AESC Plant 3, Sunderland

03/01/2024

Reference number 22A29 - R001

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

AESC PLANT 3, SUNDERLAND

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IDENTIFICATION TABLE	
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APPROVAL

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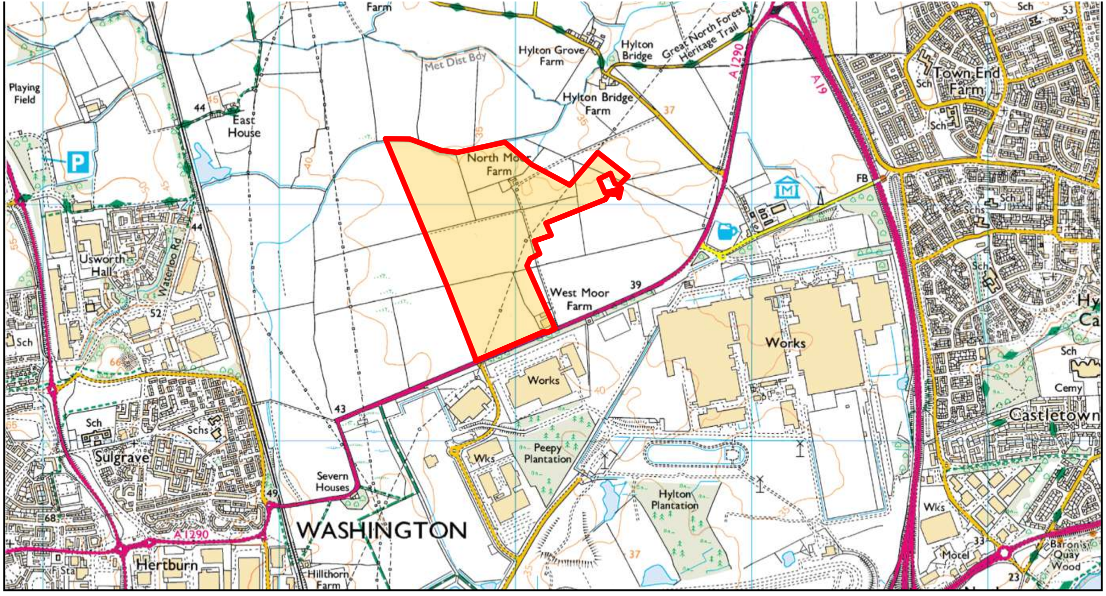
1. INTRODUCTION

1.1 Background

1.1.1 AESC UK proposes to develop a second battery factory (AESC Plant 3) and warehouse on farmland immediately west of their AESC Plant 2 development that is currently under construction. The site is partially located within the boundaries of the International Advanced Manufacturing Park (IAMP) ONE Phase 2 on land north of the Nissan UK's Sunderland factory.

1.1.2 The site is located north of the A1290 Washington Road. The former West Moor Farm (now demolished) was nearby to the east. North Moor Farm is close to the northeast corner of the site. The location of AESC Plant 3 is shown on **Figure 1.**

Figure 1. Site location



Source: Ordnance Survey. Crown Copyright reserved.

1.2 Scope of Report

1.2.1 The purpose of this assessment is to develop a full appreciation of possible flood risks to the development and to other properties in the surrounding areas that may be affected as a result. It describes the strategy for managing the drainage needs of the proposed scheme in order to satisfy the requirements set out in '*National Planning Policy Framework*' (1) and '*Planning Practice Guidance*' (2) together with the specific requirements of the Environment Agency (EA) and Lead Local Flood Authority (LLFA) which in this case is Sunderland City Council (SCC).

2. SITE INFORMATION

2.1 Site Description

2.1.1 The AESC Plant 3 site occupies approximately 32ha of arable farmland between the A1290 Washington Road and Usworth Burn, which flows eastward past the northern end of the site. The site abuts the AESC Plant 2 to the east and will share access onto International Drive with that development. Farmland and open ground lie to the west with the edge of Washington 1km away.

2.1.2 Part of the access route to the Proposed Development also passes through the IAMP ONE area where both Plants 2 and 3 will share an access route onto International Drive. The majority of the Plant 3 scheme lies outside of the IAMP limits. Part of the Plant 3 site boundary overlaps with the planning application boundary for AESC Plant 2, which is now under construction. The majority of the Plant 3 scheme lies outside the area allocated for development within the IAMP Area Action Plan and on land designated, and implemented, as an Ecological and Landscape Mitigation Area.

2.1.3 The Usworth Burn and River Don both pass to the north of the site. A series of field-boundary ditches are currently draining the land, part draining northwards into the Burn and part flowing south to discharge into a dyke and culvert that runs along the southern side of the A1290.

2.1.4 The A1290 is to be widened to a dual carriageway as part of the Early Infrastructure and Northern Employment Area planning permission.

2.2 Site topography and land drainage

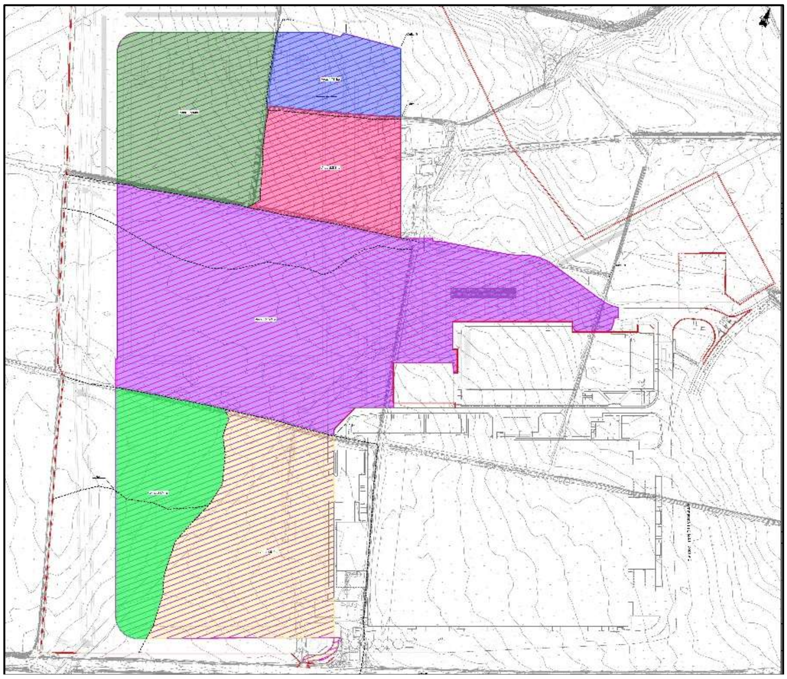
2.2.1 A survey of existing land levels is shown on drawings 22A29-FRA-TOPO-01 and 02 in **Appendix A**. A plan showing how the land splits into a series of sub-catchments is shown in **Figure 2** (extract of SYSTRA drg nr 21B34-SYS-HDG-Z0-DR-CH-02-500).

2.2.2 The proposed development land is bisected by two land-drains running east to west, though the eastern ends of these have been affected by the Plant 2 development. Drains also run south to north. The central and northern areas drain northwards to the Usworth Burn upstream of its confluence with the River Don near Hylton Bridge, north-east of the site. The south-western section of land is believed to drain to a low point north-west of the former West Moor Farm. The wider drainage pattern in this part of the site sees the land drain to an open drain that runs along the southern side of A1290 Washington Road. The drain appears to reach a summit opposite the Farm's site and flows away both eastwards and westwards from this point.

2.2.3 The site levels sit mostly between 38-40mOD, falling to around 37mOD at North Moor Farm.

2.2.4 The site's contour pattern is included on SYSTRA drawings nr 22A29-FRA-TOPO-01 and 02 in **Appendix A**.

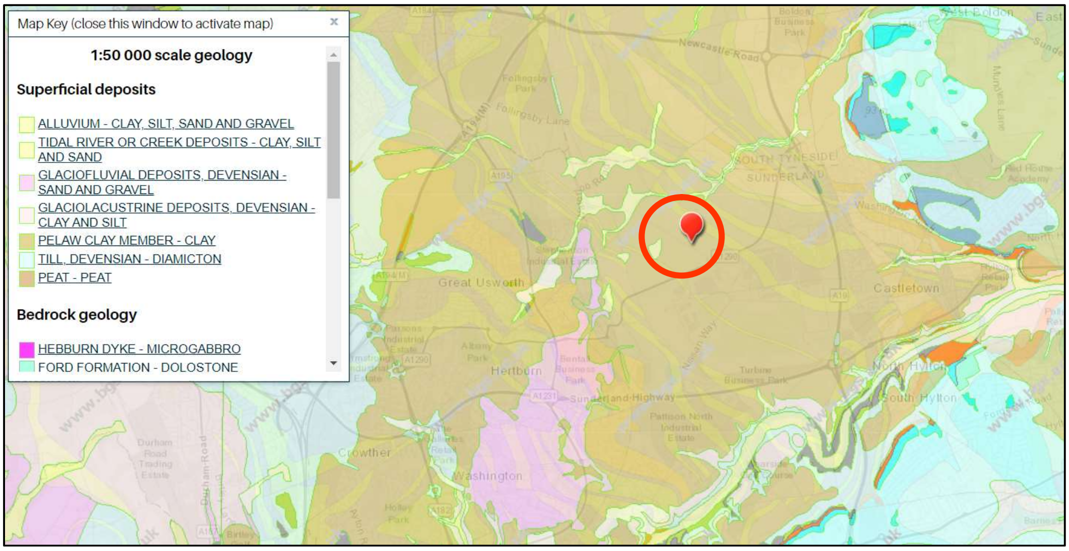
Figure 2. Existing land drainage sub-catchments



2.3 Ground conditions

2.3.1 Publicly-available records from the British Geological Survey (**Figure 3**) indicate the superficial geology to be Pelaw Clay. Site-investigations (6) in 2017 on the eastern part of the site within the original IAMP ONE extent recorded slightly sandy or gravelly clay or silty clay over mudstone or sandstone: the corresponding borehole logs are included for information in **Appendix B**. Where granular material (gravel) was present, this was at depths below which soakaway structures would be practicable and which were below such groundwater levels as were recorded.

Figure 3. Superficial surface geology



Source: British Geological Society website, 2019

2.3.2 More recently, a study by RPS (15) described the general ground conditions as "… *underlain by … … the Pennine Middle Coal Measures Formation, and also Alluvium, mapped across the northern site boundary. Superficial Deposits including Pelaw Clay, Laminated Clay and Glacial Till represent unproductive strata overlying the bedrock of variable thickness.*"

2.3.3 Past observations of the general behaviour of the land noted surface ponding on the fields at local low spots during heavy or prolonged wet weather. Soakaway tests across the IAMP ONE area returned permeability factors no higher than $5x10^{-7}m/s$. This is reflected in observations of the area's behavior during and after prolonged wet weather where surface ponding is a frequent result.

2.3.4 The site is located outside of any groundwater source protection zone. The nearest potentially sensitive groundwater abstraction is a fish farm about 2km north of the site.

2.4 Surface Water Features

2.4.1 Usworth Burn runs eastwards passing the north edge of the site, joining the River Don approximately 460m from the northern corner of the site. The River Don continues to the east passing through Hylton Bridge nearby and then passing beneath the A19 immediately downstream of an old railway bridge across the river. It eventually discharges to the River Tyne in Jarrow. The Burn's flood behavior is addressed in more detail in Section 4.

2.4.2 A pond is recorded on early mapping close to North Moor Farm but later maps suggest that it was filled in during the early 1900s,

2.4.3 A ditch runs alongside the A1290 past the site's southern boundary flowing eastwards into a piped culvert that follows Washington Road beyond the Nissan entrance or westwards to discharge to a small tributary stream to Usworth Burn west of Cherry Blossom Way.

2.4.4 The site is crossed by a number of ditches which convey flows in different directions; the main falls across the site are northern-east towards the Usworth Burn or, for the southern part, eastwards toward International Drive. There is a small ditch flowing towards the north which continues beyond the site's northern edge and discharges into Usworth Burn. The south-west corner of the site drains toward the eastern edges. There are no other surface water-features of note within or close to the proposed development site.

2.5 Drainage Infrastructure

2.5.1 There are no public surface water or foul sewers within the site. The two farmsteads are believed to have relied upon septic or cess tanks for their domestic drainage. The nearest public sewers are those laid for the AESC Plant 2 and IAMP ONE. Those were designed to serve only the IAMP project and made no allowance for any further development outside of the IAMP limits. There are trunk sewers to the west at the edge of the Washington urban area and those drain southwards to a sewage treatment works south-east of Barmston.

2.5.2 The A1290 highway drainage discharges into an open drain along the south side of the road which flows away from a high point opposite West Moor Farm, eastwards towards the culverted watercourse along Washington Road or westwards towards Washington and Cherry Blossom Way.

3. REGULATORY REQUIREMENTS

3.1 Environment Agency

3.1.1 The Environment Agency (EA) is the drainage authority for the River Don and Usworth Burn which are both designated 'main river'. Their main interest is in the fluvial flood-risk management for the development and compliance with the Water Framework Directive (WFD) (9).

3.1.2 With regard to the WFD, the Northumbria River Basin Management Plan (10) deems the site to be split between the Don and the Wear Lower & Estuary surface-water units. This corresponds with the topography of the site and the split between those two destinations. There is no local groundwater unit.

3.1.3 A Water Framework Assessment (11) produced for the overall IAMP development did not record any additional constraints upon the scheme that impact specifically upon this scheme.

3.2 Lead Local Flood and Planning Authorities requirements.

3.2.1 SCC is the LLFA and LPA for this site as it sits entirely south of the River Don (the boundary with South Tyneside Council). The land drains are classed as 'ordinary watercourses' and fall under their oversight. As LLFA, they are also a statutory consultee to the planning process.

3.2.2 The most recent version (12) of their Strategic Flood Risk Assessment (SFRA) was published in 2017.

3.2.3 The SFRA mentions the IAMP development, principally referring to it in respect of a 2016 Flood Risk and Water Management Report (4) produced as part of the IAMP AAP. The SFRA highlighted four key objectives for drainage strategy and flood-risk management for the IAMP project drawn from this document, of which three are pertinent to this particular site:

- Managing flood risk from large paved areas.
- Controlling run-off from new development.
- Managing water quality of development run-off.

3.2.4 SCC, in its role as LLFA, maintains a Local Flood Risk Management Strategy (13). This sets out a series of measures to manage flood risk of which the following are pertinent to this site:

- Development drainage on greenfield sites should be designed to discharge at greenfield run-off rates for the 1 in 1-year and 1 in 100-year rainfall events.
- Greenfield (and brownfield) sites should be checked on a 6-hour rainfall duration and any flooding constrained within the development site, causing no flooding to any buildings. Such flood water must be able to enter back into the system.
- Major Planning Application schemes should include some form of SuDS attenuation and source control.

3.2.5 The LFRMS identifies part of IAMP TWO as land where development potentially conflicts with known flood risk but that is outside the extent of this particular site.

3.2.6 SCC's Local Plan includes two documents which have some bearing on this assessment:

- The Core Strategy and Development Plan (CSDP) (14) which sets out the overarching spatial strategy for development within the city from 2015-2033, adopted in 2020.
- The IAMP AAP (3) which was prepared jointly by SCC and STC and adopted in 2017.

3.2.7 The CSDP includes a series of policies relating to drainage and flood risk:

- WWE2 Flood Risk and Coastal Management.
- WWE3 Water Management
- WWE4 Water Quality
- WWE5 Disposal of Foul Water

3.2.8 Policy WWE2 broadly restates principal elements of the general thread for flood-risk management from NPPF (1). It also requires development to contribute to the objectives of the local river basin management plan and to utilise SuDS measures as part of wider 'green infrastructure' systems. Policy WWE3 requires development to demonstrate that it passes the Sequential Test for flooding, to match greenfield run-off rates for surface drainage at the 1-year and 100-year return periods and to apply suitable provision for climate-change effects.

3.2.9 Policy WWE4 obliges development discharging to a watercourse to make appropriate pollution control measures. Policy WWE5 sets out a hierarchy of preference for sewage disposal from new development. The full text of all four policies is included in **Appendix C** for reference.

3.3 Northumbrian Water

3.3.1 NWL is the incumbent sewer authority. Any new trunk foul sewer serving the AESC Plant 3 site that are to be adopted will comply with the Sewerage Sector Guidance (7), the current design standard for such works.

3.4 Other

3.4.1 A portion of the Plant 3 site is within the IAMP ONE scheme extent. The following reports were produced for the overall IAMP ONE development to inform earlier stages of the planning and design process related to flood risk and drainage matters:

- AAP Flood Risk and Water Management Technical Background Report (4).
- IAMP ONE: Environmental Statement: Chapter I: Water resources & flood risk (5).

4. PROPOSED DEVELOPMENT

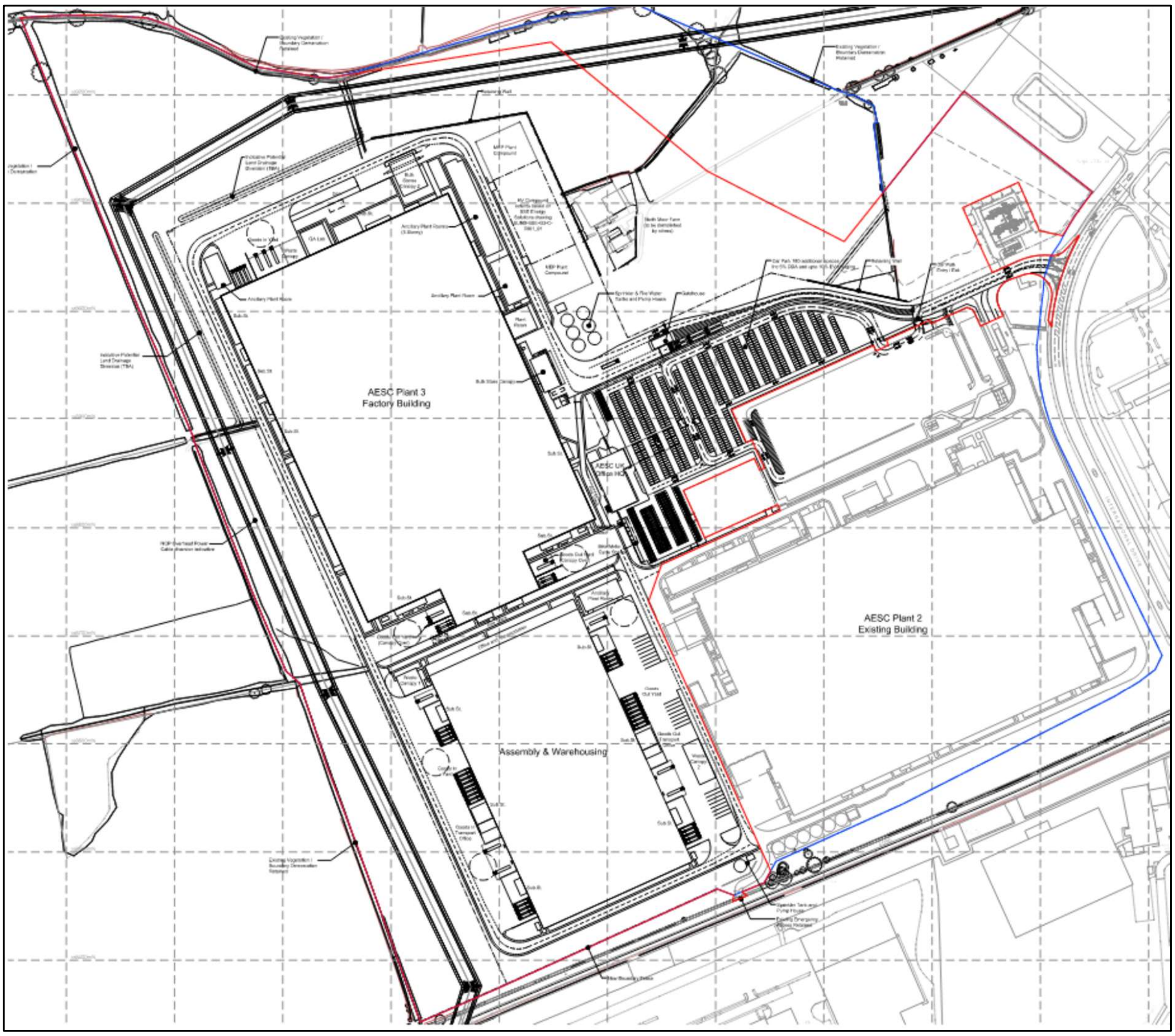
4.1 Introduction

4.1.1 The proposed development comprises erection of a building to be used for the manufacture of batteries for electric vehicles, an assembly & warehousing building, an office building, a sub-station, gatehouse, ancillary compounds/structures and associated infrastructure provision, access, parking, drainage and landscaping. The proposed layout is shown in **Figure 4** which also shows the adjacent Plant 2, currently under construction. The diverted

National Grid power lines run alongside the western and northern sides of the proposed development. A larger plan is included in **Appendix A**.

4.1.2 The facility will employ up to 1,900 staff across the factory, warehouse and office.

Figure 4. Proposed layout including AESC Plant 2



Source: IAMP AAP

4.2 Planning Context

4.2.1 The proposed development will use certain hazardous substances, the presence of which will classify the development as '*highly Vulnerable*' according to Table 2 from the flood management section of the PPG website. The offices and sub-station elements of the scheme are classed as '*less vulnerable'*.

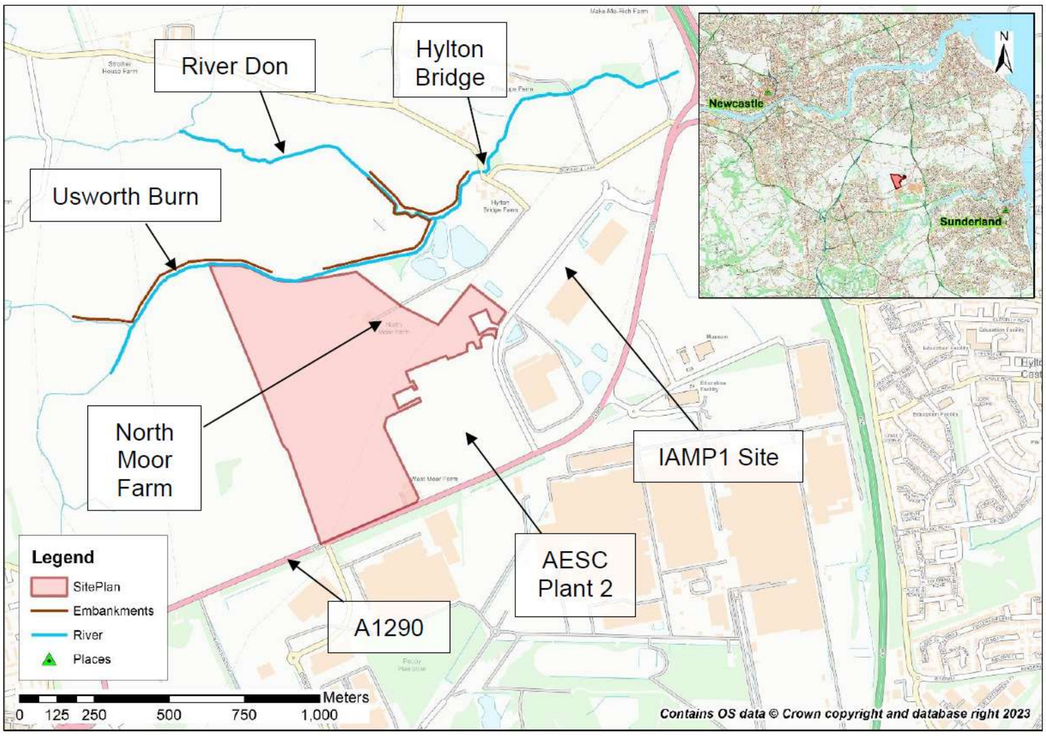
5. FLOOD RISK ASSESMENT

5.1 Existing flood risk

Fluvial Flooding

5.1.1 A small river known as Usworth Burn runs north of the site, flowing eastwards. The Burn converges with the River Don west of Hylton Bridge where Follingsby Lane crosses the Don. The river continues eastwards and passes beneath the A19 just north of the A19/A1290 Downhill Lane junction. These features are located as shown in **Figure 5**.

Figure 5. **Usworth Burn and River Don**



Source: JBA report 2023

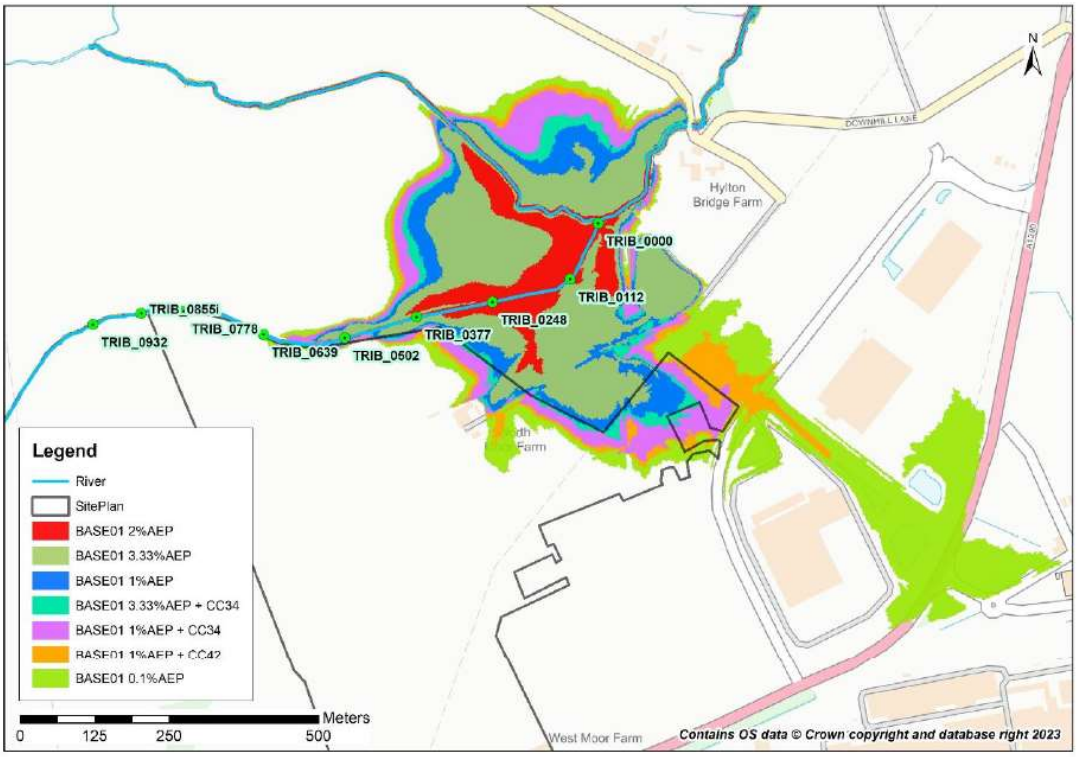
5.1.2 The EA's indicative flood mapping of the Don and the Burn was too coarse to be relied upon for the purposes of flood risk assessment for the project. A detailed river model was originally compiled to provide detailed forecasts of the design flood extents in order to inform the flood risk assessment process for the IAMP scheme. This model has been reused and updated as appropriate to provide site-specific flood level information for the AESC Plant 3 scheme. JBA's report (8) contains full details of the modelling work and results and is included in **Appendix D**.

5.1.3 Selected present-day and future flood extents across and close to the proposed development together with the proposed development planning boundary are shown in **Figure 6**.

5.1.4 The present-day 1% AEP flood reaches the planning outline of the proposed development either side of North Moor Farm and extends across this boundary north of the proposed parking area. The design flood including for the effects of climate change (1% AEP+CC34) encroaches slightly further onto the margins of the proposed planning area either side of North Moor Farm and towards International Drive. These areas are outside of the developed footprint and will be retained as part of the scheme's landscaping works. These areas lie to the north-east of the main buildings and the predicted flood flows are contained within the Burn's channel where it passes north of the proposed development.

5.1.5 The Usworth Brun is part of the Tyne Management Catchment for the purposes of deriving climate-change allowances. Allowances have been based on the 2080s epoch in view of the proposed lifetime of the facility. A 34% (Central) allowance is appropriate for the AESC Plant 3 site, if (as expected) it is categorised as '*Highly Vulnerable*'. The modelling also tested a 42% allowance (Higher Central) to provide design levels if the development were to be classed as '*essential infrastructure*'.

Figure 6. Existing and future Usworth Burn flood extents

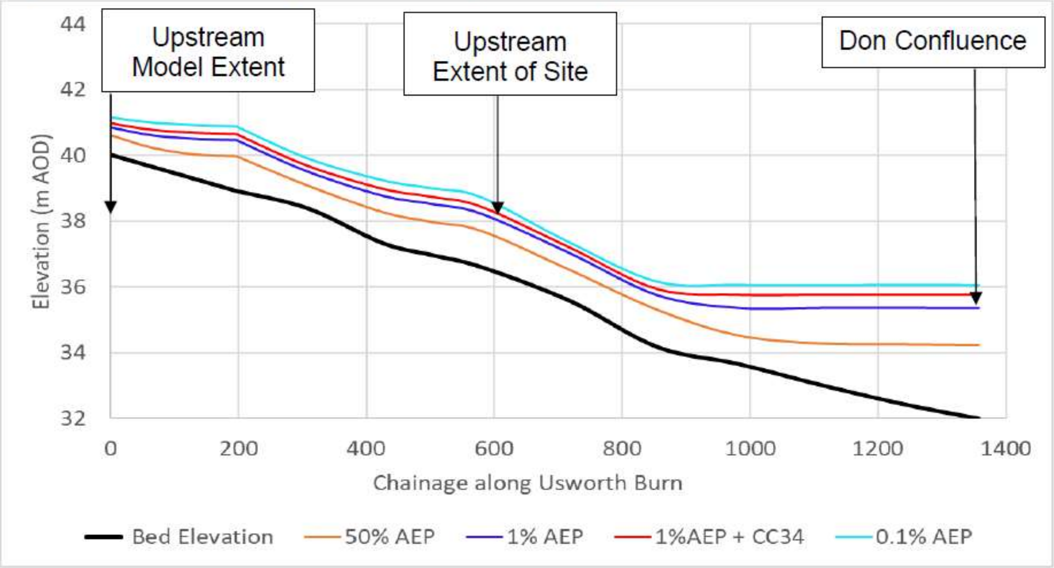


Source: JBA report, 2023

5.1.6 Almost all the proposed development sits within the low-risk category of Flood Zone 1. Flood Zone 2 encroaches onto the north-eastern end of the proposed development and affects part of the site entrance off International Drive. Flood Zone 3A extends onto the landscaped margins of the proposed development but does not reach the proposed buildings.

5.1.7 The flooding is driven mainly by the restriction to flow at Hylton Bridge as is shown in the series of water-level profiles shown in **Figure 7**. The constraints imposed by the A19 culvert do not overly influence flood levels this far upstream: peak flood levels at the design-flood level of severity are about 1m lower upstream of the A19 than upstream of Hylton Bridge.

Figure 7. Flood profiles along Usworth Burn



Source: JBA report 2023

5.1.8 Key flood levels from the river modelling are shown in **Table 1**. The node locations can be seen on Figure 6. 0855i is opposite the north-western corner of the main buildings. 0502 is roughly opposite the north-eastern corner and 0248 is opposite North Moor Farm. This latter node correlates to the backed-up section of the flood profile, upstream of Hylton Bridge.

Table 1. Selected flood level forecasts

NODE	1% AEP	1%NAEP + CC34%	0.1% AEP
0855i	38.52mOD	38.74mOD	39.00mOD
0502	35.74	35.93	36.15
0248	35.35	35.76	36.05

5.1.9 The design life of the development exceeds 50 years so allowances from the 2080s column have been used.

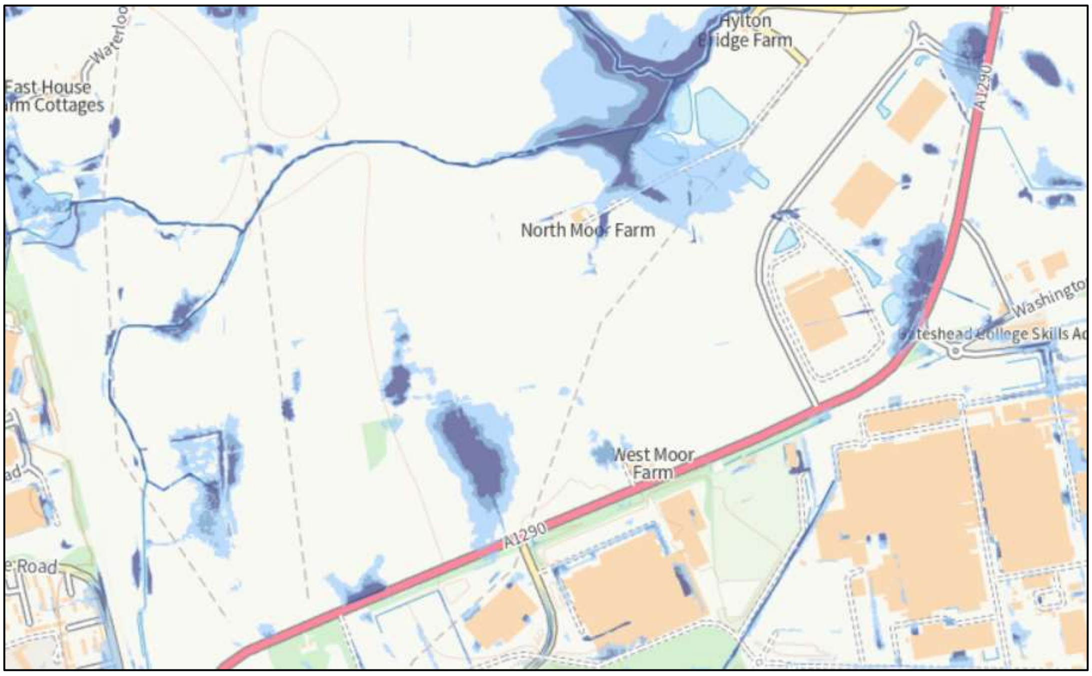
5.1.10 The modelling included existing flood defences within the model: a comparison was made omitting those defences but showed no meaningful difference in results at design flood levels. This is due to the low standard of protection afforded by those features: they are overwhelmed at the design flood conditions.

5.1.11 Overall, there is only a **VERY LOW** risk of fluvial flooding at present with all but a small area of the proposed development located in Flood Zone 1. There is a very low residual risk of flood flows crossing the eastern end of the site and continuing down to the A1290 and across to Washington Road and towards the Nissan factory.

Surface Water Flooding

5.1.12 The at-risk areas affected by surface flooding largely align with those affected by fluvial flooding. **Figure 8** shows the EA's indicative mapping for surface flooding across proposed development site. A localised low area on the western side of the site opposite the warehouse location is forecast to have a high risk of such flooding but the site is otherwise largely free of such risk.

Figure 8. **Flood risk from surface water**



Source: EA website, 2023

5.1.13 The AESC Plant 2 complex adjacent to the proposed development site creates a substantial paved and built area which potentially generates substantial quantities of run-off. That scheme includes new surface drainage designed to manage that run-off to the requisite standards and which therefore significantly reduces that risk.

5.1.14 A localised low area of high surface-flood risk is situated on the western side of the proposed site. The site is however otherwise largely clear of surface flood risk other than an area around North Moor Farm which is on the periphery of the proposed site.

5.1.15 Given those provisions, surface flooding is considered to present a **LOW** risk of flooding to the proposed development or neighbouring areas.

Artificial sources

5.1.16 There are no nearby artificial water bodies (e.g. canals, SuDS basins) beyond those created specifically for the IAMP scheme to the east. This potential source poses no material risk of flooding to the site.

Groundwater flooding

5.1.17 Groundwater is not considered to pose any meaningful risk of flooding to the site. The physical nature of the soils locally does not permit ready movement of groundwater and there is no underlying mobile water table that would be expected to rise to the surface. The risk of flooding to the site from groundwater is considered **NEGLIGIBLE**.

Drainage flooding

5.1.18 The closest location of any known sewer flooding issues was on Washington Road adjacent to the former Three Horse Shoes Public House opposite the air museum. This was understood to be caused by or exacerbated by land-drainage flows that were culverted west of the pub and discharged into piped drains running along Washington Road, as well as local deficiencies in the pipe works themselves. Such flooding is too far away to pose any risk to the site or cause any significant interference with off-site access.

5.1.19 The main surface water sewer close to the site is the new drainage system to serve the AESC Plant 2 development, currently under construction. The new drainage is designed to convey flows up to and including the 1 in 100-year event with a 40% climate change allowance.

5.1.20 There are no recorded instances of flooding on the A1290 from the highway drainage network in the vicinity of the site.

5.1.21 Drainage flooding is not considered to present anything more than a **VERY LOW** risk of flooding to the site or its accesses.

Summary

5.1.22 The main risk of flooding to the existing site arises from surface flooding on a localised low area straddling the south-west boundary of the proposed development. The Usworth Burn will flood peripheral areas either side of North Moor Farm but such flooding will not extend any significant distance into the body of the site. Such flooding only occurs at or around the design flood standard. The probability of flooding from any source other than the localised high-risk surface flooding occurrence is no more than **LOW**.

5.2 Post-development flood risk

Fluvial flooding

5.2.1 The proposed buildings and ancillary elements do not encroach onto the current or future Flood Zone 3. The peripheral parts of the site which are predicted to be affected at the design standard are to be part of the scheme's landscaping and will not be altered in terms of ground level. The fluvial floodplain will therefore not be altered. A plan showing the proposed development layout together with the modelled flood extents is included in **Appendix A**.

5.2.2 The site access off International Drive and a new sub-station are proposed within Flood Zone 2 and their finished levels will be set above the 0.1% flood levels. In the event that the access is obstructed for any reason, a back-up access is available at the south-east corner of this development onto the A1290. That is located in Flood Zone 1.

5.2.3 The floor levels for the new development are to be set at 39.0mOD. This is generally well above the design flood level (1% + CC) as per the levels in **Table 1**. It is only in the north-west corner of the site that the design flood profile rises to within 0.6m of the proposed floor level. The design flood level quickly falls away as the Burn runs eastward and at the north-east corner of the main factory building the flood level opposite that point is below 36mOD, 3m below the floor level. The Burn is confined even in flood within its channel at the north-west corner of the site and in this situation the floor level chosen is considered reasonable in relation to the modelled design flood profile.

5.2.4 The provision of a new surface drainage system to serve the proposed development will manage the risk of increased fluvial flooding downstream and prevent any increase in such flooding up to the requisite design standard.

5.2.5 These provisions mean that the post-development peak flood levels will be unaltered from the pre-development behaviour. The risk of fluvial flooding to or exacerbated by the proposed development remains **VERY LOW**.

Surface Water Flooding

5.2.6 The risk of external surface flooding affecting the proposed development is minimal due to the absence of large paved areas surrounding the proposed development that would shed run-off quickly onto the site.

5.2.7 The proposed development creates significant areas of paved surface and building roofs. This significantly increases the rate of run-off from the site but the provision of a new surface drainage system as part of the development will collect and manage that run-off and setting of floor levels higher than external surfaces will prevent the risk of internal flooding in such conditions. There is a residual risk of increased run-off and surface flooding at storm conditions above the drainage design standards but the levels of such risk are **LOW**.

5.2.8 Surface flooding is considered to continue to pose a **LOW RISK** of flooding overall for the site's developed form given the provision of a new drainage system to drain the scheme.

Groundwater Flooding

5.2.9 The proposed development will harden the majority of the site surface and divert rainfall away from soaking into the ground and into the new surface drainage system. This is not considered to materially alter the local groundwater behaviour given how poorly permeable is the superficial material. Any water ponding on adjacent waterlogged ground that spills onto the development if ground levels permit will be collected by the drainage system.

5.2.10 Any use of piled foundations may intrude into lower strata (e.g. sandstone) which may be more porous but are not considered to cause any material interference with the movement of groundwater in those layers as the likely spacing of such elements will be widely spread.

5.2.11 Groundwater is considered to continue to pose a **NEGLIGIBLE** risk of flooding for the proposed development.

Artificial Flooding

5.2.12 As noted earlier, this potential source is not relevant here.

Drainage flooding

5.2.13 The risk of flooding from existing off-site sewers remains no more than **LOW**. Those locations where sewer flooding has previously been reported are remote from the site and are unaffected in turn by the new development. New drainage systems provided for the proposed development itself have been designed to conform to the relevant design standards for drainage – 100-year return period plus 45% allowance for future climate change. Those systems are described in more detail in **Section 6**.

5.2.14 There is a residual risk of sewer flooding during storm conditions above the drainage design standards but the levels of such risk are **VERY LOW**.

Summary

5.2.15 The majority of the proposed development site sits within Flood Zone 1, at LOW risk of fluvial flooding from the Usworth Burn. Peripheral areas around North Moor Farm and alongside the site access from International Drive sit within Zones 2 or 3, where the risk rises to HIGH. These latter areas will be used for landscaping purposes and the new buildings are all situated in Zone 1.

5.2.16 The provision of new drainage will manage the risk of increased run-off rates from the scheme discharging into the Burn and worsening fluvial flooding downstream. The same provision will also manage the risk of surface flooding on site from the new paved and built areas and the risk of drainage flooding from the new systems. The new scheme removes a high-risk area of surface flooding within site limits as a result of the new earthworks and site levels.

5.2.17 Groundwater remains as a NEGLIGIBLE risk of flooding, as does the risk originating from artificial sources.

5.2.18 Overall the risk of flooding to or originating from the proposed development is no greater than **LOW**.

5.3 Sequential Test & Planning Context

5.3.1 The proposed development site lies almost wholly within Flood Zone 1. Those areas that fall within Flood Zones 2 and 3 are mainly used for landscaping and retained in their current landform. The positioning of development follows the sequential approach and therefore the Sequential Test is considered to be satisfied.

5.3.2 The proposed development is classed as '*highly vulnerable*' in terms of its sensitivity to flooding. This category is compatible with the development's location in Flood Zone 1, according to Table 2 *Flood risk vulnerability and flood zone 'incompatibility'* from PPG (Flood Risk and Coastal Change). No exceptions test is needed.

6. DRAINAGE STRATEGY

6.1 Existing site surface water run-off

6.1.1 The existing topography of the AESC Plant 3 site splits into two catchments that drain in different directions as shown previously in **Figure 2**. Part of the site naturally drains to Usworth Burn via a land-drain network running northward (Outfall 1) whilst the remainder drains via the IAMP ONE drainage system that the Plant 2 drainage connects to (Outfall 2).

6.1.2 The local greenfield run-off rate has previously been agreed as a $\mathbf{Q_{BAR}}$ value of **3.8l/s/ha**. This corresponds to values of **3.3**, **6.7** and **8.0l/s/ha** for the 1-year, 30-year and 100-year storm return periods respectively. The proposed development land is no different in character from the IAMP areas and it is considered appropriate for the same values to be used in the drainage design for Plant 3.

6.2 Proposed drainage strategy

6.2.1 Detailed design of the proposed development drainage is described in RPS report *AESC GIGA FACTORIES PLOT 2 – PLANNING Drainage Strateg*y, October 2023. This is included in **Appendix E** for information.

6.2.2 The surface drainage strategy for this scheme takes the same approach as that used for Plant 2. The soil is predominantly clayey and poorly permeable, as described earlier. Those conditions do not support use of infiltration drainage for development drainage purposes. Such residual infiltration as may occur from un-lined drainage features will be minimal and has not been allowed for in design of the trunk surface-drainage system at this stage.

6.2.3 Permeability values recorded from site tests ranged from '*no result*' to $\mathbf{5x10^{-7}m/s}$. The latter values would class the ground as '*very poor infiltration*' (Table 25.1, SuDS Manual) and reflect the logged descriptions of the sub-soil as clay. The Manual suggests that residual infiltration from attenuation structures (e.g. permeable pavements, cellular tanks) can be considered for levels of permeability as low as $1x10^{-8}$m/s. No such allowance for residual infiltration has been incorporated in the detailed design.

6.2.4 The ground conditions within the proposed development parcel are too poorly permeable to enable meaningful use of infiltration within the drainage system to retain an initial 5mm of rainfall run-off in tandem with the other design requirements for the system. The nature of the site's usage and the residual risks of pollution to certain types of source-control SuDS features mean that a 'hard' drainage approach for run-off collection from parking and access areas is considered more appropriate in most areas.

6.2.5 Provision of green roofs to provide this function for the factory and warehouse was ruled out by the client due to the potential consequences of a leak given the site's usage. A green/ blue roof is proposed for the new office building.

6.2.6 As stated in the RPS report, "*… it is generally not feasible to retain the first 5mm of rainfall on site. Where practicable the impermeable surface areas have been kept to a minimum and where appropriate (e.g. AESC Office HQ roof) surfacing suitable to provide interception has* *been incorporated. A wide vegetative landscaping belt has been provided to the south, west and northern boundary. Gravel landscaped areas have also been provided."*

Water quality management

6.2.7 The proposed drainage systems will provide water quality management as follows to control and prevent pollution from the surface run off. The methodology is based upon the pollution hazard and SuDS treatment indices process set out in the SuDS Manual.

6.2.8 An indices approach has been used in order to evaluate the train of treatment required for the surface water runoff from the proposed impermeable areas and it will rely upon underground storage tanks and proprietary oil separators in order to achieve the required train of treatments for the proposed outfalls.

6.2.9 The proposed development consists of different catchments by pollution risk rating as follows:

- Building roofs – low risk.
- Car parking, circulation roadways and hardstanding – medium risk
- Access roads by gatehouse – high risk (due need for all traffic to pause there).
- Delivery areas for fuel – high risk, additional treatment provision.
- Delivery areas for chemicals – very high risk, drained separately.

6.2.10 The fuel delivery areas will be locally isolated from the main circulation routes and drained through a full retention (forecourt) separator in addition to the SuDS elements provided in the wider drainage network for the medium risk catchments.

6.2.11 The chemical delivery bays are roofed over and not subject to direct rainfall. Any water that reaches these areas indirectly (dripping off vehicles, wind-blown rain in severe conditions) will drain to captive tanks to prevent any risk of spillage being flushed through into the drainage networks. Liquid collected within these tanks will be tested and appropriate waste disposal determined from the test results.

6.2.12 It is proposed to apply a green/blue roof to the office building.

6.2.13 The pollution hazard values for the three risk ratings are shown in Table 2 (taken from Table 26.2, SuDS Manual).

Table 2. Pollution hazard indices by land-use

Land-use	Pollution Hazard	TSS	Metals	Hydrocarbons
Building Roofs	Low	0.30	0.40	0.05
Circulation roads, hardstanding, car parking	Medium	0.70	0.60	0.90
Gatehouse access roads	High	0.70	0.60	0.90

6.2.14 The proposed surface water drainage strategy takes into account difference in usage between the areas and each risk-related catchment is treated independently. Table 3 sets out the SuDS component(s) applied to the main catchments, in addition to the specific arrangements described above for the fuel and chemical delivery bays.

Table 3. Water quality treatment steps

Catchment	Step One	Step Two	Destination
Factory & warehouse roofs – low risk	Vortex separator	Vortex separator	Watercourse
Office roof – low risk	Green/blue roof	Vortex separator	Watercourse
Circulation roads, hardstanding – medium risk	Full retention oil separator	Vortex separator	Watercourse
Car parks – medium risk	Bypass oil separator	Vortex separator	Watercourse
Circulation roads & fuel delivery areas – high risk	Full retention interceptor	Vortex separator	Watercourse
Access road (site entrance) – high risk	Bypass oil separator	Vortex separator	Watercourse

6.2.15 The attenuation storage elements provide a benefit through settlement of suspended solids together with any adsorbed metals or hydrocarbons but this is not a deliberate outcome and needs to be managed in order to control any build-up of silt inside those storage elements to avoid impacting their hydraulic performance. That behaviour has not been considered as reducing the pollutant index within the surface runoff with any significant effect and has been assigned indices of 0.50, 0.20 and 0.20 respectively.

6.2.16 The mitigation indices used in the design of the new surface drainage, based upon Table 26.3 of the SuDS Manual defines the mitigation indices as follows (Table 4) and the associated cumulative mitigation value for the combinations of treatment components for each catchment category. These are based upon specific proprietary products as recorded in RPS's report (15).

Table 4. SuDS water quality mitigation indices

SuDS Type	TSS	Metals	Hydrocarbons
Green/blue roof	0.80	0.70	0.90
Full retention Separator	0.80	0.60	0.99
By-Pass Oil Separator	0.80	0.60	0.90
Vortex Separator	0.50	0.40	0.80

Table 5. Cumulative treatment mitigation by catchment

Catchment	TSS	Metals	Hydrocarbons
Factory & warehouse roofs – low risk	0.75	0.60	1.20
Office roof – low risk	1.05	0.90	1.30
Circulation roads, hardstanding – medium risk	1.05	0.80	1.39
Car parks – medium risk	1.05	0.80	1.30
Circulation roads, fuel delivery areas – high risk	1.05	0.80	1.39
Access road entrance – high risk	1.05	0.80	1.30

6.2.17 These results show that even allowing for some variation in the effective indices for the proprietary systems compared with those estimated in this assessment, the proposed treatment steps in the drainage systems are sufficient to meet the predicted pollution hazard ratings for the different areas of the site.

6.2.18 Run-off is directed variously to the Usworth Burn or Hylton Dene Burn. In the latter case this is delivered via the Plant 2 drainage system that in turn discharges to the IAMP ONE storm drainage system.

6.2.19 Firefighting water storage requirements are to be agreed with the local authority. The surface and foul water systems can be shut down if needed to prevent firefighting water from leaving the site. In the event of a fire, contaminated firefighting water will be captured primarily by the surface water drainage system serving the external roads and pavements and – depending upon the fire's location - by the foul water drainage systems. It will be prevented from discharging from the site to prevent pollution downstream as far as is practicable. The on-site pump stations can be switched out to hold contaminated water within the drainage network, which can then be pumped out after the event to be disposed of appropriately.

Water quantity management

6.2.20 The design philosophy used for the proposed development is the same as used for the AESC Plant 2 and the IAMP scheme. Plot drainage is managed within the plot limits by the corresponding plots' own surface drainage systems, discharging only greenfield-equivalent flows appropriate to the receiving watercourse.

6.2.21 The Plant 3 area is split in two with the larger part set to discharge to the Usworth Burn and part to the Plant 2 and IAMP ONE storm drainage that in turn eventually feeds into the Hylton Dene Burn headwaters. **Table 6** shows the respective areas of the drained areas.

Table 6. **Surface water drainage catchments**

SUB-CATCHMENT	AREA	DISCHARGE POINT & WATERCOURSE
South-east corner	3.9ha	Outfall 1, AESC Plant 2 & IAMP
Main site	20.66	Outfall 2, Usworth Burn

6.2.22 The proposed development has an overall drained area of 24.6ha. The section in the south-east corner of the site was originally allocated to drain via the Plant 2 drainage to the IAMP sewer network beneath International Drive. Due to the adjacent ongoing development a suitable route to discharge this area to the IAMP system is no longer available. it is proposed instead to drain this area to Usworth Burn but to restrict the overall discharge rate to the Burn to that derived for the main site area of 20.66ha, so that there is no material increase in discharge rate to the Burn.

Table 7. Surface drainage discharge rates

STORM EVENT	UNIT DISCHARGE RATE	NET DISCHARGE LIMIT
100% AEP	3.3 l/s/ha	68.2 l/s
3.3% AEP	6.7	138.4
1.0% AEP	8.8	165.3

6.2.23 The attenuation storage required to hold the excess run-off in each system pending storage will be provided via cellular storage tanks located beneath the car-parking area. The dense layout used for the scheme does not leave sufficient space to use basins or similar surface features.

6.2.24 The flow control for each of the sub-systems is derived through pumped outfalls. To give security of operation, the pump sets operate in duty/standby mode. Back-up generators are provided to give security of power supply in the event of a power outage. Connection points for mobile pumps will be provided. An extra allowance of storage of 125m^3 per system is to be provided to cater for complete pump failure.

6.2.25 The following hydraulic design criteria have been applied to the storm drainage design:

- No surcharging of drains for the Q_1 storm condition.
- No flooding of drains for the Q_{30} condition.
- Flooding up to 350mm deep on service yards and up to 125mm deep in car parking areas is allowed for in the Q_{100} condition. A climate-change allowance of 45% to be applied to rainfall.

6.2.26 The design discharges for the three storm conditions are shown in Table 8, taken at the effective outfall (link 2.025).

Table 8. Peak storm drainage discharges

RETURN PERIOD	PEAK FLOW
1% AEP	68.2 l/s
3.3% AEP	135.0
1%AEP+45%CC	151.2

6.2.27 Extracts from the MicroDrainage network details and results tables for the main sewer network (Appendix D of the RPS report) are included with the surface drainage layouts in **Appendix E**.

6.3 Foul Drainage

6.3.1 The proposed option for foul water from the proposed development is to discharge into the existing 225mm dia foul sewer beneath International Drive. This leads to a sewage pumping station that transfers sewage from IAMP ONE to an NWL public sewer west of Nissan near Seven Cottages on the old A1290 route. The pump station was not designed to handle the Plant 3 flows and to date it has not been confirmed whether it is possible to upgrade the facility to do so.

6.3.2 If the IAMP ONE system does not have sufficient spare capacity, a dedicated pump station on site and a new off-site rising main will be needed to transfer the proposed development flows to a suitable location where it can discharge to the main NWL sewer network.

6.4 Maintenance and responsibility

6.4.1 The owner and operator of the proposed development are to be responsible for constructing, owning and maintaining both the foul and surface water systems within the site boundary and the off-site connections for the relevant drainage networks.

6.4.2 The principal maintenance activities for the new drainage systems are listed in **Table 9**. The suggested frequencies should be reviewed and revised as experience of the system requires or permits and in line with manufacturers' guidance where appropriate.

Table 9. SuDS and Drainage System Maintenance Plan

DRAINAGE FEATURE	ACTION	FREQUENCY
Gully/linear drain and RWP inlets	Cleanse gullies, linear drains and RWP inlets	6 months - yearly
Underground Storage Tanks	Inspect for silt accumulation, clean out as necessary	Yearly
Bypass or full retention oil separator	Inspection, remove silt and light liquids, check flow through the unit	Yearly
Vortex Separator	Inspection, remove silt and light liquids, check flow through the unit	Yearly
Pump installations	Inspect M&E elements, replace pumps at intervals	6 months – yearly
Green/blue roof	Inspect internally and externally	Yearly

7. CONCLUSION

7.1.1 It is proposed to develop a new battery factory, warehousing and offices on farmland north of the A1290 Washington Road, west of the IAMP ONE and AESC Plant 2 developments. The proposed scheme has an approximate area of 32ha within the planning boundary and a developed footprint of about 24ha.

7.1.2 The proposed development comprises erection of a building to be used for the manufacture of batteries for electric vehicles, an assembly & warehousing building, an office building, a sub-station, gatehouse, ancillary compounds/structures and associated infrastructure provision, access, parking, drainage and landscaping.

Flood risk

7.1.3 The majority of the site sits in the Usworth Burn catchment. The Burn passes the site beyond its northern boundary before converging with the River Don to the north-east. The Don flows off eastwards, passing beneath Hylton Bridge which controls flood levels back towards North Moor Farm. The greater part of the site drains in a north-easterly direction towards Usworth Burn via a network of field ditches and land drains. A small part of the site at its south-eastern corner drains into the headwaters of Hylton Dene Burn via the IAMP ONE storm drainage.

7.1.4 The site lies almost entirely within Flood Zone 1 throughout its lifetime. The floodplain of Usworth Burn encroaches onto the northern margins of the site but only affect areas intended for landscaping. The development itself lies wholly in Flood Zone 1. There is a localized low area on the scheme’s western boundary that is at high risk of surface flooding but this will be removed by the proposed development earthworks and land drain diversions. There are no other significant sources of flood risk affecting or affected by the proposed development.

7.1.5 The proposed development is classified as ‘highly vulnerable’ to flooding, due to the use of certain raw materials that are categorized as hazardous. The vulnerability class is compatible with the level of flood risk on the development and the spatial positioning of the development satisfies the sequential approach. An exceptions test is not required.

Drainage strategy

7.1.6 Ground conditions across the site are dominated by poorly-permeable clayey and silty soils as evidenced by regular waterlogging of the farmland following wet weather and ponding in local depressions. This has dictated the surface drainage approach in that infiltration is not a practicable mechanism to drain the development. Restriction of flows to greenfield equivalent rates and attenuation of the excess run-off on site will be used to manage surface run-off up to and including the 100-year storm condition. An allowance of 45% for future climate change effects upon rainfall has been applied to the storm drainage design.

7.1.7 The storm drainage system is controlled by pumps: the size of the site and its level relative to the receiving watercourse makes a passive flow-control solution impracticable without excessive land raising. The system discharges into a small land drain near North Moor Farm before flowing into the Usworth Burn.

7.1.8 The foul drainage system for Plant 3 will pump the foul water flows generated to a suitable connection point with the NWL sewer system. The exact location of this connection has yet to be established. The likeliest location is onto a large combined sewer about 1km west of the site near the eastern edge of Washington, where the IAMP rising mains discharge.

7.1.9 The future development owner(s) and operator(s) are to be responsible for constructing, owning and maintaining both foul and surface water systems within the site boundary.

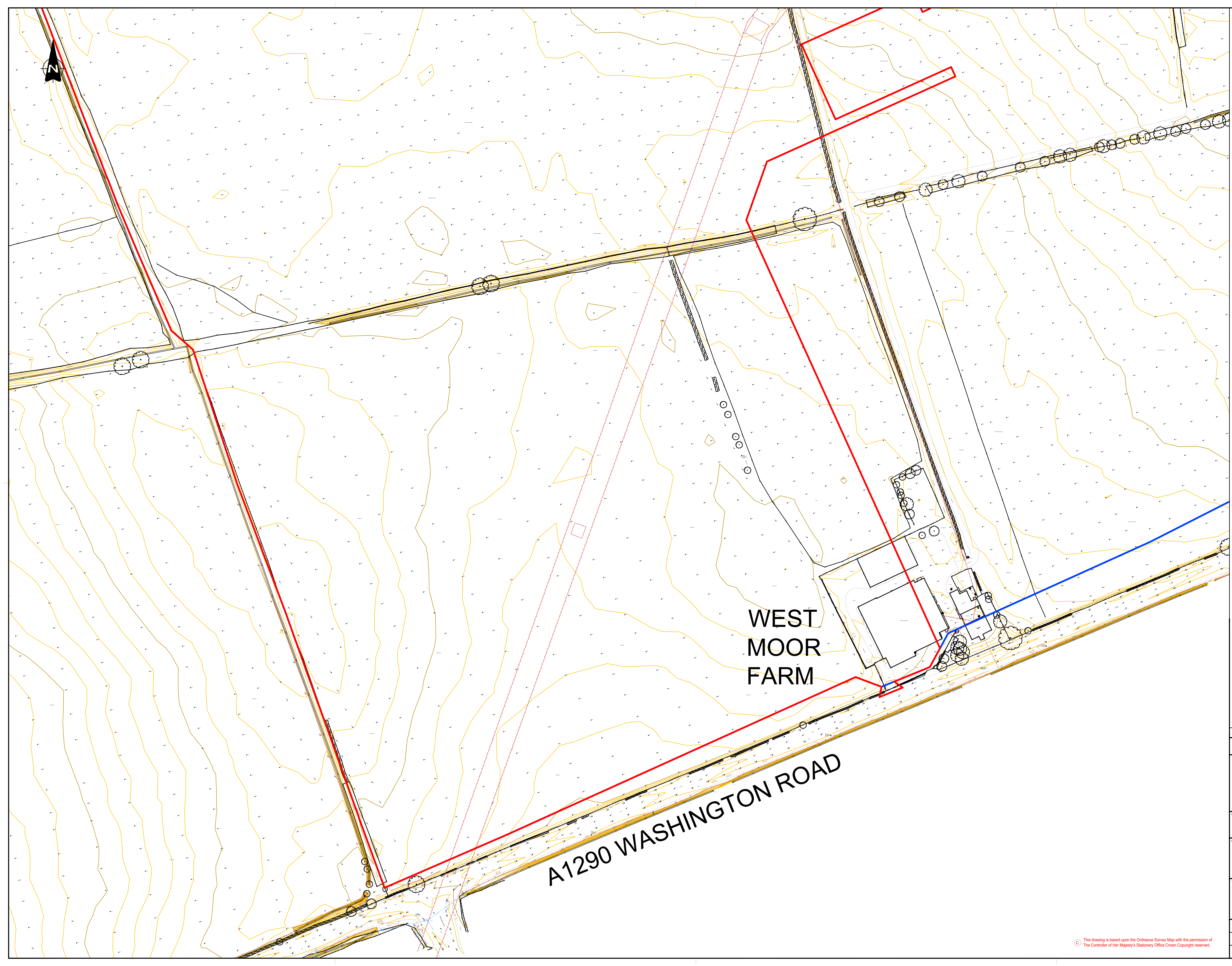
8. REFERENCES

1. National Planning Policy Framework: Development and Flood Risk; Communities & Local Government, March 2012. Last updated December 2023.
2. Technical Guidance to National Planning Policy Framework: Development and Flood Risk; Communities & Local Government, March 2012.
3. IAMP Area Action Plan, South Tyneside Council & Sunderland City Council, 2017.
4. IAMP Area Action Plan: Flood Risk and Water Management Technical Background Report, SYSTRA Ltd, 2016
5. IAMP ONE: Environmental Statement: Chapter I: Water Resources & Flood Risk, Golder Associates, March 2018.
6. Factual report on site investigation for land at IAMP, Dunelm Geotechnical & Environmental, 2018.
7. Sewers for Adoption; WRc plc, 2018 (8th Ed.)
8. IAMP ONE JBA flood modelling, JBA Consulting Ltd, March 2018
9. Water Framework Directive 2000/60/EC; European Parliament, 2000.
10. Northumbria River Basin Management Plan, Environment Agency, 2015.
11. IAMP Water Framework Assessment, JBA Consulting Ltd, 2018.
12. Sunderland Level 1 Strategic Draft Flood Risk Assessment, JBA Consulting, 2017.
13. Local Flood Risk Management Strategy, Sunderland City Council, 2016.
14. Core Strategy and Development Plan 2015 - 2033, Sunderland City Council,
15. Phase 1 Geo-Environmental Desk Study And Preliminary Risk Assessment, RPS, 2023.

Appendix A: Drawings

Appendix A: Contents

- SYSTRA drawings 22A29-FRA-TOPO-01 & 02 *Existing ground elevations and contours*
- RPS RPS drawing 204-P04 *Proposed site layout*
- RPS drawing 205-P01 *Proposed landscape plan*
- SYSTRA drawing 22A29-FRA-FLOOD-01 *Development layout and flood extents*



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NOTES

1. Do not scale from this drawing. All dimensions are in mm, levels in mOD unless stated otherwise.
2. Survey predates demolition of West Moor Farm and realignment of National Grid overhead power lines around west and north sides of AESC Plant 3 site.

KEY

Planning (red-line) boundary	🟥

Rev.	Date	Revision details	Drawn	Checked	Approved

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Client
AESC UK

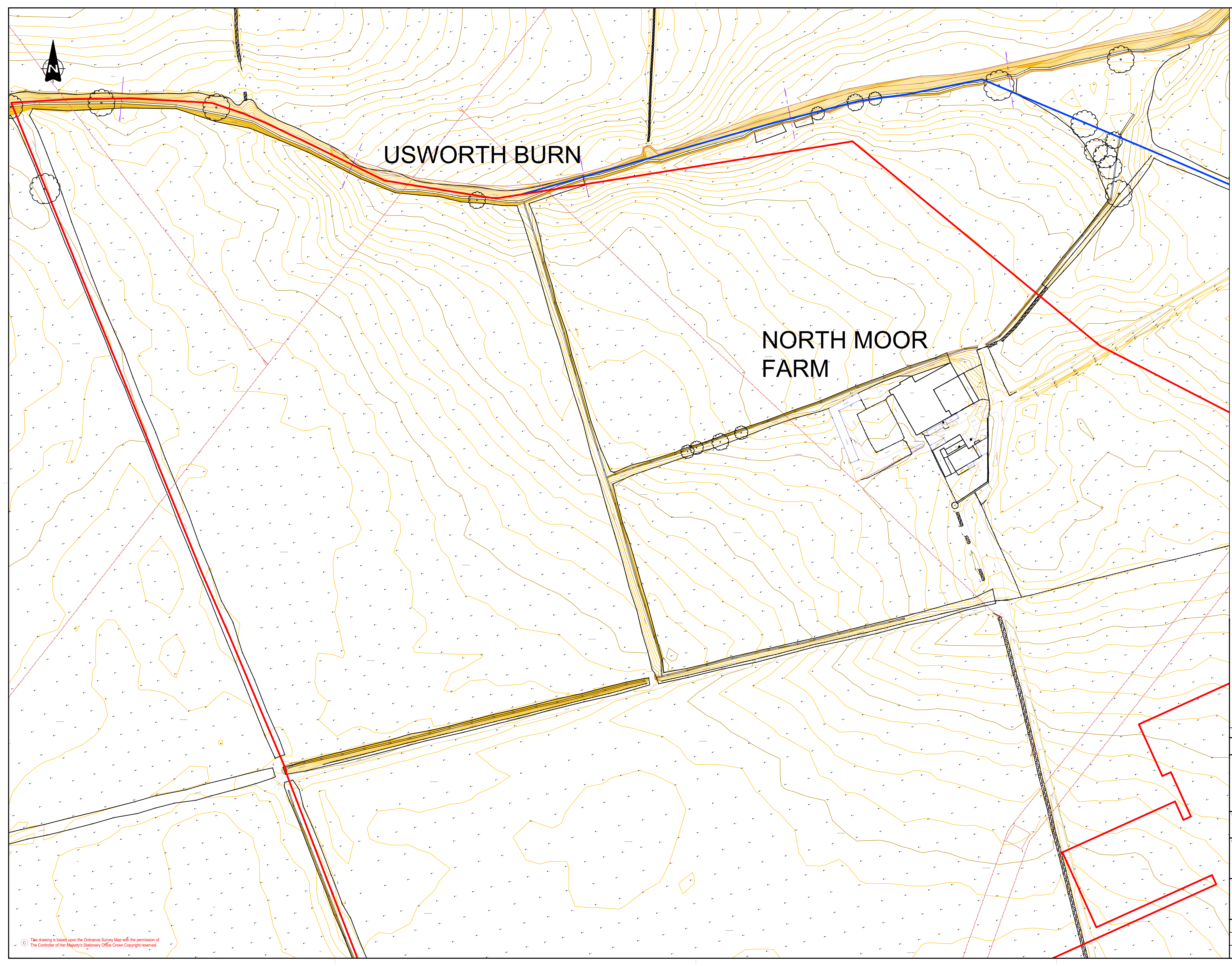
Project
AESC Plant 3
Flood Risk Assessment
& Drainage Strategy

Title
Site topography
Sheet 1 of 2

Drawn	Checked	Approved
TD	GP	SE

Original drg. size	Date	Scale
A1	October 2023	1:1,000

Drawing Status	Drawing Number	Rev.
Information	22A29-FRA-TOPO-01	P01



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NOTES

1. Do not scale from this drawing. All dimensions are in mm, levels in mOD unless stated otherwise.
2. Survey predates demolition of West Moor Farm and realignment of National Grid overhead power lines around west and north sides of AESC Plant 3 site.

KEY

Planning (red-line) boundary 🟥

Rev.	Date	Revision details	Drawn	Checked	Approved

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Project
AESC Plant 3
Flood Risk Assessment
& Drainage Strategy

Title
Site topography
Sheet 2 of 2

Drawn	Checked	Approved
TD	GP	SE

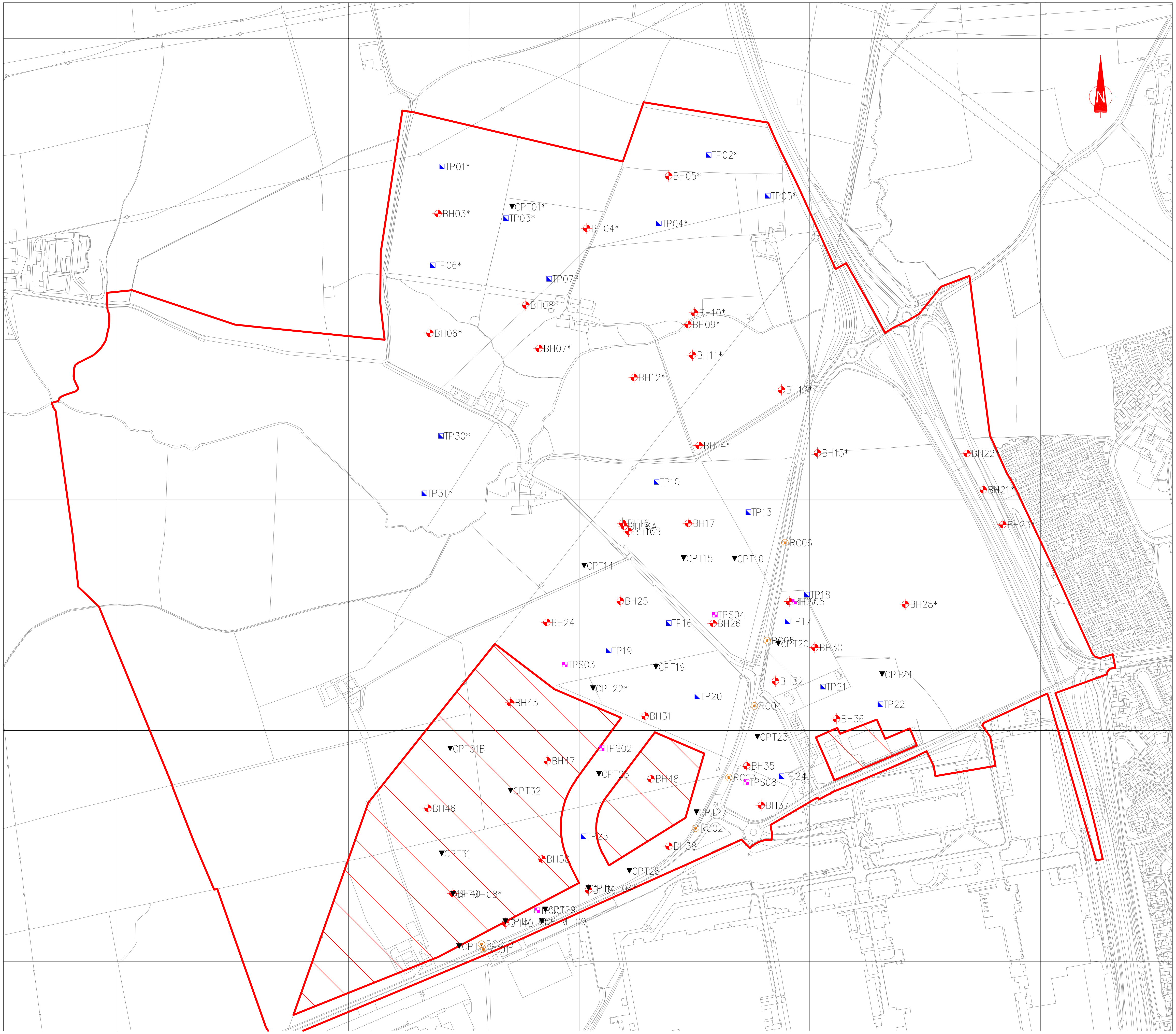
Original drg. size	Date	Scale
A1	October 2023	1:1,000

Drawing Status	Drawing Number	Rev.
Information	22A29-FRA-TOPO-02	P01

Appendix B: Ground investigation information

Appendix B: Contents

- Dunelm GI plan and borehole logs (2017)
- Dunelm GI soakaway tests (2017)



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NOT TO SCALE: Contractor to check all dimensions on site before commencement of any works. No dimensions to be scaled from this drawing.

NOTES:

BH	Location of Cable Percussive Borehole
▼CPT	Location of Cone Penetration Test
⊙RC	Location of Road Core
TP	Location of Machine Excavated Trial Pit
TPS	Location of Machine Excavated Soakaway Test

CLIENT:

SUNDERLAND COUNTY COUNCIL

PROJECT TITLE:

IAMP - PRELIMINARY GROUND INVESTIGATION

DRAWING TITLE:

Exploratory Hole Location Plan

DRAWING NUMBER:

D8044/02

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH45

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 35.63

Scale 1:50

Easting: 433350.81

Northing: 559060.39

Client: Sunderland City Council

Driller: PK/DC

Logged By: BC

Sheet 1 of 2

Method: Cable Percussive Drilling with Rotary Core Drilling

Checked By: BL

Dates: 02/08/2017 - 17/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	Insitu Testing	(Casing) Groundwater
D	0.10		
ES	0.10		
D	0.30		
B	0.50 - 1.00		
B	1.20 - 1.65		
UF	1.20 - 1.65	49 blows	
BRE	1.70		
B	2.00 - 2.45		(1.60) Dry
D	2.00		
SPT (S)	2.00 - 2.45	N=15 (3,5/4,4,3,4)	
BRE	2.50		
U	3.00 - 3.45	22 blows	
D	3.45		
BRE	3.70		
B	4.00 - 4.45		(1.60) Dry
D	4.00		
SPT (S)	4.00 - 4.45	N=7 (1,2/2,2,1,2)	
BRE	4.50		
U	5.00 - 5.45	16 blows	
D	5.45		
BRE	5.70		
B	6.00 - 6.45		(1.60) Dry
D	6.00		
SPT (S)	6.00 - 6.45	N=9 (3,2/3,2,2,2)	
BRE	6.50		
U	7.00 - 7.45	12 blows	
D	7.45		
BRE	7.70		
B	8.00 - 8.45		(1.60) Dry
D	8.00		
SPT (S)	8.00 - 8.45	N=7 (3,2/2,1,2,2)	
BRE	8.50		
B	9.00 - 9.45		(1.60) Dry
D	9.00		
SPT (S)	9.00 - 9.45	N=9 (2,3/2,2,3,2)	
BRE	9.50		
D	9.50		
B	10.00 - 10.65		

STRATA RECORD

Description	Depth (m)	Level (m AOD)
Dark brown slightly sandy slightly gravelly clayey TOPSOIL. Gravel is subangular to rounded, fine to coarse of sandstone, limestone, mudstone and coal.	(0.25) 0.25	35.38
Firm brown slightly sandy slightly gravelly CLAY of high plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal.	(0.95) 1.20	34.43
Firm greyish brown slightly sandy slightly gravelly silty CLAY of intermediate plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone, limestone and mudstone. *7.00m: Clay of high plasticity.*	(8.30) 9.50	26.13
Firm, greyish brown slightly sandy clayey SILT. Sand is fine to coarse.		

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
13.20	12.00	3.4	20		13.60	13.80	01:00	200	1.60	200	1.60
								150	13.80	150	13.60
								140	13.80	121	19.10

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH45

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 35.63 Scale 1:50

Easting: 433350.81 Northing: 559060.39

Client: Sunderland City Council | Driller: PK/DC | Logged By: BC | Sheet 2 of 2

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: BL | Dates: 02/08/2017 - 17/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	Insitu Testing	TCR%	SCR%	RQD%	FI
UF	10.00 - 10.64	4 blows				
BRE	10.70					
D	10.70					
U	11.00 - 11.45	7 blows				
D	11.45					
BRE	11.70					
D	11.90					
B	12.00 - 12.45					
D	12.00					
SPT (S)	12.00 - 12.45	N=30 (4,5/6,7,8,9)				
BRE	12.50					
D	12.80					
B	13.20 - 13.65					
D	13.20					
SPT (S)	13.20 - 13.65	N=39 (4,4/6,8,10,15)				
BRE	13.60					
D	13.70					
D	13.80					
SPT (S)	13.80 - 14.00 13.90 - 14.90	N=50+ (8,17/40,10 for 10mm)				NI
C	13.90 - 14.90 14.05 - 14.30		100	80	80	1
C	14.70 - 14.90					NI 0 A...
	14.90 - 15.90		91	91	49	3
C	15.80 - 15.90					A...
	15.90 - 16.30		90	90	90	
	16.30 - 17.70		100	100	91	1
C	16.90 - 17.20					
	17.70 - 19.10		100	80	62	NA 6 4 5
C	18.00					
C	18.20 - 18.40					

(Casing) Groundwater

Depth scale	(Casing) Groundwater
12	(11.90) Dry
13	(12.10) Dry
	03/08/2017 1700 (13.80) 3.10
14	(13.80) 3.10
	13.90 - 17.70 0 % Water
	17.70 - 19.10 75 % Water

STRATA RECORD

Description	Depth (m)	Level (m AOD)
Firm, greyish brown slightly sandy clayey SILT. Sand is fine to coarse.	(1.20) 10.70	24.93
Soft, slightly sandy slightly gravelly silty CLAY of intermediate plasticity. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone and coal. *12.00m: Stiff.*	(2.00) 12.70	22.93
Stiff reddish brown slightly sandy slightly gravelly CLAY of low plasticity. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone and coal.	(0.90) 13.60	22.03
Very dense light brown sandy GRAVEL. Gravel is angular to subangular, fine to coarse of sandstone. (Weathered rockhead).	(0.45) 14.05	21.58
Medium strong, partially weathered, light brown fine to medium grained SANDSTONE. Fractures are closely spaced, subhorizontal, planar, smooth, undulose with light brown clay infill. *14.62 - 14.72m: Fracture is subhorizontal, planar, rough, undulating with reddish brown sandstone gravel infill.* *14.90 - 14.99m: AZCL.* *15.66 - 15.77m: Fracture is 30 degrees, planar and smooth.* *15.90 - 15.94m: AZCL.* *16.46m: Fracture is 10 degrees, planar, smooth with grey clay infill.* *16.46 - 16.56m: Fractures are 30 degrees, planar, rough with grey clay infill.*	(3.80) 17.70	17.93
Firm to stiff light brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular, fine to coarse of sandstone.	(0.23) 17.93	17.70
Medium strong to strong, partially weathered light brown fine to medium grained SANDSTONE. Fractures are closely spaced, subhorizontal, planar, smooth and clean.	(0.27) 18.20	17.43
Medium strong, partially weathered, light grey fine grained SANDSTONE. Fractures are closely to medium spaced, subhorizontal, planar, smooth and clean.	(0.50) 18.70	16.93
Medium strong to strong, partially weathered, light brown fine to coarse grained SANDSTONE. Fractures are closely spaced, subhorizontal, planar, smooth and clean. *18.82m: Fractures are 20 degree, planar, smooth with black clay infill.* *18.92 - 18.99m: Fractures are subhorizontal, planar, smooth with reddish brown slightly gravelly clay infill. Gravel is angular to subangular, fine to medium of sandstone.*	(0.40) 19.10	16.53

End of Borehole at 19.10 m

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)
13.20	12.00	3.4	20	

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
13.60	13.80	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	1.60
150	13.80
140	13.80

Hole Diameter

Diameter (mm)	Depth (m)
200	1.60
150	13.60
121	19.10

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH46

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.56
Scale 1:50
Easting: 433172.22
Northing: 558831.72

Client: Sunderland City Council
Driller: RH/DC
Logged By: BC
Sheet 1 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling
Checked By: JH
Dates: 10/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	Insitu Testing
ES	0.20	
	0.40	HVP=57 kPa
ES	0.50	
B	0.60 - 1.20	
D	0.60	
BRE	1.00	
D	1.00	
UT	1.20 - 1.65	54 blows
D	1.65	
BRE	2.00	
D	2.00	
B	2.20 - 2.70	
D	2.20	
SPT (S)	2.20 - 2.29	N=50+ (25 for 40mm/50 for 50mm)
B	3.00	
BRE	3.00	
D	3.00	
B	3.20 - 3.70	
UT	3.20 - 3.65	94 blows
U	3.80 - 4.25	150 blows
D	4.25	
BRE	4.80	
D	4.80	
B	5.00 - 5.50	
D	5.00	
SPT (S)	5.00 - 5.45	N=31 (5,7/7,7,8,9)
BRE	5.80	
D	5.80	
U	6.00 - 6.45	135 blows
D	6.45	
BRE	6.80	
D	6.80	
B	7.00 - 7.50	
D	7.00	
SPT (S)	7.00 - 7.44	N=50+ (7,9/9,12,15,14 for 60mm)
BRE	7.80	
D	7.80	
D	7.90	
D	8.00	
SPT (S)	8.00 - 8.10 8.20 - 9.60	N=50+ (12,13 for 10mm/50 for 20mm)
SPT (C)	8.10 - 8.17	N=0 (25 for 40mm,0 for 30mm/)
	8.20 - 9.60	
C	9.50 - 9.60	
	9.60 - 11.10	

Core run (m)	TCR%	SCR%	RQD%	FI
8.20 - 9.60	100	92	61	NI 4

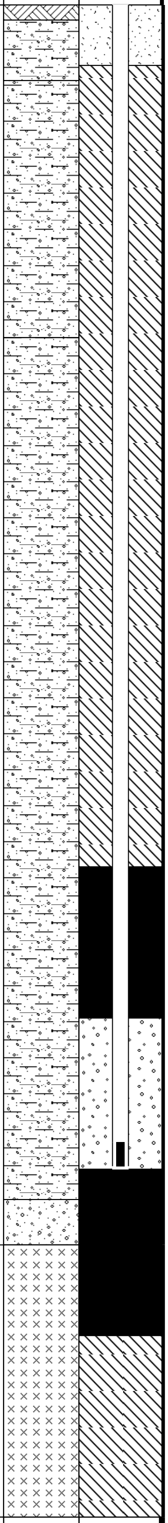
(Casing) Groundwater

Depth	(Casing) Groundwater
2	(2.00) Dry
5	(4.50) Dry
7	(6.00) Dry
8	(7.50) Dry (6.60) 2.00
8.20 - 11.10	75 % Water

STRATA RECORD

Description	Depth (m)	Level (m AOD)
Dark brown slightly sandy slightly gravelly slightly clayey TOPSOIL. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone, siltstone and coal.	(0.10) 0.10	38.46
Firm brownish grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone, siltstone and coal. Occasional rootlets noted.	(0.40) 0.50	38.06
Stiff orangish brown, mottled grey, slightly sandy slightly gravelly CLAY of intermediate plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal.	(1.70) 2.20	36.36
Stiff greyish brown slightly sandy slightly gravelly CLAY with occasional cobbles. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone, siltstone and coal. Cobbles are of sandstone. *3.20m: Clay of low plasticity.* *6.00m: Clay of intermediate plasticity.* *6.45 - 6.80m: Firm.*	(5.70) 7.90	30.66
Very dense reddish brown sandy GRAVEL. Gravel is angular to subangular, fine to coarse of siltstone. (Weathered SILTSTONE).	(0.30) 8.20	30.36
Very weak to weak, partially weathered, brownish grey SILTSTONE. Fractures are closely spaced subhorizontal planar, smooth, clean. *8.22 - 8.53m: Subvertical, stepped, smooth, clean with light brown discolouration on fracture surface.* *8.91 - 8.95m: 10 degree, planar, smooth with light grey siltstone gravel.*	8.20 (1.87)	

Legend | Well/ Backfill



Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					2.20	2.60	00:45	200	7.50	200	8.20
					8.00	8.20	01:00	140	11.00	116	30.60

Log last updated 24/01/2018

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH46

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.56 | Scale 1:50
Easting: 433172.22 | Northing: 558831.72

Client: Sunderland City Council | Driller: RH/DC | Logged By: BC | Sheet 2 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 10/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI
C	10.10 - 10.22		100	100	97	3
	11.10 - 12.60		100	95	84	4
C	12.20 - 12.35					NI
	12.60 - 14.10		100	100	97	3
C	13.30 - 13.40					
	14.10 - 15.60		100	100	100	
C	14.20 - 14.30					
	15.60 - 17.10		100	100	87	2
C	15.70 - 16.05					
	17.10 - 18.60		100	100	61	
	18.60 - 20.10		100	100	93	
	20.10 - 21.60					

(Casing) Groundwater: 11.10 - 30.60 95 % Water

STRATA RECORD

Description	Depth (m)	Level (m AOD)
Very weak to weak, partially weathered, thinly laminated, brownish dark grey MUDSTONE. Fractures are closely to medium spaced subhorizontal, planar, smooth, undulose, clean. *11.32 - 11.34m: Subhorizontal, planar, smooth with light grey clay infill.* *11.88 - 11.91m: Subhorizontal, planar, smooth with light grey clay infill.*	10.07 (1.84)	28.49
Very weak to weak, partially weathered, thinly laminated grey MUDSTONE. Fractures are closely spaced subhorizontal, planar, smooth, clean. (Drillers description). *12.53 - 12.60m: Fractures are frequent, interlock and orientated.* *12.93 - 12.95m: 15 degree, planar, smooth with light grey clay infill.* *13.96 - 13.98m: 15 degree, planar, smooth with light grey clay infill.* *14.37m: Subhorizontal, stepped, smooth, clean fractures.* *14.70 - 14.71m: 20 degree planar, smooth with light grey sandstone gravel infill.*	11.91 (2.95)	26.65
Medium strong to strong, unweathered, grey fine grained SANDSTONE. Fractures are closely to medium spaced between 20-30 degrees, planar, smooth, clean. *15.28 - 15.33m: Very weak to weak blue, grey mudstone band.* *16.05 - 16.08m: Subhorizontal planar, smooth with light grey clay infill.* *16.58 - 16.62m: Weak blue, grey mudstone band.* *17.10 - 17.27m: Subvertical, planar, smooth, undulose, clean fracture* *19.70 - 19.74m: Weak thinly laminated blue, grey mudstone band.*	14.86 (5.48)	23.70

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					2.20	2.60	00:45	200	7.50	200	8.20
					8.00	8.20	01:00	140	11.00	116	30.60

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole
BH46

Contract No: D8044	**Site:** IAMP - Preliminary Ground Investigation	GL (m AOD) 38.56 Scale 1:50 Easting: 433172.22 Northing: 558831.72

Client: Sunderland City Council	Driller: RH/DC	Logged By: BC	Sheet 3 of 4
Method: Cable Percussive Drilling with Rotary Core Drilling	Checked By: JH		Dates: 10/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI
			100	100	90	4
	21.60 - 23.10		100	100	67	
	23.10 - 24.60		100	100	100	
	24.60 - 26.10		100	100	0	2
	26.10 - 27.60		100	100	0	
	27.60 - 29.10		100	100	100	
	29.10 - 30.60		100	100	100	

STRATA RECORD

Description	Depth (m)	Level (m AOD)
Very weak, partially weathered, grey MUDSTONE. Fractures are closely spaced between 5 - 20 degree, planar, smooth, clean.	20.34 (0.51)	18.22
Medium strong to strong, partially weathered, grey fine to medium grained SANDSTONE. Fractures are subhorizontal, planar, smooth, clean. *22.38m: Fractures are subhorizontal, planar, smooth, undulose with grey clay infill.* *22.59 - 22.88m: Subvertical planar, smooth, undulose, clean fractures.* *25.60m: Fractures are subhorizontal, planar, smooth, undulose with light grey clay infill.* *26.89m: Fractures are subhorizontal, planar, smooth with light grey clay infill.* *26.96m: Fractures are subhorizontal, planar, rough with grey clay infill.* *27.20m: Fractures are subhorizontal, planar, smooth with light grey sandstone gravel infill.*	20.85 (9.75)	17.71

Scale depths: 21, 22, 23, 24, 25, 26, 27, 28, 29, 30

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					2.20	2.60	00:45	200	7.50	200	8.20
					8.00	8.20	01:00	140	11.00	116	30.60

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

Log last updated 24/01/2018

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH46

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.56
Scale 1:50
Easting: 433172.22
Northing: 558831.72

Client: Sunderland City Council
Driller: RH/DC
Logged By: BC
Sheet 4 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling
Checked By: JH
Dates: 10/08/2017

SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI						
									30.60	7.96	⁙	▨
								End of Borehole at 30.60 m				

31
32
33
34
35
36
37
38
39
40

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					2.20	2.60	00:45	200	7.50	200	8.20
					8.00	8.20	01:00	140	11.00	116	30.60

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH47

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 36.54

Scale 1:50

Easting: 433430.80

Northing: 558934.44

Client: Sunderland City Council

Driller: PK/DC

Logged By: AH

Sheet 1 of 3

Method: Cable Percussive Drilling with Rotary Core Drilling

Checked By: JH

Dates: 07/08/2017 - 18/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	Insitu Testing	(Casing) Groundwater
D	0.10		
ES	0.10		
	0.30	HVP=25 kPa	
D	0.70		
ES	0.70		
	0.70	HVP=66 kPa	
B	0.80 - 1.20		1
BRE	0.80		
U	1.20 - 1.65	29 blows	
D	1.65		
BRE	1.90		
D	2.00		2 (1.60) Dry
SPT (S)	2.00 - 2.45	N=14 (2,2/3,3,4,4)	
BRE	2.50		
U	3.00 - 3.45	22 blows	3
D	3.45		
BRE	3.70		
B	4.00 - 4.45		4 (1.60) Dry
D	4.00		
SPT (S)	4.00 - 4.45	N=12 (1,2/2,3,4,3)	
D	4.30		
BRE	4.50		
UT	5.00 - 5.45	12 blows	5
D	5.45		
BRE	5.70		
B	6.00 - 6.45		6 (1.20) Dry
D	6.00		
SPT (S)	6.00 - 6.45	N=13 (2,3/3,3,3,4)	
BRE	6.50		
UT	7.00 - 7.45	22 blows	7
D	7.45		
BRE	7.70		
B	8.00 - 8.45		8 (1.60) Dry
D	8.00		
SPT (S)	8.00 - 8.45	N=20 (5,5/6,5,5,4)	
BRE	8.50		
UT	9.00 - 9.45	18 blows	9
D	9.45		
BRE	9.70		
B	10.00 - 10.45		10 (9.90) Dry

STRATA RECORD

Description	Depth (m)	Level (m AOD)
MADE GROUND: Brown slightly sandy slightly gravelly clayey topsoil. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone, coal and brick.	(0.60) 0.60	35.94
Firm, dark brown mottled grey, slightly sandy slightly gravelly CLAY of intermediate plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone, siltstone and coal. *1.20m: Stiff*	(2.50) 3.10	33.44
Firm, dark brown mottled grey, silty slightly sandy slightly gravelly CLAY of intermediate plasticity. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone and siltstone.	(1.20) 4.30	32.24
Firm thinly laminated greyish brown silty slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and siltstone. *5.00m: Clay of low plasticity.*	(3.70) 8.00	28.54
Stiff greyish brown silty slightly sandy CLAY of low plasticity.	(1.50) 9.50	27.04
Firm, slightly sandy slightly gravelly CLAY with frequent cobbles. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone, limestone and coal. Cobbles are of		

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
15.30	14.90	11.8	20		10.30	10.50	00:30	200	1.60	200	1.60
					12.80	13.10	01:00	150	15.00	150	15.30
					13.90	14.20	00:45	140	18.00	121	20.70
					14.40	14.50	00:20				
					14.90	15.30	01:00				

Log last updated 24/01/2018

General Remarks

1. Hand dug inspection pit to 1.20m.

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH47

Contract No: D8044	**Site:** IAMP - Preliminary Ground Investigation	GL (m AOD) 36.54 Scale 1:50 Easting: 433430.80 Northing: 558934.44
Client: Sunderland City Council	Driller: PK/DC Logged By: AH	Sheet 2 of 3
Method: Cable Percussive Drilling with Rotary Core Drilling	Checked By: JH	Dates: 07/08/2017 - 18/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	Insitu Testing	TCR%	SCR%	RQD%	FI
D	10.00					
SPT (S)	10.00 - 10.37	N=50+ (5,9/12,11,27 for 70mm)				
BRE	10.50					
U	11.00 - 11.45	56 blows				
D	11.45					
BRE	11.70					
B	12.00 - 12.45					
D	12.00					
SPT (S)	12.00 - 12.44	N=50+ (7,10/12,14,14,10 for 70mm)				
BRE	12.50					
D	12.70					
B	13.00 - 13.45					
D	13.00					
SPT (S)	13.00 - 13.38	N=49 (25/12,11,11,15)				
BRE	13.50					
D	13.80					
B	14.00 - 14.40					
D	14.00					
SPT (S)	14.00 - 14.22	N=50+ (21,4 for 10mm/21,29 for 60mm)				
D	14.80					
	15.20 - 16.70					
D	15.30					
	15.20 - 16.70					
SPT (S)	15.30 - 15.39	N=50+ (25 for 45mm/50 for 45mm)				NI
D	15.30					
SPT (S)	15.30 - 15.39	N=50+ (25 for 45mm/50 for 45mm)	100	72	53	3
C	15.47 - 15.89					
C	16.10 - 16.29					40
C	16.70 - 16.83		100	100	100	3
	16.70 - 18.20					
C	17.70 - 17.84					
	18.20 - 19.70		100	80	20	12
						30
	19.70 - 20.70					10

(Casing) Groundwater

11

07/08/2017
(10.90) Dry

08/08/2017 0800
12 (10.90) Dry
(11.90) Dry

13 (12.90) Dry

14 (13.90) Dry

15

08/08/2017 1700
15.20 - 16.70
(15.00) Dry
55 % Water
(15.00) Dry
08/08/2017 1700
(15.00) Dry
(15.00) Dry

16

16.70 - 18.20
60 % Water

17

18

18.20 - 19.70
45 % Water

19

19.70 - 20.70
90 % Water

20

STRATA RECORD

Description	Depth (m)	Level (m AOD)
Firm, slightly sandy slightly gravelly CLAY with frequent cobbles. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone, limestone and coal. Cobbles are of sandstone. *10.00m: Very stiff.* *11.00m: Clay of low plasticity.*	(5.30)	
	14.80	21.74
Very dense yellowish brown sandy GRAVEL. Gravel is subangular to angular, fine to coarse of sandstone. (Weathered sandstone, rockhead).	(0.50)	
	15.30 15.30	21.24
Weak, partially weathered, light brown fine to medium SANDSTONE. Fractures are closely to medium spaced, subhorizontal, planar, smooth and clean. Below 16.62m fractures are medium to widely spaced. *16.25 - 16.70m: Subvertical, planar, smooth, clean fracture.* *16.40 - 16.62m: Frequent subvertical fractures with brown clay infill.* *17.50 - 18.00m: Dark red staining.*	(2.75)	
	18.05	18.49
Weak, partially weathered, orange brown fine, predominantly medium to coarse, micaceous SANDSTONE. Fractures are subhorizontal, planar, smooth with dark red staining. *18.05 - 19.05m: Subvertical, undulose fracture with orange staining.* *19.04 - 19.06m: Dark red brown clay.*	(1.00)	
	19.05	17.49
Extremely weak, partially weathered, thinly to thickly bedded red brown MUDSTONE with occasional thin laminae of siltstone. Fractures are very closely spaced, subhorizontal, planar, smooth and clean. *19.38m: Subvertical, planar, smooth, clean fracture.*	(0.95)	
	20.00	16.54

Continued on next sheet

Ground Water (m)

Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)
15.30	14.90	11.8	20	

Chiselling / Hard Strata

From (m)	To (m)	Time (hr)
10.30	10.50	00:30
12.80	13.10	01:00
13.90	14.20	00:45
14.40	14.50	00:20
14.90	15.30	01:00

Casing Depths

Diameter (mm)	Depth (m)
200	1.60
150	15.00
140	18.00

Hole Diameter

Diameter (mm)	Depth (m)
200	1.60
150	15.30
121	20.70

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH47

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 36.54

Scale 1:50

Easting: 433430.80

Northing: 558934.44

Client: Sunderland City Council

Driller: PK/DC

Logged By: AH

Sheet 3 of 3

Method: Cable Percussive Drilling with Rotary Core Drilling

Checked By: JH

Dates: 07/08/2017 - 18/08/2017

SAMPLE DETAILS							**(Casing) Groundwater**	**STRATA RECORD Description**	**Depth (m)**	**Level (m AOD)**	**Legend**	**Well/ Backfill**
Type	**Depth From-To (m)**	**N (cu)**	**TCR %**	**SCR %**	**RQD %**	**FI**						
						28		*19.90 - 20.08m: 40 - 60 degree planar, smooth, clean fracture.*				
			100	40	10	NI		Extremely weak to weak, partially weathered, dark grey red brown MUDSTONE. Fractures are subhorizontal, planar, smooth with occasional clay infill.	(0.40) 20.40	16.14		
								Red brown gravelly CLAY. Gravel is angular, fine to coarse of mudstone. (Weathered MUDSTONE). Occasional very thin beds of mudstone.	(0.30) 20.70	15.84		
								End of Borehole at 20.70 m				

21

22

23

24

25

26

27

28

29

30

Ground Water (m)					**Chiselling / Hard Strata**			**Casing Depths**		**Hole Diameter**	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
15.30	14.90				10.30	10.50	00:30	200	1.60	200	1.60
					12.80	13.10	01:00	150	15.00	150	15.30
					13.90	14.20	00:45	140	18.00	121	20.70
					14.40	14.50	00:20				
					14.90	15.30	01:00				

Log last updated 24/01/2018

General Remarks

1. Hand dug inspection pit to 1.20m.

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH48

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 35.44

Scale 1:50

Easting: 433655.60

Northing: 558895.29

Client: Sunderland City Council

Driller: PK/DC

Logged By: BC

Sheet 1 of 3

Method: Cable Percussive Drilling with Rotary Core Drilling

Checked By: JH

Dates: 08/08/2017 - 18/08/2017

SAMPLE DETAILS

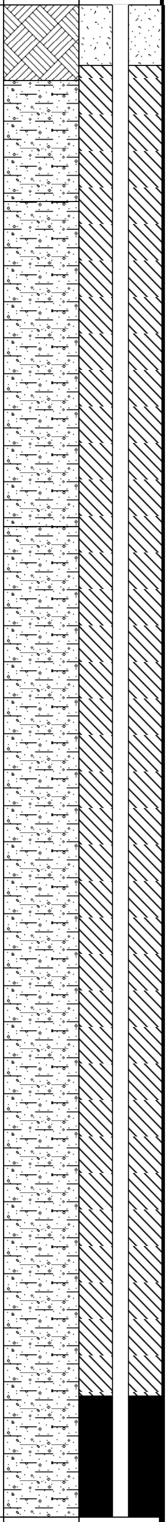
Type	Depth From-To (m)	Insitu Testing
D	0.10	
ES	0.10	
	0.40	HVP=26 kPa
D	0.50	
ES	0.50	
B	0.60 - 1.20	
BRE	0.60	
	0.70	HVP=68 kPa
U	1.20 - 1.65	29 blows
D	1.65	
BRE	1.90	
B	2.00 - 2.45	
D	2.00	
SPT (S)	2.00 - 2.45	N=17 (2,3/3,4,5,5)
BRE	2.50	
U	3.00 - 3.45	15 blows
D	3.45	
BRE	3.70	
B	4.00 - 4.45	
D	4.00	
SPT (S)	4.00 - 4.45	N=9 (1,2/2,2,2,3)
BRE	4.50	
UT	5.00 - 5.45	9 blows
D	5.45	
BRE	5.70	
B	6.00 - 6.45	
D	6.00	
SPT (S)	6.00 - 6.45	N=10 (2,2/2,2,3,3)
BRE	6.50	
UT	7.00 - 7.45	12 blows
D	7.45	
BRE	7.70	
B	8.00 - 8.45	
D	8.00	
SPT (S)	8.00 - 8.45	N=9 (2,2/2,2,2,3)
BRE	8.50	
UT	9.00 - 9.45	10 blows
D	9.45	
BRE	9.70	
B	10.00 - 10.45	

(Casing) Groundwater

Depth (m)	(Casing) Groundwater
2	(1.60) Dry
4	(1.60) Dry
6	(1.60) Dry
	08/08/2017 1700 (1.60) Dry 09/08/2017 0800 (1.60) 2.10
8	(1.60) Dry
10	(9.90) Dry

STRATA RECORD Description

Description	Depth (m)	Level (m AOD)
Dark brown slightly sandy slightly gravelly clayey TOPSOIL. Gravel is subangular to rounded, fine to coarse of sandstone, limestone, mudstone, siltstone and coal.	(0.50) 0.50	34.94
Firm, brown mottled light brown, slightly sandy slightly gravelly CLAY of high plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal.	(0.80) 1.30	34.14
Firm brown, mottled light grey, slightly sandy slightly gravelly CLAY of intermediate plasticity. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone and coal. *2.00m: Stiff*	(2.15) 3.45	31.99
Firm, thinly laminated, greyish brown, slightly sandy slightly gravelly CLAY. Gravel is subrounded to rounded, fine to coarse of sandstone, mudstone and coal. *5.00m: Clay of intermediate plasticity.* *8.00m: Clay of high plasticity.*	(7.35)	



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Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
18.00	12.40	5.3	20		14.90	15.10	00:20	200	1.60	200	10.00
					17.10	17.20	00:20	150	11.50	150	18.50
					18.00	18.30	01:00	140	22.50	121	23.50

Log last updated 24/01/2018

General Remarks

1. Hand dug inspection pit to 1.20m.

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH48

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 35.44 Scale 1:50

Easting: 433655.60 Northing: 558895.29

Client: Sunderland City Council | Driller: PK/DC | Logged By: BC | Sheet 2 of 3

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 08/08/2017 - 18/08/2017

Type	Depth From-To (m)	Insitu Testing	(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)
D SPT (S)	10.00 10.00 - 10.45	N=10 (1,2/2,2,3,3)		Firm, thinly laminated, greyish brown, slightly sandy slightly gravelly CLAY. Gravel is subrounded to rounded, fine to coarse of sandstone, mudstone and coal.		
BRE	10.50					
D B UF	10.90 11.00 - 11.65 11.00 - 11.65	4 blows	11	Soft, thinly laminated slightly sandy silty CLAY of intermediate plasticity.	10.80 (1.00)	24.64
BRE D	11.70 11.80					
B D SPT (S)	12.00 - 12.45 12.00 12.00 - 12.45	N=22 (3,4/4,5,6,7)	12 (11.90) Dry	Stiff, brown slightly sandy slightly gravelly CLAY. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone and coal.	11.80	23.64
BRE	12.50					
U	13.00 - 13.45	60 blows	13	*13.00m: Clay of low plasticity.*		
D	13.45					
BRE	13.70					
B D SPT (S)	14.00 - 14.45 14.00 14.00 - 14.45	N=29 (4,5/7,8,8,6)	14 (12.40) Dry			
BRE	14.50					
			15		(6.20)	
B D SPT (S)	15.20 - 15.65 15.20 15.20 - 15.64	N=50+ (6,8/13,14,11,12 for 70mm)	(12.40) Dry			
BRE	15.70					
U	16.00 - 16.45	72 blows	16			
D	16.45					
BRE	16.70					
B D SPT (S)	17.00 - 17.45 17.00 17.00 - 17.20	N=50+ (9,16 for 55mm/50)	17 (12.40) Dry			
BRE	17.50					
B D SPT (S)	18.00 - 18.30 18.00 18.00 - 18.14	N=50+ (15,10 for 15mm/50 for 55mm)	18 (12.40) Dry (12.40) 4.70	Very dense reddish brown sandy GRAVEL. Gravel is subangular to angular, fine to coarse of sandstone. (Weathered SANDSTONE).	18.00 (0.50)	17.44
D	18.30					
SPT (S) C	18.50 - 18.50 18.50 - 20.00		09/08/2017 1700 (12.40) 4.70 18.50 - 20.00 80 % Water	Weak to medium strong, partially weathered, brown fine to coarse grained SANDSTONE. Fractures are very closely to closely spaced, subhorizontal, planar, smooth with localised clay infill. *18.83 - 18.85m: Fractures are subhorizontal, planar, smooth, undulose with light brown clay infill.* *18.90 - 19.01m: Fractures are 60 degrees, steeped, smooth and clean.*	18.50 (0.79)	16.94
			19			
C	19.40 - 19.60			Very weak to weak, partially weathered, brown fine to coarse grained SANDSTONE. Frequent randomly orientated interlocking fractures.	19.29 (0.15) 19.44 (0.33)	16.15 16.00
				Medium strong to strong, partially weathered, light brown fine	19.77 (0.16) 19.93	15.67 15.51
	20.00 - 21.30		20			

Core run 18.50 - 20.00:

TCR%	SCR%	RQD%	FI
100	81	29	NI 10 NI 0 12

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
18.00	12.40	5.3	20		14.90	15.10	00:20	200	1.60	200	10.00
					17.10	17.20	00:20	150	11.50	150	18.50
					18.00	18.30	01:00	140	22.50	121	23.50

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH48

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 35.44 Scale 1:50

Easting: 433655.60 Northing: 558895.29

Client: Sunderland City Council

Driller: PK/DC

Logged By: BC

Sheet 3 of 3

Method: Cable Percussive Drilling with Rotary Core Drilling

Checked By: JH

Dates: 08/08/2017 - 18/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI	(Casing) Groundwater
						2	20.00 - 21.30 50 % Water
			100	85	44	NI	
						5	
C	20.95 - 21.10					NA	
	21.30 - 22.50						21.30 - 22.50 60 % Water
C	21.50 - 21.60						
			100	83	56	4	
						A…	
	22.50 - 23.50						22.50 - 23.50 90 % Water
			90	90	62	4	

21 22 23 24 25 26 27 28 29 30

STRATA RECORD Description

to medium grained SANDSTONE.

Weak to medium strong, partially weathered, brown fine to coarse grained SANDSTONE. Fractures are very closely to closely spaced, subhorizontal, planar, smooth with localised clay infill.

19.82 - 19.93m: Fractures are subvertical, planar, smooth, undulose and clean.

Medium strong to strong, partially weathered, reddish brown fine to medium grained SANDSTONE. Fractures are medium spaced, subhorizontal, planar, smooth and clean.

Weak to medium strong, partially weathered, reddish brown fine to medium grained SANDSTONE. Frequent randomly orientated interlocking fractures.

Medium strong to strong, partially weathered, brown fine to coarse grained SANDSTONE.

20.76 - 20.88m: Fracture is 35 degrees, planar, smooth and clean.

21.01m: Fracture is subhorizontal, planar, smooth with light grey clay infill.

21.06 - 21.11m: Fracture is 25 degrees, planar, smooth and clean with light grey discolouration on surface of fracture.

Firm brown slightly sandy CLAY.

Weak to medium strong, partially weathered, greyish brown SILTSTONE. Fractures are closely to medium spaced, subhorizontal, planar, smooth and clean.

21.76 -21.79m: Fracture is subhorizontal, planar, smooth with reddish brown clay infill.

22.50 - 22.60m: AZCL.

23.16 - 23.17m: Fracture is subhorizontal, planar, smooth with brown clay infill.

End of Borehole at 23.50 m

Depth (m)	Level (m AOD)
(0.49)	
20.42	15.02
(0.10)	14.92
20.52	
(0.61)	
21.13	14.31
(0.10)	14.21
21.23	
(2.27)	
23.50	11.94

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
18.00	12.40				14.90	15.10	00:20	200	1.60	200	10.00
					17.10	17.20	00:20	150	11.50	150	18.50
					18.00	18.30	01:00	140	22.50	121	23.50

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH49

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 39.21 | Scale 1:50

Easting: 433226.03 | Northing: 558647.01

Client: Sunderland City Council | Driller: RH/DC | Logged By: BC | Sheet 1 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling | Checked By: JH | Dates: 11/08/2017 - 24/08/2017

SAMPLE DETAILS

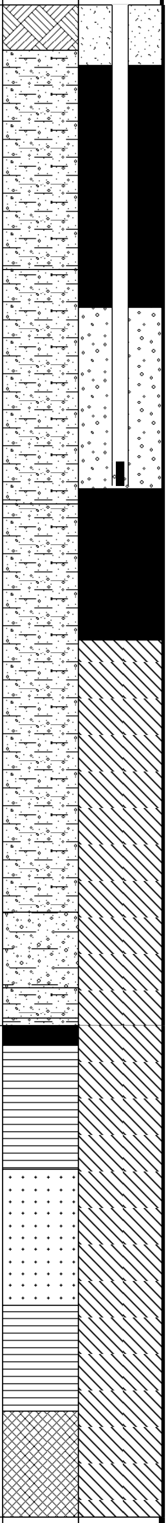
Type	Depth From-To (m)	Insitu Testing
D	0.20	
ES	0.20	
	0.20	HVP=24 kPa
B	0.50 - 1.20	
D	0.50	
ES	0.50	
	0.70	HVP=65 kPa
BRE	1.00	
D	1.00	
B	1.20 - 1.60	
D	1.20	
SPT (S)	1.20 - 1.65	N=10 (2,2/2,2,3,3)
BRE	1.75	
U	2.20 - 2.45	100 blows
D	2.50	
BRE	2.70	
D	2.90	
B	3.00 - 3.50	
D	3.00	
SPT (S)	3.00 - 3.45	N=12 (2,2/3,3,3,3)
BRE	3.75	
UF	4.20 - 4.70	100 blows
B	4.70 - 5.20	
SPT (S)	4.70 - 4.91	N=50+ (3,3/50 for 60mm)
BRE	4.75	
BRE	5.20	
B	5.75 - 6.25	
D	5.75	
SPT (S)	5.75 - 6.20	N=42 (5,5/8,10,10,14)
BRE	6.20	
D	6.75	
D	6.75	
SPT (S)	6.75 - 7.14	N=50+ (10,13/16,21,13,8)
SPT (S)	6.75 - 7.14	N=50+ (10,13/16 ,21,13,8)
	6.75 - 8.00	
	6.75 - 8.00	
	8.00 - 9.50	
C	9.00 - 9.12	
	9.50 - 11.00	

Core run (m)	TCR%	SCR%	RQD%	FI
6.75 - 8.00	100	100	66	NI 40 12 A...
8.00 - 9.50	96	84	0	15 NI
9.50 - 11.00				

(Casing) Groundwater:
- Dry
- (2.90) Dry
- (4.60) Dry
- (5.70) Dry
- (6.70) Dry
- (6.70) Dry

STRATA RECORD

Description	Depth (m)	Level (m AOD)
Dark brown slightly sandy, slightly gravelly clayey TOPSOIL. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal.	(0.30) 0.30	38.91
Firm brown mottled light grey slightly sandy slightly gravelly CLAY of intermediate plasticity. Gravel is subangular to subrounded, fine to coarse of mudstone, siltstone and coal.	(1.45) 1.75	37.46
Firm brown slightly sandy slightly gravelly CLAY of high plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone and mudstone.	(1.55) 3.30	35.91
Stiff dark brown slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal. *5.75m: Clay of low plasticity.*	(2.70) 6.00	33.21
Very dense grey slightly clayey sandy GRAVEL. Gravel is angular to subangular, fine to coarse of mudstone. (Lightly weathered mudstone, possible rockhead).	(0.50) 6.50	32.71
Stiff red brown slightly sandy, slightly gravelly CLAY. Gravel is angular to subangular, fine to coarse of mudstone and coal. (drillers description).	(0.20) 6.70	32.51
Stiff dark grey slightly sandy gravelly CLAY. Gravel is angular to subangular, fine to coarse of mudstone and sandstone. (drillers description).	6.75 (0.05) (0.13) 6.75	32.46
Black COAL.	6.88	32.33
Extremely weak very thinly laminated dark grey MUDSTONE. Fractures are extremely closely spaced, subhorizontal, planar, smooth, clean.	(0.82) 7.70	31.51
Very weak dark grey fine SANDSTONE. Fractures are closely spaced, subhorizontal planar, smooth, clean. *8.05 - 8.30m: Subvertical undulating, smooth fracture.* *8.55 - 8.65m: 40-60 degree, stepped, smooth, clean fracture.*	(0.90) 8.60	30.61
Extremely weak dark grey MUDSTONE with bands. Fractures are very closely spaced, subhorizontal planar, smooth, clean.	(0.70) 9.30	29.91
Weak dark grey SILTSTONE with bands of mudstone. Fractures are very closely to closely spaced, subhorizontal planar, smooth, clean.		



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Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					4.90	5.10	00:30	150	6.70	150	6.85
					6.70	7.00	01:00	140	11.00	121	30.30

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH49

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 39.21
Scale 1:50
Easting: 433226.03
Northing: 558647.01

Client: Sunderland City Council
Driller: RH/DC
Logged By: BC
Sheet 2 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling
Checked By: JH
Dates: 11/08/2017 - 24/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI
C	10.30 - 10.45		100	100	53	
	11.00 - 11.30		100	83	83	11
	11.30 - 12.80		100	100	80	
C	11.83 - 11.93					
C	12.50 - 12.90					
C	12.55 - 12.80					
	12.80 - 14.30		100	96	80	40
C	13.90					20
	14.30 - 15.80		100	96	93	
C	14.80 - 15.00					
	15.80 - 17.00		100	83	28	20
C	15.90 - 16.00					NI A...
	17.00 - 17.80		87	66	22	12
	17.80 - 19.00		100	86	13	20
	19.00 - 20.80		100	93	90	

STRATA RECORD

(Casing) Groundwater	Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
	9.95 - 10.10m: Subvertical planar, smooth, clean fracture. *10.05 - 10.30m: Weak grey mudstone.* *10.70 - 10.80m: Subvertical planar, smooth, clean fracture.* *11.12 - 11.15m: Subvertical planar, smooth, clean fracture* *11.24 - 11.27m: Subvertical undulating, smooth, clean fracture.* *11.40 - 11.45m: Subhorizontal planar, smooth fracture.* *11.40 - 11.50m: Subvertical undulating, smooth, clean fracture.* *12.55m: Medium strong.*	(3.30) 12.60	26.61		
	Weak, partially weathered, orange brown medium grained SANDSTONE. Fractures are closely spaced, subhorizontal planar, smooth. *12.94 - 13.00m: Subvertical planar, smooth, clean fracture.* *15.55 - 15.60m: Subrounded to rounded, medium to coarse of grout.*	(3.40) 16.00	23.21		
	Very weak, partially weathered, thinly bedded, dark grey MUDSTONE. Fractures are extremely closely to very closely spaced, planar with clay infill. *16.00 - 16.10m: Subvertical planar, smooth, clean fracture.* *17.45 - 17.55m: Subvertical planar, smooth, clean, fracture.*	(1.50) 17.50	21.71		
	Very weak, partially weathered black carbonated MUDSTONE. Fractures are very closely spaced, subhorizontal planar, smooth, clean. *18.20 - 18.35m: Subvertical undulating, smooth, fracture.* *18.75 - 18.95m: Subvertical, stepped, smooth, clean, fracture.* *19.15 - 19.30m: Subvertical planar, smooth, clean fracture.*	(1.90) 19.40	19.81		
	Weak, partially weathered dark grey SILTSTONE with bands of fine to medium sandstone. Fractures are closely to medium spaced, subhorizontal planar, smooth, clean.				

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					4.90	5.10	00:30	150	6.70	150	6.85
					6.70	7.00	01:00	140	11.00	121	30.30

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

Log last updated 24/01/2018

BOREHOLE RECORD

Borehole BH49

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 39.21
Scale 1:50
Easting: 433226.03
Northing: 558647.01

Client: Sunderland City Council
Driller: RH/DC
Logged By: BC
Sheet 3 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling
Checked By: JH
Dates: 11/08/2017 - 24/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %
	20.80 - 22.30		100	100	83
	22.30 - 23.80		100	93	73
	23.80 - 24.80		95	75	70
	24.80 - 26.30		96	96	86
	26.30 - 27.80		100	100	73
	27.80 - 29.30		100	100	53
	29.30 - 30.30		100	85	30

FI: 6, 15, A…, 12, 4, 15

(Casing) Groundwater

STRATA RECORD

Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
20.30 - 20.45: Dark grey fine to medium sandstone. *20.70 - 20.80m: Dark grey fine to medium sandstone.* *21.22 - 21.36m: Subvertical undulating, smooth, clean fracture.*	(2.05) 21.45	17.76	▩	▧
Weak, partially weathered dark grey fine to medium SANDSTONE. Fractures are closely to medium spaced, subhorizontal planar, smooth, clean.	(1.15) 22.60	16.61	⁘	▧
Weak, partially weathered thinly bedded dark grey SILSTONE. Fractures are closely to medium spaced, subhorizontal planar, smooth, clean. *22.90 - 23.00m: Subvertical stepped, smooth, clean fracture.* *23.20 - 23.50m: Subvertical undulating, smooth, clean fracture.*	(1.35) 23.95	15.26	×	▧
Weak, partially weathered dark grey SILSTONE. Fractures are very closely to closely spaced, planar, smooth. *24.55m: Subvertical planar, smooth, clean fracture.* *25.80 - 26.00m: Subvertical planar, smooth, clean fracture.* *26.30 - 26.45m: Subvertical planar, smooth, clean fracture.* *26.58 - 26.62m: Subvertical planar, smooth, clean fracture.*	(4.30) 28.25	10.96	×	▧
Very weak, partially weathered dark grey MUDSTONE. Fractures are very closely to closely spaced *28.90 - 29.50m: Subvertical planar, smooth, clean fracture.*	(2.05)		☰	▧

Depth scale: 21, 22, 23, 24, 25, 26, 27, 28, 29, 30

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					4.90	5.10	00:30	150	6.70	150	6.85
					6.70	7.00	01:00	140	11.00	121	30.30

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

Log last updated 24/01/2018

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH49

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 39.21

Scale 1:50

Easting: 433226.03

Northing: 558647.01

Client: Sunderland City Council

Driller: RH/DC

Logged By: BC

Sheet 4 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling

Checked By: JH

Dates: 11/08/2017 - 24/08/2017

SAMPLE DETAILS												
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI A…	(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
								30.18 - 30.24m: Subvertical planar, smooth, clean fracture.	30.30	8.91		▨
								End of Borehole at 30.30 m				

31

32

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39

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Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					4.90	5.10	00:30	150	6.70	150	6.85
					6.70	7.00	01:00	140	11.00	121	30.30

General Remarks

1. Hand dug inspection pit to 1.20m.
2. No groundwater encountered.

Log last updated 24/01/2018

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH50

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.09

Scale 1:50

Easting: 433419.38

Northing: 558721.55

Client: Sunderland City Council

Driller: CT/DC

Logged By: BC

Sheet 1 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling

Checked By: JH

Dates: 24/08/2017 - 25/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	Insitu Testing	(Casing) Groundwater
B	0.00 - 0.30		
D	0.10		
ES	0.20		
D	0.35		
B	0.40 - 0.90		
ES	0.50		
BRE	0.75		
ES	1.00		
B	1.20 - 1.70		Dry
D	1.20		
SPT (S)	1.20 - 1.65	N=11 (2,2/2,3,3,3)	
BRE	1.75		
U	2.20 - 2.65	76 blows	
D	2.70		
BRE	2.75		
B	3.20		(3.10) Dry
D	3.20		
SPT (S)	3.20 - 3.65	N=17 (4,4/4,4,4,5)	
BRE	3.75		
U	4.20 - 4.65	57 blows	
D	4.70		
BRE	4.90		
B	5.20 - 5.70		(4.50) Dry
D	5.20		
SPT (S)	5.20 - 5.65	N=11 (1,3/3,2,2,4)	
BRE	5.90		
U	6.20 - 6.50	100 blows	
D	6.60		
BRE	6.90		
B	7.20 - 7.70		(4.50) Dry
D	7.20		
SPT (S)	7.20 - 7.46	N=50+ (5,7/26,24 for 40mm)	
BRE	7.90		
U	8.20 - 8.70	100 blows	
B	8.70 - 9.20		(4.50) Dry
D	8.70		
SPT (S)	8.70 - 9.14	N=50+ (6,7/8,11,16,15 for 70mm)	
BRE	8.90		
B	9.70 - 10.20		(4.50) Dry
D	9.70		
SPT (S)	9.70 - 10.15	N=42 (6,9/9,10,10,13)	
BRE	9.90		

STRATA RECORD

Description	Depth (m)	Level (m AOD)
Brown slightly sandy slightly gravelly clayey TOPSOIL. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone, siltstone and coal.	(0.35) 0.35	37.74
Firm brown mottled light grey slightly sandy slightly gravelly CLAY. Gravel is subangular to rounded, fine to coarse of sandstone, mudstone and coal.	(0.75) 1.10	36.99
Firm dark brown mottled dark grey slightly sandy, slightly gravelly CLAY of intermediate plasticity. Gravel is subangular to subrounded, fine to coarse of sandstone, siltstone, mudstone and coal. *2.20m: Stiff.*	(2.00) 3.10	34.99
Stiff greyish brown silty slightly sandy CLAY of low plasticity. Sand is fine to medium. *3.20-4.70m: Silt bands noted.* *4.20m: Firm silt of low plasticity.*	(3.30) 6.40	31.69
Stiff brownish grey slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal. *7.90m: Very soft band noted.*	(4.20)	

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					9.00	9.10	00:20	200	4.50	200	10.60
					10.70	10.85	01:00	140	15.00	116	31.20

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH50

Contract No: D8044	**Site:** IAMP - Preliminary Ground Investigation	GL (m AOD) 38.09 Scale 1:50 Easting: 433419.38 Northing: 558721.55
Client: Sunderland City Council	Driller: CT/DC Logged By: BC	Sheet 2 of 4
Method: Cable Percussive Drilling with Rotary Core Drilling	Checked By: JH	Dates: 24/08/2017 - 25/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	Insitu Testing	TCR%	SCR%	RQD%	FI	(Casing) Groundwater
	10.60 - 14.40 10.60 - 14.40					NI	10.60 - 15.40 80 % Water (4.50) Dry
D	10.70						
SPT (S)	10.70 - 10.91	N=50+ (7,11/9,23,18 for 20mm)				18	
						6	
	11.40 - 12.40					28	
			100	40	0		
C	12.20 - 12.40						
	12.40 - 13.90		100	9	0	7	
C	13.20 - 13.40		100	100	95		
	13.90 - 15.40						
C	14.00 - 14.15					20	
			100	93	86		
C	14.85 - 15.15					4	
C	15.20 - 15.40						
	15.40 - 16.35						15.40 - 19.35 100 % Water
C	16.00 - 16.10		46	43	43		
						AZCL	
	16.35 - 17.85					6	
			100	100	70		
						20	
	17.85 - 19.35					12	
						NI	
						20	
						NI	
						6	
			96	70	6	NI	
						40	
	19.35 - 20.85					A...	19.35 - 22.35 95 % Water
						40	
						NI	

STRATA RECORD

Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Stiff brownish grey slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of sandstone, mudstone and coal.				
Very dense reddish grey sandy GRAVEL. Gravel is angular to subangular, fine to coarse of sandstone. (Weathered SANDSTONE).	10.60 10.60 (0.35)	27.49		
Weak, partially weathered, reddish brown SANDSTONE.	10.95 (0.06)	27.14		
Weak, partially weathered, reddish brown fine to medium grained SANDSTONE. Fractures are very closely to closely spaced, subhorizontal planar, smooth, clean.	11.01 (0.39)	27.08		
Very weak, partially weathered, reddish brown thinly interbedded MUDSTONE and SILTSTONE. Fractures are subangular, closely to very closely spaced, subhorizontal planar, smooth, clean.	11.40 (6.00)	26.69		
Extremely weak, partially weathered, dark grey MUDSTONE. Fractures are extremely closely spaced, planar, smooth. *18.05m: Subvertical, planar, clean fracture.*	17.40 (2.35)	20.69		
Very weak, partially weathered, dark grey MUDSTONE.	19.75	18.34		

Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					9.00	9.10	00:20	200	4.50	200	10.60
					10.70	10.85	01:00	140	15.00	116	31.20

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH50

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.09
Scale 1:50
Easting: 433419.38
Northing: 558721.55

Client: Sunderland City Council
Driller: CT/DC
Logged By: BC
Sheet 3 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling
Checked By: JH
Dates: 24/08/2017 - 25/08/2017

SAMPLE DETAILS

Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %
			90	46	0
	20.85 - 22.35		100	100	33
	22.35 - 23.85		100	73	73
	23.85 - 25.35		100	95	53
	25.35 - 26.85		100	73	66
	26.85 - 28.20		88	88	26
	28.20 - 29.70		100	46	10
	29.70 - 31.20				

FI: 40, 12, 1, 12, 30, NI, 15, 40, 15

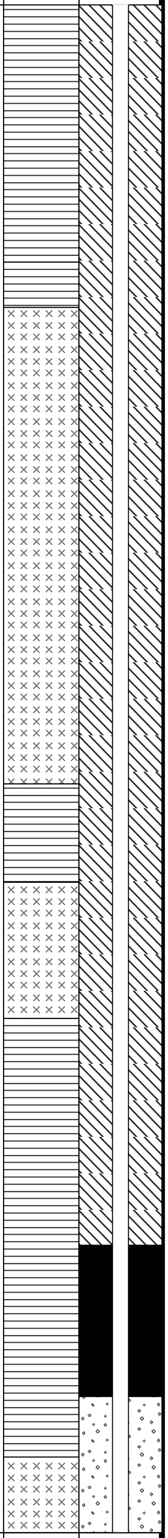
(Casing) Groundwater:
22.35 - 23.85 100 % Water
23.85 - 25.35 95 % Water
25.35 - 26.85 100 % Water
26.85 - 31.20 100 % Water

STRATA RECORD

Description	Depth (m)	Level (m AOD)
Fractures are very closely to subhorizontal, planar, smooth, clean. (drillers description). *20.30 - 20.35m: Medium strong dark grey fine to medium sandstone.* *20.66 - 20.76m: Weak dark grey siltstone.* *21.00 - 21.15m: Subvertical planar, smooth fracture.* *21.50 - 21.70m: Subvertical undulating, smooth, rough, clean fracture.*	(1.95) 21.70	16.39
Weak, partially weathered, dark grey MUDSTONE. Fractures are subhorizontal planar, smooth, clean. *21.75 - 21.90m: Subvertical undulating, smooth, clean fracture.*	(0.30) 22.00	16.09
Weak to medium strong, partially weathered, dark grey SILTSTONE with bands of sandstone. Fractures are very closely to closely subhorizontal planar, clean. *22.95 - 23.10m: Subvertical planar, smooth, clean fracture.*	(3.15) 25.15	12.94
Extremely weak, partially weathered, dark grey MUDSTONE. Fractures are very closely subhorizontal, planar, smooth, clean.	(0.65) 25.80	12.29
Very weak, partially weathered, dark grey SILTSTONE. Fractures are closely subhorizontal, planar, smooth, clean. *25.85 - 26.00m: Subvertical planar, smooth, clean fracture* *26.60 - 26.75m: Subvertical planar, smooth, clean fracture.*	(0.90) 26.70	11.39
Extremely weak, partially weathered, dark grey MUDSTONE. Fractures are very closely subhorizontal, planar, smooth, clean. *28.20 - 28.70m: Subvertical planar, smooth, tight, clean fracture.* *29.00 - 29.25m: Subvertical undulating, smooth, clean fracture* *29.32 - 29.42m: Medium strong dark grey sandstone.*	(2.90) 29.60	8.49
Weak dark grey SILTSTONE with occasional thin beds of mudstone. Fractures are closely subhorizontal planar, smooth, clean.		

Depth scale: 21, 22, 23, 24, 25, 26, 27, 28, 29, 30

Legend / Well/ Backfill



Continued on next sheet

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					9.00	9.10	00:20	200	4.50	200	10.60
					10.70	10.85	01:00	140	15.00	116	31.20

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

DUNELM GEOTECHNICAL & ENVIRONMENTAL

BRITISH DRILLING ASSOCIATION

BOREHOLE RECORD

Borehole BH50

Contract No: D8044

Site: IAMP - Preliminary Ground Investigation

GL (m AOD) 38.09

Scale 1:50

Easting: 433419.38

Northing: 558721.55

Client: Sunderland City Council

Driller: CT/DC

Logged By: BC

Sheet 4 of 4

Method: Cable Percussive Drilling with Rotary Core Drilling

Checked By: JH

Dates: 24/08/2017 - 25/08/2017

SAMPLE DETAILS												
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI	(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
								29.70 - 29.85m: Subvertical undulating, smooth, clean fracture.				
			100	50	50				(1.60)			
							31		31.20	6.89		
								End of Borehole at 31.20 m				
							32					
							33					
							34					
							35					
							36					
							37					
							38					
							39					
							40					

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter	
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)
					9.00	9.10	00:20	200	4.50	200	10.60
					10.70	10.85	01:00	140	15.00	116	31.20

General Remarks

1. Hand dug inspection pit to 1.20m.

Log last updated 24/01/2018

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client:	**Sunderland City Council**			
Site:	**International Advanced Manufacturing Park (IAMP), Sunderland**			
Job No:	**D8044**			
Pit No:	**TPS-01**	**Test No:**	**1**	

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)
0	0.96
0.5	0.965
1	0.97
2	0.97
3	0.97
4	0.975
5	0.975
6	0.975
7	0.975
8	0.975
9	0.975
10	0.975
15	0.975
20	0.975
25	0.975
30	0.975
40	0.975
50	0.975
60	0.975
90	0.975
120	
180	

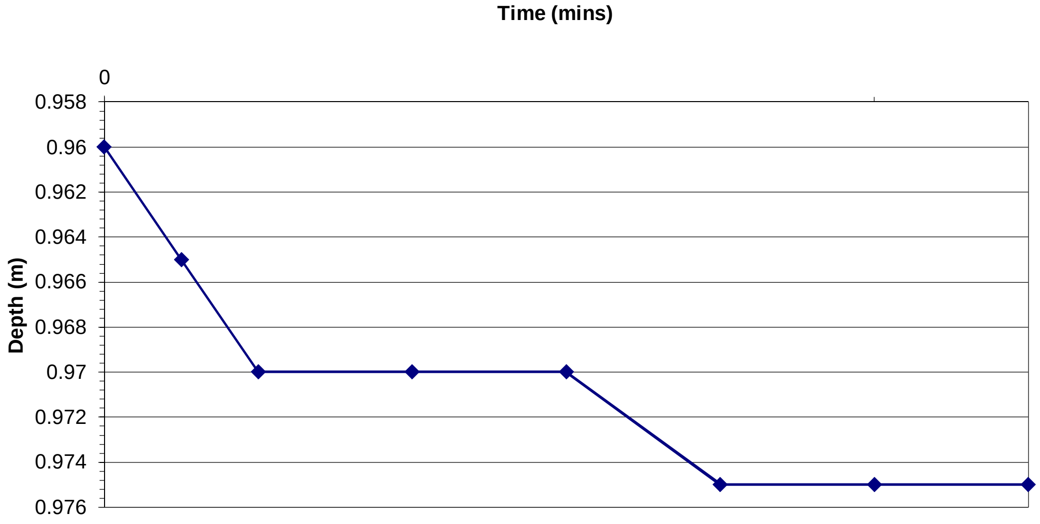
Pit Dimensions		
	Length (m) =	2.00
	Width (m) =	0.65
	Depth (m) =	2.00

Depth at start of test (m) =	0.960
Depth at end of test (m)=	0.975
75% level (m)=	N/A
50% Effective Depth	1.0325
25% level (m)=	N/A
Base area of pit (m^2) =	1.300
Vp_{75-25} (m^3) =	N/A
α_{p50} (m^2) =	6.772

V	0.0195
T	5400

Soil infiltration rate, f, (m/s) =	**5.33E-07**	**Inferred value**

Input by:	**SJS**	**Date:**	**29/08/2017**
Checked by:		**Date:**	



Notes:

1. Insufficent change in head and lack of infiltration to accurately calculate infiltration rate. Quoted rate should be regarded as indictaive only.

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016

BRE Digest 365, Figure 2, Page 5

Client: Sunderland City Council

Site: International Advanced Manufacturing Park (IAMP), Sunderland

Job No: D8044

Pit No: TPS-02 **Test No:** 1

CALCULATION OF SOIL INFILTRATION RATE

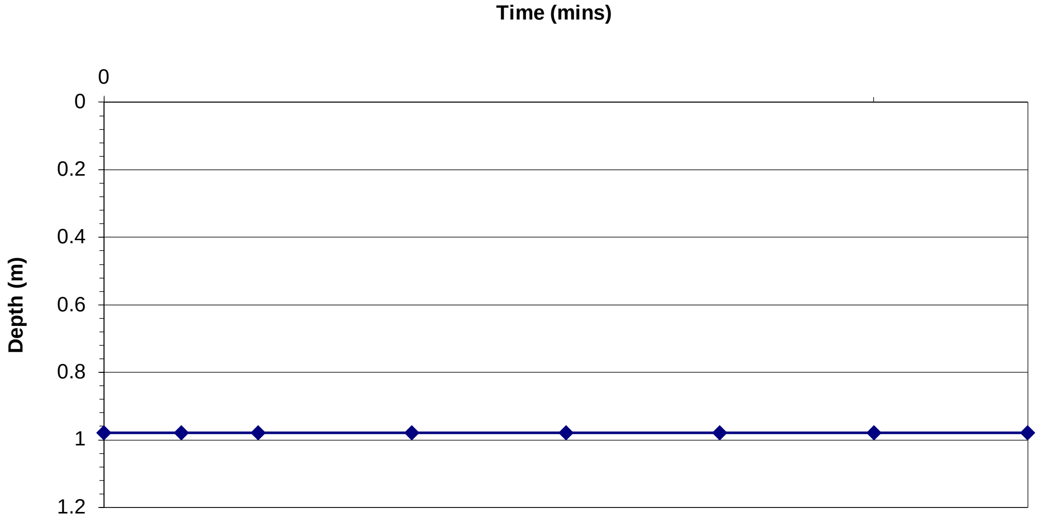
Time (min)	Depth (m)
0	0.98
0.5	0.98
1	0.98
2	0.98
3	0.98
4	0.98
5	0.98
6	0.98
7	0.98
8	0.98
9	0.98
10	0.98
15	0.98
20	0.98
25	0.98
30	0.98
40	0.98
50	0.98
60	0.98
90	0.98
120	
180	

Pit Dimensions		
	Length (m) =	1.90
	Width (m) =	0.65
	Depth (m) =	2.10

Depth at start of test (m) =	0.980
Depth at end of test (m)=	0.980
75% level (m)=	N/A
50% Effective Depth	1.12
25% level (m)=	N/A
Base area of pit (m^2) =	1.235
Vp_{75-25} (m^3) =	N/A
α_{p50} (m^2) =	6.947
V	0
T	5400

Soil infiltration rate, f, (m/s) = **0.00E+00**

Input by:	**SJS**	**Date:**	**29/08/2017**
Checked by:		**Date:**	



Notes:

1. Insufficent change in head and lack of infiltration to accurately calculate infiltration rate.

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client:	**Sunderland City Council**		
Site:	**International Advanced Manufacturing Park (IAMP), Sunderland**		
Job No:	**D8044**		
Pit No:	**TPS-03**	**Test No:**	**1**

CALCULATION OF SOIL INFILTRATION RATE

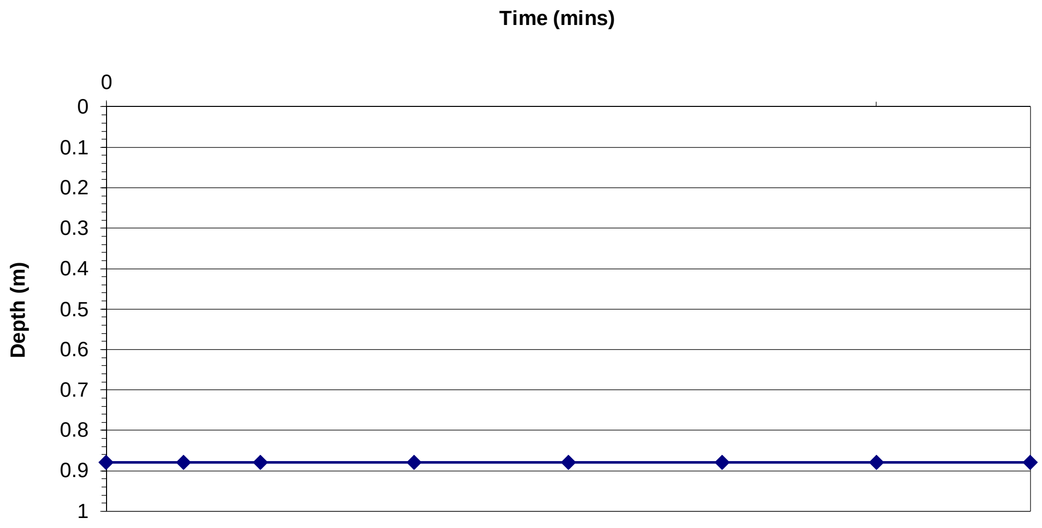
Time (min)	Depth (m)
0	0.88
0.5	0.88
1	0.88
2	0.88
3	0.88
4	0.88
5	0.88
6	0.88
7	0.88
8	0.88
9	0.88
10	0.88
15	0.88
20	0.88
25	0.88
30	0.88
40	0.88
50	0.88
60	0.88
90	0.88
120	
180	

Pit Dimensions		
	Length (m) =	2.10
	Width (m) =	0.65
	Depth (m) =	2.00

Depth at start of test (m) =	0.880
Depth at end of test (m)=	0.880
75% level (m)=	N/A
50% Effective Depth	1.12
25% level (m)=	N/A
Base area of pit (m^2) =	1.365
Vp$_{75-25}$ (m^3) =	N/A
α_{p50} **(m^2) =**	7.525
V	0
T	5400

Soil infiltration rate, f, (m/s) =	**0.00E+00**	**Inferred value**

Input by:	**SJS**	**Date:**	**29/08/2017**
Checked by:		**Date:**	



Notes:

1. Insufficent change in head and lack of infiltration to accurately calculate infiltration rate.

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client: Sunderland City Council
Site: International Advanced Manufacturing Park (IAMP), Sunderland
Job No: D8044
Pit No: TPS-04 **Test No:** 1

CALCULATION OF SOIL INFILTRATION RATE

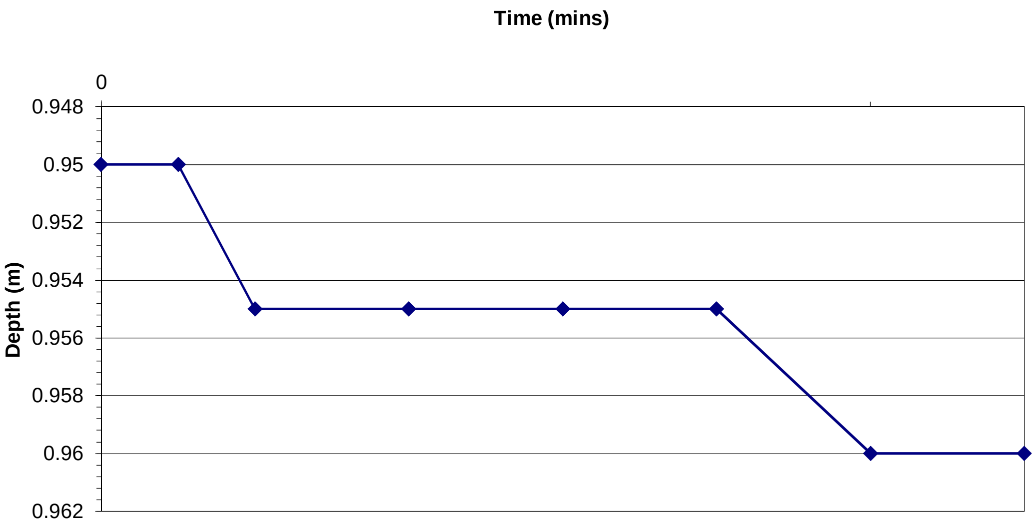
Time (min)	Depth (m)
0	0.95
0.5	0.95
1	0.955
2	0.955
3	0.955
4	0.955
5	0.96
6	0.96
7	0.96
8	0.96
9	0.96
10	0.96
15	0.96
20	0.96
25	0.96
30	0.96
40	0.96
50	0.96
60	0.96
90	0.96
120	
180	

Pit Dimensions		
	Length (m) =	2.00
	Width (m) =	0.65
	Depth (m) =	2.00

Depth at start of test (m) =	0.950
Depth at end of test (m)=	0.960
75% level (m)=	N/A
50% Effective Depth	1.045
25% level (m)=	N/A
Base area of pit (m^2) =	1.300
Vp_{75-25} (m^3) =	N/A
α_{p50} (m^2) =	6.839
V	0.013
T	5400

Soil infiltration rate, f, (m/s) =	**3.52E-07**	**Inferred value**

Input by:	**SJS**	**Date:**	**29/08/2017**
Checked by:		**Date:**	



Notes:
1. Insufficent change in head and lack of infiltration to accurately calculate infiltration rate. Quoted rate should be regarded as indictaive only.

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client: Sunderland City Council
Site: International Advanced Manufacturing Park (IAMP), Sunderland
Job No: D8044
Pit No: TPS-05 **Test No:** 1

CALCULATION OF SOIL INFILTRATION RATE

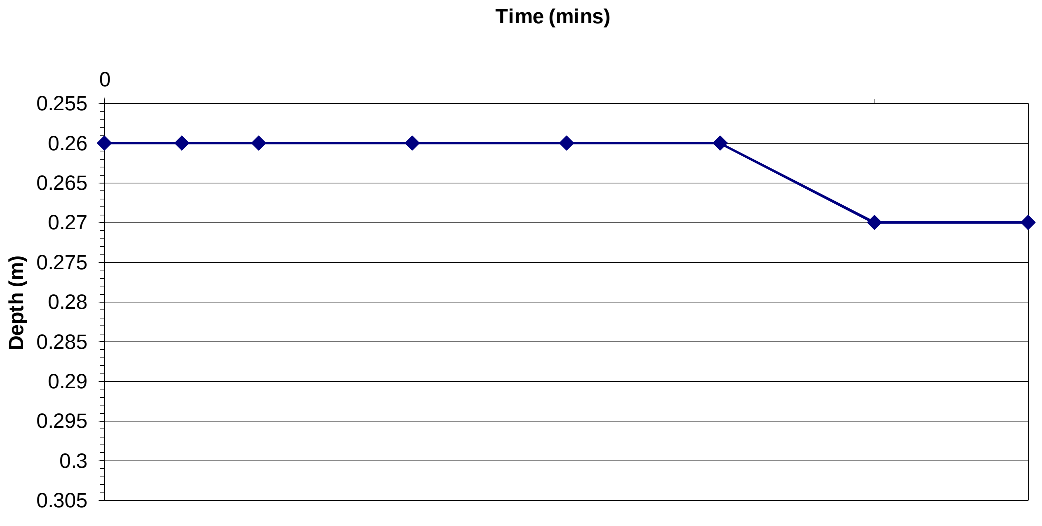
Time (min)	Depth (m)
0	0.26
0.5	0.26
1	0.26
2	0.26
3	0.26
4	0.26
5	0.27
6	0.27
7	0.27
8	0.27
9	0.27
10	0.27
15	0.275
20	0.275
25	0.275
30	0.275
40	0.275
50	0.275
60	0.275
90	0.285
120	0.285
180	0.29
240	0.3
300	0.3

Pit Dimensions		
	Length (m) =	2.00
	Width (m) =	0.65
	Depth (m) =	2.00

Depth at start of test (m) =	0.260
Depth at end of test (m)=	0.290
75% level (m)=	N/A
50% Effective Depth	1.725
25% level (m)=	N/A
Base area of pit (m^2) =	1.300
Vp_{75-25} (m^3) =	N/A
α_{p50} **(m^2) =**	10.443
V	0.039
T	18000

Soil infiltration rate, f, (m/s) =	**2.07E-07**	**Inferred value**

Input by:	**SJS**	**Date:**	**29/08/2017**
Checked by:		**Date:**	



Notes:

1. Insufficent change in head and lack of infiltration to accurately calculate infiltration rate. Quoted rate should be regarded as indictaive only.

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client: Sunderland City Council
Site: International Advanced Manufacturing Park (IAMP), Sunderland
Job No: D8044
Pit No: TPS-08 **Test No:** 1

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)
0	0.53
0.5	0.53
1	0.53
2	0.53
3	0.53
4	0.53
5	0.53
6	0.53
7	0.53
8	0.53
9	0.53
10	0.53
15	0.53
20	0.53
25	0.53
30	0.53
40	0.53
50	0.53
60	0.53
90	0.53
120	
180	

Pit Dimensions		
	Length (m) =	2.00
	Width (m) =	0.70
	Depth (m) =	2.00

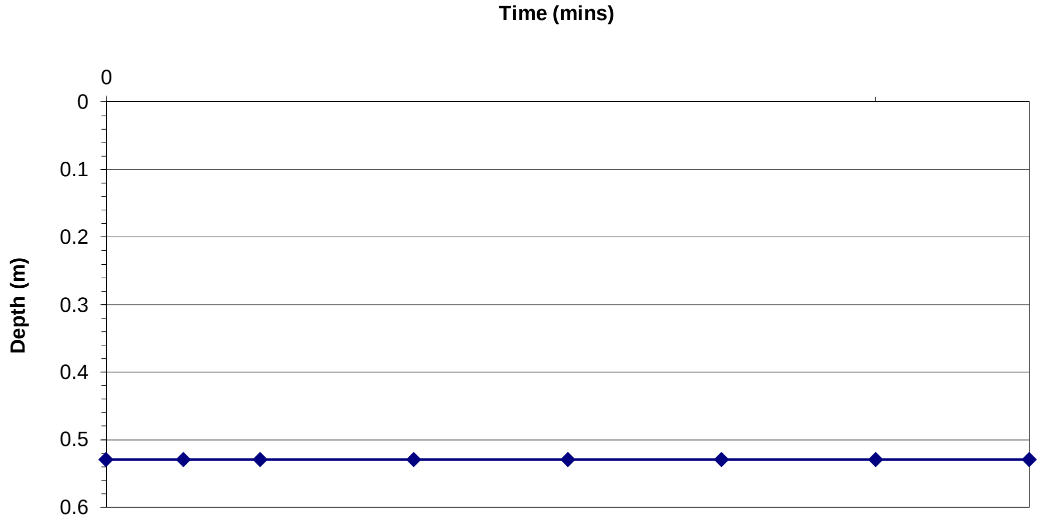
Depth at start of test (m) = 0.530
Depth at end of test (m)= 0.530
75% level (m)= N/A
50% Effective Depth 1.47
25% level (m)= N/A

Base area of pit (m^2) = 1.400
Vp_{75-25} (m^3) = N/A
α_{p50} (m^2) = 9.338

V 0
T 5400

Soil infiltration rate, f, (m/s) = **0.00E+00** **Inferred value**

Input by: **SJS** **Date:** **29/08/2017**
Checked by: **Date:**



Notes:

1. Insufficent change in head and lack of infiltration to accurately calculate infiltration rate.

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016

BRE Digest 365, Figure 2, Page 5

Client:	**Sunderland City Council**			
Site:	**IAMP - Preliminary Ground Investigation**			
Job No:	**D8044**			
Pit No:	**TPS11**	**Test No:**	**1**	

CALCULATION OF SOIL INFILTRATION RATE

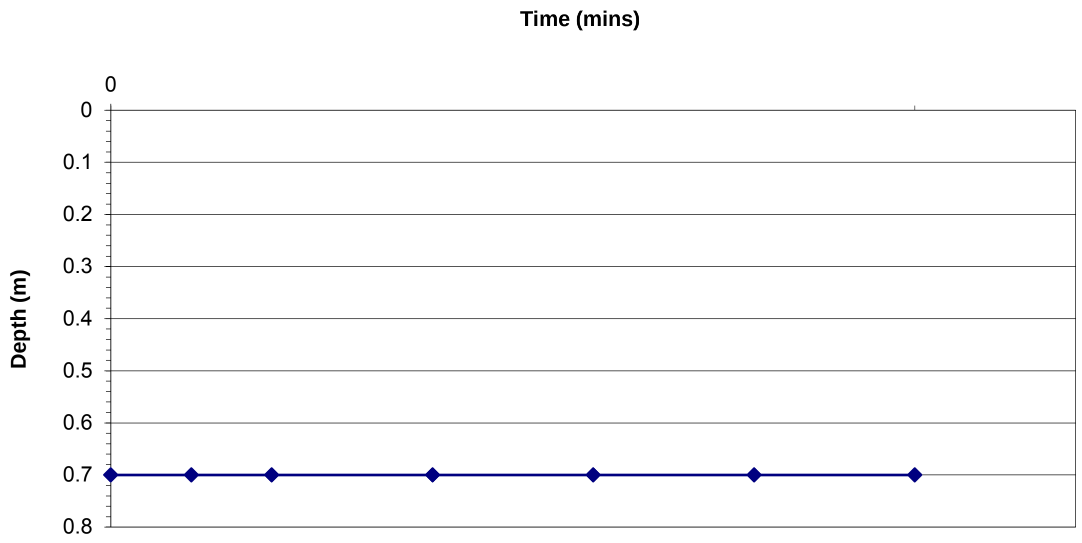
Time (min)	Depth (m)
0	0.7
0.5	0.7
1	0.7
2	0.7
3	0.7
4	0.7
5	0.7
6	0.7
7	0.7
8	0.7
9	0.7
10	0.7
15	0.7
20	0.7
25	0.7
30	0.7
40	0.7
50	0.7
60	0.7
90	0.7
120	
180	

Pit Dimensions		
	Length (m) =	3.30
	Width (m) =	0.80
	Depth (m) =	2.00

Depth at start of test (m) =	0.700
Depth at end of test (m)=	0.700
75% level (m)=	N/A
50% Effective Depth	1.3
25% level (m)=	N/A
Base area of pit (m^2) =	2.640
Vp_{75-25} (m^3) =	N/A
α_{p50} **(m^2) =**	13.300
V	0
T	5400

Soil infiltration rate, f, (m/s) =	**0.00E+00**	**Inferred value**

Input by:	**CA**	**Date:**	**25/09/2017**
Checked by:		**Date:**	



Appendix C: Regulatory Information

Appendix C: Contents

- Sunderland City Council policies WWE2 – WWE5

11.6 Significant weight is given to the wider environmental, social and economic benefits of renewable and low carbon energy generation and particularly, decentralised energy generation schemes. The impact on neighbouring residents and other sensitive receptors is also a significant consideration, but will vary, depending on the size, scale, location and type of technology proposed. Any potential cumulative impact of schemes within the area, including within and outside the city, will also be considered.

11.7 The A&D Plan will identify locations suitable for wind energy development if appropriate.

11.8 Applications for wind turbine installations will need to include details of associated infrastructure and connectivity, such as new access roads and overhead power lines, so that the council can fully assess the proposal.

Policy

WWE2 Flood risk and coastal management

1. To reduce flood risk and ensure appropriate coastal management, development:
    - i. should follow the sequential approach to determining the suitability of land for development, directing new development to areas at the lowest risk of flooding and where necessary applying the exception test, as outlined in national planning policy;
    - ii. will be required to demonstrate, where necessary, through an appropriate Flood Risk Assessment (FRA) that development will not increase flood risk on site or elsewhere, and if possible reduce the risk of flooding;
    - iii. will be required to include or contribute to flood mitigation, compensation and/or protection measures, where necessary, to manage flood risk associated with or caused by the development;
    - iv. should comply with the Water Framework Directive by contributing to the Northumbria River Basin Management Plan;
    - v. will maintain linear coastal flood defences north from Hendon Sea Wall to Seaburn, and managed coastal retreat on the Heritage Coast and north of Seaburn;
    - vi. which would adversely affect the quantity of surface or groundwater flow or ability to abstract water must demonstrate that no significant adverse impact would occur, or mitigation can be put in place to minimise this impact; and
    - vii. of additional river flood defences must demonstrate that the proposal represents the most sustainable response to a particular threat.

11.9 Flooding is a key factor in determining the scale and location of development in Sunderland. It is important that inappropriate development is avoided in areas currently at risk from flooding, or likely to be at risk as a result of climate change, or in areas where development is likely to increase flooding elsewhere. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where it is necessary, without increasing flood risk elsewhere. The National Planning Practice Guidance (NPPG), together with the council's latest Strategic Flood Risk Assessment (SFRA), Preliminary Flood Risk Assessment (PFRA) and latest Local Flood Risk Management Strategy (LFRMS) provides guidance in this respect. The SFRA provides a framework for the overall appraisal and management of risk. It allows the identification of land with the lowest probability of flooding that would be appropriate to the type of development or land use proposed.

11.10 Development should be directed towards locations which are at lowest risk from flooding. Where necessary, the applicant will be required to demonstrate that they have followed the sequential test.

11.11 Developers must consider flood risk from all sources as part of a SFRA and ensure they are utilising the most appropriate and up-to-date information in assessing the risk of flooding from all sources to the development site. Discussions should be held with the Lead Local Flood Authority when considering measures to mitigate flooding from different flood sources within development proposals. Conditions or planning obligations will be used as appropriate to secure flood risk mitigation measures.

11.12 Sunderland falls within the Northumbria River Basin Management Plan (RBMP) which provides cross-boundary guidance on good practice and measures for improvement. Drawn up by the Environment Agency, RBMPs aim to provide integrated management of surface and groundwater bodies across individual regions.

11.13 Built development can lead to increased surface water run-off; therefore new development is encouraged to incorporate mitigation techniques in its design, such as source control (interception) Sustainable Drainage Systems (SuDS) and attenuation SuDS. Where appropriate, SuDS should be used as part of the linked Green Infrastructure Network to provide multiple functions and benefits to landscape quality, recreation and biodiversity. This can be achieved through habitat creation, new open spaces and good design. SuDS should be designed to help cope with intense rainfall events as well as day-to-day rainfall events and to overcome any deterioration in water quality status. In determining the suitability of SuDS for individual development sites, developers should seek advice from the Lead Local Flood Authority.

11.14 In line with the Sunderland Corporation Act 1972 and Shoreline Management Plan, coastal flood defences will be maintained (termed "holding the line") at Hendon Beach, the Port of Sunderland, Sunderland Harbour, Roker and Seaburn Beaches. 'Managed retreat' (which monitors the coastline's natural processes but with no active intervention) will be undertaken along the Heritage Coast to the south of Hendon as well as at South Bents and Whitburn Cliffs.

11.15 This policy should be read alongside the Marine Management Organisation's North East Inshore and Offshore Plans.

Policy

WWE3 Water management

Development must consider the effect on flood risk, on-site and off-site, commensurate with the scale and impact. Development must:

1. be accompanied by a Flood Risk Assessment (where appropriate), to demonstrate that the development, including the access, will be safe, without increasing or exacerbating flood risk elsewhere and where possible will reduce flood risk overall;
2. demonstrate that they pass the Sequential Test and if necessary the Exceptions Test in flood Zones 2 and 3;
3. discharge at greenfield runoff rates for the 1 in 1 and 1 in 100 flood events plus the relevant climate change allowance for greenfield and brownfield sites in accordance with the latest Local Flood Risk Management Strategy;
4. incorporate a Sustainable Drainage System (SuDS) to manage surface water drainage. Where SuDS are provided, arrangements must be put in place for their whole life management and maintenance;
5. separate, minimise and control surface water runoff by discharging in the following order:
    i. to an infiltration or soak away system;
    ii. to a watercourse (open or closed);
    iii. to a surface water sewer; then
    iv. to a combined sewer.

    However, if sites are within 250m of a tidal estuary or the sea, surface water can be discharged directly);
6. ensure adequate protection where sites may be susceptible to over land flood flows (as shown in the Strategic Flood Risk Assessment) or lie within a Surface Water Risk Area (as shown on the Environment Agency flood maps);
7. incorporate allowance for climate change in accordance with the latest Environment Agency Guidance;
8. make developer contributions, where needed, to ensure that the drainage infrastructure can cope with the capacity needed to support proposed new development;
9. demonstrate control of the quality of surface water runoff during construction and for the lifetime of the development. For all developments the management of water should be an intrinsic part of the overall development; and
10. not have a detrimental impact on the city's water resources, including the Magnesian Limestone Aquifer and its ground source protection zones. Development along the River Wear and coast should take account of the Northumbria River Basin Management Plan, to deliver continuing improvements in water quality.

11.16 Flooding from sewers is increasingly recognised as an issue in areas that are not necessarily at risk from fluvial flooding – whereby rainfall events, sometimes away from the area concerned, cause major surface water run-off to enter the sewerage system.

11.17 This policy seeks to minimise the risk that future development locations could be flooded from sewers or add to an existing risk by ensuring that surface water run-off entering the sewer system is kept to an absolute minimum. Other benefits of such an approach will include a much reduced risk to water quality.

11.18 To help adapt to expected climate change, the policy provides the broad framework for addressing the increased risk of flooding including a requirement for sustainable drainage systems.

11.19 Where appropriate, SuDS should contribute to the provision of green infrastructure whilst retaining acceptable levels of useable amenity space.

11.20 In order to protect the Magnesian Limestone Aquifer and its ground source protection zones, the use of deep infiltration SUDS and other infiltration SuDS will not be supported where they are likely to have an adverse impact on drinking water supply. Ground investigations would need to be considered on a case by case basis and should be guided by the Environment Agency's approach to groundwater protection.

Policy

WWE4 Water quality

The quantity and quality of surface and groundwater bodies and quality of bathing water shall be protected and where possible enhanced in accordance with the Northumbria River Basin Management Plan.

1. Water quality assessments will be required for:
   - i. any physical modifications to a watercourse; and
   - ii. any development which could indirectly, adversely affect water bodies.
2. Development that discharges water into a watercourse will be required to incorporate appropriate water pollution control measures.
3. Development that incorporates infiltration based SuDS will be required to incorporate appropriate water pollution control measures.
4. Development adjacent to, over or in, a main river or ordinary watercourse should consider opportunities to improve the river environment and water quality by:
   - i. naturalising watercourse channels;
   - ii. improving the biodiversity and ecological connectivity of watercourses;
   - iii. safeguarding and enlarging river buffers with appropriate habitat; and
   - iv. mitigating diffuse agricultural and urban pollution.

11.21 This policy seeks to minimise the impact of development on the quality of surface water and the Magnesian Limestone Aquifer and its ground source protection zones.

11.22 The potential to pollute our groundwater aquifers is significant. Intense rainfall can cause localised flooding and erosion, and storm sewage overflows are known to affect water quality, environmental quality and affect important wildlife sites. Furthermore, old mine workings within the city have the potential to release heavy metals into the groundwater aquifers, and in areas along the coast, over-pumping of the aquifer has resulted in saline intrusions. Increased use of fertilizers in the catchment by the agricultural industry is also resulting in increasing nitrite concentrations, and landfill sites also present a high risk to groundwater.

11.23 The Environment Agency and the Coal Authority recommend a hydrogeological risk assessment is provided on the impact of development on the existing minewater 'blocks' (in terms of flood risk and water quality) as identified by the Coal Authority. Further advice should be sought with the local planning authority.

11.24 The council, in conjunction with the Environment Agency and the sewerage undertaker, will seek to resist development that threatens water quality and quantity, and will generally encourage initiatives that result in an improvement of water quality and the capacity of surface waters to support wildlife. The WFD became part of UK law in 2003 with the primary objectives of achieving good ecological status in water bodies, and providing protection for drinking water sources and protected sites (Habitats Directive Sites and Sites of Special Scientific Interest). These requirements are reflected in the Environment Agency's Northumbria River Basin Management Plan, which covers the city area.

11.25 Early engagement with the local planning authority, the LLFA, Environment Agency and relevant water and sewerage companies can help to establish if water quality is likely to be a significant planning concern and, if it is, to clarify what assessment will be needed to support the application. Applicants should provide sufficient information for the council to be able to identify the likely impacts on water quality. The information supplied should be proportionate to the nature and scale of the development proposed and the level of concern about water quality.

11.26 Water quality at the designated bathing water sites at Roker and Seaburn is assessed by the Environment Agency. From May to September, weekly assessments measure current water quality, and at a number of sites daily pollution risk forecasts are issued. Both beaches have been rated as excellent for 2015, 2016 and 2017.

Policy

WWE5 Disposal of foul water

1. Development should utilise the following drainage hierarchy:
   i. connection to a public sewer;
   ii. package sewage treatment plant (which can be offered to the Sewerage Undertaker for adoption); then
   iii. septic tank.
2. Development involving the use of non-main methods of drainage in areas where public sewerage exists or the use of Cess Pits will not be permitted.
3. Development of new or extensions/ improvements to existing waste water, sludge or sewage treatment works, will normally be supported unless the adverse impact of the development significantly outweighs the need for greater capacity.

11.27 For further information regarding the drainage hierarchy and use of non-main methods of drainage advice should be sought from Northumbria Water.

Policy

WWE6 Waste management

Development that encourages and supports the minimisation of waste production, and the re-use and recovery of waste materials including, for example, re-cycling, composting and Energy from Waste will normally be supported. Proposals for waste management facilities to deal with waste arisings will be encouraged based upon the following principles:

1. managing waste through the waste hierarchy in sequential order. Sites for the disposal of waste will only be permitted where it meets a need which cannot be met by treatment higher in the waste hierarchy;
2. promoting the opportunities for on-site management of waste where it arises and encouraging co-location of waste developments that can use each other's waste materials;
3. ensuring that sufficient capacity is located within the city to accommodate forecast waste arisings of all types during the Plan period, reducing the reliance on other authority areas;
4. supporting delivery of the South Tyne and Wear Joint Municipal Waste Management Strategy;
5. facilitating the development of recycling facilities across the city including civic amenity sites and small recycling 'bring' banks to ensure there is sufficient capacity and access for the deposit of municipal waste for re-use, recycling and disposal;
6. facilitating the development of a network of small scale local waste management facilities in accessible locations, and effective methods of waste management such as suitable facilities to separate or store different types of waste, including materials that are required to be separated for kerbside collection schemes;
7. ensuring new waste developments are located and designed to avoid unacceptable adverse impacts on landscape, wildlife, heritage assets and amenity;
8. working collaboratively with neighbouring local authorities with responsibilities for waste and other local authorities where waste import/export relationships exist. This will ensure a co-operative cross boundary approach to waste management is established and maintained; and

Appendix D: JBA river modelling report

Appendix D: Contents

- Fluvial Flood Risk Report for AESC Plant 3 site, JBA Consulting, October 2023
- SYSTRA drg nr 22A29-FRA-FLOOD-01 P01 Predicted flood extents

Fluvial Flood Risk Report for AESC Plant 3 site

Draft v4.0

October 2023

Prepared for:
SYSTRA

www.jbaconsulting.com

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Contract

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This report describes work commissioned by SYSTRA, on behalf of AESC UK, by an instruction dated 09th May 2023. The Client's representative for the contract was Tim Dawe of SYSTRA. Chulani Herath and Kevin Frodsham of JBA Consulting carried out this work.

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Abbreviations

1D	One-Dimensional
2D	Two-Dimensional
AEP	Annual Exceedance Probability
AESC Plant 3	Name of Development Site
CC	Climate Change
CSD	Critical Storm Duration
DTM	Digital Terrain Model
FEH	Flood Estimation Handbook
FEP	Flow Estimation Point
FRA	Flood Risk Assessment
IAMP	International Advanced Motoring Park
LIDAR	Light Detection and Ranging (remote sensing data)
LMED	Median Annual Stage (L)
m AOD	metres Above Ordnance Datum
NGR	National Grid Reference
QMED	Median Annual Flow (Q)
ReFH	Revitalised Rainfall-Run Off
URBEXT	Urban Extent (FEH catchment descriptor)

Executive Summary

Introduction

JBA were commissioned by SYSTRA to produce a fluvial flood risk report to inform a prospective new development site (i.e., the AESC Plant 3 site) adjacent to the International Advanced Manufacturing Park (IAMP) near Washington, Tyne and Wear. This information is expected to be used by SYSTRA to prepare a Flood Risk Assessment (FRA) for the site.

The Usworth Burn, a tributary of the River Don (Jarrow), flows along the northern edge of the AESC Plant 3 site. JBA previously modelled the fluvial flood risk from the River Don and Usworth Burn for SYSTRA between 2015 and 2018 to inform the FRA for the IAMP (Stage 1), which has now been implemented. The hydrology and hydraulic modelling that underpinned the IAMP FRA were reviewed and accepted by the Environment Agency in 2017 and the results were used to update their Flood Map locally.

Model and Hydrology Review and Updates

One requirement of the current study was to determine what, if any, updates were needed to the existing IAMP (2017) hydrology and hydraulic model to provide an up-to-date picture of the fluvial flood risk to the AESC Plant 3 site. To this purpose, a high-level review of the hydrology and hydraulic model were undertaken, which led to the following outcomes.

- Hydrology
    - The IAMP (2017) model inflows were retained in the knowledge that they have previously been reviewed and accepted by the Environment Agency and are known to be conservative. The critical storm duration for the Usworth Burn alongside the Plot 2 site was also confirmed to be the same as was used for the IAMP site (i.e., 12 hours).
    - The inflows for climate change scenarios were updated to reflect the current recommended climate change uplifts for the study watercourse over the lifetime of the development. A +34% (Central) allowance should be appropriate for the AESC Plant 3 site, if (as expected) it is categorised as 'Highly Vulnerable'. However, a 1% AEP +42% (Higher Central) uplift has also been modelled in this study to provide design levels should the development be categorised as 'essential infrastructure'.
- Hydraulic Modelling - The following model updates were undertaken.
    - The floodplain and bank crests were updated to reflect the latest LIDAR data (i.e., National LIDAR 2022 composite DTM - flown in 2021). This supersedes the combination of old LIDAR (believed from 2009), topographic survey and proposed IAMP levels that was used in the IAMP (2017) model.
    - The floodplain roughness map was updated to reflect the current state of the IAMP1 development in relation to new buildings, roads, hard standing areas and surface water.

Model Runs and Outcomes

The following model simulations were undertaken.

- Baseline (existing risk) AESC Plant 3 scenario.
  - Present day (i.e., without climate change) - 50%, 3.3%, 1% and 0.1% AEP
  - Future (i.e., with climate change) - 3.3% AEP Central (+34%), 1% AEP Central (+34%) and 1% AEP Higher Central (+42%)
- Undefended (Defence Failure) - 1% AEP Central (+34%) event.
- Site Fully Raised - 1% AEP Central (+34%) event.
- Sensitivity Tests - Storm duration, Flow, Roughness and Downstream Boundary.

The modelled baseline (existing risk) flood outlines predict that only a small area along the north-eastern periphery of the AESC Plant 3 site would be at fluvial flood risk. The baseline peak 1% AEP with climate change (+34%) flood levels modelled in the Usworth Burn alongside the site range from 38.43m AOD in the west to 35.76m AOD in the east.

The undefended model predicts that failure of the local (relatively low-level) earth embankments would not increase the flood risk to the AESC Plant 3 site.

The 'site fully raised' scenario predicts that there would be off-site impacts in a 1% AEP with climate change (+34%) event, should the whole of the development site be raised above flood levels.

Implications for Development

Most of the site remains dry in 0.1% AEP event so there would be no fluvial flood risk constraints on developing these parts of the site (providing that excavation is not undertaken to below the modelled flood levels). By contrast, there will be constraints on developing those parts of the site that are modelled to be at fluvial flood risk. The outcome of the 'site fully raised' scenario shows that raising these areas out of the flood zones would lead to adverse off-site impacts so our recommendation would be to avoid any development (including ground level changes) across these areas or else some additional flood mitigation measures would likely be needed to avoid an Environment Agency objection. From a set of proposed development platform levels that were supplied to JBA by SYSTRA in July 2023, the site could be safely developed as planned without having any off-site impacts, but the platform elevations would need to be tapered sharply down to existing levels along the eastern edge of the Giga 3 platform.

There would be no residual risk to the site from defence failure or blockage along the Usworth Burn and River Don. However, one might want to consider whether it would be appropriate to build in resilience to an extreme (0.1% AEP) flood event within any critical parts of the site.

There would be no emergency access/egress issues for the site as dry access would be possible along the A1290 in all events.

Recommendations

The main recommendation from this study would be to ensure that no development takes place within the modelled area of the 1% AEP with climate change (+34%) flood outline. This would ensure that the site was suitably safe and would have no adverse off-site impacts. If ground levels are to be changed across this area, then further work may be needed to quantify the impacts and deliver appropriate mitigation. An alternative approach would be undertake fresh hydrology that would seek to downscale the importance of the Hylton Bridge adjustment factor that underpins the current model hydrology and has led to what is expected to be a conservative assessment of the flood risk.

Limitations

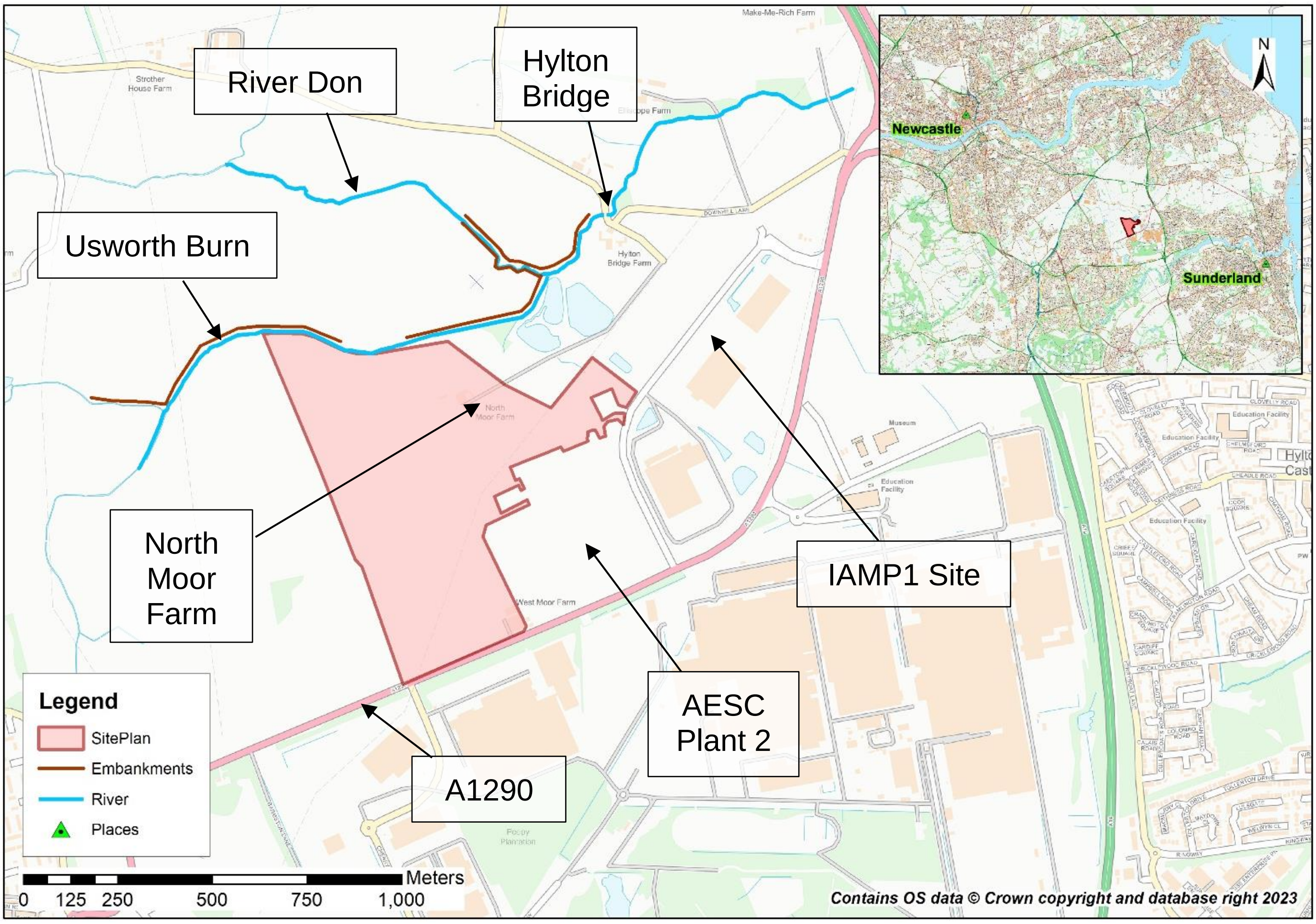
The flood risk presented in this report is based on a model with only minor updates to an existing model that was previously reviewed and accepted by the Environment Agency in 2017. However, the Environment Agency will still likely seek to review the hydraulic model and hydrology after a Flood Risk Assessment has been submitted before removing any objection to the development. There is therefore a risk that the Environment Agency review may require a response that would require further work, which could include a request to update the hydrology or certain parts of the hydraulic model.

1 Introduction

SYSTRA is assisting with the potential development of a commercial (AESC Plant 3) site, which is located between the A1290 and a watercourse called the Usworth Burn near the town of Washington, Tyne and Wear (Figure 1-1). The AESC Plant 3 development site is immediately to the west of the initial stages of the IAMP (International Advanced Motoring Park) development site[1], for which JBA previously assisted SYSTRA between 2015 and 2018 in relation to the fluvial flood risk. The AESC 3 site will be sited alongside the AESC Plant 2, which is now already under construction as part of the IAMP development.

The Usworth Burn is a tributary of the River Don (Jarrow) that flows along the northern edge of the AESC Plant 3 site. There is, therefore, a potential fluvial flood risk to the site that needs to be quantified so that the magnitude of any flood mitigation measures that may be needed can be determined before submitting a site-specific Flood Risk Assessment (FRA) to planning.

Figure 1-1: Planning Boundary for AESC Plant 3 and location



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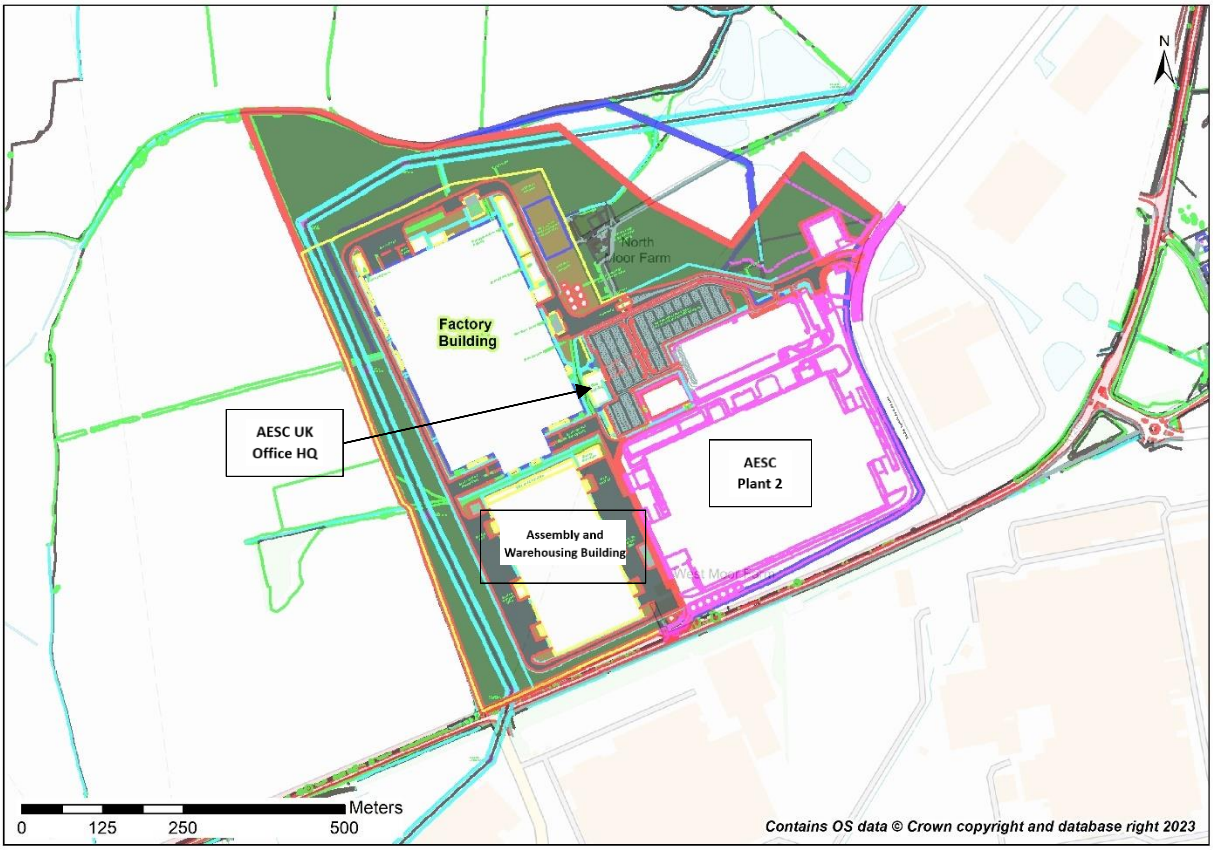
[1] https://iampnortheast.co.uk/

The proposed site layout is shown in Figure 1-2. The main components of the site design are a large factory building, a large assembly and warehousing building, and a smaller office building. These buildings would be partly surrounded by hardstanding areas (grey on Figure 1-2) with a retaining wall separating this from green space (green on Figure 1-2). The main access to the site is planned to be from International Drive to the east alongside the AESC Plant 2. It is expected that North Moor Farm will be demolished by a third party.

Figure 1-2: Current site layout for the AESC Plant 3 site.



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An initial inspection of the results of the previous work on the IAMP site would suggest that the fluvial flood risk to the AESC Plant 3 site is likely to be low. Therefore, the initial commission between JBA and SYSTRA is limited to quantifying the existing fluvial flood risk to the site, which would be needed to present the baseline risk within a Flood Risk Assessment (FRA). Should the existing (baseline) risk be found to place significant constraints on the development, then further work may be needed to identify mitigation measures and quantify their impact.

For the purposes of understanding the existing risk to the site and planning a site-specific flood risk assessment (FRA), up-to-date hydraulic modelling will be required for the AESC Plant 3 site and the outcomes of the following fluvial flood events are required to help inform the fluvial risk and site drainage strategy.

- 1-year, 30-year, 100-year, 1,000-year and 30-yr & 100-yr+climate change.

The climate change (CC) allowances must follow the latest guidance on developing in flood zones[2], which has changed since the IAMP models were last edited.

Any fluvial hydraulic modelling that is used to underpin an FRA will likely be reviewed by the Environment Agency before an objection to development on flood risk grounds is removed. Since the IAMP model and hydrology were previously reviewed and accepted by the Environment Agency in 2017, it is not expected that significant issues will be raised in response to re-using the existing model and flows (updated, as necessary, with the latest climate change allowances). However, if there have been any changes to hydraulic modelling or hydrology best practices since 2017, or, if any new information has become available since 2017 that could call into question the accuracy of the existing model, then some model updates might be required before the Environment Agency is able to sign off the modelling work. Therefore, before re-running the models, a high-level review of the existing IAMP (2017) model and hydrology was undertaken to see what (if any) improvements could be made to the existing hydraulic model. These reviews are documented in Section 2 of this report. The methodology for quantifying the fluvial flood risk to the AESC Plant 3 site is then discussed in Section 3 before the modelling outcomes are presented in Section 4, together with some commentary on the resulting development constraints. Some limitations of the study are listed in Section 5.

This report has been written to summarise the existing fluvial risk to the site to a standard that can be presented as a modelling Appendix to a Flood Risk Assessment.

---

[2] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

2 Model and Hydrology Review

2.1 Hydraulic Modelling History

The River Don is situated in Tyne and Wear and flows from a source in Washington to the River Tyne at Jarrow. The Usworth Burn is a short tributary of the Don that originates in Usworth and flows into the Don alongside the IAMP1 development. Prior to 2015 there were no detailed hydraulic models of either the River Don or Usworth Burn. Therefore, to assess the risk from these watercourses to the IAMP development, a detailed model was developed by JBA under commission from SYSTRA between 2015 and 2017, which ultimately informed the Flood Risk Assessment (FRA) for the IAMP1 site. The outputs from that model were subsequently used by the Environment Agency to update part of the Flood Zones between Usworth and the A19 (Washington Road). The model was subsequently updated by JBA in October 2018 to reflect a further potential phase of development (IAMP2) but these features have not been implemented so the IAMP1 model represents the most suitable starting point for any existing risk modelling. JBA were involved in a further phase of modelling of the Don and Usworth Burn for South Tyneside Council in 2018/19 as part of a fluvial modelling study for a small number of sites along the River Don. However, this later study merely appended the IAMP1 model into upstream and downstream extensions of the River Don so did not contain any model improvements that could influence the AESC Plant 3 site (other than a fresh set of hydrology calculations).

This chapter documents the development of these flood risk models in a little more detail leading to a more detailed review of the latest model and hydrology.

2.1.1 IAMP1 model

JBA Consulting were originally commissioned by SYSTRA (via JMP) in 2015 to undertake a flood risk modelling study of the fluvial flood risk from the River Don in Washington. The study was used to support the outline planning application for the initial stages of the International Advanced Manufacturing Park (IAMP) development on undeveloped land upstream of the A19.

The study required the production of a hydrology report to define the model inflows and the creation of a new-build hydraulic model of the River Don and Usworth Burn to define the fluvial flood risk.

The hydraulic model is a linked 1D-2D (ISIS-TUFLOW) model that includes a 2.6-kilometre reach of the River Don and a 1.4-kilometre reach of the Usworth Burn (Figure 2-1). The upstream modelled extents on these watercourses are located at Strother House Farm Bridge on the River Don (NGR 432354, 559708) and approximately 600 metres upstream of the upstream extent of the AESC Plant 3 site on the Usworth Burn (NGR 432130, 558907). The downstream model extent is located approximately 500 metres downstream of the A19 (at NGR 431525, 559646), at which point the River Don drains a catchment area of around 17km^2.

Figure 2-1: IAMP1 Model Schematic

Some of the key data components of the model are as follows.

- **Survey** - Topographic survey to underpin the IAMP model was collected by Academy Geomatics in November 2015 and March 2017. This included 38 cross sections along the River Don and Usworth Burn that were used to define the channel geometry and structures within the 1D component of the hydraulic model. Bank height information and floodplain levels were also surveyed.
- **LIDAR** - 1m DTM tiles (believed to have been flown in 2009) were used in combination with topographic survey to define the floodplain topography within the 2D domain of the model.

Both baseline (existing risk) and post-development model scenarios were created as part of the IAMP modelling.

The model was reviewed and accepted by the Environment Agency following a model review undertaken in June 2017. The modelled flood outlines adjacent to the IAMP development were then used to update the Environment Agency's Flood Maps.

2.1.2 IAMP2 modelling - October 2018

This phase of modelling was undertaken in response to the following potential changes that were being considered as a subsequent stage (2) of the IAMP development.

- The inclusion of a new access bridge
- The inclusion of a new hotel platform (raised above flood levels)
- The removal of the Elliscope Farm Access Bridge.

No changes were made to the IAMP1 model inflows at this stage.

None of the studied measures have yet been implemented. Furthermore, none of the modelled changes was predicted to have any impacts when evaluated against the IAMP1 post development model. Therefore, the IAMP1 model would still seem to be the more appropriate baseline model for assessing the baseline (existing risk) to the AESC Plant 3 site.

2.1.3 River Don - South Tyneside Council

This study added both up and downstream extensions to the IAMP1 mode so that the model extended from Northumberland Avenue (A195) to downstream of New Road (B1298) in East Boldon. However, the 1D model remained effectively unchanged through the IAMP model and the 2D model component required a larger (4 metre) cell size because of the increased model extent. In addition, to our knowledge, the model was never received by the Environment Agency. Therefore, the IAMP1 model would still appear to be the best model to use to assess the flood risk to the AESC Plant 3 site. However, a fresh hydrology calculation record was undertaken for the Don (STC) study that is potentially relevant to the AESC Plant 3 site assessment.

2.2 Hydrology Review

2.2.1 IAMP methodology

The IAMP1 and IAMP2 models both utilised the inflows that had been calculated for the IAMP1 study in 2017. Flood estimates were limited to the IAMP model extents as shown in Figure 2-2. Both FEH Statistical and (Urban) ReFH peak flows were estimated for these locations, and the final model inflows were derived as ReFH hydrographs that were scaled (as necessary) to match the FEH Statistical peak flows shown in

Table 2-1. One key assumption of the IAMP hydrology was that the (discontinued) gauge record from Hylton Bridge was appropriate for deriving a donor adjustment factor for the FEH Statistical peak flow estimates. The inclusion of this donor factor more than doubled the peak flows relative to those based on catchment descriptors alone (with or without donor factors from other, more distant, gauges). Hence, the IAMP FRA was undertaken in the expectation that the modelled flows were likely quite conservative.

The IAMP hydrology was signed off by the Environment Agency along with the IAMP model in 2017. Therefore, this review is aimed at checking whether the original IAMP flows are still appropriate for undertaking an FRA for the AESC Plant 3 site in 2023. Given the short time between the two studies, they should still be appropriate subject to the following checks.

1. The age of the data underpinning the hydrology (i.e., has any new data become available since the IAMP1 model).
2. Hydrology guidance (i.e., has anything changed in terms of standards that could mean that some changes are needed to the original hydrology method).
3. Are any changes needed because the primary fluvial risk to the western extension will be from the Usworth Burn rather than the River Don.

Figure 2-2: Flow Estimation Points (FEPs) for the IAMP study

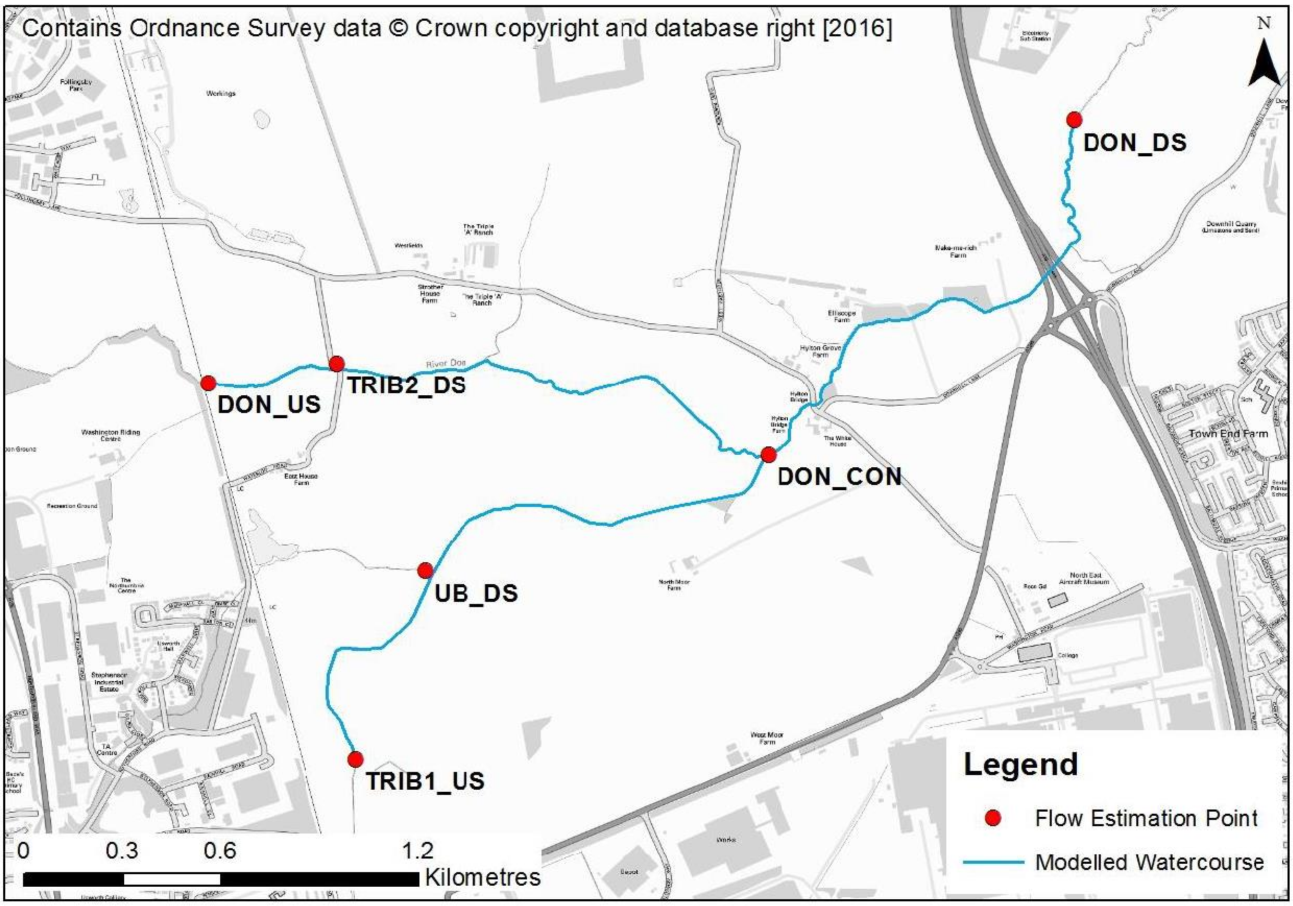
Contains Ordnance Survey data © Crown copyright and database right [2016]

Table 2-1: Final lumped peak flow estimates from the IAMP (2017) study

Flow Estimation Point	Flood peak (m^3/s) for the following AEP events (%)									
	50	20	10	5	3.33	2	1.33	1	0.5	0.1
DON_US	2.8	4.1	4.9	5.7	6.2	6.8	7.3	7.6	8.5	10.5
UB_DS	1.6	2.2	2.6	3.0	3.3	3.6	3.9	4.1	4.7	6.1
TRIB1_US	0.7	0.9	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.5
TRIB2_DS	1.4	1.9	2.3	2.7	2.9	3.2	3.5	3.6	4.0	5.0
DON_CON	7.6	10.8	13.0	15.1	16.4	18.1	19.4	20.3	22.6	28.3
DON_DS	8.4	11.9	14.4	16.8	18.2	20.0	21.4	22.4	25.0	31.0

Issues related to the age of the data

The Hylton Bridge gauge was only operational between October 2005 and June 2014. Therefore, there is no new gauge data within the catchment that could be used to improve the Hylton Bridge donor adjustment that underpins the peak flows used by the IAMP model. If the Hylton Bridge donor factor were to be disregarded, then one would potentially have to resort to using one of the other three gauges (outside the catchment) that were listed in the IAMP Calculation Record as a donor. There may be up to five more years data from these other potential donor sites, but five years additional data is unlikely to induce any significant change to these other donor factors which were all previously either close to or lower than 1.0. An additional five years of data could influence the pooling groups that were used to estimate the growth curves but a major change in the growth curve in relation to this length of additional record is considered unlikely.

Issues related to changes in guidance

In recent years, flow estimation guidelines have shifted from recommending ReFH to using ReFH2 when applying a rainfall run-off method. Therefore, any new calculation record would be expected to list the ReFH2 calculated flows instead of ReFH. However, the peak IAMP model inflows are based on the FEH Statistical method so any update of the ReFH2 flows would likely only have a relatively small influence on the IAMP inflows[3]. If one were to abandon the original preference for generating peak flows via the FEH Statistical approach to generating them via the ReFH2 method, this would bring about an overall reduction in flows because of the magnitude of the Hylton bridge adjustment factor.

It is noted that the local sewer network data was not used in the IAMP study. It was, therefore, assumed that there was no significant transfer of water in or out of the topographic catchments via the sewers. This is a fair assumption for an FRA, for which sourcing the sewer network data would be potentially problematic. However, given the extent of upstream urbanisation, there is a risk that some run-off may be diverted either in or out of the study catchments.

The IAMP hydrology was based on the following software: FEH CD-ROM v3.01, WINFAP-FEH v3.0.0032 and ISIS v3.7 (for urban ReFH). These products have all subsequently been updated, which could lead to changes in any fresh hydrology calculations. However, it is considered highly unlikely that these would lead to a significantly more conservative assessment of the IAMP flows.

Issues related to Usworth Burn being the primary source of risk

The IAMP FRA documents the outcome of storm duration testing, which justified the use of a 12-hour storm for modelling the risk to the IAMP site, which is situated close to the Don / Usworth Burn confluence. However, Table 2-2 (reproduced from the IAMP 2017 report) hints that a shorter storm may be critical along the Usworth Burn. Therefore, the AESC

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[3] Via a subtly changed hydrograph shape and/or altered 1%:0.1% AEP ratio, which is used to derive the 0.1% AEP inflows. In addition, the IAMP study made use of the Urban ReFH approach, which represented an improvement over earlier ReFH approaches.

Plant 3 study should seek to confirm the critical storm duration for the site before running design events (see Section 4.4.1).

Table 2-2: Peak river levels modelled in response to different 1% AEP storm durations (reproduced from the IAMP 2017 reporting)

Location	Peak river levels (m AOD) for the following storm durations				
	4 hr	8 hr	12 hr	14 hr	16 hr
US extent of River Don	37.15	37.21	37.19	37.18	37.16
US extent of tributary	40.76	40.73	40.70	40.69	40.67
DS of confluence	34.45	34.59	34.60	34.59	34.58
US face of Hylton Bridge	33.96	34.09	34.10	34.09	34.08
US face of A19 road bridge	32.19	32.42	32.46	32.45	32.43
DS extent of River Don	29.99	30.06	30.07	30.07	30.07

2.2.2 River Don STC Study

Whereas the IAMP study was restricted to the upper reaches of the Don, the STC study undertaken undertook a more holistic assessment to the River Don hydrology to inform three separate models at various regions within the Don catchment, one of which was the extended IAMP model (listed in Section 2.1.3). The detail of this more recent calculation record is not reviewed in detail here partly because it was undertaken for another client and partly because it is mainly referenced to provide a ballpark comparison with the previous IAMP model approach.

The STC calculation record considered donor adjustments based on the same gauges as the IAMP study and concluded that the value of QMED, derived via the Hylton Bridge gauge record, was simply too different without any additional supporting evidence to be used as a donor site. The STC study favoured an adjustment to the initial FEH Statistical flow estimates based on the Team Valley gauge. However, the hydrology report ultimately recommended that the design flows should be derived on the basis of a distributed unscaled (Urban) ReFH approach. This was largely based on the observation that the (Urban) ReFH derived peak flows were (a little) more conservative than the flows generated by the FEH Statistical method[4]. In addition, the urban component of the ReFH approach had been studied in more detail than for the IAMP study, giving increased confidence in the results. The resulting flows appeared to produce reasonable results when assessed against the recent flood history along the River Don suggesting that any widespread donor adjustment based on Hylton Bridge would likely lead to an overestimate of flows.

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[4] Note that the difference between FEH Statistical and ReFH derived flows was much smaller than for the IAMP hydrology, so the two approaches led to broadly similar peak flows.

2.2.3 Re-assessment of Hylton Bridge QMED flow

The QMED derivation process used in the IAMP study has been re-examined as part of this study to assess whether there is any evidence of why the IAMP analysis led to such a high donor adjustment.

The previous QMED assessment at the Hylton Road gauge derived an LMED value of 1.635m ALD (Above Level Datum) from the POT series, which, when appended to the supplied Environment Agency datum of 32.081m AOD, produces an LMED value in m AOD of 33.716m AOD. The equivalent QMED flow was then read from the IAMP model rating (Figure 2-3) to be 7.0m^3/s. This contrasted with a value of 2.6m3/s that had been derived from catchment descriptors alone, which ultimately led to QMED donor adjustment factors (when adjusted for both URBEXT and centroid distance) of between 2.0 and 2.5[5] at all FEPs (flow estimation points) within the IAMP model.

One concern with the original LMED/QMED conversion process was the accuracy of the gauge datum, which could not be checked when surveyors visited the watercourse in 2017 with an instruction to check the gauge datum because the gauge board had been removed. The following paragraph details some new information on the datum issue that was not examined in the IAMP study.

The recorded baseflow level in the Hylton Bridge gauge record is around 32.3m AOD based on the supplied Environment Agency datum (Figure 2-4). By contrast, the water levels recorded in two different river surveys at the upstream and downstream faces of Hylton Bridge that were undertaken for the IAMP study in November 2015 and March 2017 were 32.15 and 32.14m AOD, respectively. In addition, both surveys recorded a channel invert level in the order of 31.95m AOD and flow conditions on the day of both surveys were relatively benign. This suggests that there is likely a discrepancy of at least 0.16 metres between the surveyed and gauged (low flow) water levels at the gauge location. This might be due to issues with the gauge and/or survey datums or the fact that the downstream cross-section at the bridge is not sufficiently close to the gauge location. In any case this re-analysis would suggest that the previously calculated LMED value of 1.635m ALD should be added to a datum that is at least 0.16 metres lower than the Environment Agency gauge datum. When this is done, the outcome is an LMED value of 33.556m AOD, which from the model rating would arise from a reduced QMED flow of 5.6m^3/s (Figure 2-3). This represents an approximate 25% reduction in the 7.0m^3/s flow that was used to inform the IAMP hydrology.

Although this reassessment of QMED is perhaps lacking in the certainty needed to rubber stamp a fresh calculation record with reduced flows, it is a further line of evidence that the IAMP model inflows will likely lead to a conservative assessment of the site risk. Therefore, we can be confident that, even if the Environment Agency were to request an updated hydrology report for the FRA, it would be lower than the fluvial flood risk that arises from the existing IAMP model inflows. Hence, the **minimum** design levels provided in this report

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[5] Note that a donor factor of 2.2 was derived for the Usworth Burn.

from running the IAMP inflows are considered very unlikely to have to be raised should any fresh hydrology calculations be undertaken in future.

Figure 2-3: Model rating at the gauge location on the downstream face of Hylton Bridge

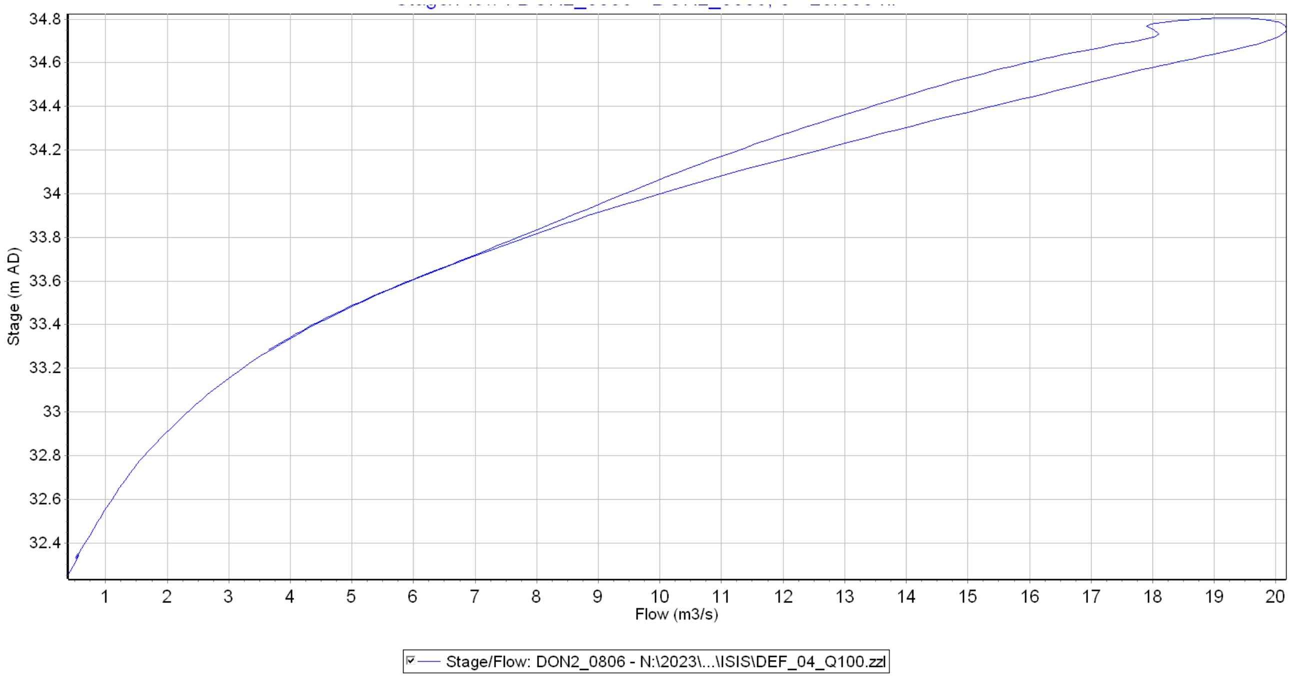
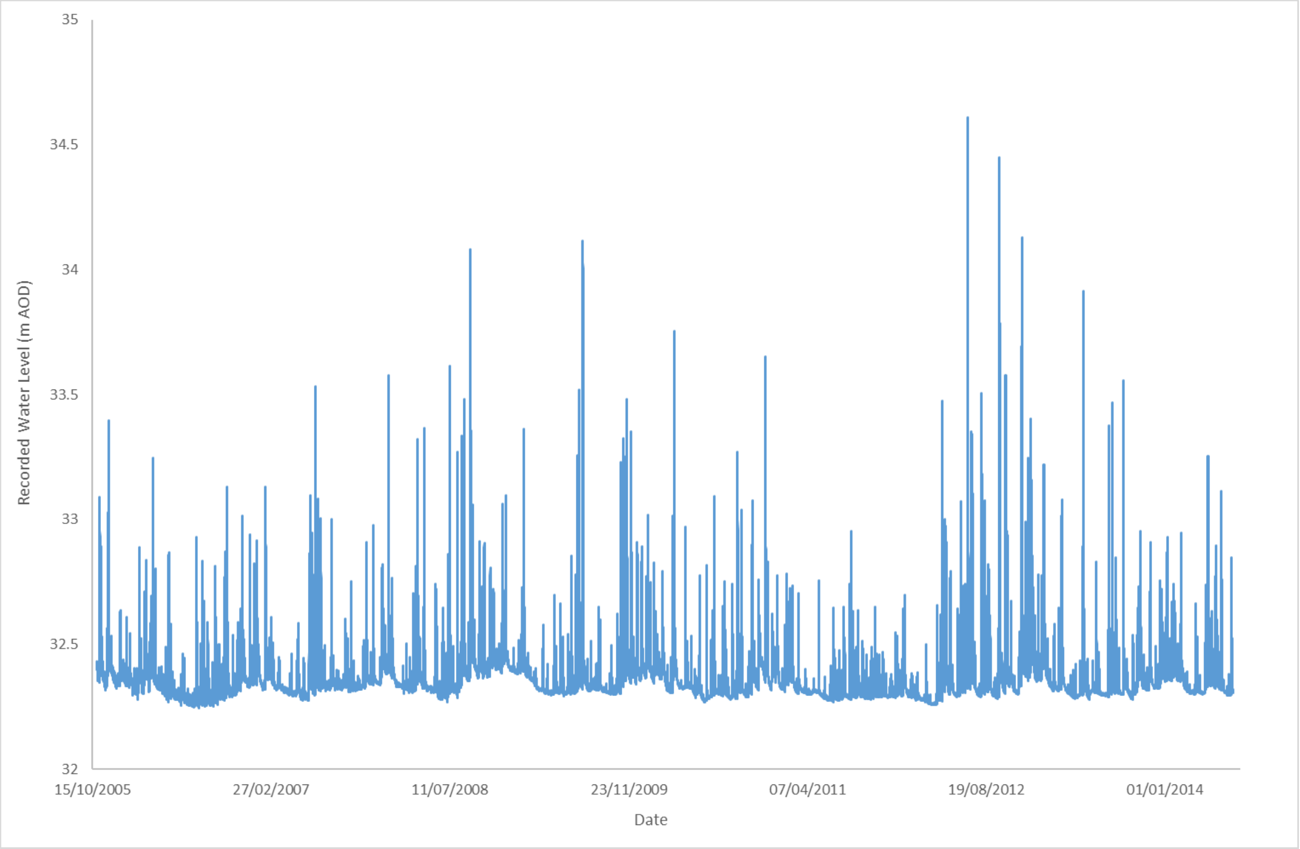


Figure 2-4: Hylton Bridge gauge record (m AOD based on the supplied Agency datum)



2.2.4 Hydrology Approach

The outcome of the hydrology review is that it is recommended that the following approach should be taken towards deriving the model inflows for the AESC Plant 3 site.

- The IAMP derived peak flows should be retained.
- The critical storm for the Usworth Burn alongside the AESC Plant 3 site should be tested and, if necessary, the IAMP model inflows should be adjusted to the modelled critical storm duration.

The main limitation of this approach is that the Environment Agency could request a full hydrology update due to uncertainties in the previous approach. If this were to be the case, then the Hylton Bridge donor adjustment would come under more scrutiny than in the previous IAMP hydrology calculations with the likelihood that the model inflows would ultimately be reduced, whether based on the FEH Statistical approach (with alternative donor factor) or unscaled ReFH2.

2.3 Hydraulic Model Review

Section 2.1 noted the history of flood modelling at this site. Given that the IAMP1 development has now been implemented but none of the works simulated by the IAMP2 model have yet been constructed, the more appropriate starting point for baseline (existing risk) modelling at the AESC Plant 3 site would be the post-development IAMP1 model scenario[6]. The Don STC model contains a larger reach of the River Don than the IAMP models but the Usworth Burn in the STC model is a straight copy of the Usworth Burn representation in the IAMP models. Therefore, given that the IAMP1 model has previously been signed off by the Environment Agency, uses a more conservative hydrology and has a higher floodplain definition, the IAMP1 model is considered more appropriate than the STC model for assessing the risk to the AESC Plant 3 site.

As the IAMP1 model was signed off by the Environment Agency in 2017, it should still be appropriate for assessing the risk to the AESC Plant 3 site subject to the following checks.

- The age of the data underpinning the model (i.e., has any new data become available since the IAMP1 model was produced).
- Floodplain development (i.e., have there been any changes on the floodplain since the IAMP1 model was produced).
- Modelling Standards (i.e., has anything changed in terms of standards that could mean that some changes are needed to the original modelling process e.g., new software versions, modelling techniques etc).
- Are any changes needed because the primary fluvial risk to the western extension will be from the Usworth Burn rather than the River Don.

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[6] Note that because the IAMP2 model predicted that the post-development IAMP1 and IAMP2 river levels along the Usworth Burn would be identical (i.e., there would be no impacts along the Usworth Burn due to the IAMP2 development), the risk to the western extension from any subsequent IAMP2 development should also be covered by the IAMP1 model.

2.3.1 Topographic Data

- **River Survey** - The majority of the river channel survey in the IAMP model was collected by Academy Geometrics in November 2015. This was supplemented by some additional river survey downstream of Hylton Bridge that was collected in March 2017. The river survey is less than 10 years' old so should still be appropriate for evaluating the baseline site risk to a site in 2023 without the need for check survey.
- **LIDAR** - The original model used a combination of LIDAR DTM and topographic survey to define the floodplain topography. Topographic survey was used across the southeastern corner of the model because the available LIDAR did not cover the full extent of the modelled flood outlines. it is believed that the LIDAR that was used in the IAMP1 model was flown in 2009.
  1m composite LIDAR DTM now covers the whole of the model domain. This has been downloaded and cross-checked against the existing model topography, which shows that fresh LIDAR is available for the whole of the 2D model domain (i.e., the latest composite does not seem to contain any of the 2009 data). A check on LIDAR flight dates implies that the latest LIDAR was flown in 2021 as part of the National LIDAR programme.
- **Topographic Survey** - A large topographic survey was undertaken in 2015 that covers the whole of the IAMP1 and AESC Plant 3 sites. Since development has occurred across the IAMP1 site but not the Plot 2 site, then this topographic survey should still be relevant to the Plot 2 site but not for the developed parts of the IAMP1 site.

2.3.2 Recent Development

The main ground level changes to the floodplain associated with the IAMP1 site were implemented prior to 2017 so would have been in place by the time of the National LIDAR overflights in 2021. Therefore, subject to some checks (presented in Section 3.3), the 2021 LIDAR is expected to present an accurate picture of present-day floodplain elevations. This implies that the model can be safely updated with the latest LIDAR and that there is now no need to include the topographic patches that were used to define the proposed ground level changes that were read into the IAMP1 post-development scenario.

2.3.3 Modelling Standards

There have been no major changes in modelling guidelines that could impact on the suitability of the IAMP model. There have, however, been incremental improvements to the software. The IAMP1 model was previously run with ISIS v3.7 and TUFLOW 2016-03-AD-w64, whereas the updated model ought to be run with more recent versions of both software packages.

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[7] Some works are still ongoing, but these are outside of the floodplain so should not influence the fluvial flood modelling results.

2.3.4 Usworth Burn Risk

The only factor that might need to be changed as a consequence of the AESC Plant 3 site being located further upstream in the Usworth Burn relative to the main part the IAMP1 site is that the critical storm duration along the Usworth Burn might be shorter than along the River Don. Therefore, it is recommended that storm duration testing is carried to verify if the 12-hour storm used for the IAMP1 model is still appropriate for the AESC Plant 3 site. This is reported in Section 4.4.1.

2.3.5 Other issues noted during the model review.

- The 1D (channel) bed and bank roughnesses were previously accepted for the IAMP FRA modelling and seem reasonable so will be maintained for this study. Sensitivity testing of the roughness will be carried out to demonstrate the model sensitivities and to inform the Agency review.
- There are no structures in the model that could influence the risk along the Usworth Burn. Therefore, any modification of the existing structures would not influence the current study.
- The 2D domain is based on a cell size of 2 metres so there would be little benefit from reducing the cell size further to increase the model definition.
- The bank crests are currently based on the topographic survey that was undertaken in November 2017. This seems reasonable but, because it is recommended to update the floodplain to reflect the latest (2021) LIDAR DTM, it would also be appropriate to update the bank crests likewise. The 1 metre definition of the LIDAR should ensure that the crest height of the earth embankments is represented in the model to a reasonable level of accuracy, although ultimately the local embankments were previously shown to have little impact during major flood events.
- There will have been changes in roughness across the IAMP development area so a local update to the floodplain roughness will be needed. Floodplain roughness was previously determined by drawing a set of polygons around buildings, roads etc as depicted on an Open Source map background and this approach should be adequate to incorporate recent changes across the IAMP site.
- An HQ boundary was previously placed along part of the southern edge of the 2D domain to avoid undue ponding of water against the edge of the 2D domain in an 0.1% AEP event. This was necessary because there was no further topographic data (LIDAR or topo survey) available in this area. This could be rectified in the current study because the LIDAR is more extensive. However, because this floodwater was already within the adjacent catchment and will have no impact on the western extension, there is no necessity to update the model hereabouts.
- The IAMP currently contains several stability fixes (roughness patches and a Boundary Viscosity Factor = 2) to control 1D-2D oscillation. An updated model run with more recent software version may enable these stability fixes to be reduced in scale.

3 Methodology

3.1 Hydrology Updates

Section 2.2 provided a detailed summary of the status of the IAMP model hydrology and led to the following recommended approach for the assessing the risk to the AESC Plant 3 site.

- The peak flows derived for the IAMP study should be retained.
- The critical storm duration (CSD) along the Usworth Burn should be tested and, if necessary, a new set of inflow (IED) files should be created and run for the relevant CSD.
- Up to date climate change factors should be applied.

Section 4.4.1 lists the outcome of the storm duration testing, which verifies that the same 12-hour storm as was used for the IAMP assessment is still appropriate for the AESC Plant 3 site. Therefore, the only modification needed to the IAMP model inflows was to apply the updated uplifts for the climate change simulations (see Section 3.2).

The above approach is considered appropriate for an FRA at the AESC Plant 3 site, but the following potential limitations are noted.

- The inflows are likely to be conservative (based on the discussions in Section 2).
- The IAMP hydrology was calculated in 2017. The Environment Agency could request a fresh hydrology, but it is considered that the current hydrology is defensible on the grounds that it is relatively recent and likely to be conservative.

3.2 Climate change uplifts

The climate change uplifts required of an FRA are dependent on the nature of the development. The climate change guidance in relation to fluvial flows has changed across England since uplifts of +20, +25 and +50% were previously modelled for the IAMP study.

For the AESC Plant 3 site, it is expected that the site will be classified as 'highly vulnerable' because of the storage of certain hazardous materials that will be required to be used in the battery manufacturing process. An FRA for a 'highly vulnerable' development site would require an assessment of the ‘Central’ emissions climate change scenario, which evaluates to a +34% uplift for watercourses in the Tyne catchment. In addition to the 'Central' emissions scenario, the 'Higher Central' climate change allowance of +42% has also been modelled in this study to provide a steer should the Environment Agency wish to see the impact of development at this level of climate change uplift, which would normally only be required for developments categorised as 'essential infrastructure'. Hence, both uplifts have been modelled in conjunction with the 1% AEP event for this study. The central uplift was also run at the client's request for a 3.3% event

3.3 Data Checks

The original IAMP model grid was based primarily on the latest available LIDAR (1m DTM tiles) that was available at the time[8] but with some topographic survey included where the LIDAR was absent. The proposed IAMP mitigation measures (platform raising and additional floodplain storage) were then included as topographic adjustments to this underlying ground level model.

A model should ideally use the most up-to-date available data (of suitable quality) and it is evident that LIDAR has been re-flown since the IAMP model was created. Therefore, the 1m LIDAR DTM (2022) composite across the IAMP model extent was downloaded in June 2023[9]. However, before updating the model to include for the most recent LIDAR, some checks were undertaken against the topographic datasets that had been used in the original IAMP model. This was to check for consistency between the datasets and highlight areas where ground level changes had taken place between the different data collections.

3.3.1 LIDAR (2023) vs LIDAR (2009)

The difference in elevation between the two LIDAR datasets is shown in Figure 3-1. This illustrates that, beyond the extent of the IAMP development, the two LIDAR datasets are generally consistent in that elevations are typically within ±0.1 metres of one another but there is a tendency for the most recent LIDAR DTM to be higher than the previous LIDAR[10]. This observation could help explain why the original study found some discrepancies between the (old) LIDAR and topographic survey across some areas (most notably on the left bank of the River Don downstream of Hylton Bridge). Across the IAMP development, there are clear differences between the two LIDAR datasets, which reflect the fact that the old LIDAR was flown before the IAMP development took place whilst the most recent LIDAR was flown after development. Hence the new LIDAR is higher across the raised platform of the IAMP site and lower across the areas where additional floodplain storage was created.

3.3.2 LIDAR 2023 versus 2015 topographic survey

An extensive topographic survey was collected by Academy Geomatics for the initial IAMP study in November 2015. Figure 3-2 shows a comparison between the elevations in the topographic survey and the 2022 LIDAR DTM. This was created by point inspecting the

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[8] From checking the LIDAR 'time stamped' extents at https://environment.data.gov.uk/DefraDataDownload/, this data would appear to have been flown in 2009.

[9] The DEFRA website states that the composite dataset is derived from a combination of the 'time stamped' archive and 'National LIDAR Programme', and that where repeat surveys have been undertaken the newest, best resolution data is used. A look at the 'time stamped' and 'National' LIDAR coverage would, therefore, imply that the 2022 composite should be wholly (subject to no poor data quality defects) based on the 2021 National LIDAR across the IAMP model extent.

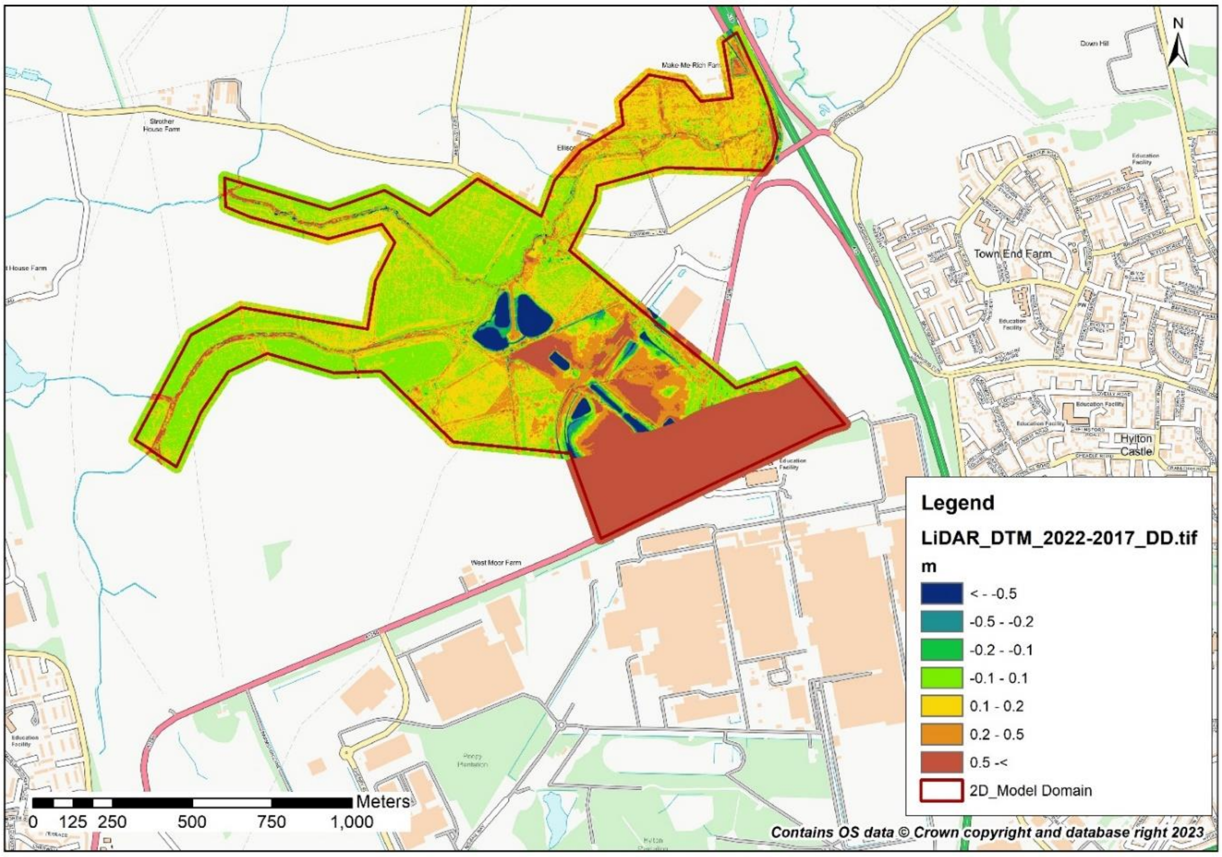
[10] Note that the old LIDAR did not cover the south-eastern edge of the IAMP site, which is why the comparison figure exhibits a uniform colour across this region.

LIDAR at all points in the topographic survey, calculating the differences between the two datasets and creating a raster grid of these differences. This plot reveals a very similar pattern to the LIDAR comparison.

Because the 2015 topographic survey predated the IAMP development, significant topographic differences are again evident within the developed areas of the IAMP site. However, elsewhere the levels between the two datasets are generally consistent but with some evidence for the LIDAR tending to be slightly higher rather than lower than the topographic survey. Hence, Figure 3-2 shows that the LIDAR across most of the Plot 2 site is between 0.1 metres lower and 0.2 metres higher than the topographic survey yet no development has taken place across the area of Plot 2 site since the topographic survey.

It should be noted that the river survey was largely carried out at the same time as the site topographic survey so the fact that there is a reasonable consistency between the LIDAR and top of bank levels in the topographic survey suggests that there should also be consistency between the LIDAR with river cross-sections[11].

Figure 3-1: LIDAR comparison (2015 DTM composite versus 2022 DTM composite)



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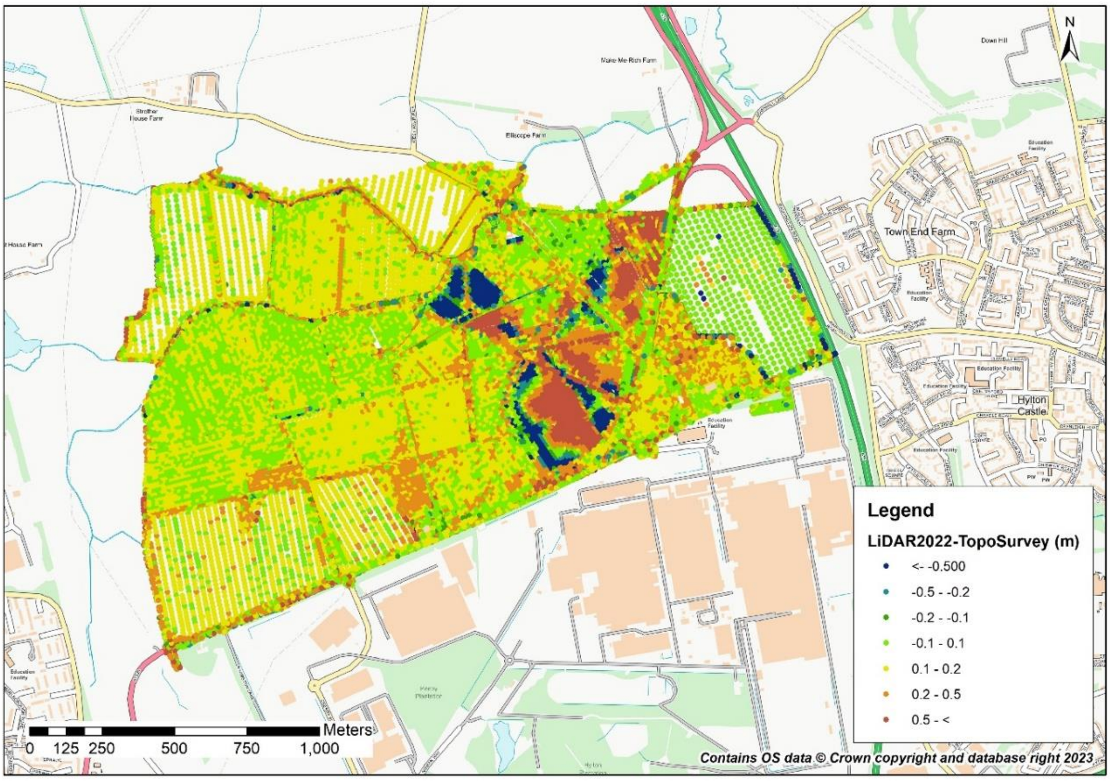
[11] Note that the LIDAR cannot be trusted with the in-channel geometry as it will be reflected from the water surface and the immediate banks are often lined with thick vegetation.

Figure 3-2: LIDAR 2022 DTM composite versus topographic survey (2015)



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3.3.3 Summary of topographic checks

Given the relatively low magnitude of differences between the latest LIDAR and previous topographic datasets across the AESC Plant 3 site and the facts that the LIDAR is the most recent dataset and captures the post-development ground levels changes that have so far been involved across the IAMP site, it would seem reasonable to update the model topography to be based on the new LIDAR.

3.4 Hydraulic Model Updates

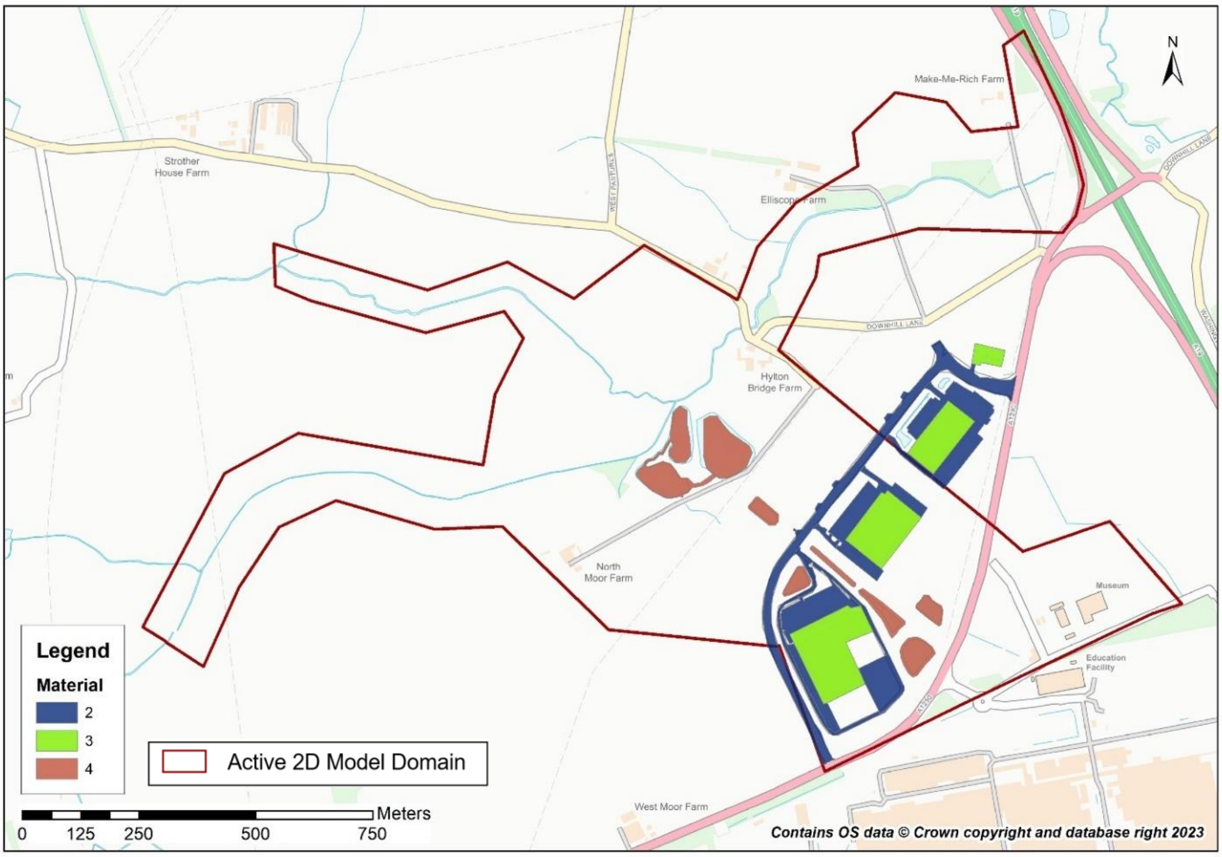
The following updates to the IAMP model were undertaken following the model review (summarised in Section 2.3) and data checks (summarised in Section 3.3).

- The entire floodplain topography was updated from the combination of sources (old LIDAR, local topographic survey and proposed ground level changes) that had been used to model the IAMP post-development scenario to the 1m composite (2022) LIDAR DTM, (believed based solely on National LIDAR Programme 2021 flights).
- The bank crest levels alongside the Usworth Burn and River Don were updated to reflect the elevations in the 1m composite (2022) LIDAR DTM.
- The floodplain roughness map was updated to reflect the current state of the IAMP1 development by stamping the polygons shown in Figure 3-3 to the general floodplain roughness of 0.05 that had previously been applied to this area of the IAMP baseline model. As with the previous model, these polygons (representing

obvious buildings, roads, hard standing areas and surface water) were traced from open-source maps.

Note that because no floodwater is modelled to flow towards the site from the upstream reaches of the Usworth Burn, there was no need to extend the active model domain from the existing model to cover the whole of the AESC Plant 3 site. Hence, the active extent of the model domain as shown in Figure 3-3 remains the same as that of the 2018 model. Extending the domain across the AESC Plant 3 site would have just created a larger model that would have taken longer to run.

Figure 3-3: Updates to the floodplain roughness map across the IAMP site



2= Hardstanding Area, 3 = Building, 4 = Surface Water

3.5 Model Simulations

Once the relevant changes to the model inflow files (listed in Section 3.1) and model (listed in Section 3.4), had been made, the following model simulations were undertaken.

- Baseline (existing risk) AESC Plant 3 scenario (see Section 4.1).
  - Present day (i.e., without climate change) - 50%, 3.3%, 1% and 0.1% AEP
  - Future (i.e., with climate change) - 3.3% AEP Central (+34%), 1% AEP Central (+34%) and 1% AEP Higher Central (+42%)
- Undefended (Defence Failure) - 1% AEP Central (+34%) event (see Section 4.2). The low-level 'defence' embankments alongside the Don and Usworth Burn (see Figure 1-1 for location) were removed from the model by re-using the defence

removal GIS layer that had previously been used to examine the impact of defence failure for the IAMP study.

- (AESC Plant 3) Site Fully Raised - 1% AEP Central (+34%) event (see Section 4.3). The entire Plot 2 site polygon (as shown in Figure 1-1) was raised to above flood levels to quantify the likely worst-case impact of development if the whole site were to be removed from the floodplain.

- Sensitivity Tests (see Section 4.4) - A small number of sensitivity tests were run to justify the current model configuration and enable the model to pass an external review.
    - Storm duration - The updated model was tested against the five (4, 8, 12, 14 and 16-hour), unscaled ReFH, 1% AEP storms that had been created for the original model.
    - Flow ±20%
    - Roughness (channel and floodplain) ±20%
    - Downstream Boundary (steeper and gentler gradient).

4 Outcomes

4.1 Baseline (Existing) Flood Risk

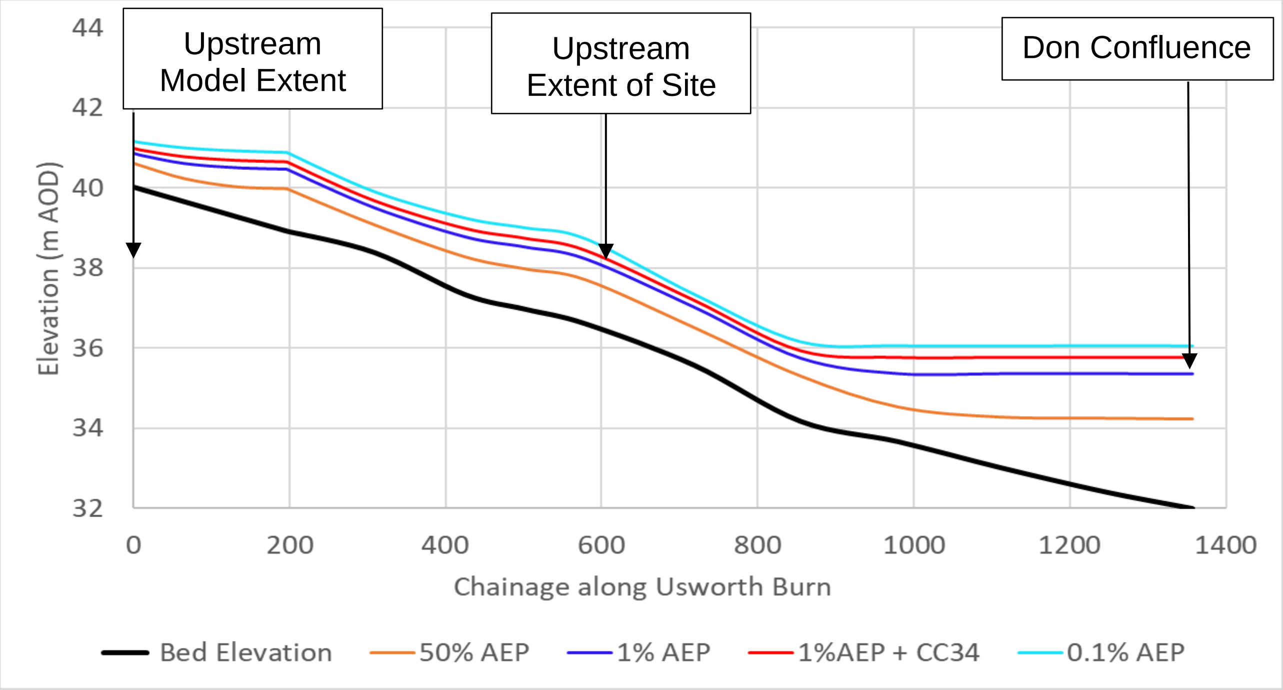
The modelled peak river levels in the Usworth Burn for a select number of 1D model nodes alongside the site are shown in Table 4-1. These illustrate that whereas there is a quite a steep gradient in the peak river levels alongside the upstream part of the site, the peak river level gradient along the Usworth Burn flattens out downstream of the North Moor Farm (i.e., around node TRIB_0377). This pattern largely reflects the backwater influence of the River Don as can be seen in a long section profile of the Usworth Burn for a select number of the modelled flood events in Figure 4-1.

Table 4-1: Modelled peak river levels (m AOD) along the Usworth Burn for specified nodes

Model Node	Annual Exceedance Probability (%)						
	50	3.3	3.3+CC34%	1	1+CC34%	1+CC42%	0.1
TRIB_0855i	37.97	38.35	38.55	38.52	**38.74**	38.79	39.00
TRIB_0778	37.70	38.06	38.26	38.22	**38.43**	38.49	38.72
TRIB_0639	36.51	36.89	37.05	37.01	**37.19**	37.22	37.34
TRIB_0502	35.32	35.63	35.76	35.74	**35.93**	36.00	36.15
TRIB_0377	34.53	35.12	35.47	35.35	**35.76**	35.86	36.05
TRIB_0000	34.23	35.10	35.47	35.34	**35.76**	35.86	36.05

See Figure 4-2 for node locations.

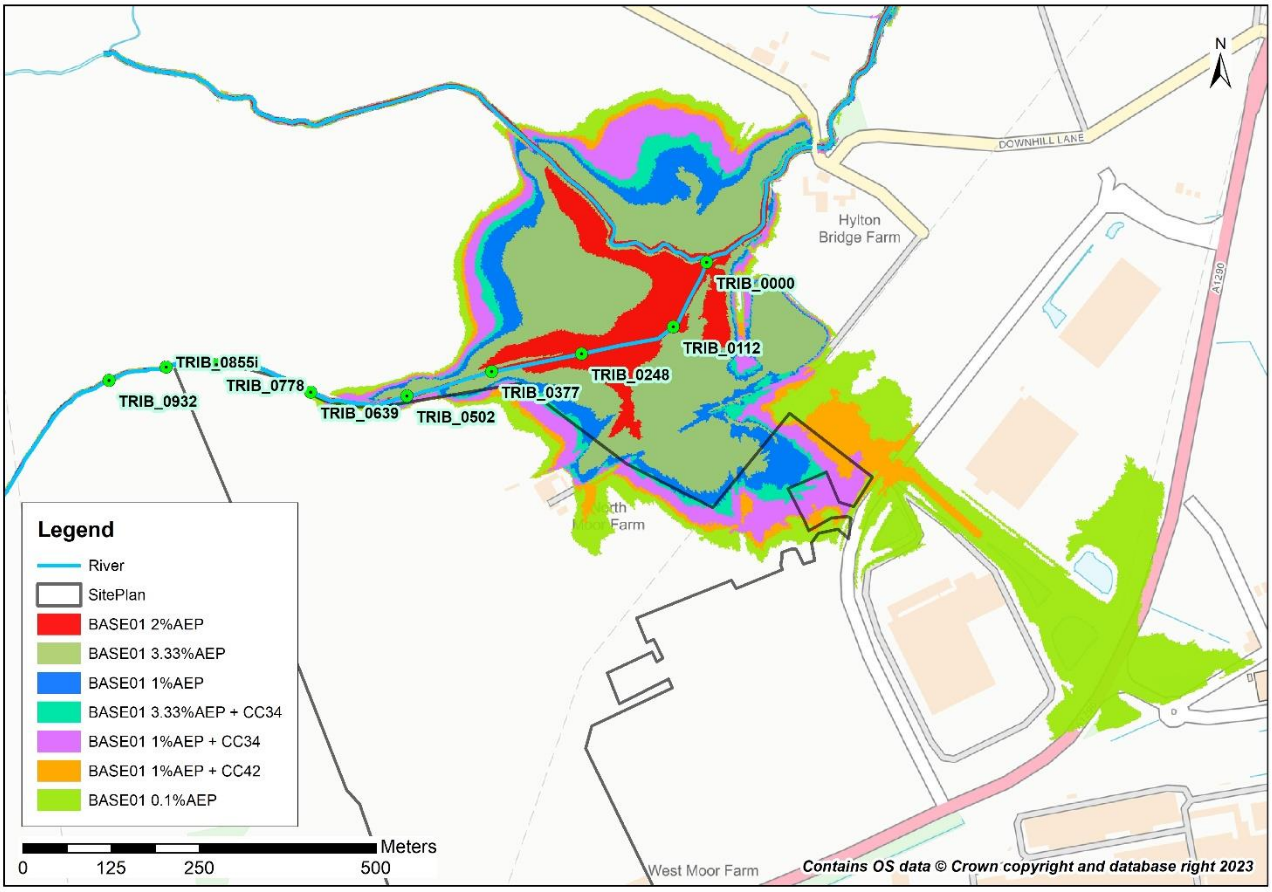
Figure 4-1: Modelled long section event profiles along the Usworth Burn



NB 1% AEP + 42% omitted for clarity.

The modelled flood outlines in the vicinity of the site are shown in Figure 4-2. These illustrate that only a very small area of the site between North Moor Farm and International Drive is modelled to be at fluvial flood risk. This implies that there will be some fluvial flood risk constraints on development on parts of the site but that development across most the site will not be constrained by fluvial flood risk (assuming that excavation below the modelled flood levels is not being planned).

Figure 4-2: Modelled Flood Outlines adjacent to the IAMP site extension.



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The design levels for the development proposed in an FRA would generally need to be based on the 1% with climate change (+34%) flood levels with resilience levels based on the 0.1% AEP flood levels. In addition, any off-site impacts would also need to be judged against the 1% with climate change (+34%) and lower events.

4.2 Defence Failure

The IAMP study demonstrated that the flood defence embankments that are depicted on the Environment Agency's Flood Maps (see Figure 1-1 for location) play no significant flood defence role. They are primarily low-lying earth embankments that were presumably constructed with the aim of reducing the frequency of flooding to some of the agricultural land adjacent to the River Don and Usworth Burn. Hence, Figure 4-2 shows that the embankments around the Don confluence are already modelled to be overtopped and/or bypassed in the 50% AEP event.

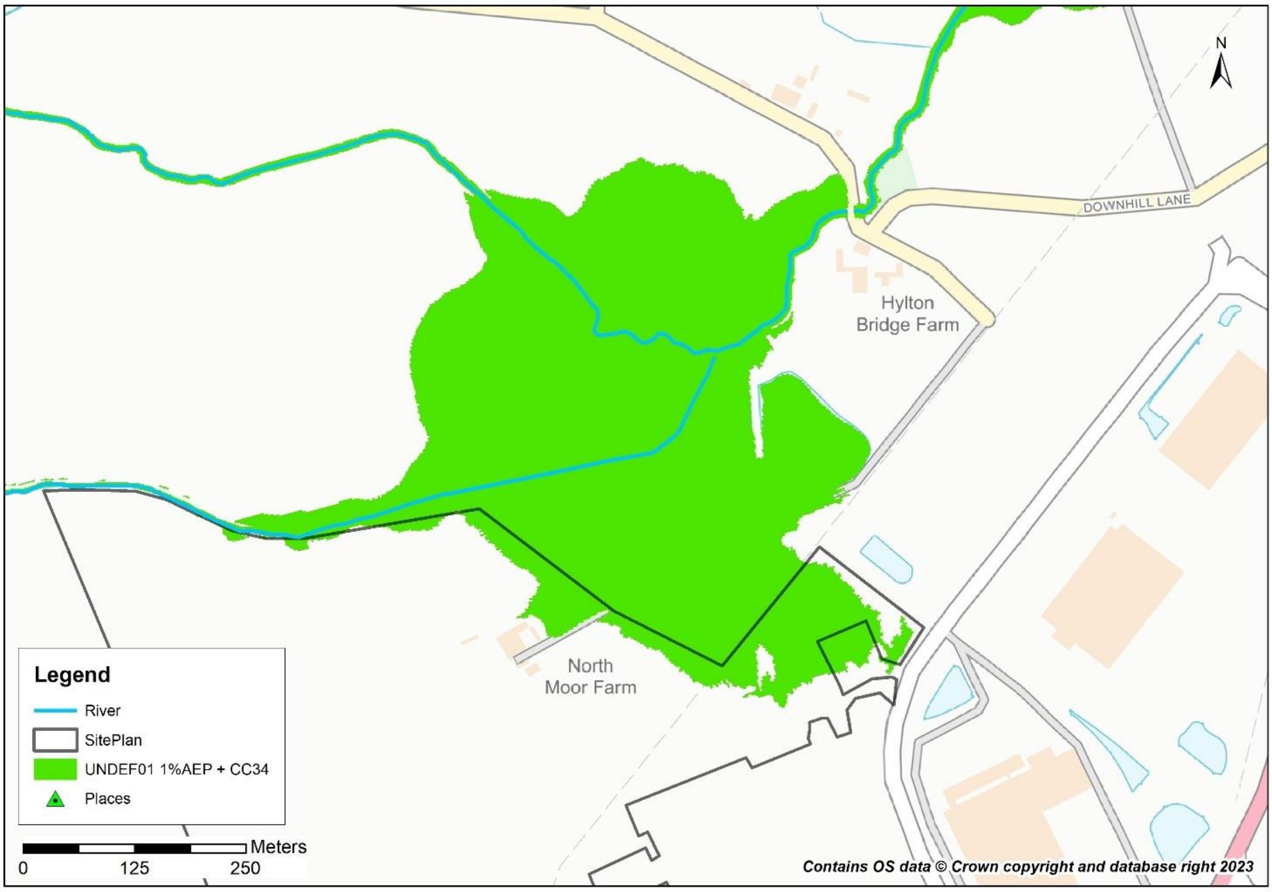
To confirm that the AESC Plant 3 site was not at increased risk from defence failure, a 1% AEP + 34% design event was run through an undefended version of the model (i.e., with embankment crests reduced to ground levels). The main outcomes of this model run are shown in Table 4-2 and Figure 4-3. Table 4-2 shows that defence failure would lead to some small, localised variations in the peak 1% AEP (+34%) river level alongside the Plot 2 site. Figure 4-3 shows that the undefended 1 % AEP (+34%) flood outline is almost identical to the defended flood outline (shown in Figure 4-2). This confirms the findings of the IAMP study that the residual risk from failure of the local earth embankments would not obviously increased relative to the existing (baseline) site risk.

Table 4-2: Modelled impact of removing the defence embankments on peak 1% AEP (+34%) river levels (m AOD)

Scenario	Model Node					
	TRIB_0778	TRIB_0639	TRIB_0502	TRIB_0377	TRIB_0000	DON2_0813*
Baseline	38.44	37.19	35.92	35.76	35.76	35.48
Undefended	38.40	37.24	35.92	35.73	35.72	35.53

* Hylton Bridge

Figure 4-3: Modelled undefended 1% AEP (+34%) flood outline.



4.3 Impact of Fully Land Raising

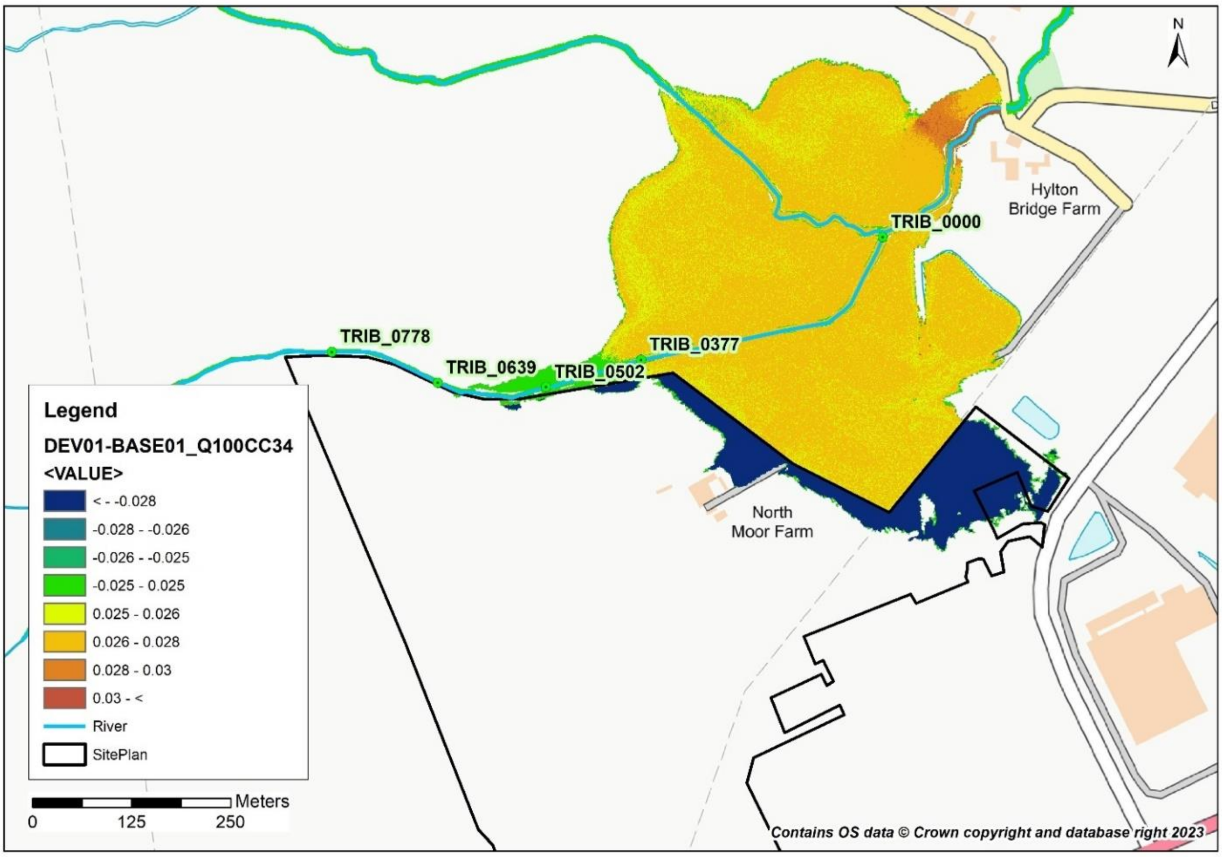
The impact of fully raising the AESC Plant 3 site polygon above all modelled flood levels is illustrated by reference to the changes in peak river level and flood outlines. Table 4-3 illustrates that the impact of fully raising the site would increase river levels by up to 0.03 metres downstream of North Moor Farm. Impacts are modelled to continue beyond Hylton Bridge to the downstream extent of the model where a 0.1 metre increase in the peak river level is modelled downstream of the A19. Figure 4-4 shows that the model predicts that the displaced floodwater would increase the peak flood depth across the nearby floodplain by between 0.025 and 0.03 metres.

Table 4-3: Modelled impact of fully raising the Plot 2 site on peak 1% AEP (+34%) river levels (m AOD)

Scenario	Model Node					
	TRIB_0778	TRIB_0639	TRIB_0502	TRIB_0377	TRIB_0000	DON2_0813*
Baseline	38.44	37.19	35.92	35.76	35.76	35.48
Site Raised	38.44	37.19	35.94	35.79	35.78	35.51

* Hylton Bridge

Figure 4-4: Impact of fully raising Plot 2 site on peak 1% AEP (+34%) floodplain depths.



This map was obtained by subtracting the flood depths from the 'baseline' scenario from the those from the 'fully raised' scenario.

4.4 Sensitivity testing

Sensitivity testing for the AESC Plant 3 site was carried out to demonstrate that the updated model sensitivities have been tested in readiness for any Environment Agency review of the model. Hence the results of the sensitivity test are presented here with little commentary.

4.4.1 Storm Duration

The results of the storm duration testing revealed that an 8-hour storm produces the highest river levels on the Usworth Burn upstream of North Moor Farm but that a 12-hour storm produces the highest river levels downstream of that location (Table 4-4)[12]. The modelled flood outlines (Figure 4-5) also show that a 12-hour storm led to the largest outline (albeit only subtly so) of the tested storms. Given that inundation of the floodplain is limited to the reach downstream of North Moor Farm, it was, therefore, considered appropriate to model design events for the AESC Plant 3 site based on the 12-hour storm, which is also consistent with the critical storm previously modelled for the IAMP site.

Table 4-4: Modelled peak river levels (m AOD) along the Usworth Burn for specified 1% AEP storm durations,

Model Node	Storm Duration				
	4	8	12	14	16
TRIB_0855i	38.17	**38.18**	38.15	38.13	38.11
TRIB_0778	37.86	**37.87**	37.85	37.83	37.82
TRIB_0639	36.69	**36.72**	36.70	36.69	36.68
TRIB_0502	35.47	**35.48**	35.45	34.44	35.42
TRIB_0377	34.66	34.73	**34.74**	34.74	34.73
TRIB_0000	34.39	34.59	**34.60**	34.59	34.58

4.4.2 Other Tests

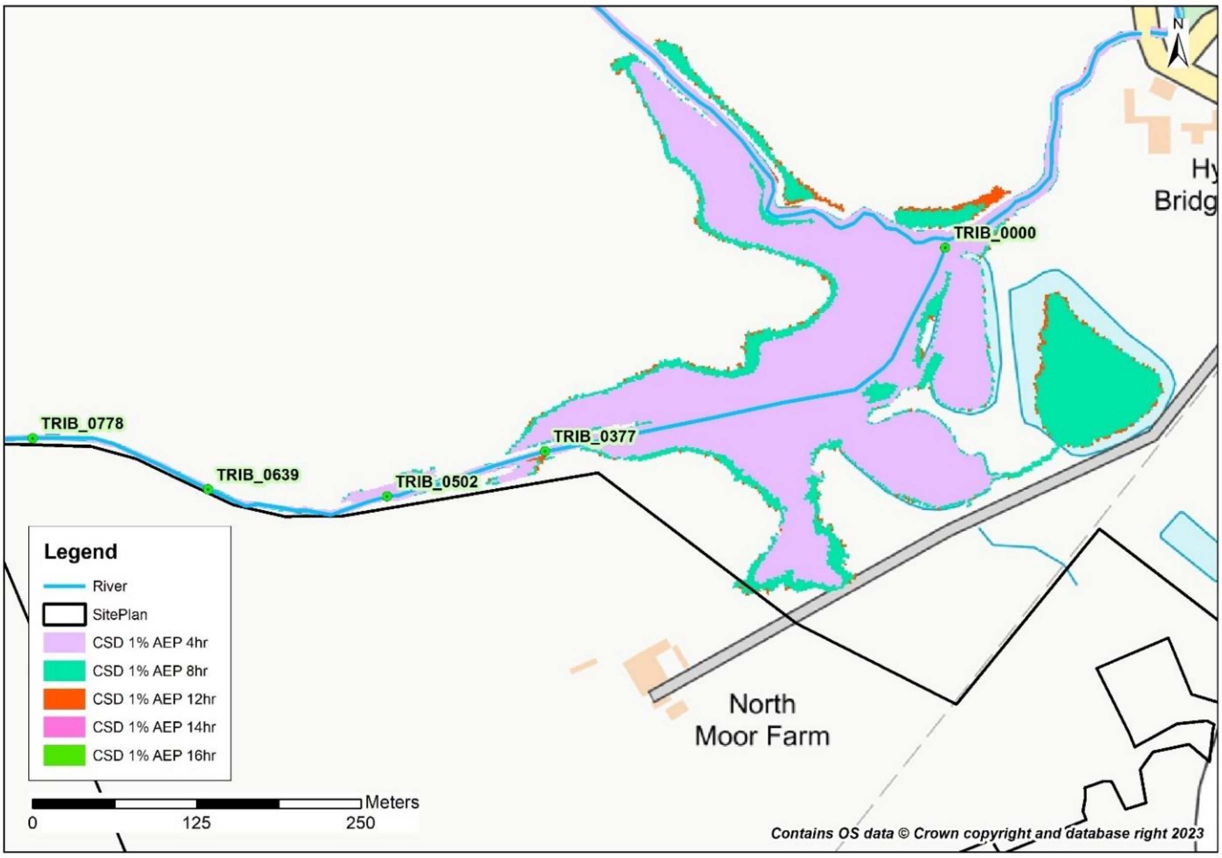
Note that the sensitivity tests were carried out on the 1% AEP (CC+34%) event because this is the key design event for an FRA so the outcomes of these tests show how the design levels and outlines might change in response to moderate changes to some of the model parameters.

The downstream boundary tests demonstrated that, because the boundary is downstream of the A19, there would be no downstream boundary impacts on the flood risk at the AESC Plant 3 site. Hence the modelled levels and outlines from this test were unchanged from those shown in Table 4-1 and Figure 4-2.

---

[12] Note that the storm duration testing was carried out on the (unscaled) 1% AEP event. Hence, the levels reported in Table 4-4 are noticeably lower than the design levels reported in Table 4-1, which were generated from the final design flows in which the ReFH hydrographs were scaled to match the estimated FEH Statistical peak flows.

Figure 4-5: Modelled flood outlines arising from storm duration testing.



Note that the 14- and 16-hour outlines are hidden behind the 12-hour outline because they are both smaller.

The flow and roughness tests did produce some observable changes to both the 1% AEP (CC+34%) peak river levels and outlines adjacent to the AESC Plant 3 site. The peak river levels are shown in Table 4-5, which shows that the model sensitivity to flow and roughness are generally quite similar with levels varying between ± 0.2 metres in response to the ±20% change in parameters.

Table 4-5: Modelled peak river levels (m AOD) along the Usworth Burn from sensitivity tests

Model Node	Baseline	Flow +20%	Flow -20%	Roughness +20%	Roughness -20%
TRIB_0855i	**38.74**	38.86	38.61	38.90	38.58
TRIB_0778	**38.43**	38.56	38.31	38.62	38.28
TRIB_0639	**37.19**	37.27	37.08	37.30	37.04
TRIB_0502	**35.93**	36.09	35.79	36.03	35.77
TRIB_0377	**35.76**	35.96	35.53	35.88	35.62
TRIB_0000	**35.76**	35.96	35.52	35.88	35.62

The flood outlines arising from the flow and roughness sensitivity tests are illustrated in Figure 4-6 and Figure 4-7, respectively. These demonstrate that the extent of inundation would not be greatly changed in response to changes in these model parameters with the at-risk area still limited to the north-eastern edge of the AESC Plant 3 site.

Figure 4-6: Impact of flow testing (±20%) on the 1% AEP (+34%) flood outline.

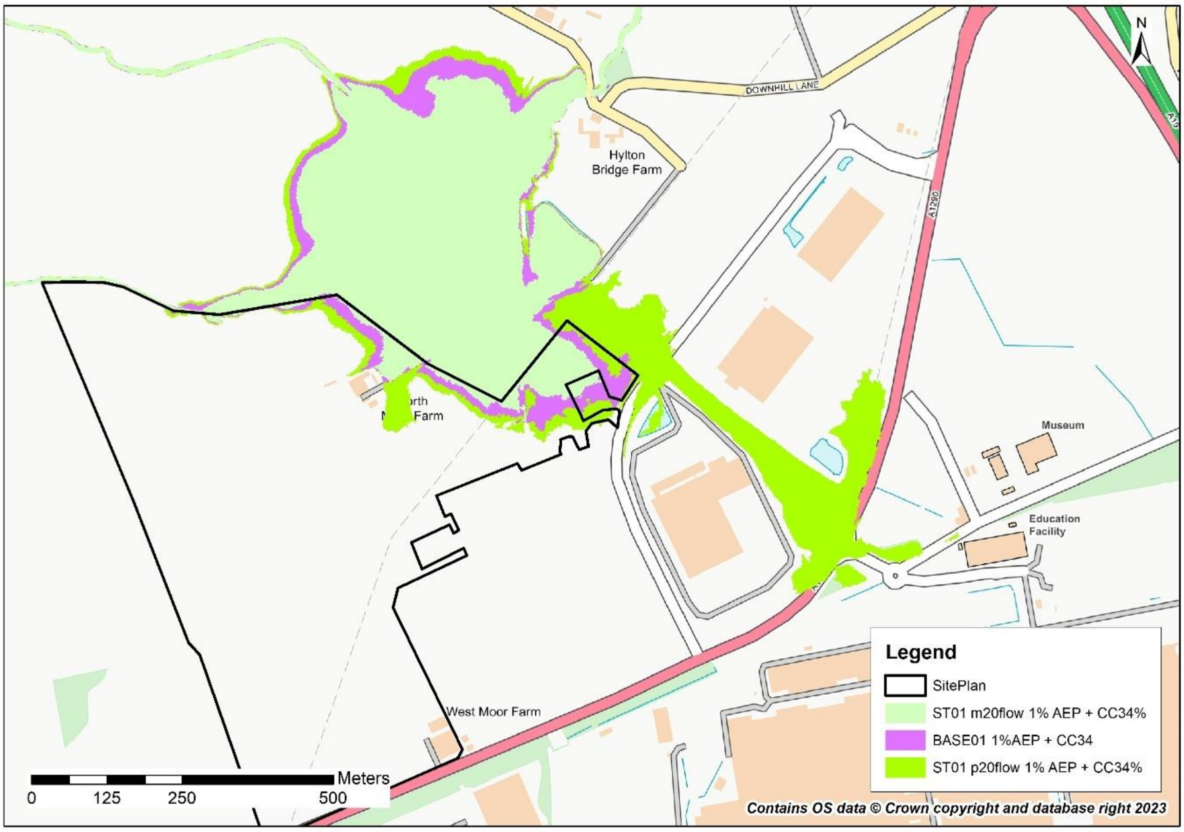
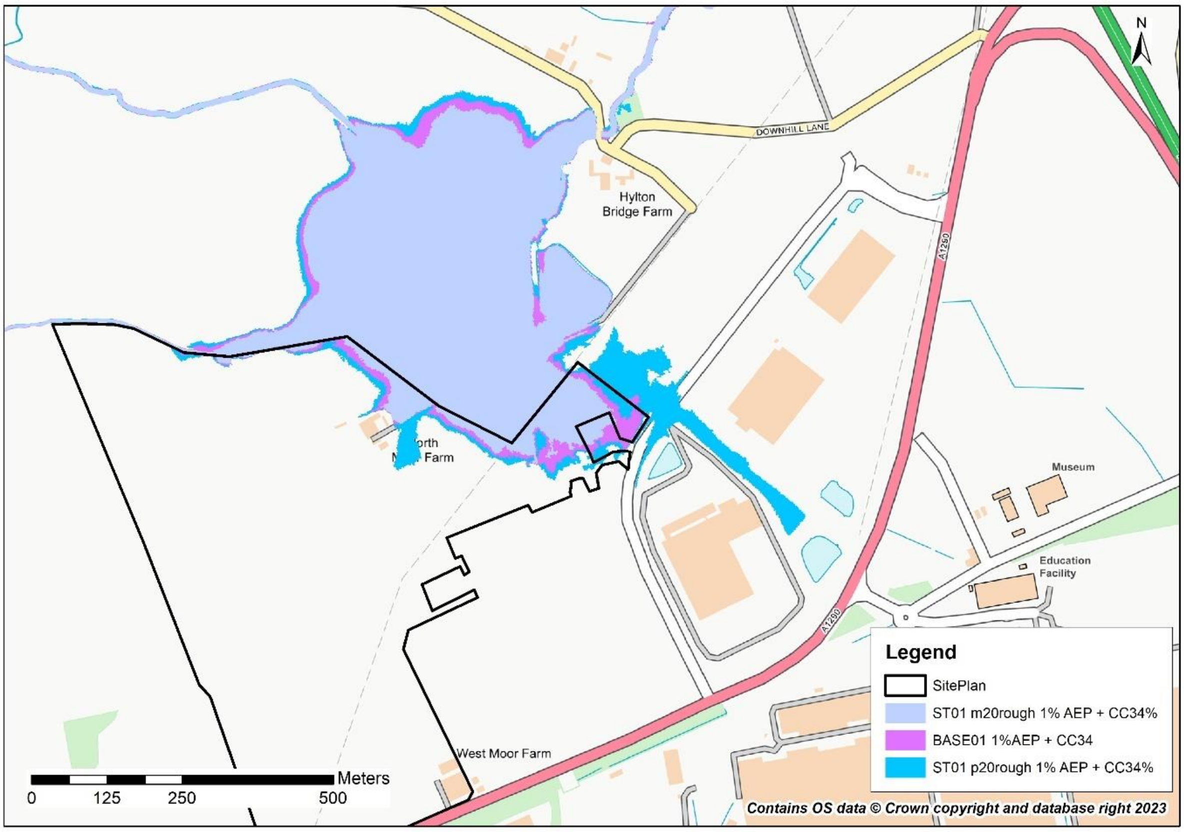


Figure 4-7: Impact of roughness testing (±20%) on the 1% AEP (+34%) flood outline.



In general, the sensitivity tests replicate the sensitivities documented in the IAMP modelling and imply that the flood risk would not be radically changed in response to moderate changes in the model parametrisation. These sensitivities would be covered by a standard (600mm) freeboard allowance.

4.5 Summary of modelling results and implications for development

The baseline (existing risk) model results predict that the majority of the AESC Plant 3 site would be at low risk of fluvial flooding (i.e., outside of Flood Zone 2). Therefore, there should be few fluvial flood risk constraints to development on much of the site. However, the 1% AEP with climate change (+34%) and 0.1% AEP flood outlines are modelled to flood a small part of the site along the north-eastern boundary of the site. There will consequently be some local constraints on development in these areas in that design floor levels of any buildings would likely need to be set above the 1% AEP with climate change (+34%) flood level (plus a freeboard). However, any ground raising across the flooded area could potentially lead to adverse off-site impacts (e.g., as modelled in Section 4.3).

From the site plan '204-P01-Proposed Site Layout' that was supplied in early July 2023 (Figure 1-2), it would not appear that any significant development features are planned within the areas that are modelled to be at flood risk except for a possible track around the circumference of the site that might be at risk in a major flood event. Therefore, the simplest solution to the modelled fluvial flood risk would be to avoid developing those parts within the site boundary that are within the modelled flood outlines, in which case there would be no off-site impacts from developing the AESC Plant 3 site. If these areas were to be developed, then some mitigation measures would likely be needed. However, an alternative approach before considering mitigation measures, would be undertake a fresh hydrology that would seek to downscale the importance of the Hylton Bridge adjustment factor that underpins the current model hydrology and has led to what is expected to be a conservative assessment of the flood risk.

4.5.1 Proposed Site Levels

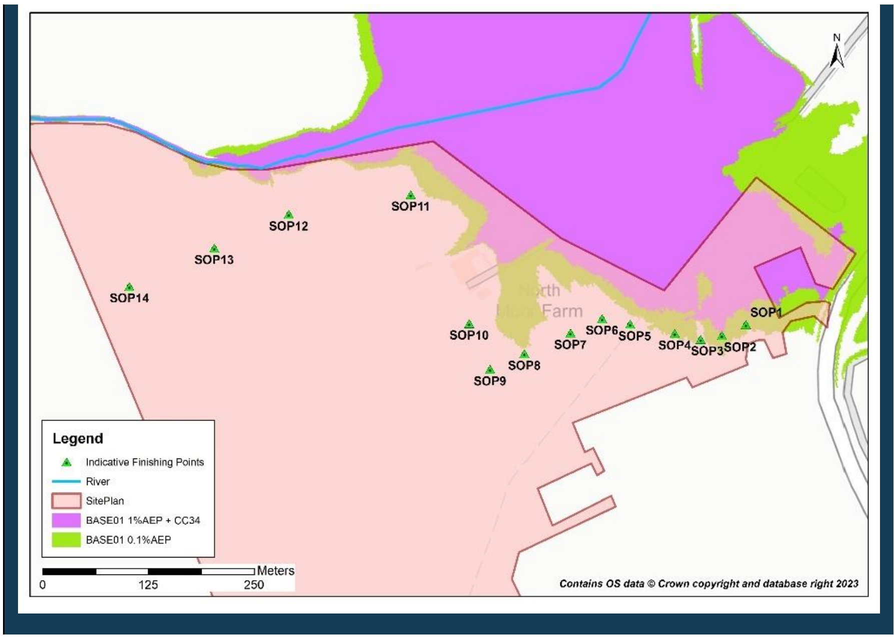
Further detail of the site plan with some prospective site levels was supplied in mid-July 2023[13]. This shows that some of the proposed levels are close to the edge of the modelled flood outlines (Figure 4-8). The table on the right-hand side of Figure 4-8 shows that the proposed site levels grade up from 37.0m AOD in the east to 38.5m AOD in the west. The existing elevations at these locations (as derived from point inspecting the 2022 LIDAR composite DTM) are also shown Figure 4-8 and this shows that most of the points (SOP1 to SOP12) are proposed to be raised (some by up to 1.5 metres) around the north-eastern periphery of the proposed platform. None of these points is currently within the modelled 1% AEP with climate change flood outline but to avoid any offsite impacts from the

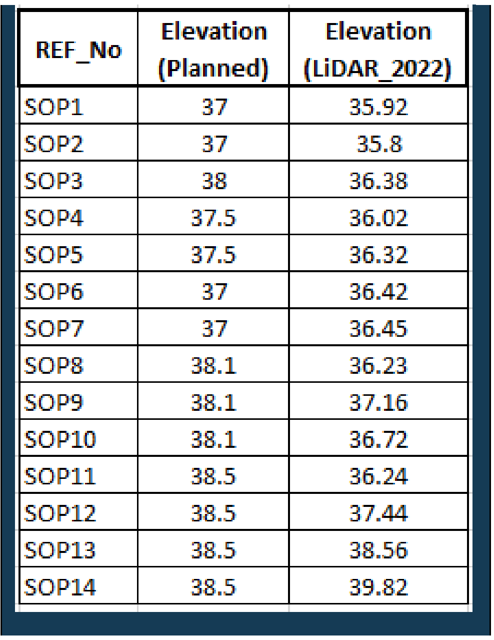
---

[13] ENV3-RPS-ST-XX-SK-A-000086-P01-Northern boundary plateau level concept evaluation for purpose of flood modeling.pdf

development, the proposed ground levels would need to be tapered down to existing ground levels across the area of the modelled 1% AEP with climate change flood outline.

Figure 4-8: Proposed site elevations in the north-east of AESC Plant 3 site.





REF_No	Elevation (Planned)	Elevation (LiDAR_2022)
SOP1	37	35.92
SOP2	37	35.8
SOP3	38	36.38
SOP4	37.5	36.02
SOP5	37.5	36.32
SOP6	37	36.42
SOP7	37	36.45
SOP8	38.1	36.23
SOP9	38.1	37.16
SOP10	38.1	36.72
SOP11	38.5	36.24
SOP12	38.5	37.44
SOP13	38.5	38.56
SOP14	38.5	39.82

By contrast to the more easterly points, Figure 4-8 shows that the two most westerly points on the proposed site plan (SOP13 and SOP14) are proposed to be lowered relative to existing (LIDAR) ground levels. As the proposed levels are above the peak river levels in the adjacent Usworth Burn (Table 4-1), the site would remain safe from fluvial flooding. However, ground levels should not be excavated much lower than proposed because this could place the site at direct risk from the flood levels modelled for the Usworth Burn (as shown in Table 4-1).

4.5.2 Residual Risk

The residual risk to the site from the hydraulic modelling results is assessed as follows.

- **Extreme Event** - the risk from an event more extreme than the design standard 1% AEP with climate change (+34%) event is covered by the results of the baseline 0.1% AEP scenario. This is modelled to place a slightly larger area of the AESC Plant 3 site at risk (Figure 4-2) but the extent is not dramatically increased so the best mitigation against an extreme event would simply be to avoid developing within the modelled 0.1% AEP flood extent. One might also consider making the development flood resilient to a level above the modelled 0.1% AEP level (see Table 4-1) with a suitable freeboard allowance.
- **Defence Failure** - The modelling work has demonstrated that defence failure of the local earth embankments alongside the Usworth Burn and River Don would not noticeably increase the flood risk to the AESC Plant 3 site during a 1% AEP with climate change (+34%) event (see Section 4.2). Hence, the residual risk

from defence failure would be effectively unchanged from the baseline (existing) risk.

- **Blockage** - The residual risk from blockage is not a material concern for this site since there are no structures along the Usworth Burn that could block and any structures on the River Don are too far downstream to have any impact at the AESC Plant 3 site.

4.5.3 Emergency Access/Egress

Dry emergency access and egress via the main site access route onto International Drive and the A1290 is modelled in a 1% AEP with climate change event, which should be sufficient to cover the risk expected of an FRA. However, it should be noted that Figure 4-8 shows that the site access road and International Drive to the north of the site are modelled to flood in a 0.1% AEP event so there is a potential residual risk to the main access route. However, the 0.1% AEP flood depths are modelled to be shallow (less than 0.2 metres) and low velocity on the site access road so there should be little danger for either vehicular and/or pedestrian access from an emergency route along the main site access road and southwards along International Drive in an extreme event. To further minimise the risk, it would also be possible to have an evacuation route from the southern boundary of the site directly onto the A1290. Hence, the fluvial flood risk from the Usworth Burn and River Don should not pose a significant risk to emergency access/egress.

5 Assumptions and Limitations

This study has built on the existing IAMP1 model that JBA created for SYSTRA between 2015 and 2017. The model was reviewed by the Environment Agency in 2017 and the 1% and 0.1% AEP flood outlines were later subsequently used to update the Environment Agency's Flood Maps. Hence, because the model was considered appropriate for flood mapping and informing a site-specific FRA on the adjacent IAMP1 site as recently as 2017, a simple review and update approach has been taken to inform this report for the AESC Plant 3 site in 2023. However, we recognise that the Environment Agency may request to review the model prior to removing any objection to development on flood risk grounds. Reviews can be subjective so it is possible that the Environment Agency might request further updates to the model and/or hydrology at the review stage.

We would defend the current model for the reasons listed below.

- The IAMP model, which was the starting point for the AESC Plant 3 model, was signed off by the Environment Agency in 2017 so should be a good template for any revised model.
- We are aware that there are significant uncertainties in the hydrology, most notably with the Hylton Bridge donor factor. Having reviewed the previous hydrology calculations for the catchment, we believe that it was appropriate to retain the existing inflows from the IAMP model, given that a review suggests that the existing model inflows are conservative, and their re-use ensures a consistency of approach with the IAMP development. Note that any new hydrology would be faced with the (subjective) decision of whether to retain the Hylton Bridge donor factor, which would likely far outweigh the impacts of any other new hydrological information.
- Since National LIDAR, which was flown in 2021 after the primary IAMP earth movements had been completed, is now available across the whole study area, it was considered appropriate to update the topography of the model floodplain and bank crests to be based on this new LIDAR data. Checks have demonstrated a reasonable level of consistency with the existing (2015) topographic survey across the AESC Plant 3 site and, given that one would expect a greater degree of accuracy from the most recent LIDAR dataset, the replacement of the existing (2009) LIDAR seems justified. Any other model changes were sufficiently low key as to have very little impact on the model results.

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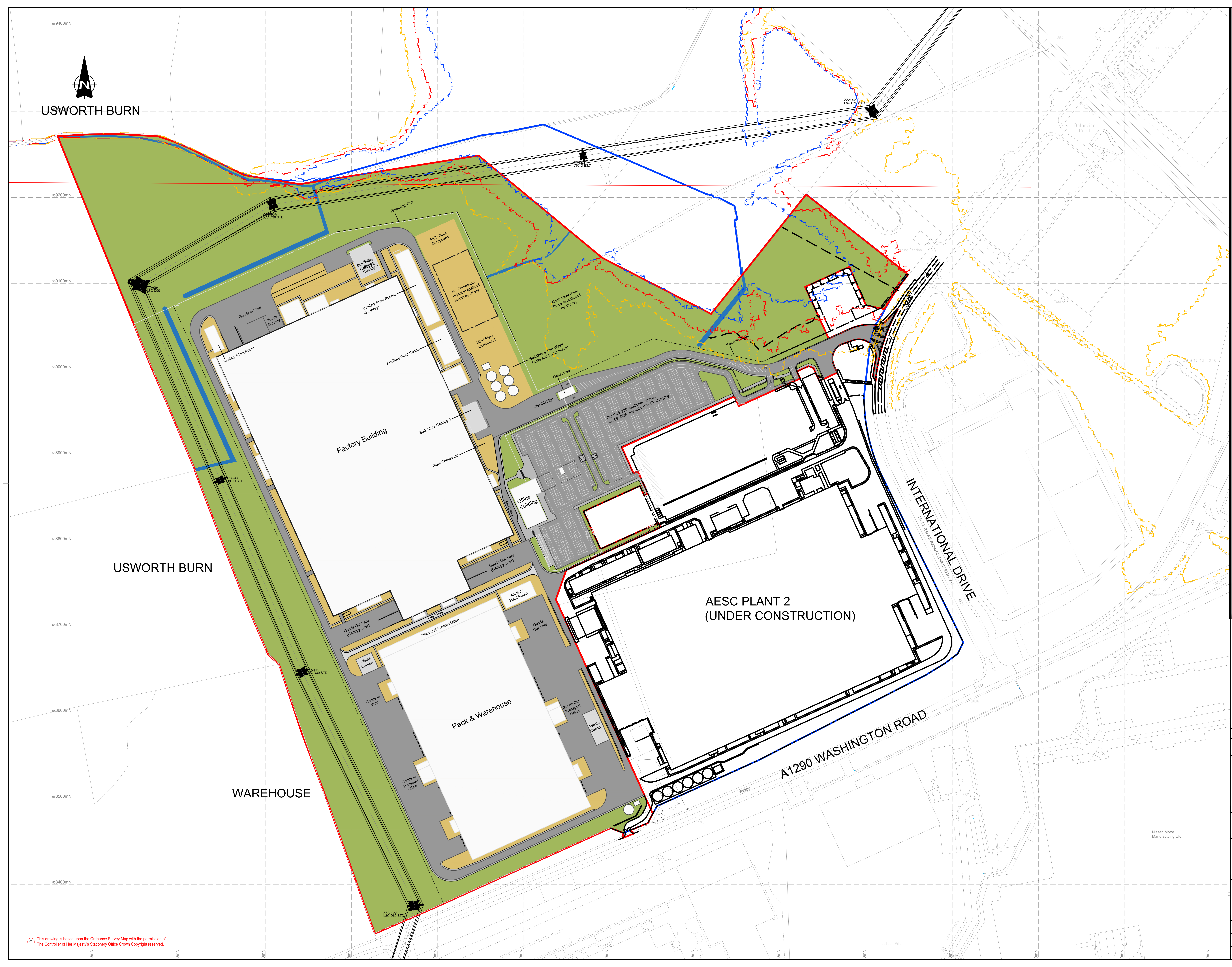

NOTES

1. Do not scale from this drawing. All dimensions in mm, levels in mOD unless stated otherwise.
2. Flood outlines derived by JBA from updated hydraulic model of River Don and Usworth Burn. Refer to JBA report *Fluvial Flood Risk Report for AESC Plant 3 site 2023*.
3. Development layout based on RPS drawing *204 Proposed site layout*.

KEY

Predicted flood extents

3.3% AEP + 34% CC	🟦
1.0% AEP + 34% CC	🟥
0.1% AEP	🟧

Rev.	Date	Revision details	Drawn	Checked	Approved

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AESC UK

Project
Plant 3, Sunderland
Flood Risk Assessment

Title
Proposed development and
flood extents

Drawn	Checked	Approved
TD	GP	SE

Original drg. size	Date	Scale
A1	Nov' 2023	1:2,000

Drawing Status	Drawing Number	Rev.
Information	22A29-FRA-FLOOD-01	P01

Appendix E: Surface Drainage System Details

Appendix E: Contents

- RPS report AESC Giga Factories Plot 2 – Planning Drainage Strategy – Appendix D (MicroDrainage model details and results)
- RPS drg 251-P01-Proposed Site Surface Water Drainage Layout Sheet 1
- RPS drg 252-P01-Proposed Site Surface Water Drainage Layout Sheet 2
- RPS drg 253-P01-Proposed Site Surface Water Drainage Layout Sheet 3
- RPS drg 257-P01-Proposed Site Surface Water Drainage Exceedance Plan

Appendix D:
Microdrainage Design Model Details

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
OB1	38.657	0.992	Open Manhole	450	2.000	37.665	150				
OB2	38.310	0.992	Open Manhole	450	3.000	37.318	150				
S100	38.200	1.173	Open Manhole	1500	2.001	37.027	225	2.000	37.102	150	
								3.000	37.102	150	
OB3	37.610	1.085	Open Manhole	450	4.000	36.525	225				
OB4	38.220	1.085	Open Manhole	450	5.000	37.135	225				
S101	38.054	1.941	Open Manhole	1800	2.002	36.113	375	2.001	36.263	225	
								4.000	36.263	225	
								5.000	36.263	225	
OB5	38.220	1.085	Open Manhole	450	6.000	37.135	300				
S102	38.386	2.719	Open Manhole	1500	2.003	35.667	450	2.002	35.742	375	
								6.000	35.817	300	
OB6	37.610	1.125	Open Manhole	450	7.000	36.485	225				
OB7	38.220	1.125	Open Manhole	450	8.000	37.095	225				
S103	38.054	3.070	Open Manhole	1800	2.004	34.984	525	2.003	35.059	450	
								7.000	35.284	225	
								8.000	35.284	225	
S104	38.386	3.549	Open Manhole	1800	2.005	34.837	525	2.004	34.837	525	
OB8	38.400	0.992	Open Manhole	450	9.000	37.408	150				
S105	38.550	3.879	Open Manhole	1800	2.006	34.671	600	2.005	34.746	525	
								9.000	36.771	150	1650
OB9	38.555	0.992	Open Manhole	450	10.000	37.563	150				
S106	38.597	1.209	Open Manhole	1500	10.001	37.388	225	10.000	37.463	150	
OB10	38.555	0.992	Open Manhole	450	11.000	37.563	225				
S107	38.597	2.142	Open Manhole	1500	10.002	36.455	225	10.001	36.455	225	
								11.000	36.455	225	
OB11	38.550	0.987	Open Manhole	450	12.000	37.563	225				
S108	38.597	2.917	Open Manhole	1500	10.003	35.680	300	10.002	35.755	225	
								12.000	35.755	225	
OB12	38.555	0.992	Open Manhole	450	13.000	37.563	150				
S109	38.557	3.512	Open Manhole	1500	10.004	35.045	375	10.003	35.120	300	
								13.000	35.270	150	
S110	38.557	4.010	Open Manhole	1800	2.007	34.547	675	2.006	34.622	600	
								10.004	34.847	375	
OB13	38.075	1.085	Open Manhole	450	14.000	36.990	225				
OB14	37.610	1.085	Open Manhole	450	15.000	36.525	150				
S111	38.300	2.900	Open Manhole	1500	14.001	35.400	225	14.000	35.400	225	
								15.000	35.475	150	
OB15	38.519	0.990	Open Manhole	450	16.000	37.529	150				
S112	38.557	4.166	Open Manhole	1800	2.008	34.391	675	2.007	34.391	675	
								14.001	34.841	225	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out			Pipes In			Backdrop (mm)
					PN	Invert Level (m)	Diameter (mm)	PN	Invert Level (m)	Diameter (mm)	
								16.000	36.566	150	1650
OB16	38.519	0.990	Open Manhole	450	17.000	37.529	150				
S113	38.557	4.406	Open Manhole	1800	2.009	34.151	675	2.008	34.151	675	
								17.000	36.326	150	1650
OB17	38.519	0.990	Open Manhole	450	18.000	37.529	150				
S114	38.557	4.647	Open Manhole	1800	2.010	33.910	675	2.009	33.910	675	
								18.000	36.085	150	1650
OB18	38.687	0.992	Open Manhole	450	19.000	37.695	150				
S115	38.727	1.377	Open Manhole	1500	19.001	37.350	150	19.000	37.350	150	
OB19	38.687	0.992	Open Manhole	450	20.000	37.695	150				
S116	38.727	2.385	Open Manhole	1500	19.002	36.342	225	19.001	36.417	150	
								20.000	36.417	150	
S117	37.727	1.865	Open Manhole	1500	19.003	35.862	225	19.002	35.862	225	
OB20	37.976	0.992	Open Manhole	450	21.000	36.984	150				
OB21	38.220	1.085	Open Manhole	450	22.000	37.135	150				
S118	38.055	2.534	Open Manhole	1500	19.004	35.521	375	19.003	35.671	225	
								21.000	35.746	150	
								22.000	35.746	150	
OB22	37.610	1.085	Open Manhole	450	23.000	36.525	225				
OB23	38.220	1.050	Open Manhole	450	24.000	37.170	150				
S119	38.055	2.592	Open Manhole	1500	19.005	35.463	375	19.004	35.463	375	
								23.000	35.613	225	
								24.000	35.688	150	
OB24	38.220	1.085	Open Manhole	450	25.000	37.135	225				
S120	38.386	3.258	Open Manhole	1500	19.006	35.128	450	19.005	35.203	375	
								25.000	35.353	225	
OB25	38.220	1.085	Open Manhole	450	26.000	37.135	225				
OB26	37.610	1.085	Open Manhole	450	27.000	36.525	225				
S121	38.055	3.381	Open Manhole	1500	19.007	34.674	600	19.006	34.824	450	
								26.000	35.049	225	
								27.000	35.049	225	
S122	38.386	3.906	Open Manhole	1800	19.008	34.480	600	19.007	34.480	600	
S123	38.608	4.400	Open Manhole	1800	19.009	34.208	600	19.008	34.208	600	
OB27	38.605	0.992	Open Manhole	450	28.000	37.613	150				
S124	38.660	4.675	Open Manhole	1800	19.010	33.985	600	19.009	33.985	600	
								28.000	35.935	150	1500
OB28	38.519	2.083	Open Manhole	450	29.000	36.436	150				
S125	38.557	4.979	Open Manhole	1800	2.011	33.578	900	2.010	33.800	675	
								19.010	33.878	600	
								29.000	35.935	150	1607
OB29	37.610	1.085	Open Manhole	450	30.000	36.525	150				

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
OB30	38.075	1.085	Open Manhole	450	31.000	36.990	225				
S126	38.180	2.070	Open Manhole	1500	30.001	36.110	225	30.000	36.185	150	
								31.000	36.110	225	
S127	38.525	4.963	Open Manhole	1800	2.012	33.562	900	2.011	33.562	900	
								30.001	35.737	225	1500
INT01	38.600	5.210	Open Manhole	1200	2.013	33.390	900	2.012	33.490	900	100
SDP01	39.000	1.500	Open Manhole	1200	32.000	37.500	375				
RWP01	38.850	1.200	Open Manhole	150	33.000	37.650	150				
S200	38.700	1.427	Open Manhole	1500	33.001	37.273	150	33.000	37.273	150	
RWP03	39.000	1.350	Open Manhole	150	34.000	37.650	150				
S201	38.695	1.537	Open Manhole	1500	34.001	37.158	150	34.000	37.158	150	
RWP04	39.000	1.350	Open Manhole	150	35.000	37.650	150				
BRANCH	38.695	1.730	Junction		34.002	36.965	150	34.001	36.965	150	
								35.000	36.965	150	
RWP05	39.000	1.350	Open Manhole	150	36.000	37.650	150				
BRANCH	38.820	2.048	Junction		34.003	36.772	150	34.002	36.772	150	
								36.000	36.772	150	
RWP02	38.850	1.200	Open Manhole	150	37.000	37.650	150				
S202(V)	38.820	2.484	Open Manhole	2400	32.001	36.336	525	32.000	37.350	375	864
								33.001	36.711	150	
								34.003	36.711	150	
								37.000	36.711	150	
S203	38.433	2.136	Open Manhole	2100	32.002	36.297	525	32.001	36.297	525	
RWP06	39.000	1.350	Open Manhole	150	38.000	37.650	150				
BRANCH	38.433	2.281	Junction		32.003	36.152	525	32.002	36.152	525	
								38.000	36.527	150	
SWP07	39.000	1.350	Open Manhole	150	39.000	37.650	150				
BRANCH	38.433	2.314	Junction		32.004	36.119	525	32.003	36.119	525	
								39.000	36.494	150	
RWP08	39.000	1.350	Open Manhole	150	40.000	37.650	150				
S204	38.010	2.019	Open Manhole	2100	32.005	35.991	600	32.004	36.066	525	
								40.000	36.441	150	
SDP02	39.000	1.500	Open Manhole	450	41.000	37.500	375				
RWP09	39.000	1.350	Open Manhole	150	42.000	37.650	150				
S205	38.700	1.428	Open Manhole	1500	42.001	37.272	150	42.000	37.272	150	
RWP10	39.000	1.350	Open Manhole	150	43.000	37.650	150				
RWP11	39.000	1.939	Open Manhole	150	44.000	37.061	150				
RWP12	39.000	1.350	Open Manhole	150	45.000	37.650	150				
BRANCH	38.760	1.993	Junction		44.001	36.767	150	44.000	36.767	150	
								45.000	36.767	150	
S206(V)	38.825	2.564	Open Manhole	2400	41.001	36.261	450	41.000	37.350	375	1014

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
								42.001	36.561	150	
								43.000	37.061	150	500
								44.001	36.561	150	
S207	38.433	2.863	Open Manhole	2100	32.006	35.570	750	32.005	35.720	600	
								41.001	35.870	450	
RWP13	38.850	1.350	Open Manhole	150	46.000	37.500	150				
S208	38.565	3.063	Open Manhole	2100	32.007	35.502	750	32.006	35.502	750	
								46.000	37.102	150	1000
S209	38.719	3.259	Open Manhole	2100	32.008	35.460	750	32.007	35.460	750	
RWP14	38.850	1.000	Open Manhole	150	47.000	37.850	150				
BRANCH	38.719	3.267	Junction		32.009	35.452	750	32.008	35.452	750	
								47.000	36.052	150	
RWP15	38.850	1.000	Open Manhole	150	48.000	37.850	150				
S210	38.800	1.350	Open Manhole	460	48.001	37.450	150	48.000	37.450	150	
RWP16	38.850	1.000	Open Manhole	150	49.000	37.850	150				
BRANCH	38.800	1.534	Junction		48.002	37.266	150	48.001	37.266	150	
								49.000	37.266	150	
RWP17	39.000	1.200	Open Manhole	150	50.000	37.800	150				
RWP18	39.000	1.200	Open Manhole	150	51.000	37.800	150				
S211	38.815	1.465	Open Manhole	1500	50.001	37.350	150	50.000	37.350	150	
								51.000	37.350	150	
RWP19	38.850	1.415	Open Manhole	150	52.000	37.435	150				
BRANCH	38.600	1.556	Junction		50.002	37.044	150	50.001	37.044	150	
								52.000	37.044	150	
RWP20	38.850	1.000	Open Manhole	150	53.000	37.850	150				
BRANCH	38.250	1.606	Junction		50.003	36.644	150	50.002	36.644	150	
								53.000	36.644	150	
S212	38.300	1.805	Open Manhole	1500	50.004	36.495	150	50.003	36.495	150	
S213	38.719	3.337	Open Manhole	2100	32.010	35.382	750	32.009	35.382	750	
								48.002	37.068	150	1086
								50.004	35.982	150	
RWP21	39.000	1.150	Open Manhole	150	54.000	37.850	150				
BRANCH	38.719	3.356	Junction		32.011	35.363	750	32.010	35.363	750	
								54.000	35.963	150	
RWP22	39.000	1.150	Open Manhole	150	55.000	37.850	150				
BRANCH	38.719	3.394	Junction		32.012	35.325	750	32.011	35.325	750	
								55.000	35.925	150	
RWP23	39.000	1.150	Open Manhole	150	56.000	37.850	150				
BRANCH	38.719	3.432	Junction		32.013	35.288	750	32.012	35.288	750	
								56.000	35.888	150	
RWP24	39.000	1.150	Open Manhole	150	57.000	37.850	150				

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
BRANCH	38.719	3.468	Junction		32.014	35.251	750	32.013	35.251	750	
								57.000	35.851	150	
RWP25	39.000	1.150	Open Manhole	150	58.000	37.850	150				
BRANCH	38.719	3.508	Junction		32.015	35.211	750	32.014	35.211	750	
								58.000	35.811	150	
SDP12	39.000	1.650	Open Manhole	450	59.000	37.350	375				
SDP13	39.000	1.650	Open Manhole	450	60.000	37.350	300				
SDP14	39.000	1.650	Open Manhole	450	61.000	37.350	375				
RWP29	38.850	1.350	Open Manhole	150	62.000	37.500	150				
S214	38.590	1.490	Open Manhole	1500	62.001	37.100	150	62.000	37.100	150	
RWP30	38.850	1.000	Open Manhole	150	63.000	37.850	150				
S215(V)	38.590	3.095	Open Manhole	2700	61.001	35.495	525	61.000	36.837	375	1192
								62.001	36.995	150	1125
								63.000	35.870	150	
RWP27	38.850	1.500	Open Manhole	150	64.000	37.350	150				
S214a	38.590	1.490	Open Manhole	1500	64.001	37.100	150	64.000	37.100	150	
RWP28	38.850	1.000	Open Manhole	150	65.000	37.850	150				
S216(V)	38.590	3.275	Open Manhole	2700	59.001	35.315	675	59.000	36.837	375	1222
								60.000	36.837	300	1147
								61.001	35.460	525	
								64.001	36.935	150	1095
								65.000	35.835	150	
RWP26	39.000	1.150	Open Manhole	150	66.000	37.850	150				
S217	38.719	3.695	Open Manhole	2700	32.016	35.024	900	32.015	35.174	750	
								59.001	35.249	675	
								66.000	37.048	150	1274
RWP31	39.000	1.150	Open Manhole	150	67.000	37.850	150				
BRANCH	38.719	3.729	Junction		32.017	34.990	900	32.016	34.990	900	
								67.000	35.740	150	
RWP32	39.000	1.000	Open Manhole	150	68.000	38.000	150				
BRANCH	38.719	3.762	Junction		32.018	34.957	900	32.017	34.957	900	
								68.000	35.707	150	
RWP33	39.000	1.000	Open Manhole	150	69.000	38.000	150				
BRANCH	38.719	3.799	Junction		32.019	34.920	900	32.018	34.920	900	
								69.000	35.670	150	
RWP34	39.000	1.000	Open Manhole	150	70.000	38.000	150				
BRANCH	38.719	3.828	Junction		32.020	34.891	900	32.019	34.891	900	
								70.000	35.641	150	
RWP36	39.000	1.200	Open Manhole	150	71.000	37.800	150				
RWP35	39.000	1.200	Open Manhole	150	72.000	37.800	150				
S218	38.825	1.475	Open Manhole	1500	71.001	37.350	150	71.000	37.350	150	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
								72.000	37.350	150	
RWP37	38.850	1.000	Open Manhole	150	73.000	37.850	150				
BRANCH	38.585	1.541	Junction		71.002	37.044	150	71.001	37.044	150	
								73.000	37.044	150	
RWP38	38.850	1.000	Open Manhole	150	74.000	37.850	150				
S219	38.250	1.573	Open Manhole	1500	71.003	36.677	150	71.002	36.677	150	
								74.000	36.677	150	
RWP39	39.000	1.000	Open Manhole	150	75.000	38.000	150				
S220	38.719	3.871	Open Manhole	2100	32.021	34.848	900	32.020	34.848	900	
								71.003	35.598	150	
								75.000	37.272	150	1674
RWP40	39.000	1.000	Open Manhole	150	76.000	38.000	150				
BRANCH	38.719	3.890	Junction		32.022	34.829	900	32.021	34.829	900	
								76.000	35.579	150	
RWP41	39.000	1.000	Open Manhole	150	77.000	38.000	150				
BRANCH	38.719	3.912	Junction		32.023	34.807	900	32.022	34.807	900	
								77.000	35.557	150	
RWP42	39.000	1.000	Open Manhole	150	78.000	38.000	150				
S221 (SUDS)	38.719	3.942	Open Manhole	4000	32.024	34.777	900	32.023	34.777	900	
								78.000	37.201	150	1674
SDP03	39.000	1.500	Open Manhole	450	79.000	37.500	375				
RWP43	38.850	1.200	Open Manhole	150	80.000	37.650	150				
S222	38.700	1.427	Open Manhole	1500	80.001	37.273	150	80.000	37.273	150	
RWP44	38.850	1.200	Open Manhole	150	81.000	37.650	150				
RWP45	39.000	1.350	Open Manhole	150	82.000	37.650	150				
S223	38.695	1.545	Open Manhole	1500	82.001	37.150	150	82.000	37.150	150	
RWP46	39.000	1.350	Open Manhole	150	83.000	37.650	150				
BRANCH	38.695	1.725	Junction		82.002	36.970	150	82.001	36.970	150	
								83.000	36.970	150	
RWP47	39.000	1.350	Open Manhole	150	84.000	37.650	150				
BRANCH	38.825	2.035	Junction		82.003	36.790	150	82.002	36.790	150	
								84.000	36.790	150	
S224(V)	38.820	2.461	Open Manhole	2100	79.001	36.359	525	79.000	37.350	375	841
								80.001	36.734	150	
								81.000	36.734	150	
								82.003	36.734	150	
S225	38.433	2.166	Open Manhole	1800	79.002	36.267	525	79.001	36.267	525	
RWP48	38.250	0.800	Open Manhole	150	85.000	37.450	150				
BRANCH	38.430	2.207	Junction		79.003	36.223	525	79.002	36.223	525	
								85.000	36.598	150	
RWP49	38.250	1.000	Open Manhole	150	86.000	37.250	150				

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)		Pipe Out			Pipes In		
					PN	Invert Level (m)	Diameter (mm)	PN	Invert Level (m)	Diameter (mm)	Backdrop (mm)
BRANCH	38.430	2.252	Junction		79.004	36.178	525	79.003	36.178	525	
								86.000	36.553	150	
RWP50	38.250	1.000	Open Manhole	150	87.000	37.250	150				
BRANCH	38.430	2.297	Junction		79.005	36.133	525	79.004	36.133	525	
								87.000	36.508	150	
RWP51	38.250	1.000	Open Manhole	150	88.000	37.250	150				
BRANCH	38.500	2.412	Junction		79.006	36.088	525	79.005	36.088	525	
								88.000	36.463	150	
RWP52	38.700	1.000	Open Manhole	150	89.000	37.700	150				
BRANCH	38.500	2.436	Junction		79.007	36.064	525	79.006	36.064	525	
								89.000	36.439	150	
RWP53	38.555	1.000	Open Manhole	150	90.000	37.555	150				
BRANCH	38.500	2.471	Junction		79.008	36.029	525	79.007	36.029	525	
								90.000	36.404	150	
RWP54	38.100	1.000	Open Manhole	150	91.000	37.100	150				
S226	38.010	2.068	Open Manhole	1800	79.009	35.942	525	79.008	35.942	525	
								91.000	36.317	150	
SDP04	39.000	1.500	Open Manhole	450	92.000	37.500	375				
RWP55	38.850	1.200	Open Manhole	150	93.000	37.650	150				
S227	38.700	1.428	Open Manhole	1500	93.001	37.272	150	93.000	37.272	150	
RWP56	38.850	1.200	Open Manhole	150	94.000	37.650	150				
RWP57	39.000	1.350	Open Manhole	150	95.000	37.650	150				
RWP58	39.000	1.939	Open Manhole	150	96.000	37.061	150				
BRANCH	38.760	1.993	Junction		95.001	36.767	150	95.000	36.767	150	
								96.000	36.767	150	
S228(V)	38.700	2.364	Open Manhole	2100	92.001	36.336	375	92.000	37.350	375	1014
								93.001	36.561	150	
								94.000	37.061	150	500
								95.001	36.561	150	
S229	38.430	3.018	Open Manhole	2100	79.010	35.412	675	79.009	35.562	525	
								92.001	35.712	375	
S230(SUDS)	38.600	3.321	Open Manhole	3000	79.011	35.279	675	79.010	35.279	675	
S231	38.700	3.937	Open Manhole	2700	32.025	34.763	-1	32.024	34.763	900	
								79.011	34.988	675	
S232	38.790	5.761	Open Manhole	3000	2.014	33.029	1200	2.013	33.329	900	
								32.025	34.734	-1	1405
S233	38.571	5.664	Open Manhole	2400	2.015	32.907	1200	2.014	32.907	1200	
RWP59	38.800	1.350	Open Manhole	150	97.000	37.450	150				
RWP60	38.800	1.350	Open Manhole	150	98.000	37.450	150				
S234	38.550	5.770	Open Manhole	2400	2.016	32.780	1200	2.015	32.780	1200	
								97.000	35.449	150	1619

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out			Pipes In			Backdrop (mm)
					PN	Invert Level (m)	Diameter (mm)	PN	Invert Level (m)	Diameter (mm)	
								98.000	35.449	150	1619
S235	37.908	5.239	Open Manhole	2400	2.017	32.669	1200	2.016	32.669	1200	
RWP61	38.800	1.050	Open Manhole	150	99.000	37.750	150				
S236	38.660	1.065	Open Manhole	460	99.001	37.595	150	99.000	37.595	150	
RWP62	38.800	1.050	Open Manhole	150	100.000	37.750	150				
BRANCH	38.660	1.222	Junction		99.002	37.438	150	99.001	37.438	150	
								100.000	37.438	150	
S237	38.660	1.457	Open Manhole	1200	99.003	37.203	150	99.002	37.203	150	
RWP63	38.800	1.150	Open Manhole	150	101.000	37.650	150				
BRANCH	39.100	2.029	Junction		99.004	37.071	150	99.003	37.071	150	
								101.000	37.071	150	
RWP64	38.800	1.000	Open Manhole	150	102.000	37.800	150				
S238	38.800	3.368	Sealed Manhole	1200	99.005	35.432	225	99.004	36.932	150	1425
								102.000	36.932	150	1425
RWP65	38.256	1.200	Open Manhole	150	103.000	37.056	150				
BRANCH	38.170	3.238	Junction		99.006	34.932	225	99.005	34.932	225	
								103.000	35.007	150	
RWP66	38.246	1.200	Open Manhole	150	104.000	37.046	150				
BRANCH	38.201	3.529	Junction		99.007	34.672	225	99.006	34.672	225	
								104.000	34.747	150	
RWP67	37.806	1.000	Open Manhole	150	105.000	36.806	150				
S239	37.908	5.320	Open Manhole	2700	2.018	32.588	1200	2.017	32.588	1200	
								99.007	34.379	225	816
								105.000	34.799	150	1161
ATT INLET 01	37.908	5.333	Junction		2.019	32.575	1200	2.018	32.575	1200	
SDP05	39.000	1.500	Open Manhole	450	106.000	37.500	375				
S400(V)	38.647	1.822	Open Manhole	2100	106.001	36.825	525	106.000	37.350	375	375
RWP60	38.850	1.200	Open Manhole	150	107.000	37.650	150				
S401	38.647	2.163	Open Manhole	1800	106.002	36.484	525	106.001	36.484	525	
								107.000	36.859	150	
RWP61	38.850	1.200	Open Manhole	150	108.000	37.650	150				
BRANCH	38.647	2.200	Junction		106.003	36.447	525	106.002	36.447	525	
								108.000	36.822	150	
RWP62	38.850	1.200	Open Manhole	150	109.000	37.650	150				
BRANCH	38.647	2.292	Junction		106.004	36.355	525	106.003	36.355	525	
								109.000	36.730	150	
RWP63	38.850	1.200	Open Manhole	150	110.000	37.650	150				
S402	38.647	2.426	Open Manhole	1800	106.005	36.221	600	106.004	36.296	525	
								110.000	36.671	150	
RWP64	38.850	1.200	Open Manhole	150	111.000	37.650	150				
BRANCH	38.647	2.457	Junction		106.006	36.190	600	106.005	36.190	600	

Manhole Schedules for Storm

MH	MH	MH	MH	MH		Pipe Out			Pipes In		
Name	CL (m)	Depth (m)	Connection	Diam.,L*W (mm)	PN	Invert Level (m)	Diameter (mm)	PN	Invert Level (m)	Diameter (mm)	Backdrop (mm)
								111.000	36.640	150	
RWP65	38.850	1.200	Open Manhole	150	112.000	37.650	150				
BRANCH	38.647	2.497	Junction		106.007	36.150	600	106.006	36.150	600	
								112.000	36.600	150	
SDP06	39.000	1.500	Open Manhole	450	113.000	37.500	375				
S403	38.647	2.616	Open Manhole	1800	106.008	36.031	675	106.007	36.106	600	
								113.000	37.350	375	1019
RWP66	38.850	1.200	Open Manhole	150	114.000	37.650	150				
BRANCH	38.647	2.642	Junction		106.009	36.005	675	106.008	36.005	675	
								114.000	36.530	150	
RWP67	38.850	1.200	Open Manhole	150	115.000	37.650	150				
BRANCH	38.647	2.677	Junction		106.010	35.970	675	106.009	35.970	675	
								115.000	36.495	150	
RWP68	38.850	1.200	Open Manhole	150	116.000	37.650	150				
BRANCH	38.647	2.715	Junction		106.011	35.932	675	106.010	35.932	675	
								116.000	36.457	150	
RWP69	38.850	1.200	Open Manhole	150	117.000	37.650	150				
S404	38.460	2.596	Open Manhole	1800	106.012	35.864	675	106.011	35.864	675	
								117.000	36.389	150	
RWP70	38.850	1.000	Open Manhole	150	118.000	37.850	150				
BRANCH	38.290	2.452	Junction		106.013	35.838	675	106.012	35.838	675	
								118.000	36.363	150	
S405	38.130	2.315	Open Manhole	1800	106.014	35.815	675	106.013	35.815	675	
RWP71	39.000	1.050	Open Manhole	150	119.000	37.950	150				
S406	38.730	1.255	Open Manhole	1500	119.001	37.475	150	119.000	37.475	150	
RWP72	39.000	1.050	Open Manhole	150	120.000	37.950	150				
BRANCH	38.730	1.575	Junction		119.002	37.155	150	119.001	37.155	150	
								120.000	37.155	150	
RWP73	39.000	1.050	Open Manhole	150	121.000	37.950	150				
S407	38.730	1.935	Open Manhole	1500	119.003	36.795	150	119.002	36.795	150	
								121.000	36.795	150	
S408	38.150	2.602	Open Manhole	1800	106.015	35.548	750	106.014	35.623	675	
								119.003	36.148	150	
RWP74	38.700	1.100	Open Manhole	150	122.000	37.600	150				
S409	38.650	1.094	Open Manhole	1500	122.001	37.556	150	122.000	37.556	150	
RWP75	38.700	1.000	Open Manhole	150	123.000	37.700	150				
BRANCH	38.650	1.164	Junction		122.002	37.486	150	122.001	37.486	150	
								123.000	37.486	150	
RWP76	38.700	1.000	Open Manhole	150	124.000	37.700	150				
BRANCH	38.650	1.234	Junction		122.003	37.416	150	122.002	37.416	150	
								124.000	37.416	150	

Manhole Schedules for Storm

MH Name	**MH CL (m)**	**MH Depth (m)**	**MH Connection**	**MH Diam.,L*W (mm)**	**PN**	**Pipe Out Invert Level (m)**	**Diameter (mm)**	**PN**	**Pipes In Invert Level (m)**	**Diameter (mm)**	**Backdrop (mm)**
SDP7	39.000	1.500	Open Manhole	600	125.000	37.500	450				
SDP8	39.000	1.500	Open Manhole	600	126.000	37.500	450				
S410(V)	38.650	2.330	Open Manhole	2400	122.004	36.320	750	122.003	37.370	150	450
								125.000	37.350	450	730
								126.000	37.350	450	730
SDP9	39.000	1.500	Open Manhole	600	127.000	37.500	450				
S411(V)	38.650	2.379	Open Manhole	2100	122.005	36.271	750	122.004	36.271	750	
								127.000	37.350	450	779
RWP77	38.700	1.000	Open Manhole	150	128.000	37.700	150				
BRANCH	38.650	2.513	Junction		122.006	36.137	750	122.005	36.137	750	
								128.000	36.737	150	
RWP78	38.700	1.000	Open Manhole	150	129.000	37.700	150				
BRANCH	38.650	2.750	Junction		122.007	35.900	750	122.006	35.900	750	
								129.000	36.500	150	
RWP79	38.850	1.150	Open Manhole	150	130.000	37.700	150				
S412	38.550	1.160	Open Manhole	460	130.001	37.400	150	130.000	37.390	150	
RWP80	38.200	0.950	Open Manhole	150	131.000	37.250	150				
S413	38.750	1.569	Open Manhole	1500	130.002	37.181	150	130.001	37.181	150	
								131.000	37.181	150	
RWP81	38.850	1.000	Open Manhole	150	132.000	37.850	150				
BRANCH	38.750	1.712	Junction		130.003	37.038	150	130.002	37.038	150	
								132.000	37.038	150	
RWP82	38.200	1.000	Open Manhole	150	133.000	37.200	150				
BRANCH	38.750	1.817	Junction		130.004	36.933	150	130.003	36.933	150	
								133.000	36.933	150	
RWP83	38.850	1.000	Open Manhole	150	134.000	37.850	150				
BRANCH	38.600	1.854	Junction		130.005	36.746	150	130.004	36.746	150	
								134.000	36.746	150	
RWP84	38.850	1.000	Open Manhole	150	135.000	37.850	150				
S414	38.750	2.254	Open Manhole	1500	130.006	36.496	150	130.005	36.496	150	
								135.000	36.496	150	
S415	38.650	2.945	Open Manhole	1800	122.008	35.705	750	122.007	35.705	750	
								130.006	36.305	150	
S416	38.000	2.775	Open Manhole	2400	106.016	35.225	900	106.015	35.375	750	
								122.008	35.375	750	
RWP85	38.200	1.350	Open Manhole	150	136.000	36.850	150				
S417	37.750	2.607	Open Manhole	2400	106.017	35.143	900	106.016	35.143	900	
								136.000	35.893	150	
RWP86	38.200	1.350	Open Manhole	150	137.000	36.850	150				
S418	37.750	2.669	Open Manhole	2400	106.018	35.081	900	106.017	35.081	900	
								137.000	35.831	150	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S419	38.450	3.481	Open Manhole	2400	106.019	34.969	900	106.018	34.969	900	
RWP87	38.850	1.000	Open Manhole	150	138.000	37.850	150				
BRANCH	38.490	3.561	Junction		106.020	34.929	900	106.019	34.929	900	
								138.000	35.679	150	
RWP88	38.850	1.000	Open Manhole	150	139.000	37.850	150				
BRANCH	38.490	3.588	Junction		106.021	34.902	900	106.020	34.902	900	
								139.000	35.652	150	
RWP89	38.850	1.000	Open Manhole	150	140.000	37.850	150				
S420	38.490	3.630	Open Manhole	2400	106.022	34.860	900	106.021	34.860	900	
								140.000	35.610	150	
RWP90	38.850	1.000	Open Manhole	150	141.000	37.850	150				
BRANCH	38.490	3.662	Junction		106.023	34.828	900	106.022	34.828	900	
								141.000	35.578	150	
RWP91	38.850	1.000	Open Manhole	150	142.000	37.850	150				
BRANCH	38.490	3.687	Junction		106.024	34.803	900	106.023	34.803	900	
								142.000	35.553	150	
RWP92	38.850	1.000	Open Manhole	150	143.000	37.850	150				
BRANCH	38.490	3.715	Junction		106.025	34.775	900	106.024	34.775	900	
								143.000	35.525	150	
GULLEY	38.850	1.050	Open Manhole	150	144.000	37.800	150				
S421	38.850	1.258	Open Manhole	1500	144.001	37.592	150	144.000	37.592	150	
S422	38.490	3.737	Open Manhole	2400	106.026	34.753	900	106.025	34.753	900	
								144.001	37.175	150	1672
RWP93	38.850	1.000	Open Manhole	150	145.000	37.850	150				
BRANCH	38.490	3.747	Junction		106.027	34.743	900	106.026	34.743	900	
								145.000	35.493	150	
RWP94	38.850	1.000	Open Manhole	150	146.000	37.850	150				
BRANCH	38.490	3.774	Junction		106.028	34.716	900	106.027	34.716	900	
								146.000	35.466	150	
RWP95	38.850	1.000	Open Manhole	150	147.000	37.850	150				
BRANCH	38.490	3.812	Junction		106.029	34.678	900	106.028	34.678	900	
								147.000	35.428	150	
RWP96	38.850	1.000	Open Manhole	150	148.000	37.850	150				
S423	38.490	3.839	Open Manhole	2400	106.030	34.651	900	106.029	34.651	900	
								148.000	35.401	150	
RWP96	38.850	1.000	Open Manhole	150	149.000	37.850	150				
BRANCH	38.490	3.873	Junction		106.031	34.617	900	106.030	34.617	900	
								149.000	35.367	150	
RWP97	38.850	1.000	Open Manhole	150	150.000	37.850	150				
BRANCH	38.490	3.893	Junction		106.032	34.597	900	106.031	34.597	900	
								150.000	35.347	150	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SDP10	39.000	1.500	Open Manhole	450	151.000	37.500	375				
S424(V)	38.850	2.025	Open Manhole	2400	151.001	36.825	525	151.000	37.350	375	375
RWP98	38.850	1.000	Open Manhole	150	152.000	37.850	150				
S425	38.850	2.063	Open Manhole	1800	151.002	36.787	525	151.001	36.787	525	
								152.000	37.162	150	
RWP99	38.600	1.000	Open Manhole	150	153.000	37.600	150				
BRANCH	38.580	1.862	Junction		151.003	36.718	525	151.002	36.718	525	
								153.000	37.093	150	
RWP100	38.600	1.000	Open Manhole	150	154.000	37.600	150				
BRANCH	38.550	1.838	Junction		151.004	36.712	525	151.003	36.712	525	
								154.000	37.087	150	
S426	38.490	4.025	Open Manhole	2400	106.033	34.465	975	106.032	34.540	900	
								151.004	36.690	525	1775
RWP101	38.850	1.000	Open Manhole	150	155.000	37.850	150				
S427	38.850	1.468	Open Manhole	1500	155.001	37.382	150	155.000	37.382	150	
RWP102	38.600	1.000	Open Manhole	1500	156.000	37.600	150				
BRANCH	38.580	1.545	Junction		155.002	37.035	150	155.001	37.035	150	
								156.000	37.035	150	
RWP103	38.600	1.000	Open Manhole	150	157.000	37.600	150				
BRANCH	38.550	1.546	Junction		155.003	37.004	150	155.002	37.004	150	
								157.000	37.004	150	
S428	38.490	4.214	Open Manhole	2100	106.034	34.276	975	106.033	34.276	975	
								155.003	36.896	150	1795
RWP106	38.850	1.050	Open Manhole	150	158.000	37.800	150				
S429	38.800	1.141	Open Manhole	460	158.001	37.659	150	158.000	37.659	150	
RWP107	38.850	1.000	Open Manhole	150	159.000	37.850	150				
SDP11	39.000	1.500	Open Manhole	450	160.000	37.500	375				
S430(V)	38.800	1.900	Open Manhole	2100	158.002	36.900	450	158.001	37.200	150	
								159.000	37.200	150	
								160.000	37.350	375	375
S431	38.500	4.425	Open Manhole	2400	106.035	34.075	975	106.034	34.075	975	
								158.002	36.744	450	2144
S432(SUDS)	38.500	4.483	Open Manhole	3600	106.036	34.017	975	106.035	34.017	975	
ATT INLET 03	38.500	4.507	Junction		106.037	33.993	975	106.036	33.993	975	
OB31	38.555	1.050	Open Manhole	450	161.000	37.505	150				
S300	38.612	1.250	Open Manhole	1500	161.001	37.362	225	161.000	37.437	150	
OB32	38.555	1.050	Open Manhole	450	162.000	37.505	150				
S301	38.612	2.125	Open Manhole	1500	161.002	36.487	225	161.001	36.487	225	
								162.000	36.562	150	
OB33	38.231	1.000	Open Manhole	450	163.000	37.231	150				
BRANCH	38.288	2.207	Junction		161.003	36.081	225	161.002	36.081	225	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out			Pipes In			Backdrop (mm)
					PN	Invert Level (m)	Diameter (mm)	PN	Invert Level (m)	Diameter (mm)	
								163.000	36.156	150	
S302	38.002	2.149	Open Manhole	1500	161.004	35.853	300	161.003	35.928	225	
OB34	37.690	1.050	Open Manhole	450	164.000	36.640	225				
BRANCH	37.815	2.251	Junction		161.005	35.564	300	161.004	35.564	300	
								164.000	35.639	225	
OB37	37.690	1.125	Open Manhole	450	165.000	36.565	150				
OB35	37.610	1.050	Open Manhole	450	166.000	36.560	150				
S303	38.300	2.740	Open Manhole	1500	166.001	35.560	150	166.000	35.560	150	
OB36	38.075	1.125	Open Manhole	450	167.000	36.950	225				
S304	37.743	2.892	Open Manhole	1500	161.006	34.851	450	161.005	35.001	300	
								165.000	35.151	150	
								166.001	35.151	150	
								167.000	35.076	225	
OB38	37.690	1.125	Open Manhole	450	168.000	36.565	225				
S305	37.743	3.167	Open Manhole	1500	161.007	34.576	525	161.006	34.651	450	
								168.000	34.876	225	
OB39	37.690	1.125	Open Manhole	450	169.000	36.565	225				
BRANCH	37.743	3.338	Junction		161.008	34.405	525	161.007	34.405	525	
								169.000	34.705	225	
OB40	37.883	1.000	Open Manhole	450	170.000	36.883	150				
S306	37.743	3.385	Open Manhole	1800	161.009	34.358	525	161.008	34.358	525	
								170.000	36.383	150	1650
OB40a	37.883	1.000	Open Manhole	450	171.000	36.883	150				
OB41	37.690	1.125	Open Manhole	450	172.000	36.565	225				
S307	37.743	3.547	Open Manhole	1800	161.010	34.196	600	161.009	34.271	525	
								171.000	36.296	150	1650
								172.000	36.221	225	1650
OB42	37.700	1.000	Open Manhole	450	173.000	36.700	150				
BRANCH	37.970	3.849	Junction		161.011	34.121	600	161.010	34.121	600	
								173.000	34.571	150	
OB43	38.265	1.000	Open Manhole	450	174.000	37.265	150				
S308	38.300	4.241	Open Manhole	1800	161.012	34.059	600	161.011	34.059	600	
								174.000	36.195	150	1686
OB44	38.415	1.000	Open Manhole	450	175.000	37.415	150				
BRANCH	38.463	4.489	Junction		161.013	33.974	600	161.012	33.974	600	
								175.000	34.397	150	
OB45	38.415	1.000	Open Manhole	450	176.000	37.415	225				
S309	38.463	4.735	Open Manhole	1800	161.014	33.728	675	161.013	33.803	600	
								176.000	35.932	225	1754
OB46	38.415	1.000	Open Manhole	450	177.000	37.415	150				
S310	38.463	4.887	Open Manhole	1800	161.015	33.576	675	161.014	33.576	675	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
								177.000	35.895	150	1794
OB47	38.365	1.000	Open Manhole	450	178.000	37.365	150				
BRANCH	38.463	4.937	Junction		161.016	33.526	675	161.015	33.526	675	
								178.000	34.051	150	
OB48	38.400	1.000	Open Manhole	450	179.000	37.400	150				
OB49	38.518	1.000	Open Manhole	450	180.000	37.518	150				
S311	38.463	5.063	Open Manhole	1800	161.017	33.400	675	161.016	33.400	675	
								179.000	35.925	150	2000
								180.000	35.925	150	2000
OB50	38.517	1.050	Open Manhole	450	181.000	37.467	150				
S312	38.560	1.267	Open Manhole	1500	181.001	37.293	150	181.000	37.293	150	
OB51	38.517	1.000	Open Manhole	450	182.000	37.517	150				
S313	38.590	1.790	Open Manhole	1500	181.002	36.800	225	181.001	36.875	150	
								182.000	36.875	150	
OB52	38.480	1.050	Open Manhole	450	183.000	37.430	150				
BRANCH	38.520	2.379	Junction		181.003	36.141	225	181.002	36.141	225	
								183.000	36.216	150	
S314	38.500	2.645	Open Manhole	1500	181.004	35.855	225	181.003	35.855	225	
OB53	38.380	1.000	Open Manhole	450	184.000	37.380	150				
S315	38.600	5.415	Open Manhole	2400	161.018	33.185	750	161.017	33.260	675	
								181.004	35.654	225	1944
								184.000	35.435	150	1650
INT02 (SUDS)	38.600	5.546	Open Manhole	1100	161.019	33.054	750	161.018	33.154	750	100
S316	38.700	5.677	Open Manhole	2100	161.020	33.023	750	161.019	33.023	750	
ATT INLET 02	38.620	5.620	Junction		161.021	33.000	750	161.020	33.000	750	
ATT TANK 01	37.900	5.500	Open Manhole	1200	2.020	32.400	1200	2.019	32.500	1200	100
								106.037	33.846	975	1221
								161.021	32.850	750	
CONNECTION	38.000	5.650	Open Manhole	1200	2.021	32.350	1200	2.020	32.350	1200	
OB60	38.424	1.125	Open Manhole	450	185.000	37.299	300				
OB61	38.262	1.125	Open Manhole	450	186.000	37.137	300				
S500	38.512	1.692	Open Manhole	1500	185.001	36.820	375	185.000	36.895	300	
								186.000	36.895	300	
S501	38.539	1.874	Open Manhole	1500	185.002	36.665	375	185.001	36.665	375	
OB62	38.103	1.125	Open Manhole	450	187.000	36.978	300				
BRANCH	38.500	2.004	Junction		185.003	36.496	375	185.002	36.496	375	
								187.000	36.571	300	
OB63	37.891	1.000	Open Manhole	450	188.000	36.891	150				
OB64	37.819	1.050	Open Manhole	450	189.000	36.769	150				
S502	38.000	1.739	Open Manhole	1500	185.004	36.261	375	185.003	36.261	375	
								188.000	36.486	150	

Manhole Schedules for Storm

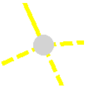
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
								189.000	36.486	150	
OB65	37.619	1.050	Open Manhole	450	190.000	36.569	150				
BRANCH	37.500	1.367	Junction		185.005	36.133	375	185.004	36.133	375	
								190.000	36.358	150	
OB66	37.619	1.000	Open Manhole	450	191.000	36.619	150				
S503	37.580	1.571	Open Manhole	1500	185.006	36.009	450	185.005	36.084	375	
								191.000	36.309	150	
OB67	37.239	1.125	Open Manhole	450	192.000	36.114	225				
BRANCH	37.360	1.515	Junction		185.007	35.845	450	185.006	35.845	450	
								192.000	36.070	225	
OB68	37.566	1.000	Open Manhole	450	193.000	36.566	150				
BRANCH	37.600	1.899	Junction		185.008	35.701	450	185.007	35.701	450	
								193.000	36.001	150	
OB69	37.320	0.992	Open Manhole	450	194.000	36.328	150				
OB70	37.250	1.200	Open Manhole	450	195.000	36.050	300				
S504	37.380	1.500	Open Manhole	1500	194.001	35.880	300	194.000	36.030	150	
								195.000	35.880	300	
OB71	37.228	1.050	Open Manhole	450	196.000	36.178	150				
S505	37.380	1.635	Open Manhole	1500	194.002	35.745	300	194.001	35.745	300	
								196.000	35.895	150	
OB72	37.315	1.000	Open Manhole	450	197.000	36.315	150				
OB73	37.220	1.125	Open Manhole	450	198.000	36.095	300				
S506	37.320	1.833	Open Manhole	1500	194.003	35.487	450	194.002	35.637	300	
								197.000	35.787	150	
								198.000	35.637	300	
OB75	37.347	1.000	Open Manhole	450	199.000	36.347	150				
OB74	37.503	0.992	Open Manhole	450	200.000	36.511	150				
S507	37.535	1.278	Open Manhole	1500	200.001	36.257	150	200.000	36.257	150	
S508	37.410	1.522	Open Manhole	1500	199.001	35.888	150	199.000	35.888	150	
								200.001	35.888	150	
OB76	37.404	0.986	Open Manhole	450	201.000	36.418	150				
S509	37.500	2.172	Open Manhole	1800	194.004	35.328	450	194.003	35.328	450	
								199.001	35.628	150	
								201.000	35.628	150	
S510	37.850	2.603	Open Manhole	1800	194.005	35.247	450	194.004	35.247	450	
OB77	37.649	1.050	Open Manhole	450	202.000	36.599	150				
S511	37.687	2.582	Open Manhole	1800	194.006	35.105	450	194.005	35.105	450	
								202.000	35.405	150	
OB78	37.649	1.050	Open Manhole	450	203.000	36.599	150				
S512	37.687	2.864	Open Manhole	1800	194.007	34.823	525	194.006	34.898	450	
								203.000	35.198	150	

Manhole Schedules for Storm

MH	MH	MH	MH	MH		Pipe Out			Pipes In		
Name	**CL (m)**	**Depth (m)**	**Connection**	**Diam.,L*W (mm)**	**PN**	**Invert Level (m)**	**Diameter (mm)**	**PN**	**Invert Level (m)**	**Diameter (mm)**	**Backdrop (mm)**
S513	37.687	3.223	Open Manhole	1800	185.009	34.464	750	185.008	35.646	450	882
								194.007	34.688	525	
OB79	38.103	1.085	Open Manhole	450	204.000	37.018	300				
S514	38.200	1.500	Open Manhole	1500	204.001	36.700	300	204.000	36.700	300	
OB80	37.819	1.125	Open Manhole	450	205.000	36.694	225				
BRANCH	37.844	1.275	Junction		204.002	36.569	300	204.001	36.569	300	
								205.000	36.644	225	
S515	37.720	3.383	Open Manhole	2100	185.010	34.337	825	185.009	34.412	750	
								204.002	36.506	300	1644
OB83	37.900	1.050	Open Manhole	450	206.000	36.850	150				
OB84	37.960	1.000	Open Manhole	450	207.000	36.960	150				
OB81	38.139	0.992	Open Manhole	450	208.000	37.147	150				
OB82	38.104	0.992	Open Manhole	450	209.000	37.112	150				
S516	38.210	1.425	Open Manhole	1500	208.001	36.785	225	208.000	36.860	150	
								209.000	36.860	150	
GULLY	38.335	1.000	Open Manhole	450	210.000	37.335	150				
BRANCH	38.210	1.599	Junction		208.002	36.611	225	208.001	36.611	225	
								210.000	36.686	150	
S517	38.000	1.576	Open Manhole	1500	206.001	36.424	300	206.000	36.574	150	
								207.000	36.574	150	
								208.002	36.499	225	
OB90A	38.200	1.400	Open Manhole	150	211.000	36.800	150				
OB90	38.200	1.400	Open Manhole	150	212.000	36.800	150				
OB85	37.780	0.992	Open Manhole	450	213.000	36.788	150				
OB86	37.520	0.992	Open Manhole	450	214.000	36.528	150				
S518	37.680	1.500	Open Manhole	1500	213.001	36.180	225	213.000	36.255	150	
								214.000	36.255	150	
OB87	37.720	1.000	Open Manhole	450	215.000	36.720	150				
BRANCH	37.830	1.795	Junction		213.002	36.035	225	213.001	36.035	225	
								215.000	36.110	150	
OB88	37.897	1.050	Open Manhole	450	216.000	36.847	150				
OB89	37.886	1.000	Open Manhole	450	217.000	36.886	150				
S519	37.980	2.188	Open Manhole	1800	213.003	35.792	300	213.002	35.867	225	
								216.000	35.942	150	
								217.000	35.942	150	
S520	37.980	2.333	Open Manhole	1800	206.002	35.647	375	206.001	36.338	300	616
								211.000	35.872	150	
								212.000	35.872	150	
								213.003	35.722	300	
OB92	37.958	1.085	Open Manhole	450	218.000	36.873	150				
OB91	37.350	0.992	Open Manhole	450	219.000	36.358	150				

Manhole Schedules for Storm

MH Name	**MH CL (m)**	**MH Depth (m)**	**MH Connection**	**MH Diam.,L*W (mm)**	**PN**	**Pipe Out Invert Level (m)**	**Diameter (mm)**	**PN**	**Pipes In Invert Level (m)**	**Diameter (mm)**	**Backdrop (mm)**
OB93	37.250	1.085	Open Manhole	450	220.000	36.165	225				
S521	37.500	2.277	Open Manhole	1800	206.003	35.223	450	206.002	35.298	375	
								218.000	35.523	150	
								219.000	35.523	150	
								220.000	35.448	225	
OB94	37.220	0.992	Open Manhole	450	221.000	36.228	225				
BRANCH	37.400	2.586	Junction		206.004	34.814	450	206.003	34.814	450	
								221.000	35.039	225	
OB95	37.600	1.000	Open Manhole	450	222.000	36.600	150				
S522	37.400	3.185	Open Manhole	2400	185.011	34.215	900	185.010	34.290	825	
								206.004	34.673	450	8
								222.000	34.973	150	8
INT03 (SUDS)	37.350	3.481	Open Manhole	1200	185.012	33.869	900	185.011	34.204	900	335
S523	37.700	3.858	Open Manhole	2400	185.013	33.842	900	185.012	33.842	900	
ATT INLET 04	37.700	3.876	Junction		185.014	33.824	900	185.013	33.824	900	
ATT TANK 02	37.300	5.000	Open Manhole	1200	2.022	32.300	525	2.021	32.300	1200	
								185.014	32.300	900	
S523	37.285	5.022	Open Manhole	1800	2.023	32.263	525	2.022	32.263	525	
S524 (SUDS)	38.070	5.875	Open Manhole	2100	2.024	32.195	525	2.023	32.195	525	
SWPS01	38.070	5.885	Open Manhole	2475	2.025	32.185	300	2.024	32.185	525	
458	37.350	1.500	Open Manhole	2475	2.026	35.850	450	2.025	36.000	300	
	36.250	0.450	Open Manhole	30		OUTFALL		2.026	35.800	450	

MH Name	**Manhole Easting (m)**	**Manhole Northing (m)**	**Intersection Easting (m)**	**Intersection Northing (m)**	**Manhole Access**	**Layout (North)**
OB1	432926.589	558417.741	432926.589	558417.741	Required	
OB2	432904.611	558421.682	432904.611	558421.682	Required	
S100	432913.751	558427.466	432913.751	558427.466	Required	
OB3	432925.361	558446.461	432925.361	558446.461	Required	
OB4	432899.079	558442.204	432899.079	558442.204	Required	
S101	432905.727	558445.210	432905.727	558445.210	Required	

Manhole Schedules for Storm

MH Name	**Manhole Easting (m)**	**Manhole Northing (m)**	**Intersection Easting (m)**	**Intersection Northing (m)**	**Manhole Access**	**Layout (North)**
458	432963.975	559109.920	432963.975	559109.920	Required	
	432966.471	559111.049			No Entry	

Free Flowing Outfall Details for Storm

Outfall Pipe Number	**Outfall Name**	**C. Level (m)**	**I. Level (m)**	**Min I. Level (m)**	**D,L (mm)**	**W (mm)**
2.026		36.250	35.800	34.600	30	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.300	Storm Duration (mins)	30
Ratio R	0.350		

Online Controls for Storm

Pump Manhole: SWPS01, DS/PN: 2.025, Volume (m³): 28.6

Invert Level (m) 32.185

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.200	68.2000	1.400	138.4000	2.600	165.3000	3.800	165.3000	5.000	165.3000
0.400	68.2000	1.600	138.4000	2.800	165.3000	4.000	165.3000	5.200	165.3000
0.633	68.2000	1.801	165.3000	3.000	165.3000	4.200	165.3000	5.400	165.3000
0.650	138.4000	2.000	165.3000	3.200	165.3000	4.400	165.3000	5.600	165.3000
1.000	138.4000	2.200	165.3000	3.400	165.3000	4.600	165.3000	5.800	165.3000
1.200	138.4000	2.400	165.3000	3.600	165.3000	4.800	165.3000	6.000	165.3000

Storage Structures for Storm

Tank or Pond Manhole: ATT TANK 01, DS/PN: 2.020

Invert Level (m) 32.400

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	2808.9	2.490	2808.9	2.491	0.0

Tank or Pond Manhole: ATT TANK 02, DS/PN: 2.022

Invert Level (m) 32.300

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	5517.0	2.490	5517.0	2.491	0.0

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.300 Cv (Summer) 1.000
Region England and Wales Ratio R 0.350 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
2.000	OB1	15 Summer	1	+0%	100/15 Summer				37.717	-0.098	0.000
3.000	OB2	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.388	-0.080	0.000
2.001	S100	15 Summer	1	+0%	100/15 Summer	100/15 Summer			37.094	-0.158	0.000
4.000	OB3	15 Summer	1	+0%	100/15 Summer	100/15 Summer			36.613	-0.137	0.000
5.000	OB4	15 Summer	1	+0%	100/15 Summer				37.189	-0.171	0.000
2.002	S101	15 Summer	1	+0%	100/15 Summer	100/15 Summer			36.272	-0.216	0.000
6.000	OB5	15 Summer	1	+0%	100/15 Summer	100/30 Summer			37.209	-0.226	0.000
2.003	S102	15 Summer	1	+0%	30/15 Summer				35.846	-0.271	0.000
7.000	OB6	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.580	-0.130	0.000
8.000	OB7	15 Summer	1	+0%	100/15 Summer	100/15 Summer			37.169	-0.151	0.000
2.004	S103	15 Summer	1	+0%	30/15 Summer				35.336	-0.173	0.000
2.005	S104	15 Summer	1	+0%	30/15 Summer				35.184	-0.178	0.000
9.000	OB8	15 Summer	1	+0%	100/15 Summer				37.451	-0.107	0.000
2.006	S105	15 Summer	1	+0%	30/15 Summer				35.014	-0.257	0.000
10.000	OB9	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.660	-0.053	0.000
10.001	S106	15 Summer	1	+0%	100/15 Summer				37.465	-0.148	0.000
11.000	OB10	15 Summer	1	+0%	100/15 Summer	100/30 Summer			37.612	-0.176	0.000
10.002	S107	15 Summer	1	+0%	30/15 Summer				36.579	-0.101	0.000
12.000	OB11	15 Summer	1	+0%	100/15 Summer				37.606	-0.182	0.000
10.003	S108	15 Summer	1	+0%	100/15 Summer				35.822	-0.158	0.000
13.000	OB12	15 Summer	1	+0%	100/15 Summer				37.597	-0.116	0.000
10.004	S109	15 Summer	1	+0%	30/15 Summer				35.193	-0.227	0.000
2.007	S110	15 Summer	1	+0%	30/15 Summer				34.883	-0.339	0.000
14.000	OB13	15 Summer	1	+0%	100/15 Summer	100/15 Summer			37.058	-0.157	0.000
15.000	OB14	15 Summer	1	+0%	100/15 Summer	100/15 Summer			36.560	-0.115	0.000
14.001	S111	15 Summer	1	+0%	30/15 Summer				35.514	-0.111	0.000
16.000	OB15	15 Summer	1	+0%	100/30 Summer				37.570	-0.109	0.000
2.008	S112	15 Summer	1	+0%	30/15 Summer				34.697	-0.369	0.000
17.000	OB16	15 Summer	1	+0%					37.568	-0.111	0.000

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.000	OB1	0.26			7.9	OK	
3.000	OB2	0.44			10.0	OK	2
2.001	S100	0.19			17.7	OK	1
4.000	OB3	0.32			17.6	OK	7
5.000	OB4	0.13			17.5	OK	
2.002	S101	0.36			51.4	OK	3
6.000	OB5	0.14			40.0	OK	3
2.003	S102	0.32			87.6	OK	
7.000	OB6	0.37			44.7	OK	7
8.000	OB7	0.23			44.4	OK	5
2.004	S103	0.75			166.9	OK	
2.005	S104	0.76			159.3	OK	
9.000	OB8	0.18			9.1	OK	
2.006	S105	0.62			162.7	OK	
10.000	OB9	0.73			14.5	OK	5
10.001	S106	0.25			14.2	OK	
11.000	OB10	0.11			15.7	OK	1
10.002	S107	0.56			28.4	OK	
12.000	OB11	0.08			15.7	OK	
10.003	S108	0.44			41.8	OK	
13.000	OB12	0.12			11.0	OK	
10.004	S109	0.33			51.2	OK	
2.007	S110	0.49			202.6	OK	
14.000	OB13	0.20			34.7	OK	4
15.000	OB14	0.12			4.6	OK	6
14.001	S111	0.50			39.0	OK	
16.000	OB15	0.17			10.2	OK	
2.008	S112	0.42			218.7	OK	
17.000	OB16	0.15			10.4	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
2.009	S113	30 Summer	1	+0%	30/15 Summer				34.465	-0.361	0.000
18.000	OB17	15 Summer	1	+0%					37.566	-0.113	0.000
2.010	S114	30 Summer	1	+0%	30/15 Summer				34.342	-0.243	0.000
19.000	OB18	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.759	-0.086	0.000
19.001	S115	15 Summer	1	+0%	30/15 Summer				37.444	-0.056	0.000
20.000	OB19	15 Summer	1	+0%	100/15 Summer				37.740	-0.105	0.000
19.002	S116	15 Summer	1	+0%	30/15 Summer				36.467	-0.100	0.000
19.003	S117	15 Summer	1	+0%	30/15 Summer	100/15 Summer			35.988	-0.099	0.000
21.000	OB20	15 Summer	1	+0%	100/15 Summer				37.026	-0.108	0.000
22.000	OB21	15 Summer	1	+0%	100/15 Summer				37.172	-0.113	0.000
19.004	S118	15 Summer	1	+0%	30/15 Summer				35.714	-0.182	0.000
23.000	OB22	15 Summer	1	+0%	100/15 Summer	100/15 Summer			36.591	-0.159	0.000
24.000	OB23	15 Summer	1	+0%	100/15 Summer	100/15 Summer			37.220	-0.100	0.000
19.005	S119	15 Summer	1	+0%	30/15 Summer				35.682	-0.156	0.000
25.000	OB24	15 Summer	1	+0%	100/15 Summer				37.197	-0.163	0.000
19.006	S120	15 Summer	1	+0%	30/15 Summer				35.360	-0.218	0.000
26.000	OB25	15 Summer	1	+0%	100/15 Summer				37.203	-0.157	0.000
27.000	OB26	15 Summer	1	+0%	100/15 Summer	100/15 Summer			36.615	-0.135	0.000
19.007	S121	15 Summer	1	+0%	30/15 Summer				34.967	-0.307	0.000
19.008	S122	15 Summer	1	+0%	30/15 Summer				34.713	-0.367	0.000
19.009	S123	15 Summer	1	+0%	30/15 Summer				34.450	-0.358	0.000
28.000	OB27	15 Summer	1	+0%					37.660	-0.103	0.000
19.010	S124	30 Summer	1	+0%	30/15 Summer				34.364	-0.221	0.000
29.000	OB28	15 Summer	1	+0%	100/15 Summer				36.479	-0.107	0.000
2.011	S125	30 Summer	1	+0%	30/15 Summer				34.301	-0.177	0.000
30.000	OB29	15 Summer	1	+0%	100/15 Summer				36.574	-0.101	0.000
31.000	OB30	15 Summer	1	+0%	100/15 Summer				37.064	-0.151	0.000
30.001	S126	15 Summer	1	+0%	30/15 Summer				36.218	-0.117	0.000
2.012	S127	30 Summer	1	+0%	30/15 Summer				34.063	-0.399	0.000
2.013	INT01	30 Summer	1	+0%	30/15 Summer				33.887	-0.403	0.000
32.000	SDP01	15 Summer	1	+0%	1/15 Summer	100/15 Summer			37.943	0.068	0.000
33.000	RWP01	15 Summer	1	+0%	30/15 Summer				37.666	-0.134	0.000
33.001	S200	15 Summer	1	+0%	30/15 Summer				37.290	-0.133	0.000
34.000	RWP03	15 Summer	1	+0%	30/15 Summer				37.687	-0.113	0.000
34.001	S201	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.211	-0.097	0.000
35.000	RWP04	15 Summer	1	+0%	30/15 Summer				37.683	-0.117	0.000
34.002	BRANCH	15 Summer	1	+0%					37.037	-0.078	0.000
36.000	RWP05	15 Summer	1	+0%	30/15 Summer				37.682	-0.118	0.000
34.003	BRANCH	15 Summer	1	+0%					36.904	-0.018	0.000
37.000	RWP02	15 Summer	1	+0%	30/15 Summer				37.662	-0.138	0.000
32.001	S202(V)	15 Summer	1	+0%	30/15 Summer				36.861	0.000	0.000
32.002	S203	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.688	-0.134	0.000
38.000	RWP06	15 Summer	1	+0%	30/15 Summer				37.671	-0.129	0.000
32.003	BRANCH	15 Summer	1	+0%					36.494	-0.183	0.000
39.000	SWP07	15 Summer	1	+0%	30/15 Summer				37.670	-0.130	0.000
32.004	BRANCH	15 Summer	1	+0%					36.448	-0.196	0.000
40.000	RWP08	15 Summer	1	+0%	30/15 Summer				37.671	-0.129	0.000
32.005	S204	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.302	-0.289	0.000
41.000	SDP02	15 Summer	1	+0%	1/15 Summer	100/15 Summer			37.947	0.072	0.000
42.000	RWP09	15 Summer	1	+0%	30/15 Summer				37.666	-0.134	0.000
42.001	S205	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.289	-0.133	0.000
43.000	RWP10	15 Summer	1	+0%	30/15 Summer				37.665	-0.135	0.000
44.000	RWP11	15 Summer	1	+0%	30/15 Summer				37.091	-0.120	0.000
45.000	RWP12	15 Summer	1	+0%	30/15 Summer				37.670	-0.130	0.000

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.009	S113	0.41			214.1	OK	
18.000	OB17	0.14			10.6	OK	
2.010	S114	0.46			211.5	OK	
19.000	OB18	0.38			13.9	OK	7
19.001	S115	0.67			13.2	OK	
20.000	OB19	0.20			13.9	OK	
19.002	S116	0.58			25.8	OK	
19.003	S117	0.60			25.6	OK	7
21.000	OB20	0.17			11.2	OK	
22.000	OB21	0.14			7.8	OK	
19.004	S118	0.42			41.9	OK	
23.000	OB22	0.19			19.1	OK	7
24.000	OB23	0.24			16.4	OK	5
19.005	S119	0.61			72.9	OK	
25.000	OB24	0.17			31.7	OK	
19.006	S120	0.50			95.5	OK	
26.000	OB25	0.20			40.5	OK	
27.000	OB26	0.34			44.7	OK	6
19.007	S121	0.46			164.1	OK	
19.008	S122	0.32			162.9	OK	
19.009	S123	0.34			162.3	OK	
28.000	OB27	0.22			13.7	OK	
19.010	S124	0.62			156.3	OK	
29.000	OB28	0.18			7.9	OK	
2.011	S125	1.14			341.4	OK	
30.000	OB29	0.23			4.5	OK	
31.000	OB30	0.24			31.2	OK	
30.001	S126	0.46			35.4	OK	
2.012	S127	0.60			349.7	OK	
2.013	INT01	0.46			347.9	OK	
32.000	SDP01	1.20			181.9	SURCHARGED	7
33.000	RWP01	0.03			1.0	OK	
33.001	S200	0.03			1.0	OK	
34.000	RWP03	0.13			4.8	OK	
34.001	S201	0.26			4.6	OK	7
35.000	RWP04	0.11			4.6	OK	
34.002	BRANCH	0.44			9.1	OK*	
36.000	RWP05	0.10			4.8	OK	
34.003	BRANCH	0.83			12.8	OK*	
37.000	RWP02	0.02			1.0	OK	
32.001	S202(V)	1.11			188.8	OK	
32.002	S203	0.84			179.9	OK	7
38.000	RWP06	0.05			2.8	OK	
32.003	BRANCH	0.75			178.5	OK*	
39.000	SWP07	0.04			2.5	OK	
32.004	BRANCH	0.72			178.6	OK*	
40.000	RWP08	0.05			2.5	OK	
32.005	S204	0.47			160.2	OK	7
41.000	SDP02	1.21			183.0	SURCHARGED	7
42.000	RWP09	0.03			1.0	OK	
42.001	S205	0.03			1.0	OK	1
43.000	RWP10	0.02			1.0	OK	
44.000	RWP11	0.09			2.5	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
45.000	RWP12	0.04			2.5	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
44.001	BRANCH	15 Summer	1	+0%					36.810	-0.107	0.000
41.001	S206(V)	15 Summer	1	+0%	30/15 Summer				36.497	-0.214	0.000
32.006	S207	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.053	-0.267	0.000
46.000	RWP13	15 Summer	1	+0%	30/15 Summer				37.522	-0.128	0.000
32.007	S208	15 Summer	1	+0%	30/15 Summer				36.016	-0.236	0.000
32.008	S209	15 Summer	1	+0%	30/15 Summer				35.985	-0.225	0.000
47.000	RWP14	15 Summer	1	+0%	100/15 Summer				37.866	-0.134	0.000
32.009	BRANCH	15 Summer	1	+0%					35.904	-0.298	0.000
48.000	RWP15	15 Summer	1	+0%	100/15 Summer				37.875	-0.125	0.000
48.001	S210	15 Summer	1	+0%	100/15 Summer				37.478	-0.122	0.000
49.000	RWP16	15 Summer	1	+0%	100/15 Summer				37.870	-0.130	0.000
48.002	BRANCH	15 Summer	1	+0%					37.305	-0.111	0.000
50.000	RWP17	15 Summer	1	+0%	100/15 Summer				37.830	-0.120	0.000
51.000	RWP18	15 Summer	1	+0%	100/15 Summer				37.827	-0.123	0.000
50.001	S211	15 Summer	1	+0%	100/15 Summer				37.398	-0.102	0.000
52.000	RWP19	15 Summer	1	+0%	100/15 Summer				37.456	-0.129	0.000
50.002	BRANCH	15 Summer	1	+0%					37.097	-0.097	0.000
53.000	RWP20	15 Summer	1	+0%	100/15 Summer				37.866	-0.134	0.000
50.003	BRANCH	15 Summer	1	+0%					36.709	-0.085	0.000
50.004	S212	15 Summer	1	+0%	30/15 Summer	100/30 Summer			36.570	-0.075	0.000
32.010	S213	15 Summer	1	+0%	30/15 Summer				35.866	-0.266	0.000
54.000	RWP21	15 Summer	1	+0%	100/15 Summer				37.868	-0.132	0.000
32.011	BRANCH	15 Summer	1	+0%					35.842	-0.271	0.000
55.000	RWP22	15 Summer	1	+0%	100/15 Summer				37.868	-0.132	0.000
32.012	BRANCH	15 Summer	1	+0%					35.815	-0.260	0.000
56.000	RWP23	15 Summer	1	+0%	100/15 Summer				37.868	-0.132	0.000
32.013	BRANCH	30 Summer	1	+0%					35.785	-0.253	0.000
57.000	RWP24	15 Summer	1	+0%	100/15 Summer				37.868	-0.132	0.000
32.014	BRANCH	30 Summer	1	+0%					35.762	-0.239	0.000
58.000	RWP25	15 Summer	1	+0%	100/30 Summer				37.868	-0.132	0.000
32.015	BRANCH	30 Summer	1	+0%					35.736	-0.225	0.000
59.000	SDP12	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.598	-0.127	0.000
60.000	SDP13	15 Summer	1	+0%	100/15 Summer				37.439	-0.211	0.000
61.000	SDP14	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.598	-0.127	0.000
62.000	RWP29	15 Summer	1	+0%	100/15 Summer				37.515	-0.135	0.000
62.001	S214	15 Summer	1	+0%	30/30 Summer				37.126	-0.124	0.000
63.000	RWP30	15 Summer	1	+0%	100/15 Summer				37.857	-0.143	0.000
61.001	S215(V)	15 Summer	1	+0%	1/15 Summer				36.041	0.021	0.000
64.000	RWP27	15 Summer	1	+0%	100/15 Summer				37.367	-0.133	0.000
64.001	S214a	15 Summer	1	+0%	100/15 Summer				37.124	-0.126	0.000
65.000	RWP28	15 Summer	1	+0%	100/15 Summer				37.858	-0.142	0.000
59.001	S216(V)	15 Summer	1	+0%	30/15 Summer				35.861	-0.129	0.000
66.000	RWP26	15 Summer	1	+0%	100/30 Summer				37.873	-0.127	0.000
32.016	S217	30 Summer	1	+0%	30/15 Summer				35.710	-0.214	0.000
67.000	RWP31	15 Summer	1	+0%					37.867	-0.133	0.000
32.017	BRANCH	30 Summer	1	+0%					35.605	-0.285	0.000
68.000	RWP32	15 Summer	1	+0%					38.018	-0.132	0.000
32.018	BRANCH	30 Summer	1	+0%					35.582	-0.275	0.000
69.000	RWP33	15 Summer	1	+0%					38.018	-0.132	0.000
32.019	BRANCH	30 Summer	1	+0%					35.559	-0.261	0.000
70.000	RWP34	15 Summer	1	+0%					38.017	-0.133	0.000
32.020	BRANCH	30 Summer	1	+0%					35.542	-0.249	0.000
71.000	RWP36	15 Summer	1	+0%					37.829	-0.121	0.000
72.000	RWP35	15 Summer	1	+0%					37.831	-0.119	0.000

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
44.001	BRANCH	0.17			4.9	OK*	
41.001	S206(V)	0.54			189.8	OK	
32.006	S207	0.51			237.4	OK	2
46.000	RWP13	0.05			2.1	OK	
32.007	S208	0.60			227.8	OK	
32.008	S209	0.83			228.7	OK	
47.000	RWP14	0.02			2.1	OK	
32.009	BRANCH	0.37			227.3	OK*	
48.000	RWP15	0.06			2.1	OK	
48.001	S210	0.07			2.0	OK	
49.000	RWP16	0.04			2.1	OK	
48.002	BRANCH	0.14			4.0	OK*	
50.000	RWP17	0.08			2.7	OK	
51.000	RWP18	0.08			2.7	OK	
50.001	S211	0.21			5.3	OK	
52.000	RWP19	0.05			1.8	OK	
50.002	BRANCH	0.25			7.1	OK*	
53.000	RWP20	0.03			1.8	OK	
50.003	BRANCH	0.37			9.0	OK*	
50.004	S212	0.50			8.9	OK	3
32.010	S213	0.79			232.2	OK	
54.000	RWP21	0.03			3.0	OK	
32.011	BRANCH	0.44			234.0	OK*	
55.000	RWP22	0.04			3.1	OK	
32.012	BRANCH	0.45			237.9	OK*	
56.000	RWP23	0.03			2.9	OK	
32.013	BRANCH	0.46			245.0	OK*	
57.000	RWP24	0.03			3.1	OK	
32.014	BRANCH	0.46			251.2	OK*	
58.000	RWP25	0.03			2.9	OK	
32.015	BRANCH	0.48			258.4	OK*	
59.000	SDP12	0.73			204.6	OK	6
60.000	SDP13	0.19			33.9	OK	
61.000	SDP14	0.73			204.6	OK	6
62.000	RWP29	0.02			0.9	OK	
62.001	S214	0.07			0.8	OK	
63.000	RWP30	0.01			0.9	OK	
61.001	S215(V)	1.39			204.5	SURCHARGED	
64.000	RWP27	0.03			0.9	OK	
64.001	S214a	0.06			0.8	OK	
65.000	RWP28	0.01			0.9	OK	
59.001	S216(V)	0.97			449.9	OK	
66.000	RWP26	0.06			3.2	OK	
32.016	S217	0.94			441.0	OK	
67.000	RWP31	0.03			2.8	OK	
32.017	BRANCH	0.57			437.9	OK*	
68.000	RWP32	0.03			3.0	OK	
32.018	BRANCH	0.53			432.5	OK*	
69.000	RWP33	0.03			3.1	OK	
32.019	BRANCH	0.56			429.1	OK*	
70.000	RWP34	0.03			2.8	OK	
32.020	BRANCH	0.49			428.3	OK*	
71.000	RWP36	0.08			3.0	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
72.000	RWP35	0.09			3.0	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
71.001	S218	15 Summer	1	+0%	100/15 Summer				37.399	-0.101
73.000	RWP37	15 Summer	1	+0%					37.868	-0.132
71.002	BRANCH	15 Summer	1	+0%					37.098	-0.096
74.000	RWP38	15 Summer	1	+0%					37.866	-0.134
71.003	S219	15 Summer	1	+0%	100/15 Summer				36.740	-0.087
75.000	RWP39	15 Summer	1	+0%					38.000	-0.150
32.021	S220	30 Summer	1	+0%	30/15 Summer				35.512	-0.236
76.000	RWP40	15 Summer	1	+0%					38.018	-0.132
32.022	BRANCH	30 Summer	1	+0%					35.473	-0.256
77.000	RWP41	15 Summer	1	+0%					38.018	-0.132
32.023	BRANCH	30 Summer	1	+0%					35.461	-0.246
78.000	RWP42	15 Summer	1	+0%					38.023	-0.127
32.024	S221 (SUDS)	30 Summer	1	+0%	30/15 Summer				35.443	-0.234
79.000	SDP03	15 Summer	1	+0%	1/15 Summer	100/15 Summer			37.947	0.072
80.000	RWP43	15 Summer	1	+0%	30/15 Summer				37.666	-0.134
80.001	S222	15 Summer	1	+0%	30/15 Summer				37.290	-0.133
81.000	RWP44	15 Summer	1	+0%	30/15 Summer				37.662	-0.138
82.000	RWP45	15 Summer	1	+0%	30/15 Summer				37.685	-0.115
82.001	S223	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.202	-0.098
83.000	RWP46	15 Summer	1	+0%	30/15 Summer				37.685	-0.115
82.002	BRANCH	15 Summer	1	+0%					37.045	-0.075
84.000	RWP47	15 Summer	1	+0%	30/15 Summer				37.681	-0.119
82.003	BRANCH	15 Summer	1	+0%					36.918	-0.022
79.001	S224(V)	15 Summer	1	+0%	1/15 Summer				36.910	0.026
79.002	S225	15 Summer	1	+0%	30/15 Summer	100/30 Summer			36.792	0.000
85.000	RWP48	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.475	-0.125
79.003	BRANCH	15 Summer	1	+0%					36.563	-0.185
86.000	RWP49	15 Summer	1	+0%	30/15 Summer				37.281	-0.119
79.004	BRANCH	15 Summer	1	+0%					36.515	-0.188
87.000	RWP50	15 Summer	1	+0%	30/15 Summer				37.281	-0.119
79.005	BRANCH	15 Summer	1	+0%					36.479	-0.179
88.000	RWP51	15 Summer	1	+0%	100/15 Summer				37.275	-0.125
79.006	BRANCH	15 Summer	1	+0%					36.435	-0.178
89.000	RWP52	15 Summer	1	+0%					37.720	-0.130
79.007	BRANCH	15 Summer	1	+0%					36.410	-0.179
90.000	RWP53	15 Summer	1	+0%	100/30 Summer				37.575	-0.130
79.008	BRANCH	15 Summer	1	+0%					36.373	-0.181
91.000	RWP54	15 Summer	1	+0%	100/15 Summer				37.123	-0.127
79.009	S226	15 Summer	1	+0%	30/15 Summer				36.257	-0.210
92.000	SDP04	15 Summer	1	+0%	1/15 Summer	100/15 Summer			37.947	0.072
93.000	RWP55	15 Summer	1	+0%	100/15 Summer				37.666	-0.134
93.001	S227	15 Summer	1	+0%	100/15 Summer				37.288	-0.134
94.000	RWP56	15 Summer	1	+0%	100/15 Summer				37.665	-0.135
95.000	RWP57	15 Summer	1	+0%	100/15 Summer				37.670	-0.130
96.000	RWP58	15 Summer	1	+0%	30/15 Summer				37.091	-0.120
95.001	BRANCH	15 Summer	1	+0%					36.810	-0.107
92.001	S228(V)	15 Summer	1	+0%	30/15 Summer				36.550	-0.161
79.010	S229	15 Summer	1	+0%	30/15 Summer				35.794	-0.293
79.011	S230(SUDS)	15 Summer	1	+0%	30/15 Summer				35.580	-0.374
32.025	S231	30 Summer	1	+0%	30/15 Summer				35.423	-0.240
2.014	S232	30 Summer	1	+0%	30/15 Summer				33.852	-0.377
2.015	S233	30 Summer	1	+0%	30/15 Summer				33.771	-0.336
97.000	RWP59	15 Summer	1	+0%					37.470	-0.130
98.000	RWP60	15 Summer	1	+0%					37.479	-0.121

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
71.001	S218	0.000	0.22			5.7	OK	
73.000	RWP37	0.000	0.03			1.8	OK	
71.002	BRANCH	0.000	0.27			7.5	OK*	
74.000	RWP38	0.000	0.03			1.8	OK	
71.003	S219	0.000	0.36			9.5	OK	
75.000	RWP39	0.000	0.00			0.0	OK	
32.021	S220	0.000	1.07			430.2	OK	
76.000	RWP40	0.000	0.03			3.2	OK	
32.022	BRANCH	0.000	0.57			432.2	OK*	
77.000	RWP41	0.000	0.03			3.2	OK	
32.023	BRANCH	0.000	0.57			433.7	OK*	
78.000	RWP42	0.000	0.06			3.2	OK	
32.024	S221 (SUDS)	0.000	0.89			437.0	OK	
79.000	SDP03	0.000	1.21			183.0	SURCHARGED	6
80.000	RWP43	0.000	0.03			1.0	OK	
80.001	S222	0.000	0.03			0.9	OK	
81.000	RWP44	0.000	0.02			1.0	OK	
82.000	RWP45	0.000	0.12			4.4	OK	
82.001	S223	0.000	0.25			4.2	OK	6
83.000	RWP46	0.000	0.12			5.2	OK	
82.002	BRANCH	0.000	0.47			9.3	OK*	
84.000	RWP47	0.000	0.10			4.5	OK	
82.003	BRANCH	0.000	0.91			13.5	OK*	
79.001	S224(V)	0.000	0.76			188.0	SURCHARGED	
79.002	S225	0.000	1.05			181.4	OK	3
85.000	RWP48	0.000	0.06			2.7	OK	6
79.003	BRANCH	0.000	0.74			184.7	OK*	
86.000	RWP49	0.000	0.10			3.7	OK	
79.004	BRANCH	0.000	0.75			186.2	OK*	
87.000	RWP50	0.000	0.09			3.7	OK	
79.005	BRANCH	0.000	0.75			186.0	OK*	
88.000	RWP51	0.000	0.06			2.7	OK	
79.006	BRANCH	0.000	0.76			188.5	OK*	
89.000	RWP52	0.000	0.04			2.7	OK	
79.007	BRANCH	0.000	0.77			190.5	OK*	
90.000	RWP53	0.000	0.04			2.5	OK	
79.008	BRANCH	0.000	0.77			190.2	OK*	
91.000	RWP54	0.000	0.06			2.5	OK	
79.009	S226	0.000	0.61			175.9	OK	
92.000	SDP04	0.000	1.21			183.0	SURCHARGED	5
93.000	RWP55	0.000	0.03			1.0	OK	
93.001	S227	0.000	0.03			0.9	OK	
94.000	RWP56	0.000	0.02			1.0	OK	
95.000	RWP57	0.000	0.04			2.5	OK	
96.000	RWP58	0.000	0.09			2.5	OK	
95.001	BRANCH	0.000	0.17			4.9	OK*	
92.001	S228(V)	0.000	0.61			189.7	OK	
79.010	S229	0.000	0.60			277.7	OK	
79.011	S230(SUDS)	0.000	0.41			280.8	OK	
32.025	S231	0.000	1.04			670.7	OK	
2.014	S232	0.000	0.63			967.8	OK	
2.015	S233	0.000	0.67			918.6	OK	
97.000	RWP59	0.000	0.04			2.6	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
98.000	RWP60	0.000	0.08			5.0	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
2.016	S234	30 Summer	1	+0%	30/15 Summer				33.678	-0.302
2.017	S235	30 Summer	1	+0%	30/15 Summer				33.582	-0.287
99.000	RWP61	15 Summer	1	+0%	100/15 Summer				37.783	-0.117
99.001	S236	15 Summer	1	+0%	100/15 Summer				37.635	-0.110
100.000	RWP62	15 Summer	1	+0%	100/15 Summer				37.784	-0.116
99.002	BRANCH	15 Summer	1	+0%					37.502	-0.086
99.003	S237	15 Summer	1	+0%	30/15 Summer				37.272	-0.081
101.000	RWP63	15 Summer	1	+0%					37.669	-0.131
99.004	BRANCH	15 Summer	1	+0%					37.144	-0.077
102.000	RWP64	15 Summer	1	+0%					37.817	-0.133
99.005	S238	15 Summer	1	+0%					35.492	-0.165
103.000	RWP65	15 Summer	1	+0%					37.081	-0.125
99.006	BRANCH	15 Summer	1	+0%					35.006	-0.151
104.000	RWP66	15 Summer	1	+0%					37.065	-0.131
99.007	BRANCH	15 Summer	1	+0%					34.754	-0.143
105.000	RWP67	15 Summer	1	+0%					36.822	-0.134
2.018	S239	30 Summer	1	+0%	30/15 Summer				33.496	-0.292
2.019	ATT INLET 01	30 Summer	1	+0%					33.127	-0.648
106.000	SDP05	15 Summer	1	+0%	1/15 Summer	100/15 Summer			37.926	0.051
106.001	S400(V)	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.123	-0.227
107.000	RWP60	15 Summer	1	+0%	30/15 Summer				37.668	-0.132
106.002	S401	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.836	-0.173
108.000	RWP61	15 Summer	1	+0%	30/15 Summer				37.668	-0.132
106.003	BRANCH	15 Summer	1	+0%					36.752	-0.220
109.000	RWP62	15 Summer	1	+0%	30/15 Summer				37.662	-0.138
106.004	BRANCH	15 Summer	1	+0%					36.672	-0.208
110.000	RWP63	15 Summer	1	+0%	100/15 Summer				37.667	-0.133
106.005	S402	15 Summer	1	+0%	30/15 Summer	100/30 Summer			36.630	-0.191
111.000	RWP64	15 Summer	1	+0%	100/15 Summer				37.667	-0.133
106.006	BRANCH	15 Summer	1	+0%					36.607	-0.183
112.000	RWP65	15 Summer	1	+0%	100/15 Summer				37.650	-0.150
106.007	BRANCH	15 Summer	1	+0%					36.576	-0.174
113.000	SDP06	15 Summer	1	+0%	1/15 Summer	100/15 Summer			37.923	0.048
106.008	S403	15 Summer	1	+0%	30/15 Summer	100/30 Summer			36.540	-0.166
114.000	RWP66	15 Summer	1	+0%	100/15 Summer				37.666	-0.134
106.009	BRANCH	15 Summer	1	+0%					36.475	-0.205
115.000	RWP67	15 Summer	1	+0%	100/15 Summer				37.667	-0.133
106.010	BRANCH	15 Summer	1	+0%					36.453	-0.192
116.000	RWP68	15 Summer	1	+0%	100/15 Summer				37.666	-0.134
106.011	BRANCH	15 Summer	1	+0%					36.429	-0.178
117.000	RWP69	15 Summer	1	+0%	100/15 Summer				37.678	-0.122
106.012	S404	15 Summer	1	+0%	30/15 Summer				36.379	-0.160
118.000	RWP70	15 Summer	1	+0%	100/15 Summer				37.875	-0.125
106.013	BRANCH	30 Summer	1	+0%					36.213	-0.300
106.014	S405	30 Summer	1	+0%	30/15 Summer	100/15 Summer			36.178	-0.312
119.000	RWP71	15 Summer	1	+0%	100/15 Summer				37.987	-0.113
119.001	S406	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.526	-0.099
120.000	RWP72	15 Summer	1	+0%	100/15 Summer				37.986	-0.114
119.002	BRANCH	15 Summer	1	+0%					37.230	-0.075
121.000	RWP73	15 Summer	1	+0%	100/15 Summer				37.987	-0.113
119.003	S407	15 Summer	1	+0%	30/15 Summer	100/30 Summer			36.905	-0.040
106.015	S408	30 Summer	1	+0%	30/15 Summer	100/15 Winter			35.889	-0.409
122.000	RWP74	15 Summer	1	+0%	30/15 Summer	100/30 Summer			37.658	-0.092
122.001	S409	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.615	-0.091

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.016	S234	0.000	0.72			875.4	OK	
2.017	S235	0.000	0.78			851.1	OK	
99.000	RWP61	0.000	0.11			2.6	OK	
99.001	S236	0.000	0.16			2.6	OK	
100.000	RWP62	0.000	0.12			4.1	OK	
99.002	BRANCH	0.000	0.37			6.6	OK*	
99.003	S237	0.000	0.44			6.7	OK	
101.000	RWP63	0.000	0.04			1.8	OK	
99.004	BRANCH	0.000	0.47			8.4	OK*	
102.000	RWP64	0.000	0.03			1.8	OK	
99.005	S238	0.000	0.16			10.1	OK	
103.000	RWP65	0.000	0.06			5.8	OK	
99.006	BRANCH	0.000	0.23			15.7	OK*	
104.000	RWP66	0.000	0.04			3.6	OK	
99.007	BRANCH	0.000	0.28			19.1	OK*	
105.000	RWP67	0.000	0.02			2.0	OK	
2.018	S239	0.000	0.93			854.2	OK	
2.019	ATT INLET 01	0.000	0.43			852.4	OK*	
106.000	SDP05	0.000	1.14			173.4	SURCHARGED	7
106.001	S400(V)	0.000	0.57			156.8	OK	7
107.000	RWP60	0.000	0.03			1.8	OK	
106.002	S401	0.000	0.77			147.0	OK	7
108.000	RWP61	0.000	0.03			1.8	OK	
106.003	BRANCH	0.000	0.59			146.2	OK*	
109.000	RWP62	0.000	0.02			0.9	OK	
106.004	BRANCH	0.000	0.60			148.2	OK*	
110.000	RWP63	0.000	0.03			1.8	OK	
106.005	S402	0.000	0.71			154.6	OK	1
111.000	RWP64	0.000	0.03			1.8	OK	
106.006	BRANCH	0.000	0.46			158.8	OK*	
112.000	RWP65	0.000	0.00			0.0	OK	
106.007	BRANCH	0.000	0.47			162.5	OK*	
113.000	SDP06	0.000	1.14			173.0	SURCHARGED	6
106.008	S403	0.000	0.91			225.6	OK	
114.000	RWP66	0.000	0.03			1.8	OK	
106.009	BRANCH	0.000	0.55			223.2	OK*	
115.000	RWP67	0.000	0.03			1.9	OK	
106.010	BRANCH	0.000	0.54			217.5	OK*	
116.000	RWP68	0.000	0.03			1.8	OK	
106.011	BRANCH	0.000	0.45			212.0	OK*	
117.000	RWP69	0.000	0.08			4.3	OK	
106.012	S404	0.000	0.93			211.7	OK	
118.000	RWP70	0.000	0.07			4.3	OK	
106.013	BRANCH	0.000	0.59			211.5	OK*	
106.014	S405	0.000	0.54			204.7	OK	7
119.000	RWP71	0.000	0.13			5.5	OK	
119.001	S406	0.000	0.24			5.3	OK	5
120.000	RWP72	0.000	0.13			6.8	OK	
119.002	BRANCH	0.000	0.47			11.8	OK*	
121.000	RWP73	0.000	0.13			8.3	OK	
119.003	S407	0.000	0.87			20.4	OK	2
106.015	S408	0.000	0.40			205.2	OK	
122.000	RWP74	0.000	0.31			4.1	OK	1

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	**US/MH Name**	**Flooded Volume (m³)**	**Flow / Cap.**	**Overflow (l/s)**	**Half Drain Time (mins)**	**Pipe Flow (l/s)**	**Status**	**Level Exceeded**
122.001	S409	0.000	0.31			4.0	OK	5

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
123.000	RWP75	15 Summer	1	+0%	100/15 Summer	100/30 Summer			37.734	-0.116	0.000
122.002	BRANCH	15 Summer	1	+0%					37.557	-0.079	0.000
124.000	RWP76	15 Summer	1	+0%	100/15 Summer				37.730	-0.120	0.000
122.003	BRANCH	15 Summer	1	+0%					37.515	-0.051	0.000
125.000	SDP7	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.830	-0.120	0.000
126.000	SDP8	15 Summer	1	+0%	100/15 Summer				37.610	-0.340	0.000
122.004	S410(V)	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.728	-0.342	0.000
127.000	SDP9	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.830	-0.120	0.000
122.005	S411(V)	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.717	-0.304	0.000
128.000	RWP77	15 Summer	1	+0%	100/15 Summer				37.728	-0.122	0.000
122.006	BRANCH	15 Summer	1	+0%					36.519	-0.368	0.000
129.000	RWP78	15 Summer	1	+0%	100/15 Summer				37.726	-0.124	0.000
122.007	BRANCH	15 Summer	1	+0%					36.311	-0.339	0.000
130.000	RWP79	15 Summer	1	+0%	100/15 Summer				37.716	-0.134	0.000
130.001	S412	15 Summer	1	+0%	100/15 Summer				37.421	-0.129	0.000
131.000	RWP80	15 Summer	1	+0%	100/15 Summer	100/15 Summer			37.306	-0.094	0.000
130.002	S413	15 Summer	1	+0%	100/15 Summer				37.240	-0.091	0.000
132.000	RWP81	15 Summer	1	+0%	100/15 Summer				37.864	-0.136	0.000
130.003	BRANCH	15 Summer	1	+0%					37.100	-0.088	0.000
133.000	RWP82	15 Summer	1	+0%	100/15 Summer	100/15 Summer			37.239	-0.111	0.000
130.004	BRANCH	15 Summer	1	+0%					37.015	-0.068	0.000
134.000	RWP83	15 Summer	1	+0%	100/15 Summer				37.860	-0.140	0.000
130.005	BRANCH	15 Summer	1	+0%					36.831	-0.065	0.000
135.000	RWP84	15 Summer	1	+0%	100/15 Summer				37.859	-0.141	0.000
130.006	S414	15 Summer	1	+0%	30/15 Summer				36.594	-0.052	0.000
122.008	S415	15 Summer	1	+0%	30/15 Summer				36.067	-0.388	0.000
106.016	S416	15 Summer	1	+0%	30/15 Summer	100/15 Summer			35.747	-0.378	0.000
136.000	RWP85	15 Summer	1	+0%	100/15 Summer				36.874	-0.126	0.000
106.017	S417	30 Summer	1	+0%	30/15 Summer	100/15 Summer			35.666	-0.377	0.000
137.000	RWP86	15 Summer	1	+0%	100/15 Summer				36.874	-0.126	0.000
106.018	S418	30 Summer	1	+0%	30/15 Summer	100/15 Summer			35.608	-0.373	0.000
106.019	S419	30 Summer	1	+0%	30/15 Summer				35.530	-0.339	0.000
138.000	RWP87	15 Summer	1	+0%					37.875	-0.125	0.000
106.020	BRANCH	30 Summer	1	+0%					35.483	-0.346	0.000
139.000	RWP88	15 Summer	1	+0%					37.879	-0.121	0.000
106.021	BRANCH	30 Summer	1	+0%					35.467	-0.335	0.000
140.000	RWP89	15 Summer	1	+0%					37.875	-0.125	0.000
106.022	S420	30 Summer	1	+0%	30/15 Summer				35.444	-0.316	0.000
141.000	RWP90	15 Summer	1	+0%					37.872	-0.128	0.000
106.023	BRANCH	30 Summer	1	+0%					35.343	-0.385	0.000
142.000	RWP91	15 Summer	1	+0%					37.871	-0.129	0.000
106.024	BRANCH	30 Summer	1	+0%					35.325	-0.378	0.000
143.000	RWP92	15 Summer	1	+0%					37.871	-0.129	0.000
106.025	BRANCH	30 Summer	1	+0%					35.305	-0.370	0.000
144.000	GULLEY	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.866	-0.084	0.000
144.001	S421	15 Summer	1	+0%	30/15 Summer				37.667	-0.075	0.000
106.026	S422	30 Summer	1	+0%	30/15 Summer				35.292	-0.361	0.000
145.000	RWP93	15 Summer	1	+0%					37.850	-0.150	0.000
106.027	BRANCH	30 Summer	1	+0%					35.272	-0.371	0.000
146.000	RWP94	15 Summer	1	+0%					37.850	-0.150	0.000
106.028	BRANCH	30 Summer	1	+0%					35.253	-0.363	0.000
147.000	RWP95	15 Summer	1	+0%					37.850	-0.150	0.000
106.029	BRANCH	30 Summer	1	+0%					35.231	-0.347	0.000
148.000	RWP96	15 Summer	1	+0%					37.850	-0.150	0.000

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
123.000	RWP75	0.11			3.3	OK	3
122.002	BRANCH	0.44			7.2	OK*	
124.000	RWP76	0.08			2.8	OK	
122.003	BRANCH	0.75			10.0	OK*	
125.000	SDP7	0.84			174.9	OK	5
126.000	SDP8	0.13			26.9	OK	
122.004	S410(V)	0.39			215.4	OK	5
127.000	SDP9	0.84			174.9	OK	5
122.005	S411(V)	0.65			394.6	OK	4
128.000	RWP77	0.08			3.7	OK	
122.006	BRANCH	0.52			396.7	OK*	
129.000	RWP78	0.07			3.7	OK	
122.007	BRANCH	0.57			390.9	OK*	
130.000	RWP79	0.03			0.8	OK	
130.001	S412	0.05			0.8	OK	
131.000	RWP80	0.30			4.3	OK	6
130.002	S413	0.31			5.1	OK	
132.000	RWP81	0.02			1.1	OK	
130.003	BRANCH	0.35			6.2	OK*	
133.000	RWP82	0.15			4.3	OK	6
130.004	BRANCH	0.57			10.2	OK*	
134.000	RWP83	0.01			0.9	OK	
130.005	BRANCH	0.59			10.4	OK*	
135.000	RWP84	0.01			0.9	OK	
130.006	S414	0.74			11.5	OK	
122.008	S415	0.45			403.4	OK	
106.016	S416	0.59			422.7	OK	5
136.000	RWP85	0.06			3.8	OK	
106.017	S417	0.57			384.0	OK	6
137.000	RWP86	0.06			3.9	OK	
106.018	S418	0.48			369.3	OK	2
106.019	S419	0.64			350.5	OK	
138.000	RWP87	0.06			5.4	OK	
106.020	BRANCH	0.45			345.3	OK*	
139.000	RWP88	0.08			6.9	OK	
106.021	BRANCH	0.40			344.3	OK*	
140.000	RWP89	0.06			5.5	OK	
106.022	S420	0.75			344.6	OK	
141.000	RWP90	0.05			4.3	OK	
106.023	BRANCH	0.45			342.4	OK*	
142.000	RWP91	0.05			4.1	OK	
106.024	BRANCH	0.45			342.5	OK*	
143.000	RWP92	0.05			4.2	OK	
106.025	BRANCH	0.45			342.4	OK*	
144.000	GULLEY	0.39			11.2	OK	1
144.001	S421	0.47			10.8	OK	
106.026	S422	0.67			343.2	OK	
145.000	RWP93	0.00			0.0	OK	
106.027	BRANCH	0.44			343.0	OK*	
146.000	RWP94	0.00			0.0	OK	
106.028	BRANCH	0.42			341.2	OK*	
147.000	RWP95	0.00			0.0	OK	
106.029	BRANCH	0.44			339.5	OK*	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
148.000	RWP96	0.00			0.0	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
106.030	S423	30 Summer	1	+0%	30/30 Summer				35.215	-0.336
149.000	RWP96	15 Summer	1	+0%					37.874	-0.126
106.031	BRANCH	30 Summer	1	+0%					35.032	-0.485
150.000	RWP97	15 Summer	1	+0%					37.874	-0.126
106.032	BRANCH	30 Summer	1	+0%					34.972	-0.525
151.000	SDP10	15 Summer	1	+0%	1/15 Summer	100/15 Summer			37.921	0.046
151.001	S424(V)	15 Summer	1	+0%	30/15 Summer				37.350	0.000
152.000	RWP98	15 Summer	1	+0%	100/15 Summer				37.873	-0.127
151.002	S425	15 Summer	1	+0%	30/15 Summer				37.165	-0.147
153.000	RWP99	15 Summer	1	+0%	100/15 Summer				37.625	-0.125
151.003	BRANCH	15 Summer	1	+0%					37.038	-0.205
154.000	RWP100	15 Summer	1	+0%					37.615	-0.135
151.004	BRANCH	15 Summer	1	+0%					37.030	-0.207
106.033	S426	30 Summer	1	+0%	100/15 Summer				34.835	-0.605
155.000	RWP101	15 Summer	1	+0%					37.876	-0.124
155.001	S427	15 Summer	1	+0%					37.419	-0.113
156.000	RWP102	15 Summer	1	+0%					37.625	-0.125
155.002	BRANCH	15 Summer	1	+0%					37.114	-0.071
157.000	RWP103	15 Summer	1	+0%					37.615	-0.135
155.003	BRANCH	15 Summer	1	+0%					37.064	-0.090
106.034	S428	30 Summer	1	+0%	100/15 Summer				34.693	-0.558
158.000	RWP106	15 Summer	1	+0%					37.819	-0.131
158.001	S429	15 Summer	1	+0%	30/15 Summer				37.676	-0.133
159.000	RWP107	15 Summer	1	+0%					37.862	-0.138
160.000	SDP11	15 Summer	1	+0%	1/15 Summer	100/15 Summer			37.923	0.048
158.002	S430(V)	15 Summer	1	+0%	30/15 Summer				37.226	-0.124
106.035	S431	30 Summer	1	+0%	30/30 Summer				34.600	-0.450
106.036	S432(SUDS)	30 Summer	1	+0%	100/15 Summer				34.547	-0.445
106.037	ATT INLET 03	30 Summer	1	+0%					34.371	-0.597
161.000	OB31	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.620	-0.035
161.001	S300	15 Summer	1	+0%	100/15 Summer				37.443	-0.144
162.000	OB32	15 Summer	1	+0%	100/15 Summer	100/15 Summer			37.544	-0.111
161.002	S301	15 Summer	1	+0%	30/15 Summer				36.597	-0.115
163.000	OB33	15 Summer	1	+0%	100/15 Summer				37.256	-0.125
161.003	BRANCH	15 Summer	1	+0%					36.198	-0.108
161.004	S302	15 Summer	1	+0%	100/15 Summer				35.958	-0.195
164.000	OB34	15 Summer	1	+0%	100/15 Summer	100/15 Summer			36.702	-0.163
161.005	BRANCH	15 Summer	1	+0%					35.695	-0.169
165.000	OB37	15 Summer	1	+0%	100/15 Summer	100/15 Summer			36.614	-0.101
166.000	OB35	15 Summer	1	+0%	100/15 Summer	100/15 Summer			36.605	-0.105
166.001	S303	15 Summer	1	+0%	30/15 Summer				35.633	-0.077
167.000	OB36	15 Summer	1	+0%	100/15 Summer	100/15 Summer			37.014	-0.161
161.006	S304	15 Summer	1	+0%	30/15 Summer				35.106	-0.195
168.000	OB38	15 Summer	1	+0%	100/15 Summer	100/15 Summer			36.631	-0.159
161.007	S305	15 Summer	1	+0%	30/15 Summer				34.856	-0.245
169.000	OB39	15 Summer	1	+0%	100/15 Summer				36.622	-0.168
161.008	BRANCH	15 Summer	1	+0%					34.719	-0.211
170.000	OB40	15 Summer	1	+0%	100/30 Summer				36.919	-0.114
161.009	S306	15 Summer	1	+0%	30/15 Summer				34.680	-0.203
171.000	OB40a	15 Summer	1	+0%					36.923	-0.110
172.000	OB41	15 Summer	1	+0%	100/15 Summer				36.640	-0.150
161.010	S307	15 Summer	1	+0%	30/15 Summer				34.506	-0.290
173.000	OB42	15 Summer	1	+0%					36.700	-0.150
161.011	BRANCH	15 Summer	1	+0%					34.422	-0.299

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	**US/MH Name**	**Flooded Volume (m^3)**	**Flow / Cap.**	**Overflow (l/s)**	**Half Drain Time (mins)**	**Pipe Flow (l/s)**	**Status**	**Level Exceeded**
106.030	S423	0.000	0.71			338.9	OK	
149.000	RWP96	0.000	0.06			5.6	OK	
106.031	BRANCH	0.000	0.44			339.1	OK*	
150.000	RWP97	0.000	0.06			5.6	OK	
106.032	BRANCH	0.000	0.36			340.1	OK*	
151.000	SDP10	0.000	1.14			172.8	SURCHARGED	5
151.001	S424(V)	0.000	1.04			165.9	OK	
152.000	RWP98	0.000	0.06			2.9	OK	
151.002	S425	0.000	0.84			168.3	OK	
153.000	RWP99	0.000	0.07			3.0	OK	
151.003	BRANCH	0.000	0.69			170.5	OK*	
154.000	RWP100	0.000	0.02			0.9	OK	
151.004	BRANCH	0.000	0.68			170.2	OK*	
106.033	S426	0.000	0.31			360.9	OK	
155.000	RWP101	0.000	0.07			2.9	OK	
155.001	S427	0.000	0.13			2.8	OK	
156.000	RWP102	0.000	0.06			2.9	OK	
155.002	BRANCH	0.000	0.53			5.8	OK*	
157.000	RWP103	0.000	0.02			0.9	OK	
155.003	BRANCH	0.000	0.33			6.8	OK*	
106.034	S428	0.000	0.30			357.4	OK	
158.000	RWP106	0.000	0.04			0.9	OK	
158.001	S429	0.000	0.03			0.8	OK	
159.000	RWP107	0.000	0.02			0.9	OK	
160.000	SDP11	0.000	1.14			173.1	SURCHARGED	5
158.002	S430(V)	0.000	0.88			172.9	OK	
106.035	S431	0.000	0.56			374.2	OK	
106.036	S432(SUDS)	0.000	0.57			373.4	OK	
106.037	ATT INLET 03	0.000	0.32			374.0	OK*	
161.000	OB31	0.000	0.93			15.2	OK	5
161.001	S300	0.000	0.27			14.8	OK	
162.000	OB32	0.000	0.15			9.4	OK	3
161.002	S301	0.000	0.47			23.3	OK	
163.000	OB33	0.000	0.07			4.3	OK	
161.003	BRANCH	0.000	0.53			27.3	OK*	
161.004	S302	0.000	0.27			27.5	OK	
164.000	OB34	0.000	0.17			23.5	OK	5
161.005	BRANCH	0.000	0.38			48.5	OK*	
165.000	OB37	0.000	0.24			17.6	OK	5
166.000	OB35	0.000	0.19			8.2	OK	5
166.001	S303	0.000	0.48			8.3	OK	
167.000	OB36	0.000	0.18			31.8	OK	2
161.006	S304	0.000	0.59			100.6	OK	
168.000	OB38	0.000	0.19			34.0	OK	2
161.007	S305	0.000	0.53			124.8	OK	
169.000	OB39	0.000	0.15			27.9	OK	
161.008	BRANCH	0.000	0.57			141.3	OK*	
170.000	OB40	0.000	0.13			4.8	OK	
161.009	S306	0.000	0.68			141.2	OK	
171.000	OB40a	0.000	0.16			6.0	OK	
172.000	OB41	0.000	0.24			19.8	OK	
161.010	S307	0.000	0.52			152.1	OK	
173.000	OB42	0.000	0.00			0.0	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
161.011	BRANCH	0.000	0.43			150.1	OK*	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
174.000	OB43	15 Summer	1	+0%	100/15 Summer				37.319	-0.096
161.012	S308	15 Summer	1	+0%	100/15 Summer				34.367	-0.292
175.000	OB44	15 Summer	1	+0%					37.456	-0.109
161.013	BRANCH	30 Summer	1	+0%					34.252	-0.322
176.000	OB45	15 Summer	1	+0%	100/15 Summer				37.488	-0.152
161.014	S309	30 Summer	1	+0%	100/15 Summer				34.033	-0.370
177.000	OB46	15 Summer	1	+0%					37.439	-0.126
161.015	S310	30 Summer	1	+0%	100/15 Summer				33.906	-0.345
178.000	OB47	15 Summer	1	+0%					37.394	-0.121
161.016	BRANCH	30 Summer	1	+0%					33.821	-0.380
179.000	OB48	15 Summer	1	+0%					37.425	-0.125
180.000	OB49	15 Summer	1	+0%	100/15 Summer				37.571	-0.097
161.017	S311	30 Summer	1	+0%	100/15 Summer				33.701	-0.374
181.000	OB50	15 Summer	1	+0%	100/15 Summer				37.527	-0.090
181.001	S312	15 Summer	1	+0%	100/15 Summer				37.359	-0.084
182.000	OB51	15 Summer	1	+0%					37.553	-0.114
181.002	S313	15 Summer	1	+0%	100/15 Summer				36.874	-0.151
183.000	OB52	15 Summer	1	+0%					37.468	-0.112
181.003	BRANCH	15 Summer	1	+0%					36.236	-0.130
181.004	S314	15 Summer	1	+0%	30/15 Summer				35.965	-0.115
184.000	OB53	15 Summer	1	+0%					37.407	-0.123
161.018	S315	30 Summer	1	+0%	100/15 Summer				33.559	-0.376
161.019	INT02 (SUDS)	30 Summer	1	+0%	30/15 Summer				33.505	-0.299
161.020	S316	30 Summer	1	+0%	100/15 Summer				33.485	-0.288
161.021	ATT INLET 02	30 Summer	1	+0%					33.277	-0.473
2.020	ATT TANK 01	240 Summer	1	+0%	30/60 Summer				33.035	-0.565
2.021	CONNECTION	240 Summer	1	+0%	100/30 Summer				32.843	-0.707
185.000	OB60	15 Summer	1	+0%	100/15 Summer	100/15 Summer			37.388	-0.211
186.000	OB61	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.228	-0.209
185.001	S500	15 Summer	1	+0%	30/15 Summer				36.985	-0.210
185.002	S501	15 Summer	1	+0%	30/15 Summer				36.827	-0.213
187.000	OB62	15 Summer	1	+0%	100/15 Summer	100/15 Summer			37.051	-0.227
185.003	BRANCH	15 Summer	1	+0%					36.664	-0.207
188.000	OB63	15 Summer	1	+0%	100/15 Summer				36.923	-0.118
189.000	OB64	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.832	-0.087
185.004	S502	15 Summer	1	+0%	30/15 Summer				36.480	-0.156
190.000	OB65	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.618	-0.101
185.005	BRANCH	15 Summer	1	+0%					36.408	-0.100
191.000	OB66	15 Summer	1	+0%	100/15 Summer				36.642	-0.127
185.006	S503	15 Summer	1	+0%	30/15 Summer				36.227	-0.232
192.000	OB67	15 Summer	1	+0%	30/15 Summer				36.247	-0.092
185.007	BRANCH	15 Summer	1	+0%					36.078	-0.217
193.000	OB68	15 Summer	1	+0%					36.600	-0.116
185.008	BRANCH	15 Summer	1	+0%					35.977	-0.174
194.000	OB69	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.390	-0.088
195.000	OB70	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.160	-0.190
194.001	S504	15 Summer	1	+0%	30/15 Summer				36.028	-0.152
196.000	OB71	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.235	-0.093
194.002	S505	15 Summer	1	+0%	30/15 Summer				35.918	-0.127
197.000	OB72	15 Summer	1	+0%	100/15 Summer				36.338	-0.127
198.000	OB73	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.200	-0.195
194.003	S506	15 Summer	1	+0%	30/15 Summer				35.694	-0.243
199.000	OB75	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.398	-0.099
200.000	OB74	15 Summer	1	+0%	30/15 Summer				36.548	-0.113

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
174.000	OB43	0.000	0.28			17.9	OK	
161.012	S308	0.000	0.52			155.4	OK	
175.000	OB44	0.000	0.16			17.8	OK	
161.013	BRANCH	0.000	0.44			159.2	OK*	
176.000	OB45	0.000	0.23			39.6	OK	
161.014	S309	0.000	0.39			168.6	OK	
177.000	OB46	0.000	0.06			4.9	OK	
161.015	S310	0.000	0.48			168.6	OK	
178.000	OB47	0.000	0.08			9.3	OK	
161.016	BRANCH	0.000	0.36			170.0	OK*	
179.000	OB48	0.000	0.06			4.8	OK	
180.000	OB49	0.000	0.27			21.0	OK	
161.017	S311	0.000	0.41			173.6	OK	
181.000	OB50	0.000	0.33			8.7	OK	
181.001	S312	0.000	0.40			8.7	OK	
182.000	OB51	0.000	0.13			6.4	OK	
181.002	S313	0.000	0.24			15.1	OK	
183.000	OB52	0.000	0.15			10.2	OK	
181.003	BRANCH	0.000	0.37			25.0	OK*	
181.004	S314	0.000	0.48			25.1	OK	
184.000	OB53	0.000	0.08			6.4	OK	
161.018	S315	0.000	0.50			178.9	OK	
161.019	INT02 (SUDS)	0.000	0.50			179.0	OK	
161.020	S316	0.000	0.70			179.0	OK	
161.021	ATT INLET 02	0.000	0.29			178.8	OK*	
2.020	ATT TANK 01	0.000	0.55			451.1	OK	
2.021	CONNECTION	0.000	0.36			451.6	OK	
185.000	OB60	0.000	0.19			27.6	OK	4
186.000	OB61	0.000	0.20			24.7	OK	5
185.001	S500	0.000	0.39			51.8	OK	
185.002	S501	0.000	0.39			52.4	OK	
187.000	OB62	0.000	0.13			21.4	OK	5
185.003	BRANCH	0.000	0.42			72.9	OK*	
188.000	OB63	0.000	0.10			4.0	OK	
189.000	OB64	0.000	0.37			12.2	OK	5
185.004	S502	0.000	0.63			87.5	OK	
190.000	OB65	0.000	0.24			6.8	OK	3
185.005	BRANCH	0.000	0.88			94.6	OK*	
191.000	OB66	0.000	0.06			1.3	OK	
185.006	S503	0.000	0.47			95.9	OK	
192.000	OB67	0.000	0.64			19.2	OK	
185.007	BRANCH	0.000	0.53			112.9	OK*	
193.000	OB68	0.000	0.12			5.6	OK	
185.008	BRANCH	0.000	0.69			117.0	OK*	
194.000	OB69	0.000	0.36			9.2	OK	5
195.000	OB70	0.000	0.29			29.7	OK	5
194.001	S504	0.000	0.48			38.6	OK	
196.000	OB71	0.000	0.31			9.4	OK	5
194.002	S505	0.000	0.63			48.4	OK	
197.000	OB72	0.000	0.06			2.5	OK	
198.000	OB73	0.000	0.26			44.8	OK	5
194.003	S506	0.000	0.43			95.3	OK	
199.000	OB75	0.000	0.25			10.6	OK	5

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
200.000	OB74	0.000	0.14			4.2	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
200.001	S507	15 Summer	1	+0%	30/15 Summer				36.305	-0.102
199.001	S508	15 Summer	1	+0%	30/15 Summer				35.989	-0.049
201.000	OB76	15 Summer	1	+0%	100/15 Summer				36.455	-0.113
194.004	S509	15 Summer	1	+0%	30/15 Summer				35.625	-0.153
194.005	S510	15 Summer	1	+0%	30/15 Summer				35.549	-0.148
202.000	OB77	15 Summer	1	+0%	100/15 Summer				36.637	-0.112
194.006	S511	15 Summer	1	+0%	30/15 Summer				35.380	-0.175
203.000	OB78	15 Summer	1	+0%					36.633	-0.116
194.007	S512	15 Summer	1	+0%	30/15 Summer				35.102	-0.246
185.009	S513	15 Summer	1	+0%	30/15 Summer				35.004	-0.210
204.000	OB79	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.128	-0.190
204.001	S514	15 Summer	1	+0%	30/15 Summer				36.857	-0.143
205.000	OB80	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.823	-0.096
204.002	BRANCH	15 Summer	1	+0%					36.796	-0.073
185.010	S515	15 Summer	1	+0%	30/15 Summer				34.979	-0.183
206.000	OB83	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.921	-0.079
207.000	OB84	15 Summer	1	+0%	100/15 Summer				37.012	-0.098
208.000	OB81	15 Summer	1	+0%	30/15 Summer	100/15 Summer			37.227	-0.070
209.000	OB82	15 Summer	1	+0%	100/15 Summer				37.161	-0.101
208.001	S516	15 Summer	1	+0%	30/15 Summer				36.899	-0.111
210.000	GULLY	15 Summer	1	+0%	100/15 Summer				37.335	-0.150
208.002	BRANCH	15 Summer	1	+0%					36.715	-0.121
206.001	S517	15 Summer	1	+0%	30/15 Summer				36.601	-0.123
211.000	OB90A	15 Summer	1	+0%	100/15 Summer				36.814	-0.136
212.000	OB90	15 Summer	1	+0%	100/15 Summer				36.814	-0.136
213.000	OB85	15 Summer	1	+0%	100/15 Summer				36.834	-0.104
214.000	OB86	15 Summer	1	+0%	30/15 Summer	100/15 Summer			36.591	-0.087
213.001	S518	15 Summer	1	+0%	30/15 Summer				36.295	-0.110
215.000	OB87	15 Summer	1	+0%	100/15 Summer	100/15 Summer			36.760	-0.110
213.002	BRANCH	15 Summer	1	+0%					36.166	-0.094
216.000	OB88	15 Summer	1	+0%	100/15 Summer				36.891	-0.106
217.000	OB89	15 Summer	1	+0%	100/15 Summer				36.919	-0.117
213.003	S519	15 Summer	1	+0%	30/15 Summer				35.952	-0.140
206.002	S520	15 Summer	1	+0%	100/15 Summer				35.807	-0.215
218.000	OB92	15 Summer	1	+0%					36.898	-0.125
219.000	OB91	15 Summer	1	+0%	100/15 Summer				36.394	-0.114
220.000	OB93	15 Summer	1	+0%	100/15 Summer				36.229	-0.161
206.003	S521	15 Summer	1	+0%	100/15 Summer				35.394	-0.279
221.000	OB94	15 Summer	1	+0%	100/15 Summer				36.296	-0.157
206.004	BRANCH	15 Summer	1	+0%					35.074	-0.190
222.000	OB95	15 Summer	1	+0%					36.622	-0.128
185.011	S522	15 Summer	1	+0%	30/15 Summer				34.957	-0.158
185.012	INT03 (SUDS)	15 Summer	1	+0%	30/15 Summer				34.540	-0.229
185.013	S523	15 Summer	1	+0%	30/15 Summer				34.511	-0.231
185.014	ATT INLET 04	15 Summer	1	+0%					34.035	-0.689
2.022	ATT TANK 02	360 Winter	1	+0%	30/60 Summer				32.808	-0.017
2.023	S523	360 Summer	1	+0%	1/360 Summer				32.813	0.025
2.024	S524 (SUDS)	360 Summer	1	+0%	1/240 Summer				32.755	0.035
2.025	SWPS01	360 Summer	1	+0%	1/120 Summer				32.751	0.266
2.026	458	360 Winter	1	+0%					36.075	-0.225

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
200.001	S507	0.000	0.22			4.1	OK	
199.001	S508	0.000	0.78			14.6	OK	
201.000	OB76	0.000	0.14			7.7	OK	
194.004	S509	0.000	0.74			115.6	OK	
194.005	S510	0.000	0.76			111.1	OK	
202.000	OB77	0.000	0.14			9.7	OK	
194.006	S511	0.000	0.66			112.6	OK	
203.000	OB78	0.000	0.12			8.8	OK	
194.007	S512	0.000	0.50			115.2	OK	
185.009	S513	0.000	0.46			220.6	OK	
204.000	OB79	0.000	0.29			39.2	OK	3
204.001	S514	0.000	0.53			39.0	OK	
205.000	OB80	0.000	0.61			19.4	OK	1
204.002	BRANCH	0.000	0.93			58.4	OK*	
185.010	S515	0.000	0.45			257.1	OK	
206.000	OB83	0.000	0.44			8.8	OK	3
207.000	OB84	0.000	0.26			9.7	OK	
208.000	OB81	0.000	0.55			11.7	OK	3
209.000	OB82	0.000	0.23			7.0	OK	
208.001	S516	0.000	0.50			18.6	OK	
210.000	GULLY	0.000	0.00			0.0	OK	
208.002	BRANCH	0.000	0.44			18.7	OK*	
206.001	S517	0.000	0.65			36.8	OK	
211.000	OB90A	0.000	0.02			1.2	OK	
212.000	OB90	0.000	0.02			1.2	OK	
213.000	OB85	0.000	0.20			8.5	OK	
214.000	OB86	0.000	0.36			8.2	OK	4
213.001	S518	0.000	0.51			16.5	OK	
215.000	OB87	0.000	0.16			7.2	OK	1
213.002	BRANCH	0.000	0.63			23.0	OK*	
216.000	OB88	0.000	0.19			6.8	OK	
217.000	OB89	0.000	0.11			6.7	OK	
213.003	S519	0.000	0.54			35.2	OK	
206.002	S520	0.000	0.38			74.3	OK	
218.000	OB92	0.000	0.06			2.9	OK	
219.000	OB91	0.000	0.13			7.5	OK	
220.000	OB93	0.000	0.18			21.4	OK	
206.003	S521	0.000	0.30			103.6	OK	
221.000	OB94	0.000	0.20			29.6	OK	
206.004	BRANCH	0.000	0.62			131.2	OK*	
222.000	OB95	0.000	0.05			4.3	OK	
185.011	S522	0.000	1.00			350.6	OK	
185.012	INT03 (SUDS)	0.000	0.92			350.6	OK	
185.013	S523	0.000	0.95			350.2	OK	
185.014	ATT INLET 04	0.000	0.13			349.7	OK*	
2.022	ATT TANK 02	0.000	0.65			76.7	OK	
2.023	S523	0.000	0.38			75.6	SURCHARGED	
2.024	S524 (SUDS)	0.000	0.62			71.8	SURCHARGED	
2.025	SWPS01	0.000	2.06			68.2	SURCHARGED	
2.026	458	0.000	0.50			68.2	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.300 Cv (Summer) 1.000
Region England and Wales Ratio R 0.350 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
2.000	OB1	15 Summer	30	+0%	100/15 Summer				37.752	-0.063	0.000
3.000	OB2	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.501	0.033	0.000
2.001	S100	15 Summer	30	+0%	100/15 Summer	100/15 Summer			37.135	-0.117	0.000
4.000	OB3	15 Summer	30	+0%	100/15 Summer	100/15 Summer			36.678	-0.072	0.000
5.000	OB4	15 Summer	30	+0%	100/15 Summer				37.223	-0.137	0.000
2.002	S101	15 Summer	30	+0%	100/15 Summer	100/15 Summer			36.432	-0.056	0.000
6.000	OB5	15 Summer	30	+0%	100/15 Summer	100/30 Summer			37.256	-0.179	0.000
2.003	S102	15 Summer	30	+0%	30/15 Summer				36.238	0.121	0.000
7.000	OB6	15 Summer	30	+0%	30/15 Summer	100/15 Summer			36.720	0.010	0.000
8.000	OB7	15 Summer	30	+0%	100/15 Summer	100/15 Summer			37.218	-0.102	0.000
2.004	S103	15 Summer	30	+0%	30/15 Summer				35.962	0.453	0.000
2.005	S104	30 Summer	30	+0%	30/15 Summer				35.756	0.394	0.000
9.000	OB8	15 Summer	30	+0%	100/15 Summer				37.478	-0.080	0.000
2.006	S105	30 Summer	30	+0%	30/15 Summer				35.664	0.393	0.000
10.000	OB9	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.930	0.217	0.000
10.001	S106	15 Summer	30	+0%	100/15 Summer				37.516	-0.097	0.000
11.000	OB10	15 Summer	30	+0%	100/15 Summer	100/30 Summer			37.641	-0.147	0.000
10.002	S107	15 Summer	30	+0%	30/15 Summer				37.076	0.396	0.000
12.000	OB11	15 Summer	30	+0%	100/15 Summer				37.632	-0.156	0.000
10.003	S108	30 Summer	30	+0%	100/15 Summer				35.935	-0.045	0.000
13.000	OB12	15 Summer	30	+0%	100/15 Summer				37.617	-0.096	0.000
10.004	S109	30 Summer	30	+0%	30/15 Summer				35.750	0.330	0.000
2.007	S110	30 Summer	30	+0%	30/15 Summer				35.620	0.398	0.000
14.000	OB13	15 Summer	30	+0%	100/15 Summer	100/15 Summer			37.100	-0.115	0.000
15.000	OB14	15 Summer	30	+0%	100/15 Summer	100/15 Summer			36.581	-0.094	0.000
14.001	S111	15 Summer	30	+0%	30/15 Summer				35.901	0.276	0.000
16.000	OB15	15 Summer	30	+0%	100/30 Summer				37.595	-0.084	0.000
2.008	S112	30 Summer	30	+0%	30/15 Summer				35.533	0.467	0.000
17.000	OB16	15 Summer	30	+0%					37.592	-0.087	0.000

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.000	OB1	0.63			19.4	OK	
3.000	OB2	1.07			24.2	SURCHARGED	2
2.001	S100	0.46			43.3	OK	1
4.000	OB3	0.79			43.0	OK	7
5.000	OB4	0.32			42.8	OK	
2.002	S101	0.87			124.2	OK	3
6.000	OB5	0.34			98.0	OK	3
2.003	S102	0.68			184.7	SURCHARGED	
7.000	OB6	0.89			106.5	SURCHARGED	7
8.000	OB7	0.57			108.8	OK	5
2.004	S103	1.59			352.5	SURCHARGED	
2.005	S104	1.59			334.2	SURCHARGED	
9.000	OB8	0.45			22.3	OK	
2.006	S105	1.29			339.8	SURCHARGED	
10.000	OB9	1.78			35.2	SURCHARGED	5
10.001	S106	0.60			34.2	OK	
11.000	OB10	0.26			38.5	OK	1
10.002	S107	1.23			62.1	SURCHARGED	
12.000	OB11	0.20			38.5	OK	
10.003	S108	0.92			87.8	OK	
13.000	OB12	0.28			26.9	OK	
10.004	S109	0.69			108.4	SURCHARGED	
2.007	S110	0.95			397.1	SURCHARGED	
14.000	OB13	0.48			85.1	OK	4
15.000	OB14	0.30			11.1	OK	6
14.001	S111	1.22			95.5	SURCHARGED	
16.000	OB15	0.40			24.9	OK	
2.008	S112	0.79			412.4	SURCHARGED	
17.000	OB16	0.37			25.5	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
2.009	S113	30 Summer	30	+0%	30/15 Summer				35.420	0.594	0.000
18.000	OB17	15 Summer	30	+0%					37.590	-0.089	0.000
2.010	S114	30 Summer	30	+0%	30/15 Summer				35.306	0.721	0.000
19.000	OB18	15 Summer	30	+0%	30/15 Summer	100/15 Summer			38.332	0.487	0.000
19.001	S115	15 Summer	30	+0%	30/15 Summer				38.181	0.681	0.000
20.000	OB19	15 Summer	30	+0%	100/15 Summer				37.769	-0.076	0.000
19.002	S116	15 Summer	30	+0%	30/15 Summer				36.918	0.351	0.000
19.003	S117	15 Summer	30	+0%	30/15 Summer	100/15 Summer			36.356	0.269	0.000
21.000	OB20	15 Summer	30	+0%	100/15 Summer				37.052	-0.082	0.000
22.000	OB21	15 Summer	30	+0%	100/15 Summer				37.196	-0.089	0.000
19.004	S118	15 Summer	30	+0%	30/15 Summer				36.148	0.252	0.000
23.000	OB22	15 Summer	30	+0%	100/15 Summer	100/15 Summer			36.632	-0.118	0.000
24.000	OB23	15 Summer	30	+0%	100/15 Summer	100/15 Summer			37.253	-0.067	0.000
19.005	S119	15 Summer	30	+0%	30/15 Summer				36.061	0.223	0.000
25.000	OB24	15 Summer	30	+0%	100/15 Summer				37.236	-0.124	0.000
19.006	S120	30 Summer	30	+0%	30/15 Summer				35.794	0.216	0.000
26.000	OB25	15 Summer	30	+0%	100/15 Summer				37.246	-0.114	0.000
27.000	OB26	15 Summer	30	+0%	100/15 Summer	100/15 Summer			36.682	-0.068	0.000
19.007	S121	30 Summer	30	+0%	30/15 Summer				35.675	0.401	0.000
19.008	S122	30 Summer	30	+0%	30/15 Summer				35.616	0.536	0.000
19.009	S123	30 Summer	30	+0%	30/15 Summer				35.437	0.629	0.000
28.000	OB27	15 Summer	30	+0%					37.691	-0.072	0.000
19.010	S124	30 Summer	30	+0%	30/15 Summer				35.290	0.705	0.000
29.000	OB28	15 Summer	30	+0%	100/15 Summer				36.506	-0.080	0.000
2.011	S125	30 Summer	30	+0%	30/15 Summer				35.247	0.769	0.000
30.000	OB29	15 Summer	30	+0%	100/15 Summer				36.607	-0.068	0.000
31.000	OB30	15 Summer	30	+0%	100/15 Summer				37.114	-0.101	0.000
30.001	S126	15 Summer	30	+0%	30/15 Summer				36.432	0.097	0.000
2.012	S127	30 Summer	30	+0%	30/15 Summer				35.205	0.743	0.000
2.013	INT01	30 Summer	30	+0%	30/15 Summer				35.146	0.856	0.000
32.000	SDP01	15 Summer	30	+0%	1/15 Summer	100/15 Summer			38.852	0.977	0.000
33.000	RWP01	15 Summer	30	+0%	30/15 Summer				38.263	0.463	0.000
33.001	S200	15 Summer	30	+0%	30/15 Summer				38.261	0.838	0.000
34.000	RWP03	15 Summer	30	+0%	30/15 Summer				38.292	0.492	0.000
34.001	S201	15 Summer	30	+0%	30/15 Summer	100/15 Summer			38.278	0.970	0.000
35.000	RWP04	15 Summer	30	+0%	30/15 Summer				38.269	0.469	0.000
34.002	BRANCH	15 Summer	30	+0%					37.115	0.000	0.000
36.000	RWP05	15 Summer	30	+0%	30/15 Summer				38.258	0.458	0.000
34.003	BRANCH	15 Summer	30	+0%					36.922	0.000	0.000
37.000	RWP02	15 Summer	30	+0%	30/15 Summer				38.304	0.504	0.000
32.001	S202(V)	15 Summer	30	+0%	30/15 Summer				38.299	1.438	0.000
32.002	S203	15 Summer	30	+0%	30/15 Summer	100/15 Summer			38.248	1.426	0.000
38.000	RWP06	15 Summer	30	+0%	30/15 Summer				38.108	0.308	0.000
32.003	BRANCH	15 Summer	30	+0%					36.677	0.000	0.000
39.000	SWP07	15 Summer	30	+0%	30/15 Summer				37.983	0.183	0.000
32.004	BRANCH	15 Summer	30	+0%					36.644	0.000	0.000
40.000	RWP08	15 Summer	30	+0%	30/15 Summer				37.926	0.126	0.000
32.005	S204	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.913	1.322	0.000
41.000	SDP02	15 Summer	30	+0%	1/15 Summer	100/15 Summer			38.877	1.002	0.000
42.000	RWP09	15 Summer	30	+0%	30/15 Summer				37.938	0.138	0.000
42.001	S205	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.936	0.514	0.000
43.000	RWP10	15 Summer	30	+0%	30/15 Summer				37.922	0.122	0.000
44.000	RWP11	15 Summer	30	+0%	30/15 Summer				37.933	0.722	0.000
45.000	RWP12	15 Summer	30	+0%	30/15 Summer				37.931	0.131	0.000

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.009	S113	0.78			406.0	SURCHARGED	
18.000	OB17	0.34			25.9	OK	
2.010	S114	0.89			410.3	SURCHARGED	
19.000	OB18	0.73			27.0	SURCHARGED	7
19.001	S115	1.18			23.2	SURCHARGED	
20.000	OB19	0.48			34.0	OK	
19.002	S116	1.07			48.1	SURCHARGED	
19.003	S117	1.31			56.0	SURCHARGED	7
21.000	OB20	0.42			27.3	OK	
22.000	OB21	0.34			19.1	OK	
19.004	S118	0.81			81.2	SURCHARGED	
23.000	OB22	0.46			46.7	OK	7
24.000	OB23	0.58			40.2	OK	5
19.005	S119	1.29			153.4	SURCHARGED	
25.000	OB24	0.41			77.6	OK	
19.006	S120	1.03			196.8	SURCHARGED	
26.000	OB25	0.49			99.1	OK	
27.000	OB26	0.82			109.3	OK	6
19.007	S121	0.99			352.4	SURCHARGED	
19.008	S122	0.63			320.7	SURCHARGED	
19.009	S123	0.59			278.1	SURCHARGED	
28.000	OB27	0.53			33.4	OK	
19.010	S124	1.13			283.2	SURCHARGED	
29.000	OB28	0.44			19.4	OK	
2.011	S125	2.09			624.5	SURCHARGED	
30.000	OB29	0.57			11.0	OK	
31.000	OB30	0.58			76.5	OK	
30.001	S126	1.13			87.1	SURCHARGED	
2.012	S127	1.11			651.0	SURCHARGED	
2.013	INT01	0.86			649.6	SURCHARGED	
32.000	SDP01	2.74			414.9	FLOOD RISK	7
33.000	RWP01	0.06			2.5	SURCHARGED	
33.001	S200	0.37			12.2	SURCHARGED	
34.000	RWP03	0.33			11.7	SURCHARGED	
34.001	S201	0.78			13.9	SURCHARGED	7
35.000	RWP04	0.27			11.3	SURCHARGED	
34.002	BRANCH	1.10			22.6	SURCHARGED*	
36.000	RWP05	0.25			11.7	SURCHARGED	
34.003	BRANCH	1.98			30.6	SURCHARGED*	
37.000	RWP02	0.04			2.5	SURCHARGED	
32.001	S202(V)	2.33			395.4	SURCHARGED	
32.002	S203	1.53			327.3	FLOOD RISK	7
38.000	RWP06	0.11			6.8	SURCHARGED	
32.003	BRANCH	1.28			304.6	SURCHARGED*	
39.000	SWP07	0.10			6.2	SURCHARGED	
32.004	BRANCH	1.18			292.2	SURCHARGED*	
40.000	RWP08	0.11			6.2	SURCHARGED	
32.005	S204	0.78			266.4	FLOOD RISK	7
41.000	SDP02	2.76			418.7	FLOOD RISK	7
42.000	RWP09	0.06			2.5	SURCHARGED	
42.001	S205	0.32			11.7	SURCHARGED	1
43.000	RWP10	0.05			2.5	SURCHARGED	
44.000	RWP11	0.22			6.2	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
45.000	RWP12	0.11			6.2	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
44.001	BRANCH	15 Summer	30	+0%					36.917	0.000	0.000
41.001	S206(V)	15 Summer	30	+0%	30/15 Summer				37.920	1.209	0.000
32.006	S207	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.740	1.420	0.000
46.000	RWP13	15 Summer	30	+0%	30/15 Summer				37.684	0.034	0.000
32.007	S208	15 Summer	30	+0%	30/15 Summer				37.677	1.425	0.000
32.008	S209	15 Summer	30	+0%	30/15 Summer				37.624	1.414	0.000
47.000	RWP14	15 Summer	30	+0%	100/15 Summer				37.874	-0.126	0.000
32.009	BRANCH	15 Summer	30	+0%					36.202	0.000	0.000
48.000	RWP15	15 Summer	30	+0%	100/15 Summer				37.890	-0.110	0.000
48.001	S210	15 Summer	30	+0%	100/15 Summer				37.538	-0.062	0.000
49.000	RWP16	15 Summer	30	+0%	100/15 Summer				37.883	-0.117	0.000
48.002	BRANCH	15 Summer	30	+0%					37.416	0.000	0.000
50.000	RWP17	15 Summer	30	+0%	100/15 Summer				37.847	-0.103	0.000
51.000	RWP18	15 Summer	30	+0%	100/15 Summer				37.844	-0.106	0.000
50.001	S211	15 Summer	30	+0%	100/15 Summer				37.468	-0.032	0.000
52.000	RWP19	15 Summer	30	+0%	100/15 Summer				37.469	-0.116	0.000
50.002	BRANCH	15 Summer	30	+0%					37.194	0.000	0.000
53.000	RWP20	15 Summer	30	+0%	100/15 Summer				37.875	-0.125	0.000
50.003	BRANCH	15 Summer	30	+0%					36.794	0.000	0.000
50.004	S212	15 Summer	30	+0%	30/15 Summer	100/30 Summer			37.443	0.798	0.000
32.010	S213	15 Summer	30	+0%	30/15 Summer				37.501	1.369	0.000
54.000	RWP21	15 Summer	30	+0%	100/15 Summer				37.880	-0.120	0.000
32.011	BRANCH	15 Summer	30	+0%					36.113	0.000	0.000
55.000	RWP22	15 Summer	30	+0%	100/15 Summer				37.880	-0.120	0.000
32.012	BRANCH	15 Summer	30	+0%					36.075	0.000	0.000
56.000	RWP23	15 Summer	30	+0%	100/15 Summer				37.879	-0.121	0.000
32.013	BRANCH	15 Summer	30	+0%					36.038	0.000	0.000
57.000	RWP24	15 Summer	30	+0%	100/15 Summer				37.879	-0.121	0.000
32.014	BRANCH	15 Summer	30	+0%					36.001	0.000	0.000
58.000	RWP25	15 Summer	30	+0%	100/30 Summer				37.879	-0.121	0.000
32.015	BRANCH	15 Summer	30	+0%					35.961	0.000	0.000
59.000	SDP12	15 Summer	30	+0%	30/15 Summer	100/15 Summer			38.549	0.824	0.000
60.000	SDP13	15 Summer	30	+0%	100/15 Summer				37.496	-0.154	0.000
61.000	SDP14	15 Summer	30	+0%	30/15 Summer	100/15 Summer			38.550	0.825	0.000
62.000	RWP29	15 Summer	30	+0%	100/15 Summer				37.523	-0.127	0.000
62.001	S214	30 Summer	30	+0%	30/30 Summer				37.288	0.038	0.000
63.000	RWP30	15 Summer	30	+0%	100/15 Summer				37.866	-0.134	0.000
61.001	S215(V)	30 Summer	30	+0%	1/15 Summer				37.258	1.238	0.000
64.000	RWP27	15 Summer	30	+0%	100/15 Summer				37.376	-0.124	0.000
64.001	S214a	30 Summer	30	+0%	100/15 Summer				37.183	-0.067	0.000
65.000	RWP28	15 Summer	30	+0%	100/15 Summer				37.866	-0.134	0.000
59.001	S216(V)	30 Summer	30	+0%	30/15 Summer				37.176	1.186	0.000
66.000	RWP26	15 Summer	30	+0%	100/30 Summer				37.887	-0.113	0.000
32.016	S217	30 Summer	30	+0%	30/15 Summer				37.057	1.133	0.000
67.000	RWP31	15 Summer	30	+0%					37.878	-0.122	0.000
32.017	BRANCH	15 Summer	30	+0%					35.890	0.000	0.000
68.000	RWP32	15 Summer	30	+0%					38.028	-0.122	0.000
32.018	BRANCH	15 Summer	30	+0%					35.857	0.000	0.000
69.000	RWP33	15 Summer	30	+0%					38.028	-0.122	0.000
32.019	BRANCH	15 Summer	30	+0%					35.820	0.000	0.000
70.000	RWP34	15 Summer	30	+0%					38.026	-0.124	0.000
32.020	BRANCH	15 Summer	30	+0%					35.791	0.000	0.000
71.000	RWP36	15 Summer	30	+0%					37.846	-0.104	0.000
72.000	RWP35	15 Summer	30	+0%					37.848	-0.102	0.000

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
44.001	BRANCH	0.54			15.3	SURCHARGED*	
41.001	S206(V)	1.16			407.4	SURCHARGED	
32.006	S207	1.05			488.6	SURCHARGED	2
46.000	RWP13	0.13			5.1	SURCHARGED	
32.007	S208	1.34			508.1	SURCHARGED	
32.008	S209	1.91			525.6	SURCHARGED	
47.000	RWP14	0.06			5.1	OK	
32.009	BRANCH	0.88			530.8	SURCHARGED*	
48.000	RWP15	0.16			5.1	OK	
48.001	S210	0.18			4.9	OK	
49.000	RWP16	0.11			5.1	OK	
48.002	BRANCH	0.35			9.7	SURCHARGED*	
50.000	RWP17	0.21			6.7	OK	
51.000	RWP18	0.18			6.7	OK	
50.001	S211	0.51			13.0	OK	
52.000	RWP19	0.11			4.5	OK	
50.002	BRANCH	0.61			17.3	SURCHARGED*	
53.000	RWP20	0.07			4.5	OK	
50.003	BRANCH	0.84			20.2	SURCHARGED*	
50.004	S212	1.10			19.6	SURCHARGED	3
32.010	S213	1.94			571.9	SURCHARGED	
54.000	RWP21	0.08			7.3	OK	
32.011	BRANCH	1.09			578.5	SURCHARGED*	
55.000	RWP22	0.09			7.5	OK	
32.012	BRANCH	1.10			585.0	SURCHARGED*	
56.000	RWP23	0.08			7.1	OK	
32.013	BRANCH	1.11			591.2	SURCHARGED*	
57.000	RWP24	0.08			7.5	OK	
32.014	BRANCH	1.09			597.3	SURCHARGED*	
58.000	RWP25	0.08			7.2	OK	
32.015	BRANCH	1.13			601.5	SURCHARGED*	
59.000	SDP12	1.61			452.1	SURCHARGED	6
60.000	SDP13	0.46			83.2	OK	
61.000	SDP14	1.61			452.1	SURCHARGED	6
62.000	RWP29	0.05			2.1	OK	
62.001	S214	0.35			4.1	SURCHARGED	
63.000	RWP30	0.02			2.1	OK	
61.001	S215(V)	2.55			375.9	SURCHARGED	
64.000	RWP27	0.07			2.1	OK	
64.001	S214a	0.12			1.7	OK	
65.000	RWP28	0.03			2.1	OK	
59.001	S216(V)	1.74			810.2	SURCHARGED	
66.000	RWP26	0.14			7.7	OK	
32.016	S217	2.03			956.8	SURCHARGED	
67.000	RWP31	0.08			7.0	OK	
32.017	BRANCH	1.24			947.0	SURCHARGED*	
68.000	RWP32	0.08			7.5	OK	
32.018	BRANCH	1.17			946.1	SURCHARGED*	
69.000	RWP33	0.08			7.6	OK	
32.019	BRANCH	1.24			946.8	SURCHARGED*	
70.000	RWP34	0.07			6.8	OK	
32.020	BRANCH	1.10			952.3	SURCHARGED*	
71.000	RWP36	0.20			7.2	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
72.000	RWP35	0.22			7.2	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
71.001	S218	15 Summer	30	+0%	100/15 Summer				37.432	-0.068
73.000	RWP37	15 Summer	30	+0%					37.879	-0.121
71.002	BRANCH	15 Summer	30	+0%					37.137	-0.057
74.000	RWP38	15 Summer	30	+0%					37.875	-0.125
71.003	S219	15 Summer	30	+0%	100/15 Summer				36.788	-0.039
75.000	RWP39	15 Summer	30	+0%					38.000	-0.150
32.021	S220	30 Summer	30	+0%	30/15 Summer				36.375	0.627
76.000	RWP40	15 Summer	30	+0%					38.029	-0.121
32.022	BRANCH	15 Summer	30	+0%					35.729	0.000
77.000	RWP41	15 Summer	30	+0%					38.028	-0.122
32.023	BRANCH	15 Summer	30	+0%					35.707	0.000
78.000	RWP42	15 Summer	30	+0%					38.038	-0.112
32.024	S221 (SUDS)	30 Summer	30	+0%	30/15 Summer				35.865	0.188
79.000	SDP03	15 Summer	30	+0%	1/15 Summer	100/15 Summer			38.936	1.061
80.000	RWP43	15 Summer	30	+0%	30/15 Summer				38.137	0.337
80.001	S222	15 Summer	30	+0%	30/15 Summer				38.135	0.712
81.000	RWP44	15 Summer	30	+0%	30/15 Summer				38.132	0.332
82.000	RWP45	15 Summer	30	+0%	30/15 Summer				38.216	0.416
82.001	S223	15 Summer	30	+0%	30/15 Summer	100/15 Summer			38.199	0.899
83.000	RWP46	15 Summer	30	+0%	30/15 Summer				38.205	0.405
82.002	BRANCH	15 Summer	30	+0%					37.120	0.000
84.000	RWP47	15 Summer	30	+0%	30/15 Summer				38.165	0.365
82.003	BRANCH	15 Summer	30	+0%					36.940	0.000
79.001	S224(V)	15 Summer	30	+0%	1/15 Summer				38.130	1.246
79.002	S225	15 Summer	30	+0%	30/15 Summer	100/30 Summer			37.982	1.190
85.000	RWP48	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.845	0.245
79.003	BRANCH	15 Summer	30	+0%					36.748	0.000
86.000	RWP49	15 Summer	30	+0%	30/15 Summer				37.685	0.285
79.004	BRANCH	15 Summer	30	+0%					36.703	0.000
87.000	RWP50	15 Summer	30	+0%	30/15 Summer				37.507	0.107
79.005	BRANCH	15 Summer	30	+0%					36.658	0.000
88.000	RWP51	15 Summer	30	+0%	100/15 Summer				37.295	-0.105
79.006	BRANCH	15 Summer	30	+0%					36.613	0.000
89.000	RWP52	15 Summer	30	+0%					37.732	-0.118
79.007	BRANCH	15 Summer	30	+0%					36.589	0.000
90.000	RWP53	15 Summer	30	+0%	100/30 Summer				37.587	-0.118
79.008	BRANCH	15 Summer	30	+0%					36.554	0.000
91.000	RWP54	15 Summer	30	+0%	100/15 Summer				37.137	-0.113
79.009	S226	15 Summer	30	+0%	30/15 Summer				36.735	0.268
92.000	SDP04	15 Summer	30	+0%	1/15 Summer	100/15 Summer			38.877	1.002
93.000	RWP55	15 Summer	30	+0%	100/15 Summer				37.675	-0.125
93.001	S227	15 Summer	30	+0%	100/15 Summer				37.311	-0.111
94.000	RWP56	15 Summer	30	+0%	100/15 Summer				37.672	-0.128
95.000	RWP57	15 Summer	30	+0%	100/15 Summer				37.683	-0.117
96.000	RWP58	15 Summer	30	+0%	30/15 Summer				37.362	0.151
95.001	BRANCH	15 Summer	30	+0%					36.917	0.000
92.001	S228(V)	15 Summer	30	+0%	30/15 Summer				37.310	0.599
79.010	S229	15 Summer	30	+0%	30/15 Summer				36.207	0.120
79.011	S230(SUDS)	15 Summer	30	+0%	30/15 Summer				35.971	0.017
32.025	S231	15 Summer	30	+0%	30/15 Summer				35.710	0.047
2.014	S232	30 Summer	30	+0%	30/15 Summer				35.107	0.878
2.015	S233	30 Summer	30	+0%	30/15 Summer				34.990	0.883
97.000	RWP59	15 Summer	30	+0%					37.482	-0.118
98.000	RWP60	15 Summer	30	+0%					37.496	-0.104

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
71.001	S218	0.000	0.55			14.0	OK	
73.000	RWP37	0.000	0.08			4.5	OK	
71.002	BRANCH	0.000	0.65			18.3	OK*	
74.000	RWP38	0.000	0.07			4.5	OK	
71.003	S219	0.000	0.88			23.1	OK	
75.000	RWP39	0.000	0.00			0.0	OK	
32.021	S220	0.000	2.39			961.1	SURCHARGED	
76.000	RWP40	0.000	0.08			7.8	OK	
32.022	BRANCH	0.000	1.25			954.2	SURCHARGED*	
77.000	RWP41	0.000	0.08			7.8	OK	
32.023	BRANCH	0.000	1.25			954.2	SURCHARGED*	
78.000	RWP42	0.000	0.14			7.8	OK	
32.024	S221 (SUDS)	0.000	1.96			959.4	SURCHARGED	
79.000	SDP03	0.000	2.66			402.7	FLOOD RISK	6
80.000	RWP43	0.000	0.06			2.4	SURCHARGED	
80.001	S222	0.000	0.36			11.6	SURCHARGED	
81.000	RWP44	0.000	0.04			2.4	SURCHARGED	
82.000	RWP45	0.000	0.30			10.8	SURCHARGED	
82.001	S223	0.000	0.71			12.2	SURCHARGED	6
83.000	RWP46	0.000	0.30			12.7	SURCHARGED	
82.002	BRANCH	0.000	1.06			21.1	SURCHARGED*	
84.000	RWP47	0.000	0.24			11.1	SURCHARGED	
82.003	BRANCH	0.000	1.95			28.9	SURCHARGED*	
79.001	S224(V)	0.000	1.43			355.7	SURCHARGED	
79.002	S225	0.000	1.95			337.7	SURCHARGED	3
85.000	RWP48	0.000	0.15			6.6	SURCHARGED	6
79.003	BRANCH	0.000	1.36			339.3	SURCHARGED*	
86.000	RWP49	0.000	0.23			9.1	SURCHARGED	
79.004	BRANCH	0.000	1.37			340.0	SURCHARGED*	
87.000	RWP50	0.000	0.23			9.2	SURCHARGED	
79.005	BRANCH	0.000	1.37			339.6	SURCHARGED*	
88.000	RWP51	0.000	0.16			6.6	OK	
79.006	BRANCH	0.000	1.36			337.8	SURCHARGED*	
89.000	RWP52	0.000	0.10			6.7	OK	
79.007	BRANCH	0.000	1.35			336.1	SURCHARGED*	
90.000	RWP53	0.000	0.10			6.2	OK	
79.008	BRANCH	0.000	1.36			337.8	SURCHARGED*	
91.000	RWP54	0.000	0.14			6.2	OK	
79.009	S226	0.000	1.12			322.3	SURCHARGED	
92.000	SDP04	0.000	2.76			418.7	FLOOD RISK	5
93.000	RWP55	0.000	0.06			2.4	OK	
93.001	S227	0.000	0.06			2.3	OK	
94.000	RWP56	0.000	0.05			2.4	OK	
95.000	RWP57	0.000	0.11			6.2	OK	
96.000	RWP58	0.000	0.22			6.2	SURCHARGED	
95.001	BRANCH	0.000	0.53			15.1	SURCHARGED*	
92.001	S228(V)	0.000	1.36			421.1	SURCHARGED	
79.010	S229	0.000	1.32			617.4	SURCHARGED	
79.011	S230(SUDS)	0.000	0.91			624.0	SURCHARGED	
32.025	S231	0.000	2.45			1575.9	SURCHARGED	
2.014	S232	0.000	1.37			2112.5	SURCHARGED	
2.015	S233	0.000	1.52			2071.0	SURCHARGED	
97.000	RWP59	0.000	0.11			6.4	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	**US/MH Name**	**Flooded Volume (m³)**	**Flow / Cap.**	**Overflow (l/s)**	**Half Drain Time (mins)**	**Pipe Flow (l/s)**	**Status**	**Level Exceeded**
98.000	RWP60	0.000	0.20			12.2	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
2.016	S234	30 Summer	30	+0%	30/15 Summer				34.741	0.761
2.017	S235	30 Summer	30	+0%	30/15 Summer				34.435	0.566
99.000	RWP61	15 Summer	30	+0%	100/15 Summer				37.802	-0.098
99.001	S236	15 Summer	30	+0%	100/15 Summer				37.660	-0.085
100.000	RWP62	15 Summer	30	+0%	100/15 Summer				37.805	-0.095
99.002	BRANCH	15 Summer	30	+0%					37.552	-0.036
99.003	S237	15 Summer	30	+0%	30/15 Summer				37.371	0.018
101.000	RWP63	15 Summer	30	+0%					37.681	-0.119
99.004	BRANCH	15 Summer	30	+0%					37.221	0.000
102.000	RWP64	15 Summer	30	+0%					37.828	-0.122
99.005	S238	15 Summer	30	+0%					35.526	-0.131
103.000	RWP65	15 Summer	30	+0%					37.096	-0.110
99.006	BRANCH	15 Summer	30	+0%					35.050	-0.107
104.000	RWP66	15 Summer	30	+0%					37.077	-0.119
99.007	BRANCH	15 Summer	30	+0%					34.808	-0.089
105.000	RWP67	15 Summer	30	+0%					36.830	-0.126
2.018	S239	30 Summer	30	+0%	30/15 Summer				34.150	0.362
2.019	ATT INLET 01	30 Summer	30	+0%					33.775	0.000
106.000	SDP05	15 Summer	30	+0%	1/15 Summer	100/15 Summer			38.885	1.010
106.001	S400(V)	15 Summer	30	+0%	30/15 Summer	100/15 Summer			38.414	1.064
107.000	RWP60	15 Summer	30	+0%	30/15 Summer				38.135	0.335
106.002	S401	15 Summer	30	+0%	30/15 Summer	100/15 Summer			38.126	1.117
108.000	RWP61	15 Summer	30	+0%	30/15 Summer				37.972	0.172
106.003	BRANCH	15 Summer	30	+0%					36.972	0.000
109.000	RWP62	15 Summer	30	+0%	30/15 Summer				37.855	0.055
106.004	BRANCH	15 Summer	30	+0%					36.880	0.000
110.000	RWP63	15 Summer	30	+0%	100/15 Summer				37.738	-0.062
106.005	S402	15 Summer	30	+0%	30/15 Summer	100/30 Summer			37.735	0.914
111.000	RWP64	15 Summer	30	+0%	100/15 Summer				37.697	-0.103
106.006	BRANCH	15 Summer	30	+0%					36.790	0.000
112.000	RWP65	15 Summer	30	+0%	100/15 Summer				37.656	-0.144
106.007	BRANCH	15 Summer	30	+0%					36.750	0.000
113.000	SDP06	15 Summer	30	+0%	1/15 Summer	100/15 Summer			38.804	0.929
106.008	S403	15 Summer	30	+0%	30/15 Summer	100/30 Summer			37.550	0.844
114.000	RWP66	15 Summer	30	+0%	100/15 Summer				37.675	-0.125
106.009	BRANCH	15 Summer	30	+0%					36.680	0.000
115.000	RWP67	15 Summer	30	+0%	100/15 Summer				37.676	-0.124
106.010	BRANCH	15 Summer	30	+0%					36.645	0.000
116.000	RWP68	15 Summer	30	+0%	100/15 Summer				37.675	-0.125
106.011	BRANCH	15 Summer	30	+0%					36.607	0.000
117.000	RWP69	15 Summer	30	+0%	100/15 Summer				37.695	-0.105
106.012	S404	30 Summer	30	+0%	30/15 Summer				37.081	0.542
118.000	RWP70	15 Summer	30	+0%	100/15 Summer				37.891	-0.109
106.013	BRANCH	15 Summer	30	+0%					36.513	0.000
106.014	S405	30 Summer	30	+0%	30/15 Summer	100/15 Summer			36.844	0.354
119.000	RWP71	15 Summer	30	+0%	100/15 Summer				38.010	-0.090
119.001	S406	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.836	0.211
120.000	RWP72	15 Summer	30	+0%	100/15 Summer				38.008	-0.092
119.002	BRANCH	15 Summer	30	+0%					37.305	0.000
121.000	RWP73	15 Summer	30	+0%	100/15 Summer				38.010	-0.090
119.003	S407	15 Summer	30	+0%	30/15 Summer	100/30 Summer			37.593	0.648
106.015	S408	30 Summer	30	+0%	30/15 Summer	100/15 Winter			36.551	0.253
122.000	RWP74	15 Summer	30	+0%	30/15 Summer	100/30 Summer			37.751	0.001
122.001	S409	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.736	0.030

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.016	S234	0.000	1.69			2045.5	SURCHARGED	
2.017	S235	0.000	1.86			2023.4	SURCHARGED	
99.000	RWP61	0.000	0.26			6.4	OK	
99.001	S236	0.000	0.39			6.4	OK	
100.000	RWP62	0.000	0.29			10.0	OK	
99.002	BRANCH	0.000	0.91			16.2	OK*	
99.003	S237	0.000	1.01			15.4	SURCHARGED	
101.000	RWP63	0.000	0.09			4.5	OK	
99.004	BRANCH	0.000	1.08			19.1	SURCHARGED*	
102.000	RWP64	0.000	0.08			4.5	OK	
99.005	S238	0.000	0.36			22.9	OK	
103.000	RWP65	0.000	0.16			14.2	OK	
99.006	BRANCH	0.000	0.54			36.3	OK*	
104.000	RWP66	0.000	0.09			8.7	OK	
99.007	BRANCH	0.000	0.67			44.8	OK*	
105.000	RWP67	0.000	0.06			4.8	OK	
2.018	S239	0.000	2.20			2024.9	SURCHARGED	
2.019	ATT INLET 01	0.000	1.03			2013.5	SURCHARGED*	
106.000	SDP05	0.000	2.54			384.4	FLOOD RISK	7
106.001	S400(V)	0.000	1.10			303.6	FLOOD RISK	7
107.000	RWP60	0.000	0.08			4.5	SURCHARGED	
106.002	S401	0.000	1.52			288.8	SURCHARGED	7
108.000	RWP61	0.000	0.08			4.5	SURCHARGED	
106.003	BRANCH	0.000	1.16			288.6	SURCHARGED*	
109.000	RWP62	0.000	0.04			2.2	SURCHARGED	
106.004	BRANCH	0.000	1.16			289.6	SURCHARGED*	
110.000	RWP63	0.000	0.07			4.5	OK	
106.005	S402	0.000	1.32			286.9	SURCHARGED	1
111.000	RWP64	0.000	0.07			4.5	OK	
106.006	BRANCH	0.000	0.83			286.0	SURCHARGED*	
112.000	RWP65	0.000	0.00			0.0	OK	
106.007	BRANCH	0.000	0.85			291.0	SURCHARGED*	
113.000	SDP06	0.000	2.67			404.0	FLOOD RISK	6
106.008	S403	0.000	2.12			524.0	SURCHARGED	
114.000	RWP66	0.000	0.07			4.3	OK	
106.009	BRANCH	0.000	1.29			519.8	SURCHARGED*	
115.000	RWP67	0.000	0.07			4.5	OK	
106.010	BRANCH	0.000	1.26			510.4	SURCHARGED*	
116.000	RWP68	0.000	0.07			4.5	OK	
106.011	BRANCH	0.000	1.07			496.7	SURCHARGED*	
117.000	RWP69	0.000	0.19			10.5	OK	
106.012	S404	0.000	2.21			502.1	SURCHARGED	
118.000	RWP70	0.000	0.16			10.5	OK	
106.013	BRANCH	0.000	1.40			501.4	SURCHARGED*	
106.014	S405	0.000	1.24			466.8	SURCHARGED	7
119.000	RWP71	0.000	0.33			13.4	OK	
119.001	S406	0.000	0.49			10.8	SURCHARGED	5
120.000	RWP72	0.000	0.31			16.6	OK	
119.002	BRANCH	0.000	0.77			19.6	SURCHARGED*	
121.000	RWP73	0.000	0.33			20.2	OK	
119.003	S407	0.000	1.41			33.2	SURCHARGED	2
106.015	S408	0.000	0.91			468.3	SURCHARGED	
122.000	RWP74	0.000	0.74			9.8	SURCHARGED	1

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
122.001	S409	0.000	0.69			8.8	SURCHARGED	5

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
123.000	RWP75	15 Summer	30	+0%	100/15 Summer	100/30 Summer			37.754	-0.096	0.000
122.002	BRANCH	15 Summer	30	+0%					37.636	0.000	0.000
124.000	RWP76	15 Summer	30	+0%	100/15 Summer				37.746	-0.104	0.000
122.003	BRANCH	15 Summer	30	+0%					37.566	0.000	0.000
125.000	SDP7	15 Summer	30	+0%	30/15 Summer	100/15 Summer			38.434	0.484	0.000
126.000	SDP8	15 Summer	30	+0%	100/15 Summer				37.679	-0.271	0.000
122.004	S410(V)	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.499	0.429	0.000
127.000	SDP9	15 Summer	30	+0%	30/15 Summer	100/15 Summer			38.436	0.486	0.000
122.005	S411(V)	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.459	0.438	0.000
128.000	RWP77	15 Summer	30	+0%	100/15 Summer				37.744	-0.106	0.000
122.006	BRANCH	15 Summer	30	+0%					36.887	0.000	0.000
129.000	RWP78	15 Summer	30	+0%	100/15 Summer				37.742	-0.108	0.000
122.007	BRANCH	15 Summer	30	+0%					36.650	0.000	0.000
130.000	RWP79	15 Summer	30	+0%	100/15 Summer				37.725	-0.125	0.000
130.001	S412	15 Summer	30	+0%	100/15 Summer				37.434	-0.116	0.000
131.000	RWP80	15 Summer	30	+0%	100/15 Summer	100/15 Summer			37.347	-0.053	0.000
130.002	S413	15 Summer	30	+0%	100/15 Summer				37.295	-0.036	0.000
132.000	RWP81	15 Summer	30	+0%	100/15 Summer				37.871	-0.129	0.000
130.003	BRANCH	15 Summer	30	+0%					37.188	0.000	0.000
133.000	RWP82	15 Summer	30	+0%	100/15 Summer	100/15 Summer			37.263	-0.087	0.000
130.004	BRANCH	15 Summer	30	+0%					37.083	0.000	0.000
134.000	RWP83	15 Summer	30	+0%	100/15 Summer				37.868	-0.132	0.000
130.005	BRANCH	15 Summer	30	+0%					36.896	0.000	0.000
135.000	RWP84	15 Summer	30	+0%	100/15 Summer				37.867	-0.133	0.000
130.006	S414	15 Summer	30	+0%	30/15 Summer				36.763	0.117	0.000
122.008	S415	30 Summer	30	+0%	30/15 Summer				36.498	0.043	0.000
106.016	S416	15 Summer	30	+0%	30/15 Summer	100/15 Summer			36.440	0.315	0.000
136.000	RWP85	15 Summer	30	+0%	100/15 Summer				36.889	-0.111	0.000
106.017	S417	15 Summer	30	+0%	30/15 Summer	100/15 Summer			36.284	0.241	0.000
137.000	RWP86	15 Summer	30	+0%	100/15 Summer				36.889	-0.111	0.000
106.018	S418	30 Summer	30	+0%	30/15 Summer	100/15 Summer			36.161	0.180	0.000
106.019	S419	30 Summer	30	+0%	30/15 Summer				36.063	0.194	0.000
138.000	RWP87	15 Summer	30	+0%					37.890	-0.110	0.000
106.020	BRANCH	15 Summer	30	+0%					35.829	0.000	0.000
139.000	RWP88	15 Summer	30	+0%					37.895	-0.105	0.000
106.021	BRANCH	15 Summer	30	+0%					35.802	0.000	0.000
140.000	RWP89	15 Summer	30	+0%					37.890	-0.110	0.000
106.022	S420	30 Summer	30	+0%	30/15 Summer				35.930	0.170	0.000
141.000	RWP90	15 Summer	30	+0%					37.885	-0.115	0.000
106.023	BRANCH	15 Summer	30	+0%					35.728	0.000	0.000
142.000	RWP91	15 Summer	30	+0%					37.884	-0.116	0.000
106.024	BRANCH	15 Summer	30	+0%					35.703	0.000	0.000
143.000	RWP92	15 Summer	30	+0%					37.884	-0.116	0.000
106.025	BRANCH	15 Summer	30	+0%					35.675	0.000	0.000
144.000	GULLEY	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.994	0.044	0.000
144.001	S421	15 Summer	30	+0%	30/15 Summer				37.811	0.069	0.000
106.026	S422	30 Summer	30	+0%	30/15 Summer				35.781	0.128	0.000
145.000	RWP93	15 Summer	30	+0%					37.850	-0.150	0.000
106.027	BRANCH	15 Summer	30	+0%					35.643	0.000	0.000
146.000	RWP94	15 Summer	30	+0%					37.850	-0.150	0.000
106.028	BRANCH	15 Summer	30	+0%					35.616	0.000	0.000
147.000	RWP95	15 Summer	30	+0%					37.850	-0.150	0.000
106.029	BRANCH	15 Summer	30	+0%					35.578	0.000	0.000
148.000	RWP96	15 Summer	30	+0%					37.850	-0.150	0.000

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
123.000	RWP75	0.28			8.0	OK	3
122.002	BRANCH	0.94			15.6	SURCHARGED*	
124.000	RWP76	0.21			6.9	OK	
122.003	BRANCH	1.61			21.6	SURCHARGED*	
125.000	SDP7	2.03			422.5	SURCHARGED	5
126.000	SDP8	0.32			65.9	OK	
122.004	S410(V)	0.87			480.5	SURCHARGED	5
127.000	SDP9	2.04			422.3	SURCHARGED	5
122.005	S411(V)	1.46			884.6	SURCHARGED	4
128.000	RWP77	0.19			9.1	OK	
122.006	BRANCH	1.17			891.5	SURCHARGED*	
129.000	RWP78	0.17			9.1	OK	
122.007	BRANCH	1.31			904.4	SURCHARGED*	
130.000	RWP79	0.06			2.0	OK	
130.001	S412	0.11			1.9	OK	
131.000	RWP80	0.72			10.7	OK	6
130.002	S413	0.72			11.7	OK	
132.000	RWP81	0.05			2.7	OK	
130.003	BRANCH	0.67			12.0	SURCHARGED*	
133.000	RWP82	0.36			10.5	OK	6
130.004	BRANCH	1.09			19.3	SURCHARGED*	
134.000	RWP83	0.03			2.3	OK	
130.005	BRANCH	1.06			18.9	SURCHARGED*	
135.000	RWP84	0.03			2.3	OK	
130.006	S414	1.27			19.5	SURCHARGED	
122.008	S415	0.87			784.3	SURCHARGED	
106.016	S416	1.28			928.1	SURCHARGED	5
136.000	RWP85	0.15			9.3	OK	
106.017	S417	1.33			905.2	SURCHARGED	6
137.000	RWP86	0.15			9.5	OK	
106.018	S418	1.11			846.0	SURCHARGED	2
106.019	S419	1.55			844.6	SURCHARGED	
138.000	RWP87	0.16			13.3	OK	
106.020	BRANCH	1.07			819.0	SURCHARGED*	
139.000	RWP88	0.20			16.9	OK	
106.021	BRANCH	0.96			827.3	SURCHARGED*	
140.000	RWP89	0.16			13.6	OK	
106.022	S420	1.81			831.0	SURCHARGED	
141.000	RWP90	0.12			10.6	OK	
106.023	BRANCH	1.03			784.0	SURCHARGED*	
142.000	RWP91	0.11			10.0	OK	
106.024	BRANCH	1.04			793.1	SURCHARGED*	
143.000	RWP92	0.12			10.4	OK	
106.025	BRANCH	1.04			793.0	SURCHARGED*	
144.000	GULLEY	0.91			25.9	SURCHARGED	1
144.001	S421	1.08			25.3	SURCHARGED	
106.026	S422	1.65			850.7	SURCHARGED	
145.000	RWP93	0.00			0.0	OK	
106.027	BRANCH	0.97			749.8	SURCHARGED*	
146.000	RWP94	0.00			0.0	OK	
106.028	BRANCH	0.93			760.4	SURCHARGED*	
147.000	RWP95	0.00			0.0	OK	
106.029	BRANCH	0.99			766.2	SURCHARGED*	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
148.000	RWP96	0.00			0.0	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
106.030	S423	30 Summer	30	+0%	30/30 Summer				35.585	0.034
149.000	RWP96	15 Summer	30	+0%					37.889	-0.111
106.031	BRANCH	30 Summer	30	+0%					35.517	0.000
150.000	RWP97	15 Summer	30	+0%					37.889	-0.111
106.032	BRANCH	30 Summer	30	+0%					35.497	0.000
151.000	SDP10	15 Summer	30	+0%	1/15 Summer	100/15 Summer			38.946	1.071
151.001	S424(V)	15 Summer	30	+0%	30/15 Summer				38.088	0.738
152.000	RWP98	15 Summer	30	+0%	100/15 Summer				37.887	-0.113
151.002	S425	15 Summer	30	+0%	30/15 Summer				37.867	0.555
153.000	RWP99	15 Summer	30	+0%	100/15 Summer				37.655	-0.095
151.003	BRANCH	15 Summer	30	+0%					37.243	0.000
154.000	RWP100	15 Summer	30	+0%					37.622	-0.128
151.004	BRANCH	15 Summer	30	+0%					37.237	0.000
106.033	S426	30 Summer	30	+0%	100/15 Summer				35.363	-0.077
155.000	RWP101	15 Summer	30	+0%					37.892	-0.108
155.001	S427	15 Summer	30	+0%					37.441	-0.091
156.000	RWP102	15 Summer	30	+0%					37.640	-0.110
155.002	BRANCH	15 Summer	30	+0%					37.185	0.000
157.000	RWP103	15 Summer	30	+0%					37.621	-0.129
155.003	BRANCH	15 Summer	30	+0%					37.109	-0.045
106.034	S428	30 Summer	30	+0%	100/15 Summer				35.251	0.000
158.000	RWP106	15 Summer	30	+0%					37.831	-0.119
158.001	S429	15 Summer	30	+0%	30/15 Summer				37.819	0.010
159.000	RWP107	15 Summer	30	+0%					37.870	-0.130
160.000	SDP11	15 Summer	30	+0%	1/15 Summer	100/15 Summer			38.814	0.939
158.002	S430(V)	15 Summer	30	+0%	30/15 Summer				37.811	0.461
106.035	S431	30 Summer	30	+0%	30/30 Summer				35.104	0.054
106.036	S432(SUDS)	60 Summer	30	+0%	100/15 Summer				34.992	0.000
106.037	ATT INLET 03	30 Summer	30	+0%					34.648	-0.320
161.000	OB31	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.933	0.278
161.001	S300	15 Summer	30	+0%	100/15 Summer				37.498	-0.089
162.000	OB32	15 Summer	30	+0%	100/15 Summer	100/15 Summer			37.569	-0.086
161.002	S301	15 Summer	30	+0%	30/15 Summer				36.827	0.115
163.000	OB33	15 Summer	30	+0%	100/15 Summer				37.271	-0.110
161.003	BRANCH	15 Summer	30	+0%					36.306	0.000
161.004	S302	15 Summer	30	+0%	100/15 Summer				36.118	-0.035
164.000	OB34	15 Summer	30	+0%	100/15 Summer	100/15 Summer			36.740	-0.125
161.005	BRANCH	15 Summer	30	+0%					35.864	0.000
165.000	OB37	15 Summer	30	+0%	100/15 Summer	100/15 Summer			36.647	-0.068
166.000	OB35	15 Summer	30	+0%	100/15 Summer	100/15 Summer			36.633	-0.077
166.001	S303	15 Summer	30	+0%	30/15 Summer				35.992	0.282
167.000	OB36	15 Summer	30	+0%	100/15 Summer	100/15 Summer			37.055	-0.120
161.006	S304	15 Summer	30	+0%	30/15 Summer				35.674	0.373
168.000	OB38	15 Summer	30	+0%	100/15 Summer	100/15 Summer			36.672	-0.118
161.007	S305	15 Summer	30	+0%	30/15 Summer				35.397	0.296
169.000	OB39	15 Summer	30	+0%	100/15 Summer				36.658	-0.132
161.008	BRANCH	15 Summer	30	+0%					34.930	0.000
170.000	OB40	15 Summer	30	+0%	100/30 Summer				36.941	-0.092
161.009	S306	30 Summer	30	+0%	30/15 Summer				35.046	0.163
171.000	OB40a	15 Summer	30	+0%					36.948	-0.085
172.000	OB41	15 Summer	30	+0%	100/15 Summer				36.690	-0.100
161.010	S307	30 Summer	30	+0%	30/15 Summer				34.874	0.078
173.000	OB42	15 Summer	30	+0%					36.700	-0.150
161.011	BRANCH	15 Summer	30	+0%					34.721	0.000

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
106.030	S423	0.000	1.77			842.3	SURCHARGED	
149.000	RWP96	0.000	0.15			13.6	OK	
106.031	BRANCH	0.000	1.09			829.4	SURCHARGED*	
150.000	RWP97	0.000	0.15			13.6	OK	
106.032	BRANCH	0.000	0.88			823.1	OK*	
151.000	SDP10	0.000	2.40			363.3	FLOOD RISK	5
151.001	S424(V)	0.000	2.20			350.3	SURCHARGED	
152.000	RWP98	0.000	0.14			7.2	OK	
151.002	S425	0.000	1.79			358.1	SURCHARGED	
153.000	RWP99	0.000	0.16			7.2	OK	
151.003	BRANCH	0.000	1.46			362.6	SURCHARGED*	
154.000	RWP100	0.000	0.05			2.3	OK	
151.004	BRANCH	0.000	1.46			362.9	SURCHARGED*	
106.033	S426	0.000	0.74			869.4	OK	
155.000	RWP101	0.000	0.17			7.2	OK	
155.001	S427	0.000	0.31			6.9	OK	
156.000	RWP102	0.000	0.15			7.2	OK	
155.002	BRANCH	0.000	1.30			14.4	SURCHARGED*	
157.000	RWP103	0.000	0.05			2.3	OK	
155.003	BRANCH	0.000	0.81			16.8	OK*	
106.034	S428	0.000	0.73			860.6	OK	
158.000	RWP106	0.000	0.09			2.1	OK	
158.001	S429	0.000	0.07			2.1	SURCHARGED	
159.000	RWP107	0.000	0.04			2.1	OK	
160.000	SDP11	0.000	2.59			393.2	FLOOD RISK	5
158.002	S430(V)	0.000	2.00			390.7	SURCHARGED	
106.035	S431	0.000	1.38			914.5	SURCHARGED	
106.036	S432(SUDS)	0.000	1.37			895.0	OK	
106.037	ATT INLET 03	0.000	0.79			918.9	OK*	
161.000	OB31	0.000	2.25			36.8	SURCHARGED	5
161.001	S300	0.000	0.66			35.7	OK	
162.000	OB32	0.000	0.38			23.0	OK	3
161.002	S301	0.000	1.07			52.8	SURCHARGED	
163.000	OB33	0.000	0.16			10.4	OK	
161.003	BRANCH	0.000	1.16			60.4	SURCHARGED*	
161.004	S302	0.000	0.61			62.3	OK	
164.000	OB34	0.000	0.41			57.5	OK	5
161.005	BRANCH	0.000	0.81			102.9	SURCHARGED*	
165.000	OB37	0.000	0.58			43.1	OK	5
166.000	OB35	0.000	0.47			20.1	OK	5
166.001	S303	0.000	0.97			16.7	SURCHARGED	
167.000	OB36	0.000	0.44			78.0	OK	2
161.006	S304	0.000	1.25			214.0	SURCHARGED	
168.000	OB38	0.000	0.46			83.3	OK	2
161.007	S305	0.000	1.12			261.3	SURCHARGED	
169.000	OB39	0.000	0.36			68.3	OK	
161.008	BRANCH	0.000	1.23			305.4	SURCHARGED*	
170.000	OB40	0.000	0.32			11.9	OK	
161.009	S306	0.000	1.46			301.8	SURCHARGED	
171.000	OB40a	0.000	0.39			14.7	OK	
172.000	OB41	0.000	0.59			48.5	OK	
161.010	S307	0.000	1.13			330.8	SURCHARGED	
173.000	OB42	0.000	0.00			0.0	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
161.011	BRANCH	0.000	0.90			312.8	SURCHARGED*	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
174.000	OB43	15 Summer	30	+0%	100/15 Summer				37.356	-0.059
161.012	S308	15 Winter	30	+0%	100/15 Summer				34.659	0.000
175.000	OB44	15 Summer	30	+0%					37.481	-0.084
161.013	BRANCH	30 Summer	30	+0%					34.439	-0.135
176.000	OB45	15 Summer	30	+0%	100/15 Summer				37.537	-0.103
161.014	S309	30 Summer	30	+0%	100/15 Summer				34.279	-0.124
177.000	OB46	15 Summer	30	+0%					37.454	-0.111
161.015	S310	30 Summer	30	+0%	100/15 Summer				34.183	-0.068
178.000	OB47	15 Summer	30	+0%					37.411	-0.104
161.016	BRANCH	30 Summer	30	+0%					34.101	-0.100
179.000	OB48	15 Summer	30	+0%					37.440	-0.110
180.000	OB49	15 Summer	30	+0%	100/15 Summer				37.608	-0.060
161.017	S311	30 Summer	30	+0%	100/15 Summer				34.007	-0.068
181.000	OB50	15 Summer	30	+0%	100/15 Summer				37.571	-0.046
181.001	S312	15 Summer	30	+0%	100/15 Summer				37.412	-0.031
182.000	OB51	15 Summer	30	+0%					37.575	-0.092
181.002	S313	15 Summer	30	+0%	100/15 Summer				36.924	-0.101
183.000	OB52	15 Summer	30	+0%					37.492	-0.088
181.003	BRANCH	15 Summer	30	+0%					36.360	-0.006
181.004	S314	15 Summer	30	+0%	30/15 Summer				36.132	0.052
184.000	OB53	15 Summer	30	+0%					37.423	-0.107
161.018	S315	30 Winter	30	+0%	100/15 Summer				33.899	-0.036
161.019	INT02 (SUDS)	30 Winter	30	+0%	30/15 Summer				33.806	0.002
161.020	S316	60 Winter	30	+0%	100/15 Summer				33.773	0.000
161.021	ATT INLET 02	120 Summer	30	+0%					33.750	0.000
2.020	ATT TANK 01	120 Summer	30	+0%	30/60 Summer				33.625	0.025
2.021	CONNECTION	360 Winter	30	+0%	100/30 Summer				33.433	-0.117
185.000	OB60	15 Summer	30	+0%	100/15 Summer	100/15 Summer			37.444	-0.155
186.000	OB61	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.563	0.126
185.001	S500	15 Summer	30	+0%	30/15 Summer				37.391	0.196
185.002	S501	15 Summer	30	+0%	30/15 Summer				37.270	0.230
187.000	OB62	15 Summer	30	+0%	100/15 Summer	100/15 Summer			37.183	-0.095
185.003	BRANCH	15 Summer	30	+0%					36.871	0.000
188.000	OB63	15 Summer	30	+0%	100/15 Summer				37.017	-0.024
189.000	OB64	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.168	0.249
185.004	S502	15 Summer	30	+0%	30/15 Summer				36.998	0.362
190.000	OB65	15 Summer	30	+0%	30/15 Summer	100/15 Summer			36.856	0.137
185.005	BRANCH	15 Summer	30	+0%					36.508	0.000
191.000	OB66	15 Summer	30	+0%	100/15 Summer				36.656	-0.113
185.006	S503	15 Summer	30	+0%	30/15 Summer				36.565	0.106
192.000	OB67	15 Summer	30	+0%	30/15 Summer				36.520	0.181
185.007	BRANCH	15 Summer	30	+0%					36.295	0.000
193.000	OB68	15 Summer	30	+0%					36.621	-0.095
185.008	BRANCH	15 Summer	30	+0%					36.151	0.000
194.000	OB69	15 Summer	30	+0%	30/15 Summer	100/15 Summer			36.735	0.257
195.000	OB70	15 Summer	30	+0%	30/15 Summer	100/15 Summer			36.734	0.384
194.001	S504	15 Summer	30	+0%	30/15 Summer				36.593	0.413
196.000	OB71	15 Summer	30	+0%	30/15 Summer	100/15 Summer			36.581	0.253
194.002	S505	15 Summer	30	+0%	30/15 Summer				36.480	0.435
197.000	OB72	15 Summer	30	+0%	100/15 Summer				36.352	-0.113
198.000	OB73	15 Summer	30	+0%	30/15 Summer	100/15 Summer			36.564	0.169
194.003	S506	15 Summer	30	+0%	30/15 Summer				36.337	0.400
199.000	OB75	15 Summer	30	+0%	30/15 Summer	100/15 Summer			36.719	0.222
200.000	OB74	15 Summer	30	+0%	30/15 Summer				36.683	0.022

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
174.000	OB43	0.000	0.68			43.8	OK	
161.012	S308	0.000	1.04			311.1	OK	
175.000	OB44	0.000	0.40			43.5	OK	
161.013	BRANCH	0.000	0.94			343.5	OK*	
176.000	OB45	0.000	0.56			96.9	OK	
161.014	S309	0.000	0.83			360.5	OK	
177.000	OB46	0.000	0.15			11.9	OK	
161.015	S310	0.000	1.00			351.5	OK	
178.000	OB47	0.000	0.20			22.8	OK	
161.016	BRANCH	0.000	0.76			356.4	OK*	
179.000	OB48	0.000	0.16			11.9	OK	
180.000	OB49	0.000	0.66			51.4	OK	
161.017	S311	0.000	0.86			368.8	OK	
181.000	OB50	0.000	0.82			21.4	OK	
181.001	S312	0.000	0.97			21.3	OK	
182.000	OB51	0.000	0.31			15.7	OK	
181.002	S313	0.000	0.58			36.8	OK	
183.000	OB52	0.000	0.36			24.9	OK	
181.003	BRANCH	0.000	0.89			59.6	OK*	
181.004	S314	0.000	1.14			59.7	SURCHARGED	
184.000	OB53	0.000	0.18			15.7	OK	
161.018	S315	0.000	1.07			385.9	OK	
161.019	INT02 (SUDS)	0.000	1.07			386.0	SURCHARGED	
161.020	S316	0.000	1.41			361.5	OK	
161.021	ATT INLET 02	0.000	0.52			318.1	SURCHARGED*	
2.020	ATT TANK 01	0.000	1.61			1322.2	SURCHARGED	
2.021	CONNECTION	0.000	0.65			820.8	OK	
185.000	OB60	0.000	0.47			67.6	OK	4
186.000	OB61	0.000	0.49			60.5	SURCHARGED	5
185.001	S500	0.000	0.86			113.6	SURCHARGED	
185.002	S501	0.000	0.73			98.6	SURCHARGED	
187.000	OB62	0.000	0.33			52.4	OK	5
185.003	BRANCH	0.000	0.81			142.0	SURCHARGED*	
188.000	OB63	0.000	0.25			9.9	OK	
189.000	OB64	0.000	0.81			27.1	SURCHARGED	5
185.004	S502	0.000	1.26			174.2	SURCHARGED	
190.000	OB65	0.000	0.54			15.5	SURCHARGED	3
185.005	BRANCH	0.000	1.75			187.4	SURCHARGED*	
191.000	OB66	0.000	0.14			3.1	OK	
185.006	S503	0.000	0.94			191.1	SURCHARGED	
192.000	OB67	0.000	1.57			46.9	SURCHARGED	
185.007	BRANCH	0.000	1.07			228.0	SURCHARGED*	
193.000	OB68	0.000	0.29			13.6	OK	
185.008	BRANCH	0.000	1.41			238.0	SURCHARGED*	
194.000	OB69	0.000	0.80			20.4	SURCHARGED	5
195.000	OB70	0.000	0.59			61.3	SURCHARGED	5
194.001	S504	0.000	0.91			73.9	SURCHARGED	
196.000	OB71	0.000	0.70			21.3	SURCHARGED	5
194.002	S505	0.000	1.16			89.9	SURCHARGED	
197.000	OB72	0.000	0.13			6.1	OK	
198.000	OB73	0.000	0.62			104.6	SURCHARGED	5
194.003	S506	0.000	0.85			189.6	SURCHARGED	
199.000	OB75	0.000	0.56			24.0	SURCHARGED	5

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
200.000	OB74	0.000	0.34			10.2	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
200.001	S507	15 Summer	30	+0%	30/15 Summer				36.665	0.258
199.001	S508	15 Summer	30	+0%	30/15 Summer				36.624	0.586
201.000	OB76	15 Summer	30	+0%	100/15 Summer				36.478	-0.090
194.004	S509	15 Summer	30	+0%	30/15 Summer				36.203	0.425
194.005	S510	15 Summer	30	+0%	30/15 Summer				36.051	0.354
202.000	OB77	15 Summer	30	+0%	100/15 Summer				36.660	-0.089
194.006	S511	15 Summer	30	+0%	30/15 Summer				35.762	0.207
203.000	OB78	15 Summer	30	+0%					36.654	-0.095
194.007	S512	15 Summer	30	+0%	30/15 Summer				35.404	0.056
185.009	S513	15 Summer	30	+0%	30/15 Summer				35.273	0.059
204.000	OB79	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.449	0.131
204.001	S514	15 Summer	30	+0%	30/15 Summer				37.267	0.267
205.000	OB80	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.180	0.261
204.002	BRANCH	15 Summer	30	+0%					36.869	0.000
185.010	S515	15 Summer	30	+0%	30/15 Summer				35.225	0.063
206.000	OB83	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.099	0.099
207.000	OB84	15 Summer	30	+0%	100/15 Summer				37.047	-0.063
208.000	OB81	15 Summer	30	+0%	30/15 Summer	100/15 Summer			37.565	0.268
209.000	OB82	15 Summer	30	+0%	100/15 Summer				37.196	-0.066
208.001	S516	15 Summer	30	+0%	30/15 Summer				37.128	0.118
210.000	GULLY	15 Summer	30	+0%	100/15 Summer				37.335	-0.150
208.002	BRANCH	15 Summer	30	+0%					36.836	0.000
206.001	S517	15 Summer	30	+0%	30/15 Summer				36.804	0.080
211.000	OB90A	15 Summer	30	+0%	100/15 Summer				36.821	-0.129
212.000	OB90	15 Summer	30	+0%	100/15 Summer				36.821	-0.129
213.000	OB85	15 Summer	30	+0%	100/15 Summer				36.863	-0.075
214.000	OB86	15 Summer	30	+0%	30/15 Summer	100/15 Summer			36.806	0.128
213.001	S518	15 Summer	30	+0%	30/15 Summer				36.635	0.230
215.000	OB87	15 Summer	30	+0%	100/15 Summer	100/15 Summer			36.786	-0.084
213.002	BRANCH	15 Summer	30	+0%					36.260	0.000
216.000	OB88	15 Summer	30	+0%	100/15 Summer				36.918	-0.079
217.000	OB89	15 Summer	30	+0%	100/15 Summer				36.939	-0.097
213.003	S519	15 Summer	30	+0%	30/15 Summer				36.123	0.031
206.002	S520	15 Summer	30	+0%	100/15 Summer				35.913	-0.109
218.000	OB92	15 Summer	30	+0%					36.912	-0.111
219.000	OB91	15 Summer	30	+0%	100/15 Summer				36.417	-0.091
220.000	OB93	15 Summer	30	+0%	100/15 Summer				36.270	-0.120
206.003	S521	15 Summer	30	+0%	100/15 Summer				35.619	-0.054
221.000	OB94	15 Summer	30	+0%	100/15 Summer				36.339	-0.114
206.004	BRANCH	15 Summer	30	+0%					35.264	0.000
222.000	OB95	15 Summer	30	+0%					36.636	-0.114
185.011	S522	15 Summer	30	+0%	30/15 Summer				35.178	0.063
185.012	INT03 (SUDS)	15 Summer	30	+0%	30/15 Summer				34.881	0.112
185.013	S523	15 Summer	30	+0%	30/15 Summer				34.776	0.034
185.014	ATT INLET 04	15 Summer	30	+0%					34.164	-0.560
2.022	ATT TANK 02	360 Winter	30	+0%	30/60 Summer				33.393	0.568
2.023	S523	360 Winter	30	+0%	1/360 Summer				33.663	0.875
2.024	S524 (SUDS)	360 Winter	30	+0%	1/240 Summer				33.914	1.194
2.025	SWPS01	360 Winter	30	+0%	1/120 Summer				33.949	1.464
2.026	458	360 Winter	30	+0%					36.207	-0.093

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
200.001	S507	0.000	0.45			8.6	SURCHARGED	
199.001	S508	0.000	1.31			24.5	SURCHARGED	
201.000	OB76	0.000	0.34			18.7	OK	
194.004	S509	0.000	1.41			218.9	SURCHARGED	
194.005	S510	0.000	1.43			210.4	SURCHARGED	
202.000	OB77	0.000	0.35			23.8	OK	
194.006	S511	0.000	1.28			219.3	SURCHARGED	
203.000	OB78	0.000	0.29			21.5	OK	
194.007	S512	0.000	1.02			233.4	SURCHARGED	
185.009	S513	0.000	0.95			453.4	SURCHARGED	
204.000	OB79	0.000	0.65			88.9	SURCHARGED	3
204.001	S514	0.000	1.18			87.1	SURCHARGED	
205.000	OB80	0.000	1.44			45.5	SURCHARGED	1
204.002	BRANCH	0.000	2.08			130.9	SURCHARGED*	
185.010	S515	0.000	0.98			562.3	SURCHARGED	
206.000	OB83	0.000	1.04			20.6	SURCHARGED	3
207.000	OB84	0.000	0.63			23.8	OK	
208.000	OB81	0.000	1.22			26.1	SURCHARGED	3
209.000	OB82	0.000	0.56			17.2	OK	
208.001	S516	0.000	1.11			41.1	SURCHARGED	
210.000	GULLY	0.000	0.00			0.0	OK	
208.002	BRANCH	0.000	1.00			42.5	SURCHARGED*	
206.001	S517	0.000	1.44			81.4	SURCHARGED	
211.000	OB90A	0.000	0.05			2.9	OK	
212.000	OB90	0.000	0.05			2.9	OK	
213.000	OB85	0.000	0.50			20.8	OK	
214.000	OB86	0.000	0.82			18.4	SURCHARGED	4
213.001	S518	0.000	1.10			35.7	SURCHARGED	
215.000	OB87	0.000	0.40			17.7	OK	1
213.002	BRANCH	0.000	1.39			50.7	SURCHARGED*	
216.000	OB88	0.000	0.46			16.7	OK	
217.000	OB89	0.000	0.27			16.4	OK	
213.003	S519	0.000	1.24			80.9	SURCHARGED	
206.002	S520	0.000	0.85			167.1	OK	
218.000	OB92	0.000	0.16			7.2	OK	
219.000	OB91	0.000	0.32			18.4	OK	
220.000	OB93	0.000	0.44			52.4	OK	
206.003	S521	0.000	0.67			229.6	OK	
221.000	OB94	0.000	0.48			72.4	OK	
206.004	BRANCH	0.000	1.36			287.8	SURCHARGED*	
222.000	OB95	0.000	0.13			10.6	OK	
185.011	S522	0.000	2.42			848.8	SURCHARGED	
185.012	INT03 (SUDS)	0.000	2.23			848.8	SURCHARGED	
185.013	S523	0.000	2.31			846.1	SURCHARGED	
185.014	ATT INLET 04	0.000	0.30			840.4	OK*	
2.022	ATT TANK 02	0.000	1.36			160.8	SURCHARGED	
2.023	S523	0.000	0.80			158.6	SURCHARGED	
2.024	S524 (SUDS)	0.000	1.23			143.8	SURCHARGED	
2.025	SWPS01	0.000	4.07			135.0	SURCHARGED	
2.026	458	0.000	0.99			135.1	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.300 Cv (Summer) 1.000
Region England and Wales Ratio R 0.350 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
2.000	OB1	15 Summer	100	+45%	100/15 Summer				38.635	0.820	0.000
3.000	OB2	30 Summer	100	+45%	30/15 Summer	100/15 Summer			38.311	0.843	1.051
2.001	S100	30 Summer	100	+45%	100/15 Summer	100/15 Summer			38.200	0.948	0.099
4.000	OB3	30 Summer	100	+45%	100/15 Summer	100/15 Summer			37.656	0.906	46.142
5.000	OB4	30 Summer	100	+45%	100/15 Summer				38.216	0.856	0.000
2.002	S101	30 Summer	100	+45%	100/15 Summer	100/15 Summer			38.058	1.570	3.534
6.000	OB5	30 Summer	100	+45%	100/15 Summer	100/30 Summer			38.225	0.790	4.991
2.003	S102	30 Summer	100	+45%	30/15 Summer				38.154	2.037	0.000
7.000	OB6	30 Summer	100	+45%	30/15 Summer	100/15 Summer			37.664	0.954	54.168
8.000	OB7	30 Summer	100	+45%	100/15 Summer	100/15 Summer			38.228	0.908	7.848
2.004	S103	30 Summer	100	+45%	30/15 Summer				38.030	2.521	0.000
2.005	S104	30 Summer	100	+45%	30/15 Summer				37.956	2.594	0.000
9.000	OB8	30 Summer	100	+45%	100/15 Summer				37.956	0.398	0.000
2.006	S105	30 Summer	100	+45%	30/15 Summer				37.835	2.564	0.000
10.000	OB9	30 Summer	100	+45%	30/15 Summer	100/15 Summer			38.565	0.852	9.984
10.001	S106	30 Summer	100	+45%	100/15 Summer				38.570	0.957	0.000
11.000	OB10	30 Summer	100	+45%	100/15 Summer	100/30 Summer			38.556	0.768	0.574
10.002	S107	30 Winter	100	+45%	30/15 Summer				38.542	1.862	0.000
12.000	OB11	30 Summer	100	+45%	100/15 Summer				38.268	0.480	0.000
10.003	S108	30 Summer	100	+45%	100/15 Summer				38.248	2.268	0.000
13.000	OB12	30 Summer	100	+45%	100/15 Summer				38.059	0.346	0.000
10.004	S109	30 Summer	100	+45%	30/15 Summer				37.977	2.557	0.000
2.007	S110	30 Summer	100	+45%	30/15 Summer				37.787	2.565	0.000
14.000	OB13	30 Summer	100	+45%	100/15 Summer	100/15 Summer			38.077	0.862	2.512
15.000	OB14	30 Summer	100	+45%	100/15 Summer	100/15 Summer			37.617	0.942	6.765
14.001	S111	30 Summer	100	+45%	30/15 Summer				37.890	2.265	0.000
16.000	OB15	30 Summer	100	+45%	100/30 Summer				37.807	0.128	0.000
2.008	S112	30 Summer	100	+45%	30/15 Summer				37.666	2.600	0.000
17.000	OB16	15 Summer	100	+45%					37.622	-0.057	0.000

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.000	OB1	1.01			31.2	FLOOD RISK	
3.000	OB2	1.55			35.1	FLOOD	2
2.001	S100	0.62			57.9	FLOOD	1
4.000	OB3	1.81			98.4	FLOOD	7
5.000	OB4	0.50			65.2	FLOOD RISK	
2.002	S101	0.94			133.8	FLOOD	3
6.000	OB5	0.53			153.0	FLOOD	3
2.003	S102	0.90			244.1	FLOOD RISK	
7.000	OB6	1.02			122.2	FLOOD	7
8.000	OB7	0.82			155.1	FLOOD	5
2.004	S103	2.05			454.1	FLOOD RISK	
2.005	S104	1.94			407.7	SURCHARGED	
9.000	OB8	0.78			38.8	SURCHARGED	
2.006	S105	1.56			411.3	SURCHARGED	
10.000	OB9	2.36			46.7	FLOOD	5
10.001	S106	0.74			41.9	FLOOD RISK	
11.000	OB10	0.40			58.7	FLOOD	1
10.002	S107	1.34			67.7	FLOOD RISK	
12.000	OB11	0.35			67.1	FLOOD RISK	
10.003	S108	1.10			104.8	SURCHARGED	
13.000	OB12	0.49			46.9	SURCHARGED	
10.004	S109	0.84			131.4	SURCHARGED	
2.007	S110	1.17			486.6	SURCHARGED	
14.000	OB13	0.68			121.6	FLOOD	4
15.000	OB14	0.87			32.3	FLOOD	6
14.001	S111	1.66			129.7	SURCHARGED	
16.000	OB15	0.71			43.3	SURCHARGED	
2.008	S112	1.11			580.1	SURCHARGED	
17.000	OB16	0.70			47.8	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
2.009	S113	30 Summer	100	+45%	30/15 Summer				37.481	2.655	0.000
18.000	OB17	15 Summer	100	+45%					37.617	-0.062	0.000
2.010	S114	30 Summer	100	+45%	30/15 Summer				37.245	2.660	0.000
19.000	OB18	30 Summer	100	+45%	30/15 Summer	100/15 Summer			38.698	0.853	11.345
19.001	S115	30 Summer	100	+45%	30/15 Summer				38.677	1.177	0.000
20.000	OB19	15 Summer	100	+45%	100/15 Summer				38.687	0.842	0.000
19.002	S116	30 Summer	100	+45%	30/15 Summer				38.358	1.791	0.000
19.003	S117	30 Summer	100	+45%	30/15 Summer	100/15 Summer			37.748	1.661	21.006
21.000	OB20	30 Summer	100	+45%	100/15 Summer				37.975	0.841	0.000
22.000	OB21	30 Summer	100	+45%	100/15 Summer				38.087	0.802	0.000
19.004	S118	30 Summer	100	+45%	30/15 Summer				37.830	1.934	0.000
23.000	OB22	30 Summer	100	+45%	100/15 Summer	100/15 Summer			37.635	0.885	25.447
24.000	OB23	30 Summer	100	+45%	100/15 Summer	100/15 Summer			38.222	0.902	2.013
19.005	S119	30 Summer	100	+45%	30/15 Summer				37.823	1.985	0.000
25.000	OB24	30 Summer	100	+45%	100/15 Summer				38.087	0.727	0.000
19.006	S120	30 Summer	100	+45%	30/15 Summer				37.810	2.232	0.000
26.000	OB25	30 Summer	100	+45%	100/15 Summer				37.993	0.633	0.000
27.000	OB26	30 Summer	100	+45%	100/15 Summer	100/15 Summer			37.633	0.883	23.402
19.007	S121	30 Summer	100	+45%	30/15 Summer				37.683	2.409	0.000
19.008	S122	30 Summer	100	+45%	30/15 Summer				37.585	2.505	0.000
19.009	S123	30 Summer	100	+45%	30/15 Summer				37.418	2.610	0.000
28.000	OB27	15 Summer	100	+45%					37.740	-0.023	0.000
19.010	S124	30 Summer	100	+45%	30/15 Summer				37.277	2.692	0.000
29.000	OB28	30 Summer	100	+45%	100/15 Summer				37.131	0.545	0.000
2.011	S125	30 Summer	100	+45%	30/15 Summer				37.068	2.590	0.000
30.000	OB29	15 Summer	100	+45%	100/15 Summer				37.548	0.873	0.000
31.000	OB30	15 Summer	100	+45%	100/15 Summer				38.058	0.843	0.000
30.001	S126	30 Summer	100	+45%	30/15 Summer				37.260	0.925	0.000
2.012	S127	30 Summer	100	+45%	30/15 Summer				36.926	2.464	0.000
2.013	INT01	30 Summer	100	+45%	30/15 Summer				36.714	2.424	0.000
32.000	SDP01	30 Summer	100	+45%	1/15 Summer	100/15 Summer			39.089	1.214	88.654
33.000	RWP01	15 Summer	100	+45%	30/15 Summer				38.635	0.835	0.000
33.001	S200	15 Summer	100	+45%	30/15 Summer				38.628	1.205	0.000
34.000	RWP03	15 Summer	100	+45%	30/15 Summer				38.877	1.077	0.000
34.001	S201	30 Winter	100	+45%	30/15 Summer	100/15 Summer			38.699	1.391	4.125
35.000	RWP04	15 Summer	100	+45%	30/15 Summer				38.948	1.148	0.000
34.002	BRANCH	15 Summer	100	+45%					37.115	0.000	0.000
36.000	RWP05	30 Summer	100	+45%	30/15 Summer				38.881	1.081	0.000
34.003	BRANCH	15 Summer	100	+45%					36.922	0.000	0.000
37.000	RWP02	60 Summer	100	+45%	30/15 Summer				38.598	0.798	0.000
32.001	S202(V)	60 Summer	100	+45%	30/15 Summer				38.597	1.736	0.000
32.002	S203	60 Summer	100	+45%	30/15 Summer	100/15 Summer			38.477	1.655	43.987
38.000	RWP06	60 Summer	100	+45%	30/15 Summer				38.370	0.570	0.000
32.003	BRANCH	15 Summer	100	+45%					36.677	0.000	0.000
39.000	SWP07	60 Summer	100	+45%	30/15 Summer				38.328	0.528	0.000
32.004	BRANCH	15 Summer	100	+45%					36.644	0.000	0.000
40.000	RWP08	60 Summer	100	+45%	30/15 Summer				38.219	0.419	0.000
32.005	S204	60 Summer	100	+45%	30/15 Summer	100/15 Summer			38.214	1.623	205.731
41.000	SDP02	15 Summer	100	+45%	1/15 Summer	100/15 Summer			39.080	1.205	80.125
42.000	RWP09	15 Summer	100	+45%	30/15 Summer				38.704	0.904	0.000
42.001	S205	15 Summer	100	+45%	30/15 Summer	100/15 Summer			38.700	1.278	0.014
43.000	RWP10	15 Summer	100	+45%	30/15 Summer				38.675	0.875	0.000
44.000	RWP11	15 Winter	100	+45%	30/15 Summer				38.737	1.526	0.000
45.000	RWP12	15 Winter	100	+45%	30/15 Summer				38.730	0.930	0.000

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.009	S113	1.10			574.9	SURCHARGED	
18.000	OB17	0.64			48.5	OK	
2.010	S114	1.26			583.1	SURCHARGED	
19.000	OB18	0.91			33.6	FLOOD	7
19.001	S115	1.34			26.4	FLOOD RISK	
20.000	OB19	0.75			53.2	FLOOD RISK	
19.002	S116	1.12			50.2	SURCHARGED	
19.003	S117	1.92			82.0	FLOOD	7
21.000	OB20	0.64			41.7	FLOOD RISK	
22.000	OB21	0.55			30.3	FLOOD RISK	
19.004	S118	0.92			92.5	FLOOD RISK	
23.000	OB22	0.76			77.2	FLOOD	7
24.000	OB23	0.81			56.2	FLOOD	5
19.005	S119	1.46			173.5	FLOOD RISK	
25.000	OB24	0.71			132.8	FLOOD RISK	
19.006	S120	1.38			264.4	SURCHARGED	
26.000	OB25	0.83			169.6	FLOOD RISK	
27.000	OB26	1.09			145.1	FLOOD	6
19.007	S121	1.44			508.8	SURCHARGED	
19.008	S122	0.93			475.4	SURCHARGED	
19.009	S123	0.94			444.4	SURCHARGED	
28.000	OB27	0.99			62.3	OK	
19.010	S124	1.79			449.4	SURCHARGED	
29.000	OB28	0.76			33.8	SURCHARGED	
2.011	S125	3.38			1011.9	SURCHARGED	
30.000	OB29	0.93			18.1	FLOOD RISK	
31.000	OB30	0.95			124.9	FLOOD RISK	
30.001	S126	1.76			135.7	SURCHARGED	
2.012	S127	1.88			1103.2	SURCHARGED	
2.013	INT01	1.45			1095.6	SURCHARGED	
32.000	SDP01	2.63			398.8	FLOOD	7
33.000	RWP01	0.11			4.1	FLOOD RISK	
33.001	S200	0.59			19.3	FLOOD RISK	
34.000	RWP03	0.50			17.8	FLOOD RISK	
34.001	S201	1.00			17.8	FLOOD	7
35.000	RWP04	0.41			17.3	FLOOD RISK	
34.002	BRANCH	1.16			23.9	SURCHARGED*	
36.000	RWP05	0.33			15.8	FLOOD RISK	
34.003	BRANCH	2.11			32.7	SURCHARGED*	
37.000	RWP02	0.04			2.5	FLOOD RISK	
32.001	S202(V)	1.74			296.1	FLOOD RISK	
32.002	S203	1.24			264.6	FLOOD	7
38.000	RWP06	0.12			7.0	SURCHARGED	
32.003	BRANCH	1.20			286.6	SURCHARGED*	
39.000	SWP07	0.10			6.4	SURCHARGED	
32.004	BRANCH	1.19			295.8	SURCHARGED*	
40.000	RWP08	0.11			6.4	SURCHARGED	
32.005	S204	1.37			464.9	FLOOD	7
41.000	SDP02	2.95			447.3	FLOOD	7
42.000	RWP09	0.12			4.6	FLOOD RISK	
42.001	S205	0.31			11.6	FLOOD	1
43.000	RWP10	0.09			4.4	SURCHARGED	
44.000	RWP11	0.30			8.6	FLOOD RISK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
45.000	RWP12	0.15			8.7	FLOOD RISK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
44.001	BRANCH	15 Summer	100	+45%					36.917	0.000	0.000
41.001	S206(V)	15 Summer	100	+45%	30/15 Summer				38.672	1.961	0.000
32.006	S207	15 Summer	100	+45%	30/15 Summer	100/15 Summer			38.445	2.125	12.170
46.000	RWP13	15 Winter	100	+45%	30/15 Summer				38.460	0.810	0.000
32.007	S208	15 Winter	100	+45%	30/15 Summer				38.444	2.192	0.000
32.008	S209	15 Winter	100	+45%	30/15 Summer				38.411	2.201	0.000
47.000	RWP14	15 Winter	100	+45%	100/15 Summer				38.387	0.387	0.000
32.009	BRANCH	15 Summer	100	+45%					36.202	0.000	0.000
48.000	RWP15	15 Summer	100	+45%	100/15 Summer				38.441	0.441	0.000
48.001	S210	15 Summer	100	+45%	100/15 Summer				38.411	0.811	0.000
49.000	RWP16	15 Summer	100	+45%	100/15 Summer				38.407	0.407	0.000
48.002	BRANCH	15 Summer	100	+45%					37.416	0.000	0.000
50.000	RWP17	30 Winter	100	+45%	100/15 Summer				38.522	0.572	0.000
51.000	RWP18	30 Winter	100	+45%	100/15 Summer				38.519	0.569	0.000
50.001	S211	30 Winter	100	+45%	100/15 Summer				38.503	1.003	0.000
52.000	RWP19	30 Winter	100	+45%	100/15 Summer				38.461	0.876	0.000
50.002	BRANCH	15 Summer	100	+45%					37.194	0.000	0.000
53.000	RWP20	30 Winter	100	+45%	100/15 Summer				38.373	0.373	0.000
50.003	BRANCH	15 Summer	100	+45%					36.794	0.000	0.000
50.004	S212	30 Winter	100	+45%	30/15 Summer	100/30 Summer			38.301	1.656	0.649
32.010	S213	15 Winter	100	+45%	30/15 Summer				38.341	2.209	0.000
54.000	RWP21	15 Winter	100	+45%	100/15 Summer				38.337	0.337	0.000
32.011	BRANCH	15 Summer	100	+45%					36.113	0.000	0.000
55.000	RWP22	15 Summer	100	+45%	100/15 Summer				38.252	0.252	0.000
32.012	BRANCH	15 Summer	100	+45%					36.075	0.000	0.000
56.000	RWP23	30 Winter	100	+45%	100/15 Summer				38.206	0.206	0.000
32.013	BRANCH	15 Summer	100	+45%					36.038	0.000	0.000
57.000	RWP24	30 Winter	100	+45%	100/15 Summer				38.185	0.185	0.000
32.014	BRANCH	15 Summer	100	+45%					36.001	0.000	0.000
58.000	RWP25	30 Winter	100	+45%	100/30 Summer				38.159	0.159	0.000
32.015	BRANCH	15 Summer	100	+45%					35.961	0.000	0.000
59.000	SDP12	30 Summer	100	+45%	30/15 Summer	100/15 Summer			39.074	1.349	73.860
60.000	SDP13	30 Summer	100	+45%	100/15 Summer				38.650	1.000	0.000
61.000	SDP14	30 Summer	100	+45%	30/15 Summer	100/15 Summer			39.085	1.360	84.676
62.000	RWP29	30 Summer	100	+45%	100/15 Summer				38.561	0.911	0.000
62.001	S214	30 Summer	100	+45%	30/30 Summer				38.558	1.308	0.000
63.000	RWP30	30 Summer	100	+45%	100/15 Summer				38.546	0.546	0.000
61.001	S215(V)	30 Summer	100	+45%	1/15 Summer				38.543	2.523	0.000
64.000	RWP27	30 Summer	100	+45%	100/15 Summer				38.417	0.917	0.000
64.001	S214a	30 Summer	100	+45%	100/15 Summer				38.414	1.164	0.000
65.000	RWP28	30 Winter	100	+45%	100/15 Summer				38.406	0.406	0.000
59.001	S216(V)	30 Winter	100	+45%	30/15 Summer				38.400	2.410	0.000
66.000	RWP26	30 Winter	100	+45%	100/30 Summer				38.132	0.132	0.000
32.016	S217	30 Winter	100	+45%	30/15 Summer				38.117	2.193	0.000
67.000	RWP31	60 Summer	100	+45%					37.964	-0.036	0.000
32.017	BRANCH	15 Summer	100	+45%					35.890	0.000	0.000
68.000	RWP32	15 Summer	100	+45%					38.039	-0.111	0.000
32.018	BRANCH	15 Summer	100	+45%					35.857	0.000	0.000
69.000	RWP33	15 Summer	100	+45%					38.039	-0.111	0.000
32.019	BRANCH	15 Summer	100	+45%					35.820	0.000	0.000
70.000	RWP34	15 Summer	100	+45%					38.037	-0.113	0.000
32.020	BRANCH	15 Summer	100	+45%					35.791	0.000	0.000
71.000	RWP36	15 Summer	100	+45%					37.864	-0.086	0.000
72.000	RWP35	15 Summer	100	+45%					37.868	-0.082	0.000

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	**US/MH Name**	**Flow / Cap.**	**Overflow (l/s)**	**Half Drain Time (mins)**	**Pipe Flow (l/s)**	**Status**	**Level Exceeded**
44.001	BRANCH	0.44			12.5	SURCHARGED*	
41.001	S206(V)	1.11			390.1	FLOOD RISK	
32.006	S207	1.36			636.2	FLOOD	2
46.000	RWP13	0.19			7.4	SURCHARGED	
32.007	S208	1.66			626.0	FLOOD RISK	
32.008	S209	2.27			625.6	SURCHARGED	
47.000	RWP14	0.10			8.0	SURCHARGED	
32.009	BRANCH	1.01			610.1	SURCHARGED*	
48.000	RWP15	0.30			9.5	SURCHARGED	
48.001	S210	0.35			9.3	SURCHARGED	
49.000	RWP16	0.20			9.5	SURCHARGED	
48.002	BRANCH	0.74			20.5	SURCHARGED*	
50.000	RWP17	0.24			7.7	SURCHARGED	
51.000	RWP18	0.21			7.7	SURCHARGED	
50.001	S211	0.54			13.7	SURCHARGED	
52.000	RWP19	0.12			4.7	SURCHARGED	
50.002	BRANCH	0.84			23.6	SURCHARGED*	
53.000	RWP20	0.07			5.1	SURCHARGED	
50.003	BRANCH	0.96			23.1	SURCHARGED*	
50.004	S212	1.13			20.2	FLOOD	3
32.010	S213	2.12			623.1	SURCHARGED	
54.000	RWP21	0.13			11.5	SURCHARGED	
32.011	BRANCH	1.17			622.8	SURCHARGED*	
55.000	RWP22	0.16			14.1	SURCHARGED	
32.012	BRANCH	1.17			621.1	SURCHARGED*	
56.000	RWP23	0.09			8.1	SURCHARGED	
32.013	BRANCH	1.16			618.1	SURCHARGED*	
57.000	RWP24	0.10			8.5	SURCHARGED	
32.014	BRANCH	1.13			618.4	SURCHARGED*	
58.000	RWP25	0.09			8.2	SURCHARGED	
32.015	BRANCH	1.16			620.3	SURCHARGED*	
59.000	SDP12	1.73			484.9	FLOOD	6
60.000	SDP13	0.61			109.2	SURCHARGED	
61.000	SDP14	1.61			451.7	FLOOD	6
62.000	RWP29	0.07			2.7	FLOOD RISK	
62.001	S214	0.44			5.2	FLOOD RISK	
63.000	RWP30	0.03			2.8	SURCHARGED	
61.001	S215(V)	2.59			381.8	FLOOD RISK	
64.000	RWP27	0.09			2.9	SURCHARGED	
64.001	S214a	0.34			4.7	FLOOD RISK	
65.000	RWP28	0.03			2.2	SURCHARGED	
59.001	S216(V)	1.73			804.8	FLOOD RISK	
66.000	RWP26	0.16			8.8	SURCHARGED	
32.016	S217	2.38			1122.0	SURCHARGED	
67.000	RWP31	0.08			7.5	OK	
32.017	BRANCH	1.42			1083.3	SURCHARGED*	
68.000	RWP32	0.15			14.0	OK	
32.018	BRANCH	1.33			1079.5	SURCHARGED*	
69.000	RWP33	0.15			14.3	OK	
32.019	BRANCH	1.41			1075.1	SURCHARGED*	
70.000	RWP34	0.13			12.8	OK	
32.020	BRANCH	1.25			1085.3	SURCHARGED*	
71.000	RWP36	0.37			13.6	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
72.000	RWP35	0.42			13.6	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
71.001	S218	30 Summer	100	+45%	100/15 Summer				37.705	0.205
73.000	RWP37	15 Summer	100	+45%					37.889	-0.111
71.002	BRANCH	15 Summer	100	+45%					37.194	0.000
74.000	RWP38	15 Summer	100	+45%					37.885	-0.115
71.003	S219	60 Summer	100	+45%	100/15 Summer				37.534	0.707
75.000	RWP39	15 Summer	100	+45%					38.000	-0.150
32.021	S220	30 Summer	100	+45%	30/15 Summer				37.395	1.647
76.000	RWP40	15 Summer	100	+45%					38.039	-0.111
32.022	BRANCH	15 Summer	100	+45%					35.729	0.000
77.000	RWP41	15 Summer	100	+45%					38.039	-0.111
32.023	BRANCH	15 Summer	100	+45%					35.707	0.000
78.000	RWP42	15 Summer	100	+45%					38.053	-0.097
32.024	S221 (SUDS)	30 Summer	100	+45%	30/15 Summer				36.839	1.162
79.000	SDP03	15 Summer	100	+45%	1/15 Summer	100/15 Summer			39.085	1.210
80.000	RWP43	30 Summer	100	+45%	30/15 Summer				38.594	0.794
80.001	S222	30 Summer	100	+45%	30/15 Summer				38.589	1.166
81.000	RWP44	30 Summer	100	+45%	30/15 Summer				38.581	0.781
82.000	RWP45	15 Summer	100	+45%	30/15 Summer				38.831	1.031
82.001	S223	30 Summer	100	+45%	30/15 Summer	100/15 Summer			38.698	1.398
83.000	RWP46	15 Summer	100	+45%	30/15 Summer				38.969	1.169
82.002	BRANCH	15 Summer	100	+45%					37.120	0.000
84.000	RWP47	15 Summer	100	+45%	30/15 Summer				38.857	1.057
82.003	BRANCH	15 Summer	100	+45%					36.940	0.000
79.001	S224(V)	30 Summer	100	+45%	1/15 Summer				38.579	1.695
79.002	S225	30 Winter	100	+45%	30/15 Summer	100/30 Summer			38.437	1.645
85.000	RWP48	60 Summer	100	+45%	30/15 Summer	100/15 Summer			38.253	0.653
79.003	BRANCH	15 Summer	100	+45%					36.748	0.000
86.000	RWP49	30 Summer	100	+45%	30/15 Summer				38.241	0.841
79.004	BRANCH	15 Summer	100	+45%					36.703	0.000
87.000	RWP50	30 Summer	100	+45%	30/15 Summer				38.118	0.718
79.005	BRANCH	15 Summer	100	+45%					36.658	0.000
88.000	RWP51	30 Summer	100	+45%	100/15 Summer				37.983	0.583
79.006	BRANCH	15 Summer	100	+45%					36.613	0.000
89.000	RWP52	30 Summer	100	+45%					37.846	-0.004
79.007	BRANCH	15 Summer	100	+45%					36.589	0.000
90.000	RWP53	30 Summer	100	+45%	100/30 Summer				37.722	0.017
79.008	BRANCH	15 Summer	100	+45%					36.554	0.000
91.000	RWP54	30 Summer	100	+45%	100/15 Summer				37.593	0.343
79.009	S226	30 Summer	100	+45%	30/15 Summer				37.585	1.118
92.000	SDP04	15 Summer	100	+45%	1/15 Summer	100/15 Summer			39.062	1.187
93.000	RWP55	30 Summer	100	+45%	100/15 Summer				38.124	0.324
93.001	S227	30 Summer	100	+45%	100/15 Summer				38.123	0.701
94.000	RWP56	30 Summer	100	+45%	100/15 Summer				38.124	0.324
95.000	RWP57	30 Summer	100	+45%	100/15 Summer				38.135	0.335
96.000	RWP58	30 Summer	100	+45%	30/15 Summer				38.137	0.926
95.001	BRANCH	15 Summer	100	+45%					36.917	0.000
92.001	S228(V)	30 Summer	100	+45%	30/15 Summer				38.123	1.412
79.010	S229	30 Summer	100	+45%	30/15 Summer				37.206	1.119
79.011	S230(SUDS)	30 Summer	100	+45%	30/15 Summer				36.931	0.977
32.025	S231	30 Summer	100	+45%	30/15 Summer				36.650	0.987
2.014	S232	30 Summer	100	+45%	30/15 Summer				36.522	2.293
2.015	S233	30 Summer	100	+45%	30/15 Summer				36.094	1.987
97.000	RWP59	15 Summer	100	+45%					37.495	-0.105
98.000	RWP60	15 Summer	100	+45%					37.514	-0.086

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
71.001	S218	0.000	0.81			20.7	SURCHARGED	
73.000	RWP37	0.000	0.15			8.4	OK	
71.002	BRANCH	0.000	0.95			26.8	SURCHARGED*	
74.000	RWP38	0.000	0.12			8.4	OK	
71.003	S219	0.000	0.74			19.6	SURCHARGED	
75.000	RWP39	0.000	0.00			0.0	OK	
32.021	S220	0.000	2.87			1155.8	SURCHARGED	
76.000	RWP40	0.000	0.15			14.7	OK	
32.022	BRANCH	0.000	1.46			1113.9	SURCHARGED*	
77.000	RWP41	0.000	0.15			14.7	OK	
32.023	BRANCH	0.000	1.46			1114.2	SURCHARGED*	
78.000	RWP42	0.000	0.26			14.6	OK	
32.024	S221 (SUDS)	0.000	2.37			1157.4	SURCHARGED	
79.000	SDP03	84.864	2.70			410.0	FLOOD	6
80.000	RWP43	0.000	0.08			3.2	FLOOD RISK	
80.001	S222	0.000	0.20			6.4	FLOOD RISK	
81.000	RWP44	0.000	0.06			3.3	FLOOD RISK	
82.000	RWP45	0.000	0.45			16.1	FLOOD RISK	
82.001	S223	3.189	1.02			17.6	FLOOD	6
83.000	RWP46	0.000	0.44			18.6	FLOOD RISK	
82.002	BRANCH	0.000	1.22			24.2	SURCHARGED*	
84.000	RWP47	0.000	0.35			16.5	FLOOD RISK	
82.003	BRANCH	0.000	2.08			30.8	SURCHARGED*	
79.001	S224(V)	0.000	1.43			356.4	FLOOD RISK	
79.002	S225	3.838	1.93			334.2	FLOOD	3
85.000	RWP48	3.309	0.55			23.7	FLOOD	6
79.003	BRANCH	0.000	1.38			342.7	SURCHARGED*	
86.000	RWP49	0.000	0.30			11.8	FLOOD RISK	
79.004	BRANCH	0.000	1.38			343.8	SURCHARGED*	
87.000	RWP50	0.000	0.29			11.8	FLOOD RISK	
79.005	BRANCH	0.000	1.42			353.3	SURCHARGED*	
88.000	RWP51	0.000	0.23			9.5	FLOOD RISK	
79.006	BRANCH	0.000	1.44			358.0	SURCHARGED*	
89.000	RWP52	0.000	0.16			10.3	OK	
79.007	BRANCH	0.000	1.46			363.3	SURCHARGED*	
90.000	RWP53	0.000	0.16			9.6	SURCHARGED	
79.008	BRANCH	0.000	1.47			366.0	SURCHARGED*	
91.000	RWP54	0.000	0.21			9.6	SURCHARGED	
79.009	S226	0.000	1.23			351.9	SURCHARGED	
92.000	SDP04	62.081	2.99			453.0	FLOOD	5
93.000	RWP55	0.000	0.10			3.7	SURCHARGED	
93.001	S227	0.000	0.32			11.6	SURCHARGED	
94.000	RWP56	0.000	0.08			3.7	SURCHARGED	
95.000	RWP57	0.000	0.16			9.4	SURCHARGED	
96.000	RWP58	0.000	0.32			9.3	SURCHARGED	
95.001	BRANCH	0.000	0.69			19.6	SURCHARGED*	
92.001	S228(V)	0.000	1.46			452.3	SURCHARGED	
79.010	S229	0.000	1.70			790.9	SURCHARGED	
79.011	S230(SUDS)	0.000	1.14			777.5	SURCHARGED	
32.025	S231	0.000	2.98			1918.2	SURCHARGED	
2.014	S232	0.000	1.79			2769.1	SURCHARGED	
2.015	S233	0.000	1.99			2706.4	SURCHARGED	
97.000	RWP59	0.000	0.20			12.1	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
98.000	RWP60	0.000	0.38			22.9	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
2.016	S234	30 Summer	100	+45%	30/15 Summer				35.611	1.631
2.017	S235	120 Summer	100	+45%	30/15 Summer				35.069	1.200
99.000	RWP61	15 Summer	100	+45%	100/15 Summer				38.288	0.388
99.001	S236	15 Summer	100	+45%	100/15 Summer				38.270	0.525
100.000	RWP62	15 Summer	100	+45%	100/15 Summer				38.274	0.374
99.002	BRANCH	15 Summer	100	+45%					37.588	0.000
99.003	S237	15 Summer	100	+45%	30/15 Summer				37.798	0.445
101.000	RWP63	15 Summer	100	+45%					37.692	-0.108
99.004	BRANCH	15 Summer	100	+45%					37.221	0.000
102.000	RWP64	15 Summer	100	+45%					37.838	-0.112
99.005	S238	15 Summer	100	+45%					35.556	-0.101
103.000	RWP65	15 Summer	100	+45%					37.112	-0.094
99.006	BRANCH	15 Summer	100	+45%					35.153	-0.004
104.000	RWP66	15 Summer	100	+45%					37.088	-0.108
99.007	BRANCH	15 Summer	100	+45%					34.897	0.000
105.000	RWP67	15 Summer	100	+45%					36.839	-0.117
2.018	S239	120 Summer	100	+45%	30/15 Summer				34.765	0.977
2.019	ATT INLET 01	15 Summer	100	+45%					33.775	0.000
106.000	SDP05	30 Summer	100	+45%	1/15 Summer	100/15 Summer			39.090	1.215
106.001	S400(V)	60 Summer	100	+45%	30/15 Summer	100/15 Summer			38.752	1.402
107.000	RWP60	60 Summer	100	+45%	30/15 Summer				38.699	0.899
106.002	S401	60 Summer	100	+45%	30/15 Summer	100/15 Summer			38.697	1.688
108.000	RWP61	60 Summer	100	+45%	30/15 Summer				38.680	0.880
106.003	BRANCH	15 Summer	100	+45%					36.972	0.000
109.000	RWP62	30 Summer	100	+45%	30/15 Summer				38.658	0.858
106.004	BRANCH	15 Summer	100	+45%					36.880	0.000
110.000	RWP63	30 Summer	100	+45%	100/15 Summer				38.661	0.861
106.005	S402	30 Summer	100	+45%	30/15 Summer	100/30 Summer			38.649	1.828
111.000	RWP64	30 Summer	100	+45%	100/15 Summer				38.591	0.791
106.006	BRANCH	15 Summer	100	+45%					36.790	0.000
112.000	RWP65	30 Summer	100	+45%	100/15 Summer				38.570	0.770
106.007	BRANCH	15 Summer	100	+45%					36.750	0.000
113.000	SDP06	30 Summer	100	+45%	1/15 Summer	100/15 Summer			39.062	1.187
106.008	S403	30 Summer	100	+45%	30/15 Summer	100/30 Summer			38.569	1.863
114.000	RWP66	30 Summer	100	+45%	100/15 Summer				38.561	0.761
106.009	BRANCH	15 Summer	100	+45%					36.680	0.000
115.000	RWP67	30 Summer	100	+45%	100/15 Summer				38.531	0.731
106.010	BRANCH	15 Summer	100	+45%					36.645	0.000
116.000	RWP68	30 Winter	100	+45%	100/15 Summer				38.431	0.631
106.011	BRANCH	15 Summer	100	+45%					36.607	0.000
117.000	RWP69	60 Winter	100	+45%	100/15 Summer				38.378	0.578
106.012	S404	60 Winter	100	+45%	30/15 Summer				38.340	1.801
118.000	RWP70	60 Winter	100	+45%	100/15 Summer				38.306	0.306
106.013	BRANCH	15 Summer	100	+45%					36.513	0.000
106.014	S405	60 Summer	100	+45%	30/15 Summer	100/15 Summer			38.174	1.684
119.000	RWP71	15 Summer	100	+45%	100/15 Summer				38.890	0.790
119.001	S406	30 Summer	100	+45%	30/15 Summer	100/15 Summer			38.733	1.108
120.000	RWP72	15 Summer	100	+45%	100/15 Summer				38.979	0.879
119.002	BRANCH	15 Summer	100	+45%					37.305	0.000
121.000	RWP73	30 Summer	100	+45%	100/15 Summer				38.843	0.743
119.003	S407	30 Summer	100	+45%	30/15 Summer	100/30 Summer			38.730	1.785
106.015	S408	30 Summer	100	+45%	30/15 Summer	100/15 Winter			38.128	1.830
122.000	RWP74	30 Summer	100	+45%	30/15 Summer	100/30 Summer			38.700	0.950
122.001	S409	30 Winter	100	+45%	30/15 Summer	100/15 Summer			38.654	0.948

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.016	S234	0.000	2.23			2692.7	SURCHARGED	
2.017	S235	0.000	2.24			2428.4	SURCHARGED	
99.000	RWP61	0.000	0.44			10.7	SURCHARGED	
99.001	S236	0.000	0.62			10.1	SURCHARGED	
100.000	RWP62	0.000	0.48			16.9	SURCHARGED	
99.002	BRANCH	0.000	1.36			24.1	SURCHARGED*	
99.003	S237	0.000	1.58			24.1	SURCHARGED	
101.000	RWP63	0.000	0.18			8.4	OK	
99.004	BRANCH	0.000	1.66			29.6	SURCHARGED*	
102.000	RWP64	0.000	0.14			8.4	OK	
99.005	S238	0.000	0.58			36.3	OK	
103.000	RWP65	0.000	0.30			26.5	OK	
99.006	BRANCH	0.000	0.88			59.4	OK*	
104.000	RWP66	0.000	0.17			16.3	OK	
99.007	BRANCH	0.000	1.09			73.5	SURCHARGED*	
105.000	RWP67	0.000	0.11			9.1	OK	
2.018	S239	0.000	2.67			2455.8	SURCHARGED	
2.019	ATT INLET 01	0.000	1.35			2650.5	SURCHARGED*	
106.000	SDP05	90.184	2.46			373.6	FLOOD	7
106.001	S400(V)	105.545	0.94			260.1	FLOOD	7
107.000	RWP60	0.000	0.07			4.1	FLOOD RISK	
106.002	S401	50.366	1.62			307.4	FLOOD	7
108.000	RWP61	0.000	0.07			4.0	FLOOD RISK	
106.003	BRANCH	0.000	1.11			276.2	SURCHARGED*	
109.000	RWP62	0.000	0.05			2.7	FLOOD RISK	
106.004	BRANCH	0.000	1.08			267.5	SURCHARGED*	
110.000	RWP63	0.000	0.09			5.8	FLOOD RISK	
106.005	S402	2.375	1.13			244.7	FLOOD	1
111.000	RWP64	0.000	0.09			5.9	FLOOD RISK	
106.006	BRANCH	0.000	0.73			250.9	SURCHARGED*	
112.000	RWP65	0.000	0.00			0.1	FLOOD RISK	
106.007	BRANCH	0.000	0.72			248.5	SURCHARGED*	
113.000	SDP06	62.407	2.93			444.5	FLOOD	6
106.008	S403	0.032	2.41			595.0	FLOOD	
114.000	RWP66	0.000	0.10			6.5	FLOOD RISK	
106.009	BRANCH	0.000	1.48			598.1	SURCHARGED*	
115.000	RWP67	0.000	0.10			6.8	SURCHARGED	
106.010	BRANCH	0.000	1.47			595.4	SURCHARGED*	
116.000	RWP68	0.000	0.07			5.1	SURCHARGED	
106.011	BRANCH	0.000	1.23			574.4	SURCHARGED*	
117.000	RWP69	0.000	0.14			7.7	SURCHARGED	
106.012	S404	0.000	2.15			486.7	FLOOD RISK	
118.000	RWP70	0.000	0.12			8.0	SURCHARGED	
106.013	BRANCH	0.000	1.56			560.5	SURCHARGED*	
106.014	S405	45.101	1.17			439.1	FLOOD	7
119.000	RWP71	0.000	0.50			20.5	FLOOD RISK	
119.001	S406	3.306	0.59			13.1	FLOOD	5
120.000	RWP72	0.000	0.47			25.0	FLOOD RISK	
119.002	BRANCH	0.000	0.88			22.2	SURCHARGED*	
121.000	RWP73	0.000	0.45			27.9	FLOOD RISK	
119.003	S407	0.363	1.58			37.0	FLOOD	2
106.015	S408	0.000	0.81			421.2	FLOOD RISK	
122.000	RWP74	0.001	1.04			13.6	FLOOD	1

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
122.001	S409	3.601	1.69			21.7	FLOOD	5

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)
123.000	RWP75	30 Winter	100	+45%	100/15 Summer	100/30 Summer			38.700	0.850	0.057
122.002	BRANCH	15 Summer	100	+45%					37.636	0.000	0.000
124.000	RWP76	30 Summer	100	+45%	100/15 Summer				38.694	0.844	0.000
122.003	BRANCH	15 Summer	100	+45%					37.566	0.000	0.000
125.000	SDP7	15 Summer	100	+45%	30/15 Summer	100/15 Summer			39.038	1.088	37.937
126.000	SDP8	30 Winter	100	+45%	100/15 Summer				38.794	0.844	0.000
122.004	S410(V)	30 Winter	100	+45%	30/15 Summer	100/15 Summer			38.669	1.599	18.998
127.000	SDP9	15 Summer	100	+45%	30/15 Summer	100/15 Summer			39.036	1.086	36.085
122.005	S411(V)	30 Winter	100	+45%	30/15 Summer	100/15 Summer			38.651	1.630	1.418
128.000	RWP77	60 Summer	100	+45%	100/15 Summer				38.558	0.708	0.000
122.006	BRANCH	15 Summer	100	+45%					36.887	0.000	0.000
129.000	RWP78	30 Winter	100	+45%	100/15 Summer				38.385	0.535	0.000
122.007	BRANCH	15 Summer	100	+45%					36.650	0.000	0.000
130.000	RWP79	30 Winter	100	+45%	100/15 Summer				38.242	0.392	0.000
130.001	S412	30 Winter	100	+45%	100/15 Summer				38.236	0.686	0.000
131.000	RWP80	60 Summer	100	+45%	100/15 Summer	100/15 Summer			38.202	0.802	2.440
130.002	S413	30 Winter	100	+45%	100/15 Summer				38.228	0.897	0.000
132.000	RWP81	30 Winter	100	+45%	100/15 Summer				38.235	0.235	0.000
130.003	BRANCH	15 Summer	100	+45%					37.188	0.000	0.000
133.000	RWP82	60 Summer	100	+45%	100/15 Summer	100/15 Summer			38.202	0.852	1.630
130.004	BRANCH	15 Summer	100	+45%					37.083	0.000	0.000
134.000	RWP83	30 Summer	100	+45%	100/15 Summer				38.215	0.215	0.000
130.005	BRANCH	15 Summer	100	+45%					36.896	0.000	0.000
135.000	RWP84	60 Summer	100	+45%	100/15 Summer				38.211	0.211	0.000
130.006	S414	60 Summer	100	+45%	30/15 Summer				38.208	1.562	0.000
122.008	S415	60 Summer	100	+45%	30/15 Summer				38.194	1.739	0.000
106.016	S416	15 Winter	100	+45%	30/15 Summer	100/15 Summer			38.002	1.877	2.234
136.000	RWP85	60 Summer	100	+45%	100/15 Summer				37.835	0.835	0.000
106.017	S417	60 Summer	100	+45%	30/15 Summer	100/15 Summer			37.826	1.783	82.262
137.000	RWP86	60 Summer	100	+45%	100/15 Summer				37.777	0.777	0.000
106.018	S418	60 Summer	100	+45%	30/15 Summer	100/15 Summer			37.755	1.774	13.350
106.019	S419	60 Summer	100	+45%	30/15 Summer				37.750	1.881	0.000
138.000	RWP87	15 Summer	100	+45%					37.906	-0.094	0.000
106.020	BRANCH	15 Summer	100	+45%					35.829	0.000	0.000
139.000	RWP88	15 Summer	100	+45%					37.914	-0.086	0.000
106.021	BRANCH	15 Summer	100	+45%					35.802	0.000	0.000
140.000	RWP89	15 Summer	100	+45%					37.906	-0.094	0.000
106.022	S420	60 Winter	100	+45%	30/15 Summer				37.379	1.619	0.000
141.000	RWP90	15 Summer	100	+45%					37.899	-0.101	0.000
106.023	BRANCH	15 Summer	100	+45%					35.728	0.000	0.000
142.000	RWP91	15 Summer	100	+45%					37.897	-0.103	0.000
106.024	BRANCH	15 Summer	100	+45%					35.703	0.000	0.000
143.000	RWP92	15 Summer	100	+45%					37.898	-0.102	0.000
106.025	BRANCH	15 Summer	100	+45%					35.675	0.000	0.000
144.000	GULLEY	15 Summer	100	+45%	30/15 Summer	100/15 Summer			38.850	0.900	0.291
144.001	S421	15 Summer	100	+45%	30/15 Summer				38.483	0.741	0.000
106.026	S422	60 Winter	100	+45%	30/15 Summer				37.143	1.490	0.000
145.000	RWP93	15 Summer	100	+45%					37.850	-0.150	0.000
106.027	BRANCH	15 Summer	100	+45%					35.643	0.000	0.000
146.000	RWP94	15 Summer	100	+45%					37.850	-0.150	0.000
106.028	BRANCH	15 Summer	100	+45%					35.616	0.000	0.000
147.000	RWP95	15 Summer	100	+45%					37.850	-0.150	0.000
106.029	BRANCH	15 Summer	100	+45%					35.578	0.000	0.000
148.000	RWP96	15 Summer	100	+45%					37.850	-0.150	0.000

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
123.000	RWP75	0.30			8.6	FLOOD	3
122.002	BRANCH	1.06			17.6	SURCHARGED*	
124.000	RWP76	0.27			9.0	FLOOD RISK	
122.003	BRANCH	1.77			23.8	SURCHARGED*	
125.000	SDP7	2.70			561.2	FLOOD	5
126.000	SDP8	0.36			74.5	FLOOD RISK	
122.004	S410(V)	0.85			474.0	FLOOD	5
127.000	SDP9	2.74			569.1	FLOOD	5
122.005	S411(V)	1.48			899.8	FLOOD	4
128.000	RWP77	0.18			8.8	FLOOD RISK	
122.006	BRANCH	1.44			1095.9	SURCHARGED*	
129.000	RWP78	0.20			10.5	SURCHARGED	
122.007	BRANCH	1.60			1108.8	SURCHARGED*	
130.000	RWP79	0.07			2.3	SURCHARGED	
130.001	S412	0.13			2.2	SURCHARGED	
131.000	RWP80	0.87			12.8	FLOOD	6
130.002	S413	1.02			16.6	SURCHARGED	
132.000	RWP81	0.06			3.2	SURCHARGED	
130.003	BRANCH	0.72			12.7	SURCHARGED*	
133.000	RWP82	0.35			10.1	FLOOD	6
130.004	BRANCH	1.25			22.3	SURCHARGED*	
134.000	RWP83	0.05			3.5	SURCHARGED	
130.005	BRANCH	1.21			21.5	SURCHARGED*	
135.000	RWP84	0.03			2.5	SURCHARGED	
130.006	S414	1.76			27.2	SURCHARGED	
122.008	S415	0.91			821.9	SURCHARGED	
106.016	S416	1.77			1279.5	FLOOD	5
136.000	RWP85	0.16			10.0	SURCHARGED	
106.017	S417	1.54			1048.5	FLOOD	6
137.000	RWP86	0.16			10.3	SURCHARGED	
106.018	S418	1.37			1046.8	FLOOD	2
106.019	S419	1.82			990.4	SURCHARGED	
138.000	RWP87	0.29			25.0	OK	
106.020	BRANCH	1.33			1019.1	SURCHARGED*	
139.000	RWP88	0.37			31.6	OK	
106.021	BRANCH	1.20			1029.3	SURCHARGED*	
140.000	RWP89	0.29			25.4	OK	
106.022	S420	2.07			949.7	SURCHARGED	
141.000	RWP90	0.23			19.8	OK	
106.023	BRANCH	1.28			976.2	SURCHARGED*	
142.000	RWP91	0.21			18.8	OK	
106.024	BRANCH	1.29			982.5	SURCHARGED*	
143.000	RWP92	0.22			19.4	OK	
106.025	BRANCH	1.30			990.4	SURCHARGED*	
144.000	GULLEY	1.46			41.8	FLOOD	1
144.001	S421	1.66			38.7	SURCHARGED	
106.026	S422	1.86			957.3	SURCHARGED	
145.000	RWP93	0.00			0.0	OK	
106.027	BRANCH	1.26			979.2	SURCHARGED*	
146.000	RWP94	0.00			0.0	OK	
106.028	BRANCH	1.19			969.9	SURCHARGED*	
147.000	RWP95	0.00			0.0	OK	
106.029	BRANCH	1.24			961.4	SURCHARGED*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
148.000	RWP96	0.00			0.0	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
106.030	S423	60 Summer	100	+45%	30/30 Summer				36.752	1.201
149.000	RWP96	15 Summer	100	+45%					37.905	-0.095
106.031	BRANCH	15 Summer	100	+45%					35.517	0.000
150.000	RWP97	15 Summer	100	+45%					37.905	-0.095
106.032	BRANCH	15 Summer	100	+45%					35.497	0.000
151.000	SDP10	15 Summer	100	+45%	1/15 Summer	100/15 Summer			39.069	1.194
151.001	S424(V)	15 Summer	100	+45%	30/15 Summer				38.185	0.835
152.000	RWP98	15 Summer	100	+45%	100/15 Summer				38.010	0.010
151.002	S425	15 Summer	100	+45%	30/15 Summer				37.961	0.649
153.000	RWP99	15 Summer	100	+45%	100/15 Summer				37.764	0.014
151.003	BRANCH	15 Summer	100	+45%					37.243	0.000
154.000	RWP100	15 Summer	100	+45%					37.632	-0.118
151.004	BRANCH	15 Summer	100	+45%					37.237	0.000
106.033	S426	60 Summer	100	+45%	100/15 Summer				36.501	1.061
155.000	RWP101	15 Summer	100	+45%					37.908	-0.092
155.001	S427	15 Summer	100	+45%					37.501	-0.031
156.000	RWP102	15 Summer	100	+45%					37.655	-0.095
155.002	BRANCH	15 Summer	100	+45%					37.185	0.000
157.000	RWP103	15 Summer	100	+45%					37.631	-0.119
155.003	BRANCH	15 Summer	100	+45%					37.154	0.000
106.034	S428	60 Summer	100	+45%	100/15 Summer				36.249	0.998
158.000	RWP106	15 Summer	100	+45%					37.936	-0.014
158.001	S429	15 Summer	100	+45%	30/15 Summer				37.929	0.120
159.000	RWP107	15 Summer	100	+45%					37.914	-0.086
160.000	SDP11	15 Summer	100	+45%	1/15 Summer	100/15 Summer			39.060	1.185
158.002	S430(V)	15 Summer	100	+45%	30/15 Summer				37.910	0.560
106.035	S431	30 Summer	100	+45%	30/30 Summer				36.001	0.951
106.036	S432(SUDS)	30 Summer	100	+45%	100/15 Summer				35.588	0.596
106.037	ATT INLET 03	15 Summer	100	+45%					34.968	0.000
161.000	OB31	30 Summer	100	+45%	30/15 Summer	100/15 Summer			38.562	0.907
161.001	S300	30 Summer	100	+45%	100/15 Summer				38.517	0.930
162.000	OB32	30 Summer	100	+45%	100/15 Summer	100/15 Summer			38.556	0.901
161.002	S301	30 Summer	100	+45%	30/15 Summer				38.441	1.729
163.000	OB33	15 Summer	100	+45%	100/15 Summer				38.163	0.782
161.003	BRANCH	15 Summer	100	+45%					36.306	0.000
161.004	S302	30 Summer	100	+45%	100/15 Summer				37.895	1.742
164.000	OB34	30 Summer	100	+45%	100/15 Summer	100/15 Summer			37.706	0.841
161.005	BRANCH	15 Summer	100	+45%					35.864	0.000
165.000	OB37	30 Summer	100	+45%	100/15 Summer	100/15 Summer			37.697	0.982
166.000	OB35	30 Summer	100	+45%	100/15 Summer	100/15 Summer			37.614	0.904
166.001	S303	30 Summer	100	+45%	30/15 Summer				37.619	1.909
167.000	OB36	30 Summer	100	+45%	100/15 Summer	100/15 Summer			38.076	0.901
161.006	S304	30 Summer	100	+45%	30/15 Summer				37.638	2.337
168.000	OB38	30 Summer	100	+45%	100/15 Summer	100/15 Summer			37.693	0.903
161.007	S305	30 Summer	100	+45%	30/15 Summer				37.495	2.394
169.000	OB39	30 Summer	100	+45%	100/15 Summer				37.547	0.757
161.008	BRANCH	15 Summer	100	+45%					34.930	0.000
170.000	OB40	30 Summer	100	+45%	100/30 Summer				37.133	0.100
161.009	S306	30 Summer	100	+45%	30/15 Summer				37.096	2.213
171.000	OB40a	15 Summer	100	+45%					36.979	-0.054
172.000	OB41	30 Summer	100	+45%	100/15 Summer				36.977	0.187
161.010	S307	30 Summer	100	+45%	30/15 Summer				36.838	2.042
173.000	OB42	15 Summer	100	+45%					36.700	-0.150
161.011	BRANCH	15 Summer	100	+45%					34.721	0.000

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
106.030	S423	0.000	2.03			964.1	SURCHARGED	
149.000	RWP96	0.000	0.28			25.5	OK	
106.031	BRANCH	0.000	1.27			968.8	SURCHARGED*	
150.000	RWP97	0.000	0.28			25.5	OK	
106.032	BRANCH	0.000	1.04			970.9	SURCHARGED*	
151.000	SDP10	69.428	2.58			391.0	FLOOD	5
151.001	S424(V)	0.000	2.33			372.0	SURCHARGED	
152.000	RWP98	0.000	0.25			12.8	SURCHARGED	
151.002	S425	0.000	1.89			377.3	SURCHARGED	
153.000	RWP99	0.000	0.29			12.8	SURCHARGED	
151.003	BRANCH	0.000	1.57			389.1	SURCHARGED*	
154.000	RWP100	0.000	0.10			4.2	OK	
151.004	BRANCH	0.000	1.58			392.9	SURCHARGED*	
106.033	S426	0.000	1.09			1268.0	SURCHARGED	
155.000	RWP101	0.000	0.32			13.5	OK	
155.001	S427	0.000	0.56			12.5	OK	
156.000	RWP102	0.000	0.29			13.4	OK	
155.002	BRANCH	0.000	2.22			24.5	SURCHARGED*	
157.000	RWP103	0.000	0.09			4.3	OK	
155.003	BRANCH	0.000	1.37			28.1	SURCHARGED*	
106.034	S428	0.000	1.10			1306.6	SURCHARGED	
158.000	RWP106	0.000	0.17			4.0	OK	
158.001	S429	0.000	0.12			3.8	SURCHARGED	
159.000	RWP107	0.000	0.08			4.0	OK	
160.000	SDP11	59.746	2.77			420.2	FLOOD	5
158.002	S430(V)	0.000	2.17			425.0	SURCHARGED	
106.035	S431	0.000	2.55			1688.9	SURCHARGED	
106.036	S432(SUDS)	0.000	2.60			1692.7	SURCHARGED	
106.037	ATT INLET 03	0.000	1.25			1465.7	SURCHARGED*	
161.000	OB31	7.290	3.20			52.3	FLOOD	5
161.001	S300	0.000	0.77			41.5	FLOOD RISK	
162.000	OB32	0.689	0.60			36.2	FLOOD	3
161.002	S301	0.000	1.31			64.8	FLOOD RISK	
163.000	OB33	0.000	0.28			18.3	FLOOD RISK	
161.003	BRANCH	0.000	1.48			77.1	SURCHARGED*	
161.004	S302	0.000	0.86			88.2	FLOOD RISK	
164.000	OB34	16.272	0.73			102.4	FLOOD	5
161.005	BRANCH	0.000	1.19			150.2	SURCHARGED*	
165.000	OB37	6.780	0.84			62.3	FLOOD	5
166.000	OB35	4.507	0.69			29.2	FLOOD	5
166.001	S303	0.000	1.72			29.7	SURCHARGED	
167.000	OB36	1.126	0.67			118.0	FLOOD	2
161.006	S304	0.000	1.44			247.1	FLOOD RISK	
168.000	OB38	3.190	0.69			126.8	FLOOD	2
161.007	S305	0.000	1.43			334.0	FLOOD RISK	
169.000	OB39	0.000	0.61			117.0	FLOOD RISK	
161.008	BRANCH	0.000	1.82			452.5	SURCHARGED*	
170.000	OB40	0.000	0.55			20.7	SURCHARGED	
161.009	S306	0.000	2.02			416.8	SURCHARGED	
171.000	OB40a	0.000	0.73			27.6	OK	
172.000	OB41	0.000	1.02			84.0	SURCHARGED	
161.010	S307	0.000	1.71			499.1	SURCHARGED	
173.000	OB42	0.000	0.00			0.0	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
161.011	BRANCH	0.000	1.46			508.3	SURCHARGED*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
174.000	OB43	15 Summer	100	+45%	100/15 Summer				37.868	0.453
161.012	S308	30 Summer	100	+45%	100/15 Summer				36.483	1.824
175.000	OB44	15 Summer	100	+45%					37.513	-0.052
161.013	BRANCH	15 Summer	100	+45%					34.574	0.000
176.000	OB45	15 Summer	100	+45%	100/15 Summer				37.724	0.084
161.014	S309	30 Summer	100	+45%	100/15 Summer				35.912	1.509
177.000	OB46	15 Summer	100	+45%					37.470	-0.095
161.015	S310	30 Summer	100	+45%	100/15 Summer				35.584	1.333
178.000	OB47	15 Summer	100	+45%					37.429	-0.086
161.016	BRANCH	15 Summer	100	+45%					34.201	0.000
179.000	OB48	15 Summer	100	+45%					37.455	-0.095
180.000	OB49	15 Summer	100	+45%	100/15 Summer				38.152	0.484
161.017	S311	30 Summer	100	+45%	100/15 Summer				35.028	0.953
181.000	OB50	15 Summer	100	+45%	100/15 Summer				38.458	0.841
181.001	S312	15 Summer	100	+45%	100/15 Summer				38.219	0.776
182.000	OB51	15 Summer	100	+45%					37.608	-0.059
181.002	S313	15 Summer	100	+45%	100/15 Summer				37.442	0.417
183.000	OB52	15 Summer	100	+45%					37.521	-0.059
181.003	BRANCH	15 Summer	100	+45%					36.366	0.000
181.004	S314	15 Summer	100	+45%	30/15 Summer				36.472	0.392
184.000	OB53	15 Summer	100	+45%					37.441	-0.089
161.018	S315	30 Summer	100	+45%	100/15 Summer				34.638	0.703
161.019	INT02 (SUDS)	360 Winter	100	+45%	30/15 Summer				34.443	0.639
161.020	S316	360 Winter	100	+45%	100/15 Summer				34.442	0.669
161.021	ATT INLET 02	15 Summer	100	+45%					33.750	0.000
2.020	ATT TANK 01	360 Winter	100	+45%	30/60 Summer				34.438	0.838
2.021	CONNECTION	360 Winter	100	+45%	100/30 Summer				34.431	0.881
185.000	OB60	15 Summer	100	+45%	100/15 Summer	100/15 Summer			38.427	0.828
186.000	OB61	15 Summer	100	+45%	30/15 Summer	100/15 Summer			38.275	0.838
185.001	S500	15 Summer	100	+45%	30/15 Summer				38.268	1.073
185.002	S501	15 Summer	100	+45%	30/15 Summer				38.164	1.124
187.000	OB62	15 Summer	100	+45%	100/15 Summer	100/15 Summer			38.107	0.829
185.003	BRANCH	15 Summer	100	+45%					36.871	0.000
188.000	OB63	30 Summer	100	+45%	100/15 Summer				37.846	0.805
189.000	OB64	15 Summer	100	+45%	30/15 Summer	100/15 Summer			37.825	0.906
185.004	S502	15 Summer	100	+45%	30/15 Summer				37.764	1.128
190.000	OB65	15 Summer	100	+45%	30/15 Summer	100/15 Summer			37.619	0.900
185.005	BRANCH	15 Summer	100	+45%					36.508	0.000
191.000	OB66	15 Summer	100	+45%	100/15 Summer				37.095	0.326
185.006	S503	15 Summer	100	+45%	30/15 Summer				37.067	0.608
192.000	OB67	15 Summer	100	+45%	30/15 Summer				37.184	0.845
185.007	BRANCH	15 Summer	100	+45%					36.295	0.000
193.000	OB68	15 Summer	100	+45%					36.645	-0.071
185.008	BRANCH	15 Summer	100	+45%					36.151	0.000
194.000	OB69	30 Summer	100	+45%	30/15 Summer	100/15 Summer			37.325	0.847
195.000	OB70	30 Summer	100	+45%	30/15 Summer	100/15 Summer			37.273	0.923
194.001	S504	15 Summer	100	+45%	30/15 Summer				37.261	1.081
196.000	OB71	30 Summer	100	+45%	30/15 Summer	100/15 Summer			37.233	0.905
194.002	S505	15 Summer	100	+45%	30/15 Summer				37.217	1.172
197.000	OB72	15 Summer	100	+45%	100/15 Summer				37.171	0.706
198.000	OB73	15 Summer	100	+45%	30/15 Summer	100/15 Summer			37.236	0.841
194.003	S506	15 Summer	100	+45%	30/15 Summer				37.140	1.203
199.000	OB75	30 Summer	100	+45%	30/15 Summer	100/15 Summer			37.353	0.856
200.000	OB74	15 Summer	100	+45%	30/15 Summer				37.501	0.840

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
174.000	OB43	0.000	1.18			76.5	SURCHARGED	
161.012	S308	0.000	1.78			530.7	SURCHARGED	
175.000	OB44	0.000	0.75			81.5	OK	
161.013	BRANCH	0.000	1.59			583.1	SURCHARGED*	
176.000	OB45	0.000	1.03			176.5	SURCHARGED	
161.014	S309	0.000	1.53			664.6	SURCHARGED	
177.000	OB46	0.000	0.29			22.3	OK	
161.015	S310	0.000	1.89			665.7	SURCHARGED	
178.000	OB47	0.000	0.38			42.8	OK	
161.016	BRANCH	0.000	1.38			644.8	SURCHARGED*	
179.000	OB48	0.000	0.29			22.2	OK	
180.000	OB49	0.000	1.13			87.8	SURCHARGED	
161.017	S311	0.000	1.68			720.4	SURCHARGED	
181.000	OB50	0.000	1.31			34.3	FLOOD RISK	
181.001	S312	0.000	1.39			30.5	SURCHARGED	
182.000	OB51	0.000	0.58			29.4	OK	
181.002	S313	0.000	0.84			53.5	SURCHARGED	
183.000	OB52	0.000	0.67			46.6	OK	
181.003	BRANCH	0.000	1.35			91.0	SURCHARGED*	
181.004	S314	0.000	1.74			90.8	SURCHARGED	
184.000	OB53	0.000	0.35			29.4	OK	
161.018	S315	0.000	2.25			808.8	SURCHARGED	
161.019	INT02 (SUDS)	0.000	0.64			230.6	SURCHARGED	
161.020	S316	0.000	0.90			230.3	SURCHARGED	
161.021	ATT INLET 02	0.000	1.24			750.1	SURCHARGED*	
2.020	ATT TANK 01	0.000	2.15			1767.3	SURCHARGED	
2.021	CONNECTION	0.000	1.39			1765.2	SURCHARGED	
185.000	OB60	3.141	0.66			95.0	FLOOD	4
186.000	OB61	13.254	0.77			94.3	FLOOD	5
185.001	S500	0.000	1.04			137.4	FLOOD RISK	
185.002	S501	0.000	0.95			128.1	SURCHARGED	
187.000	OB62	4.320	0.44			70.3	FLOOD	5
185.003	BRANCH	0.000	1.09			191.5	SURCHARGED*	
188.000	OB63	0.000	0.42			16.8	FLOOD RISK	
189.000	OB64	5.539	1.37			45.7	FLOOD	5
185.004	S502	0.000	1.67			231.4	FLOOD RISK	
190.000	OB65	0.261	0.95			27.3	FLOOD	3
185.005	BRANCH	0.000	2.28			244.7	SURCHARGED*	
191.000	OB66	0.000	0.23			5.1	SURCHARGED	
185.006	S503	0.000	1.24			250.3	SURCHARGED	
192.000	OB67	0.000	2.73			81.5	FLOOD RISK	
185.007	BRANCH	0.000	1.54			329.0	SURCHARGED*	
193.000	OB68	0.000	0.54			25.5	OK	
185.008	BRANCH	0.000	2.08			352.1	SURCHARGED*	
194.000	OB69	5.000	1.07			27.3	FLOOD	5
195.000	OB70	22.633	0.84			86.3	FLOOD	5
194.001	S504	0.000	1.15			93.6	FLOOD RISK	
196.000	OB71	5.386	1.07			32.7	FLOOD	5
194.002	S505	0.000	1.44			111.8	FLOOD RISK	
197.000	OB72	0.000	0.22			10.0	FLOOD RISK	
198.000	OB73	16.041	0.81			137.9	FLOOD	5
194.003	S506	0.000	1.08			238.8	FLOOD RISK	
199.000	OB75	5.902	0.74			31.4	FLOOD	5

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

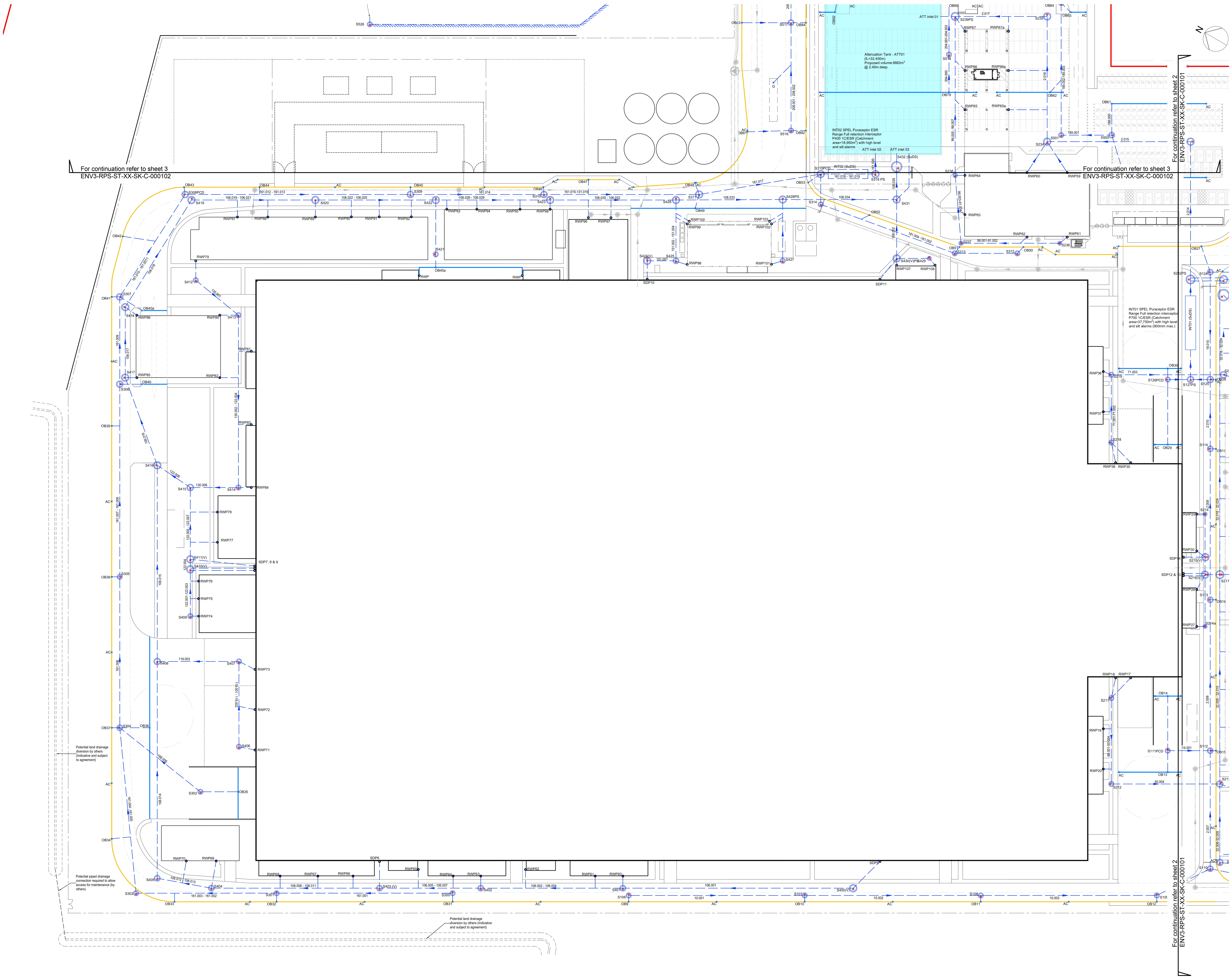
PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
200.000	OB74	0.000	0.48			14.5	FLOOD RISK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
200.001	S507	15 Summer	100	+45%	30/15 Summer				37.482	1.075
199.001	S508	15 Summer	100	+45%	30/15 Summer				37.334	1.296
201.000	OB76	15 Summer	100	+45%	100/15 Summer				37.308	0.740
194.004	S509	15 Summer	100	+45%	30/15 Summer				37.041	1.263
194.005	S510	15 Summer	100	+45%	30/15 Summer				36.901	1.204
202.000	OB77	15 Summer	100	+45%	100/15 Summer				36.952	0.203
194.006	S511	15 Summer	100	+45%	30/15 Summer				36.640	1.085
203.000	OB78	15 Summer	100	+45%					36.678	-0.071
194.007	S512	15 Summer	100	+45%	30/15 Summer				36.209	0.861
185.009	S513	15 Summer	100	+45%	30/15 Summer				35.993	0.779
204.000	OB79	15 Summer	100	+45%	30/15 Summer	100/15 Summer			38.110	0.792
204.001	S514	15 Winter	100	+45%	30/15 Summer				37.848	0.848
205.000	OB80	15 Summer	100	+45%	30/15 Summer	100/15 Summer			37.819	0.900
204.002	BRANCH	15 Summer	100	+45%					36.869	0.000
185.010	S515	15 Summer	100	+45%	30/15 Summer				35.832	0.670
206.000	OB83	15 Summer	100	+45%	30/15 Summer	100/15 Summer			37.901	0.901
207.000	OB84	15 Summer	100	+45%	100/15 Summer				37.661	0.551
208.000	OB81	15 Summer	100	+45%	30/15 Summer	100/15 Summer			38.142	0.845
209.000	OB82	15 Summer	100	+45%	100/15 Summer				37.961	0.699
208.001	S516	15 Summer	100	+45%	30/15 Summer				37.795	0.785
210.000	GULLY	15 Summer	100	+45%	100/15 Summer				37.502	0.017
208.002	BRANCH	15 Summer	100	+45%					36.836	0.000
206.001	S517	15 Summer	100	+45%	30/15 Summer				37.354	0.630
211.000	OB90A	15 Summer	100	+45%	100/15 Summer				37.033	0.083
212.000	OB90	15 Summer	100	+45%	100/15 Summer				37.032	0.082
213.000	OB85	15 Summer	100	+45%	100/15 Summer				37.779	0.841
214.000	OB86	30 Summer	100	+45%	30/15 Summer	100/15 Summer			37.526	0.848
213.001	S518	15 Summer	100	+45%	30/15 Summer				37.567	1.162
215.000	OB87	15 Summer	100	+45%	100/15 Summer	100/15 Summer			37.720	0.850
213.002	BRANCH	15 Summer	100	+45%					36.260	0.000
216.000	OB88	15 Summer	100	+45%	100/15 Summer				37.559	0.562
217.000	OB89	15 Summer	100	+45%	100/15 Summer				37.333	0.297
213.003	S519	15 Summer	100	+45%	30/15 Summer				37.185	1.093
206.002	S520	15 Summer	100	+45%	100/15 Summer				37.025	1.003
218.000	OB92	15 Summer	100	+45%					36.928	-0.095
219.000	OB91	15 Summer	100	+45%	100/15 Summer				36.770	0.262
220.000	OB93	15 Summer	100	+45%	100/15 Summer				36.878	0.488
206.003	S521	15 Summer	100	+45%	100/15 Summer				36.599	0.926
221.000	OB94	15 Summer	100	+45%	100/15 Summer				36.848	0.395
206.004	BRANCH	15 Summer	100	+45%					35.264	0.000
222.000	OB95	15 Summer	100	+45%					36.651	-0.099
185.011	S522	15 Summer	100	+45%	30/15 Summer				35.638	0.523
185.012	INT03 (SUDS)	15 Summer	100	+45%	30/15 Summer				35.318	0.549
185.013	S523	15 Summer	100	+45%	30/15 Summer				34.997	0.255
185.014	ATT INLET 04	360 Winter	100	+45%					34.425	-0.299
2.022	ATT TANK 02	360 Winter	100	+45%	30/60 Summer				34.425	1.600
2.023	S523	360 Summer	100	+45%	1/360 Summer				34.747	1.959
2.024	S524 (SUDS)	360 Winter	100	+45%	1/240 Summer				34.901	2.181
2.025	SWPS01	360 Winter	100	+45%	1/120 Summer				35.025	2.540
2.026	458	120 Summer	100	+45%					36.300	0.000

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
200.001	S507	0.000	0.65			12.4	FLOOD RISK	
199.001	S508	0.000	1.74			32.6	FLOOD RISK	
201.000	OB76	0.000	0.54			30.3	FLOOD RISK	
194.004	S509	0.000	1.71			265.0	SURCHARGED	
194.005	S510	0.000	1.69			247.8	SURCHARGED	
202.000	OB77	0.000	0.65			44.6	SURCHARGED	
194.006	S511	0.000	1.52			260.5	SURCHARGED	
203.000	OB78	0.000	0.54			40.2	OK	
194.007	S512	0.000	1.23			281.7	SURCHARGED	
185.009	S513	0.000	1.30			623.3	SURCHARGED	
204.000	OB79	7.466	0.94			128.1	FLOOD	3
204.001	S514	0.000	1.76			130.3	SURCHARGED	
205.000	OB80	0.447	2.62			82.5	FLOOD	1
204.002	BRANCH	0.000	3.29			207.0	SURCHARGED*	
185.010	S515	0.000	1.44			826.2	SURCHARGED	
206.000	OB83	0.693	1.69			33.5	FLOOD	3
207.000	OB84	0.000	1.04			39.6	FLOOD RISK	
208.000	OB81	3.449	1.73			36.9	FLOOD	3
209.000	OB82	0.000	0.94			28.8	FLOOD RISK	
208.001	S516	0.000	1.45			53.9	SURCHARGED	
210.000	GULLY	0.000	0.01			0.3	SURCHARGED	
208.002	BRANCH	0.000	1.29			54.6	SURCHARGED*	
206.001	S517	0.000	2.08			117.4	SURCHARGED	
211.000	OB90A	0.000	0.09			5.5	SURCHARGED	
212.000	OB90	0.000	0.09			5.5	SURCHARGED	
213.000	OB85	0.000	0.70			29.1	FLOOD RISK	
214.000	OB86	5.981	1.65			37.3	FLOOD	4
213.001	S518	0.000	1.52			49.3	FLOOD RISK	
215.000	OB87	0.006	0.61			27.2	FLOOD	1
213.002	BRANCH	0.000	1.61			59.0	SURCHARGED*	
216.000	OB88	0.000	0.79			29.0	SURCHARGED	
217.000	OB89	0.000	0.51			30.5	SURCHARGED	
213.003	S519	0.000	1.51			97.9	SURCHARGED	
206.002	S520	0.000	1.21			237.4	SURCHARGED	
218.000	OB92	0.000	0.29			13.4	OK	
219.000	OB91	0.000	0.59			33.6	SURCHARGED	
220.000	OB93	0.000	0.75			90.1	SURCHARGED	
206.003	S521	0.000	0.95			325.2	SURCHARGED	
221.000	OB94	0.000	0.80			120.8	SURCHARGED	
206.004	BRANCH	0.000	2.05			434.8	SURCHARGED*	
222.000	OB95	0.000	0.25			19.8	OK	
185.011	S522	0.000	3.62			1269.5	SURCHARGED	
185.012	INT03 (SUDS)	0.000	3.35			1270.4	SURCHARGED	
185.013	S523	0.000	3.46			1268.7	SURCHARGED	
185.014	ATT INLET 04	0.000	0.11			306.7	OK*	
2.022	ATT TANK 02	0.000	1.75			207.5	SURCHARGED	
2.023	S523	0.000	0.97			193.1	SURCHARGED	
2.024	S524 (SUDS)	0.000	1.45			168.9	SURCHARGED	
2.025	SWPS01	0.000	4.56			151.2	SURCHARGED	
2.026	458	0.000	1.06			144.7	OK	



Plot 2 Proposed Site Surface Water Drainage Layout Sheet 1

Scale: 1:500

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4. The scheme is subject to statutory approvals, surveys and design development.
5. [illegible]

Drawing to be read in conjunction with:
252 - Proposed Surface Water Drainage Layout Sheet 2
253 - Proposed Surface Water Drainage Layout Sheet 3
254 - Proposed Foul Water Drainage Layout Sheet 1
255 - Proposed Foul Water Drainage Layout Sheet 2
256 - Proposed Foul Water Drainage Layout Sheet 3
257 - Surface Water Drainage Exceedance Plan

Surface Water Drainage Requirements

1. Outfall rates limited during all events and surcharged during 1in100+45%cc event as per ENV1 agreed discharge rates.
2. Internal manholes to be double sealed with internal plates.
3. Pump Stations:
   - 3.1. Duty and standby pump arrangements in pump stations.
   - 3.2. Variable pump rates where required (i.e. duty, standby and assist).
   - 3.3. ATEX rated chambers.
   - 3.4. Pumps to be linked to BMS/Gatehouse for remote shut down in emergencies.
   - 3.5. Back up power supply to be provided for pumpstations/ provision for standby generators to be brought to site in even of power outage.
4. Pollution Containment Device locations are subject to detail design / operations review.
5. Fire Fighting Water
   - 5.1. The volume of firefighting water required to be attenuated is subject to agree loment withcal fire authority

     No allowance is made for a dedicated spent fire water tank.

SuDS features

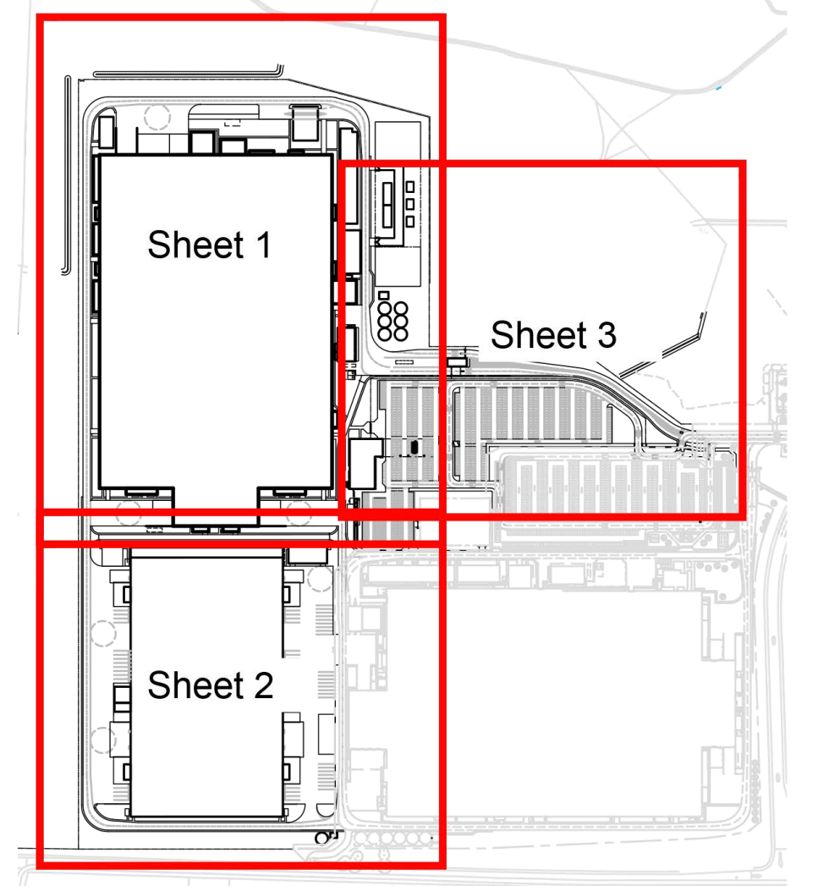
SuDS feature Schedule - Vortex separator (Stormcleanser by FPMCCANN)

1. SuDS feature 1 (S221) - 1No. vortex separator 410l/s treatment flow 1156 max. flow (4.0m• •chamber or equal approved).
2. SuDS feature 2 (S230) - 1No. vortex separator 253l/s treatment flow 737l/s max flow (3.0m• •chamber or equal approved).
3. SuDS feature 3 (S433) - 1No. vortex separators 301l/s treatment flow 1662l/s max flow (3.6m• •chamber (with 525mm• •bypass pipe).
4. SuDS feature 4 (S524) - 1No. vortex separator 131l/s treatment flow 196l/s max. flow (2.1m• •chamber or equal approved).

Spel SuDS features are as indicated within the drawing.

Key:

— — —	SW Sewer (I/D & Gradient)
S100	SW Manhole
▲	Pump station
▨	Pressure main
- - - -	Existing SW sewer
—	Linear drain
—	Kerb drain
▬	Class Z surround (& trench fill to underside of foundation where adjacent foundations)
⊠ OB	Outlet Box
⊠ AC	Access chamber for linear drain
● RWP	Rainwater Pipe (c/w RE)
⊠ G	Gully
PCD	Pollution Containment Device with manual / remotely actuatable valve subject to agreement with AESC .
PS	Penstock, manual operation to facilitate maintenance operations.
🟦	Surface Water Attenuation tank



Key Plan
Scale: 1:7500

P01	First issue	LMA	MM	20/09/23
Rev	Description	By	Ckd	Date

A TETRA TECH COMPANY
Sherwood House, Sherwood Avenue,
Newark, Nottinghamshire, NG24 1QQ
T:01636 605 700 E: rpsnewark@rpsgroup.com

Client

AESC Wates

Project AESC Giga Factories
Plot 2 Planning

Title Proposed Site Surface Water
Drainage Layout Sheet 1

RPS Project Number NK020439P
Scale @ A0 1:500
Date Created 20/09/23
Task Team Manager TH
Information Author LMA
Task Information Manager MM
Status S2 (Suitable for Information)
Document Number 251
Revision P01
Project Code - Originator - Function - Space - Type - Role - Number

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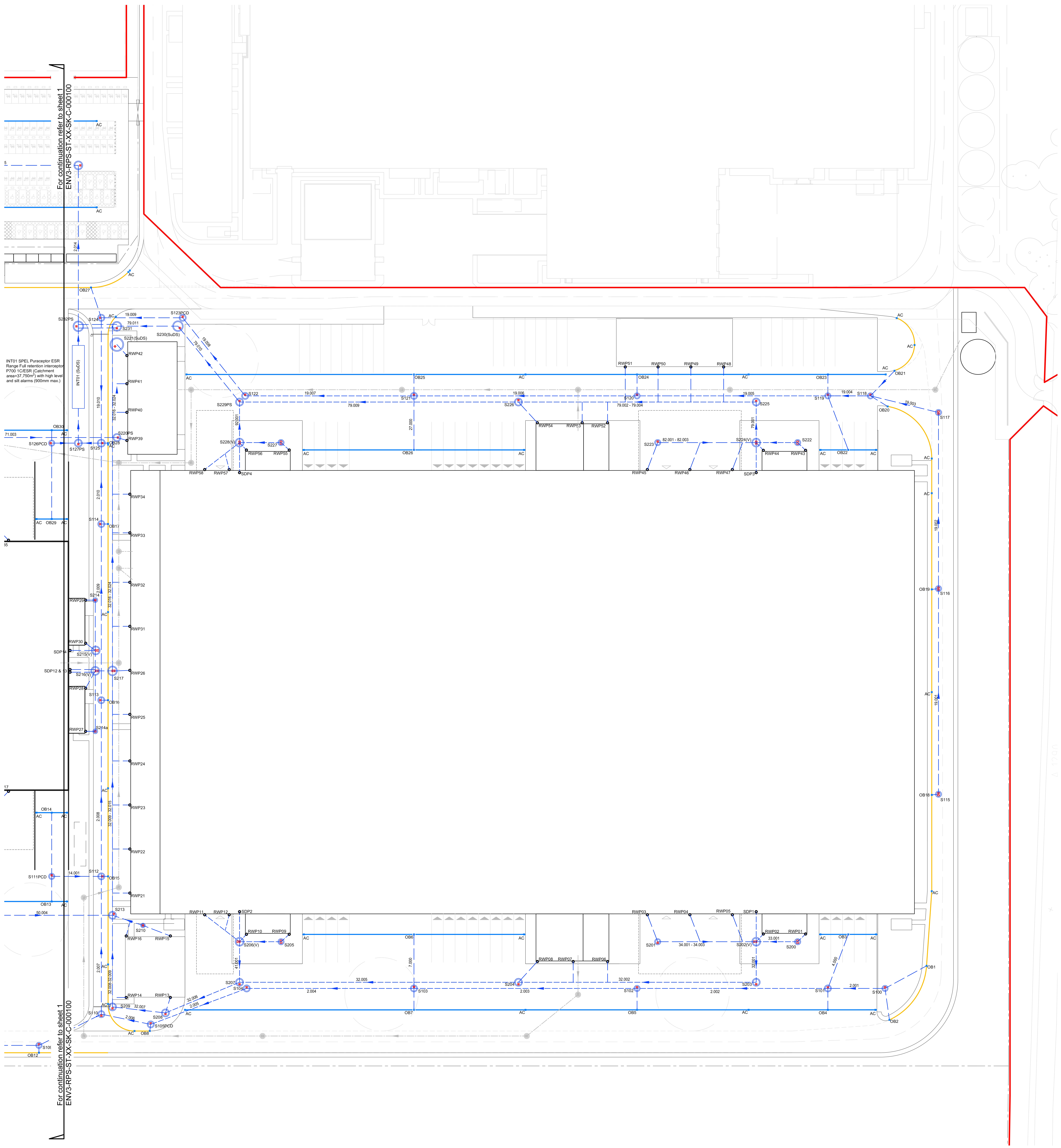

Plot 2 Proposed Site Surface Water Drainage Layout Sheet 2

Scale: 1:500

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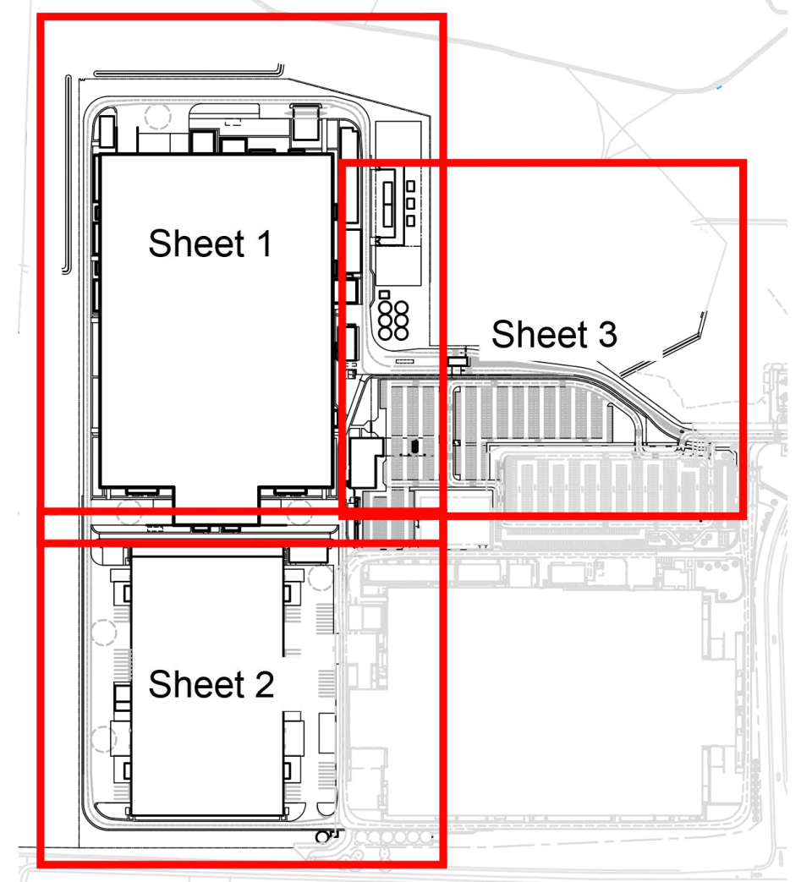
Drawing to be read in conjunction with:
251 - Proposed Surface Water Drainage Layout Sheet 1
253 - Proposed Surface Water Drainage Layout Sheet 3
254 - Proposed Foul Water Drainage Layout Sheet 1
255 - Proposed Foul Water Drainage Layout Sheet 2
256 - Proposed Foul Water Drainage Layout Sheet 3
257 - Surface Water Drainage Exceedance Plan

Key:

— — —	SW Sewer (I/D & Gradient)
S100 ⊠	SW Manhole
▲	Pump station
▨	Pressure main
- - - -	Existing SW sewer
━	Linear drain
━	Kerb drain
▬	Class Z surround (& trench fill to underside of foundation where adjacent foundations)
⊠ OB	Outlet Box
⊠ AC	Access chamber for linear drain
● RWP	Rainwater Pipe (c/w RE)
⊠ G	Gully
PCD	Pollution Containment Device with manual / remotely actuatable valve subject to agreement with AESC .
PS	Penstock, manual operation to facilitate maintenance operations.
▭	Surface Water Attenuation tank



Key Plan

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Rev	Description	By	Ckd	Date
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Client

AESC Wates

Project: AESC Giga Factories
Plot 2 Planning

Title: Proposed Site Surface Water
Drainage Layout Sheet 2

RPS Project Number	Scale @ A0	Date Created
NK020439P	1:500	20/09/23
Task Team Manager	Information Author	Task Information Manager
TH	LMA	MM

Status: S2 (Suitable for Information)

Document Number: 252

Revision: P01

Project Code - Originator - Function - Space - Type - Role - Number

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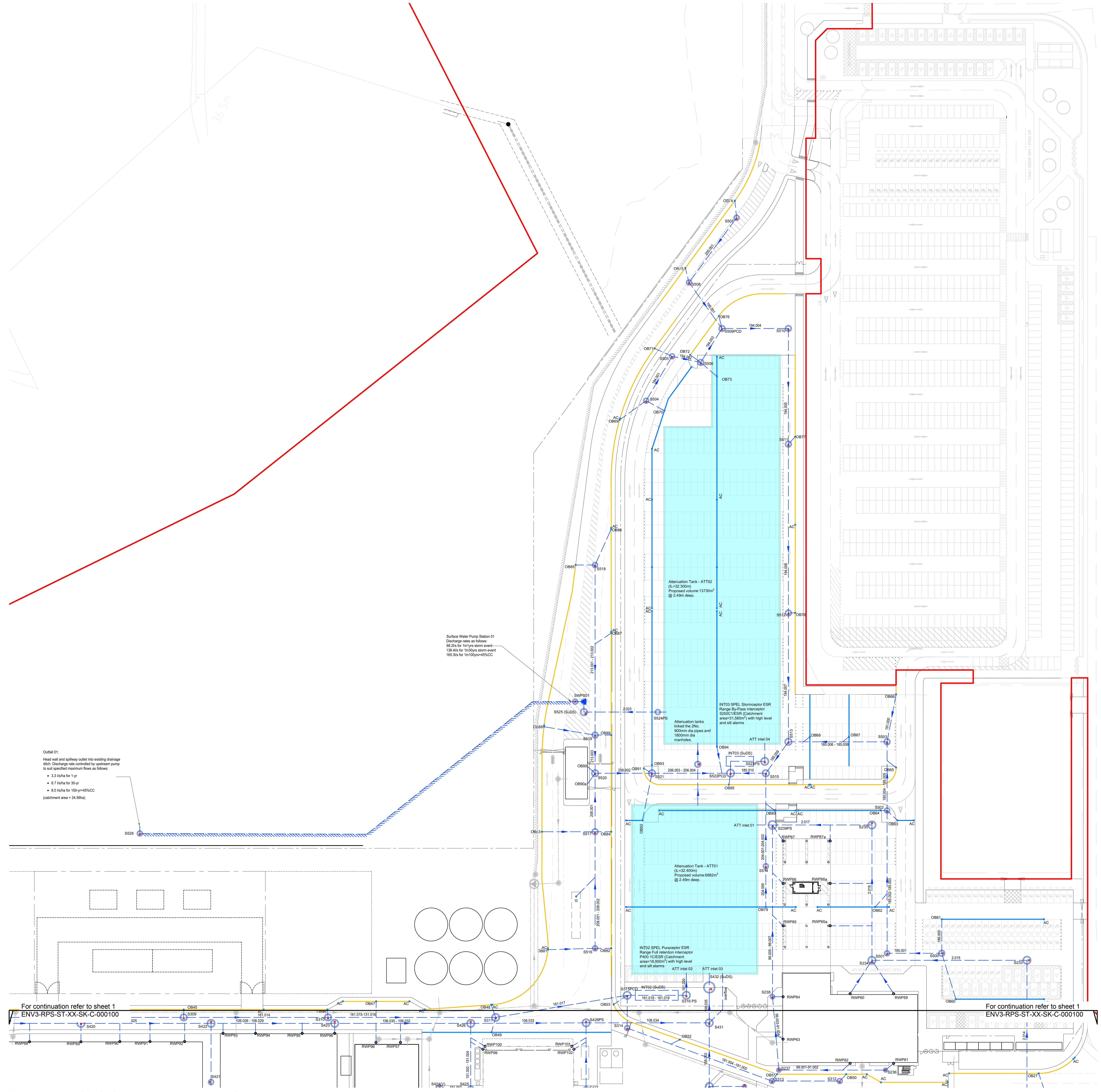

For continuation refer to sheet 1
ENV3-RPS-ST-XX-SK-C-000100

For continuation refer to sheet 1
ENV3-RPS-ST-XX-SK-C-000100

Surface Water Pump Station 01
Discharge rates as follows:
68.2l/s for 1in1yrs storm event
138.4l/s for 1in30yrs storm event
165.3l/s for 1in100yrs+45%CC

Outfall 01:

Head wall and spillway outlet into existing drainage ditch. Discharge rate controlled by upstream pump to suit specified maximum flows as follows:

- 3.3 l/s/ha for 1-yr
- 6.7 l/s/ha for 30-yr
- 8.0 l/s/ha for 100-yr+45%CC

(catchment area = 24.56ha)

Attenuation Tank - ATT02
(IL=32.300m)
Proposed volume:13730m^3
@ 2.49m deep.

Attenuation tanks linked the 2No. 900mm dia pipes and 1800mm dia manholes.

INT03 SPEL Stormceptor ESR Range By-Pass interceptor 5250C1/ESR (Catchment area=31,580m^2) with high level and silt alarms

Attenuation Tank - ATT01
(IL=32.400m)
Proposed volume:6882m^3
@ 2.49m deep.

INT02 SPEL Puraceptor ESR Range Full retention interceptor P400 1C/ESR (Catchment area=18,950m^3) with high level and silt alarms

Plot 2 Proposed Site Surface Water Drainage Layout Sheet 3
Scale: 1:500

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Drawing to be read in conjunction with:
251 - Proposed Surface Water Drainage Layout Sheet 1
252 - Proposed Surface Water Drainage Layout Sheet 2
254 - Proposed Foul Water Drainage Layout Sheet 1
255 - Proposed Foul Water Drainage Layout Sheet 2
256 - Proposed Foul Water Drainage Layout Sheet 3
257 - Surface Water Drainage Exceedance Plan

Key:

— — —	SW Sewer (I/D & Gradient)
S100	SW Manhole
▲	Pump station
▨	Pressure main
- - - -	Existing SW sewer
—	Linear drain
—	Kerb drain
▬	Class Z surround (& trench fill to underside of foundation where adjacent foundations)
⊠ OB	Outlet Box
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● RWP	Rainwater Pipe (c/w RE)
⊠ G	Gully
PCD	Pollution Containment Device with manual / remotely actuatable valve subject to agreement with AESC .
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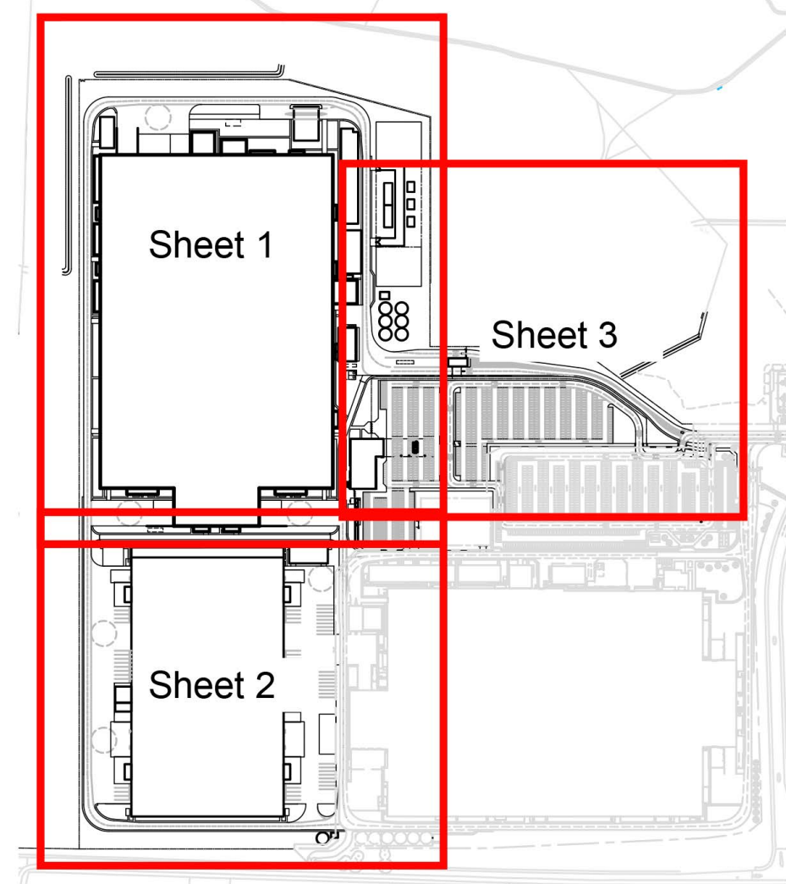
🟦	Surface Water Attenuation tank



Key Plan
Scale: 1:7500

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Client

AESC Wates

Project AESC Giga Factories
Plot 2 Planning

Title Proposed Site Surface Water
Drainage Sheet 3

RPS Project Number NK020439-P
Scale @ A0 1:500
Date Created 20/09/23
Task Team Manager TH
Information Author LMA
Task Information Manager MM
Status S2 (Suitable for Information)
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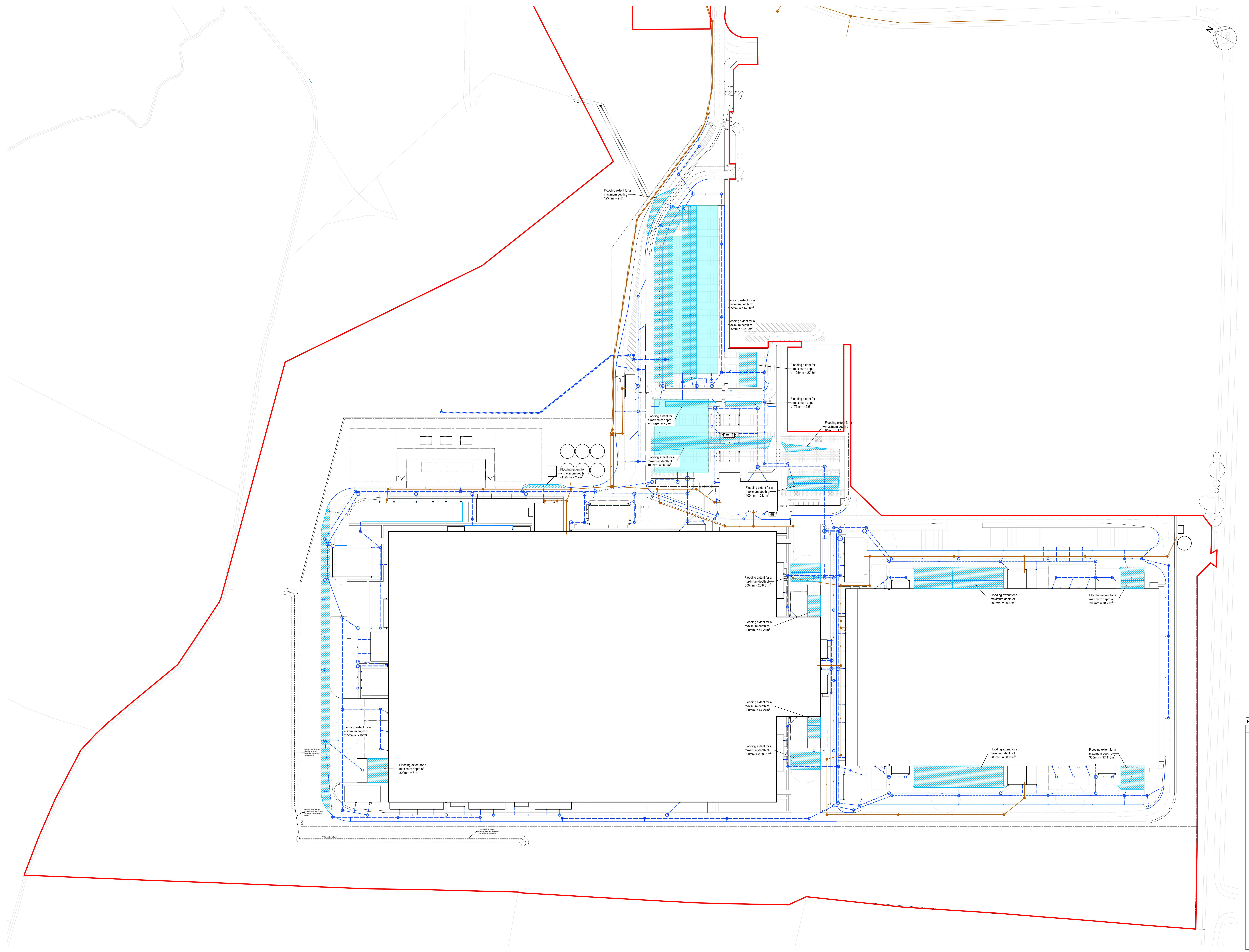

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5. [illegible]

Surface Water drainage Notes

1. Exceedences illustrated are for 1 in 100 year rainfall event plus 45% climate change.

Drawing to be read in conjunction with:
251 - Proposed Surface Water Drainage Layout Sheet 1
252 - Proposed Surface Water Drainage Layout Sheet 2
253 - Proposed Surface Water Drainage Layout Sheet 3
254 - Proposed Foul Water Drainage Layout Sheet 1
255 - Proposed Foul Water Drainage Layout Sheet 2
256 - Proposed Foul Water Drainage Layout Sheet 3

P01	First issue	LMA	MM	20/09/23
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Client

AESC Wates

Project
AESC Giga Factories
Plot 2 Planning

Title
Proposed Site Surface Water
Drainage Exceedance Plan

RPS Project Number	Scale @ A0	Date Created
NK020439-P	1:1000	20/09/23
Task Team Manager	Information Author	Task Information Manager
TH	LMA	MM

Status
S2 (Suitable for Information)

Document Number
257

Revision
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Project Code - Originator - Function - Space - Type - Role - Number

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