

Surface Water Drainage Statement

Proposed Production Building Extension at

**Sefter Farm South
Pagham Rd, Bognor Regis, West Sussex**

On behalf of

Barfoots of Botley

March 2025

Document History and Status

Project Number 23995

Date	Version	Prepared By	Reviewed By	Approved By
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1 Non Technical Summary

- 1.1 This Drainage Statement has been undertaken on behalf of Barfoots of Botley in support of a Planning Application for the construction of a 2,180m² extension to the south side of the existing Sefter Farm South production building and hard standing together with a watercourse diversion and resulting reduction in plan area of the irrigation reservoir immediately south of the development proposals at Sefter Farm, Pagham Rd, Bognor Regis West Sussex.
- 1.2 The existing packhouse was granted planning permission on 9 June 2017 under reference P/76/16/PL.
- 1.3 This Statement is to be read in conjunction with all planning, architectural and other reports that accompany the Planning Application for the proposed development.
- 1.4 The proposed development will incorporate a sustainable drainage system which will recycle surface water collected from the extension roof for irrigation and discharge surface water collected from the hardstanding at a suitably restricted rate to the relocated onsite watercourse which discharges to the Pagham Rife to the west of the site.
- 1.5 Sufficient storage will be provided for all storm return periods up to and including the 1:100 year rainfall event with an allowance for climate change.
- 1.6 This report concludes that a suitable surface water and foul water drainage system has been designed to accommodate the anticipated flows from the proposed development.

2 Planning Policy Context

2.1 National Planning Policy Framework

2.1.1 The National Planning Policy Framework was last updated on 12 December 2024.

2.1.2 With regard to major developments the NPPF states that *'sustainable drainage systems provided as part of proposals for major development should:*

- a) take account of advice from the Lead Local Flood Authority;*
- b) have appropriate proposed minimum operational standards; and*
- c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development.'*

2.1.3 Major development is defined as follows:

'For housing, development where 10 or more homes will be provided, or the site has an area of 0.5 hectares or more. For non-residential development it means additional floorspace of 1,000m² or more, or a site of 1 hectare or more, or as otherwise provided in the Town and Country Planning (Development Management Procedure) (England) Order 2015.'

2.2 Lead Local Flood Authority

2.2.1 West Sussex County Council became a Lead Local Flood Authority under the Flood and Water Management Act 2010 and was given a series of new responsibilities including the role of statutory consultee for surface water management for Major Planning Applications.

2.2.2 As part of their role West Sussex County Council updated their Policy for the Management of Surface Water in November 2018.

2.2.3 That document has been reviewed in the preparation of this report.

2.1 Non Technical Standards for SuDS

2.1.1 The Non Technical Standards for SuDS dated March 2015 are intended to be used in conjunction with the National Planning Policy Framework.

2.1.2 With regard to peak runoff **Non Statutory Standard S2** states that *'for greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.'*

2.1.3 With regard to peak volume **Non Statutory Standard S4** states that *‘where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.’*

2.1.4 **Non Statutory Standard S6** states that *‘where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.’*

2.2 Arun District Council

2.2.1 Arun District Council have produced a Surface Water Drainage Design Checklist, the current version of Full Surface Water Drainage Design Checklist version 6 dated 13 September 2024 has been reviewed in the preparation of this report.

3 Existing Site

3.1 Site Location

- 3.1.1 The development site is located at the south of the Sefter Farm South Packhouse on Sefter Farm, Pagham Road, Bognor Regis, West Sussex, PO21 3PX.



Image 1: Site Location

- 3.1.2 The closest watercourse is the Pagham Rife which is located approximately 200m from the western site boundary. The Pagham Rife is classified as Main River.
- 3.1.3 A copy of the site location plan is located in Appendix 1 at the rear of this report.

3.2 Site Description

- 3.2.1 The site is approximately 2.74ha in area and currently comprises the access road from Pagham Road to the northeast of the site, part of the existing hardstanding to the south and west of the existing pack house, the existing irrigation reservoir to the south of the pack house with the remainder of the site being unpaved soft landscaping.
- 3.2.2 Existing ground levels across the part of the site comprising the area where the new hardstanding and the packhouse extension will be located are between the existing packhouse and reservoir are highest at the southeastern at approximately 5.45m AOD and lowest at the southwest at approximately 3.4m AOD.

3.2.3 A copy of the existing site layout plan is located in Appendix 2 at the rear of this report.

3.3 Existing Drainage

3.3.1 Surface water collected from the roof of the existing pack house and the area to the west of the packhouse is collected via an existing piped drainage network and pumped to an irrigation reservoir to the northeast of the Sefter Farm site.

3.3.2 There is a drainage ditch to the south of the existing packhouse which conveys greenfield runoff from land to the east of the site and in part from the existing hard standing to the south of the packhouse to a piped surface water network to the west of the packhouse.

3.3.3 That drainage system discharges surface water by gravity via a surface water drain located beneath the workers' accommodation to the west of the Sefter South site to the Pagham Rife.

3.3.4 Pre-developed greenfield runoff rates have been established using the HR Wallingford tool for Greenfield Runoff Estimation based on the FEH Statistical Method for rainfall estimation.

3.3.5 The Hydrology of Soil Type (HOST) has been confirmed by the National Soil Resources Institute at Cranfield University as soil type 9 which is classified as *'Soils seasonally waterlogged by fluctuating groundwater and with relatively slow lateral saturated conductivity'*.



Greenfield runoff rate estimation for sites

www.uksubs.com | Greenfield runoff tool

Calculated by: Steve Doughty

Site name: Sefter Farm

Site location: Pagham

Site Details

Latitude: 50.78889° N

Longitude: 0.73656° W

Reference: 823552576

Date: Mar 11 2025 15:50

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', SCD030219 (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.

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha): 1

Methodology

Q_{MED} estimation method: Calculate from BFI and SAAR

BFI and SPR method: Calculate from dominant HOST

HOST class: 9

BFI / BFIHOST: 0.682

Q_{MED} (l/s): 1.51

Q_{BAR} / Q_{MED} factor: 1.14

Hydrological characteristics

	Default	Edited
SAAR (mm):	700	700
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	1.72	1.72
1 in 1 year (l/s):	1.46	1.46
1 in 30 years (l/s):	3.95	3.95
1 in 100 year (l/s):	5.48	5.48
1 in 200 years (l/s):	6.43	6.43

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksubs.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.uksubs.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.

Image 2: Greenfield Runoff Calculation

3.3.6 The pre-developed greenfield runoff rates are as follows:

- Q_{bar} 1.72 l/s/ha
- 1:30 year 3.95 l/s/ha
- 1:100 year 5.48 l/s/ha

3.4 Geology and Groundwater

- 3.4.1 A site investigation was undertaken on the site by Constructive Evaluation in June 2016.
- 3.4.2 The surficial cover to the development area was predominantly found to be formed by Made Ground to a maximum depth of 0.80mbgl overlying clay substrata.
- 3.4.3 Groundwater observations confirmed groundwater is perched within the superficial soils at a depth of 0.70-0.80mbgl.
- 3.4.4 Extracts from the site investigation are located in Appendix 3 at the rear of this report.

4 Development Proposals

4.1 Description

4.1.1 The development proposals are for the construction of a 2,195m² extension to the south side of the existing Sefton Farm South production building and hard standing together with a watercourse diversion and resulting reduction in plan area of the irrigation reservoir immediately south of the development proposals.

4.1.2 The areas of the positively drained elements of the development are summarised as follows:

- Extension Roof Area 2,195m²
- External Hard Standing (Including Dock Leveller) 3,490m²

4.1.3 A copy of the proposed site layout plan showing the positively drained areas is located in Appendix 4 at the rear of this report.

4.2 Surface Water Drainage Generally

4.2.1 CIRIA report C753 The SuDS Manual-v6 provides guidance on surface water drainage. The aim for surface water runoff is to match greenfield runoff rates and volumes where reasonably achievable.

4.2.2 National planning guidance sets out the drainage hierarchy for surface water drainage and notes the following list of drainage options in order of preference:

- 1 Infiltration to ground
- 2 Discharge to a surface water body
- 3 Discharge to a surface water sewer, highway drain, or another drainage system
- 4 Discharge to a combined sewer

4.2.3 The preferred surface water drainage strategy should where possible be based on infiltration to ground, however, as previously noted during site investigation work the site was predominantly found to be formed by Made Ground to a maximum depth of 0.80mbgl over clay substrata.

4.2.4 Groundwater observations confirmed that groundwater is perched within the superficial soils at a depth of 0.70-0.80mbgl and as such infiltration is not a practical method of discharging surface water runoff from this site.

4.2.5 The possibility of providing an infiltration based drainage system was also previously investigated and ruled out during the planning application process for the existing Sefter House South packhouse as detailed in the Flood Risk Assessment for that building which was undertaken in July 2016 by The Civil Engineering Practice Limited. The planning permission reference for that development is P/76/16/PL.

4.2.6 Where practical surface water will be collected for reuse within the existing onsite irrigation system.

4.3 Surface Water Drainage for Extension Roof

4.3.1 Surface water collected from the new roof will be collected and discharged to the existing pumping station to the west of the Sefter South packhouse and pumped to the existing reservoir to the northeast of the site for reuse within the wider site's irrigation process.

4.3.2 That reservoir has a surface area at top of bank of approximately 10,855m² and is maintained with 500mm of freeboard with maximum upper surface water area of approximately 9,195m².

4.3.3 The total positively drained area of the new extension will be 2,195m².

4.3.4 A surface water drainage network has been designed with all infrastructure sized to accommodate a 1:100year +45% storm event.

4.3.5 In accordance with Non Statutory Technical Standards for SuDS S4 the runoff collected from the area of the new extension for the 1 in 100 year, 6 hour rainfall event will be stored in the existing irrigation reservoir and reused for irrigation with no discharge from the site during any event.

4.3.6 Calculations have been undertaken to determine the total volume of water collected from the site during a six hour 1:100year +45% rainfall event.

4.3.7 This volume will be approximately 206m³ and equates to a rise of 22mm across the existing reservoir resulting in a new freeboard of 478mm which is well within the required 300mm minimum.

4.4 Surface Water Drainage for New Hardstanding

4.4.1 Surface water collected from the new hardstanding will be discharged at a suitably restricted rate to the relocated watercourse to the south of the proposed extension.

4.4.2 The total positively drained area of the hardstanding and dock leveller will be approximately 3,490m² and the equivalent greenfield runoffs are as follows:

- Q_{bar} (approximate 1:2 year at 1.72 l/s/ha 0.6 l/s
- 1:30 year at 3.95 l/s/ha 1.4 l/s
- 1:100 year at 5.48 l/s/ha 1.9 l/s

4.4.3 HR Wallingford guidance recommends that when Q_{bar} runoff rates are below 2l/s/ha limiting discharge rates should be set to 2l/s/ha.

4.4.4 HR Wallingford guidance also notes that where flow rates are less than 5l/s consent for discharge is usually set at 5l/s if a blockage from vegetation and other materials is possible and that lower rates may be set where blockage risk is addressed using appropriate drainage elements.

4.4.5 Rates of 1l/s are now achievable for discharges from permeable paving systems.

4.4.6 Calculations have been prepared based on a discharge rate no greater than 1l/s during 1:2 year storm event and no greater than 2l/s during the 1:100 year plus climate change event.

4.4.7 The calculations confirm that a 30% voided subbase divided into three separate sections discharging east to west through a series of flow control devices beneath a 200mm concrete slab will provide sufficient storage to accommodate this rainfall event with a 1l/s restriction of the Q_{bar} event and a resultant 1.7l/s restriction during the 1:100 year+45% event.

4.5 Watercourse Diversion

4.5.1 The existing watercourse to the south of Seftor South packhouse will be relocated to the south of the new proposal such that it continues to accept the existing surface water runoff from the area to the east of the packhouse.

4.5.2 The outfall from the existing ditch is a 225mm diameter pipe laid at a gradient of 1:39 which in turn discharges to a further 44m of 225mm diameter pipes laid with a combined hydraulic gradient of 1:366.

4.5.3 Using the Colebrook White equation for circular pipes under full bore conditions and a pipe roughness of 0.6mm this network has a conveyance capacity of 26.9l/s.

4.5.4 In order to provide sufficient depth of subbase beneath the new hardstanding the invert level of the outfall from the realigned ditch will need to be lowered to 2.9m AOD resulting in the existing outfall pipe gradient being slackened to 1:155.

4.5.5 Full bore conditions for the resultant out fall pipe as calculated above confirm a conveyance capacity of 41.6l/s and a velocity of 1.05 m/s.

- 4.5.6 The alterations are therefore capable of passing the same flow as the existing downstream network and maintain a self cleansing velocity.
- 4.5.7 The increased depth of realigned ditch will also provide a greater level of storage than the existing ditch which while not required will provide an additional benefit to the site as a whole.

4.6 Reduction of Existing Irrigation Reservoir Surface Area

- 4.6.1 The existing reservoir south of the proposed extension has a surface area at top of bank of approximately 11,602m² and is maintained with 500mm of freeboard with maximum upper surface water area of approximately 10,962m².
- 4.6.2 This reservoir is an irrigation balancing reservoir which is managed as part of the wider irrigation network across the site.
- 4.6.3 The reduced size reservoir will have a surface area at top of bank of approximately 5,134m² and will be maintained with 500mm of freeboard with maximum upper surface water area of approximately 4,713m².
- 4.6.4 There are proposals for a new 125,000m³ reservoir to the north of the Sefter Farm buildings which has planning permission under reference P/127/24/AG.
- 4.6.5 Water levels and stored volume will be managed with a reduction of abstraction currently permitted from the Pagham Rife under the existing abstraction licence held by Barfoots of Botley leading to a temporarily reduced capacity within the wider irrigation network until such time as the new reservoir is constructed.
- 4.6.6 Copies of the detailed surface water drainage proposals together with construction details and supporting calculations are located in Appendix 5 at the rear of this report.

4.7 Water Quality

- 4.7.1 The proposed development is for commercial agricultural use. In accordance with CIRIA SuDS Manual 2015 (Report C753), the pollution hazard level for this type of development is classified as between low and medium depending on the use / area of the site.
- 4.7.2 The surface water scheme will include mitigation to ensure that surface water is suitably treated and any pollution risk adequately managed prior to irrigation reuse and in the case of the new hardstanding prior to a restricted discharge to the onsite drainage ditch and to the Pagham Rife.

4.7.3 Table 26.2 in Chapter 26 of CIRIA report C753 The SuDS Manual provides Pollution Hazard Indices for varying land types. Those of relevance to the development proposals are as follows:

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Commercial / Industrial roofs	Low	0.3	0.2	0.05
Commercial yards and delivery areas	Medium	0.7	0.6	0.7

Table 1: Pollution Hazard Indices

4.7.4 The surface water drainage design will include the use of permeable subbase acting as a filter strip, on site watercourse (swale), and ponds / reservoirs.

SuDS Type	Total suspended solids (TSS)	Metals	Hydrocarbons
Swale	0.5	0.6	0.6
Filter Strip	0.4	0.4	0.5
Pond / Reservoir	0.7	0.7	0.5

Table 2: Pollution Mitigation Indices

4.7.5 Where multiple drainage components are used in series the individual mitigation index of secondary and tertiary components is lowered by 50% due to reduced performance associated with primary treatment and the proposed infrastructure will meet the target treatment level required as follows:

Extension Roof	Total suspended solids (TSS)	Metals	Hydrocarbons
Pond / Reservoir	0.7	0.7	0.5

Commercial Hardstanding	Total suspended solids (TSS)	Metals	Hydrocarbons
Filter Strip	0.4	0.4	0.5
Swale at 50%	0.25	0.3	0.3
Total Treatment	0.65	0.7	0.8

Table 3: Pollution Mitigation Provision

4.7.6 An interim drainage management and maintenance plan is located in Appendix 6 at the rear of this report.

4.8 Risk to Others

- 4.8.1 The proposed surface water drainage system will be designed to current standards incorporating SuDS elements providing attenuation and storage which will minimise runoff leaving the site during times of heavy rain.
- 4.8.2 Allowance has been made for a 45% increase in rainfall intensities which accords with the latest figures published by the Environment Agency with the requirements under the National Planning Policy Framework.
- 4.8.3 The proposed drainage system will incorporate sufficient treatment prior to final discharge thus mitigating the risk of pollution from the site.
- 4.8.4 The residual risk of sewer flooding from this development for the foreseeable future is therefore negligible.

4.9 Surface Water Exceedance Route

- 4.9.1 In the event that part of the onsite surface water drainage network was to become blocked, suffer a failure due to lack of maintenance or be inundated with a storm beyond the 1:100 year +45% design storm surface water would migrate overland towards the Pagham Rife.
- 4.9.2 A surface water exceedance route plan is located in Appendix 7 at the rear of this report.

5 Conclusions

- 5.1 The geology of the area is predominantly clay and is not suitable to accommodate an infiltration drainage system.
- 5.2 A suitable SuDS drainage system is proposed which accords with the requirements of national and local policy.
- 5.3 A SuDS drainage system is proposed which accords with the requirements of national and local policy and will ensure 100% reused of rainwater captured from the extension roof for irrigation.
- 5.4 Surface water collected from the new hardstanding area will be collected with surface water restricted to Q_{bar} greenfield runoff rates and discharged to the relocated onsite watercourse which discharges to the Pagham Rife to the west of the site.
- 5.5 Calculations confirm that surface water runoff generated by the proposed development can be attenuated on site for all rainfall events up to the 1:100 year event including an allowance for climate change.
- 5.6 Water quality improvement will be provided to mitigate against any risk to the receiving waterbodies.
- 5.7 A suitable surface water and foul water drainage system has been designed to accommodate the anticipated flows from the proposed development and in terms of drainage the development proposals are suitable at this location.

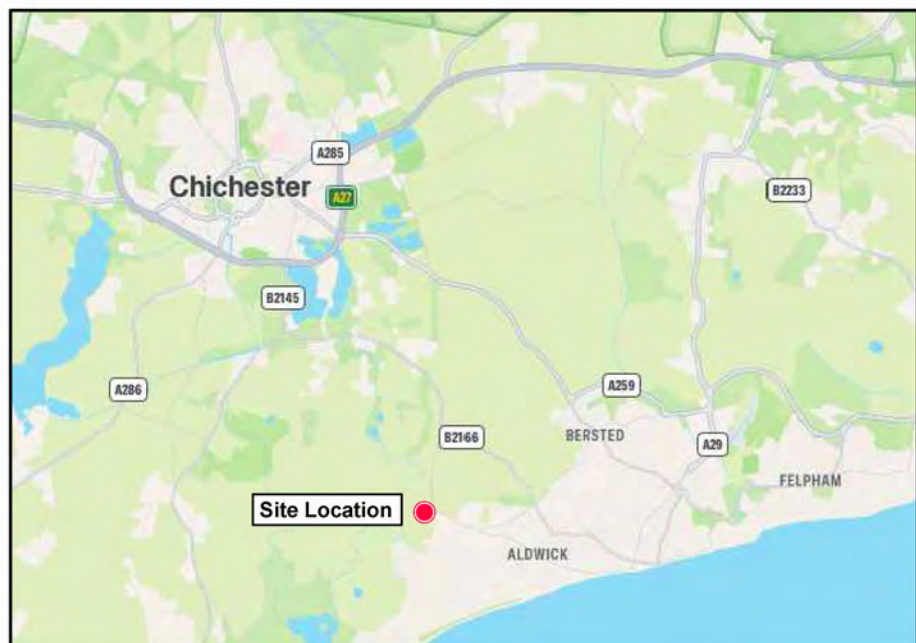
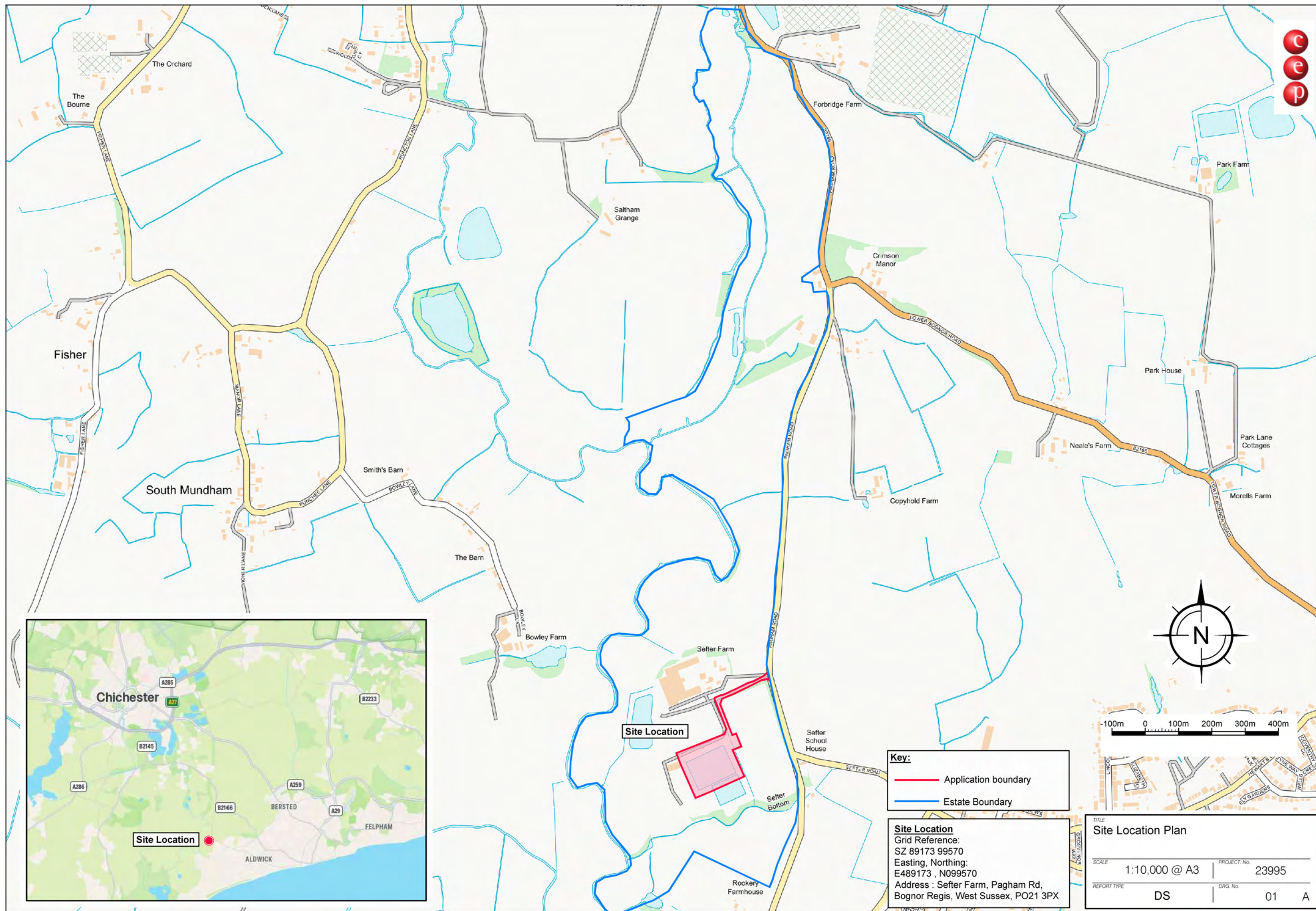
6 List of Appendices, Images and Tables

Appendix 1	Site Location Plan
Appendix 2	Existing Site Layout Plan
Appendix 3	Extracts from Site Investigation
Appendix 4	Proposed Site Layout and Drained Areas Plan
Appendix 5	Detailed Surface Water Drainage Drawings and Calculations
Appendix 6	Interim Drainage Management and Maintenance Plan
Appendix 7	Surface Water Exceedance Route Plan

Image 1	Site Location
Image 2	Greenfield Runoff Calculation

Table 1	Pollution Hazard Indices
Table 2	Pollution Mitigation Indices
Table 3	Pollution Mitigation Provision

Appendix 1
Site Location Plan



Key:

- Application boundary
- Estate Boundary

Site Location
 Grid Reference:
 SZ 89173 99570
 Easting, Northing:
 E489173 , N099570
 Address : Seftor Farm, Pagham Rd,
 Bognor Regis, West Sussex, PO21 3PX

TITLE Site Location Plan			
SCALE 1:10,000 @ A3	PROJECT No. 23995		
REPORT TYPE DS	DRG. No. 01	A	

Appendix 2
Existing Site Layout Plan



TITLE Existing Site Layout Plan			
SCALE	1:1000 @ A3	PROJECT No.	23995
REPORT TYPE	DS	DRG. No.	02 A

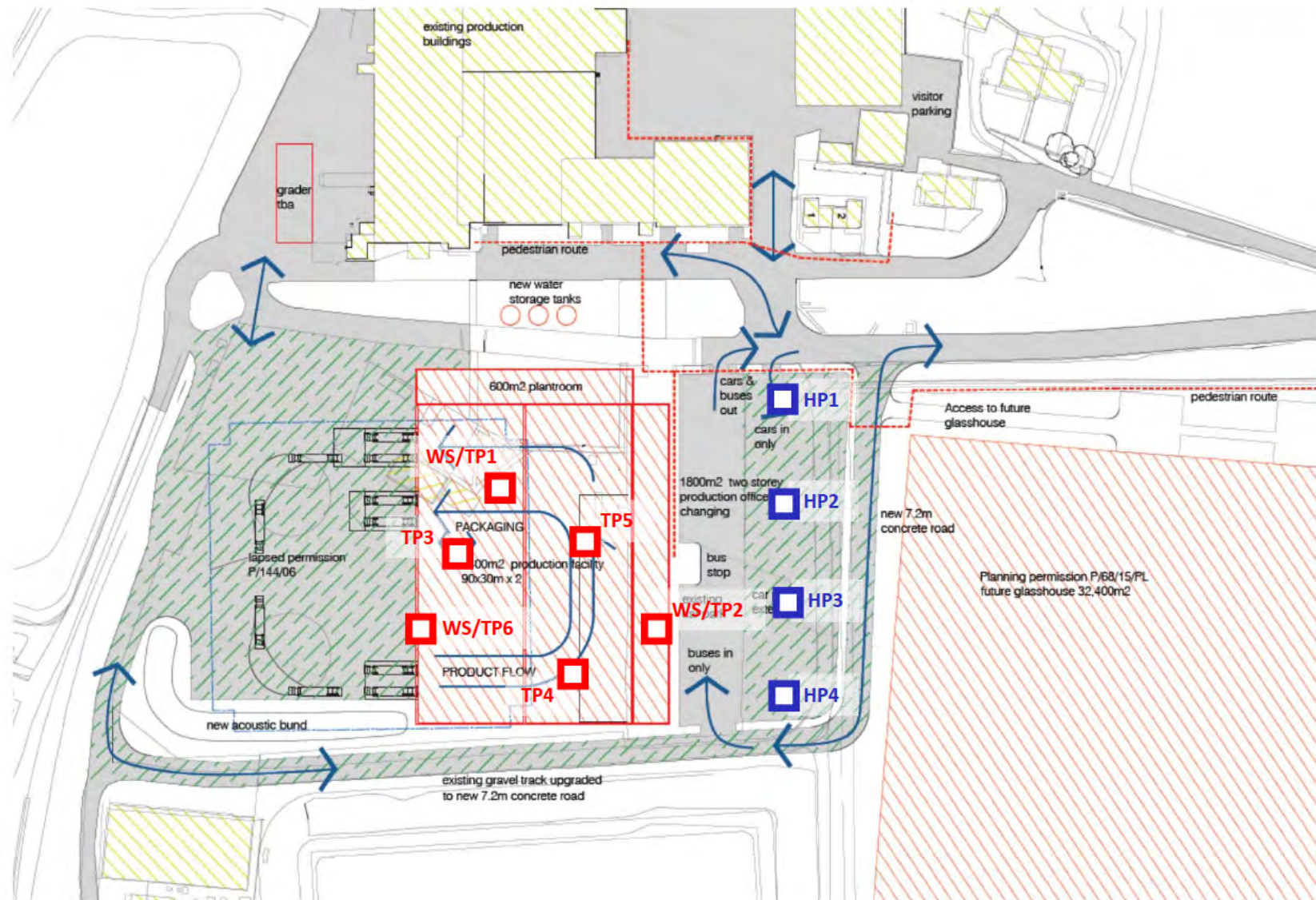
Appendix 3

Extracts from Site Investigation

Investigation Plan

Project Ref: 16.9088

Site Name: Seftor Farm



Please refer to the stratigraphic logs contained within Appendix B for a more detailed description.

5.2 Groundwater

Shallow groundwater was encountered across the site, occurring as seepages within deep trial pits and window sample boreholes at depths of 0.70m to 2.00mbgl. Resting levels within the window sample boreholes were found to range from 0.70m to 0.80mbgl.

5.3 Visual and Olfactory Observations

The Made Ground across the site was found to contain various detritus, including masonry rubble and discrete horizons of wood chipping, however no evidence of soil contamination was observed within any of the exploratory holes.

6.0 GEOTECHNICAL TESTING

6.1 Geotechnical Testing

6.1.1 Atterberg Limits and Natural Moisture Content

In total, ten disturbed samples of the underlying soils were submitted for determination of their Natural Moisture Content (NMC) and Plasticity Index (PI). Five of these samples were recovered from the London Clay Formation, and five from the overlying superficial soils.

NMC values in the superficial deposits ranged from 18-30%. The underlying London Clay recorded NMC values of 26-35%.

Liquid limit values in the superficial deposits ranged from 21% to 43% and modified plasticity index values were recorded as 11-22%, once the portion retained on the 425micron sieve had been accounted for (11-25%). On this basis the superficial soils would be classified as clays of low to intermediate plasticity and of low to medium shrinkage potential on the basis of NHBC guidance, chapter 4.2 'Building Near Trees'.

Within the London Clay Formation, liquid limits ranged from 52-71%, and the modified plasticity on the basis of the portion retained on the 425 micron sieve (0-25%) is recorded as 27-47%. These soils would be classified as high to very high plasticity clay and would be of medium to high shrinkage potential on the basis of the NHBC guidance.

6.1.2 Sulphate and pH Analysis

Twenty samples were submitted for determination of pH and Water Soluble Sulphate concentration.

Water soluble sulphate concentrations were found to range from <10mg/l to 363mg/l, with pH levels ranging from 5.6 to 8.1.

Full laboratory test results can be found in Appendix D.

N-values within the Bognor Sand Member soils recorded values of N=52-101, these values are indicative of very dense granular soils.

6.3.2 Dynamic Cone Penetrometer Testing

A total of three locations were tested using Dynamic Cone Penetrometer (DCP) equipment with two test completed at locations DCP2 and DCP3 where one test was positioned on the verge and one in the haul road. The testing was completed to provide insitu CBR values for pavement design.

The table below provides the recorded equivalent CBR values in each test over a range of formations levels.

Formation Depth (mm)	Equivalent CBR %				
	DCP1	DCP2	DCP2A	DCP3	DCP3A
100	17	153	88	3	45
200	28	440	78	6	48
300	21	-	-	5	30
400	12	-	-	12	16
500	5	-	-	7	11
600	7	-	-	8	8
700	6	-	-	10	7

The results of this insitu testing are shown in Appendix B.

7.0 DISCUSSION OF GROUND CONDITIONS

7.1 Soil Engineering Properties

It is understood that the proposals for the site include the construction of a new portal framed distribution building, which will include an internal finished floor level of approximately 1.00-1.50mbgl above current ground level. Final loadings are not known at the time of writing, however considering the nature of the structure column loads are expected to be moderately high.

In order to produce the raised ground floor slab options including suspended slab and the construction of an earth embankment utilising material sourced from elsewhere on site are considered as construction options.

The surficial cover to the development area was predominantly found to be formed by Made Ground soils to a maximum depth of 0.80mbgl, with local topsoil deposits. This Made Ground shows compositional variation, however is largely formed by a sandy and gravelly Clay, however granular portions are described locally.

Superficial deposits underlying the surface cover have been proved to comprise a composite deposit with stratigraphic records indicating mixed gravelly Clay, gravelly Sand and silty Sand soils to a maximum depth of 2.00mbgl. These deposits are considered to form interdigitating Raised Marine and Head Deposit soils.

Insitu testing has indicated that these superficial soils are of low to medium strength character with SPT N-values indicative of soft to firm or firm consistency clay soils and loose to medium dense granular soils.

The results of laboratory testing indicate that the superficial deposits are of low to intermediate plasticity and of low to medium shrinkage potential in accordance with NHBC guidance.

The underlying London Clay formation is initially encountered as a stiff consistency fissured and thinly laminated silty Clay. This results of insitu testing indicate this material to be firm to stiff consistency, becoming stiff consistency with depth. Laboratory testing indicates that the London Clay is of high to very high plasticity and is of medium to high shrinkage potential. This stratum is encountered to a maximum depth of 5.00mbgl.

Within WS/TP1 and WS/TP2 at depths of 3.90m and 4.40mbgl to the maximum drilled depth of 5.00mbgl, soils considered representative of the Bognor Sand Member were encountered and were described as dense silty Sand. Insitu test results however indicate that this sand is a very dense granular soil.

Groundwater observations indicate that the groundwater is perched within the superficial soils at a depth of 0.70-0.80mbgl.

7.2 Shallow Foundations

It cannot be recommended that major structural foundations are formed with the made Ground revealed by this investigation. Soils of this origin are frequently present in a weak and variable condition such that unacceptable settlement would be expected, even under the action of light loading intensities.

Furthermore the low to medium strength character and highly variable composition of the superficial soils across the site are expected to preclude that use of a spread type foundation as total and differential settlement levels would be expected to exceed tolerable limits.

Additionally the temporary works involved in the formation of a spread foundation would likely prove problematic owing to the presence of water bearing low strength and / or granular soils. Open excavations in these water bearing soils would be prone to collapse.

7.3 Deep Foundations

In order to overcome the issues associated with weak and compositionally inconsistent superficial soils it is recommended that a piled foundation is used for the new building, particularly given the anticipated spans and potentially suspended floor for the new development.

The bedrock geology is also found to be variable in terms of composition, with the Bognor Sand Member encountered in two of the three window sample boreholes. Whilst the London Clay Formation is expected to act as a suitable bearing medium for piled foundations, the thickness / extent of the Bognor Sand would need to be ascertained as well as the geotechnical parameters to at least 5.00m below the depth of piled foundations to allow a suitable economic foundation to be designed.

It would be recommended that additional investigations are undertaken within the footprint of the new development to allow pile design to be completed. This is expected to take the form of at least 2no exploratory cable percussion boreholes to a depth of 15.00-20.00mbgl.

7.4 Floor Slabs and Pavements

The floor slab design will depend on the final foundation designs and is dependent on the underlying materials, including bearing capacity and the presence of any cohesive or Made Ground Soils.

Given the variable thickness of Made Ground and the locally potentially shrinkable soils encountered, it is considered that a fully suspended floor would be most suitable from the perspective of design confidence.

However the proposed use of the floor itself may make the use of a suspended floor slab uneconomic or impractical in terms of additional column loading. As a result it may be prudent to consider the use of adequate compaction and establishment of a suitable thickness of engineering fill material to act as a base for the new slab. It would also be recommended to consider the use of displacement type ground improvement measures to increase the load bearing potential of the shallow soils to accept loading from a new floor.

CBR testing adjacent to the access roadway has indicated high CBR values, generally in excess of 10%. However the comparatively weak Made Ground and topsoil encountered elsewhere is unlikely to provide such a suitable subgrade material. It would be suggested that design values of 1-3% are assumed in the design of the new loading bay area and floor slab.

7.5 Excavations and Groundwater

It is likely that excavations of less than 1.20mbgl will require support to their faces due to the variable nature of Made Ground as well as locally weak and saturated shallow soils. Should excavations be taken below this then adequate support should be provided in order to satisfy statutory safety regulations.

Groundwater has been identified up to 0.70mbgl during site works.

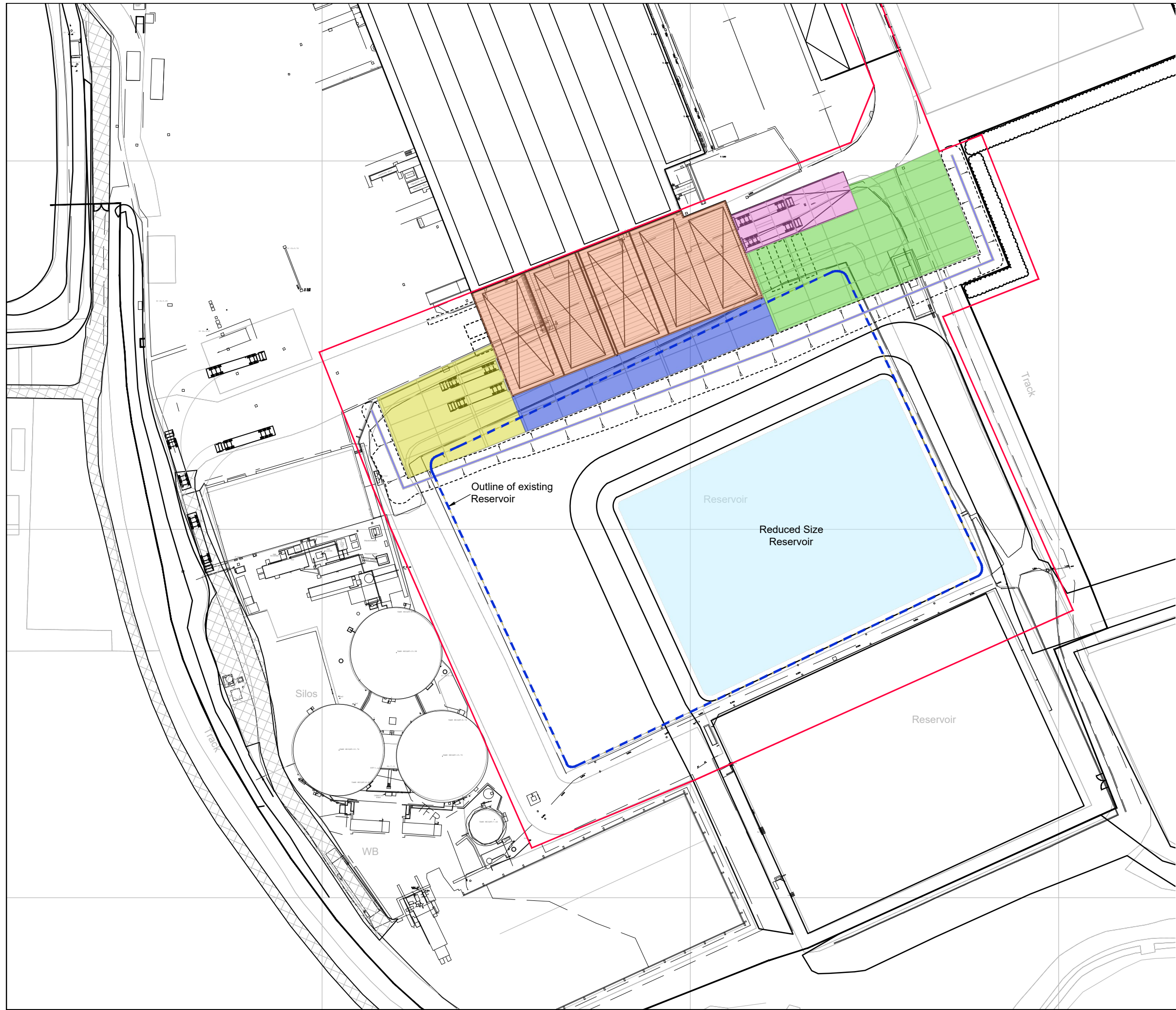
Therefore any excavation made below groundwater levels on site is expected to be subject to the inflow of groundwater which is expected to result in the further instability of excavation faces, particularly where granular soils are encountered. It is strongly recommended that provision is made in the specification of ground works for dewatering.

Where groundwater is identified within any of the excavations during the construction phase then it should be dealt with appropriately and removed using good engineering practices.

The design of any temporary retaining structures to support excavation faces should be made assuming the following moderately conservative parameters:

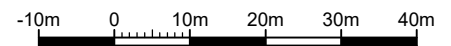
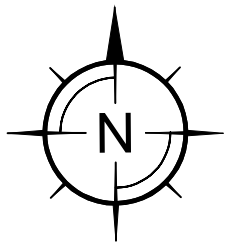
Appendix 4

**Proposed Site Layout
and Drained Areas Plan**



KEY:

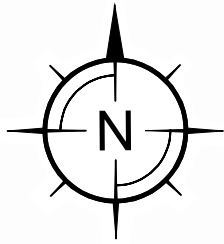
	Site Boundary 27,435m ²
	Extension to Packhouse 2,195m ²
	Hardstanding (West) 835m ²
	Hardstanding (Central) 750m ²
	Hardstanding (East) 1,540m ²
	Dock Leveller 365m ²
Total	5,685m ²



TITLE Proposed Site Layout And Drained Areas Plan			
SCALE	1:1,000 @ A3	PROJECT No.	23995
REPORT TYPE	DS	DRG. No.	03 A

Appendix 5

**Detailed Surface Water Drainage Drawings
and Calculations**

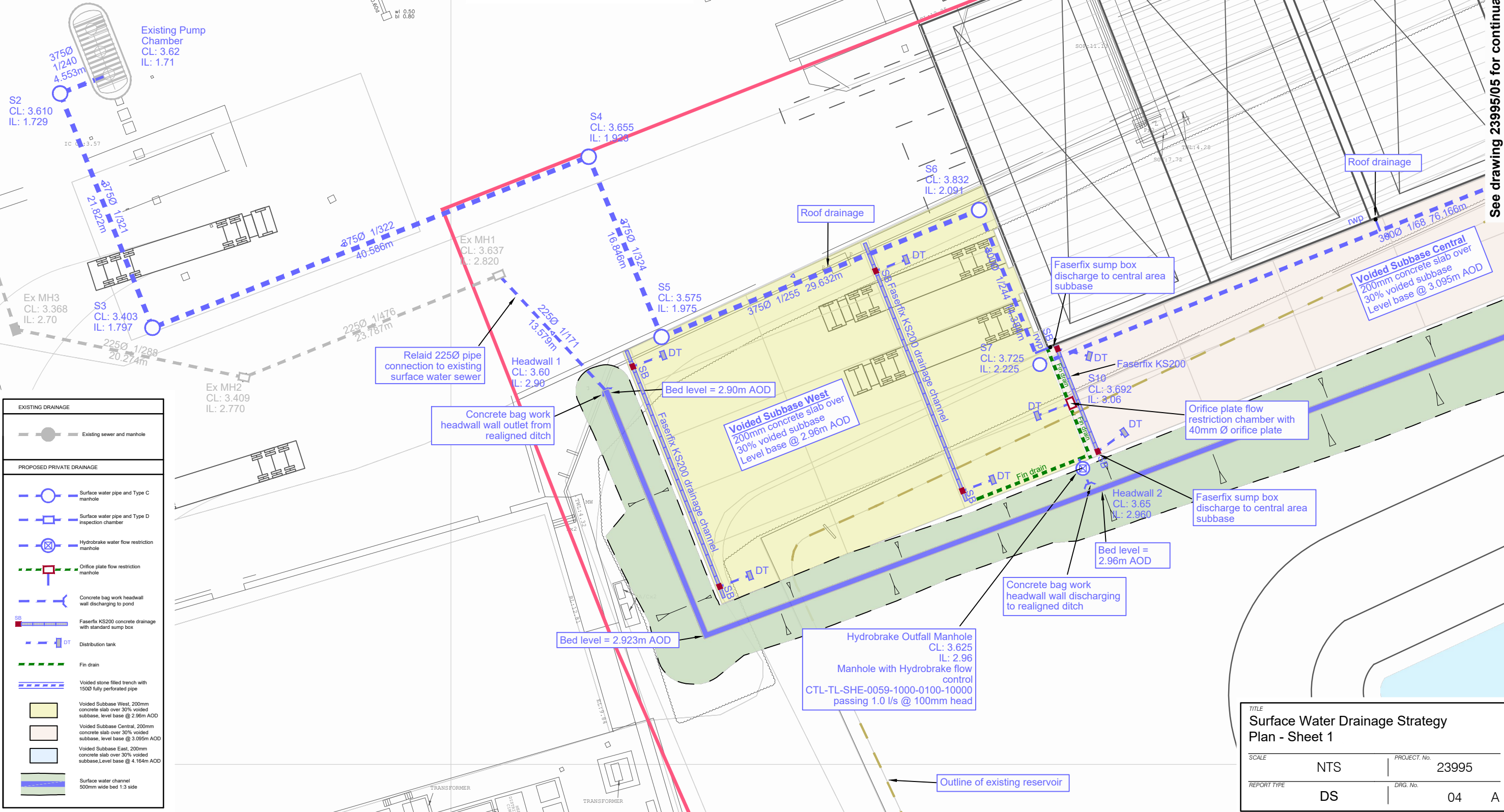


-2.5m 0 2.5 5 7.5 10 12.5m

Note:
All three sections of voided subbase to be sealed from each other with the hydraulic connections between them being solely via the proposed orifice plate flow restrictions

c
e
p

See drawing 23995/05 for continuation



EXISTING DRAINAGE	
	Existing sewer and manhole

PROPOSED PRIVATE DRAINAGE	
	Surface water pipe and Type C manhole
	Surface water pipe and Type D inspection chamber
	Hydrobrake water flow restriction manhole
	Orifice plate flow restriction manhole
	Concrete bag work headwall wall discharging to pond
	Faserfix KS200 concrete drainage with standard sump box
	Distribution tank
	Fin drain
	Voided stone filled trench with 1500 fully perforated pipe
	Voided Subbase West, 200mm concrete slab over 30% voided subbase, level base @ 2.96m AOD
	Voided Subbase Central, 200mm concrete slab over 30% voided subbase, level base @ 3.095m AOD
	Voided Subbase East, 200mm concrete slab over 30% voided subbase, level base @ 4.164m AOD
	Surface water channel 500mm wide bed 1:3 side

TITLE			
Surface Water Drainage Strategy			
Plan - Sheet 1			
SCALE	NTS	PROJECT No.	23995
REPORT TYPE	DS	DRG. No.	04 A

EXISTING DRAINAGE

Existing sewer and manhole

PROPOSED PRIVATE DRAINAGE

Surface water pipe and Type C manhole

Surface water pipe and Type D inspection chamber

Hydrobrake water flow restriction manhole

Orifice plate flow restriction manhole

Concrete bag work headwall wall discharging to pond

SB

Faserfix KS200 concrete drainage with standard sump box

DT

Distribution tank

Fin drain

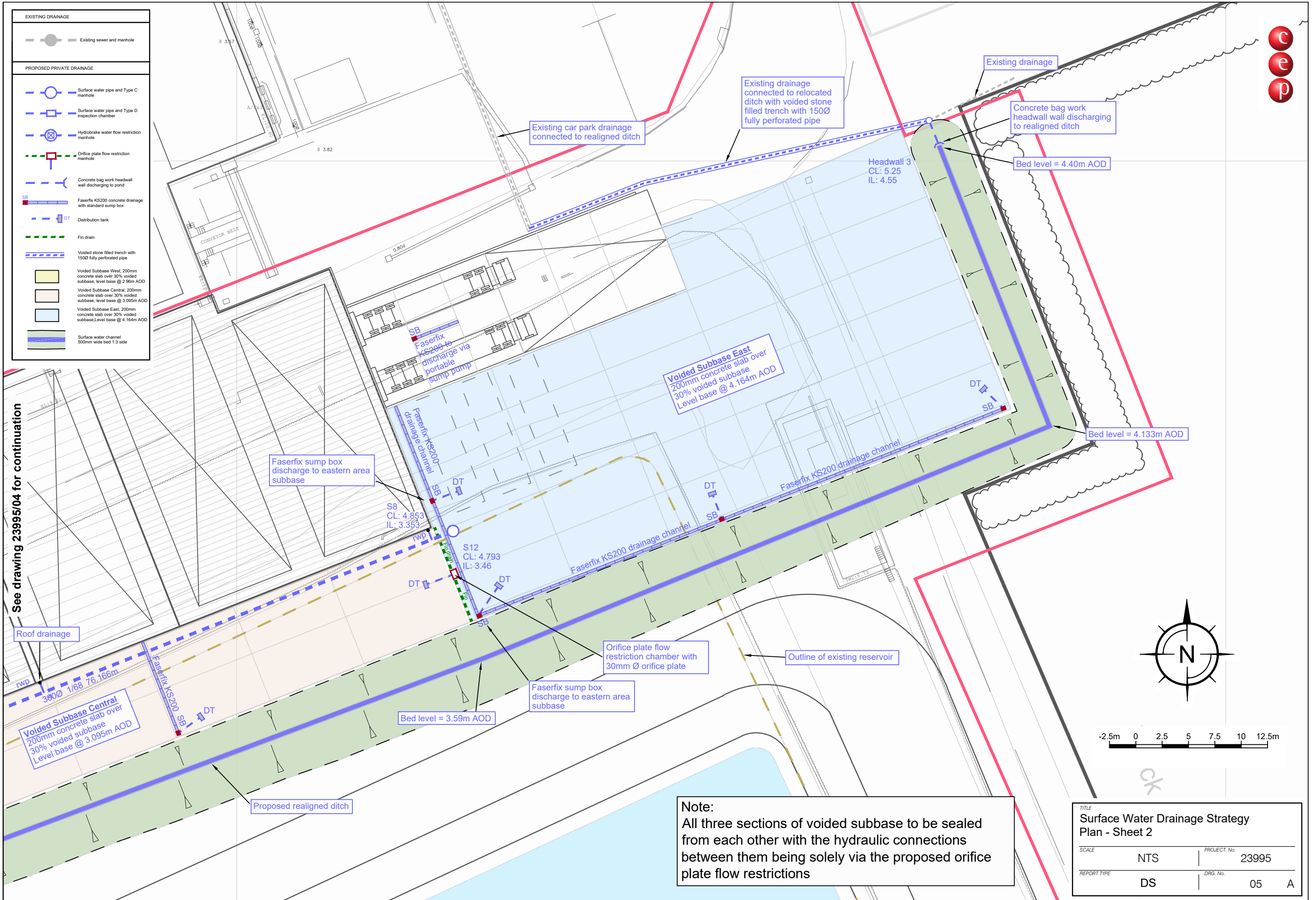
Voided stone filled trench with 1500 fully perforated pipe

Voided Subbase West, 200mm concrete slab over 30% voided subbase, level base @ 2.90m AOD

Voided Subbase Central, 200mm concrete slab over 30% voided subbase, level base @ 3.095m AOD

Voided Subbase East, 200mm concrete slab over 30% voided subbase, level base @ 4.164m AOD

Surface water channel 500mm wide bed 1:3 side



See drawing 23995/04 for continuation

Note:
All three sections of voided subbase to be sealed from each other with the hydraulic connections between them being solely via the proposed orifice plate flow restrictions

TITLE Surface Water Drainage Strategy Plan - Sheet 2		
SCALE	NTS	PROJECT No. 23995
REPORT TYPE	DS	DRG. No. 05 A

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
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)	150.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.110	5.00	4.853	1200	489221.883	99562.557	1.500
2	0.110	5.00	3.725	1200	489151.015	99534.648	1.500
3			3.745	1350	489145.761	99548.038	1.654
4			3.550	1350	489118.248	99537.034	1.575
5			3.655	1350	489111.930	99552.650	1.732
6			3.403	1350	489074.146	99537.832	1.606
7			3.610	1350	489066.146	99558.135	1.881
Existing Pump Chamber			3.620	1350	489070.387	99559.791	1.910
EX1		5.00	3.470	1200	489107.074	99543.627	0.650
EX2			3.370	1200	489082.094	99533.523	0.600
EX3			3.350	1200	489062.312	99537.702	0.650
EX4		5.00	3.820	1200	489122.050	99566.312	1.450
EX5			3.490	1200	489089.677	99548.915	1.450
EX6			3.430	1200	489077.107	99542.173	1.400

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	76.166	0.600	3.353	2.225	1.128	67.5	300	5.66	54.6
1.001	2	3	14.384	0.600	2.225	2.166	0.059	243.8	300	5.90	53.6
1.002	3	4	29.632	0.600	2.091	1.975	0.116	255.4	375	6.34	52.0
1.003	4	5	16.846	0.600	1.975	1.923	0.052	324.0	375	6.62	50.9
1.004	5	6	40.586	0.600	1.923	1.797	0.126	322.1	375	7.29	48.6
1.005	6	7	21.822	0.600	1.797	1.729	0.068	320.9	375	7.66	47.4
1.006	7	Existing Pump Chamber	4.553	0.600	1.729	1.710	0.019	239.6	375	7.72	47.2
Existing 2.000	EX1	EX2	26.946	0.600	2.820	2.770	0.050	538.9	225	5.81	54.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.916	135.4	21.7	1.200	1.200	0.110	0.0	81	1.414
1.001	1.002	70.8	42.6	1.200	1.279	0.220	0.0	168	1.047
1.002	1.129	124.7	41.3	1.279	1.200	0.220	0.0	148	1.017
1.003	1.001	110.6	40.5	1.200	1.357	0.220	0.0	156	0.925
1.004	1.004	110.9	38.6	1.357	1.231	0.220	0.0	153	0.917
1.005	1.006	111.1	37.7	1.231	1.506	0.220	0.0	151	0.913
1.006	1.166	128.8	37.5	1.506	1.535	0.220	0.0	138	1.015
Existing 2.000	0.556	22.1	0.0	0.425	0.375	0.000	0.0	0	0.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
Existing 2.001	EX2	EX3	36.770	0.600	2.770	2.700	0.070	525.3	225	6.89	55.3
Existing 3.000	EX4	EX5	36.751	0.600	2.370	2.040	0.330	111.4	225	5.49	54.7
Existing 3.001	EX5	EX6	14.264	0.600	2.040	2.030	0.010	1426.4	225	6.20	52.5

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)
Existing 2.001	0.564	22.4	0.0	0.375	0.425	0.000	0.0	0	0.000
Existing 3.000	1.238	49.2	0.0	1.225	1.225	0.000	0.0	0	0.000
Existing 3.001	0.338	13.4	0.0	1.225	1.175	0.000	0.0	0	0.000

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	76.166	67.5	300	Circular	4.853	3.353	1.200	3.725	2.225	1.200
1.001	14.384	243.8	300	Circular	3.725	2.225	1.200	3.745	2.166	1.279
1.002	29.632	255.4	375	Circular	3.745	2.091	1.279	3.550	1.975	1.200
1.003	16.846	324.0	375	Circular	3.550	1.975	1.200	3.655	1.923	1.357
1.004	40.586	322.1	375	Circular	3.655	1.923	1.357	3.403	1.797	1.231
1.005	21.822	320.9	375	Circular	3.403	1.797	1.231	3.610	1.729	1.506
1.006	4.553	239.6	375	Circular	3.610	1.729	1.506	3.620	1.710	1.535

Existing 2.000	26.946	538.9	225	Circular	3.470	2.820	0.425	3.370	2.770	0.375
Existing 2.001	36.770	525.3	225	Circular	3.370	2.770	0.375	3.350	2.700	0.425
Existing 3.000	36.751	111.4	225	Circular	3.820	2.370	1.225	3.490	2.040	1.225
Existing 3.001	14.264	1426.4	225	Circular	3.490	2.040	1.225	3.430	2.030	1.175

Link	US Node	Dia (mm)	Node Type	MH Type		DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2		1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3		1350	Manhole	Adoptable
1.002	3	1350	Manhole	Adoptable	4		1350	Manhole	Adoptable
1.003	4	1350	Manhole	Adoptable	5		1350	Manhole	Adoptable
1.004	5	1350	Manhole	Adoptable	6		1350	Manhole	Adoptable
1.005	6	1350	Manhole	Adoptable	7		1350	Manhole	Adoptable
1.006	7	1350	Manhole	Adoptable	Existing Pump Chamber		1350	Manhole	Adoptable
Existing 2.000	EX1	1200	Manhole	Adoptable	EX2		1200	Manhole	Adoptable
Existing 2.001	EX2	1200	Manhole	Adoptable	EX3		1200	Manhole	Adoptable
Existing 3.000	EX4	1200	Manhole	Adoptable	EX5		1200	Manhole	Adoptable
Existing 3.001	EX5	1200	Manhole	Adoptable	EX6		1200	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s) x
Summer CV	1.000	Drain Down Time (mins)	1140	Check Discharge Volume x
Winter CV	1.000	Additional Storage (m ³ /ha)	0.0	

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
2	0	0	0
30	0	0	0
100	0	0	0
100	45	0	0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	3.417	0.064	14.0	0.0722	0.0000	OK
15 minute summer	2	11	2.361	0.136	27.6	0.1542	0.0000	OK
15 minute summer	3	11	2.213	0.122	26.9	0.1743	0.0000	OK
15 minute summer	4	12	2.108	0.133	26.8	0.1901	0.0000	OK
15 minute summer	5	12	2.051	0.128	26.7	0.1829	0.0000	OK
15 minute summer	6	13	1.927	0.130	26.5	0.1862	0.0000	OK
15 minute summer	7	13	1.856	0.127	26.4	0.1817	0.0000	OK
15 minute summer	Existing Pump Chamber	13	1.823	0.113	26.3	0.0000	0.0000	OK
15 minute summer	EX1	1	2.820	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX2	1	2.770	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX3	1	2.700	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX4	1	2.370	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX5	1	2.040	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX6	1	2.030	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	13.6	0.692	0.101	1.5995	
15 minute summer	2	1.001	3	26.9	0.911	0.379	0.4243	
15 minute summer	3	1.002	4	26.8	0.822	0.215	0.9656	
15 minute summer	4	1.003	5	26.7	0.785	0.241	0.5730	
15 minute summer	5	1.004	6	26.5	0.803	0.239	1.3420	
15 minute summer	6	1.005	7	26.4	0.789	0.237	0.7284	
15 minute summer	7	1.006	Existing Pump Chamber	26.3	0.865	0.204	0.1384	12.1
15 minute summer	EX1	Existing 2.000	EX2	0.0	0.000	0.000	0.0000	
15 minute summer	EX2	Existing 2.001	EX3	0.0	0.000	0.000	0.0000	0.0
15 minute summer	EX4	Existing 3.000	EX5	0.0	0.000	0.000	0.0000	
15 minute summer	EX5	Existing 3.001	EX6	0.0	0.000	0.000	0.0000	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	3.431	0.078	20.7	0.0880	0.0000	OK
15 minute summer	2	11	2.398	0.173	41.0	0.1954	0.0000	OK
15 minute summer	3	11	2.244	0.153	40.0	0.2187	0.0000	OK
15 minute summer	4	12	2.142	0.167	40.0	0.2384	0.0000	OK
15 minute summer	5	12	2.083	0.160	39.5	0.2286	0.0000	OK
15 minute summer	6	13	1.960	0.163	39.7	0.2328	0.0000	OK
15 minute summer	7	13	1.887	0.158	39.0	0.2266	0.0000	OK
15 minute summer	Existing Pump Chamber	13	1.850	0.140	39.2	0.0000	0.0000	OK
15 minute summer	EX1	1	2.820	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX2	1	2.770	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX3	1	2.700	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX4	1	2.370	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX5	1	2.040	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX6	1	2.030	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	20.3	0.757	0.150	2.1457	
15 minute summer	2	1.001	3	40.0	1.019	0.565	0.5646	
15 minute summer	3	1.002	4	40.0	0.899	0.321	1.3183	
15 minute summer	4	1.003	5	39.5	0.864	0.357	0.7746	
15 minute summer	5	1.004	6	39.7	0.879	0.358	1.8321	
15 minute summer	6	1.005	7	39.0	0.868	0.351	0.9819	
15 minute summer	7	1.006	Existing Pump Chamber	39.2	0.963	0.305	0.1856	17.9
15 minute summer	EX1	Existing 2.000	EX2	0.0	0.000	0.000	0.0000	
15 minute summer	EX2	Existing 2.001	EX3	0.0	0.000	0.000	0.0000	0.0
15 minute summer	EX4	Existing 3.000	EX5	0.0	0.000	0.000	0.0000	
15 minute summer	EX5	Existing 3.001	EX6	0.0	0.000	0.000	0.0000	0.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	3.478	0.125	50.8	0.1416	0.0000	OK
15 minute summer	2	11	2.586	0.361	100.9	0.4078	0.0000	SURCHARGED
15 minute summer	3	11	2.377	0.286	99.1	0.4098	0.0000	OK
15 minute summer	4	11	2.282	0.307	99.1	0.4399	0.0000	OK
15 minute summer	5	12	2.214	0.291	97.5	0.4165	0.0000	OK
15 minute summer	6	12	2.091	0.294	96.3	0.4202	0.0000	OK
15 minute summer	7	12	1.998	0.269	95.9	0.3845	0.0000	OK
15 minute summer	Existing Pump Chamber	12	1.937	0.227	95.5	0.0000	0.0000	OK
15 minute summer	EX1	1	2.820	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX2	1	2.770	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX3	1	2.700	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX4	1	2.370	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX5	1	2.040	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX6	1	2.030	0.000	0.0	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	50.2	0.900	0.370	3.7413	
15 minute summer	2	1.001	3	99.1	1.429	1.399	0.9481	
15 minute summer	3	1.002	4	99.1	1.083	0.795	2.7710	
15 minute summer	4	1.003	5	97.5	1.050	0.882	1.5822	
15 minute summer	5	1.004	6	96.3	1.062	0.869	3.7418	
15 minute summer	6	1.005	7	95.9	1.082	0.863	1.9322	
15 minute summer	7	1.006	Existing Pump Chamber	95.5	1.236	0.741	0.3511	44.0
15 minute summer	EX1	Existing 2.000	EX2	0.0	0.000	0.000	0.0000	
15 minute summer	EX2	Existing 2.001	EX3	0.0	0.000	0.000	0.0000	0.0
15 minute summer	EX4	Existing 3.000	EX5	0.0	0.000	0.000	0.0000	
15 minute summer	EX5	Existing 3.001	EX6	0.0	0.000	0.000	0.0000	0.0

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	3.495	0.142	63.5	0.1606	0.0000	OK
15 minute summer	2	11	2.721	0.496	126.2	0.5607	0.0000	SURCHARGED
15 minute summer	3	11	2.481	0.390	122.2	0.5580	0.0000	SURCHARGED
15 minute summer	4	12	2.357	0.382	118.4	0.5461	0.0000	SURCHARGED
15 minute summer	5	12	2.281	0.358	117.7	0.5125	0.0000	OK
15 minute summer	6	12	2.140	0.343	115.4	0.4902	0.0000	OK
15 minute summer	7	12	2.032	0.303	115.5	0.4333	0.0000	OK
15 minute summer	Existing Pump Chamber	12	1.961	0.251	115.4	0.0000	0.0000	OK
15 minute summer	EX1	1	2.820	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX2	1	2.770	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX3	1	2.700	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX4	1	2.370	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX5	1	2.040	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EX6	1	2.030	0.000	0.0	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	62.8	1.056	0.463	3.9319	
15 minute summer	2	1.001	3	122.2	1.737	1.725	1.0129	
15 minute summer	3	1.002	4	118.4	1.118	0.950	3.2683	
15 minute summer	4	1.003	5	117.7	1.102	1.064	1.8429	
15 minute summer	5	1.004	6	115.4	1.107	1.041	4.3449	
15 minute summer	6	1.005	7	115.5	1.145	1.040	2.1927	
15 minute summer	7	1.006	Existing Pump Chamber	115.4	1.324	0.896	0.3952	54.9
15 minute summer	EX1	Existing 2.000	EX2	0.0	0.000	0.000	0.0000	
15 minute summer	EX2	Existing 2.001	EX3	0.0	0.000	0.000	0.0000	0.0
15 minute summer	EX4	Existing 3.000	EX5	0.0	0.000	0.000	0.0000	
15 minute summer	EX5	Existing 3.001	EX6	0.0	0.000	0.000	0.0000	0.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer 1		11	3.877	0.524	92.1	0.5922	0.0000	SURCHARGED
15 minute summer 2		12	3.414	1.189	173.3	1.3446	0.0000	SURCHARGED
15 minute summer 3		12	3.009	0.918	158.3	1.3130	0.0000	SURCHARGED
15 minute summer 4		12	2.777	0.802	157.0	1.1472	0.0000	SURCHARGED
15 minute summer 5		12	2.618	0.695	158.4	0.9949	0.0000	SURCHARGED
15 minute summer 6		12	2.304	0.507	159.3	0.7253	0.0000	SURCHARGED
15 minute summer 7		12	2.113	0.384	159.6	0.5495	0.0000	SURCHARGED
15 minute summer Existing Pump Chamber		12	2.004	0.294	159.6	0.0000	0.0000	OK
15 minute summer EX1		1	2.820	0.000	0.0	0.0000	0.0000	OK
15 minute summer EX2		1	2.770	0.000	0.0	0.0000	0.0000	OK
15 minute summer EX3		1	2.700	0.000	0.0	0.0000	0.0000	OK
15 minute summer EX4		1	2.370	0.000	0.0	0.0000	0.0000	OK
15 minute summer EX5		1	2.040	0.000	0.0	0.0000	0.0000	OK
15 minute summer EX6		1	2.030	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer 1	1	1.000	2	83.9	1.338	0.619	5.3636	
15 minute summer 2	2	1.001	3	158.3	2.248	2.235	1.0129	
15 minute summer 3	3	1.002	4	157.0	1.423	1.259	3.2683	
15 minute summer 4	4	1.003	5	158.4	1.436	1.433	1.8581	
15 minute summer 5	5	1.004	6	159.3	1.445	1.437	4.4765	
15 minute summer 6	6	1.005	7	159.6	1.447	1.437	2.4069	
15 minute summer 7	7	1.006	Existing Pump Chamber	159.6	1.522	1.240	0.4622	79.6
15 minute summer EX1	EX1	Existing 2.000	EX2	0.0	0.000	0.000	0.0000	
15 minute summer EX2	EX2	Existing 2.001	EX3	0.0	0.000	0.000	0.0000	0.0
15 minute summer EX4	EX4	Existing 3.000	EX5	0.0	0.000	0.000	0.0000	
15 minute summer EX5	EX5	Existing 3.001	EX6	0.0	0.000	0.000	0.0000	0.0

Results for 100 year +45% CC 360 minute summer. 1504 minute analysis at 8 minute timestep. Mass balance: 100.00%

Discharge
Vol (m³)

206.3

0.0

0.0

Results for 100 year +45% CC 360 minute winter. 1504 minute analysis at 8 minute timestep. Mass balance: 100.00%

Discharge
Vol (m³)

206.4

0.0

0.0

	The Civil Engineering Practice 11 Tungsten Building BN41 1RA www.civil.co.uk		File: Hardstanding Restriction and Storage Network: Storm Network Steve Doughty 20/03/2025		Page 1 Sefter Farm South, Extension Hardstanding Storage				
	Design Settings								
	Rainfall Methodology FEH-22 Return Period (years) 2 Additional Flow (%) 0 CV 1.000 Time of Entry (mins) 5.00 Maximum Time of Concentration (mins) 30.00 Maximum Rainfall (mm/hr) 150.0		Minimum Velocity (m/s) 1.00 Connection Type Level Soffits Minimum Backdrop Height (m) 0.200 Preferred Cover Depth (m) 1.200 Include Intermediate Ground ✓ Enforce best practice design rules ✓						
Nodes									
		Name	Area (ha)	Cover Level (m)	Diameter (mm)	Depth (m)			
		Voided Subbase East	0.187	4.734	1200	0.570			
		Voided Subbase Central	0.076	3.635	1200	0.540			
		Voided Subbase West	0.085	3.500	1200	0.540			
Simulation Settings									
Rainfall Methodology FEH-22 Rainfall Events Singular Summer CV 1.000 Winter CV 1.000		Analysis Speed Normal Skip Steady State x Drain Down Time (mins) 1140 Additional Storage (m³/ha) 0.0		Starting Level (m) Check Discharge Rate(s) x 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 %)				
1		0	0		0		0		
2		0	0		0		0		
30		0	0		0		0		
100		0	0		0		0		
100		45	0		0		0		
Node Voided Subbase East Offline Orifice Control									
Flap Valve x Loop to Node Voided Subbase Central Invert Level (m) 4.164		Diameter (m) 0.030 Discharge Coefficient 0.600							
Node Voided Subbase Central Offline Orifice Control									
Flap Valve x Loop to Node Voided Subbase West Invert Level (m) 3.095		Diameter (m) 0.040 Discharge Coefficient 0.600							
Node Voided Subbase West Online Hydro-Brake® Control									
Flap Valve x Replaces Downstream Link x Invert Level (m) 2.960 Design Depth (m) 0.100 Design Flow (l/s) 1.0		Objective (HE) Minimise upstream storage Sump Available ✓ Product Number CTL-SHE-0059-1000-0100-1000 Min Outlet Diameter (m) 0.075 Min Node Diameter (mm) 0							

Node Voided Subbase East Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	4.164
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	1559.0	3366.0	0.370	1559.0	3443.1	0.371	0.0	3443.1

Node Voided Subbase Central Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	3.095
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	761.0	761.0	0.340	761.0	794.2	0.341	0.0	794.2

Node Voided Subbase West Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	2.960
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	850.0	3366.0	0.340	850.0	3443.1	0.341	0.0	3443.1

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute summer	Voided Subbase East	1440	4.241	0.077	1.7	35.9065	0.0000	OK
1440 minute summer	Voided Subbase Central	960	3.159	0.064	1.4	14.7244	0.0000	OK
2160 minute summer	Voided Subbase West	1380	3.028	0.068	1.4	17.4956	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
2160 minute summer	Voided Subbase East	Orifice	Voided Subbase Central	0.5	51.7
1440 minute summer	Voided Subbase Central	Orifice	Voided Subbase West	0.7	59.4
2160 minute summer	Voided Subbase West	Hydro-Brake®		1.0	94.4

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	Voided Subbase East	1020	4.261	0.097	2.9	45.2641	0.0000	OK
960 minute winter	Voided Subbase Central	735	3.174	0.079	1.5	18.1062	0.0000	OK
960 minute summer	Voided Subbase West	855	3.046	0.086	2.4	21.9926	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
1440 minute summer	Voided Subbase East	Orifice	Voided Subbase Central	0.5	52.5
960 minute winter	Voided Subbase Central	Orifice	Voided Subbase West	0.8	63.1
960 minute summer	Voided Subbase West	Hydro-Brake®		1.0	82.4

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	Voided Subbase East	585	4.357	0.193	7.4	90.4206	0.0000	OK
720 minute winter	Voided Subbase Central	705	3.251	0.156	3.2	35.7152	0.0000	OK
960 minute winter	Voided Subbase West	945	3.143	0.183	3.2	46.9469	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
600 minute winter	Voided Subbase East	Orifice	Voided Subbase Central	0.8	62.0
720 minute winter	Voided Subbase Central	Orifice	Voided Subbase West	1.2	94.6
960 minute winter	Voided Subbase West	Hydro-Brake®		1.3	127.4

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	Voided Subbase East	705	4.409	0.245	8.0	114.8928	0.0000	OK
960 minute winter	Voided Subbase Central	930	3.304	0.209	3.3	47.9440	0.0000	OK
960 minute winter	Voided Subbase West	930	3.186	0.226	4.0	57.9138	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
720 minute winter	Voided Subbase East	Orifice	Voided Subbase Central	0.9	76.0
960 minute winter	Voided Subbase Central	Orifice	Voided Subbase West	1.2	117.2
960 minute winter	Voided Subbase West	Hydro-Brake®		1.4	142.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	Voided Subbase East	705	4.529	0.365	11.6	171.2798	0.0000	OK
1440 minute winter	Voided Subbase Central	1410	3.433	0.338	3.4	77.5326	0.0000	OK
960 minute winter	Voided Subbase West	930	3.281	0.321	5.4	82.3116	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Discharge Vol (m³)
720 minute winter	Voided Subbase East	Orifice	Voided Subbase Central	1.1	96.3
1440 minute winter	Voided Subbase Central	Orifice	Voided Subbase West	1.3	161.4
960 minute winter	Voided Subbase West	Hydro-Brake®		1.7	169.2

Appendix 6

Interim Drainage Management and Maintenance Plan

Interim Drainage Management and Maintenance Plan



Project	Sefter Farm South Pagham Rd, Bognor Regis, West Sussex
Project Number	23995

By Steve Doughty

Date 13 March 2025

1 Introduction

- 1.1 This Interim Drainage Management and Maintenance Plan has been prepared as the initial draft of the document that will become the Drainage Maintenance and Management Manual.
- 1.2 The Drainage Maintenance and Management Manual will be completed as part of the Operation and Maintenance Manual to be provided by the Principal Contractor on completion of construction.
- 1.3 The Drainage Maintenance and Management Manual will be handed over to the Site Operator on project completion.
- 1.4 The Drainage Maintenance and Management Manual will remain a live document and will be used to guide and record the maintenance and management of the surface water drainage system.

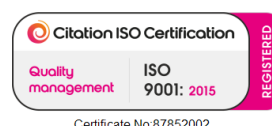
2 During Construction

- 2.1 Once appointed the Contractor will prepare a site specific method statement for the control of silt and other pollutants during construction. CIRIA Report C532, Control of water pollution from construction sites, provides further guidance on this.
- 2.2 The Contractor will maintain the proposed drainage system during construction and until the handing over of the site.

3 Surface Water Drainage System

3.1 Overview

- 3.1.1 The surface water drainage system has been designed as a Sustainable Urban Drainage System (SuDS)



- 3.1.2 The system has been designed to collect surface water from the roof of the new extension and discharge it to the existing surface water collection network for reuse within the existing site wide irrigation system.
- 3.1.3 The proposed hardstanding areas have been designed with a voided subbase providing storage which will discharge treated surface water at a restricted rate to the Pagham Rife via the existing onsite drainage system.

3.2 How the System Will Function

- 3.2.1 Surface water falling on the roof will be collected in gutters and discharged via rainwater pipes and below ground drainage pipes into the existing surface water irrigation network and pumped to the existing irrigation reservoir to the northwest of the site.
- 3.2.2 The existing chambers within the below ground pipe work system will trap silt and debris and provide a point of access for maintenance.
- 3.2.3 Surface water falling on the new hardstanding areas will be filtered through a voided subbase and discharged at a restricted rate to an open conveyance channel and via the existing onsite oil separator to the Pagham Rife.
- 3.2.4 These systems will provide water quality improvement to ensure that at the point of discharge the surface water has received suitable pollution mitigation.

4 Schedule of Maintenance

4.1 Management of the drainage facilities will be undertaken by the Site Operator.

4.2 There are three categories of maintenance activities:

- **Regular maintenance**

Basic tasks undertaken on a frequent and predictable schedule, including vegetation management, litter and debris removal, and inspections.

- **Occasional maintenance**

Tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example).

- **Remedial maintenance**

Intermittent tasks that may be required to rectify faults associated with the system. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.

4.3 The following maintenance schedule details the typical tasks to be undertaken at different intervals.

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Manage vegetation and remove nuisance plants - aesthetics	As required
	Litter and debris removal - catchpits and drainage ditch	Monthly or as required
	Maintain drainage ditch to ensure vegetation height remains at between 100mm and 150mm	Monthly or as required
	Cleaning of gutters and any filters on downpipes	3 Monthly
	Remove sediment and debris from silt trap chambers, channel drains and inlet chambers	6 monthly
	Surface water pipework - jetting / rodding	Every 2 years or as required
Occasional Maintenance	Remove silt and debris from oil interceptor	When alarm indicates
Corrective Maintenance	Remove debris / blockages to silt traps / channel drains / headwalls	As required
	Repairs to access chambers / manhole covers	As required
	Inspect inlet, outlet from downpipes, channel drains, drainage ditch, headwalls and gullies for blockages, standing water and clear	As required
	Where there is a build-up of silt in drainage ditch or at inlets of 50mm or more above the design level remove silt and spread on site. Undertake when ground is damp in autumn or early spring and transplant turf / overseed to original design levels	As required
Monitoring	Inspect silt traps and note the rate sediment has accumulated	Monthly in the first year and then annually

Indicative Schedule of Maintenance for the Proposed Drainage System

Component	Inspection Frequency						
	1 Month	3 Months	6 Months	1 Year	After leaf fall in Autumn	2 Years	When alarm indicates
Gullies, Channels and Gutters		✓			✓		
Catchpits	✓				✓		
Surface and Foul Water Pipework						✓	
Drainage Ditch		✓					
Flow Controls			✓				
Oil Interceptor				✓			✓

Inspection Frequency Summary

5 Regular Maintenance Procedures

5.1 The following procedures provide a guide to the two most common maintenance items, jetting and silt removal, to be undertaken on site:

5.2 Jetting

5.2.1 Equipment Required:

- High-pressure water jetting equipment.
- Personal protective equipment (PPE) for operators.

5.2.2 Typical Procedure:

- Perform a pre-jetting inspection to assess the level of sedimentation.
- Insert the jetting hose into the pipe, starting from the upstream end.
- Gradually move the jetting hose downstream, ensuring the entire pipe or structure length is cleaned.
- Monitor the process to avoid any damage to the drainage infrastructure.
- Collect dislodged silt and debris at the downstream end using a vacuum or manual removal.

5.3 Silt Removal and Disposal

5.3.1 Equipment Required:

- Vacuum truck or manual removal tools.
- Containers for temporary storage of silt and debris.

5.3.2 Typical Procedure:

- Collect the dislodged silt and debris from the downstream end of pipe or structure.
- Transfer the collected material to the containers.
- Dispose of the collected silt and debris following local regulations and environmental guidelines.

6 Financing

6.1 The regular and corrective maintenance of all elements of the drainage system will be managed and funded by the Site Operator.

7 Health and Safety

7.1 Designers Residual Risks

- 7.1.1 There are no significant residual risks associated with the construction of the proposed surface or foul water drainage network beyond common site risks that would reasonably be anticipated by a competent Civil Engineering Contractor.

7.2 Construction Phase

- 7.2.1 The Principal Contractor will undertake a construction phase Health and Safety Plan for the site.
- 7.2.2 Prior to handover the Principal Contractor will undertake a review of maintenance activities required and prepare suitable Health and Safety documentation as part of the site hand over documents.

8 Design Life

- 8.1 The design life of the development is likely to exceed the design life of the components within the SuDS network. During the routine drainage inspections it may be determined that some components have reached the end of their functional life cycle.
- 8.2 Where possible repairs should be the first option considered however if repairs are unviable it will be necessary for the Site Operator to arrange for the replacement of the faulty component.

9 Emergency Plan

9.1 Potential flood and maintenance indicators:

- Manholes or inspections chambers overflowing
- Gullies overflowing or ponding
- Channel drains overflowing or ponding
- Other visual indicators of the drainage system not performing as it should

9.2 Should any of the items above occur then immediate action as outlined below should be undertaken:

- Inspect for blockages in the problem area
- Should the problem not be identified via an initial inspection the site operator should appoint a suitable drainage engineer to inspect and survey the system and jet any blockages
- Where it is suspected that there is a problem with the downstream drainage network the Owner or relevant statutory undertaker of that system should be alerted

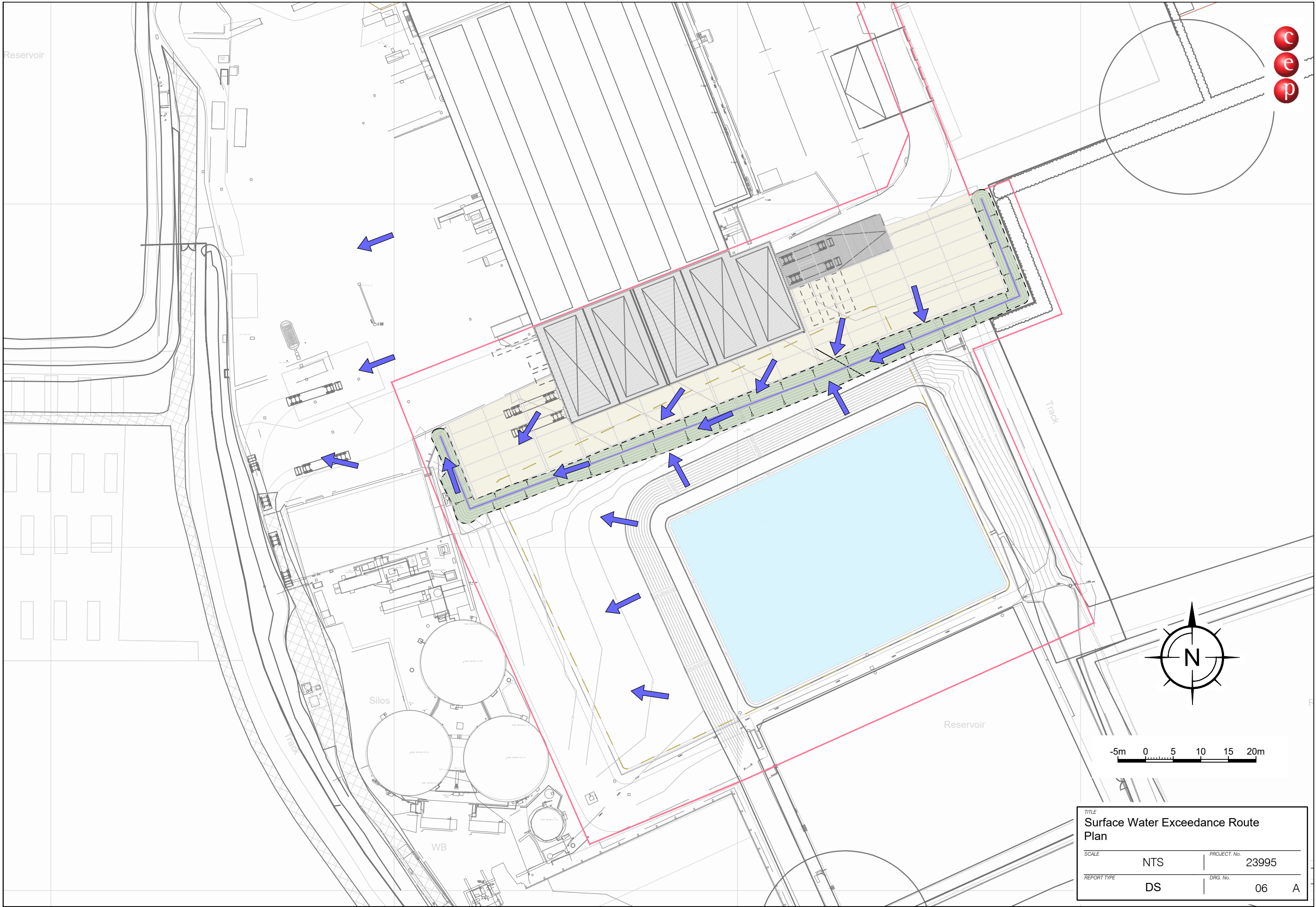
9.3 Emergency Contact Details

9.3.1 Maintenance Team

TBC

Appendix 7

Surface Water Exceedance Route Plan



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TITLE			
Surface Water Exceedance Route Plan			
SCALE	NTS	PROJECT No.	23995
REPORT TYPE	DS	DRG. No.	06 A