERSION

Pipe Code	Diameter (mm)	Gradient (1:)	Pipe Length	Upstream Manhole Number & (Cover Grade)*	Upstream Manhole Invert	Upstream Manhole Cover	Downstream Manhole Number & (Cover Grade)*	Downstream Manhole Invert	Downstream Manhole Cover
1.000	150	114	9.905	F1 (A15)	28.840	30.650	F2 (A15)	28.753	30.550
1.001	150	114	43.586	F2 (A15)	28.753	30.550	F3 (C250)	28.372	30.665
1.002	150	124	4.338	F3 (C250)	28.372	30.665	F6 (A15)	28.337	30.825
1.003	150	89	2.390	F6 (A15)	28.337	30.825	Ex. MH	28.310	30.810
2.000	100	15	16.668	F4 (A15)	31.200	32.192	F5 (C250)	30.110	32.050
2.001	100	11	19.054	F5 (C250)	30.110	32.050	F6 (A15)	28.387	30.825
3.000	100	76	13.000	F7 (A15)	30.600	32.150	F8 (A15)	30.430	32.000

STORM NETWORK

Pipe Code	Diameter (mm)	Gradient (1:)	Pipe Length	Upstream Manhole Number & (Cover Grade)*	Upstream Manhole Invert	Upstream Manhole Cover	Downstream Manhole Number & (Cover Grade)*	Downstream Manhole Invert	Downstream Manhole Cover
1.000	100	94	11.235	S1 (A15)	31.100	31.934	S2 (A15)	30.980	32.100
1.001	150	148	37.018	S2 (A15)	30.930	32.100	S4 (A15)	30.680	32.050
1.002	150	18	30.853	S4 (A15)	30.680	32.050	S8 (C250)	28.990	30.688
1.003	225	80	10.745	S8 (C250)	28.915	30.688	S8A (D400)	28.780	30.750
1.003A	225	81	10.500	S8A (D400)	28.780	30.750	S8B (D400)	28.650	30.586
1.003B	225	80	5.976	S8B (D400)	28.650	30.586	S9 (A15)	28.575	30.750
1.004	225	80	30.163	S9 (A15)	28.575	30.750	S10 (A15)	28.200	29.826
1.005	225	81	36.262	S10 (A15)	28.200	29.826	S11 (A15)	27.750	29.171
1.006	225	81	36.254	S11 (A15)	27.750	29.171	S12 (A15)	27.300	28.700
1.007	225	105	21.000	S12 (A15)	27.300	28.700	S13 (A15)	27.100	28.520
1.008	225	9	7.324	S13 (A15)	27.100	28.520	S14 (A15)	26.300	28.659
1.009	225	6	11.833	S14 (A15)	26.300	28.659	Soakaway	24.275	25.400
2.000	100	17	12.931	S3 (A15)	31.500	32.250	S4 (A15)	30.730	32.050
3.000	150	150	23.218	S5 (A15)	29.457	30.700	S6 (A15)	29.302	30.550
3.001	150	150	19.690	S6 (A15)	29.302	30.550	S7 (A15)	29.171	30.550
3.002	150	150	27.157	S7 (A15)	29.171	30.550	S8 (C250)	28.990	30.688

*** A15 - Very light duty for pedestrian areas (e.g. gardens, patios, driveways)**
C250 - Lightly trafficked roads and small private car parks.
D400 - Highways and high traffic areas (e.g. car parks)

General Notes

1. Do not scale this drawing. If in doubt, ask.

2. This drawing is to be read in conjunction with all other relevant Engineers, Architects and specialist design drawings and details.

3. All dimensions are in metres unless noted otherwise. All levels are in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the Engineer immediately.

5. It is the responsibility of the Contractor to locate any service apparatus in the vicinity of the works. The client will accept no claims whatsoever in respect of any losses or damage caused in respect of such apparatus, however caused.

6. It is the responsibility of the Contractor to execute the works at all times in strict accordance with the requirements of the Health And Safety At Work Act 1974, and the C.D.M. Regulations 2015. The Contractor will be deemed to have allowed for full compliance, including full liaison with the Planning Supervisor, within his rates.

7. The Contractor is responsible for ensuring that all works are to the satisfaction of the Engineer, and shall be deemed to have included within his rates for any necessary testing.

8. The Contractor will be responsible for providing all necessary de-watering and trench support to execute the works in a satisfactory manner, and shall be deemed to have allowed for the same within his rates.

9. The Contractor shall check all tie-ins for line and level with existing before commencing any works. The Engineer shall be notified immediately in writing, should any errors be found.

10. All buried concrete products and mortar shall be made using sulphate resisting cement.

11. Any existing land drains encountered on site during construction to be re-connected.

12. Should any departure from the slab level be considered, agreement shall be sought from the Engineer immediately and prior to commencement or continuance of any works, and should take full account of all restrictions to the slab level.

KEY:

- EXISTING SURFACE WATER DRAINAGE
- PROPOSED SURFACE WATER DIVERSION
- PROPOSED FOUL WATER DIVERSION
- EXISTING DRAINAGE TO BE ABANDONED
- PROPOSED SURFACE WATER DRAINAGE (100mmØ UNLESS NOTED OTHERWISE)
- PROPOSED FOUL WATER DRAINAGE (100mmØ UNLESS NOTED OTHERWISE)
- PROPOSED LAND DRAINAGE TO RETAINING WALL CONNECTED TO SW DRAINAGE
- SIC — PPIC SHALLOW INSPECTION CHAMBERS (TO A DEPTH OF 600mm)
- PPIC INSPECTION CHAMBERS (450mmØ - 100mmØ to 150mmØ PIPES (600mmØ - 225mmØ PIPES)
- MH — 1200mmØ PRECAST CONCRETE MANHOLE CHAMBER
- OVERLAND WATER FLOW ROUTE IN THE EVENT OF AN EXCEEDANCE OR BLOCKAGE OF THE SURFACE WATER DRAINAGE SYSTEM.

REV	AMENDMENT	BY	DATE
CP05	FLOOD VOLUMES NOTED ON DRAWING. LATEST SITE LAYOUT PLAN ADDED.	SN	10.11.23
CP04	OVERLAND FLOW ROUTING ARROWS ADDED TO DRAWING (LLFA COMMENT).	SN	13.07.23
CP03	FOUL INVERT LEVELS ADDED, SHALLOW PPIC PROPOSED AND KEY UPDATED.	SN	19.06.23
CP02	TOPO SURVEY OMITTED WITHIN EXTENTS OF NEW CAR PARK. EXISTING DRAINAGE CLOUDED.	SN	13.06.23
CP01	CONTRACTORS PROPOSALS.	SN	25.05.23
P03	DRAINAGE REVISED.	SN	19.05.23
P02	STORM DIVERTED AROUND EXISTING TANK.	SN	24.03.23
P01	FIRST ISSUE.	SN	01.03.23

CE
PROJECT EXECUTION CLASS: N/A
All materials supplied in relations to those specified on this drawing are to be CE marked in accordance with the European Union Declaration of conformity

PURPOSE OF ISSUE
CONTRACTORS PROPOSALS

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CLIENT
MORGAN SINDALL CONSTRUCTION

PROJECT
PRINCE WILLIAM SCHOOL, OUNDLE, PETERBOROUGH

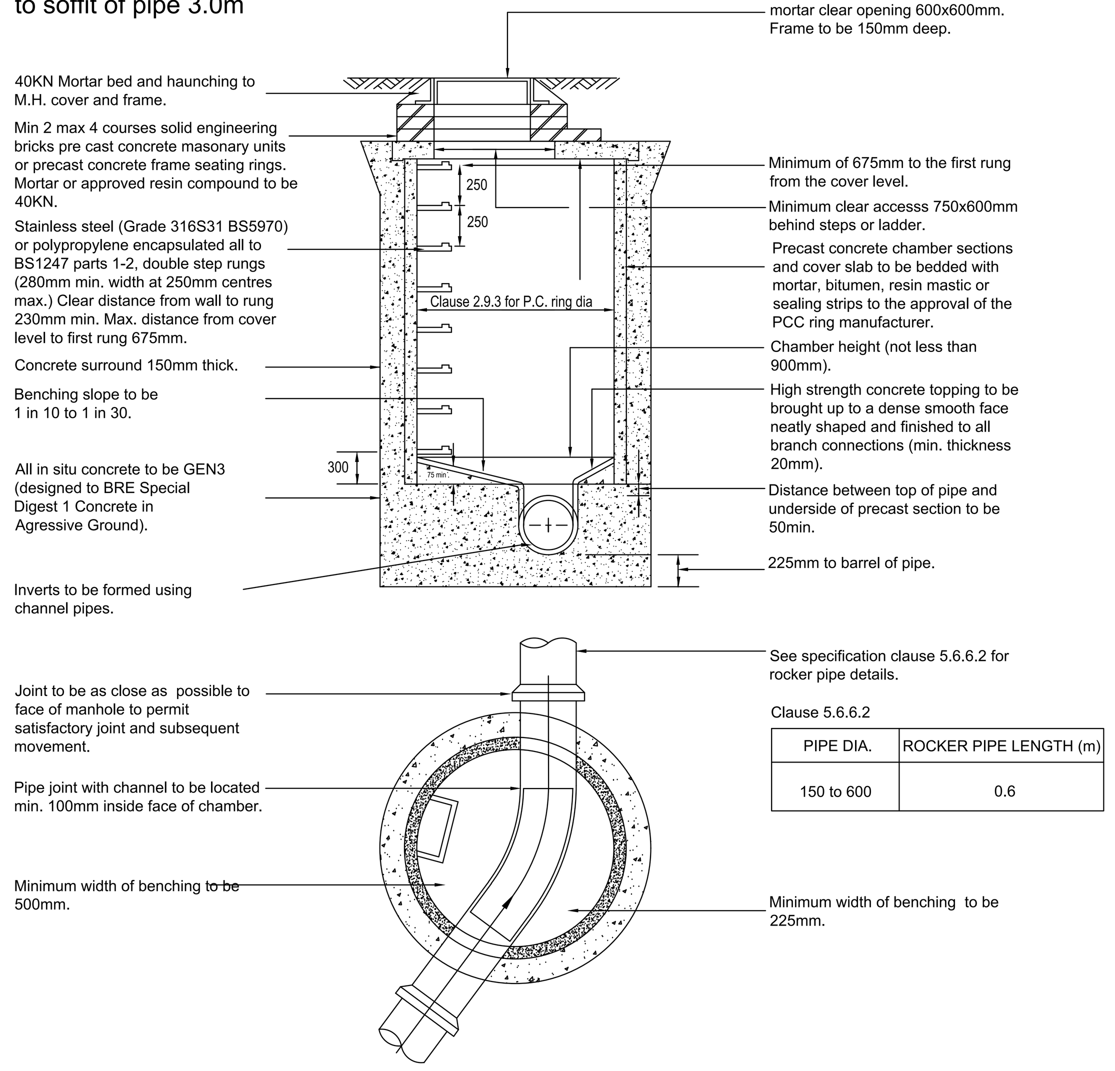
DRAWING TITLE
DRAINAGE LAYOUT

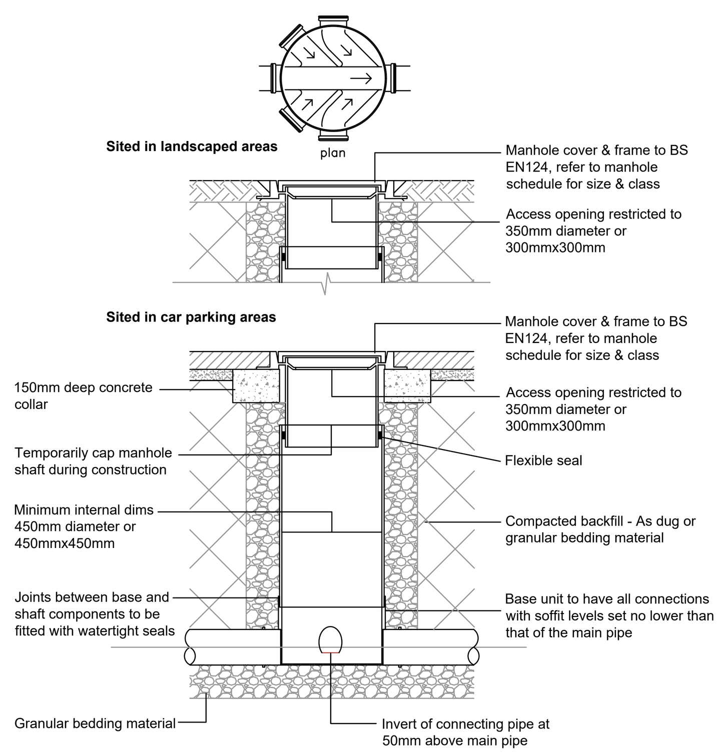
SHEET SIZE	SCALE	DATE	DRAWN	CHECKED	STATUS
A0	1:250	01.03.23	SN	NM	S5

CCE PROJECT No.	DRAWING No.	REV
8402	PWSR-CCE-CC-XX-D-C-0110	CP05

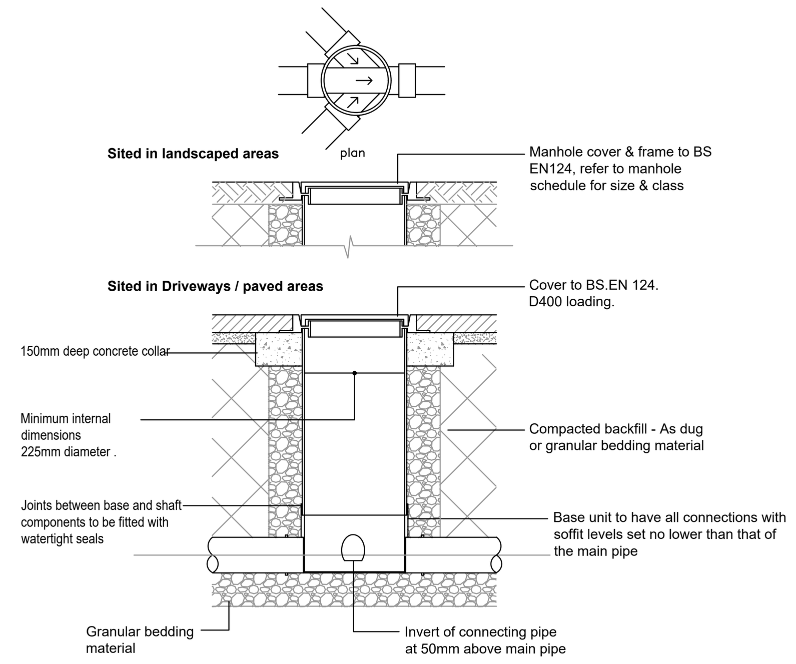
ALL DIMENSIONS TO BE CHECKED BY CONTRACTOR

Manhole Type B
Max depth from ground level to soffit of pipe 3.0m





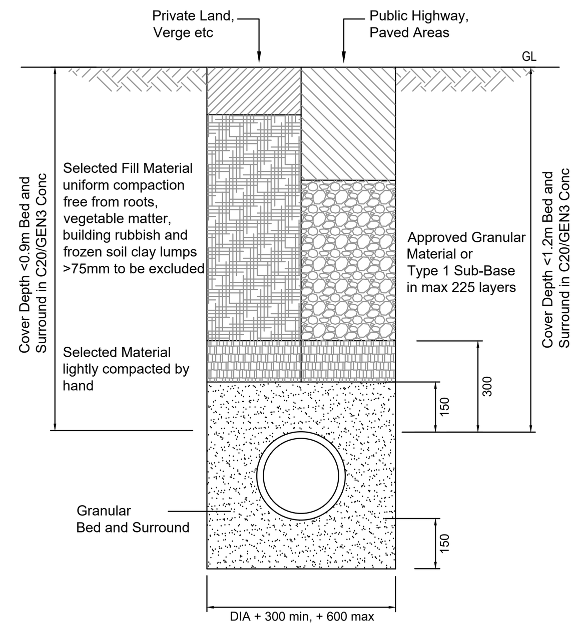
TYPICAL ACCESS CHAMBER DETAIL - P.I.C.
(Max depth to soffit of pipe in areas not subject to vehicle loading or areas subject to light vehicle loading 3.0m, non entry)



TYPICAL ACCESS CHAMBER DETAIL - S.I.C.
(Max depth to soffit of pipe 0.6m, non entry)

PIPE BEDDING and TRENCH WIDTH FOR TYPE S BEDDED PIPES			
Nominal Pipe (mm)	Granular Bedding Material		Trench Width (mm)
	Single Sized	Graded	
100	10mm	14–5mm	550
150	10/14mm	14–5/20–5mm	600
225	10/14/20mm	14–5/20–5mm	700
300	10/14/20mm	14–5/20–5mm	800
375	14/20mm	14–5/20–5mm	900
450	14/20mm	14–5/20–5mm	1050
525	14/20mm	14–5/20–5mm	1200
600	14/20/40mm	20–5mm	1500
750	14/20/40mm	20–5mm	1800
900	14/20/40mm	20–5mm	1800
1200	14/20/40mm	20–5mm	1800

All pipes built into manhole invert shall be installed with soffits level. The sizes stated above are the minimum acceptable, Where two or more pipes enter the manhole the chamber size must be sufficient to accommodate the required benching shown.



PIPE BEDDING CLASS 'S'

General Notes

1. Do not scale this drawing. If in doubt, ask.

2. This drawing is to be read in conjunction with all other relevant Engineers, Architects and specialist design drawings and details.

3. All dimensions are in metres unless noted otherwise. All levels are in metres unless noted otherwise.

4. Any discrepancies noted on site are to be reported to the Engineer immediately.

5. It is the responsibility of the Contractor to locate any service apparatus in the vicinity of the works. The client will accept no claims whatsoever in respect of any losses or damage caused in respect of such apparatus, however caused.

6. It is the responsibility of the Contractor to execute the works at all times in strict accordance with the requirements of the Health And Safety At Work Act 1974, and the C.D.M. Regulations 2015. The Contractor will be deemed to have allowed for full compliance, including full liaison with the Planning Supervisor, within his rates.

7. The Contractor is responsible for ensuring that all works are to the satisfaction of the Engineer, and shall be deemed to have included within his rates for any necessary testing.

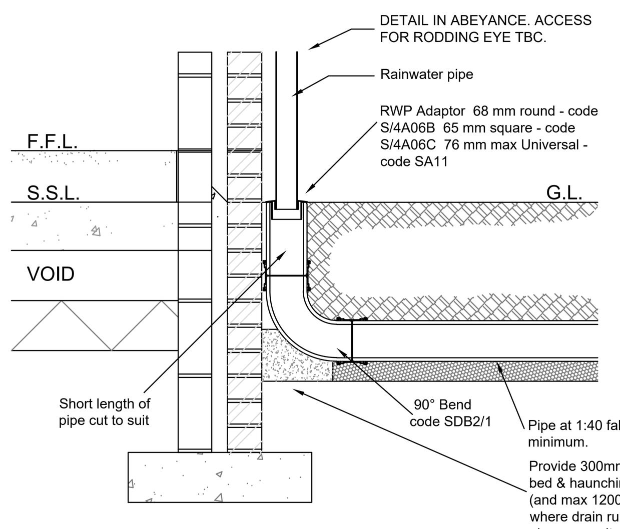
8. The Contractor will be responsible for providing all necessary de-watering and trench support to execute the works in a satisfactory manner, and shall be deemed to have allowed for the same within his rates.

9. The Contractor shall check all tie-ins for line and level with existing before commencing any works. The Engineer shall be notified immediately in writing, should any errors be found.

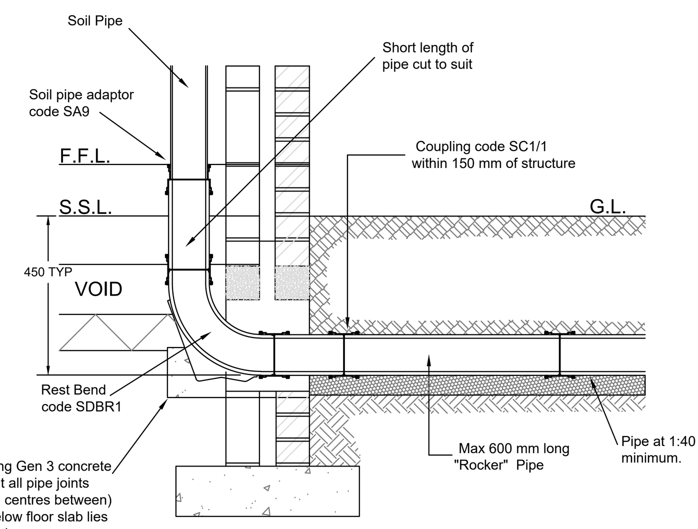
10. All buried concrete products and mortar shall be made using sulphate resisting cement.

11. Any existing land drains encountered on site during construction to be re-connected.

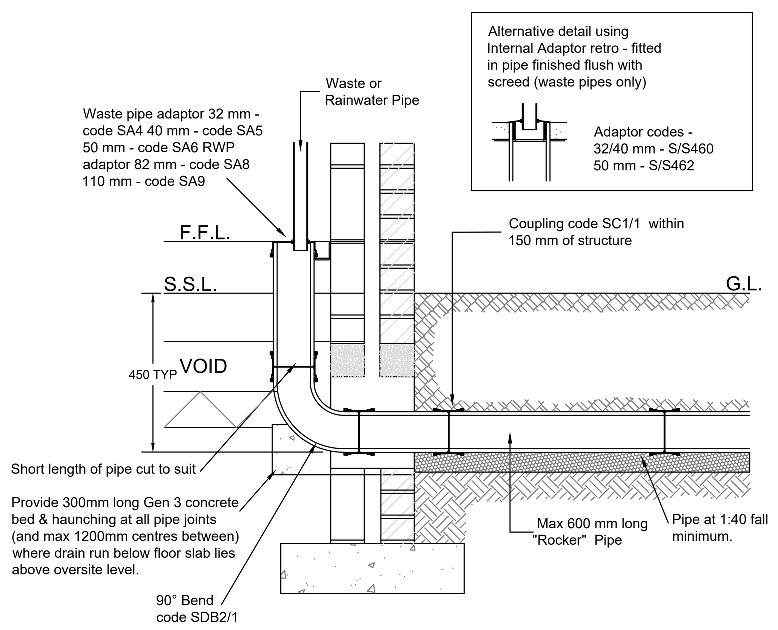
12. Should any departure from the slab level be considered, agreement shall be sought from the Engineer immediately and prior to commencement or continuance of any works, and should take full account of all restrictions to the slab level.



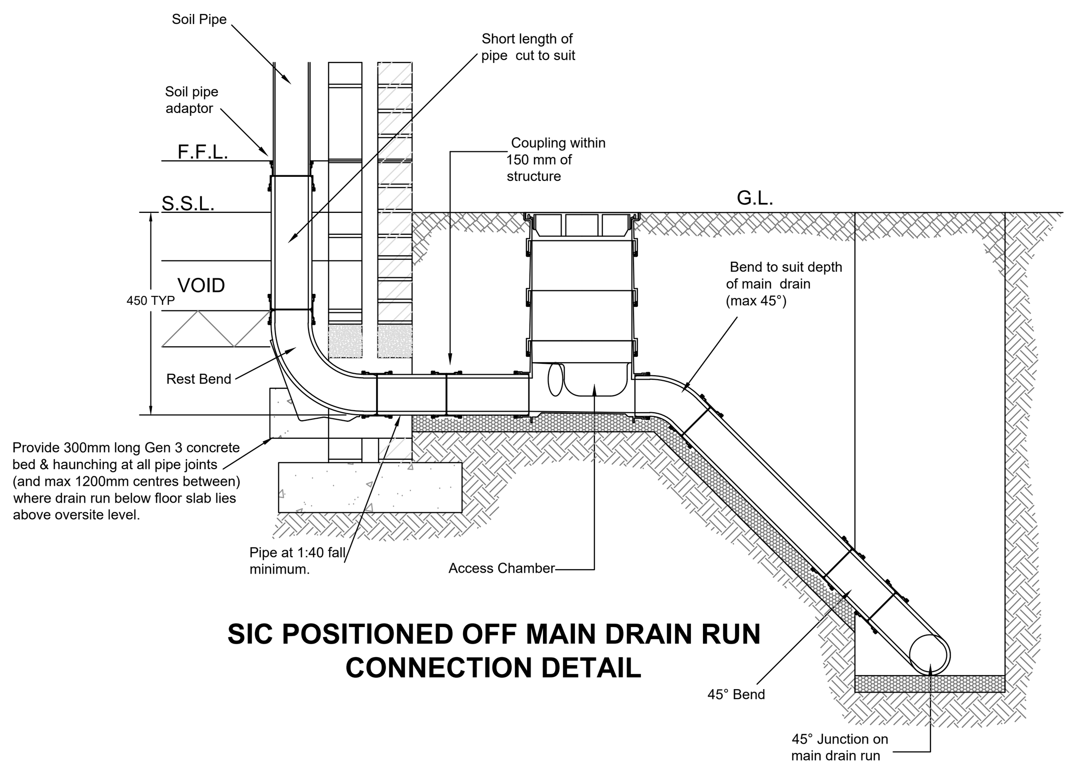
EXTERNAL RAINWATER PIPE CONNECTION DETAIL



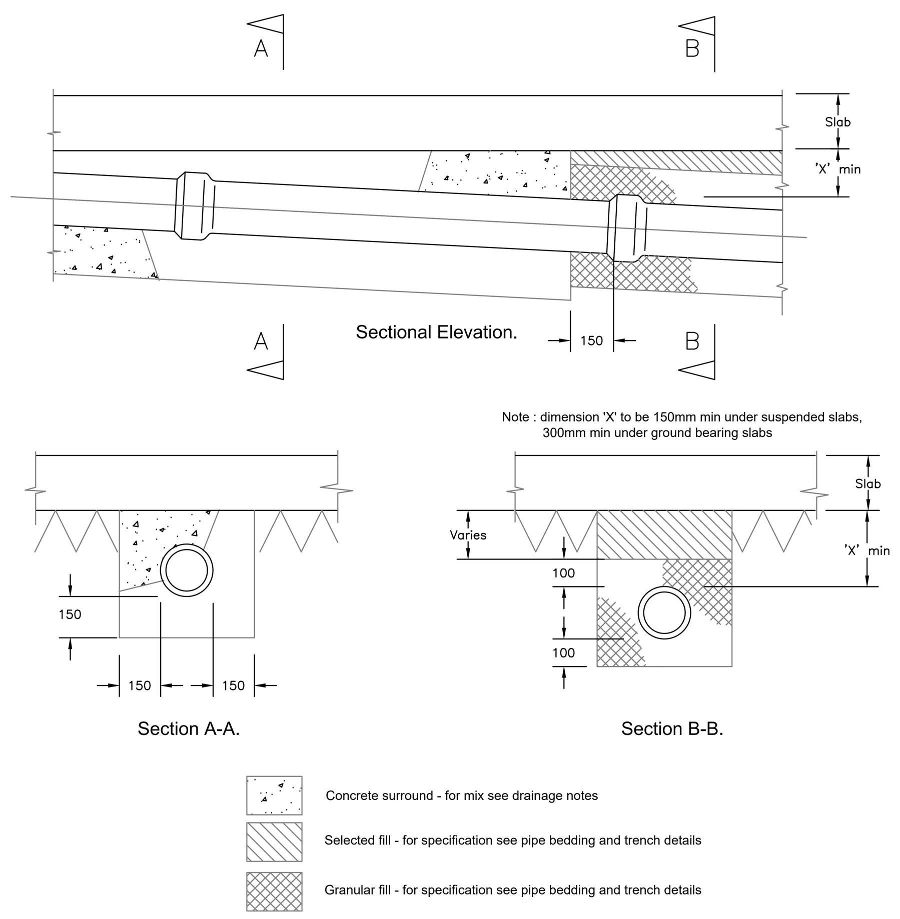
SOIL & VENT PIPE / STUB STACK / W.C. CONNECTION DETAIL



INTERNAL WASTE PIPE CONNECTION DETAIL



SIC POSITIONED OFF MAIN DRAIN RUN CONNECTION DETAIL

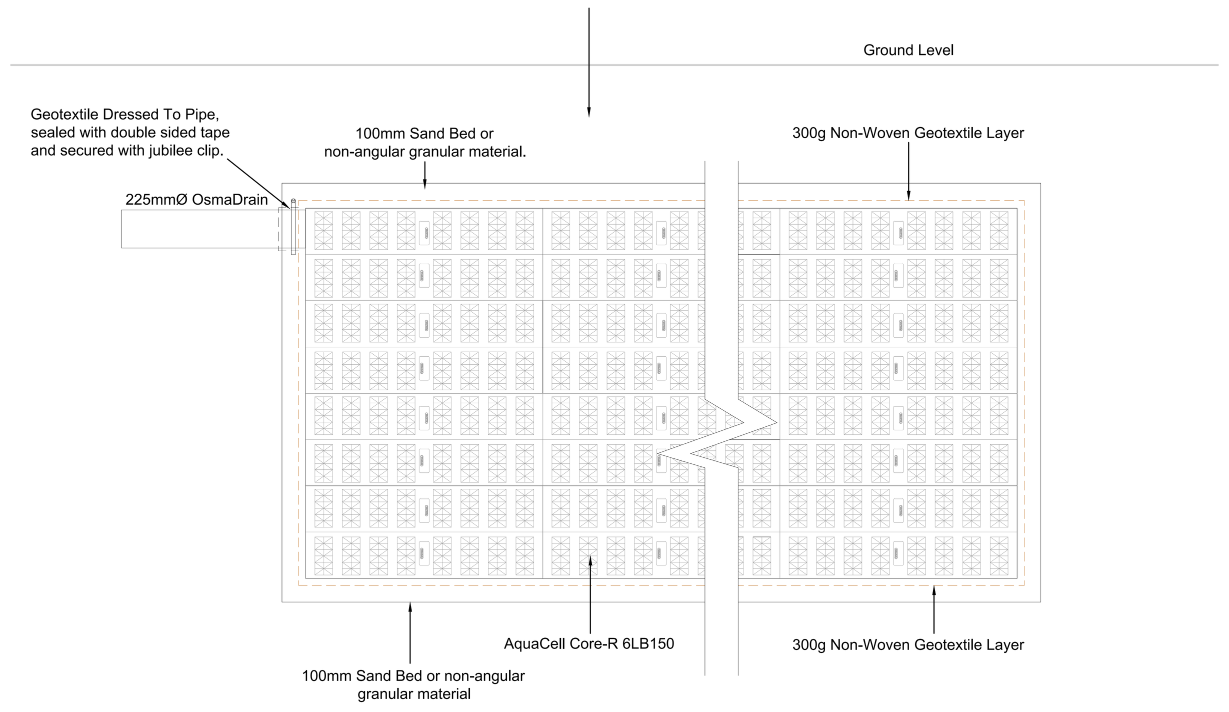


TYPICAL PIPE BEDDING SURROUND BENEATH GROUND BEARING SLAB

Backfill to be compacted granular material Type 1 (or Type 2). Tracked excavators (not exceeding 21 tonnes weight) should be used to placed fill over the AquaCell units.

At least 300mm of fill should be placed before construction traffic delivering the backfill are allowed to traffic over the units.

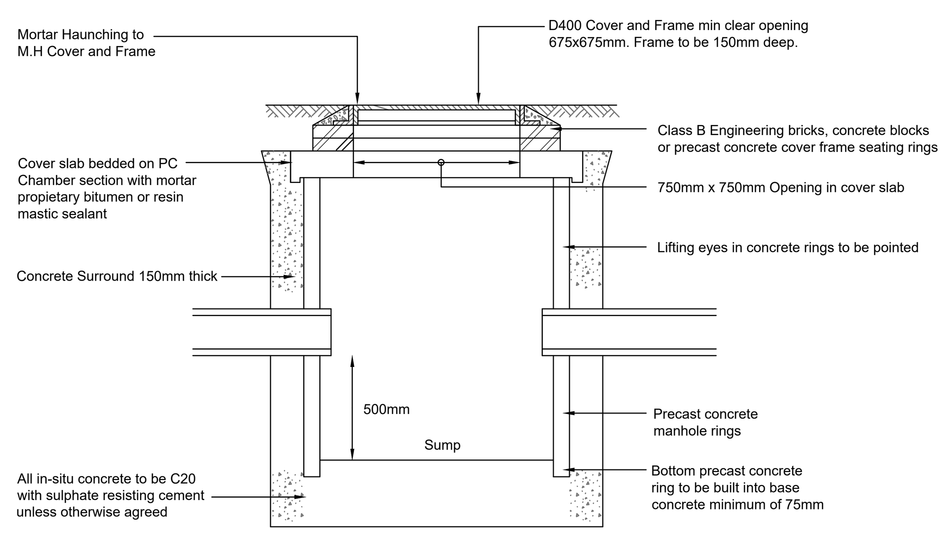
Compact in 150mm layers after the initial 300mm layer. Compaction plant should not exceed 2300 kg/m width.



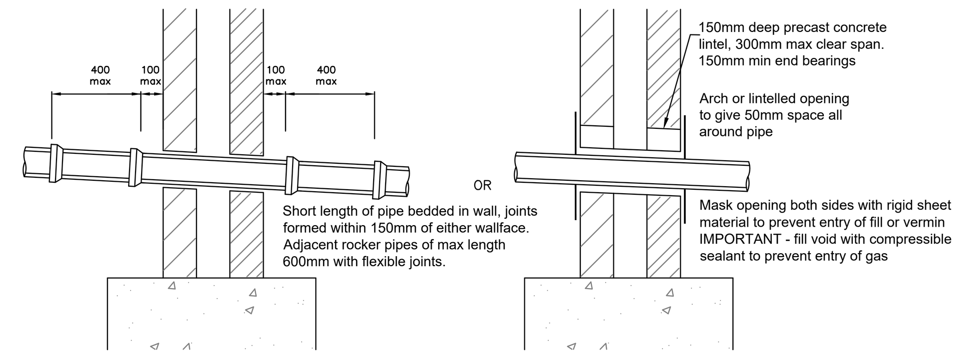
TYPICAL INSTALLATION - SURFACE WATER SOAKAWAY

General Notes:

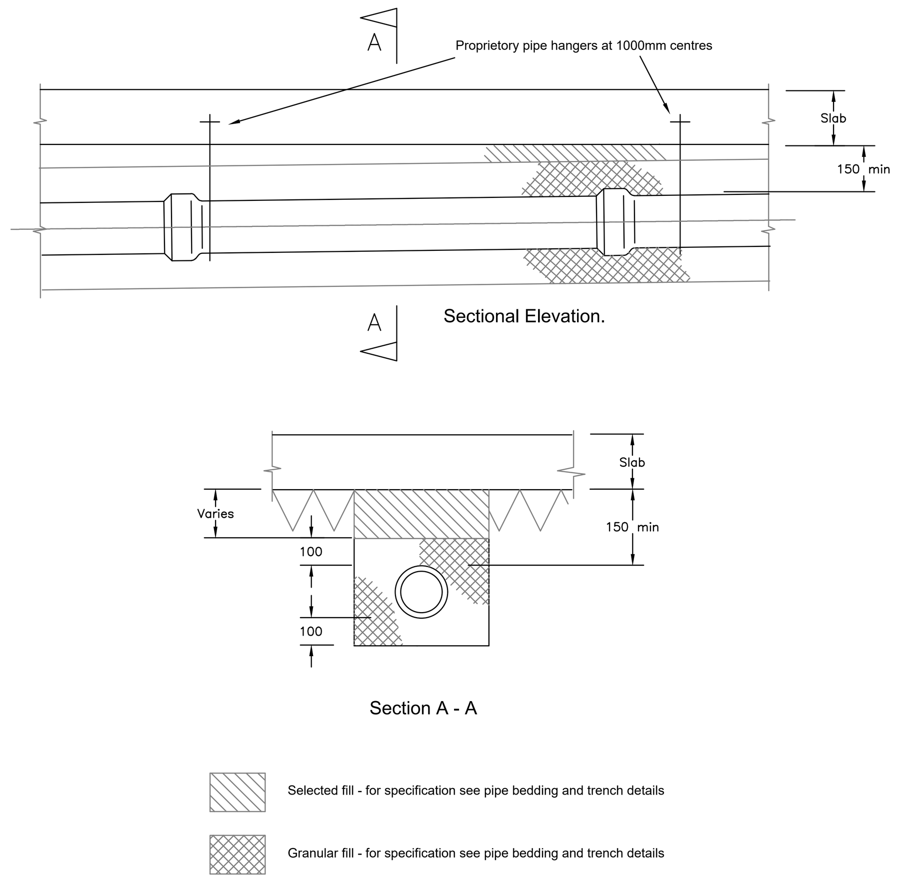
1. The details shown refer to Wavin products. Other products may be proposed subject to the approval of the Engineer.
2. The type of storage units must have sufficient loading capacities to safely operate at the depths and locations specified.
3. Storage units are to be constructed in accordance with the guidelines set out in the manufacturers specifications.
4. Any incoming drains must discharge into a silt trap chamber before entering the storage units.



SILT TRAP MANHOLE DETAIL



PIPEWORK PENETRATING WALL DETAIL



TYPICAL PIPE BEDDING SURROUND BENEATH SUSPENDED SLAB

REV	AMENDMENT	BY	DATE
CP01	CONTRACTORS PROPOSALS.	SN	25.05.23
P02	YARD GULLY DETAIL OMITTED.	SN	24.03.23
P01	FIRST ISSUE.	SN	01.03.23

CE
PROJECT EXECUTION CLASS: N/A
All materials supplied in relations to those specified on this drawing are to be CE marked in accordance with the European Union Declaration of conformity

PURPOSE OF ISSUE
CONTRACTORS PROPOSALS

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Tel: 01782 366 160
www.cceng.co.uk

CLIENT
MORGAN SINDALL CONSTRUCTION

PROJECT
PRINCE WILLIAM SCHOOL, OUNDLE, PETERBOROUGH

DRAWING TITLE
DRAINAGE CONSTRUCTION DETAILS

SHEET SIZE	SCALE	DATE	DRAWN	CHECKED	STATUS
A0	NTS	01.03.23	SN	NM	S5

CCE PROJECT No.	DRAWING No.	REV
8402	PWSR-CCE-CC-XX-D-C-0120	CP01

APPENDIX D – Surface Water Calcs

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	0.600
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.011	5.00	31.934	450	504560.798	287695.609	0.834
2	0.027	5.00	32.100	450	504570.343	287689.683	1.170
3	0.027	5.00	32.250	450	504540.864	287666.527	0.750
4	0.000		32.050	450	504550.796	287658.247	1.370
5	0.028	5.00	30.709	450	504580.995	287689.624	1.252
6	0.028	5.00	30.550	450	504599.238	287678.283	1.248
7	0.029	5.00	30.550	450	504590.084	287663.560	1.379
8	0.032	5.00	30.688	600	504574.500	287638.498	1.773
8A	0.000		30.750	600	504571.047	287628.322	1.970
8B	0.000		30.586	600	504579.281	287621.807	1.936
9	0.000		30.750	600	504584.388	287624.910	2.175
10	0.000		29.826	600	504607.794	287605.884	1.626
11	0.000		29.171	600	504635.928	287583.006	1.421
12	0.000		28.700	600	504663.713	287559.716	1.400
13	0.000		28.520	600	504680.095	287546.577	1.420
14	0.000		28.659	1200	504685.808	287541.994	2.359
15			25.400	1	504697.641	287541.994	1.125

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	1	2	11.235	0.600	31.100	30.980	0.120	93.6	100	5.24	50.0
1.001	2	4	37.018	0.600	30.930	30.680	0.250	148.1	150	5.98	50.0
2.000	3	4	12.931	0.600	31.500	30.730	0.770	16.8	100	5.11	50.0
1.002	4	8	30.853	0.600	30.680	28.990	1.690	18.3	150	6.20	50.0
3.000	5	6	23.218	0.600	29.457	29.302	0.155	149.8	150	5.47	50.0
3.001	6	7	19.690	0.600	29.302	29.171	0.131	150.3	150	5.87	50.0
3.002	7	8	27.157	0.600	29.171	28.990	0.181	150.0	150	6.43	49.9
1.003	8	8A	10.746	0.600	28.915	28.780	0.135	79.6	225	6.55	49.5
1.003A	8A	8B	10.500	0.600	28.780	28.650	0.130	80.8	225	6.67	49.0
1.003B	8B	9	5.976	0.600	28.650	28.575	0.075	79.7	225	6.74	48.8
1.004	9	10	30.163	0.600	28.575	28.200	0.375	80.4	225	7.08	47.6

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	0.795	6.2	1.5	0.734	1.020	0.011	0.0	33	0.651
1.001	0.823	14.6	5.1	1.020	1.220	0.038	0.0	62	0.755
2.000	1.894	14.9	3.7	0.650	1.220	0.027	0.0	34	1.573
1.002	2.368	41.8	8.8	1.220	1.548	0.065	0.0	47	1.881
3.000	0.819	14.5	3.8	1.102	1.098	0.028	0.0	52	0.691
3.001	0.817	14.4	7.6	1.098	1.229	0.056	0.0	77	0.826
3.002	0.818	14.5	11.5	1.229	1.548	0.085	0.0	101	0.906
1.003	1.467	58.3	24.4	1.548	1.745	0.182	0.0	102	1.404
1.003A	1.456	57.9	24.2	1.745	1.711	0.182	0.0	102	1.393
1.003B	1.466	58.3	24.1	1.711	1.950	0.182	0.0	101	1.397
1.004	1.459	58.0	23.5	1.950	1.401	0.182	0.0	100	1.385

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)
1.005	10	11	36.262	0.600	28.200	27.750	0.450	80.6	225	7.50	46.3
1.006	11	12	36.255	0.600	27.750	27.300	0.450	80.6	225	7.91	45.0
1.007	12	13	21.000	0.600	27.300	27.100	0.200	105.0	225	8.19	44.3
1.008	13	14	7.324	0.600	27.100	26.300	0.800	9.2	225	8.21	44.2
1.009	14	15	11.833	0.600	26.300	24.275	2.025	5.8	225	8.25	44.1

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)
1.005	1.458	58.0	22.9	1.401	1.196	0.182	0.0	98	1.373
1.006	1.458	58.0	22.2	1.196	1.175	0.182	0.0	96	1.362
1.007	1.275	50.7	21.8	1.175	1.195	0.182	0.0	103	1.230
1.008	4.350	173.0	21.8	1.195	2.134	0.182	0.0	54	3.013
1.009	5.448	216.6	21.7	2.134	0.900	0.182	0.0	48	3.523

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	11.235	93.6	100	Circular_Default Sewer Type	31.934	31.100	0.734	32.100	30.980	1.020
1.001	37.018	148.1	150	Circular_Default Sewer Type	32.100	30.930	1.020	32.050	30.680	1.220
2.000	12.931	16.8	100	Circular_Default Sewer Type	32.250	31.500	0.650	32.050	30.730	1.220
1.002	30.853	18.3	150	Circular_Default Sewer Type	32.050	30.680	1.220	30.688	28.990	1.548
3.000	23.218	149.8	150	Circular_Default Sewer Type	30.709	29.457	1.102	30.550	29.302	1.098
3.001	19.690	150.3	150	Circular_Default Sewer Type	30.550	29.302	1.098	30.550	29.171	1.229
3.002	27.157	150.0	150	Circular_Default Sewer Type	30.550	29.171	1.229	30.688	28.990	1.548
1.003	10.746	79.6	225	Circular_Default Sewer Type	30.688	28.915	1.548	30.750	28.780	1.745
1.003A	10.500	80.8	225	Circular_Default Sewer Type	30.750	28.780	1.745	30.586	28.650	1.711
1.003B	5.976	79.7	225	Circular_Default Sewer Type	30.586	28.650	1.711	30.750	28.575	1.950
1.004	30.163	80.4	225	Circular_Default Sewer Type	30.750	28.575	1.950	29.826	28.200	1.401
1.005	36.262	80.6	225	Circular_Default Sewer Type	29.826	28.200	1.401	29.171	27.750	1.196
1.006	36.255	80.6	225	Circular_Default Sewer Type	29.171	27.750	1.196	28.700	27.300	1.175
1.007	21.000	105.0	225	Circular_Default Sewer Type	28.700	27.300	1.175	28.520	27.100	1.195
1.008	7.324	9.2	225	Circular_Default Sewer Type	28.520	27.100	1.195	28.659	26.300	2.134
1.009	11.833	5.8	225	Circular_Default Sewer Type	28.659	26.300	2.134	25.400	24.275	0.900

Link	US Node	Dia (mm)	DS Node	Dia (mm)
1.000	1	450	2	450
1.001	2	450	4	450
2.000	3	450	4	450
1.002	4	450	8	600
3.000	5	450	6	450
3.001	6	450	7	450
3.002	7	450	8	600
1.003	8	600	8A	600
1.003A	8A	600	8B	600
1.003B	8B	600	9	600
1.004	9	600	10	600
1.005	10	600	11	600
1.006	11	600	12	600
1.007	12	600	13	600
1.008	13	600	14	1200
1.009	14	1200	15	1

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	504560.798	287695.609	31.934	0.834	450	0	1.000	31.100	100
2	504570.343	287689.683	32.100	1.170	450	1	1.000	30.980	100
						0	1.001	30.930	150
3	504540.864	287666.527	32.250	0.750	450	0	2.000	31.500	100
4	504550.796	287658.247	32.050	1.370	450	1	2.000	30.730	100
						2	1.001	30.680	150
						0	1.002	30.680	150
5	504580.995	287689.624	30.709	1.252	450	0	3.000	29.457	150
6	504599.238	287678.283	30.550	1.248	450	1	3.000	29.302	150
						0	3.001	29.302	150
7	504590.084	287663.560	30.550	1.379	450	1	3.001	29.171	150
						0	3.002	29.171	150
8	504574.500	287638.498	30.688	1.773	600	1	3.002	28.990	150
						2	1.002	28.990	150
						0	1.003	28.915	225
8A	504571.047	287628.322	30.750	1.970	600	1	1.003	28.780	225
						0	1.003A	28.780	225
8B	504579.281	287621.807	30.586	1.936	600	1	1.003A	28.650	225
						0	1.003B	28.650	225
9	504584.388	287624.910	30.750	2.175	600	1	1.003B	28.575	225
						0	1.004	28.575	225
10	504607.794	287605.884	29.826	1.626	600	1	1.004	28.200	225
						0	1.005	28.200	225
11	504635.928	287583.006	29.171	1.421	600	1	1.005	27.750	225
						0	1.006	27.750	225
12	504663.713	287559.716	28.700	1.400	600	1	1.006	27.300	225
						0	1.007	27.300	225
13	504680.095	287546.577	28.520	1.420	600	1	1.007	27.100	225
						0	1.008	27.100	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
14	504685.808	287541.994	28.659	2.359	1200	1	1.008	26.300	225
						0	1.009	26.300	225
15	504697.641	287541.994	25.400	1.125	1	1	1.009	24.275	225

Simulation Settings

Rainfall Methodology	FEH-13	Skip Steady State	✓	2 year (l/s)	0.0
Summer CV	0.750	Drain Down Time (mins)	1440	30 year (l/s)	0.0
Winter CV	0.840	Additional Storage (m³/ha)	0.0	100 year (l/s)	0.0
Analysis Speed	Detailed	Check Discharge Rate(s)	✓	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0	100	0	0	0
30	0	0	0	100	25	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	SPR	0.10	Betterment (%)	0
Greenfield Method	IH124	Region	1	QBar	
Positively Drained Area (ha)		Growth Factor 1 year	0.85	Q 1 year (l/s)	
SAAR (mm)		Growth Factor 30 year	1.95	Q 30 year (l/s)	
Soil Index	1	Growth Factor 100 year	2.48	Q 100 year (l/s)	

Node 15 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03146	Safety Factor	1.0	Invert Level (m)	23.300
Side Inf Coefficient (m/hr)	0.03146	Porosity	0.95	Time to half empty (mins)	1067

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	168.0	168.0	1.200	168.0	230.4	1.201	0.0	230.4

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	110.261	31.200	2 year 360 minute winter	10.693	4.233
2 year 15 minute winter	77.376	31.200	2 year 480 minute summer	13.010	3.438
2 year 30 minute summer	69.973	19.800	2 year 480 minute winter	8.643	3.438
2 year 30 minute winter	49.104	19.800	2 year 600 minute summer	10.640	2.910
2 year 60 minute summer	46.165	12.200	2 year 600 minute winter	7.270	2.910
2 year 60 minute winter	30.671	12.200	2 year 720 minute summer	9.447	2.532
2 year 120 minute summer	32.353	8.550	2 year 720 minute winter	6.349	2.532
2 year 120 minute winter	21.495	8.550	2 year 960 minute summer	7.668	2.019
2 year 180 minute summer	26.151	6.730	2 year 960 minute winter	5.080	2.019
2 year 180 minute winter	16.999	6.730	2 year 1440 minute summer	5.467	1.465
2 year 240 minute summer	21.190	5.600	2 year 1440 minute winter	3.674	1.465
2 year 240 minute winter	14.078	5.600	2 year 2160 minute summer	3.846	1.063
2 year 360 minute summer	16.451	4.233	2 year 2160 minute winter	2.650	1.063

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 2880 minute summer	3.170	0.850	100 year 180 minute winter	58.810	23.282
2 year 2880 minute winter	2.131	0.850	100 year 240 minute summer	71.995	19.026
2 year 4320 minute summer	2.402	0.628	100 year 240 minute winter	47.832	19.026
2 year 4320 minute winter	1.582	0.628	100 year 360 minute summer	55.085	14.175
2 year 5760 minute summer	2.001	0.512	100 year 360 minute winter	35.807	14.175
2 year 5760 minute winter	1.295	0.512	100 year 480 minute summer	43.081	11.385
2 year 7200 minute summer	1.729	0.441	100 year 480 minute winter	28.622	11.385
2 year 7200 minute winter	1.116	0.441	100 year 600 minute summer	34.886	9.542
2 year 8640 minute summer	1.540	0.393	100 year 600 minute winter	23.836	9.542
2 year 8640 minute winter	0.994	0.393	100 year 720 minute summer	30.698	8.227
2 year 10080 minute summer	1.402	0.358	100 year 720 minute winter	20.631	8.227
2 year 10080 minute winter	0.905	0.358	100 year 960 minute summer	24.541	6.462
30 year 15 minute summer	319.681	90.459	100 year 960 minute winter	16.256	6.462
30 year 15 minute winter	224.338	90.459	100 year 1440 minute summer	16.934	4.538
30 year 30 minute summer	207.923	58.835	100 year 1440 minute winter	11.381	4.538
30 year 30 minute winter	145.911	58.835	100 year 2160 minute summer	11.400	3.151
30 year 60 minute summer	138.015	36.473	100 year 2160 minute winter	7.855	3.151
30 year 60 minute winter	91.694	36.473	100 year 2880 minute summer	9.036	2.422
30 year 120 minute summer	86.220	22.786	100 year 2880 minute winter	6.073	2.422
30 year 120 minute winter	57.283	22.786	100 year 4320 minute summer	6.361	1.663
30 year 180 minute summer	66.831	17.198	100 year 4320 minute winter	4.189	1.663
30 year 180 minute winter	43.442	17.198	100 year 5760 minute summer	4.979	1.274
30 year 240 minute summer	53.050	14.019	100 year 5760 minute winter	3.222	1.274
30 year 240 minute winter	35.245	14.019	100 year 7200 minute summer	4.078	1.040
30 year 360 minute summer	40.449	10.409	100 year 7200 minute winter	2.632	1.040
30 year 360 minute winter	26.293	10.409	100 year 8640 minute summer	3.462	0.883
30 year 480 minute summer	31.574	8.344	100 year 8640 minute winter	2.235	0.883
30 year 480 minute winter	20.977	8.344	100 year 10080 minute summer	3.020	0.771
30 year 600 minute summer	25.558	6.991	100 year 10080 minute winter	1.949	0.771
30 year 600 minute winter	17.463	6.991	100 year +25% CC 15 minute summer	535.403	151.500
30 year 720 minute summer	22.500	6.030	100 year +25% CC 15 minute winter	375.721	151.500
30 year 720 minute winter	15.121	6.030	100 year +25% CC 30 minute summer	349.554	98.912
30 year 960 minute summer	18.030	4.748	100 year +25% CC 30 minute winter	245.301	98.912
30 year 960 minute winter	11.943	4.748	100 year +25% CC 60 minute summer	233.579	61.728
30 year 1440 minute summer	12.524	3.357	100 year +25% CC 60 minute winter	155.184	61.728
30 year 1440 minute winter	8.417	3.357	100 year +25% CC 120 minute summer	145.567	38.469
30 year 2160 minute summer	8.498	2.348	100 year +25% CC 120 minute winter	96.711	38.469
30 year 2160 minute winter	5.855	2.348	100 year +25% CC 180 minute summer	113.092	29.102
30 year 2880 minute summer	6.787	1.819	100 year +25% CC 180 minute winter	73.513	29.102
30 year 2880 minute winter	4.561	1.819	100 year +25% CC 240 minute summer	89.993	23.783
30 year 4320 minute summer	4.850	1.268	100 year +25% CC 240 minute winter	59.789	23.783
30 year 4320 minute winter	3.194	1.268	100 year +25% CC 360 minute summer	68.856	17.719
30 year 5760 minute summer	3.848	0.985	100 year +25% CC 360 minute winter	44.758	17.719
30 year 5760 minute winter	2.491	0.985	100 year +25% CC 480 minute summer	53.851	14.231
30 year 7200 minute summer	3.197	0.816	100 year +25% CC 480 minute winter	35.777	14.231
30 year 7200 minute winter	2.063	0.816	100 year +25% CC 600 minute summer	43.608	11.928
30 year 8640 minute summer	2.751	0.702	100 year +25% CC 600 minute winter	29.795	11.928
30 year 8640 minute winter	1.776	0.702	100 year +25% CC 720 minute summer	38.372	10.284
30 year 10080 minute summer	2.432	0.620	100 year +25% CC 720 minute winter	25.788	10.284
30 year 10080 minute winter	1.569	0.620	100 year +25% CC 960 minute summer	30.676	8.078
100 year 15 minute summer	428.322	121.200	100 year +25% CC 960 minute winter	20.320	8.078
100 year 15 minute winter	300.577	121.200	100 year +25% CC 1440 minute summer	21.167	5.673
100 year 30 minute summer	279.643	79.129	100 year +25% CC 1440 minute winter	14.226	5.673
100 year 30 minute winter	196.241	79.129	100 year +25% CC 2160 minute summer	14.250	3.938
100 year 60 minute summer	186.863	49.382	100 year +25% CC 2160 minute winter	9.819	3.938
100 year 60 minute winter	124.147	49.382	100 year +25% CC 2880 minute summer	11.295	3.027
100 year 120 minute summer	116.454	30.775	100 year +25% CC 2880 minute winter	7.591	3.027
100 year 120 minute winter	77.369	30.775	100 year +25% CC 4320 minute summer	7.951	2.079
100 year 180 minute summer	90.473	23.282	100 year +25% CC 4320 minute winter	5.236	2.079

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +25% CC 5760 minute summer	6.223	1.593	100 year +25% CC 8640 minute summer	4.328	1.104
100 year +25% CC 5760 minute winter	4.028	1.593	100 year +25% CC 8640 minute winter	2.793	1.104
100 year +25% CC 7200 minute summer	5.098	1.300	100 year +25% CC 10080 minute summer	3.775	0.963
100 year +25% CC 7200 minute winter	3.290	1.300	100 year +25% CC 10080 minute winter	2.437	0.963

Results for 2 year Critical Storm Duration. Lowest mass balance: 95.62%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	31.135	0.035	1.6	0.0056	0.0000	OK
15 minute winter	2	10	30.995	0.065	5.4	0.0104	0.0000	OK
15 minute winter	3	10	31.535	0.035	3.8	0.0056	0.0000	OK
15 minute winter	4	11	30.728	0.048	9.0	0.0076	0.0000	OK
15 minute winter	5	10	29.510	0.053	4.0	0.0084	0.0000	OK
15 minute winter	6	10	29.379	0.077	7.9	0.0123	0.0000	OK
15 minute winter	7	11	29.277	0.106	11.7	0.0168	0.0000	OK
15 minute winter	8	11	29.028	0.113	24.8	0.0319	0.0000	OK
15 minute winter	8A	11	28.894	0.114	24.9	0.0322	0.0000	OK
15 minute winter	8B	11	28.768	0.118	24.8	0.0333	0.0000	OK
15 minute winter	9	11	28.681	0.106	24.8	0.0300	0.0000	OK
15 minute winter	10	12	28.305	0.105	24.6	0.0298	0.0000	OK
15 minute winter	11	12	27.853	0.103	24.8	0.0292	0.0000	OK
15 minute winter	12	12	27.421	0.121	24.7	0.0342	0.0000	OK
15 minute winter	13	13	27.163	0.063	24.4	0.0178	0.0000	OK
15 minute winter	14	13	26.354	0.054	24.5	0.0607	0.0000	OK
240 minute winter	15	192	23.429	-0.846	6.0	20.6407	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	1	1.000	2	1.6	0.650	0.249	0.0268
15 minute winter	2	1.001	4	5.2	0.864	0.360	0.2254
15 minute winter	3	2.000	4	3.8	1.549	0.253	0.0314
15 minute winter	4	1.002	8	9.0	1.868	0.214	0.1480
15 minute winter	5	3.000	6	3.9	0.531	0.270	0.1709
15 minute winter	6	3.001	7	7.7	0.699	0.530	0.2205
15 minute winter	7	3.002	8	11.6	0.900	0.800	0.3490
15 minute winter	8	1.003	8A	24.9	1.243	0.426	0.2149
15 minute winter	8A	1.003A	8B	24.8	1.209	0.429	0.2158
15 minute winter	8B	1.003B	9	24.8	1.260	0.425	0.1175
15 minute winter	9	1.004	10	24.6	1.354	0.424	0.5480
15 minute winter	10	1.005	11	24.8	1.376	0.427	0.6526
15 minute winter	11	1.006	12	24.7	1.254	0.427	0.7156
15 minute winter	12	1.007	13	24.4	1.607	0.480	0.3226
15 minute winter	13	1.008	14	24.5	3.005	0.141	0.0597
15 minute winter	14	1.009	15	24.5	3.521	0.113	0.0825
240 minute winter	15	Infiltration		1.5			

Results for 30 year Critical Storm Duration. Lowest mass balance: 95.62%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	31.164	0.064	4.5	0.0102	0.0000	OK
15 minute winter	2	11	31.069	0.139	15.6	0.0221	0.0000	OK
15 minute winter	3	10	31.568	0.068	11.1	0.0108	0.0000	OK
15 minute winter	4	11	30.765	0.085	25.9	0.0136	0.0000	OK
15 minute winter	5	12	30.294	0.837	11.5	0.1331	0.0000	SURCHARGED
15 minute winter	6	12	30.233	0.931	18.6	0.1481	0.0000	SURCHARGED
15 minute winter	7	12	30.023	0.852	26.8	0.1355	0.0000	SURCHARGED
15 minute winter	8	12	29.361	0.446	62.6	0.1263	0.0000	SURCHARGED
15 minute winter	8A	12	29.156	0.376	60.7	0.1063	0.0000	SURCHARGED
15 minute winter	8B	13	28.974	0.324	59.9	0.0917	0.0000	SURCHARGED
15 minute winter	9	13	28.858	0.283	59.4	0.0801	0.0000	SURCHARGED
15 minute winter	10	13	28.465	0.265	58.9	0.0750	0.0000	SURCHARGED
15 minute summer	11	13	28.018	0.268	57.5	0.0758	0.0000	SURCHARGED
15 minute winter	12	12	27.566	0.266	54.4	0.0751	0.0000	SURCHARGED
15 minute winter	13	12	27.200	0.100	54.0	0.0283	0.0000	OK
15 minute winter	14	12	26.383	0.083	53.9	0.0934	0.0000	OK
360 minute winter	15	352	23.720	-0.555	11.2	67.0860	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	1	1.000	2	4.5	0.763	0.721	0.0701
15 minute winter	2	1.001	4	15.1	1.097	1.041	0.5071
15 minute winter	3	2.000	4	11.0	1.999	0.739	0.0711
15 minute winter	4	1.002	8	25.9	1.978	0.618	0.4312
15 minute winter	5	3.000	6	8.5	0.591	0.589	0.4087
15 minute winter	6	3.001	7	17.1	0.969	1.181	0.3466
15 minute winter	7	3.002	8	25.8	1.463	1.782	0.4781
15 minute winter	8	1.003	8A	60.7	1.526	1.040	0.4274
15 minute winter	8A	1.003A	8B	59.9	1.505	1.034	0.4176
15 minute winter	8B	1.003B	9	59.4	1.493	1.019	0.2377
15 minute winter	9	1.004	10	58.9	1.561	1.015	1.1996
15 minute winter	10	1.005	11	58.4	1.581	1.008	1.4422
15 minute summer	11	1.006	12	56.3	1.461	0.971	1.4419
15 minute winter	12	1.007	13	54.0	1.887	1.065	0.5962
15 minute winter	13	1.008	14	53.9	3.575	0.312	0.1106
15 minute winter	14	1.009	15	53.8	4.315	0.248	0.1475
360 minute winter	15	Infiltration		1.6			

Results for 100 year Critical Storm Duration. Lowest mass balance: 95.62%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	31.333	0.233	6.1	0.0370	0.0000	SURCHARGED
15 minute winter	2	11	31.232	0.302	19.5	0.0480	0.0000	SURCHARGED
15 minute winter	3	10	31.588	0.088	14.9	0.0140	0.0000	OK
15 minute winter	4	12	30.800	0.120	33.0	0.0191	0.0000	OK
15 minute winter	5	11	30.709	1.252	15.4	0.1991	0.0608	FLOOD
15 minute winter	6	11	30.550	1.248	28.0	0.1984	2.0931	FLOOD
15 minute winter	7	12	30.449	1.278	32.7	0.2032	0.0000	FLOOD RISK
15 minute winter	8	13	29.871	0.956	75.2	0.2705	0.0000	SURCHARGED
15 minute winter	8A	13	29.650	0.870	70.9	0.2463	0.0000	SURCHARGED
15 minute winter	8B	13	29.432	0.782	67.6	0.2212	0.0000	SURCHARGED
15 minute winter	9	13	29.281	0.706	63.9	0.1999	0.0000	SURCHARGED
15 minute winter	10	14	28.792	0.592	61.4	0.1677	0.0000	SURCHARGED
15 minute winter	11	14	28.222	0.472	60.7	0.1335	0.0000	SURCHARGED
15 minute winter	12	14	27.650	0.350	60.4	0.0990	0.0000	SURCHARGED
15 minute winter	13	14	27.207	0.107	60.3	0.0303	0.0000	OK
15 minute winter	14	14	26.388	0.088	60.3	0.0997	0.0000	OK
360 minute winter	15	352	23.922	-0.353	15.1	99.3002	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	1	1.000	2	5.5	0.768	0.883	0.0879
15 minute winter	2	1.001	4	18.7	1.119	1.287	0.6061
15 minute winter	3	2.000	4	14.7	2.046	0.990	0.0977
15 minute winter	4	1.002	8	32.0	1.949	0.766	0.5051
15 minute winter	5	3.000	6	13.5	0.766	0.932	0.4087
15 minute winter	6	3.001	7	16.7	0.946	1.154	0.3466
15 minute winter	7	3.002	8	26.6	1.511	1.841	0.4781
15 minute winter	8	1.003	8A	70.9	1.782	1.215	0.4274
15 minute winter	8A	1.003A	8B	67.6	1.700	1.168	0.4176
15 minute winter	8B	1.003B	9	63.9	1.608	1.097	0.2377
15 minute winter	9	1.004	10	61.4	1.564	1.059	1.1996
15 minute winter	10	1.005	11	60.7	1.584	1.047	1.4422
15 minute winter	11	1.006	12	60.4	1.520	1.043	1.4419
15 minute winter	12	1.007	13	60.3	1.820	1.189	0.6130
15 minute winter	13	1.008	14	60.3	3.653	0.348	0.1209
15 minute winter	14	1.009	15	60.2	4.437	0.278	0.1607
360 minute winter	15	Infiltration		1.7			

Results for 100 year +25% CC Critical Storm Duration. Lowest mass balance: 95.62%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	13	31.747	0.647	7.6	0.1028	0.0000	FLOOD RISK
15 minute winter	2	12	31.657	0.727	23.8	0.1156	0.0000	SURCHARGED
15 minute winter	3	12	32.092	0.592	18.6	0.0941	0.0000	FLOOD RISK
15 minute winter	4	13	31.235	0.555	36.6	0.0882	0.0000	SURCHARGED
15 minute winter	5	10	30.709	1.252	19.3	0.1991	0.7279	FLOOD
15 minute winter	6	10	30.550	1.248	32.8	0.1984	5.8554	FLOOD
15 minute winter	7	11	30.539	1.368	35.2	0.2174	0.0000	FLOOD RISK
15 minute winter	8	13	30.103	1.188	80.1	0.3363	0.0000	SURCHARGED
15 minute winter	8A	13	29.864	1.084	75.8	0.3068	0.0000	SURCHARGED
15 minute winter	8B	13	29.628	0.978	71.2	0.2769	0.0000	SURCHARGED
15 minute winter	9	13	29.466	0.891	66.8	0.2522	0.0000	SURCHARGED
15 minute winter	10	14	28.937	0.737	64.1	0.2085	0.0000	SURCHARGED
15 minute winter	11	14	28.312	0.562	63.3	0.1591	0.0000	SURCHARGED
15 minute winter	12	14	27.688	0.388	63.1	0.1097	0.0000	SURCHARGED
15 minute winter	13	14	27.210	0.110	63.0	0.0311	0.0000	OK
15 minute winter	14	15	26.391	0.091	63.0	0.1024	0.0000	OK
480 minute winter	15	472	24.124	-0.151	15.2	131.4477	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	1	1.000	2	6.2	0.805	0.986	0.0879
15 minute winter	2	1.001	4	20.8	1.183	1.432	0.6517
15 minute winter	3	2.000	4	15.8	2.042	1.060	0.1012
15 minute winter	4	1.002	8	31.7	1.931	0.758	0.5432
15 minute winter	5	3.000	6	13.5	0.766	0.933	0.4087
15 minute winter	6	3.001	7	16.4	0.932	1.136	0.3466
15 minute winter	7	3.002	8	26.6	1.512	1.841	0.4781
15 minute winter	8	1.003	8A	75.8	1.907	1.300	0.4274
15 minute winter	8A	1.003A	8B	71.2	1.790	1.230	0.4176
15 minute winter	8B	1.003B	9	66.8	1.679	1.145	0.2377
15 minute winter	9	1.004	10	64.1	1.611	1.104	1.1996
15 minute winter	10	1.005	11	63.3	1.592	1.092	1.4422
15 minute winter	11	1.006	12	63.1	1.587	1.089	1.4419
15 minute winter	12	1.007	13	63.0	1.859	1.242	0.6201
15 minute winter	13	1.008	14	63.0	3.684	0.364	0.1253
15 minute winter	14	1.009	15	63.0	4.486	0.291	0.1663
480 minute winter	15	Infiltration		1.8			

APPENDIX E – Geosphere Environmental – Infiltration Testing

GEOSPHERE ENVIRONMENTAL

Our Ref: 6325,SK,LTR001,GF,JG,24.03.22,V2

Starris Projects Ltd
12 West Links
Tollgate
Chandlers Ford
Hampshire
SO53 3TG

Date: 23 March 2022

For the attention of Tom Bryant

By email:
tom.bryant@starris.co.uk

Dear Mr. Bryant,

INFILTRATION TESTING AT PRINCE WILLIAM SCHOOL, OUNDLE

1. Introduction

This letter report has been prepared Starris Projects Ltd.

The primary objective of this ground investigation was to assess the infiltration potential of the natural soils beneath the site.

This was achieved by:

- Excavating a number of machine-dug trial pits across the site;
- Undertaking soakage testing in line with BRE Digest 365 guidance; and
- Undertaking infiltration calculations to allow for an assessment of the suitability of soakaways or infiltration techniques for the future development of the site.

It is understood that the proposed development will comprise additional structures to the existing school with associated infrastructure to include the potential of soakaways.

A Site Location Plan, Drawing ref. 6325,SK/001/Rev0, is presented at the end of this letter report in Appendix 4.

The purpose of this letter report is to provide factual data only.

1.1 Changes from V1 report – Location of possible former well.

During site works, a circle of concrete was recorded at grid reference 504730,287662 and as shown on Drawing 6325,SK/002/Rev1. This is inferred to potentially be a former well that has been infilled and capped with concrete but could also be for another unknown reason. Checking on the BGS website does not indicate a log for this potential well.

GEO

GEOSPHERE ENVIRONMENTAL

2. Site Works

2.1 Methodology

This ground investigation was carried out on the basis of the practices set out in BRE Digest 365, 'Soakaway Design'. 2016, which requires, in summary, a total of three infiltration tests to be undertaken in succession over a 24-hour period or tests to be undertaken on consecutive days.

Three areas for infiltration testing were provided by the client as per sections 2.2.1, 2.2.2, and 2.2.3.

2.2 Scope

Site works were carried out on 19 and 20 March 2022, and comprised the following:

- Excavation of seven machine excavated trial pits, (SK201 to SK207), to depths ranging from 0.8mbgl to 3.10mbgl;
- Undertaking infiltration testing in line with BRE Digest 365 guidance; and
- Undertaking infiltration calculations to allow for an assessment of the suitability of soakaways for the future development of the site.

An Exploratory Hole Location Plan, Drawing ref. 6325,SK/002/Rev1, is presented at the end of this letter report in Appendix 4. Selected Site Photographs are presented in Appendix 5.

Constraints and conversations with the structural engineer are as described below in each of the three proposed testing areas.

2.2.1 Adjacent to existing school

SK201, was excavated to 3.1mbgl. No potentially suitable material was encountered and therefore, no testing was undertaken.

2.2.2 South east of site at base of slope

SK202, was excavated towards the base of the slope at a depth of 2.7m BGL and encountered material assessed as potentially (although unlikely) suitable for soakaway. An infiltration test was attempted although no significant infiltration was achieved.

SK203, was excavated to 2.12m BGL further to the south east and material with a better potential infiltration potential was encountered and tested. As this material visually appeared to increase in fines content with depth, another hole, SK204 was excavated a short distance away (far enough for one hole not to affect the results of the other) to a shallower (1.7m BGL) depth and was also tested.

2.2.3 North east of site by basketball courts

SK205, was excavated to a depth of 0.8m BGL where a conduit was encountered and the hole terminated. The hole was moved a short distance to the east and reattempted as SK206 to a depth of 3.0mbgl. This hole did not encounter any potentially suitable material and no testing was undertaken.

The hole was attempted again as SK207, moved to the base of the slope, east of the proposed location and excavated to a depth of 1.7m BGL. This hole struck groundwater which rose to 1.4mbgl. Therefore, this hole was terminated.

2.2.4 Area to west of basketball court

Following unsuccessful pits to the east of the basketball courts, a final location was planned to be attempted after discussions with the structural engineer in an area where it is understood an existing soakaway has been installed.

Site staff were able to provide an indication of where the existing soakaway was positioned. In addition, a separate soakaway chamber was encountered along with services traced with a Cable Avoidance Tool and determined by following the routes of drainage pipes etc. Resultingly and as the provided service drawings did not extent this far to the site, no area could be found potentially suitable for testing due to the high potential of damage to existing services.

2.3 Ground Conditions Encountered

The sequence of the strata encountered during the investigation generally confirms with the anticipated geology as interpreted from geological mapping and previous investigations.

The sequence and indicative thickness of strata are summarised in Table 1 below, with the Exploratory Hole Logs provided in Appendix 2:

Table 1 - Ground Conditions

Strata	Depth Encountered (m BGL)		Strata Thickness (m)	Location and Composition
	From	To		
TOPSOIL (ORGANIC MADE GROUND)	0.00	0.1 – 1.5	0.1 – 1.5	All exploratory holes: Typically, dark brown sandy ORGANIC CLAY. SK205 included rubber matting.
MADE GROUND	0.1 - 1.5	0.7 – 1.8	0.3 - 1.15 (not proven in SK205)	All exploratory holes: Typically, sandy gravelly CLAY with variable organic pockets
GRANULAR	1.0 – 1.4	1.7 – 2.12	Unproven	SK203, SK204 and SK207 Typically, clayey SAND and GRAVEL
CLAY	0.7 – 1.8	2.7 – 3.0	Unproven	SK201, SK202 and SK206 Typically, Firm to very stiff grey and orangish brown slightly sandy CLAY

2.4 Groundwater

Seepage of water inferred to be perched was encountered in SK201 at a depth of 0.6mbgl.

Groundwater was encountered at SK207, first observed at 1.7mbgl, rising to 1.4mbgl.

2.5 Infiltration Testing Results

Soil infiltration testing was undertaken in accordance with BRE 365, 2016. The results are summarised in Table 2 below and are provided in full in Appendix 3, presented at the end of this letter report:

Table 2 - Summary of Soil Infiltration Results

Location	Test 1 (m/s)	Test 2 (m/s)	Test 3 (m/s)	Notes
SK201	n/a	-	-	MG over clay to 3.1m no testing undertaken
SK202	Test terminated	-	-	Excavated on slope to 2.7m. Test undertaken, no infiltration achieved
SK203	$1.47x10^{-5}$	$8.96x10^{-6}$	$8.74x10^{-6}$	Excavated to 2.12m BGL
SK204	$1.69x10^{-5}$	$8.38x10^{-6}$	$7.01x10^{-6}$	Excavated to 1.70m BGL
SK205	n/a	-	-	Hole excavated to 0.8m where conduit encountered. Pit terminated
SK206	n/a	-	-	MG over clay to 3.0m. No testing undertaken
SK207	n/a	-	-	Hole excavated to 1.7m, Water struck and steady at 1.4m

We trust the above is clear and acceptable. If you have any questions, please do not hesitate to contact us.

Yours sincerely

Geoff Faro
Principal Engineering Geologist
Geosphere Environmental Ltd
geoff@geosphere-environmental.co.uk

Enclosures:
Appendix 1 – Report Limitations and Conditions
Appendix 2 – Exploratory Hole Logs
Appendix 3 – Infiltration Testing Results
Appendix 4 – Drawings
Appendix 5 – Selected Site Photographs

Copy to: Nigel Matthews
Email: nigel.matthews@cceng.co.uk