ENGINEERING GROUP

# PROPOSED COMMERCIAL UNIT, STONEY BROOK FARM, EASTERGATE LANE, WALBERTON, BN18 0BA

Flood Risk Assessment

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# Revisions and Additional Material

## *Document History and Status*

| Revision | Date | Purpose/Status |
|---|---|---|
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## *Document Details*

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# 1 Introduction and Limitation

## *1.1 Introduction*

1.1.1 MJ Engineering Group (MJEG) has been commissioned by New City Joinery Ltd to carry out a Flood Risk Assessment and drainage strategy for the relocation of the existing New City business at Stoney Brook Farm in Walberton. The proposed layout can be found in Appendix A.

1.1.2 It is proposed to submit the Flood Risk Assessment to the Planning Authority as part of a planning application. Specifically, this assessment intends to review the following:

- Flood Risk Zone,
- Flood Risk from Overland Surface Water,
- Flood Risk from Reservoir,
- Assessment of the impact of the proposal,
- Review the existing Drainage provision that serve the existing development.

## *1.2 Limitation*

1.1.3 This Report has been prepared by MJ Engineering Group Ltd (MJEG) for the sole use of the "client" for the purpose of supporting a planning application.

1.2.2 The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by MJEG has not been independently verified unless otherwise stated in this Report.

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# 2 Site Description

## *2.1 Site Location and Existing Condition*

2.1.1 The application site is located in the village of Walberton to be south of the County of West Sussex, within the district of Arun, as shown in Figure 1 below.

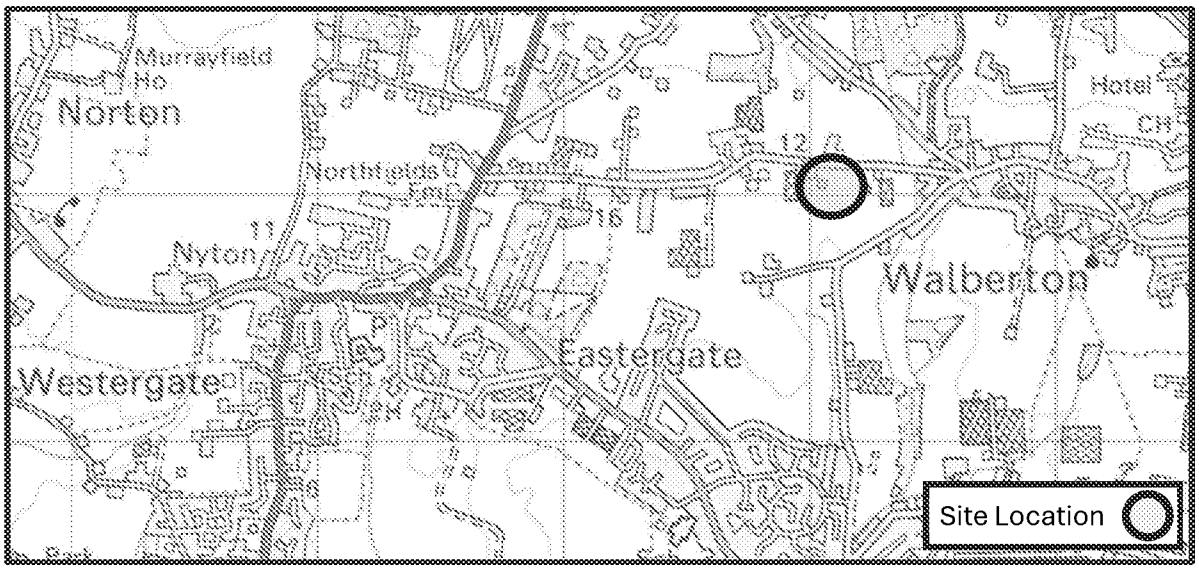



Figure 1: Wider Site Location

2.1.2 The site is situated to the west of the village along the lane known as Eastergate Lane. The site location in relation to the surrounding area is shown in Figure 2.

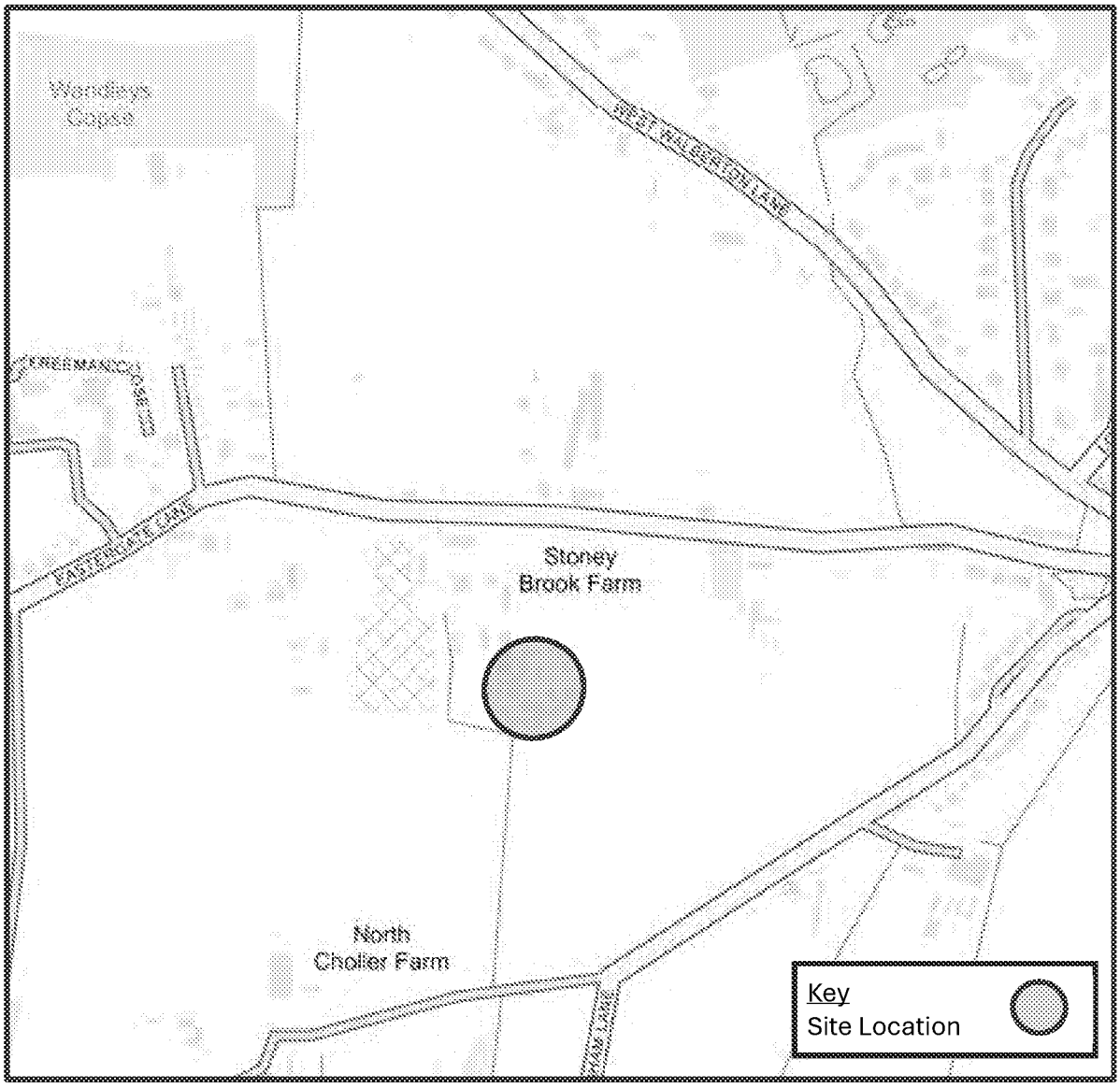



Figure 2: Site Location

2.1.3 In the immediate vicinity there are farms, garden nurseries and small business outlets. There is a watercourse located to the south of the site. The outfall pipe is a 100mm dia. pipe as the photograph below.

Photograph 1: Surface Water Outfall

2.1.4 The site is located at Ordnance Survey (OS) grid reference of SU960060 and covers a site area of circa. 0.35ha.

## 2.2 Background

2.2.1 The neighbouring site, at Brookview Nursery, has been the subject of a recent planning appeal for the redevelopment to offices and workshops (APP/C3810/W/23/3316638) which was allowed.

2.2.2 The supporting Flood Risk Assessment and Drainage Strategy to the appeal documentation provides an indication of the surrounding ground conditions for the area. The approved development identified the best form of surface water drainage and assists in providing third party information.

2.2.3 The approved drainage strategy was based on a restricted outfall to the existing watercourse, with the allowance for possible infiltration, should it be achievable.

## 2.3 Existing Sewer Assets

2.3.1 The adoptable sewer records have been obtained from Southern Water. The plan shows adoptable foul water sewer located in Eastergate Lane as Figure 3, with no surface water present. The records can be found in Appendix B.

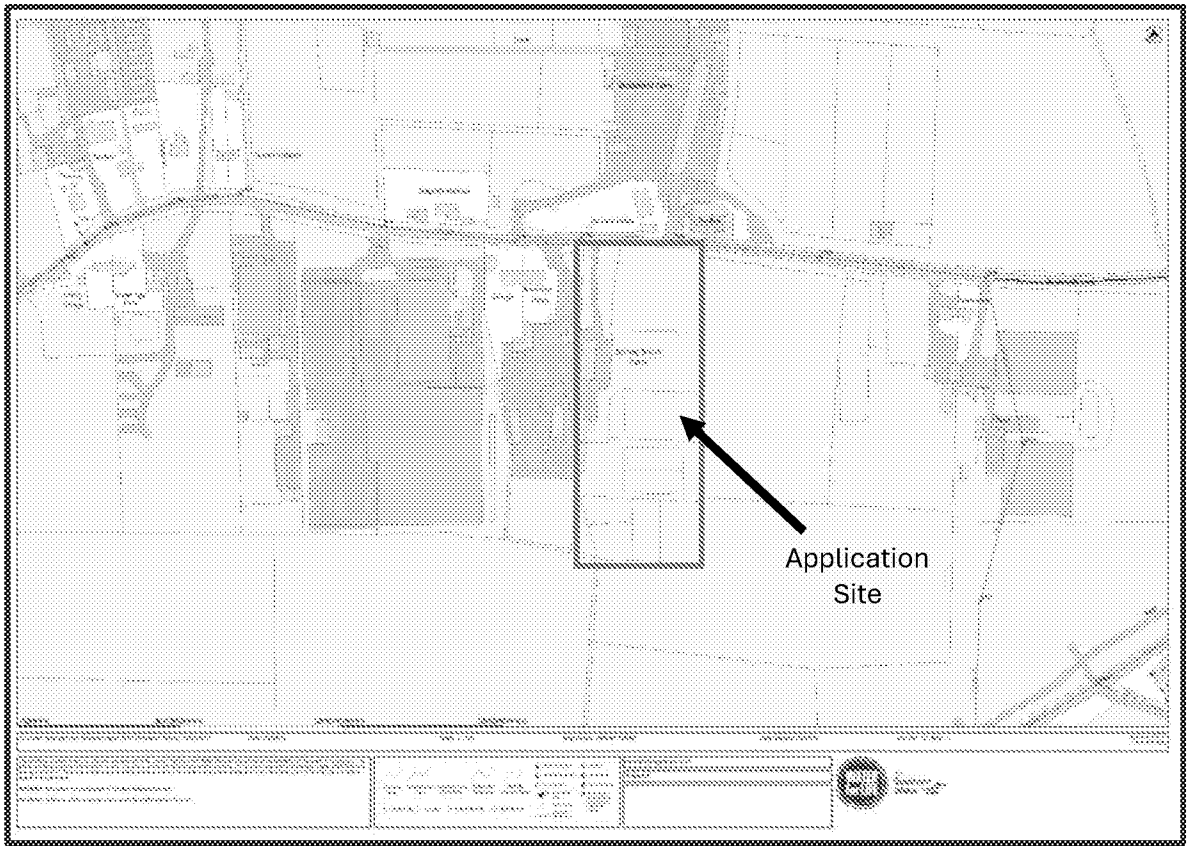



Figure 3: Extract from Southern Water records.

2.3.2 With no surface water sewer present, this would indicate either infiltration will be viable or that land is discharging to a watercourse.

## 2.4 Existing Drainage Regime

2.4.1 The existing site currently has a converted barn, and commercial workshop. The site benefits from a gravel access road with parking provision for the residential units and for the workshop.

2.4.2 The existing surface water from the residential barn outfalls via downpipes to a 100mm dia. pipe that falls south to the existing watercourse known as the 'Chalk Stream'. The existing surface water drainage is shown on drawing A001-013/100 which can be found in Appendix C.

2.4.3 There is an aco channel set below the gravel across the access which collects some surface water from the access road, however the majority drains through infiltration.

2.4.4 To determine the likely discharge rate to the Chalk Stream the Modified rational method as set out The SuDS Manual 2015 Eq.24.5 has been used, along with modelling the existing drainage network for the discharge rate during the extreme storm event.

Using Eq. 24.5 – $Q=2.78CIA$

Where: -

Q= design peak rate (l/s)

C= non-dimensional runoff coefficient (C=CvxCr)

Cv=volumetric runoff coefficient (0.6)

Cr=dimensionless routing coefficient (1.3)

i=rainfall intensity (mm/hr) (50)

A=catchment area (ha) (0.037)

2.4.5 When the existing drainage network is modelled using the latest drainage hydraulic software, the discharge rate will vary depending on the storm intensity. In reviewing storm events up to 1 in 100 plus climate change, the discharge rates to watercourse are tabled below, with hydraulic calculations shown in Appendix C.

| *Storm* | *Discharge Rate* |
|---|---|
| SuDS Manual Eq.24.5 | 4.0 |
| 1 in 1 | 6.8 |
| 1 in 30 | 8.3 |
| 1 in 100 | 8.6 |

Table 1: Brownfield Runoff Rate

2.4.6 The foul water from the site is privately pumped from a chamber outside the barn building to the main access, where a gravity connection is made to the Southern Wate main sewer in Easterbrook Lane.

## *2.5 Ground Condition*

2.5.1 From the British Geological Society (BGS) website has been reviewed to establish the ground conditions in the area and consider in more detail the findings from the neighbouring development allowed on appeal.

2.5.2 The BGS mapping identifies a large area of Head deposits which consists of Gravel, Sand, Silt and Clay. An extract of the BGS mapping covering the site is shown in Figure 4.

2.5.3 At depth the surrounding area is shown to consist of London Clay formation. The Bedrock geology comprises of Clay, Silt and Sand.

2.5.4 The neighbouring site identified 2no. borehole logs in relation the site at Stoneyfields Nursery some 600m to the southwest of the application

site. The borehole logs recorded a geological composition consisting of 'Head Gravel' to a depth of 5.79mbgl (metres below ground level), followed by 'London Clay' up to a depth of 56.23mbgl.

## *2.6 Groundwater*

2.6.1 It is a requirement by Arun District Council for monitoring of groundwater levels during the winter period. The neighbouring site carried out groundwater monitoring and recorded between December '21 to May '22 groundwater at 0.69mbgl in western pond location, and 1.17mbgl in

the initially proposed southern pond location, which was proposed along the southern and eastern boundaries. The location plan is shown below.

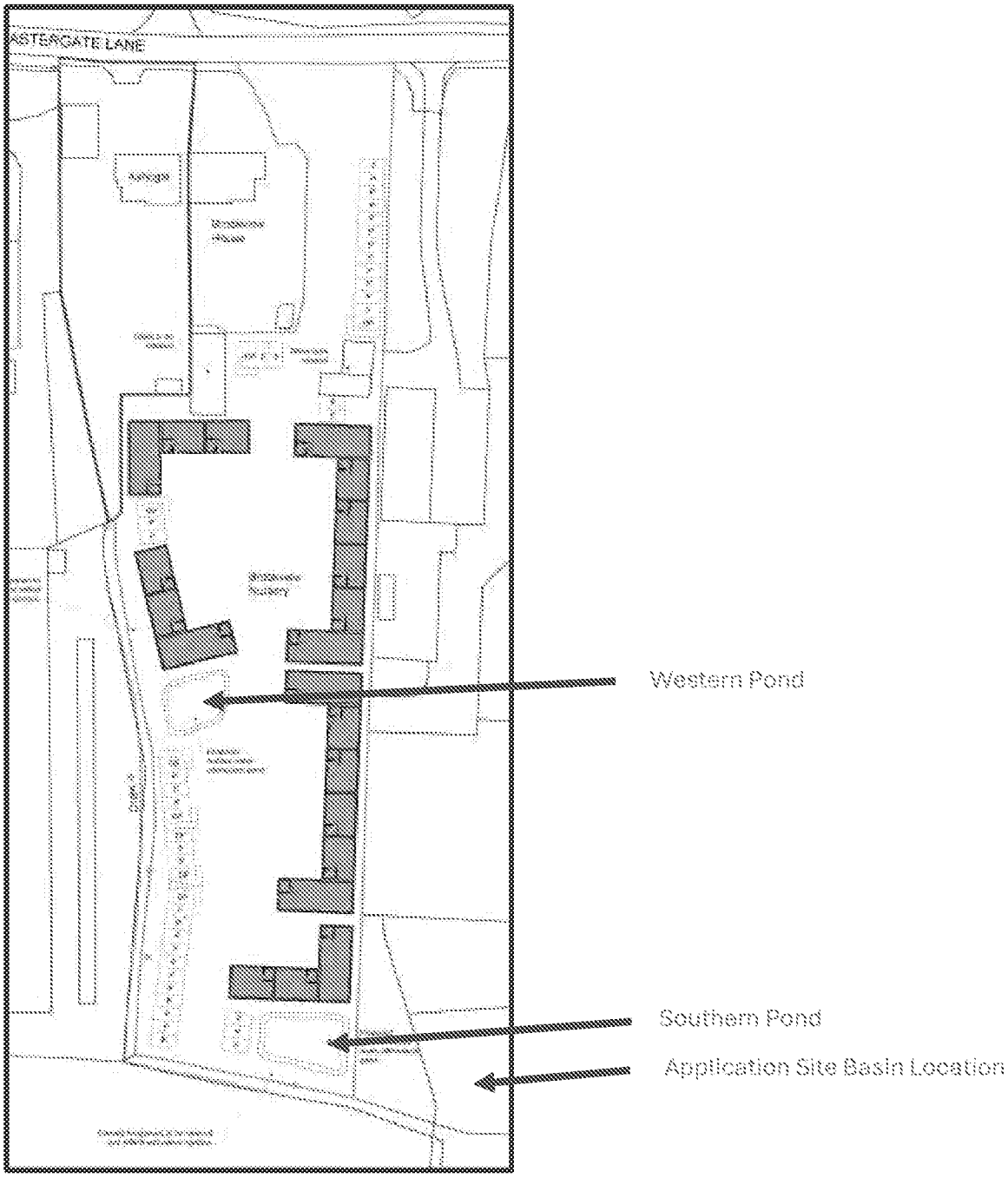



Figure 4: Extract from Brookview Nursery Application

2.6.2 In considering the groundwater level at the southern location, which is in a similar location to this application's proposed pavement and basin, the groundwater is estimated to be 10.19m.

2.6.3 As stated by Arun Engineer, to consider the worst-case situation, the drainage will need to consider groundwater at existing ground level. With no evidence of groundwater flooding at the application site a groundwater level is set at the lowest point of the site at 10.45m.

# 3 Proposed Site Use

3.0.1 The application proposes the relocation of the existing New City Joinery business from its existing workshop on Stoney Brook Farm to a new purpose-built workshop immediately to the south.

3.0.2 The proposal will consist of a 450m$^2$ workshop with associated access road and parking provision, as shown on the proposed layout plan found in Appendix A.

# 4 Planning Policy Context

## *4.0 National Planning Policy*

4.0.1 The National Planning Policy Framework (NPPF, 2023) includes government policy for developments and meeting the challenges of climate change and flood risk. The policy requires *"Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk"*.

4.0.2 New developments should avoid increased vulnerability from climate change, and where developments are brought forward in these area care should be taken to ensure that the risks are managed through suitable adaption measures.

4.0.3 The proposed development incorporates sustainable drainage systems, unless there are reasons that it is inappropriate. The development provides safe access and escape routes.

4.0.4 Development priorities are based on the specific flood risk zones outlined within Table 1 of the technical guidance, as Figure 6 below.

| *Flood Zones* | *Definition* |
|---|---|
| Zone 1<br>Low Probability | Land having a less than 1 in 1,000 annual probabilities of river or sea flooding (shown as 'clear' on the Flood Map – all land outside Zones 2 and 3) |
| Zone 2<br>Medium Probability | Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding, or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.<br>(Land shown in Light Blue in Flood Map) |
| Zone 3a<br>High Probability | Land having a 1 in 100 or greater annual probability of river flooding, or land having a 1 in 200 or greater annual probability of sea flooding.<br>(Land shown in Dark Blue on the Flood Map) |
| Zone 3b<br>The Functional Floodplain | This zone comprises land where water must flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately designated from Zone 3a) |

Figure 5: Flood Zone definitions.

4.0.5 The Environment Agency (EA) website confirms all of the proposed application site to be within flood zone 1. The full Flood map for planning can be found in Appendix D. The flood risk to the site is assessed and discussed further in Section 6 of this report.

4.0.6 Further guidance in NPF classifies commercial development schemes to be a 'less vulnerable' land class use in terms of flood risk. A land-use in Flood Zone 1 is considered acceptable.

| *Flood Risk Vulnerability Class* | *Land-use* |
|---|---|
| Essential infrastructure | • Essential transport infrastructure which has to cross the area at risk,<br>• Essential utility infrastructure,<br>• Wind turbines,<br>• Solar Farms. |
| Highly Vulnerable | • Police and ambulance stations,<br>• Emergency dispersal points,<br>• Basement dwellings,<br>• Caravans, mobile homes and park homes,<br>• Installations requiring hazardous substances consent. |
| More Vulnerable | • Hospitals,<br>• Residential institutions,<br>• Buildings used for dwelling houses,<br>• Non-residential uses,<br>• Landfill and sites used for waste management,<br>• Sites used for holiday or short let |
| Less Vulnerable | • Police, ambulance stations not required during flooding,<br>• Buildings used for shops, financial, professional, restaurants, cafes and hot food take-away, offices and general industry, storage and distribution,<br>• Land and building used for agriculture and forestry,<br>• Waste treatment,<br>• Minerals working and processing,<br>• Water treatment works,<br>• Sewerage treatment works,<br>• Car parks. |
| Water-compatible development | • Flood control infrastructure,<br>• Water transmission infrastructure & pump station<br>• Sewerage transmission & pump station<br>• Sand & gravel working,<br>• Docks, marinas and wharves,<br>• Navigation facilities,<br>• Ministry of Defence installations,<br>• Ship building, repairs, dismantling,<br>• Water-based recreation,<br>• Lifeguard and coastguard stations,<br>• Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms,<br>• Essential ancillary sleeping or residential accommodation for staff required by uses in this category. |

Figure 6: Land-Use Vulnerability Classification

# 5 Flood Risk Assessment

## 5.1 Introduction

5.1.1 The main sources of flooding have been assessed as part of this report. In line with National Planning Policy Framework (para.173) and footnote 59. Flood Risk from the following sources have been assessed:

- Tidal and Fluvial;
- Pluvial;
- Reservoirs and other artificial sources.
- Groundwater

## 5.2 Tidal and Fluvial

5.2.1 Tidal flooding is a result of flooding from tidal waters to land along the coast, or inland usually caused by high tides or storm surge. Fluvial occurs when the water level in a river or stream rises and overflows onto land as a result of the capacity of rivers being exceeded by the river flow.

5.2.2 The Environment Agency (EA) flood map for planning shows the site being within Flood Zone 1, as shown in Figure 7. The EA Flood Report can be found in Appendix D.


Figure 7: Extent Flood Risk from Rivers or Sea

## 5.3 *Pluvial*

5.3.1 Pluvial flooding occurs as a result of heavy rain creating flooding independent of a water body. Flooding occurs usually in low spots, and as a result of intense rainfall inundating the urban drainage system. The extent of flooding is shown on the Surface Water map from GOV.UK website in the figures below.

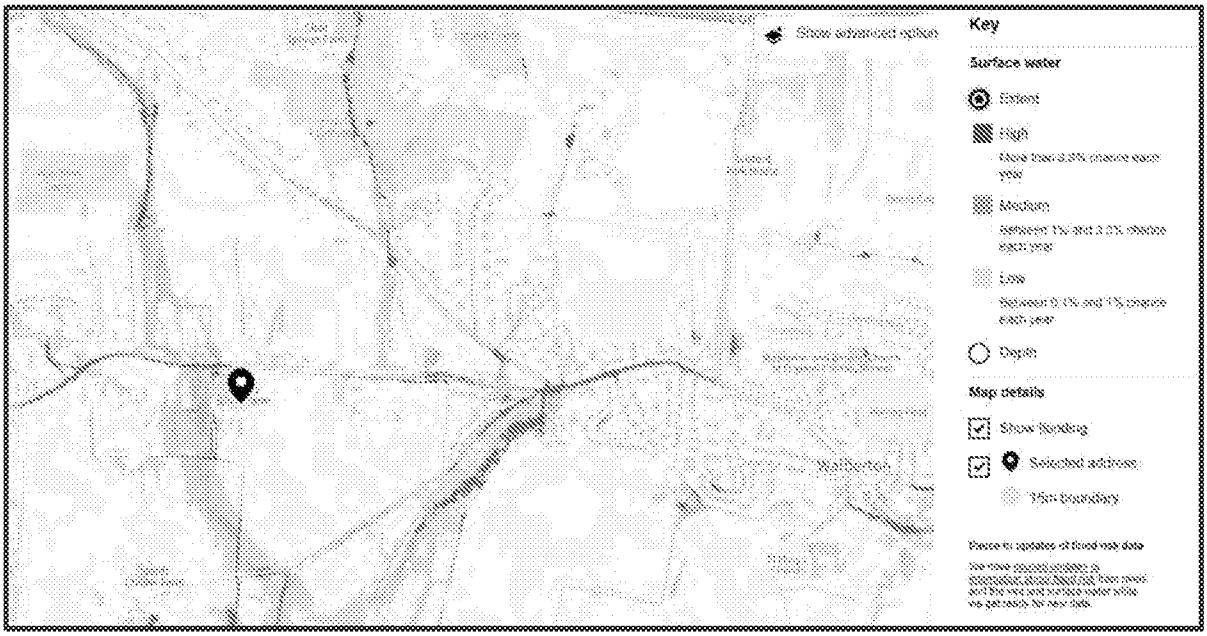



Figure 8: Extent of overland surface water flooding.

5.3.2 The extent of flooding shows no overland surface water flooding at the site, as Figure 8 above.

5.3.3 It is shown during a high-risk situation which is where there is 100% to 3.3% chance each year of flood occurring, the site and immediate vicinity is not at risk with surface water being retained within the existing chalk stream.

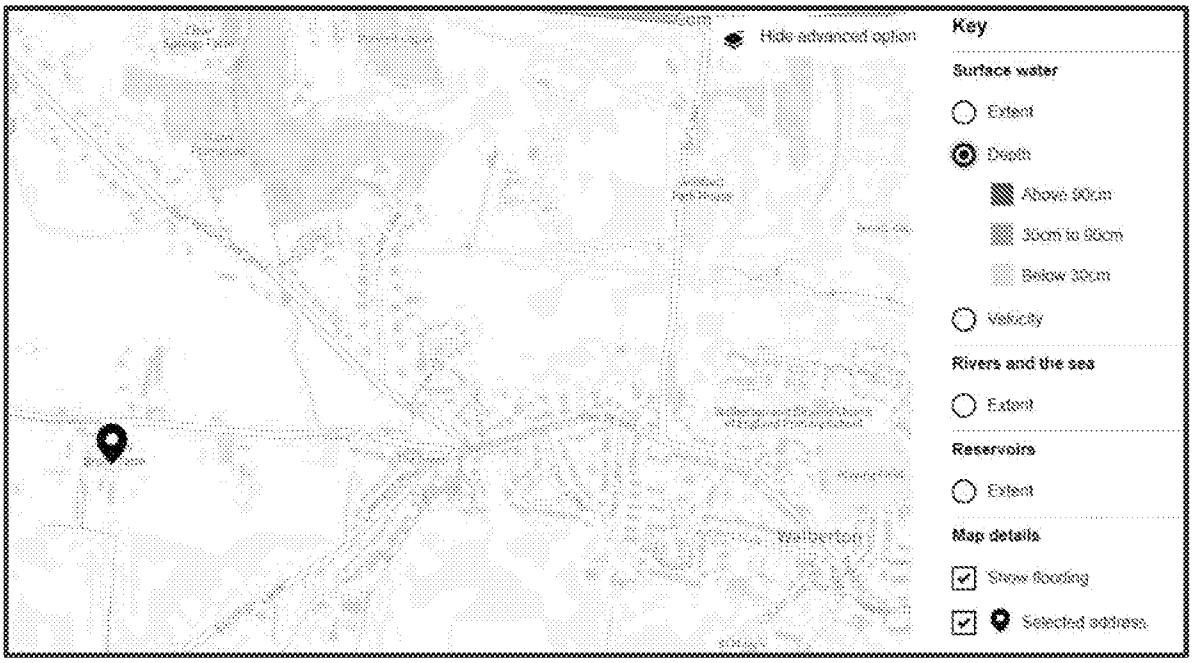



Figure 9: Extent of High-Risk overland surface water flooding.

5.3.4 For the medium-risk situation where there is a 1-3.3% chance each year, the mapping shows no risk of overland flooding.

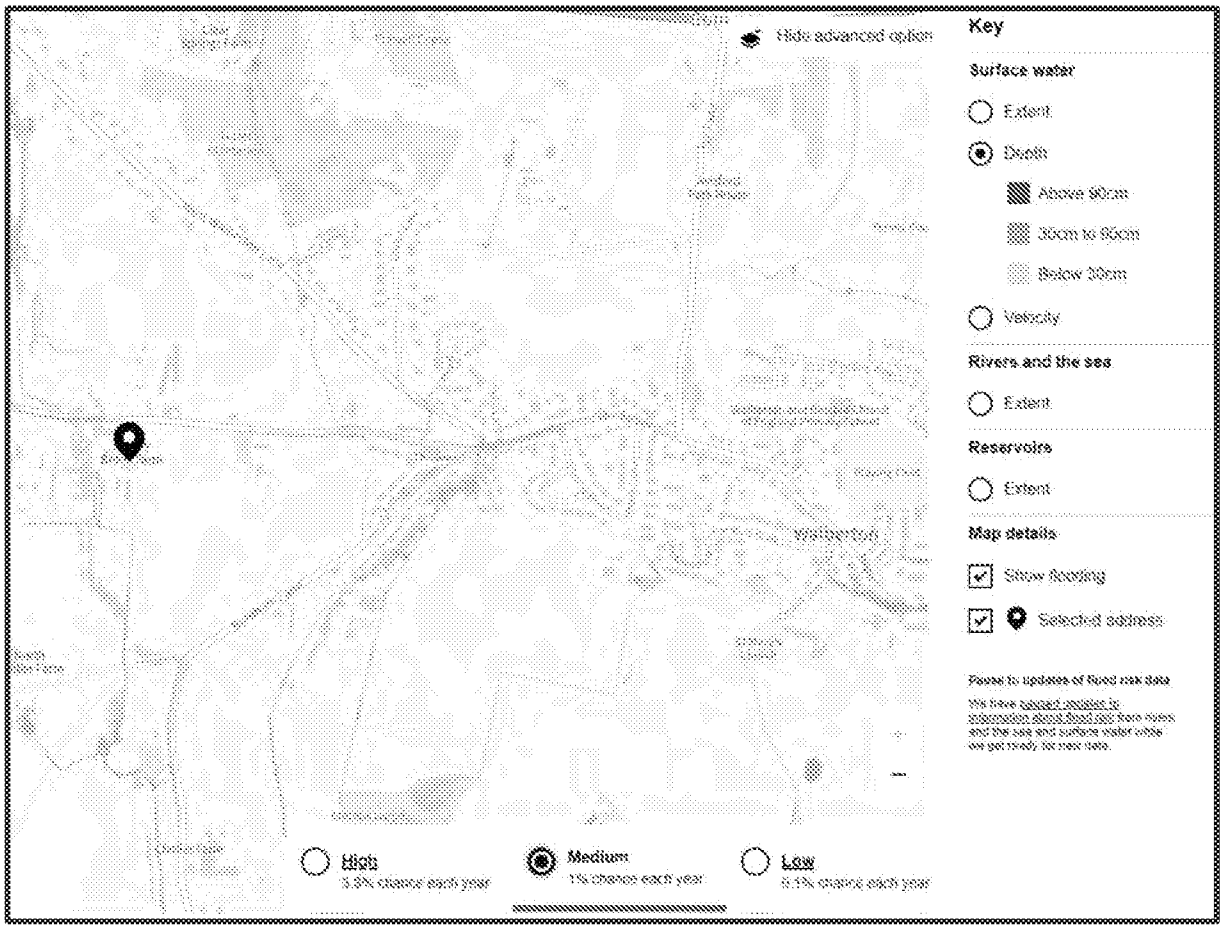



Figure 10: Extent of Medium Risk overland surface water flooding.

5.3.5 For storm events that have a 1 to 0.1% chance each year, there is no overland flooding.

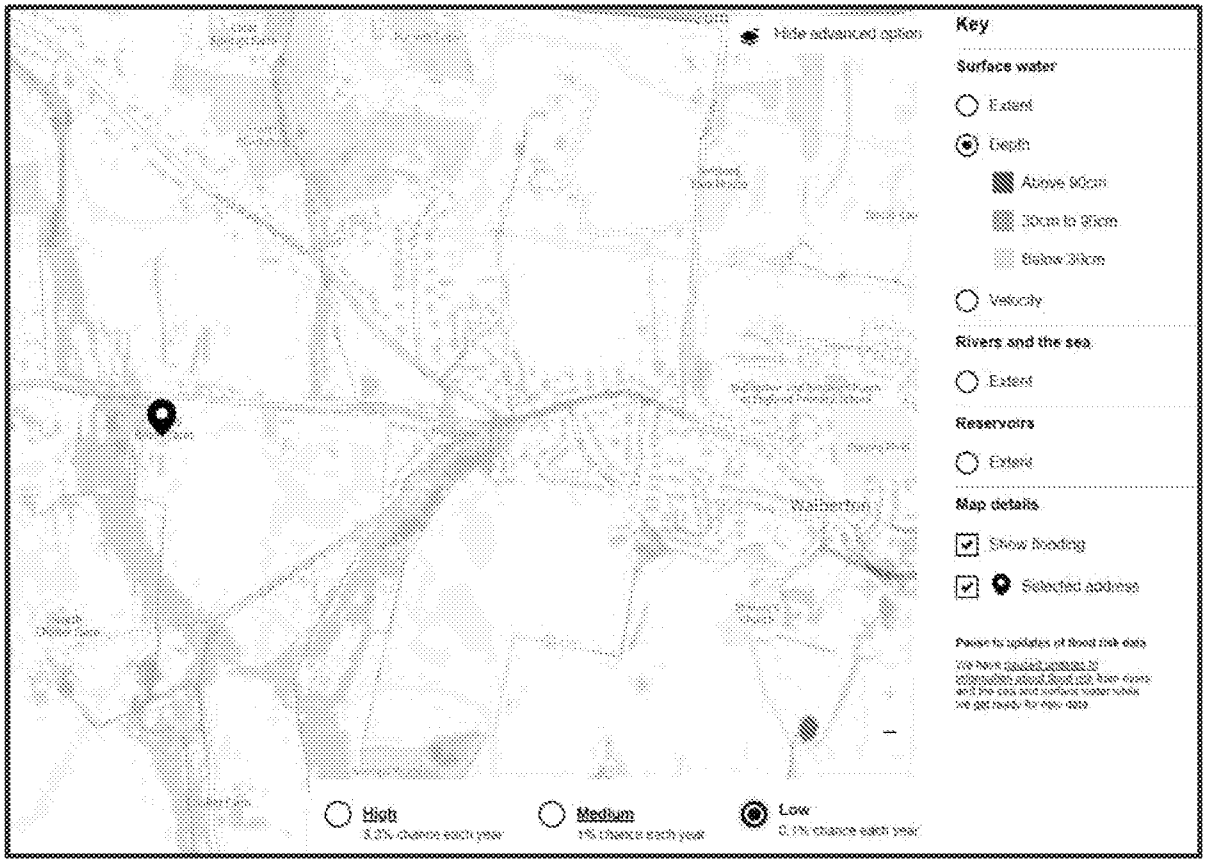



Figure 11: Extent of Low-Risk overland surface water flooding.

## 5.4 Reservoirs & Other Artificial Sources

5.4.1 The risk of flooding from the failure of a reservoir has been reviewed and shown in Figure 12 below. It is shown that the site is not at risk from reservoir flooding.

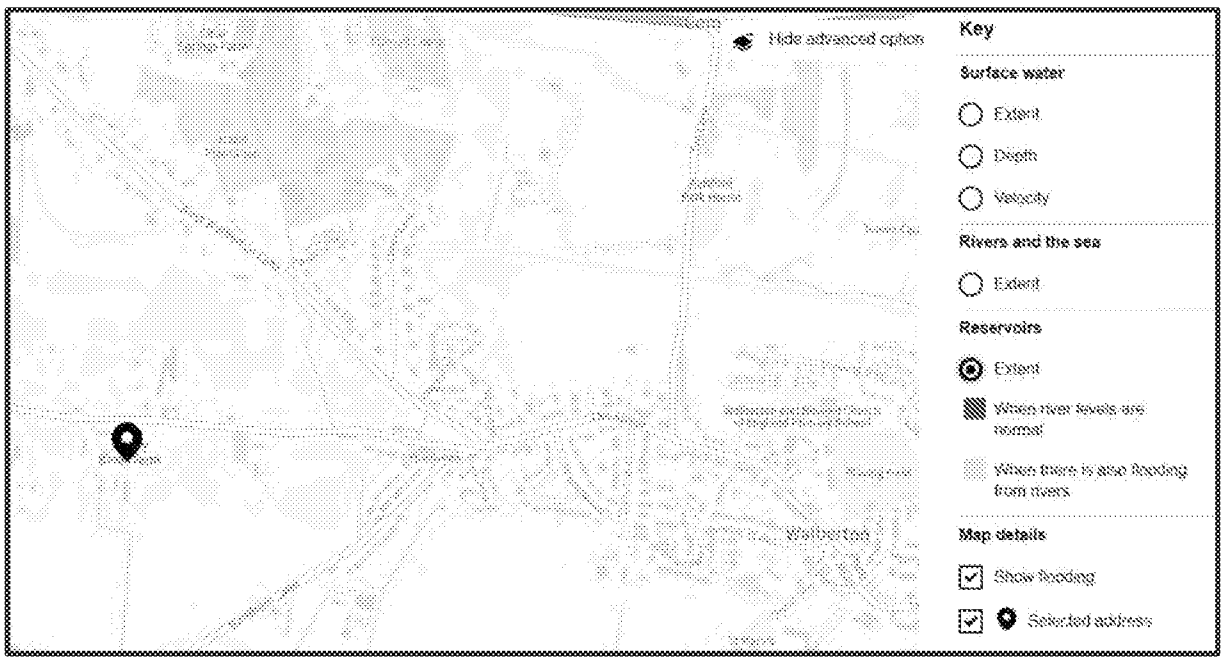


Figure 12: Extent of Reservoir Flooding

## 5.5 Groundwater

5.5.1 Groundwater flooding generally is a result of water levels below the ground rising above existing ground levels during the wet months. These flood levels fall again during the dry periods.

5.5.2 As stated in section 2.6, the EA reports flooding from groundwater is unlikely at the application site, which is further confirmed with the EA mapping and monitoring of groundwater at the immediate neighbouring site, Brookview Nursery.

5.5.3 The flood risk assessment for the Brookview Nursery application, established there to be no documented or anecdotal evidence of groundwater flooding in the area. The application carried out groundwater monitoring on this in the locations shown in Figure 4. The southern location is approximately 55m from the proposed attenuation feature.

5.5.4 From the groundwater monitoring at the southern pond location, a depth of 1.17mbgl was recorded. Based on the topographical survey at the monitoring points, the existing ground level at the southern pond is 11.36m giving a groundwater level of 10.19m.

5.5.5 The existing ground level at the western pond is 11.13m which makes the groundwater level 9.96m.

5.5.6 The western pond recorded a groundwater depth of 0.69m below the existing ground level. This would make the groundwater at the lowest point of the application site a level of 9.76m

5.5.7 Based on no historical reported flooding at the site, it is considered reasonable to model a groundwater of present at 9.76m and the worse-case scenario of 10.45m

# 6 Drainage Strategy

6.0.1 The Surface Water drainage is required to be managed in a way that replicates the existing and natural drainage processes for the site. The proposals need to consider the NPPF hierarchy as tabled below.

- Discharge into the ground.
- To a surface water body e.g., watercourse.
- To a surface water, highway drain, or another drainage system.
- To a combined sewer.

6.0.2 SuDS are designed to replicate the natural course of drainage as closely as possible with a view to reducing the impact of flooding, removing pollutants at source and combining water management with green space.

## *6.1 SuDS Strategy*

6.1.1 In considering the appropriate SuDS components, Table 7.1 of CIRIA document C753 'The SuDS Manual' indicates the benefits the SuDS components provide. The highlighted components tabled below are the be considered at the site.

| *Component Type* | *Description* | *Collection Mechanism* | *Design criteria* | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | *Water quantity* | | | | | |
| | | | *Peak runoff rate* | *Runoff volumes* | | *Water quality* | *Amenity* | *Biodiversity* |
| | | | | *Small events (interceptions)* | *Large events* | | | |
| Rainwater harvesting | System that collects runoff from the roof of a building or other paved surface for use | P | | 1 | 1 | | 1 | |
| Green roofs | Planted soil layers on the roof of buildings that slow and store runoff | S | 2 | 1 | | 1 | 1 | 1 |
| Infiltration systems | Systems that collect and store runoff, allowing it to infiltrate into the ground | P | 2 | 1 | | 1 | 1 | 1 |
| Proprietary treatment systems | Subsurface structures designed to provide treatment of runoff | P | | | | 1 | | |
| Filter strips | Grass strips that promote sedimentation and filtration as runoff is conveyed over the surface. | L | | 1 | | 1 | 2 | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Filter drains | Shallow stone-filled trenches that provide attenuation, conveyance and treatment of runoff. | L | 1 | 2 | | 1 | 2 | 2 |
| Swales | Vegetated channels (sometimes planted) used to convey and treat runoff. | L | 1 | 1 | 1 | 1 | 1 | 1 |
| Bioretention systems | Shallow landscaped depressions that allow runoff to pond temporarily on the surface, before filtering through vegetation and underlying soils. | P | 2 | 1 | 2 | 1 | 1 | 1 |
| Trees | Trees within soil-filled tree pits, tree planters or structural soils used to collect, store and treat runoff. | P | 1 | 1 | | 1 | 1 | 1 |
| Pervious pavements | Structural paving through which runoff can soak and subsequently be stored in the sub-base beneath and/or allowed to infiltrate into the ground below. | S | 1 | 1 | 1 | 1 | 2 | 2 |
| Attenuation storage tanks | Large, below-ground voided spaces used to temporarily store runoff before infiltration, controlled release or use. | P | 1 | | | | | |
| Detention basins | Vegetated depressions that store and treat runoff. | P | 1 | 1 | 1 | 1 | 1 | 1 |
| Ponds and wetlands | Permanent pools of water used to facilitate of runoff – runoff can also be stored in an attenuation zone above the pool. | P | 1 | | | 1 | 1 | 1 |
| Key<br>P-Point L-Lateral S-Surface<br>Likely valuable contribution to delivery of design criterion.<br>Some potential contribution to delivery of design criterion, if specifically in the design. | | | | | | | | |

Table 2: SuDS feature options.

## 6.2 *Surface Water Drainage Strategy*

6.2.1 As previously stated in 6.1.1, the existing ground conditions may provide shallow infiltration however with the site falling to the immediate watercourse and the existing surface water being piped to the watercourse the key principle for the surface water will be a hybrid system.

6.2.2 The primary surface water outfall will be to utilise the existing outfall to the watercourse at a controlled greenfield runoff rate. The SuDS features would be designed to allow for infiltration to reduce the demand on the outfall.

6.2.3 Based on the existing impermeable catchment and the proposed roof and paved area the greenfield runoff rate is calculated at 0.03l/s for the 1 in 1 storm event. This increases with

higher storm return periods which are tabled below, up to 1 in 100. The catchment area is as shown on drawing A001-013/200, in Appendix E along with the Greenfield runoff report.

| *Storm Return Period* | *Greenfield Rate* |
|---|---|
| 1 in 1 | 0.03 |
| 1 in 30 | 0.08 |
| 1 in 100 | 0.11 |
| 1 in 200 | 0.13 |

Table 3: Greenfield runoff rates

6.2.4 A discharge rate of 0.03l/s is considered exceptionally low which has a potential risk of blocking and creating a flood risk. It is recommended an orifice diameter of no less than 25mm is used, which generates a discharge rate of 1.4l/s during the 1 in 100 storm return plus climate change.

6.2.5 The proposed drainage layout considers the potential shallow groundwater across the site with the drainage model simulating a groundwater level at 0.69m below the lowest level on the site, and a groundwater level at the existing lowest ground level of 10.45m. The drainage network will be modelled for no groundwater present within the system. The hydraulic modelling scenarios modelled are tabled below.

| *Storm Return Period* | *Groundwater Level* |
|---|---|
| 1 in 1 | No groundwater |
| | Groundwater at 9.76m |
| | Groundwater at 10.45m |
| 1 in 30 | No groundwater |
| | Groundwater at 9.76m |
| | Groundwater at 10.45m |
| 1 in 100+CC | No groundwater |
| | Groundwater at 9.76m |
| | Groundwater at 10.45m |

Table 4: Hydraulic modelling Scenarios

6.2.6 The proposed drainage layout can be found in Appendix F, with the hydraulic modelling reports for each scenario in Appendix G. The water level in the Detention Basin for the scenarios is tabled below. These show a minimum of 300mm freeboard is provided during the extreme storm event.

| Storm Return Period | Basin Water Level (m) | Freeboard (m) | Discharge Rate (l/s) | Rate Reduction (l/s) |
|---|---|---|---|---|
| 1 in 1 | 10.104 | 1.196 | 0.9 | 5.9 |
| | 10.104 | 1.196 | 0.9 | 7.4 |
| | 10.498 | 0.802 | 1.2 | 7.4 |
| 1 in 30 | 10.307 | 0.993 | 1.1 | 5.7 |
| | 10.308 | 0.992 | 1.1 | 7.2 |
| | 10.653 | 0.647 | 1.3 | 7.3 |
| 1 in 100+CC | 10.476 | 0.824 | 1.2 | 5.6 |
| | 10.477 | 0.823 | 1.2 | 7.1 |
| | 10.784 | 0.516 | 1.4 | 7.2 |

Table 5: Hydraulic modelling Results

## 6.3 *Climate Change*

6.3.1 The climate change provision for a commercial development should be based on a design life of 50 years. The design life will therefore be beyond 2060 which will require the 2070s Epoch on a central allowance.

6.3.2 Using the Government Department for Environment Food & Rural Affairs website the climate change allowance is shown to be 25%, as shown in Figure 13.

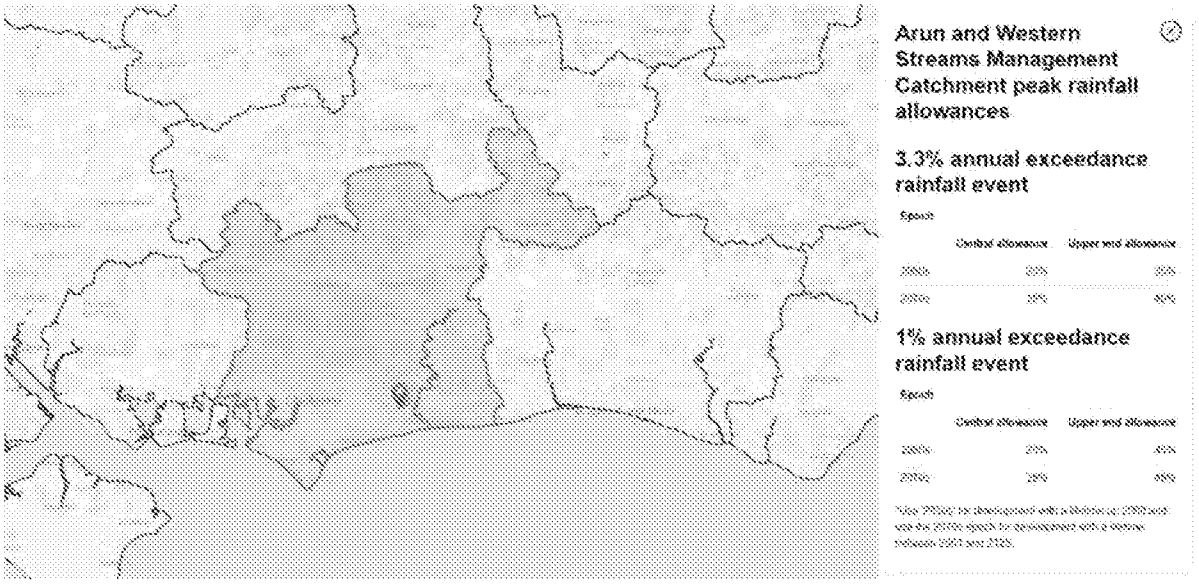



Figure 13: Extent of Climate Change value.

## 6.4 *Urban Creep*

6.4.1 To accord with National Policy an allowance for urban creep should be considered for the likely future extensions. For a commercial use, an allowance is not required.

## 6.5 *Surface Water Pollution Mitigation*

6.5.1 The proposal ensures that surface water is managed 'at source' retaining the existing outfall and utilising infiltration. Pollution indices for the proposed land use can be found in table 26.2 of C753. The highest level of pollution is therefore contributed by the access road and parking area.

| *Land Use* | *Pollution Hazard Level* | *Total suspended solids pollution index* | *Metals* | *Hydrocarbons (HC)* |
|---|---|---|---|---|
| Residential roofs | Very Low | 0.2 | 0.2 | 0.05 |
| Other roofs (typically commercial/industrial roofs) | Low | 0.3 | 0.2 | 0.05 |
| Commercial yard and delivery areas, non-residential car parking with frequent change. | Medium | 0.7 | 0.6 | 0.7 |

Table 6: Pollution indices by land use

6.5.2 It is recommended that permeable paving is utilised for the access road, roof drainage from the workshop and existing barn roof area. Once drained through the permeable paving, the surface water will be routed through a shallow swale located within the detention basin. The swale will be planted to provide additional surface water treatment.

6.5.3 The relevant SuDS component mitigation indices are tabled below, (as per table 26.3 of C753). The SuDS mitigation index will be a combination of the SuDS components with a factor of 0.5 applied to secondary and tertiary components.

| *SuDS feature* | *Total suspended solids pollution index* | *Metals* | *Hydrocarbons (HC)* |
|---|---|---|---|
| Permeable Paving | 0.7 | 0.6 | 0.7 |
| Swale | 0.25 (0.5) | 0.3 (0.6) | 0.3 (0.6) |
| Detention basin | 0.25 (0.5) | 0.25 (0.5) | 0.3 (0.6) |
| Combined | 1.2 | 1.15 | 1.3 |

Table 7: SuDS mitigation indices

6.5.4 The combined mitigation indices will provide the required treatment for the proposed and existing land uses.

## 6.6 *Foul Water*

6.6.1 The current foul water drainage that serves the existing barn conversion is a private pump system to the site frontage where its outfalls into the Southern Water adoptable sewer.

6.6.2 The foul water drainage from the proposed workshop will be drained to the pump chamber, where it will continue to pump to the site frontage and outfall to the Southern Water adoptable sewer.

# 7 Residual Risk and Mitigation

## *7.0 Residual Risk*

7.1.1 The following residual risks have been identified in relation to the proposed development, which could cause flooding:

1. Build up of debris in the watercourse;
2. Blockage of the outfall;
3. Blockage/failure of the proposed drainage system;
4. Extreme rainfall events that exceed the design criteria;
5. Surface Water flooding of proposed buildings.

## *7.1 Mitigation*

7.2.1 To reduce the risks listed in 7.1.1, mitigation measures have been considered and are numbered below to correlate to the list above.

1. The watercourse is the responsibility of the landowner and maintenance works are restricted under Riparian ownership. The condition of the watercourse will be monitored and the appropriate authorities advised should a risk arise.
2. As above, should the outfall become blocked the landowner as the Riparian owner will be advised.
3. The drainage network will be maintained in accordance with the Surface Water Maintenance Plan which can be found in Appendix H.
4. The drainage network has been modelled for the 1 in 100 storm events, plus 25% climate change. The sensitivity check has been carried out to consider a 1 in 200 storm event. The existing topography currently falls to the south and to the watercourse and away from the existing and proposed properties. These will remain unaltered and therefore the exceedance route will be to the watercourse.
5. The proposed workshop floor level has been set to ensure that a 300mm freeboard, as a minimum, is provided with design levels routing surface water away from the building.

# 8 Summary and Conclusion

## *8.0 Summary*

8.0.1 MJ Engineering Group (MJEG) has been commissioned by March Developments Ltd to carry out a Flood Risk Assessment and drainage strategy for the relocation of the existing New City workshop at Stoney Brook Farm in Walberton. The application site is located to be south of the County of West Sussex, within the district of Arun. The site is situated to the west of the village along the lane known as Eastergate Lane.

8.0.2 In the immediate vicinity are farms, garden nurseries and small business outlets. There is a watercourse located to the south of the site known as a chalk stream, which the site outfalls to. The site located at Ordnance Survey (OS) grid reference of SU960060 and covers a site area of circa. 0.35ha.

8.0.3 The BGS mapping identifies a large area of Head deposits which consists of Gravel, Sand, Silt and Clay. At depth the surrounding area is shown to consist of London Clay formation. The Bedrock geology comprises of Clay, Silt and Sand. A recent neighbouring application identified geological composition consisting of 'Head Gravel' to a depth of 5.79mbgl (metres below ground level), followed by 'London Clay' up to a depth of 56.23mbgl.

8.0.4 The neighbouring site carried out groundwater monitoring and recorded between December '21 to May '22 groundwater at 0.69mbgl in western pond location, and 1.17mbgl in the south pond, nearest to the proposed western boundary. In considering the groundwater level at the southern location, which is in a similar location to this application proposed pavement and basin, the groundwater is estimated to be 9.76m.

8.0.5 The Environment Agency (EA) flood map for planning shows the site being within Flood Zone 1, with no overland surface water flooding impacting at the site. The risk of flooding from the failure of a reservoir also shows the site to be not at risk from reservoir flooding.

8.0.6 The site currently outfalls to the Chalk Stream at an unrestricted 6.8l/s for a 1 in 1 storm event, rising to 8.6l/s during the 1 in 100. A greenfield rate for the site including the existing impermeable area would be 0.03l/s.

8.0.7 It is recommended an orifice diameter of no less than 25mm is used to minimise the risk of blockage, which generates and discharge rate of 1.4l/s during the 1 in 100 storm return plus climate change.

8.0.8 SuDS are designed to replicate the natural course of drainage as closely as possible with a view to reducing the impact of flooding, removing pollutants at source and combining water management with green space. The roof drainage will outfall through a tanked permeable paved access road and parking area.

8.0.9 A tanked permeable paved area will prevent groundwater from entering the pavement sub-base layer. Surface Water will flow through a swallow swale located within a detention bason. The swale and basin will allow for water to infiltrate into the ground naturally, however the drainage network has been modelled to not be reliant on this.

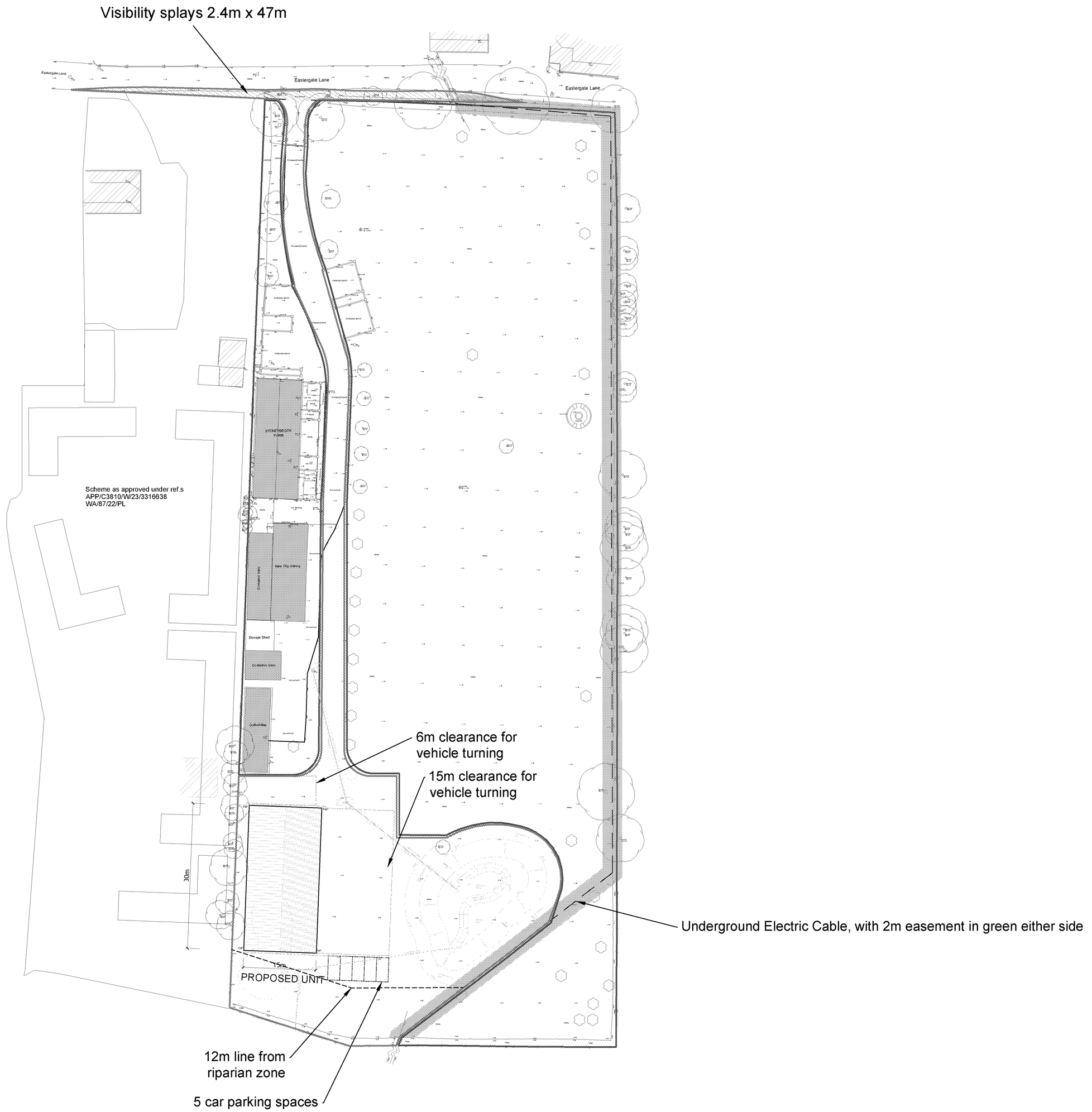
8.0.10 The detention basin is designed to provide a minimum 300mm freeboard during the worst-case scenario. To consider the worst-case situation, the network has been assessed with groundwater present at 10.45m AOD within the drainage network.

8.0.11 The foul water drainage from the proposed workshop will be drained to the pump chamber, where it will continue to pump to the site frontage and outfall to the Southern Water adoptable sewer.

## 8.1 Conclusion

8.1.1 It is concluded the relocation of the existing New City workshop is compliant with policy being in Flood Zone 1, with a surface water drainage proposal that will reduce the discharge rate to the Chalk stream with storage being provided to accommodate surface water during the extreme storm event.

# Appendix A –Proposed Indicative Layout




Site area - 0.36ha

1:500 0 10 20 30 40 50m

| DATE | REV | DESCRIPTION | DRAWN |
|---|---|---|---|
| 13.11.24 | G | Basin & red line amended | JK |
| 29.10.24 | F | Basin added & red line amended | JK |
| 17.04.24 | E | Driveway & red line amended | JK |
| 17.04.24 | D | Building position amended & parking added | JK |
| 21.03.24 | C | Amended to consultant comments | JK |
| 11.01.24 | B | Amended to consultant comments | JK |
| 10.01.24 | A | Amended to consultant comments | JK |

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+44 (0)1473 620660

2 Grange Business Centre
Tommy Flowers Drive
Grange Farm
Kesgrave, Ipswich
Suffolk, IP5 2BY

Project
Proposed Commercial Unit at:
Stoney Brook Farm, Eastergate Lane
Arundel, BN18 0BA

Client
March Developments Ltd.

Drawing Title
Proposed Block Plan

Drawing Status
Preliminary

| Scale | Paper Size | Date | Drawn |
|---|---|---|---|
| 1:500 | A1 | Dec 2023 | / |

Drawing Number
4494-02

Drawing Rev
G

# Appendix B – Southern Water Sewer Records

Track
Brookfield Farm
Fairfield
Plemont
Nursery Cottages
Dragonfly Paddock
The Farm House
The Barn
Cherry Cottage
Winter Egg Farm
Ashogle
Brookview House
Stoney Brook Farm
Strathmore
Tank
Path
7105
7101
7102
8101
0101
0102
0103
1101
2101
3001
2901
3801
0m
100m
200m
300m

(c) Crown copyright and database rights 2024 Ordnance Survey 100031673 | Date: 23/09/24 | Scale: 1:1250 | Map Centre: 496048,106049 | Data updated: 22/08/24 | Our Ref: 1575659 - 1

Wastewater Plan A2
Powered by digdat

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2024 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Foul Gravity Sewer
Combined Gravity Sewer
Culverted Water Course or Treated Effluent
Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon
Combined Pumping Station
Surface Water Pumping Station
Foul Pumping Station
Water Treatment Works
Sealed Risk Area
Building Over Agreement Area
Foul Manhole
Combined Manhole
Surface Water Manhole
Safe Entry Manhole, Ventilation Chamber, Control Manhole or Surface Water Storage
Combined Outfall
Foul Outfall
Surface Water Outfall
Surface Water Inlet

mark@mjenggroups.co.uk
Walberton

WATER for LIFE
Southern Water

ARUN DISTRICT COUNCIL WA/108/24/PL

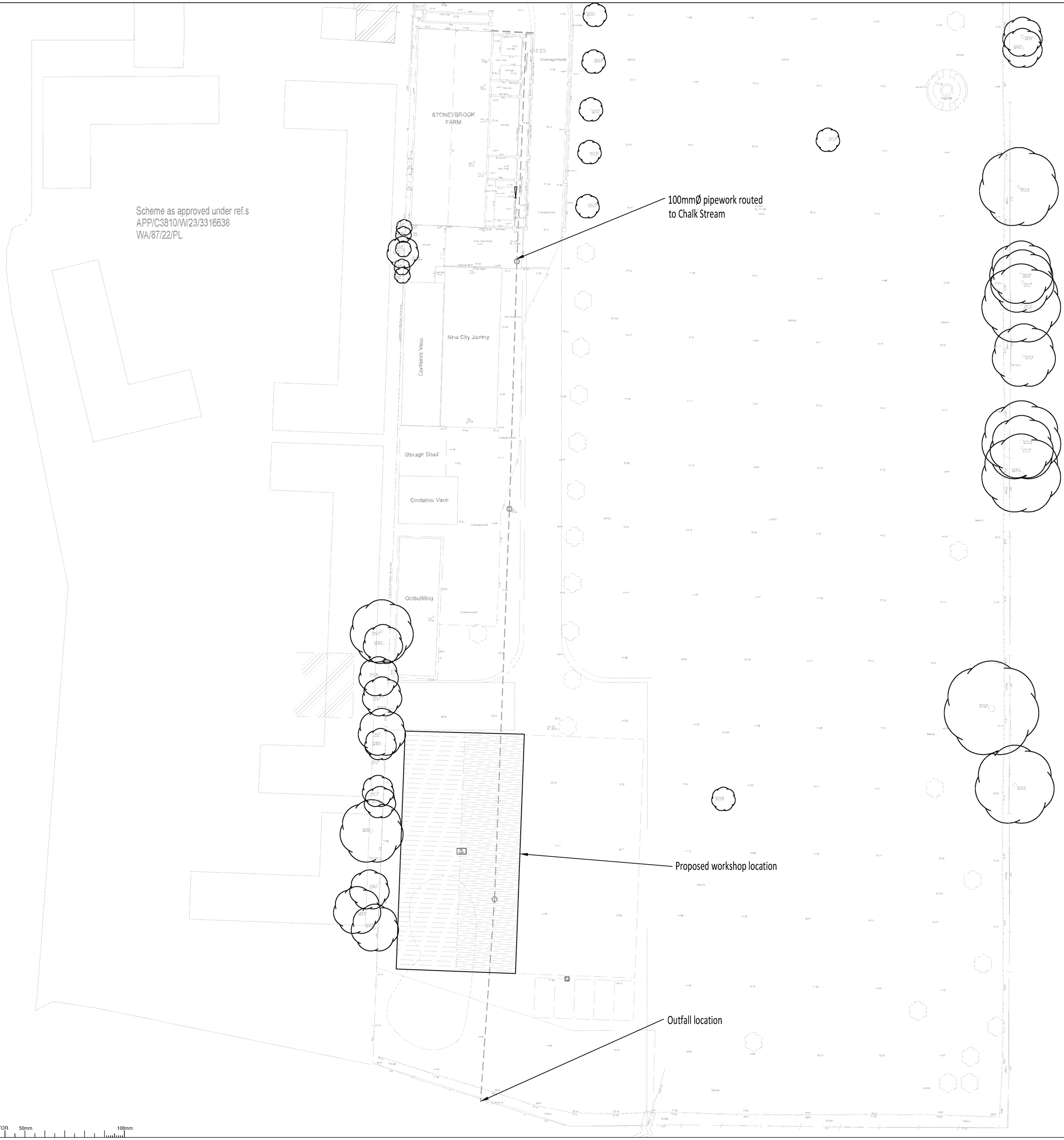
| Manhole Reference | Liquid Type | Cover Level | Invert Level | Depth to Invert |
|---|---|---|---|---|
| 0101 | F | 11.68 | 10.22 | |
| 0102 | F | 11.95 | 10.14 | |
| 0103 | F | 12.27 | 10.03 | |
| 1101 | F | 12.82 | 9.79 | |
| 2101 | F | 12.90 | 9.52 | |
| 2901 | F | 10.83 | 8.53 | |
| 3001 | F | 12.13 | 9.22 | |
| 3801 | F | 10.41 | 7.86 | |
| 3802 | F | 0.00 | 0.00 | |
| 7101 | F | 12.32 | 10.92 | |
| 7102 | F | 12.44 | 10.85 | |
| 7103 | F | 12.29 | 10.98 | |
| 7105 | F | 0.00 | 0.00 | |
| 8101 | F | 12.48 | 10.71 | |
| 9101 | F | 11.99 | 10.49 | |

| Manhole Reference | Liquid Type | Cover Level | Invert Level | Depth to Invert |
|---|---|---|---|---|

| Manhole Reference | Liquid Type | Cover Level | Invert Level | Depth to Invert |
|---|---|---|---|---|

| Manhole Reference | Liquid Type | Cover Level | Invert Level | Depth to Invert |
|---|---|---|---|---|

# Appendix C –Existing Drainage Layout




PRINT ACCURACY INDICATOR 50mm 100mm

ARUN DISTRICT COUNCIL WA/106/24/PL

General Notes:

1. Do not scale this drawing. All dimensions are in metres unless otherwise noted. Any discrepancies are to be recorded and reported to the engineers immediately.

2. This drawing is to be read in conjunction with all other engineers and architects drawings, and the specification.

3. All works are to be carried out in accordance with the specification for the works. The specification for the works refers to "Volume 1 of the Manual for Contract Documents for Highway Works" for highway works and the "Civil Engineering Specification for the Water Industry" is applicable for the drainage works.

4. All workmanship and materials are to be to current British Standards.

5. The contractor is responsible for and must take all necessary precautions to ensure the stability of the works at all times during construction.

6. All services are to be located and protected as necessary by the contractor prior to the commencement of the works.

7. Any existing details which are shown on this drawing are for guidance only and are to be checked on site by the contractor. Any variations are to be recorded and reported to the engineer immediately.

8. During construction works on site, all roads and footpaths are to be swept and kept clear of obstructions, this is to include existing highways as appropriate to ensure safe passage of all road users.

9. Provision shall be made for the installation of all mains services including ducting prior to the laying of the road base-course.

10. All road markings and signs are to be in accordance with `the traffic signs regulations and directions' 2016.

11. All private connections to adoptable sewers should be a minimum of 100mm diameter (foul) and 150mm diameter (surface) made in vitrified clay connecting soffit to soffit.

| Rev'n | Date | Description | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| | | | | | |

Status

MJ ENGINEERING GROUP

Client

New City Joinery

Project

Land at Stoney Brook Farm, Walberton

Drawing title

Existing Surface Water Drainage

| Drawn | Checked | Approved | Date |
|---|---|---|---|
| MJ | MJ | MJ | 10/24 |

Scale at A1: 1:250

Drawing no.: A001-013/100

Revision: -

# Appendix D -Environment Agency Flood Report

# Flood map for planning

| Your reference | Location (easting/northing) | Created |
|---|---|---|
| **<Unspecified>** | **496075/106031** | **24 Oct 2024 9:03** |

**Your selected location is in flood zone 1, an area with a low probability of flooding.**

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

**Notes**

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

ARUN DISTRICT COUNCIL WA/108/24/PL

Environment Agency

## Flood map for planning

Your reference
**<Unspecified>**

Location (easting/northing)
**496075/106031**

Scale
**1:2500**

Created
**24 Oct 2024 9:03**

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

# Appendix E -Greenfield runoff Report

# Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

| | |
|---|---|
| Calculated by: | Mark Jones |
| Site name: | Stoney Brook Farm |
| Site location: | Walberton |

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

## Site Details

| | |
|---|---|
| Latitude: | 50.84615° N |
| Longitude: | 0.63702° W |
| Reference: | 3519781296 |
| Date: | Oct 07 2024 15:45 |

## Runoff estimation approach

IH124

## Site characteristics

Total site area (ha): 0.18

## Methodology

| | |
|---|---|
| $Q_{BAR}$ estimation method: | Calculate from SPR and SAAR |
| SPR estimation method: | Calculate from SOIL type |

## Soil characteristics

| | Default | Edited |
|---|---|---|
| SOIL type: | 1 | 1 |
| HOST class: | N/A | N/A |
| SPR/SPRHOST: | 0.1 | 0.1 |

## Hydrological characteristics

| | Default | Edited |
|---|---|---|
| SAAR (mm): | 780 | 780 |
| Hydrological region: | 7 | 7 |
| Growth curve factor 1 year: | 0.85 | 0.85 |
| Growth curve factor 30 years: | 2.3 | 2.3 |
| Growth curve factor 100 years: | 3.19 | 3.19 |
| Growth curve factor 200 years: | 3.74 | 3.74 |

## Notes

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

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

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

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

### (3) Is SPR/SPRHOST ≤ 0.3?

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

## Greenfield runoff rates

| | Default | Edited |
|---|---|---|
| $Q_{BAR}$ (l/s): | 0.03 | 0.03 |
| 1 in 1 year (l/s): | 0.03 | 0.03 |
| 1 in 30 years (l/s): | 0.08 | 0.08 |
| 1 in 100 year (l/s): | 0.11 | 0.11 |
| 1 in 200 years (l/s): | 0.13 | 0.13 |

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FSR | Maximum Time of Concentration (mins) | 30.00 |
| Return Period (years) | 100 | Maximum Rainfall (mm/hr) | 50.0 |
| Additional Flow (%) | 0 | Minimum Velocity (m/s) | 1.00 |
| FSR Region | England and Wales | Connection Type | Level Soffits |
| M5-60 (mm) | 20.000 | Minimum Backdrop Height (m) | 0.200 |
| Ratio-R | 0.400 | Preferred Cover Depth (m) | 1.200 |
| CV | 1.000 | Include Intermediate Ground | x |
| Time of Entry (mins) | 3.00 | Enforce best practice design rules | x |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| IC01 | 0.022 | 3.00 | 11.500 | 600 | 1873687.952 | -215932.244 | 0.700 |
| IC02 | 0.015 | 3.00 | 11.480 | 600 | 1873686.779 | -215960.954 | 1.039 |
| IC03 | | | 11.100 | 600 | 1873685.842 | -215992.049 | 1.048 |
| IC04 | | | 10.600 | 600 | 1873683.973 | -216041.100 | 1.212 |
| outfall | | | 10.490 | 100 | 1873682.205 | -216066.557 | 1.357 |

## Links

| Name | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | IC01 | IC02 | 28.734 | 0.600 | 10.800 | 10.441 | 0.359 | 80.0 | 100 | 3.56 | 50.0 |
| 1.001 | IC02 | IC03 | 31.109 | 0.600 | 10.441 | 10.052 | 0.389 | 80.0 | 100 | 4.16 | 50.0 |
| 1.002 | IC03 | IC04 | 49.087 | 0.600 | 10.052 | 9.438 | 0.614 | 80.0 | 100 | 5.11 | 50.0 |
| 1.003 | IC04 | outfall | 25.518 | 0.600 | 9.388 | 9.133 | 0.255 | 100.0 | 150 | 5.53 | 50.0 |

| US Depth (m) | DS Depth (m) | Σ Area (ha) |
|---|---|---|
| 0.600 | 0.939 | 0.022 |
| 0.939 | 0.948 | 0.037 |
| 0.948 | 1.062 | 0.037 |
| 1.062 | 1.207 | 0.037 |

## Simulation Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FSR | Skip Steady State | ✓ |
| Rainfall Events | Singular | Drain Down Time (mins) | 240 |
| FSR Region | England and Wales | Additional Storage (m³/ha) | 20.0 |
| M5-60 (mm) | 20.000 | Starting Level (m) | |
| Ratio-R | 0.400 | Check Discharge Rate(s) | x |
| Summer CV | 1.000 | Check Discharge Volume | x |
| Analysis Speed | Normal | | |

### Storm Durations

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

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 100 | 0 | 0 | 0 |
| 100 | 20 | 0 | 0 |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 96.06%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | IC01 | 9 | 10.863 | 0.063 | 5.1 | 0.0572 | 0.0000 | OK |
| 15 minute summer | IC02 | 10 | 10.583 | 0.142 | 8.5 | 0.0822 | 0.0000 | SURCHARGED |
| 15 minute summer | IC03 | 11 | 10.136 | 0.084 | 7.2 | 0.0237 | 0.0000 | OK |
| 15 minute summer | IC04 | 12 | 9.454 | 0.066 | 6.7 | 0.0187 | 0.0000 | OK |
| 15 minute summer | outfall | 12 | 9.197 | 0.064 | 6.8 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | IC01 | 1.000 | IC02 | 4.9 | 0.728 | 0.719 | 0.1870 | |
| 15 minute summer | IC02 | 1.001 | IC03 | 7.2 | 1.036 | 1.059 | 0.2307 | |
| 15 minute summer | IC03 | 1.002 | IC04 | 6.7 | 0.970 | 0.997 | 0.3435 | |
| 15 minute summer | IC04 | 1.003 | outfall | 6.8 | 0.929 | 0.384 | 0.1873 | 2.9 |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 96.06%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | IC01 | 10 | 11.500 | 0.700 | 12.5 | 0.6356 | 0.4394 | FLOOD |
| 15 minute summer | IC02 | 11 | 11.307 | 0.866 | 14.9 | 0.5021 | 0.0000 | FLOOD RISK |
| 30 minute summer | IC03 | 21 | 10.459 | 0.407 | 9.8 | 0.1151 | 0.0000 | SURCHARGED |
| 30 minute summer | IC04 | 22 | 9.462 | 0.074 | 8.3 | 0.0210 | 0.0000 | OK |
| 30 minute summer | outfall | 22 | 9.205 | 0.072 | 8.3 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | IC01 | 1.000 | IC02 | 6.1 | 0.783 | 0.906 | 0.2248 | |
| 15 minute summer | IC02 | 1.001 | IC03 | 10.2 | 1.307 | 1.512 | 0.2434 | |
| 30 minute summer | IC03 | 1.002 | IC04 | 8.3 | 1.064 | 1.230 | 0.3746 | |
| 30 minute summer | IC04 | 1.003 | outfall | 8.3 | 0.976 | 0.469 | 0.2177 | 9.1 |

**Results for 100 year Critical Storm Duration. Lowest mass balance: 96.06%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | IC01 | 9 | 11.500 | 0.700 | 16.2 | 0.6356 | 1.7974 | FLOOD |
| 15 minute summer | IC02 | 10 | 11.480 | 1.039 | 16.5 | 0.6026 | 0.0556 | FLOOD |
| 30 minute summer | IC03 | 21 | 10.550 | 0.498 | 10.5 | 0.1409 | 0.0000 | SURCHARGED |
| 30 minute summer | IC04 | 21 | 9.464 | 0.076 | 8.6 | 0.0215 | 0.0000 | OK |
| 30 minute summer | outfall | 22 | 9.207 | 0.074 | 8.6 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | IC01 | 1.000 | IC02 | 6.2 | 0.794 | 0.917 | 0.2248 | |
| 15 minute summer | IC02 | 1.001 | IC03 | 10.8 | 1.385 | 1.602 | 0.2434 | |
| 30 minute summer | IC03 | 1.002 | IC04 | 8.6 | 1.103 | 1.276 | 0.3760 | |
| 30 minute summer | IC04 | 1.003 | outfall | 8.6 | 0.984 | 0.486 | 0.2235 | 10.6 |

**Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 96.06%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | IC01 | 16 | 11.500 | 0.700 | 15.3 | 0.6356 | 2.8509 | FLOOD |
| 15 minute summer | IC02 | 10 | 11.480 | 1.039 | 18.0 | 0.6026 | 0.4830 | FLOOD |
| 30 minute summer | IC03 | 21 | 10.596 | 0.544 | 10.6 | 0.1539 | 0.0000 | SURCHARGED |
| 30 minute summer | IC04 | 21 | 9.465 | 0.077 | 8.8 | 0.0217 | 0.0000 | OK |
| 30 minute summer | outfall | 21 | 9.207 | 0.074 | 8.8 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | IC01 | 1.000 | IC02 | 6.1 | 0.801 | 0.895 | 0.2248 | |
| 15 minute summer | IC02 | 1.001 | IC03 | 11.1 | 1.422 | 1.645 | 0.2434 | |
| 30 minute summer | IC03 | 1.002 | IC04 | 8.8 | 1.122 | 1.298 | 0.3767 | |
| 30 minute summer | IC04 | 1.003 | outfall | 8.8 | 0.988 | 0.494 | 0.2265 | 11.6 |

# Appendix F -Proposed Drainage Layout


KEY

- Private Surface Water ditch
- Private Surface Water perforated pipe
- Private Surface Water pipe
- Private 600mm Inspection Chamber (Surface Water)
- Proposed Paved Levels
- Permeable Paving - Gravel Finished

General Notes:

1. Do not scale this drawing. All dimensions are in metres unless otherwise noted. Any discrepancies are to be recorded and reported to the engineers immediately.

2. This drawing is to be read in conjunction with all other engineers and architects drawings, and the specification.

3. All works are to be carried out in accordance with the specification for the works. The specification for the works refers to "Volume 1 of the Manual for Contract Documents for Highway Works" for highway works and the "Civil Engineering Specification for the Water Industry" is applicable for the drainage works.

4. All workmanship and materials are to be to current British Standards.

5. The contractor is responsible for and must take all necessary precautions to ensure the stability of the works at all times during construction.

6. All services are to be located and protected as necessary by the contractor prior to the commencement of the works.

7. Any existing details which are shown on this drawing are for guidance only and are to be checked on site by the contractor. Any variations are to be recorded and reported to the engineer immediately.

8. During construction works on site, all roads and footpaths are to be swept and kept clear of obstructions, this is to include existing highways as appropriate to ensure safe passage of all road users.

9. Provision shall be made for the installation of all mains services including ducting prior to the laying of the road base-course.

10. All road markings and signs are to be in accordance with `the traffic signs regulations and directions' 2016.

11. All private connections to adoptable sewers should be a minimum of 100mm diameter (foul) and 150mm diameter (surface) made in vitrified clay connecting soffit to soffit.

| Rev'n | Date | Description | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| B | 11.11.24 | Electric Cable added, | MJ | MJ | MJ |
| | | Basin location revised | | | |
| A | 18.10.24 | Basin location revised | MJ | MJ | MJ |

Status

MJ ENGINEERING GROUP

Client

New City Joinery

Project

Land at Stoney Brook Farm,
Walberton

Drawing title

Proposed Surface Water Drainage

| Drawn | Checked | Approved | Date |
|---|---|---|---|
| MJ | MJ | MJ | 10/24 |

| Scale at A1 | Drawing no. | Revision |
|---|---|---|
| 1:200 | A001-013/101 | B |

Scheme as approved under ref.s
APP/C3810/W/23/3316638
WA/87/22/PL

STONEYBROOK FARM

Driveway/Driveway

New City Joinery

Container Vans

Storage Shed

Container Vans

Outbuilding

Driveway/Driveway

RWP

450m²

1010m²

3m Maintenance Strip

Detention Basin

Upper Bay Stock 100%

Detention Basin

3m Maintenance Strip

3m Maintenance Strip

Underground Electric Cable, with 2m easement in green either side.

PRINT ACCURACY INDICATOR 50mm 100mm

ARUN DISTRICT COUNCIL WA/106/24/PL

General Notes:

1. Do not scale this drawing. All dimensions are in metres unless otherwise noted. Any discrepancies are to be recorded and reported to the engineers immediately.

2. This drawing is to be read in conjunction with all other engineers and architects drawings, and the specification.

3. All works are to be carried out in accordance with the specification for the works. The specification for the works refers to "Volume 1 of the Manual for Contract Documents for Highway Works" for highway works and the "Civil Engineering Specification for the Water Industry" is applicable for the drainage works.

4. All workmanship and materials are to be to current British Standards.

5. The contractor is responsible for and must take all necessary precautions to ensure the stability of the works at all times during construction.

6. All services are to be located and protected as necessary by the contractor prior to the commencement of the works.

7. Any existing details which are shown on this drawing are for guidance only and are to be checked on site by the contractor. Any variations are to be recorded and reported to the engineer immediately.

8. During construction works on site, all roads and footpaths are to be swept and kept clear of obstructions, this is to include existing highways as appropriate to ensure safe passage of all road users.

9. Provision shall be made for the installation of all mains services including ducting prior to the laying of the road base-course.

10. All road markings and signs are to be in accordance with `the traffic signs regulations and directions' 2016.

11. All private connections to adoptable sewers should be a minimum of 100mm diameter (foul) and 150mm diameter (surface) made in vitrified clay connecting soffit to soffit.

| Rev'n | Date | Description | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| A | 11.11.24 | Electric Cable added, Basin location revised | MJ | MJ | MJ |

Status

MJ ENGINEERING GROUP

Client

New City Joinery

Project

Land at Stoney Brook Farm, Walberton

Drawing title

Proposed Surface Water Impermeable Catchment Plan

| Drawn | Checked | Approved | Date |
|---|---|---|---|
| MJ | MJ | MJ | 10/24 |

Scale at A1: 1:200

Drawing no.: A001-013/200

Revision: A

# Appendix G -Hydraulic Modelling

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FSR | Maximum Time of Concentration (mins) | 30.00 |
| Return Period (years) | 1 | Maximum Rainfall (mm/hr) | 50.0 |
| Additional Flow (%) | 0 | Minimum Velocity (m/s) | 1.00 |
| FSR Region | England and Wales | Connection Type | Level Soffits |
| M5-60 (mm) | 20.000 | Minimum Backdrop Height (m) | 0.200 |
| Ratio-R | 0.400 | Preferred Cover Depth (m) | 1.200 |
| CV | 1.000 | Include Intermediate Ground | x |
| Time of Entry (mins) | 5.00 | Enforce best practice design rules | x |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| 1 | 0.022 | 5.00 | 11.500 | 600 | 1873687.952 | -215932.244 | 0.700 |
| 2 | 0.015 | 5.00 | 11.480 | 600 | 1873686.779 | -215960.954 | 0.967 |
| 3 | 0.146 | 5.00 | 11.100 | 600 | 1873685.842 | -215992.049 | 0.898 |
| 4 | | | 11.150 | 600 | 1873692.877 | -216019.300 | 1.250 |
| 5 | | | 11.300 | | 1873715.268 | -216037.046 | 1.544 |
| 20 | | | 11.300 | | 1873714.959 | -216049.326 | 1.578 |
| 21 | | | 11.150 | 600 | 1873683.089 | -216053.829 | 1.571 |
| 22 | | | 10.490 | | 1873682.205 | -216066.557 | 1.039 |
| 6 | | | 11.300 | | 1873717.843 | -216034.627 | 1.564 |
| 7 | | | 11.300 | | 1873719.676 | -216033.369 | 1.565 |
| 8 | | | 11.300 | | 1873721.802 | -216032.718 | 1.566 |
| 9 | | | 11.300 | | 1873723.587 | -216032.860 | 1.567 |
| 10 | | | 11.300 | | 1873725.136 | -216033.759 | 1.567 |
| 11 | | | 11.300 | | 1873725.830 | -216034.975 | 1.571 |
| 12 | | | 11.300 | | 1873725.101 | -216037.230 | 1.573 |
| 13 | | | 11.300 | | 1873722.729 | -216038.703 | 1.574 |
| 14 | | | 11.300 | | 1873719.996 | -216039.277 | 1.575 |
| 15 | | | 11.300 | | 1873717.972 | -216040.119 | 1.576 |
| 16 | | | 11.300 | | 1873717.120 | -216041.511 | 1.577 |
| 17 | | | 11.300 | | 1873717.019 | -216043.112 | 1.577 |
| 18 | | | 11.300 | | 1873717.027 | -216044.136 | 1.578 |
| 19 | | | 11.300 | | 1873716.501 | -216046.937 | 1.578 |

## Links

| Name | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 2 | 28.734 | 0.600 | 10.800 | 10.513 | 0.287 | 100.1 | 100 | 5.62 | 50.0 |
| 1.001 | 2 | 3 | 31.109 | 0.600 | 10.513 | 10.202 | 0.311 | 100.0 | 150 | 6.14 | 49.8 |
| 1.002 | 3 | 4 | 28.144 | 0.600 | 10.202 | 9.900 | 0.302 | 93.2 | 300 | 6.43 | 48.7 |
| 1.003 | 4 | 5 | 28.571 | 0.600 | 9.900 | 9.773 | 0.127 | 225.0 | 300 | 6.68 | 47.1 |
| 1.005 | 6 | 7 | 2.223 | 0.012 | 9.736 | 9.735 | 0.001 | 2000.0 | 300 | 7.05 | 46.6 |

| US Depth (m) | DS Depth (m) | Σ Area (ha) |
|---|---|---|
| 0.600 | 0.667 | 0.022 |
| 0.817 | 0.748 | 0.037 |
| 0.598 | 0.950 | 0.183 |
| 0.950 | 1.227 | 0.183 |
| 1.264 | 1.365 | 0.183 |

## Links

| Name | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.006 | 7 | 8 | 2.223 | 0.012 | 9.735 | 9.734 | 0.001 | 2000.0 | 300 | 7.17 | 46.2 |
| 1.004 | 5 | 6 | 3.297 | 0.012 | 9.756 | 9.736 | 0.020 | 164.9 | 300 | 6.93 | 40.8 |
| 1.010 | 11 | 12 | 3.669 | 0.012 | 9.729 | 9.727 | 0.002 | 1834.5 | 300 | 7.57 | 43.7 |
| 1.019 | 20 | 21 | 32.187 | 0.012 | 9.722 | 9.579 | 0.143 | 225.1 | 225 | 8.93 | 41.2 |
| 1.007 | 8 | 9 | 1.791 | 0.012 | 9.734 | 9.733 | 0.001 | 2000.0 | 300 | 7.26 | 45.9 |
| 1.008 | 9 | 10 | 1.000 | 0.012 | 9.733 | 9.733 | 0.000 | 2000.0 | 300 | 7.31 | 45.7 |
| 1.009 | 10 | 11 | 1.400 | 0.012 | 9.733 | 9.732 | 0.001 | 2000.0 | 300 | 7.39 | 45.5 |
| 1.020 | 21 | 22 | 12.759 | 0.012 | 9.579 | 9.451 | 0.128 | 99.7 | 100 | 9.23 | 40.5 |
| 1.011 | 12 | 13 | 2.792 | 0.012 | 9.727 | 9.726 | 0.001 | 2000.0 | 300 | 7.72 | 44.5 |
| 1.012 | 13 | 14 | 2.793 | 0.012 | 9.726 | 9.725 | 0.001 | 2000.0 | 300 | 7.86 | 44.1 |
| 1.013 | 14 | 15 | 2.192 | 0.012 | 9.725 | 9.724 | 0.001 | 2000.0 | 300 | 7.98 | 43.7 |
| 1.014 | 15 | 16 | 1.632 | 0.012 | 9.724 | 9.723 | 0.001 | 2000.0 | 300 | 8.06 | 43.5 |
| 1.015 | 16 | 17 | 1.000 | 0.012 | 9.723 | 9.723 | 0.000 | 2000.0 | 300 | 8.11 | 43.3 |
| 1.016 | 17 | 18 | 1.024 | 0.012 | 9.723 | 9.722 | 0.001 | 2000.0 | 300 | 8.17 | 43.2 |
| 1.017 | 18 | 19 | 1.000 | 0.012 | 9.722 | 9.722 | 0.000 | 2000.0 | 300 | 8.22 | 43.0 |
| 1.018 | 19 | 20 | 1.000 | 0.012 | 9.722 | 9.722 | 0.000 | 2000.0 | 300 | 8.27 | 42.9 |

| US Depth (m) | DS Depth (m) | Σ Area (ha) |
|---|---|---|
| 1.265 | 1.266 | 0.183 |
| 1.264 | 1.264 | 0.183 |
| 1.271 | 1.273 | 0.183 |
| 1.353 | 1.346 | 0.183 |
| 1.266 | 1.267 | 0.183 |
| 1.267 | 1.267 | 0.183 |
| 1.267 | 1.268 | 0.183 |
| 1.471 | 0.939 | 0.183 |
| 1.273 | 1.274 | 0.183 |
| 1.274 | 1.275 | 0.183 |
| 1.275 | 1.276 | 0.183 |
| 1.276 | 1.277 | 0.183 |
| 1.277 | 1.277 | 0.183 |
| 1.277 | 1.278 | 0.183 |
| 1.278 | 1.278 | 0.183 |
| 1.278 | 1.278 | 0.183 |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-22 | Skip Steady State | ✓ | Check Discharge Rate(s) | x |
| Rainfall Events | Singular | Drain Down Time (mins) | 10080 | Check Discharge Volume | x |
| Summer CV | 1.000 | Additional Storage (m³/ha) | 0.0 | | |
| Analysis Speed | Detailed | Starting Level (m) | | | |

### Storm Durations

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

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 100 | 25 | 0 | 0 |

## Node 21 Online Orifice Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Design Depth (m) | 0.800 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Design Flow (l/s) | 0.1 | | |
| Invert Level (m) | 9.579 | Diameter (m) | 0.025 | | |

## Node 6 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 25.4 | 0.0 | 1.250 | 55.8 | 0.0 |

## Node 7 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 17.1 | 0.0 | 1.250 | 37.6 | 0.0 |

## Node 8 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 17.1 | 0.0 | 1.250 | 37.6 | 0.0 |

## Node 9 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 13.8 | 0.0 | 1.250 | 30.3 | 0.0 |

## Node 10 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.7 | 0.0 | 1.250 | 16.9 | 0.0 |

## Node 11 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 10.8 | 0.0 | 1.250 | 23.7 | 0.0 |

## Node 12 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 28.3 | 0.0 | 1.250 | 62.0 | 0.0 |

## Node 13 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 21.5 | 0.0 | 1.250 | 47.2 | 0.0 |

## Node 14 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 21.5 | 0.0 | 1.250 | 47.2 | 0.0 |

## Node 15 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 16.9 | 0.0 | 1.250 | 37.1 | 0.0 |

## Node 16 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 12.6 | 0.0 | 1.250 | 27.6 | 0.0 |

## Node 17 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.7 | 0.0 | 1.250 | 16.9 | 0.0 |

## Node 18 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.9 | 0.0 | 1.250 | 17.3 | 0.0 |

## Node 19 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.7 | 0.0 | 1.250 | 16.9 | 0.0 |

## Node 4 Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 10.795 | Slope (1:X) | 1000.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 0 | Depth (m) | 0.225 |
| Safety Factor | 1.5 | Width (m) | 14.800 | Inf Depth (m) | |
| Porosity | 0.30 | Length (m) | 50.000 | | |

## Node 20 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.7 | 0.0 | 1.250 | 16.9 | 0.0 |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.19%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 10 | 10.847 | 0.047 | 2.7 | 0.0132 | 0.0000 | OK |
| 15 minute summer | 2 | 11 | 10.564 | 0.051 | 4.6 | 0.0145 | 0.0000 | OK |
| 15 minute summer | 3 | 10 | 10.292 | 0.090 | 22.6 | 0.0256 | 0.0000 | OK |
| 360 minute summer | 4 | 280 | 10.104 | 0.204 | 6.8 | 0.0577 | 0.0000 | OK |
| 360 minute summer | 5 | 280 | 10.104 | 0.348 | 6.5 | 0.0000 | 0.0000 | SURCHARGED |
| 360 minute summer | 20 | 280 | 10.104 | 0.382 | 1.2 | 0.4292 | 0.0000 | SURCHARGED |
| 360 minute summer | 21 | 280 | 10.104 | 0.525 | 1.0 | 0.1485 | 0.0000 | SURCHARGED |
| 15 minute summer | 22 | 1 | 9.451 | 0.000 | 0.9 | 0.0000 | 0.0000 | OK |
| 360 minute summer | 6 | 280 | 10.104 | 0.368 | 6.5 | 1.4163 | 0.0000 | SURCHARGED |
| 360 minute summer | 7 | 280 | 10.104 | 0.369 | 5.9 | 0.9535 | 0.0000 | SURCHARGED |
| 360 minute summer | 8 | 280 | 10.104 | 0.370 | 5.5 | 0.9535 | 0.0000 | SURCHARGED |
| 360 minute summer | 9 | 280 | 10.104 | 0.371 | 5.1 | 0.7694 | 0.0000 | SURCHARGED |
| 360 minute summer | 10 | 280 | 10.104 | 0.371 | 4.8 | 0.4293 | 0.0000 | SURCHARGED |
| 360 minute summer | 11 | 280 | 10.104 | 0.375 | 4.6 | 0.6021 | 0.0000 | SURCHARGED |
| 360 minute summer | 12 | 280 | 10.104 | 0.377 | 4.4 | 1.5776 | 0.0000 | SURCHARGED |
| 360 minute summer | 13 | 280 | 10.104 | 0.378 | 3.8 | 1.1986 | 0.0000 | SURCHARGED |
| 360 minute summer | 14 | 280 | 10.104 | 0.379 | 3.3 | 1.1985 | 0.0000 | SURCHARGED |
| 360 minute summer | 15 | 280 | 10.104 | 0.380 | 2.7 | 0.9421 | 0.0000 | SURCHARGED |
| 360 minute summer | 16 | 280 | 10.104 | 0.381 | 2.2 | 0.7023 | 0.0000 | SURCHARGED |
| 360 minute summer | 17 | 280 | 10.104 | 0.381 | 1.9 | 0.4292 | 0.0000 | SURCHARGED |
| 360 minute summer | 18 | 280 | 10.104 | 0.382 | 1.6 | 0.4403 | 0.0000 | SURCHARGED |
| 360 minute summer | 19 | 280 | 10.104 | 0.382 | 1.4 | 0.4292 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1.000 | 2 | 2.7 | 0.705 | 0.441 | 0.1087 | |
| 15 minute summer | 2 | 1.001 | 3 | 4.5 | 0.554 | 0.252 | 0.2534 | |
| 15 minute summer | 3 | 1.002 | 4 | 22.3 | 1.088 | 0.193 | 0.5823 | |
| 360 minute summer | 4 | 1.003 | 5 | 6.5 | 0.213 | 0.088 | 1.7343 | |
| 360 minute summer | 5 | 1.004 | 6 | 6.5 | 0.369 | 0.122 | 0.2254 | |
| 360 minute summer | 20 | 1.019 | 21 | 1.0 | 0.195 | 0.030 | 1.2801 | |
| 360 minute summer | 21 | Orifice | 22 | 0.9 | | | | 38.5 |
| 360 minute summer | 6 | 1.005 | 7 | 5.9 | 0.668 | 0.384 | 0.1609 | |
| 360 minute summer | 7 | 1.006 | 8 | 5.5 | 0.272 | 0.360 | 0.1617 | |
| 360 minute summer | 8 | 1.007 | 9 | 5.1 | 0.333 | 0.335 | 0.1310 | |
| 360 minute summer | 9 | 1.008 | 10 | 4.8 | 0.339 | 0.315 | 0.0733 | |
| 360 minute summer | 10 | 1.009 | 11 | 4.6 | 0.267 | 0.304 | 0.1030 | |
| 360 minute summer | 11 | 1.010 | 12 | 4.4 | 0.236 | 0.277 | 0.2765 | |
| 360 minute summer | 12 | 1.011 | 13 | 3.8 | 0.290 | 0.250 | 0.2121 | |
| 360 minute summer | 13 | 1.012 | 14 | 3.3 | 0.491 | 0.213 | 0.2133 | |
| 360 minute summer | 14 | 1.013 | 15 | 2.7 | 0.560 | 0.177 | 0.1683 | |
| 360 minute summer | 15 | 1.014 | 16 | 2.2 | 0.311 | 0.147 | 0.1259 | |
| 360 minute summer | 16 | 1.015 | 17 | 1.9 | 0.381 | 0.123 | 0.0774 | |
| 360 minute summer | 17 | 1.016 | 18 | 1.6 | 0.548 | 0.108 | 0.0794 | |
| 360 minute summer | 18 | 1.017 | 19 | 1.4 | 0.845 | 0.091 | 0.0778 | |
| 360 minute summer | 19 | 1.018 | 20 | 1.2 | 0.789 | 0.076 | 0.0778 | |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.19%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 12 | 11.339 | 0.539 | 10.5 | 0.1526 | 0.0000 | FLOOD RISK |
| 15 minute summer | 2 | 12 | 10.664 | 0.151 | 15.4 | 0.0426 | 0.0000 | SURCHARGED |
| 15 minute summer | 3 | 11 | 10.454 | 0.252 | 83.9 | 0.0714 | 0.0000 | OK |
| 15 minute summer | 4 | 11 | 10.308 | 0.408 | 80.7 | 0.1154 | 0.0000 | SURCHARGED |
| 360 minute summer | 5 | 360 | 10.307 | 0.551 | 17.7 | 0.0000 | 0.0000 | SURCHARGED |
| 360 minute summer | 20 | 360 | 10.307 | 0.585 | 2.6 | 2.2269 | 0.0000 | SURCHARGED |
| 360 minute summer | 21 | 360 | 10.307 | 0.728 | 1.4 | 0.2060 | 0.0000 | SURCHARGED |
| 15 minute summer | 22 | 1 | 9.451 | 0.000 | 1.0 | 0.0000 | 0.0000 | OK |
| 360 minute summer | 6 | 360 | 10.307 | 0.571 | 17.6 | 7.3474 | 0.0000 | SURCHARGED |
| 360 minute summer | 7 | 360 | 10.307 | 0.572 | 15.7 | 4.9473 | 0.0000 | SURCHARGED |
| 360 minute summer | 8 | 360 | 10.307 | 0.573 | 14.5 | 4.9473 | 0.0000 | SURCHARGED |
| 360 minute summer | 9 | 360 | 10.307 | 0.574 | 13.2 | 3.9914 | 0.0000 | SURCHARGED |
| 360 minute summer | 10 | 360 | 10.307 | 0.574 | 12.2 | 2.2269 | 0.0000 | SURCHARGED |
| 360 minute summer | 11 | 360 | 10.307 | 0.578 | 11.6 | 3.1234 | 0.0000 | SURCHARGED |
| 360 minute summer | 12 | 360 | 10.307 | 0.580 | 10.8 | 8.1817 | 0.0000 | SURCHARGED |
| 360 minute summer | 13 | 360 | 10.307 | 0.581 | 8.7 | 6.2183 | 0.0000 | SURCHARGED |
| 360 minute summer | 14 | 360 | 10.307 | 0.582 | 7.1 | 6.2183 | 0.0000 | SURCHARGED |
| 360 minute summer | 15 | 360 | 10.307 | 0.583 | 5.5 | 4.8879 | 0.0000 | SURCHARGED |
| 360 minute summer | 16 | 360 | 10.307 | 0.584 | 4.3 | 3.6426 | 0.0000 | SURCHARGED |
| 360 minute summer | 17 | 360 | 10.307 | 0.584 | 3.3 | 2.2269 | 0.0000 | SURCHARGED |
| 360 minute summer | 18 | 360 | 10.307 | 0.585 | 2.8 | 2.2837 | 0.0000 | SURCHARGED |
| 360 minute summer | 19 | 360 | 10.307 | 0.585 | 2.2 | 2.2269 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1.000 | 2 | 8.7 | 1.111 | 1.441 | 0.2248 | |
| 15 minute summer | 2 | 1.001 | 3 | 15.3 | 0.894 | 0.859 | 0.5475 | |
| 15 minute summer | 3 | 1.002 | 4 | 80.7 | 1.298 | 0.701 | 1.8812 | |
| 15 minute summer | 4 | 1.003 | 5 | 80.6 | 1.144 | 1.092 | 2.0120 | |
| 360 minute summer | 5 | 1.004 | 6 | 17.6 | 0.400 | 0.331 | 0.5538 | |
| 360 minute summer | 20 | 1.019 | 21 | 1.4 | 0.351 | 0.044 | 1.2801 | |
| 360 minute summer | 21 | Orifice | 22 | 1.1 | | | | 100.7 |
| | | | | | | | | |
| 360 minute summer | 6 | 1.005 | 7 | 15.7 | 0.373 | 1.030 | 0.3874 | |
| 360 minute summer | 7 | 1.006 | 8 | 14.5 | 0.435 | 0.947 | 0.3887 | |
| 360 minute summer | 8 | 1.007 | 9 | 13.2 | 0.848 | 0.864 | 0.3142 | |
| 360 minute summer | 9 | 1.008 | 10 | 12.2 | 0.742 | 0.798 | 0.1758 | |
| 360 minute summer | 10 | 1.009 | 11 | 11.6 | 0.293 | 0.760 | 0.2466 | |
| 360 minute summer | 11 | 1.010 | 12 | 10.8 | 0.289 | 0.676 | 0.6564 | |
| 360 minute summer | 12 | 1.011 | 13 | 8.7 | 0.318 | 0.569 | 0.5021 | |
| 360 minute summer | 13 | 1.012 | 14 | 7.1 | 0.389 | 0.465 | 0.5040 | |
| 360 minute summer | 14 | 1.013 | 15 | 5.5 | 0.538 | 0.361 | 0.3969 | |
| 360 minute summer | 15 | 1.014 | 16 | 4.3 | 1.033 | 0.279 | 0.2965 | |
| 360 minute summer | 16 | 1.015 | 17 | 3.3 | 0.296 | 0.219 | 0.1820 | |
| 360 minute summer | 17 | 1.016 | 18 | 2.8 | 0.322 | 0.181 | 0.1867 | |
| 360 minute summer | 18 | 1.017 | 19 | 2.2 | 0.348 | 0.143 | 0.1826 | |
| 360 minute summer | 19 | 1.018 | 20 | 2.6 | 0.699 | 0.172 | 0.1826 | |

**Results for 100 year +25% CC Critical Storm Duration. Lowest mass balance: 99.19%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 9 | 11.500 | 0.700 | 16.4 | 0.1981 | 2.2148 | FLOOD |
| 15 minute summer | 2 | 11 | 11.286 | 0.773 | 18.2 | 0.2188 | 0.0000 | FLOOD RISK |
| 15 minute summer | 3 | 10 | 11.001 | 0.799 | 123.6 | 0.2262 | 0.0000 | FLOOD RISK |
| 15 minute summer | 4 | 11 | 10.576 | 0.676 | 121.8 | 0.1914 | 0.0000 | SURCHARGED |
| 480 minute summer | 5 | 480 | 10.476 | 0.720 | 21.4 | 0.0000 | 0.0000 | SURCHARGED |
| 480 minute summer | 20 | 480 | 10.476 | 0.754 | 2.4 | 3.9501 | 0.0000 | SURCHARGED |
| 480 minute summer | 21 | 480 | 10.476 | 0.897 | 1.5 | 0.2537 | 0.0000 | SURCHARGED |
| 15 minute summer | 22 | 1 | 9.451 | 0.000 | 1.0 | 0.0000 | 0.0000 | OK |
| 480 minute summer | 6 | 480 | 10.476 | 0.740 | 21.3 | 13.0340 | 0.0000 | SURCHARGED |
| 480 minute summer | 7 | 480 | 10.476 | 0.741 | 19.0 | 8.7773 | 0.0000 | SURCHARGED |
| 480 minute summer | 8 | 480 | 10.476 | 0.742 | 17.5 | 8.7773 | 0.0000 | SURCHARGED |
| 480 minute summer | 9 | 480 | 10.476 | 0.743 | 15.9 | 7.0803 | 0.0000 | SURCHARGED |
| 480 minute summer | 10 | 480 | 10.476 | 0.743 | 14.7 | 3.9501 | 0.0000 | SURCHARGED |
| 480 minute summer | 11 | 480 | 10.476 | 0.747 | 14.0 | 5.5401 | 0.0000 | SURCHARGED |
| 480 minute summer | 12 | 480 | 10.476 | 0.749 | 13.0 | 14.5098 | 0.0000 | SURCHARGED |
| 480 minute summer | 13 | 480 | 10.476 | 0.750 | 10.4 | 11.0304 | 0.0000 | SURCHARGED |
| 480 minute summer | 14 | 480 | 10.476 | 0.751 | 8.5 | 11.0304 | 0.0000 | SURCHARGED |
| 480 minute summer | 15 | 480 | 10.476 | 0.752 | 6.6 | 8.6703 | 0.0000 | SURCHARGED |
| 480 minute summer | 16 | 480 | 10.476 | 0.753 | 5.0 | 6.4599 | 0.0000 | SURCHARGED |
| 480 minute summer | 17 | 480 | 10.476 | 0.753 | 3.9 | 3.9501 | 0.0000 | SURCHARGED |
| 480 minute summer | 18 | 480 | 10.476 | 0.754 | 3.2 | 4.0499 | 0.0000 | SURCHARGED |
| 480 minute summer | 19 | 480 | 10.476 | 0.754 | 2.5 | 3.9501 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1.000 | 2 | 9.0 | 1.148 | 1.488 | 0.2248 | |
| 15 minute summer | 2 | 1.001 | 3 | 19.1 | 1.086 | 1.077 | 0.5477 | |
| 15 minute summer | 3 | 1.002 | 4 | 121.8 | 1.729 | 1.058 | 1.9819 | |
| 15 minute summer | 4 | 1.003 | 5 | 120.9 | 1.717 | 1.638 | 2.0120 | |
| 480 minute summer | 5 | 1.004 | 6 | 21.3 | 0.402 | 0.400 | 0.9368 | |
| 480 minute summer | 20 | 1.019 | 21 | 1.5 | 0.221 | 0.045 | 1.2801 | |
| 480 minute summer | 21 | Orifice | 22 | 1.2 | | | | 165.3 |
| | | | | | | | | |
| 480 minute summer | 6 | 1.005 | 7 | 19.0 | 0.373 | 1.245 | 0.6498 | |
| 480 minute summer | 7 | 1.006 | 8 | 17.5 | 0.439 | 1.144 | 0.6515 | |
| 480 minute summer | 8 | 1.007 | 9 | 15.9 | 0.508 | 1.044 | 0.5263 | |
| 480 minute summer | 9 | 1.008 | 10 | 14.7 | 0.902 | 0.963 | 0.2942 | |
| 480 minute summer | 10 | 1.009 | 11 | 14.0 | 0.297 | 0.917 | 0.4127 | |
| 480 minute summer | 11 | 1.010 | 12 | 13.0 | 0.291 | 0.814 | 1.0946 | |
| 480 minute summer | 12 | 1.011 | 13 | 10.4 | 0.312 | 0.684 | 0.8362 | |
| 480 minute summer | 13 | 1.012 | 14 | 8.5 | 0.346 | 0.556 | 0.8387 | |
| 480 minute summer | 14 | 1.013 | 15 | 6.6 | 0.387 | 0.430 | 0.6600 | |
| 480 minute summer | 15 | 1.014 | 16 | 5.0 | 0.397 | 0.330 | 0.4927 | |
| 480 minute summer | 16 | 1.015 | 17 | 3.9 | 0.342 | 0.257 | 0.3023 | |
| 480 minute summer | 17 | 1.016 | 18 | 3.2 | 0.883 | 0.211 | 0.3099 | |
| 480 minute summer | 18 | 1.017 | 19 | 2.5 | 0.295 | 0.164 | 0.3031 | |
| 480 minute summer | 19 | 1.018 | 20 | 2.4 | 0.713 | 0.155 | 0.3031 | |

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FSR | Maximum Time of Concentration (mins) | 30.00 |
| Return Period (years) | 1 | Maximum Rainfall (mm/hr) | 50.0 |
| Additional Flow (%) | 0 | Minimum Velocity (m/s) | 1.00 |
| FSR Region | England and Wales | Connection Type | Level Soffits |
| M5-60 (mm) | 20.000 | Minimum Backdrop Height (m) | 0.200 |
| Ratio-R | 0.400 | Preferred Cover Depth (m) | 1.200 |
| CV | 1.000 | Include Intermediate Ground | x |
| Time of Entry (mins) | 5.00 | Enforce best practice design rules | x |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| 1 | 0.022 | 5.00 | 11.500 | 600 | 1873687.952 | -215932.244 | 0.700 |
| 2 | 0.015 | 5.00 | 11.480 | 600 | 1873686.779 | -215960.954 | 0.967 |
| 3 | 0.146 | 5.00 | 11.100 | 600 | 1873685.842 | -215992.049 | 0.898 |
| 4 | | | 11.150 | 600 | 1873692.877 | -216019.300 | 1.250 |
| 5 | | | 11.300 | | 1873715.268 | -216037.046 | 1.544 |
| 20 | | | 11.300 | | 1873714.959 | -216049.326 | 1.578 |
| 21 | | | 11.150 | 600 | 1873683.089 | -216053.829 | 1.571 |
| 22 | | | 10.490 | | 1873682.205 | -216066.557 | 1.039 |
| 6 | | | 11.300 | | 1873717.843 | -216034.627 | 1.564 |
| 7 | | | 11.300 | | 1873719.676 | -216033.369 | 1.565 |
| 8 | | | 11.300 | | 1873721.802 | -216032.718 | 1.566 |
| 9 | | | 11.300 | | 1873723.587 | -216032.860 | 1.567 |
| 10 | | | 11.300 | | 1873725.136 | -216033.759 | 1.567 |
| 11 | | | 11.300 | | 1873725.830 | -216034.975 | 1.571 |
| 12 | | | 11.300 | | 1873725.101 | -216037.230 | 1.573 |
| 13 | | | 11.300 | | 1873722.729 | -216038.703 | 1.574 |
| 14 | | | 11.300 | | 1873719.996 | -216039.277 | 1.575 |
| 15 | | | 11.300 | | 1873717.972 | -216040.119 | 1.576 |
| 16 | | | 11.300 | | 1873717.120 | -216041.511 | 1.577 |
| 17 | | | 11.300 | | 1873717.019 | -216043.112 | 1.577 |
| 18 | | | 11.300 | | 1873717.027 | -216044.136 | 1.578 |
| 19 | | | 11.300 | | 1873716.501 | -216046.937 | 1.578 |

## Links

| Name | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 2 | 28.734 | 0.600 | 10.800 | 10.513 | 0.287 | 100.1 | 100 | 5.62 | 50.0 |
| 1.001 | 2 | 3 | 31.109 | 0.600 | 10.513 | 10.202 | 0.311 | 100.0 | 150 | 6.14 | 49.8 |
| 1.002 | 3 | 4 | 28.144 | 0.600 | 10.202 | 9.900 | 0.302 | 93.2 | 300 | 6.43 | 48.7 |
| 1.003 | 4 | 5 | 28.571 | 0.600 | 9.900 | 9.773 | 0.127 | 225.0 | 300 | 6.68 | 47.1 |
| 1.005 | 6 | 7 | 2.223 | 0.012 | 9.736 | 9.735 | 0.001 | 2000.0 | 300 | 7.05 | 46.6 |

| US Depth (m) | DS Depth (m) | Σ Area (ha) |
|---|---|---|
| 0.600 | 0.567 | 0.022 |
| 0.817 | 0.748 | 0.037 |
| 0.598 | 0.950 | 0.183 |
| 0.950 | 1.227 | 0.183 |
| 1.264 | 1.365 | 0.183 |

## Links

| Name | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.006 | 7 | 8 | 2.223 | 0.012 | 9.735 | 9.734 | 0.001 | 2000.0 | 300 | 7.17 | 46.2 |
| 1.004 | 5 | 6 | 3.297 | 0.012 | 9.756 | 9.736 | 0.020 | 164.9 | 300 | 6.93 | 40.8 |
| 1.010 | 11 | 12 | 3.669 | 0.012 | 9.729 | 9.727 | 0.002 | 1834.5 | 300 | 7.57 | 43.7 |
| 1.019 | 20 | 21 | 32.187 | 0.012 | 9.722 | 9.579 | 0.143 | 225.1 | 225 | 8.93 | 41.2 |
| 1.007 | 8 | 9 | 1.791 | 0.012 | 9.734 | 9.733 | 0.001 | 2000.0 | 300 | 7.26 | 45.9 |
| 1.008 | 9 | 10 | 1.000 | 0.012 | 9.733 | 9.733 | 0.000 | 2000.0 | 300 | 7.31 | 45.7 |
| 1.009 | 10 | 11 | 1.400 | 0.012 | 9.733 | 9.732 | 0.001 | 2000.0 | 300 | 7.39 | 45.5 |
| 1.020 | 21 | 22 | 12.759 | 0.012 | 9.579 | 9.451 | 0.128 | 99.7 | 100 | 9.23 | 40.5 |
| 1.011 | 12 | 13 | 2.792 | 0.012 | 9.727 | 9.726 | 0.001 | 2000.0 | 300 | 7.72 | 44.5 |
| 1.012 | 13 | 14 | 2.793 | 0.012 | 9.726 | 9.725 | 0.001 | 2000.0 | 300 | 7.86 | 44.1 |
| 1.013 | 14 | 15 | 2.192 | 0.012 | 9.725 | 9.724 | 0.001 | 2000.0 | 300 | 7.98 | 43.7 |
| 1.014 | 15 | 16 | 1.632 | 0.012 | 9.724 | 9.723 | 0.001 | 2000.0 | 300 | 8.06 | 43.5 |
| 1.015 | 16 | 17 | 1.000 | 0.012 | 9.723 | 9.723 | 0.000 | 2000.0 | 300 | 8.11 | 43.3 |
| 1.016 | 17 | 18 | 1.024 | 0.012 | 9.723 | 9.722 | 0.001 | 2000.0 | 300 | 8.17 | 43.2 |
| 1.017 | 18 | 19 | 1.000 | 0.012 | 9.722 | 9.722 | 0.000 | 2000.0 | 300 | 8.22 | 43.0 |
| 1.018 | 19 | 20 | 1.000 | 0.012 | 9.722 | 9.722 | 0.000 | 2000.0 | 300 | 8.27 | 42.9 |

| US Depth (m) | DS Depth (m) | Σ Area (ha) |
|---|---|---|
| 1.265 | 1.266 | 0.183 |
| 1.264 | 1.264 | 0.183 |
| 1.271 | 1.273 | 0.183 |
| 1.353 | 1.346 | 0.183 |
| 1.266 | 1.267 | 0.183 |
| 1.267 | 1.267 | 0.183 |
| 1.267 | 1.268 | 0.183 |
| 1.471 | 0.939 | 0.183 |
| 1.273 | 1.274 | 0.183 |
| 1.274 | 1.275 | 0.183 |
| 1.275 | 1.276 | 0.183 |
| 1.276 | 1.277 | 0.183 |
| 1.277 | 1.277 | 0.183 |
| 1.277 | 1.278 | 0.183 |
| 1.278 | 1.278 | 0.183 |
| 1.278 | 1.278 | 0.183 |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-22 | Skip Steady State | ✓ | Check Discharge Rate(s) | x |
| Rainfall Events | Singular | Drain Down Time (mins) | 10080 | Check Discharge Volume | x |
| Summer CV | 1.000 | Additional Storage (m³/ha) | 0.0 | | |
| Analysis Speed | Detailed | Starting Level (m) | 9.760 | | |

### Storm Durations

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

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 100 | 25 | 0 | 0 |

## Node 21 Online Orifice Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Design Depth (m) | 0.800 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Design Flow (l/s) | 0.1 | | |
| Invert Level (m) | 9.579 | Diameter (m) | 0.025 | | |

## Node 6 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 25.4 | 0.0 | 1.250 | 55.8 | 0.0 |

## Node 7 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 17.1 | 0.0 | 1.250 | 37.6 | 0.0 |

## Node 8 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 17.1 | 0.0 | 1.250 | 37.6 | 0.0 |

## Node 9 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 13.8 | 0.0 | 1.250 | 30.3 | 0.0 |

## Node 10 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.7 | 0.0 | 1.250 | 16.9 | 0.0 |

## Node 11 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 10.8 | 0.0 | 1.250 | 23.7 | 0.0 |

## Node 12 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 28.3 | 0.0 | 1.250 | 62.0 | 0.0 |

## Node 13 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 21.5 | 0.0 | 1.250 | 47.2 | 0.0 |

## Node 14 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 21.5 | 0.0 | 1.250 | 47.2 | 0.0 |

## Node 15 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 16.9 | 0.0 | 1.250 | 37.1 | 0.0 |

## Node 16 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 12.6 | 0.0 | 1.250 | 27.6 | 0.0 |

## Node 17 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.7 | 0.0 | 1.250 | 16.9 | 0.0 |

## Node 18 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.9 | 0.0 | 1.250 | 17.3 | 0.0 |

## Node 19 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.7 | 0.0 | 1.250 | 16.9 | 0.0 |

## Node 4 Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 10.795 | Slope (1:X) | 1000.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 0 | Depth (m) | 0.225 |
| Safety Factor | 1.5 | Width (m) | 14.800 | Inf Depth (m) | |
| Porosity | 0.30 | Length (m) | 50.000 | | |

## Node 20 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 0 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.7 | 0.0 | 1.250 | 16.9 | 0.0 |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 94.61%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 10 | 10.847 | 0.047 | 2.7 | 0.0132 | 0.0000 | OK |
| 15 minute summer | 2 | 11 | 10.564 | 0.051 | 4.6 | 0.0145 | 0.0000 | OK |
| 15 minute summer | 3 | 10 | 10.292 | 0.090 | 22.6 | 0.0256 | 0.0000 | OK |
| 360 minute summer | 4 | 280 | 10.104 | 0.204 | 6.8 | 0.0578 | 0.0000 | OK |
| 360 minute summer | 5 | 280 | 10.104 | 0.348 | 6.6 | 0.0000 | 0.0000 | SURCHARGED |
| 360 minute summer | 20 | 280 | 10.104 | 0.382 | 1.4 | 0.4312 | 0.0000 | SURCHARGED |
| 360 minute summer | 21 | 280 | 10.104 | 0.525 | 1.0 | 0.1486 | 0.0000 | SURCHARGED |
| 15 minute summer | 22 | 1 | 9.451 | 0.000 | 0.9 | 0.0000 | 0.0000 | OK |
| 360 minute summer | 6 | 280 | 10.104 | 0.368 | 6.5 | 1.4228 | 0.0000 | SURCHARGED |
| 360 minute summer | 7 | 280 | 10.104 | 0.369 | 6.0 | 0.9579 | 0.0000 | SURCHARGED |
| 360 minute summer | 8 | 280 | 10.104 | 0.370 | 5.6 | 0.9579 | 0.0000 | SURCHARGED |
| 360 minute summer | 9 | 280 | 10.104 | 0.371 | 5.2 | 0.7730 | 0.0000 | SURCHARGED |
| 360 minute summer | 10 | 280 | 10.104 | 0.371 | 4.9 | 0.4313 | 0.0000 | SURCHARGED |
| 360 minute summer | 11 | 280 | 10.104 | 0.375 | 4.7 | 0.6049 | 0.0000 | SURCHARGED |
| 360 minute summer | 12 | 280 | 10.104 | 0.377 | 4.6 | 1.5848 | 0.0000 | SURCHARGED |
| 360 minute summer | 13 | 280 | 10.104 | 0.378 | 3.9 | 1.2041 | 0.0000 | SURCHARGED |
| 360 minute summer | 14 | 280 | 10.104 | 0.379 | 3.5 | 1.2041 | 0.0000 | SURCHARGED |
| 360 minute summer | 15 | 280 | 10.104 | 0.380 | 3.0 | 0.9464 | 0.0000 | SURCHARGED |
| 360 minute summer | 16 | 280 | 10.104 | 0.381 | 2.5 | 0.7055 | 0.0000 | SURCHARGED |
| 360 minute summer | 17 | 280 | 10.104 | 0.381 | 2.1 | 0.4312 | 0.0000 | SURCHARGED |
| 360 minute summer | 18 | 280 | 10.104 | 0.382 | 1.8 | 0.4423 | 0.0000 | SURCHARGED |
| 360 minute summer | 19 | 280 | 10.104 | 0.382 | 1.5 | 0.4312 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1.000 | 2 | 2.7 | 0.705 | 0.441 | 0.1087 | |
| 15 minute summer | 2 | 1.001 | 3 | 4.5 | 0.554 | 0.252 | 0.2534 | |
| 15 minute summer | 3 | 1.002 | 4 | 22.3 | 1.088 | 0.193 | 0.5823 | |
| 360 minute summer | 4 | 1.003 | 5 | 6.6 | 0.209 | 0.090 | 1.7353 | |
| 360 minute summer | 5 | 1.004 | 6 | 6.5 | 0.307 | 0.122 | 0.2257 | |
| 360 minute summer | 20 | 1.019 | 21 | 1.0 | 0.112 | 0.029 | 1.2801 | |
| 360 minute summer | 21 | Orifice | 22 | 0.9 | | | | 39.7 |
| 360 minute summer | 6 | 1.005 | 7 | 6.0 | 0.255 | 0.390 | 0.1611 | |
| 360 minute summer | 7 | 1.006 | 8 | 5.6 | 0.231 | 0.365 | 0.1619 | |
| 360 minute summer | 8 | 1.007 | 9 | 5.2 | 0.244 | 0.340 | 0.1312 | |
| 360 minute summer | 9 | 1.008 | 10 | 4.9 | 0.249 | 0.320 | 0.0734 | |
| 360 minute summer | 10 | 1.009 | 11 | 4.7 | 0.245 | 0.308 | 0.1032 | |
| 360 minute summer | 11 | 1.010 | 12 | 4.6 | 0.223 | 0.290 | 0.2769 | |
| 360 minute summer | 12 | 1.011 | 13 | 3.9 | 0.212 | 0.257 | 0.2124 | |
| 360 minute summer | 13 | 1.012 | 14 | 3.5 | 0.223 | 0.229 | 0.2135 | |
| 360 minute summer | 14 | 1.013 | 15 | 3.0 | 0.239 | 0.194 | 0.1685 | |
| 360 minute summer | 15 | 1.014 | 16 | 2.5 | 0.259 | 0.161 | 0.1261 | |
| 360 minute summer | 16 | 1.015 | 17 | 2.1 | 0.279 | 0.134 | 0.0775 | |
| 360 minute summer | 17 | 1.016 | 18 | 1.8 | 0.318 | 0.117 | 0.0795 | |
| 360 minute summer | 18 | 1.017 | 19 | 1.5 | 0.402 | 0.098 | 0.0779 | |
| 360 minute summer | 19 | 1.018 | 20 | 1.4 | 0.932 | 0.093 | 0.0779 | |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 94.61%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 12 | 11.339 | 0.539 | 10.5 | 0.1526 | 0.0000 | FLOOD RISK |
| 15 minute summer | 2 | 12 | 10.664 | 0.151 | 15.4 | 0.0427 | 0.0000 | SURCHARGED |
| 15 minute summer | 3 | 11 | 10.455 | 0.253 | 83.9 | 0.0715 | 0.0000 | OK |
| 360 minute summer | 4 | 360 | 10.308 | 0.408 | 18.1 | 0.1155 | 0.0000 | SURCHARGED |
| 360 minute summer | 5 | 360 | 10.308 | 0.552 | 17.7 | 0.0000 | 0.0000 | SURCHARGED |
| 360 minute summer | 20 | 360 | 10.308 | 0.586 | 2.7 | 2.2358 | 0.0000 | SURCHARGED |
| 360 minute summer | 21 | 360 | 10.308 | 0.729 | 1.2 | 0.2063 | 0.0000 | SURCHARGED |
| 15 minute summer | 22 | 1 | 9.451 | 0.000 | 1.0 | 0.0000 | 0.0000 | OK |
| 360 minute summer | 6 | 360 | 10.308 | 0.572 | 17.6 | 7.3766 | 0.0000 | SURCHARGED |
| 360 minute summer | 7 | 360 | 10.308 | 0.573 | 15.7 | 4.9670 | 0.0000 | SURCHARGED |
| 360 minute summer | 8 | 360 | 10.308 | 0.574 | 14.5 | 4.9670 | 0.0000 | SURCHARGED |
| 360 minute summer | 9 | 360 | 10.308 | 0.575 | 13.2 | 4.0073 | 0.0000 | SURCHARGED |
| 360 minute summer | 10 | 360 | 10.308 | 0.575 | 12.2 | 2.2358 | 0.0000 | SURCHARGED |
| 360 minute summer | 11 | 360 | 10.308 | 0.579 | 11.6 | 3.1358 | 0.0000 | SURCHARGED |
| 360 minute summer | 12 | 360 | 10.308 | 0.581 | 10.8 | 8.2143 | 0.0000 | SURCHARGED |
| 360 minute summer | 13 | 360 | 10.308 | 0.582 | 8.7 | 6.2431 | 0.0000 | SURCHARGED |
| 360 minute summer | 14 | 360 | 10.308 | 0.583 | 7.1 | 6.2431 | 0.0000 | SURCHARGED |
| 360 minute summer | 15 | 360 | 10.308 | 0.584 | 5.5 | 4.9073 | 0.0000 | SURCHARGED |
| 360 minute summer | 16 | 360 | 10.308 | 0.585 | 4.3 | 3.6571 | 0.0000 | SURCHARGED |
| 360 minute summer | 17 | 360 | 10.308 | 0.585 | 3.3 | 2.2358 | 0.0000 | SURCHARGED |
| 360 minute summer | 18 | 360 | 10.308 | 0.586 | 2.8 | 2.2928 | 0.0000 | SURCHARGED |
| 360 minute summer | 19 | 360 | 10.308 | 0.586 | 2.2 | 2.2358 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1.000 | 2 | 8.7 | 1.111 | 1.440 | 0.2248 | |
| 15 minute summer | 2 | 1.001 | 3 | 15.2 | 0.894 | 0.859 | 0.5476 | |
| 15 minute summer | 3 | 1.002 | 4 | 80.7 | 1.297 | 0.701 | 1.8815 | |
| 360 minute summer | 4 | 1.003 | 5 | 17.7 | 0.252 | 0.240 | 2.0120 | |
| 360 minute summer | 5 | 1.004 | 6 | 17.6 | 0.373 | 0.331 | 0.5556 | |
| 360 minute summer | 20 | 1.019 | 21 | 1.2 | 0.103 | 0.036 | 1.2801 | |
| 360 minute summer | 21 | Orifice | 22 | 1.1 | | | | 101.8 |
| | | | | | | | | |
| 360 minute summer | 6 | 1.005 | 7 | 15.7 | 0.330 | 1.031 | 0.3886 | |
| 360 minute summer | 7 | 1.006 | 8 | 14.5 | 0.365 | 0.947 | 0.3900 | |
| 360 minute summer | 8 | 1.007 | 9 | 13.2 | 0.410 | 0.865 | 0.3153 | |
| 360 minute summer | 9 | 1.008 | 10 | 12.2 | 0.417 | 0.798 | 0.1763 | |
| 360 minute summer | 10 | 1.009 | 11 | 11.6 | 0.317 | 0.760 | 0.2474 | |
| 360 minute summer | 11 | 1.010 | 12 | 10.8 | 0.261 | 0.676 | 0.6585 | |
| 360 minute summer | 12 | 1.011 | 13 | 8.7 | 0.274 | 0.569 | 0.5037 | |
| 360 minute summer | 13 | 1.012 | 14 | 7.1 | 0.295 | 0.465 | 0.5056 | |
| 360 minute summer | 14 | 1.013 | 15 | 5.5 | 0.326 | 0.361 | 0.3981 | |
| 360 minute summer | 15 | 1.014 | 16 | 4.3 | 0.364 | 0.280 | 0.2974 | |
| 360 minute summer | 16 | 1.015 | 17 | 3.3 | 0.402 | 0.219 | 0.1826 | |
| 360 minute summer | 17 | 1.016 | 18 | 2.8 | 0.440 | 0.181 | 0.1872 | |
| 360 minute summer | 18 | 1.017 | 19 | 2.2 | 0.497 | 0.143 | 0.1832 | |
| 360 minute summer | 19 | 1.018 | 20 | 2.7 | 1.086 | 0.178 | 0.1832 | |

**Results for 100 year +25% CC Critical Storm Duration. Lowest mass balance: 94.61%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 9 | 11.500 | 0.700 | 16.4 | 0.1981 | 2.2146 | FLOOD |
| 15 minute summer | 2 | 11 | 11.287 | 0.774 | 18.2 | 0.2189 | 0.0000 | FLOOD RISK |
| 15 minute summer | 3 | 10 | 11.001 | 0.799 | 123.6 | 0.2262 | 0.0000 | FLOOD RISK |
| 15 minute summer | 4 | 11 | 10.577 | 0.677 | 121.8 | 0.1917 | 0.0000 | SURCHARGED |
| 480 minute summer | 5 | 480 | 10.477 | 0.721 | 21.4 | 0.0000 | 0.0000 | SURCHARGED |
| 480 minute summer | 20 | 480 | 10.477 | 0.755 | 2.0 | 3.9607 | 0.0000 | SURCHARGED |
| 480 minute summer | 21 | 480 | 10.477 | 0.898 | 1.6 | 0.2540 | 0.0000 | SURCHARGED |
| 15 minute summer | 22 | 1 | 9.451 | 0.000 | 1.0 | 0.0000 | 0.0000 | OK |
| 480 minute summer | 6 | 480 | 10.477 | 0.741 | 21.3 | 13.0689 | 0.0000 | SURCHARGED |
| 480 minute summer | 7 | 480 | 10.477 | 0.742 | 19.0 | 8.8008 | 0.0000 | SURCHARGED |
| 480 minute summer | 8 | 480 | 10.477 | 0.743 | 17.5 | 8.8008 | 0.0000 | SURCHARGED |
| 480 minute summer | 9 | 480 | 10.477 | 0.744 | 15.9 | 7.0992 | 0.0000 | SURCHARGED |
| 480 minute summer | 10 | 480 | 10.477 | 0.744 | 14.7 | 3.9607 | 0.0000 | SURCHARGED |
| 480 minute summer | 11 | 480 | 10.477 | 0.748 | 14.0 | 5.5550 | 0.0000 | SURCHARGED |
| 480 minute summer | 12 | 480 | 10.477 | 0.750 | 13.0 | 14.5486 | 0.0000 | SURCHARGED |
| 480 minute summer | 13 | 480 | 10.477 | 0.751 | 10.4 | 11.0599 | 0.0000 | SURCHARGED |
| 480 minute summer | 14 | 480 | 10.477 | 0.752 | 8.5 | 11.0599 | 0.0000 | SURCHARGED |
| 480 minute summer | 15 | 480 | 10.477 | 0.753 | 6.6 | 8.6935 | 0.0000 | SURCHARGED |
| 480 minute summer | 16 | 480 | 10.477 | 0.754 | 5.0 | 6.4772 | 0.0000 | SURCHARGED |
| 480 minute summer | 17 | 480 | 10.477 | 0.754 | 3.9 | 3.9607 | 0.0000 | SURCHARGED |
| 480 minute summer | 18 | 480 | 10.477 | 0.755 | 3.2 | 4.0607 | 0.0000 | SURCHARGED |
| 480 minute summer | 19 | 480 | 10.477 | 0.755 | 2.5 | 3.9607 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1.000 | 2 | 9.0 | 1.147 | 1.488 | 0.2248 | |
| 15 minute summer | 2 | 1.001 | 3 | 19.1 | 1.085 | 1.076 | 0.5477 | |
| 15 minute summer | 3 | 1.002 | 4 | 121.8 | 1.729 | 1.057 | 1.9819 | |
| 15 minute summer | 4 | 1.003 | 5 | 120.8 | 1.716 | 1.637 | 2.0120 | |
| 480 minute summer | 5 | 1.004 | 6 | 21.3 | 0.381 | 0.400 | 0.9393 | |
| 480 minute summer | 20 | 1.019 | 21 | 1.6 | 0.096 | 0.051 | 1.2801 | |
| 480 minute summer | 21 | Orifice | 22 | 1.2 | | | | 166.5 |
| 480 minute summer | 6 | 1.005 | 7 | 19.0 | 0.338 | 1.245 | 0.6515 | |
| 480 minute summer | 7 | 1.006 | 8 | 17.5 | 0.367 | 1.144 | 0.6532 | |
| 480 minute summer | 8 | 1.007 | 9 | 15.9 | 0.404 | 1.044 | 0.5277 | |
| 480 minute summer | 9 | 1.008 | 10 | 14.7 | 0.421 | 0.963 | 0.2950 | |
| 480 minute summer | 10 | 1.009 | 11 | 14.0 | 0.409 | 0.917 | 0.4138 | |
| 480 minute summer | 11 | 1.010 | 12 | 13.0 | 0.274 | 0.814 | 1.0974 | |
| 480 minute summer | 12 | 1.011 | 13 | 10.4 | 0.286 | 0.684 | 0.8384 | |
| 480 minute summer | 13 | 1.012 | 14 | 8.5 | 0.305 | 0.556 | 0.8409 | |
| 480 minute summer | 14 | 1.013 | 15 | 6.6 | 0.330 | 0.430 | 0.6617 | |
| 480 minute summer | 15 | 1.014 | 16 | 5.0 | 0.354 | 0.330 | 0.4940 | |
| 480 minute summer | 16 | 1.015 | 17 | 3.9 | 0.370 | 0.257 | 0.3031 | |
| 480 minute summer | 17 | 1.016 | 18 | 3.2 | 0.367 | 0.211 | 0.3107 | |
| 480 minute summer | 18 | 1.017 | 19 | 2.5 | 0.314 | 0.164 | 0.3039 | |
| 480 minute summer | 19 | 1.018 | 20 | 2.0 | 0.730 | 0.130 | 0.3039 | |

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FSR | Maximum Time of Concentration (mins) | 30.00 |
| Return Period (years) | 1 | Maximum Rainfall (mm/hr) | 50.0 |
| Additional Flow (%) | 0 | Minimum Velocity (m/s) | 1.00 |
| FSR Region | England and Wales | Connection Type | Level Soffits |
| M5-60 (mm) | 20.000 | Minimum Backdrop Height (m) | 0.200 |
| Ratio-R | 0.400 | Preferred Cover Depth (m) | 1.200 |
| CV | 1.000 | Include Intermediate Ground | x |
| Time of Entry (mins) | 5.00 | Enforce best practice design rules | x |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| 1 | 0.022 | 5.00 | 11.500 | 600 | 1873687.952 | -215932.244 | 0.700 |
| 2 | 0.015 | 5.00 | 11.480 | 600 | 1873686.779 | -215960.954 | 0.967 |
| 3 | 0.146 | 5.00 | 11.100 | 600 | 1873685.842 | -215992.049 | 0.898 |
| 4 | | | 11.150 | 600 | 1873692.877 | -216019.300 | 1.250 |
| 5 | | | 11.300 | | 1873715.268 | -216037.046 | 1.544 |
| 20 | | | 11.300 | | 1873714.959 | -216049.326 | 1.578 |
| 21 | | | 11.150 | 600 | 1873683.089 | -216053.829 | 1.571 |
| 22 | | | 10.490 | | 1873682.205 | -216066.557 | 1.039 |
| 6 | | | 11.300 | | 1873717.843 | -216034.627 | 1.564 |
| 7 | | | 11.300 | | 1873719.676 | -216033.369 | 1.565 |
| 8 | | | 11.300 | | 1873721.802 | -216032.718 | 1.566 |
| 9 | | | 11.300 | | 1873723.587 | -216032.860 | 1.567 |
| 10 | | | 11.300 | | 1873725.136 | -216033.759 | 1.567 |
| 11 | | | 11.300 | | 1873725.830 | -216034.975 | 1.571 |
| 12 | | | 11.300 | | 1873725.101 | -216037.230 | 1.573 |
| 13 | | | 11.300 | | 1873722.729 | -216038.703 | 1.574 |
| 14 | | | 11.300 | | 1873719.996 | -216039.277 | 1.575 |
| 15 | | | 11.300 | | 1873717.972 | -216040.119 | 1.576 |
| 16 | | | 11.300 | | 1873717.120 | -216041.511 | 1.577 |
| 17 | | | 11.300 | | 1873717.019 | -216043.112 | 1.577 |
| 18 | | | 11.300 | | 1873717.027 | -216044.136 | 1.578 |
| 19 | | | 11.300 | | 1873716.501 | -216046.937 | 1.578 |

## Links

| Name | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 2 | 28.734 | 0.600 | 10.800 | 10.513 | 0.287 | 100.1 | 100 | 5.62 | 50.0 |
| 1.001 | 2 | 3 | 31.109 | 0.600 | 10.513 | 10.202 | 0.311 | 100.0 | 150 | 6.14 | 49.8 |
| 1.002 | 3 | 4 | 28.144 | 0.600 | 10.202 | 9.900 | 0.302 | 93.2 | 300 | 6.43 | 48.7 |
| 1.003 | 4 | 5 | 28.571 | 0.600 | 9.900 | 9.773 | 0.127 | 225.0 | 300 | 6.68 | 47.1 |
| 1.005 | 6 | 7 | 2.223 | 0.012 | 9.736 | 9.735 | 0.001 | 2000.0 | 300 | 7.05 | 46.6 |

| US Depth (m) | DS Depth (m) | Σ Area (ha) |
|---|---|---|
| 0.600 | 0.567 | 0.022 |
| 0.817 | 0.748 | 0.037 |
| 0.588 | 0.950 | 0.183 |
| 0.950 | 1.227 | 0.183 |
| 1.264 | 1.365 | 0.183 |

## Links

| Name | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.006 | 7 | 8 | 2.223 | 0.012 | 9.735 | 9.734 | 0.001 | 2000.0 | 300 | 7.17 | 46.2 |
| 1.004 | 5 | 6 | 3.297 | 0.012 | 9.756 | 9.736 | 0.020 | 164.9 | 300 | 6.93 | 40.8 |
| 1.010 | 11 | 12 | 3.669 | 0.012 | 9.729 | 9.727 | 0.002 | 1834.5 | 300 | 7.57 | 43.7 |
| 1.019 | 20 | 21 | 32.187 | 0.012 | 9.722 | 9.579 | 0.143 | 225.1 | 225 | 8.93 | 41.2 |
| 1.007 | 8 | 9 | 1.791 | 0.012 | 9.734 | 9.733 | 0.001 | 2000.0 | 300 | 7.26 | 45.9 |
| 1.008 | 9 | 10 | 1.000 | 0.012 | 9.733 | 9.733 | 0.000 | 2000.0 | 300 | 7.31 | 45.7 |
| 1.009 | 10 | 11 | 1.400 | 0.012 | 9.733 | 9.732 | 0.001 | 2000.0 | 300 | 7.39 | 45.5 |
| 1.020 | 21 | 22 | 12.759 | 0.012 | 9.579 | 9.451 | 0.128 | 99.7 | 100 | 9.23 | 40.5 |
| 1.011 | 12 | 13 | 2.792 | 0.012 | 9.727 | 9.726 | 0.001 | 2000.0 | 300 | 7.72 | 44.5 |
| 1.012 | 13 | 14 | 2.793 | 0.012 | 9.726 | 9.725 | 0.001 | 2000.0 | 300 | 7.86 | 44.1 |
| 1.013 | 14 | 15 | 2.192 | 0.012 | 9.725 | 9.724 | 0.001 | 2000.0 | 300 | 7.98 | 43.7 |
| 1.014 | 15 | 16 | 1.632 | 0.012 | 9.724 | 9.723 | 0.001 | 2000.0 | 300 | 8.06 | 43.5 |
| 1.015 | 16 | 17 | 1.000 | 0.012 | 9.723 | 9.723 | 0.000 | 2000.0 | 300 | 8.11 | 43.3 |
| 1.016 | 17 | 18 | 1.024 | 0.012 | 9.723 | 9.722 | 0.001 | 2000.0 | 300 | 8.17 | 43.2 |
| 1.017 | 18 | 19 | 1.000 | 0.012 | 9.722 | 9.722 | 0.000 | 2000.0 | 300 | 8.22 | 43.0 |
| 1.018 | 19 | 20 | 1.000 | 0.012 | 9.722 | 9.722 | 0.000 | 2000.0 | 300 | 8.27 | 42.9 |

| US Depth (m) | DS Depth (m) | Σ Area (ha) |
|---|---|---|
| 1.265 | 1.266 | 0.183 |
| 1.264 | 1.264 | 0.183 |
| 1.271 | 1.273 | 0.183 |
| 1.353 | 1.346 | 0.183 |
| 1.266 | 1.267 | 0.183 |
| 1.267 | 1.267 | 0.183 |
| 1.267 | 1.268 | 0.183 |
| 1.471 | 0.939 | 0.183 |
| 1.273 | 1.274 | 0.183 |
| 1.274 | 1.275 | 0.183 |
| 1.275 | 1.276 | 0.183 |
| 1.276 | 1.277 | 0.183 |
| 1.277 | 1.277 | 0.183 |
| 1.277 | 1.278 | 0.183 |
| 1.278 | 1.278 | 0.183 |
| 1.278 | 1.278 | 0.183 |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-22 | Skip Steady State | ✓ | Check Discharge Rate(s) | x |
| Rainfall Events | Singular | Drain Down Time (mins) | 10080 | Check Discharge Volume | x |
| Summer CV | 1.000 | Additional Storage (m³/ha) | 0.0 | | |
| Analysis Speed | Detailed | Starting Level (m) | 10.450 | | |

### Storm Durations

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

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 100 | 25 | 0 | 0 |

## Node 21 Online Orifice Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Design Depth (m) | 0.800 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Design Flow (l/s) | 0.1 | | |
| Invert Level (m) | 9.579 | Diameter (m) | 0.025 | | |

## Node 6 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 25.4 | 0.0 | 1.250 | 55.8 | 0.0 |

## Node 7 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 17.1 | 0.0 | 1.250 | 37.6 | 0.0 |

## Node 8 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 17.1 | 0.0 | 1.250 | 37.6 | 0.0 |

## Node 9 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 13.8 | 0.0 | 1.250 | 30.3 | 0.0 |

## Node 10 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.7 | 0.0 | 1.250 | 16.9 | 0.0 |

## Node 11 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 10.8 | 0.0 | 1.250 | 23.7 | 0.0 |

## Node 12 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 28.3 | 0.0 | 1.250 | 62.0 | 0.0 |

## Node 13 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 21.5 | 0.0 | 1.250 | 47.2 | 0.0 |

## Node 14 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 21.5 | 0.0 | 1.250 | 47.2 | 0.0 |

## Node 15 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 16.9 | 0.0 | 1.250 | 37.1 | 0.0 |

## Node 16 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 12.6 | 0.0 | 1.250 | 27.6 | 0.0 |

## Node 17 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.7 | 0.0 | 1.250 | 16.9 | 0.0 |

## Node 18 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.9 | 0.0 | 1.250 | 17.3 | 0.0 |

## Node 19 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.7 | 0.0 | 1.250 | 16.9 | 0.0 |

## Node 4 Carpark Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 10.795 | Slope (1:X) | 1000.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 0 | Depth (m) | 0.225 |
| Safety Factor | 1.5 | Width (m) | 14.800 | Inf Depth (m) | |
| Porosity | 0.30 | Length (m) | 50.000 | | |

## Node 20 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 10.050 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 912 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 7.7 | 0.0 | 1.250 | 16.9 | 0.0 |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 94.48%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 10 | 10.847 | 0.047 | 2.7 | 0.0132 | 0.0000 | OK |
| 15 minute summer | 2 | 11 | 10.564 | 0.051 | 4.6 | 0.0145 | 0.0000 | OK |
| 240 minute summer | 3 | 176 | 10.498 | 0.296 | 8.8 | 0.0837 | 0.0000 | OK |
| 240 minute summer | 4 | 176 | 10.498 | 0.598 | 8.7 | 0.1692 | 0.0000 | SURCHARGED |
| 240 minute summer | 5 | 180 | 10.498 | 0.742 | 8.7 | 0.0000 | 0.0000 | SURCHARGED |
| 240 minute summer | 20 | 180 | 10.498 | 0.776 | 1.5 | 4.1905 | 0.0000 | SURCHARGED |
| 240 minute summer | 21 | 180 | 10.498 | 0.919 | 1.2 | 0.2600 | 0.0000 | SURCHARGED |
| 15 minute summer | 22 | 1 | 9.451 | 0.000 | 1.2 | 0.0000 | 0.0000 | OK |
| 240 minute summer | 6 | 180 | 10.498 | 0.762 | 8.6 | 13.8275 | 0.0000 | SURCHARGED |
| 240 minute summer | 7 | 180 | 10.498 | 0.763 | 7.8 | 9.3117 | 0.0000 | SURCHARGED |
| 240 minute summer | 8 | 180 | 10.498 | 0.764 | 7.2 | 9.3116 | 0.0000 | SURCHARGED |
| 240 minute summer | 9 | 180 | 10.498 | 0.765 | 6.7 | 7.5111 | 0.0000 | SURCHARGED |
| 240 minute summer | 10 | 180 | 10.498 | 0.765 | 6.2 | 4.1904 | 0.0000 | SURCHARGED |
| 240 minute summer | 11 | 180 | 10.498 | 0.769 | 5.9 | 5.8772 | 0.0000 | SURCHARGED |
| 240 minute summer | 12 | 180 | 10.498 | 0.771 | 5.5 | 15.3924 | 0.0000 | SURCHARGED |
| 240 minute summer | 13 | 180 | 10.498 | 0.772 | 4.5 | 11.7018 | 0.0000 | SURCHARGED |
| 240 minute summer | 14 | 180 | 10.498 | 0.773 | 3.9 | 11.7017 | 0.0000 | SURCHARGED |
| 240 minute summer | 15 | 180 | 10.498 | 0.774 | 3.2 | 9.1979 | 0.0000 | SURCHARGED |
| 240 minute summer | 16 | 180 | 10.498 | 0.775 | 2.7 | 6.8528 | 0.0000 | SURCHARGED |
| 240 minute summer | 17 | 180 | 10.498 | 0.775 | 2.3 | 4.1905 | 0.0000 | SURCHARGED |
| 240 minute summer | 18 | 180 | 10.498 | 0.776 | 2.0 | 4.2962 | 0.0000 | SURCHARGED |
| 240 minute summer | 19 | 180 | 10.498 | 0.776 | 1.8 | 4.1905 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1.000 | 2 | 2.7 | 0.705 | 0.441 | 0.1087 | |
| 15 minute summer | 2 | 1.001 | 3 | 4.5 | 0.330 | 0.252 | 0.3565 | |
| 240 minute summer | 3 | 1.002 | 4 | 8.7 | 0.123 | 0.075 | 1.9793 | |
| 240 minute summer | 4 | 1.003 | 5 | 8.7 | 0.123 | 0.117 | 2.0120 | |
| 240 minute summer | 5 | 1.004 | 6 | 8.6 | 0.042 | 0.162 | 0.9941 | |
| 240 minute summer | 20 | 1.019 | 21 | 1.2 | 0.078 | 0.038 | 1.2801 | |
| 240 minute summer | 21 | Orifice | 22 | 1.2 | | | | 161.1 |
| 240 minute summer | 6 | 1.005 | 7 | 7.8 | 0.039 | 0.511 | 0.6890 | |
| 240 minute summer | 7 | 1.006 | 8 | 7.2 | 0.049 | 0.474 | 0.6908 | |
| 240 minute summer | 8 | 1.007 | 9 | 6.7 | 0.059 | 0.436 | 0.5580 | |
| 240 minute summer | 9 | 1.008 | 10 | 6.2 | 0.070 | 0.404 | 0.3119 | |
| 240 minute summer | 10 | 1.009 | 11 | 5.9 | 0.081 | 0.386 | 0.4375 | |
| 240 minute summer | 11 | 1.010 | 12 | 5.5 | 0.080 | 0.344 | 1.1600 | |
| 240 minute summer | 12 | 1.011 | 13 | 4.5 | 0.090 | 0.297 | 0.8861 | |
| 240 minute summer | 13 | 1.012 | 14 | 3.9 | 0.102 | 0.253 | 0.8887 | |
| 240 minute summer | 14 | 1.013 | 15 | 3.2 | 0.116 | 0.211 | 0.6993 | |
| 240 minute summer | 15 | 1.014 | 16 | 2.7 | 0.131 | 0.177 | 0.5219 | |
| 240 minute summer | 16 | 1.015 | 17 | 2.3 | 0.152 | 0.150 | 0.3202 | |
| 240 minute summer | 17 | 1.016 | 18 | 2.0 | 0.178 | 0.134 | 0.3283 | |
| 240 minute summer | 18 | 1.017 | 19 | 1.8 | 0.236 | 0.116 | 0.3210 | |
| 240 minute summer | 19 | 1.018 | 20 | 1.5 | 0.596 | 0.098 | 0.3210 | |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 94.48%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 11 | 11.500 | 0.700 | 10.5 | 0.1981 | 0.2425 | FLOOD |
| 15 minute summer | 2 | 11 | 11.081 | 0.568 | 13.7 | 0.1606 | 0.0000 | SURCHARGED |
| 15 minute summer | 3 | 11 | 10.865 | 0.663 | 81.6 | 0.1876 | 0.0000 | FLOOD RISK |
| 15 minute summer | 4 | 11 | 10.680 | 0.780 | 80.7 | 0.2207 | 0.0000 | SURCHARGED |
| 240 minute summer | 5 | 244 | 10.653 | 0.897 | 23.8 | 0.0000 | 0.0000 | SURCHARGED |
| 240 minute summer | 20 | 244 | 10.653 | 0.931 | 2.1 | 5.9876 | 0.0000 | SURCHARGED |
| 240 minute summer | 21 | 244 | 10.653 | 1.074 | 1.7 | 0.3039 | 0.0000 | SURCHARGED |
| 15 minute summer | 22 | 1 | 9.451 | 0.000 | 1.3 | 0.0000 | 0.0000 | OK |
| 240 minute summer | 6 | 244 | 10.653 | 0.917 | 23.6 | 19.7578 | 0.0000 | SURCHARGED |
| 240 minute summer | 7 | 244 | 10.653 | 0.918 | 21.1 | 13.3065 | 0.0000 | SURCHARGED |
| 240 minute summer | 8 | 244 | 10.653 | 0.919 | 19.4 | 13.3065 | 0.0000 | SURCHARGED |
| 240 minute summer | 9 | 244 | 10.653 | 0.920 | 17.7 | 10.7322 | 0.0000 | SURCHARGED |
| 240 minute summer | 10 | 244 | 10.653 | 0.920 | 16.3 | 5.9873 | 0.0000 | SURCHARGED |
| 240 minute summer | 11 | 244 | 10.653 | 0.924 | 15.6 | 8.3971 | 0.0000 | SURCHARGED |
| 240 minute summer | 12 | 244 | 10.653 | 0.926 | 14.4 | 21.9884 | 0.0000 | SURCHARGED |
| 240 minute summer | 13 | 244 | 10.653 | 0.927 | 11.6 | 16.7192 | 0.0000 | SURCHARGED |
| 240 minute summer | 14 | 244 | 10.653 | 0.928 | 9.5 | 16.7195 | 0.0000 | SURCHARGED |
| 240 minute summer | 15 | 244 | 10.653 | 0.929 | 7.3 | 13.1423 | 0.0000 | SURCHARGED |
| 240 minute summer | 16 | 244 | 10.653 | 0.930 | 5.6 | 9.7898 | 0.0000 | SURCHARGED |
| 240 minute summer | 17 | 244 | 10.653 | 0.930 | 4.4 | 5.9875 | 0.0000 | SURCHARGED |
| 240 minute summer | 18 | 244 | 10.653 | 0.931 | 3.6 | 6.1374 | 0.0000 | SURCHARGED |
| 240 minute summer | 19 | 244 | 10.653 | 0.931 | 2.8 | 5.9875 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute summer | 1 | 1.000 | 2 | 7.9 | 1.010 | 1.309 | 0.2248 | |
| 15 minute summer | 2 | 1.001 | 3 | 14.5 | 0.821 | 0.815 | 0.5477 | |
| 15 minute summer | 3 | 1.002 | 4 | 80.7 | 1.146 | 0.701 | 1.9819 | |
| 15 minute summer | 4 | 1.003 | 5 | 80.3 | 1.141 | 1.089 | 2.0120 | |
| 240 minute summer | 5 | 1.004 | 6 | 23.6 | 0.068 | 0.444 | 1.4472 | |
| 240 minute summer | 20 | 1.019 | 21 | 1.7 | 0.078 | 0.052 | 1.2801 | |
| 240 minute summer | 21 | Orifice | 22 | 1.3 | | | | 220.7 |
| 240 minute summer | 6 | 1.005 | 7 | 21.1 | 0.059 | 1.381 | 0.9984 | |
| 240 minute summer | 7 | 1.006 | 8 | 19.4 | 0.054 | 1.268 | 1.0005 | |
| 240 minute summer | 8 | 1.007 | 9 | 17.7 | 0.059 | 1.157 | 0.8078 | |
| 240 minute summer | 9 | 1.008 | 10 | 16.3 | 0.070 | 1.069 | 0.4515 | |
| 240 minute summer | 10 | 1.009 | 11 | 15.6 | 0.081 | 1.018 | 0.6332 | |
| 240 minute summer | 11 | 1.010 | 12 | 14.4 | 0.080 | 0.905 | 1.6753 | |
| 240 minute summer | 12 | 1.011 | 13 | 11.6 | 0.090 | 0.761 | 1.2789 | |
| 240 minute summer | 13 | 1.012 | 14 | 9.5 | 0.102 | 0.619 | 1.2821 | |
| 240 minute summer | 14 | 1.013 | 15 | 7.3 | 0.116 | 0.477 | 1.0084 | |
| 240 minute summer | 15 | 1.014 | 16 | 5.6 | 0.131 | 0.367 | 0.7523 | |
| 240 minute summer | 16 | 1.015 | 17 | 4.4 | 0.153 | 0.286 | 0.4615 | |
| 240 minute summer | 17 | 1.016 | 18 | 3.6 | 0.180 | 0.236 | 0.4731 | |
| 240 minute summer | 18 | 1.017 | 19 | 2.8 | 0.236 | 0.185 | 0.4625 | |
| 240 minute summer | 19 | 1.018 | 20 | 2.1 | 0.593 | 0.136 | 0.4625 | |

**Results for 100 year +25% CC Critical Storm Duration. Lowest mass balance: 94.48%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | 1 | 16 | 11.500 | 0.700 | 15.1 | 0.1981 | 2.7955 | FLOOD |
| 15 minute summer | 2 | 10 | 11.358 | 0.845 | 15.3 | 0.2391 | 0.0000 | FLOOD RISK |
| 15 minute summer | 3 | 9 | 11.100 | 0.898 | 124.1 | 0.2541 | 3.1129 | FLOOD |
| 30 minute summer | 4 | 20 | 10.812 | 0.912 | 101.7 | 0.9301 | 0.0000 | SURCHARGED |
| 480 minute summer | 5 | 480 | 10.784 | 1.028 | 21.6 | 0.0000 | 0.0000 | SURCHARGED |
| 480 minute summer | 20 | 480 | 10.784 | 1.062 | 2.1 | 7.6428 | 0.0000 | SURCHARGED |
| 480 minute summer | 21 | 480 | 10.784 | 1.205 | 1.4 | 0.3410 | 0.0000 | SURCHARGED |
| 15 minute summer | 22 | 1 | 9.451 | 0.000 | 1.3 | 0.0000 | 0.0000 | OK |
| 480 minute summer | 6 | 480 | 10.784 | 1.048 | 21.5 | 25.2224 | 0.0000 | SURCHARGED |
| 480 minute summer | 7 | 480 | 10.784 | 1.049 | 19.2 | 16.9878 | 0.0000 | SURCHARGED |
| 480 minute summer | 8 | 480 | 10.784 | 1.050 | 17.7 | 16.9878 | 0.0000 | SURCHARGED |
| 480 minute summer | 9 | 480 | 10.784 | 1.051 | 16.1 | 13.7000 | 0.0000 | SURCHARGED |
| 480 minute summer | 10 | 480 | 10.784 | 1.051 | 14.9 | 7.6428 | 0.0000 | SURCHARGED |
| 480 minute summer | 11 | 480 | 10.784 | 1.055 | 14.2 | 10.7189 | 0.0000 | SURCHARGED |
| 480 minute summer | 12 | 480 | 10.784 | 1.057 | 13.1 | 28.0653 | 0.0000 | SURCHARGED |
| 480 minute summer | 13 | 480 | 10.784 | 1.058 | 10.6 | 21.3427 | 0.0000 | SURCHARGED |
| 480 minute summer | 14 | 480 | 10.784 | 1.059 | 8.7 | 21.3427 | 0.0000 | SURCHARGED |
| 480 minute summer | 15 | 480 | 10.784 | 1.060 | 6.8 | 16.7760 | 0.0000 | SURCHARGED |
| 480 minute summer | 16 | 480 | 10.784 | 1.061 | 5.3 | 12.4946 | 0.0000 | SURCHARGED |
| 480 minute summer | 17 | 480 | 10.784 | 1.061 | 4.1 | 7.6428 | 0.0000 | SURCHARGED |
| 480 minute summer | 18 | 480 | 10.784 | 1.062 | 3.5 | 7.8329 | 0.0000 | SURCHARGED |
| 480 minute summer | 19 | 480 | 10.784 | 1.062 | 2.7 | 7.6428 | 0.0000 | SURCHARGED |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 30 minute summer | 1 | 1.000 | 2 | 7.5 | 0.961 | 1.246 | 0.2248 | |
| 15 minute summer | 2 | 1.001 | 3 | 16.3 | 0.926 | 0.918 | 0.5477 | |
| 15 minute summer | 3 | 1.002 | 4 | 103.9 | 1.476 | 0.903 | 1.9819 | |
| 30 minute summer | 4 | 1.003 | 5 | 99.8 | 1.417 | 1.352 | 2.0120 | |
| 480 minute summer | 5 | 1.004 | 6 | 21.5 | 0.053 | 0.404 | 1.8959 | |
| 480 minute summer | 20 | 1.019 | 21 | 1.4 | 0.078 | 0.044 | 1.2801 | |
| 480 minute summer | 21 | Orifice | 22 | 1.4 | | | | 293.0 |
| | | | | | | | | |
| 480 minute summer | 6 | 1.005 | 7 | 19.2 | 0.046 | 1.258 | 1.3041 | |
| 480 minute summer | 7 | 1.006 | 8 | 17.7 | 0.049 | 1.157 | 1.3066 | |
| 480 minute summer | 8 | 1.007 | 9 | 16.1 | 0.059 | 1.056 | 1.0546 | |
| 480 minute summer | 9 | 1.008 | 10 | 14.9 | 0.070 | 0.975 | 0.5894 | |
| 480 minute summer | 10 | 1.009 | 11 | 14.2 | 0.081 | 0.928 | 0.8264 | |
| 480 minute summer | 11 | 1.010 | 12 | 13.1 | 0.080 | 0.824 | 2.1839 | |
| 480 minute summer | 12 | 1.011 | 13 | 10.6 | 0.090 | 0.695 | 1.6666 | |
| 480 minute summer | 13 | 1.012 | 14 | 8.7 | 0.102 | 0.568 | 1.6702 | |
| 480 minute summer | 14 | 1.013 | 15 | 6.8 | 0.115 | 0.442 | 1.3133 | |
| 480 minute summer | 15 | 1.014 | 16 | 5.3 | 0.131 | 0.344 | 0.9796 | |
| 480 minute summer | 16 | 1.015 | 17 | 4.1 | 0.150 | 0.271 | 0.6008 | |
| 480 minute summer | 17 | 1.016 | 18 | 3.5 | 0.174 | 0.226 | 0.6158 | |
| 480 minute summer | 18 | 1.017 | 19 | 2.7 | 0.232 | 0.180 | 0.6019 | |
| 480 minute summer | 19 | 1.018 | 20 | 2.1 | 0.586 | 0.134 | 0.6019 | |

# Appendix H -Maintenance Schedules

| Operation and Maintenance requirements for Detention Basins | | |
|---|---|---|
| Responsible for Maintenance | Developer/Household | |
| Maintenance Schedule | Required Action | Typical Frequency |
| Regular maintenance | Remove litter and debris | Monthly |
| | Cut grass-for spillways and access routes | Monthly (during growing season), or as required |
| | Cut grass-meadow grass in and around basin | Half yearly (spring – before nesting season, and autumn) |
| | Manage other vegetation and remove nuisance plants | Monthly (at start, then as required) |
| | Inspect inlets, outlets and overflows for blockages, and clear if required | Monthly |
| | Inspect banksides, structures, pipework etc for evidence of physical damage | Monthly |
| | Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies | Monthly (for first year), then annually or as required |
| | Check any penstocks and other mechanical devices | Annually |
| | Tidy all dead growth before start of growing season | Annually |
| | Remove sediment from inlets, outlets and forebay | Annually (or as required) |
| | Manage wetland plants in outlet pool – where provided | Annually |
| Occasional maintenance | Reseed areas of poor vegetation growth | As required |
| | Prune and trim any trees and remove cuttings | Every 2 years, or as required |
| | Remove sediment from inlets, outlets, forebay and main basin when required | Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided) |

| | | |
|---|---|---|
| Remedial actions | Repair erosion or other damage by reseeding or re-turfing | As required |
| | Realignment of rip-rap | As required |
| | Repair/rehabilitation of inlets, outlets and overflows | As required |
| | Relevel uneven surfaces and reinstate design levels | As required |

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

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

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