



Highways Development Ltd

# CHIPPENHAM HUB ELECTRIC VEHICLE CHARGING HUB DRAINAGE STRATEGY

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## Highways Development Ltd

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## 1. Introduction & Brief

- 1.1 Highways Development Limited have commissioned to produce a Drainage Strategy to support the planning application for the proposed development of an Electric Vehicle Charging Hub on land Bath Road, Chippenham.
- 1.2 This report reviews the flood risk, existing drainage infrastructure, impact of the proposed development in respect of surface water management and considers the methods for disposal of surface water flows generated by the proposed development.
- 1.3 A strategy for the preferred option of surface water disposal is detailed within the report, alongside an outline strategy layout drawing.
- 1.4 The ownership and management of the proposed drainage systems is outlined, alongside maintenance requirements for the preferred system, as required.
- 1.5 This report may not be relied upon or reproduced by any third party for any use without the written agreement of Highways Development Limited.

## 2. Existing Site

### *Location*

- 2.1 The existing greenfield site is located on a parcel of land to the north of Chequers Roundabout, Bath Road, Chippenham, between the existing Sainsburys superstore and the Busy Bees Nursery. The site is located on the western outskirts of Chippenham town centre, with direct access on to the A350 junction with the A4, immediately to the south of the site.
- 2.2 The site covers an approximate area of 1820m<sup>2</sup> (0.182Ha) and is located at approximated National Grid Reference E389698 N172224 (centre of site).
- 2.3 The application site is located in the north-east corner of a larger area of land, directly adjacent and linked to the Sainsburys superstore site. The site is bordered by the Busy Bees Nursery premises to the west, a public footpath, Sainsburys superstore and associated access and car park to the east, residential housing off Beverley Way to the north, and a McDonald's Drive-Thru restaurant to the south.
- 2.4 The existing site is currently unoccupied Greenfield land, consisting of low-level landscaping and small trees only. The site is currently largely open with fencing to the northern and western boundaries, and a tree line separation to the public footpath to the eastern boundary. The southern boundary is open onto the highway footway.
- 2.5 Vehicular access is via a short spur road shared with the adjacent nursery site, connecting from the Sainsbury's access road. This access road connects to the Chequers Roundabout on Bath Road approximately 30m to the south. There is currently no formal bellmouth or dropped kerb specific to the site and therefore access will need to be created.
- 2.6 A site location plan extract and aerial image are included in Figure 1 below.

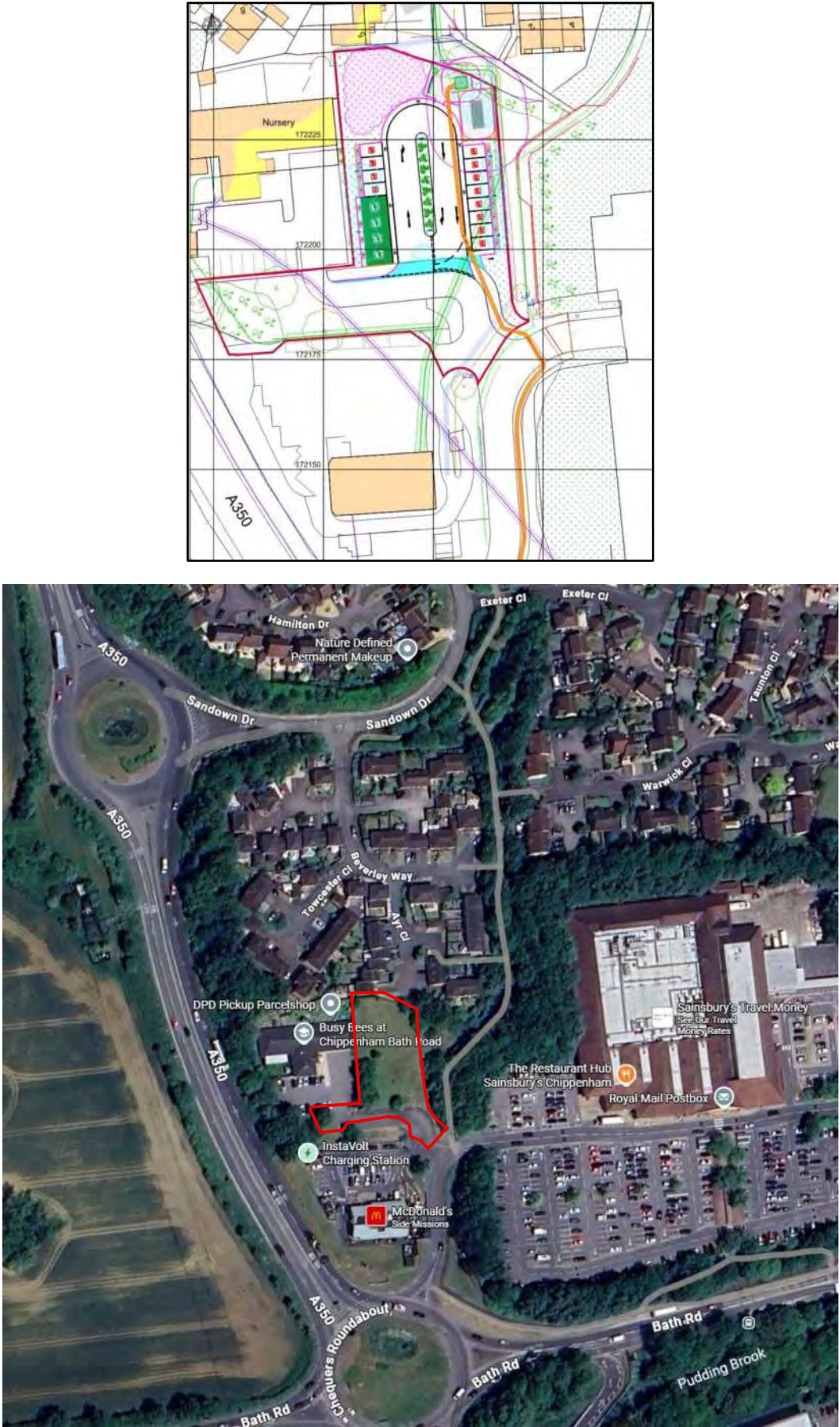


Figure 1: Site Location Plan Extract and Aerial Image (Source: Google Maps, 2025)

### Site Topography

- 2.7 Topographical survey available for the proposed site indicates the existing topography generally falls over a steady gradient from north to south. There is a localised dip towards the western boundary in the north-western corner of the site.
- 2.8 The localised high point within the site is located to northern boundary at a level of 67.85mAOD. The low point, located to the south-eastern corner of the site is at an approximate level of 64.60mAOD, adjacent to the carriageway on the access road. The site is generally level or slightly higher than the adjacent carriageway levels.
- 2.9 A topographic survey of the site undertaken for the site is included in Appendix A.

### Geology & Hydrogeology

- 2.10 British Geological Survey (BGS) and Land Information Systems (LandIS) mapping indicates the site is underlain by the outlined in Table 1 below.

| Geology Type | Classification              | Description                                                       |
|--------------|-----------------------------|-------------------------------------------------------------------|
| Soil         | Soilscape 9                 | Lime-rich loamey and clayey soils with impeded drainage           |
| Drift        | No drift deposits recorded. | No drift deposits recorded.                                       |
| Solid        | Cornbrash Formation         | Limestone. Sedimentary bedrock formed during the Jurassic Period. |

**Table 1: Site Geological Summary**

- 2.11 The British Geological Survey mapping indicates the site geology consists of Cornbrash Formation over Forest Marble Formation. The Kellaways Formation is mapped in close proximity to the south. The Cornbrash Formation consists of strong blueish grey shelly limestone, weathering to a yellowish brown. The Cornbrash is poorly bedded and sometimes interbedded with calcareous mudstone.
- 2.12 The Defra Magic Map application Aquifer Designation Map Layer indicates the site geology is designated as a Secondary A typology aquifer. Secondary A aquifers are predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
- 2.13 The Defra Magic Map application indicates the site is located within a Zone II Outer Source Protection Zone (SPZ2). A groundwater SPZ2 is defined by area around an abstraction point for domestic supply or for food production purposes that is defined either by the area where it takes groundwater that is used to supply water for domestic or food production purposes up to 400 days to travel to the groundwater abstraction point. Additionally, this zone has a minimum radius of 250 or 500 metres, depending on the size of the abstraction. The travel time is derived from consideration of the minimum time required to provide delay, dilution and attenuation of slowly degrading pollutants.

### Hydrology

- 2.14 Pudding Brook, designated as Main River, is located approximately 130m to the south of the site boundary at its nearest point, running in a west to east direction and discharging to the River Avon, approximately 6km away to the east of the site boundary. There are no other ordinary watercourses shown on OS mapping within 500m of the site boundary.

### ***Existing Drainage***

- 2.15 Sewer records for the proposed site have been obtained from the water and sewerage authority. Wessex Water records for the site and localised area indicate there are both surface and foul water public sewers within direct vicinity.
- 2.16 The sewer records show there is an existing foul water sewer and an existing surface water sewer running in parallel along the eastern boundary of the site. The existing sewers both appear to connect from the residential housing estate to the north, flowing southwards through the site and extending across the access road into the McDonalds site, before turning south-east along Bath Road. There are manhole associated with both sewers located within the south-eastern corner of the site.
- 2.17 The Twenty20 Surveys Ltd Utility Survey Report for the site indicates manhole reference AW5 on the surface water sewer line to be approximately 2.5m depth cover to invert with 225mm diameter and 375mm diameter respective incoming and outgoing pipes. Manhole reference AW6 on the foul water line is surveyed at approximately 2m depth cover to invert with 150mm diameter incoming and outgoing pipes.
- 2.18 The surface water sewer to which the sewer crossing the site connects into is designated as a strategic sewer where it reaches the Chequers roundabout on Nath Road.
- 2.19 The Wessex Water records do not show any water mains (distribution) passing directly through the development site.
- 2.20 The topographical survey for the site shows other existing surface water carrier drains within the access road footway to the frontage/southern boundary of the site. This carrier drainage appears to collect the gully connections within the access road before discharging into the Wessex Water surface water sewer through a branch connection onto the line south of manhole AW5 (between manholes AW5 and AW8). It is assumed this connection for the private highway's drainage is subject to an existing/previous connection agreement with Wessex Water. It is noted in the utility survey report that manhole reference AW8 could not be listed at the time of the survey due to access restrictions.
- 2.21 The Twenty 20 Survey Ltd Utility Report and Wessex Water sewer records and are included in Appendices A and B respectively, for reference.

### ***Ground Investigation***

- 2.22 Ground investigation specific to the current proposed development of the site has not been undertaken in advance of planning due to site access limitations.
- 2.23 Ground investigation undertaken in relation to previous development proposals for the site in identified the geology to align with the geological mapping, with topsoil over Made Ground, overlying the Cornbrash Formation approximately 0.5 to 1.0m below ground level. Groundwater levels within the testing locations were found to be at 1.65 to 2.3m below ground level, where detected.
- 2.24 No soakage testing was undertaken as part of this Ground Investigation as given the clay nature of the soils encountered at relatively shallow depth on-site, it was considered that soakaway and infiltration drainage would not be viable. Alternative options for surface water disposal were therefore progressed in relation to the development proposals at this time.

### 3. Flood Risk

#### *Tidal and Fluvial Flooding*

- 3.1 With reference to the GOV.UK flood maps, the site is located within a Flood Zone 1 (very low risk) area which is classed as having a 1 in 1000 chance of river flooding within any one year (annual chance of flooding of less than 0.1%). An extract of the flood map is included in Figure 2 below.

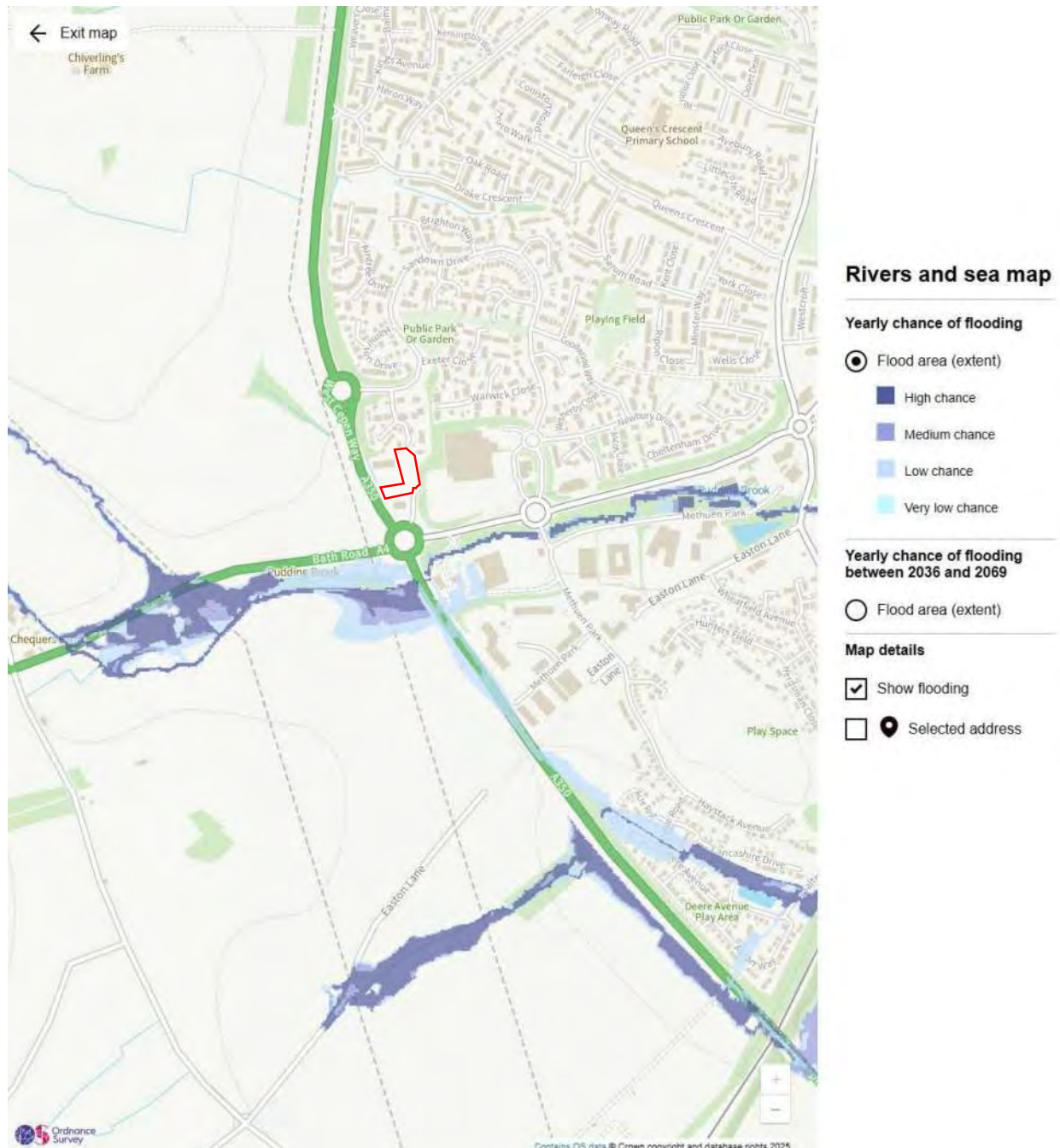


Figure 2: Flood Map showing yearly chance of rivers and sea flooding (source: GOV.UK)

- 3.2 The proposed development for an electric vehicle charging hub is classified as 'less vulnerable' which is deemed as appropriate development within a Flood Zone 1 area.

### Surface Water Flooding

- 3.3 With reference to the GOV.UK surface water mapping, the proposed site is not identified as at risk from surface water flooding within the existing situation. There are some areas at medium to high risk of surface water flooding within and adjacent to the carriageway on the A350 and Bath Road, and an area at low risk of surface water flooding within the McDonalds site to the south. These areas typically reflect surface water flow routes overland and following the route of carriageways.
- 3.4 An extract of the surface water flood mapping is included in Figure 3 below.



Figure 3: Surface Water Flood Map showing yearly chance flooding (source: GOV.UK)

***Other Sources of Flooding***

- 3.5 The GOV.UK reservoir flood mapping indicates that flooding from this source is unlikely on or in vicinity of the site. Flooding from reservoirs is also unlikely within the localised area.
- 3.6 Wiltshire Council's Strategic Flood Risk Assessment Data Explorer produced as part of the SFRA for Wiltshire Council in 2024, provides mapping data relating to groundwater emergence risk. The site location is identified to be within a zone at risk of groundwater flooding to surface and sub-surface assets, with the possibility of groundwater emerging at the surface locally. This relates to recorded groundwater levels at between 0.025 and 0.5m below ground level.
- 3.7 The SFRA mapping also provides data on sewer flooding incidents. There are no records of sewer flooding affecting the site.

## 4. Proposed Drainage Strategy

### *Proposed Development*

- 4.1 The proposed development is for the delivery of a new electric vehicle charging hub including installation of twelve rapid electric vehicle charging stations and a further four fully accessible rapid charging bays, on land lying north of Bath Road, Chippenham, Wiltshire. The proposed development will include provision of a new access via a standard priority junction from the existing access road connecting to the Chequers roundabout at Bath Road, alongside associated supporting infrastructure works and landscaping.
- 4.2 The net increase in impermeable area relating development of the site is approximately 1220m<sup>2</sup>.
- 4.3 The proposed planning layout for the development is included in Appendix C.

### *Site Assessment and Drainage Hierarchy*

- 4.4 Current legislation and guidance require developers to manage surface run-off from new developments to mitigate flood risk to the site and surrounding area and also to provide a sustainable means of disposing of run-off from impermeable areas of the site. The means of disposal are defined by a drainage hierarchy indicating the order of preference in respect of discharge of surface water, the aim of which should be to discharge as high up the drainage hierarchy as is reasonably practicable.
- 4.5 In accordance with the drainage hierarchy beyond storage of rainwater for later use, infiltration to the ground should be considered as the primary option for disposal, followed by disposal to a surface water body, discharge to a surface water sewer or highway drain, and finally discharge to a combined sewer.
- 4.6 Infiltration testing in accordance with BRE Digest 365 is required to determine suitability of infiltration to the ground as a means of disposal or surface water. No intrusive ground investigation or Infiltration testing has been undertaken specifically in relation to the proposed development.
- 4.7 British Geological Survey maps indicate that the bedrock underlying the site is comprised of the Cornbrash Member (Limestone), over the Forest Marble Formation, with no recorded superficial deposits.
- 4.8 The hydraulic conductivity of this stratum is known to be typically poor, and therefore it is not expected to have suitable infiltration characteristics to enable infiltration systems. Ground investigation undertaken for a previous development proposal for the site discounted infiltration as a means of surface water disposal due to the clay nature of the soils encountered at relatively shallow depth on-site. Infiltration as a means of surface water disposal has therefore been discounted for the proposed development.
- 4.9 The nearest watercourse to the proposed development site is Pudding Brook, located approximately 130m to the south of the site boundary, to the south of Bath Road. Pudding Brook is classified as Main River. It is unknown if the existing surface water sewer networks within the localised area discharge to this brook. Given the scale of the development, proximity of the Brook to the site, and the necessity to traverse third party land including highways network to provide an outfall, it is considered unfeasible to discharge surface water flows from the proposed development to the existing watercourse.
- 4.10 It is therefore proposed to discharge flows from the development via a connection to the existing Wessex Water public surface water sewer located running parallel to the eastern boundary of the site. Surface water flows from the proposed development will be collected and conveyed to an attenuation tank beneath the access road and charging bays, before discharging via a flow control manhole into the existing public surface water sewer, via the nearest existing Wessex Water manhole located adjacent to the east of the site access, or an approved branch connection onto this sewer line. Any connection to the public surface water sewer will be subject to the appropriate connection agreement with Wessex Water.
- 4.11 It is proposed that flows from the site will be discharged at a restricted pre-development greenfield rate, which will be achieved by attenuating surface water flows onsite. The proposed development will create areas

prevented by impervious surfacing from draining to the ground by natural processes. Surface water run-off will be directed to a new onsite surface water drainage network that will be designed to appropriately control the offsite discharge and prevent flooding within the site and downstream areas.

- 4.12 It is proposed to restrict surface water discharge from the site to the Greenfield QBar rate, calculated at 0.36 l/s. This rate is based on the impermeable area as indicated on the current site layout plans and is subject to confirmation once final plans are available. Due to practical minimum operational constraints for flow control, it is proposed to use a discharge rate of 2.0l/s. This rate will be used as the maximum discharge rate for all storm events up to the 1 in 100-year plus 40% climate change scenario.
- 4.13 Flows from the proposed development will therefore be collected and conveyed to an attenuation tank below the charging bays, before discharging via a flow control manhole into the surface water sewer. Flows will be restricted to pre-development Greenfield runoff rates (0.7l/s as lowest practicable minimum rate for the flow control device).
- 4.14 A proposed outline drainage strategy and supporting calculations for the site is included in Appendix D.

#### ***Site Constraints & Sustainable Drainage Systems***

- 4.15 It is recognised that new developments should utilise Sustainable Drainage Systems (SuDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates, as well as ensuring surface water run-off is managed as close to its source as possible in line with the drainage hierarchy detailed previously.
- 4.16 In developing the surface water drainage strategy, there are a number of site constraints that have been considered within the design:
- There are existing underground services including low voltage electricity, gas and drainage running parallel to the boundaries and crossing the site, predominantly to the southern and eastern extents.
  - The Utility Survey identified an unknown detected service or feature crossing through the centre of the site (east/west). This will require further investigation to determine any impact to the site development.
  - There are existing Wessex Water foul and surface water sewers and chambers running through the eastern portion of the site that will be retained and utilized to provide connection for surface water drainage for the site.
  - The existing highways network is to be retained, with works outside the highway boundary only, with the exception of delivery of the new access bellmouth to the site from the access road connecting to Chequers Roundabout / Bath Road.
  - Landscaping to the boundaries is to be retained to provide screening from the neighbouring residential/commercial properties.
  - Provision of incoming utilities supply for the proposed electric vehicle charging hub may impact of extents and depths of any drainage features.

#### ***Existing and Proposed Impermeable Areas***

- 4.17 The existing site covers an approximate area of 1820m<sup>2</sup> (0.182Ha) and is greenfield with no existing impermeable area. Existing drainage is to directly to ground / via infiltration.
- 4.18 The proposed development impermeable area is approximately 1220m<sup>2</sup> (0.122Ha). This area comprising charging bays, access road and associated infrastructure will require drainage.

#### ***Proposed Drainage Strategy***

- 4.19 It is proposed that flows from the site will be discharged to the public surface water sewer system owned and operated by Wessex Water. This will be achieved through positive drainage within the proposed charging hub consisting of a system of gullies and carrier drains collecting and conveying flows to attenuation crates below the

charging bays/access/landscaping. The attenuation solution has been sized to accommodate flows for the 1 in 100 rainfall event plus 40% climate change utilising FEH rainfall data, in accordance with the requirements of the Wiltshire Council Strategic Flood Risk Assessment and National Planning Policy Framework (NPPF) requirements. The new drainage network will be designed to appropriately control the offsite discharge and prevent flooding within the site and downstream areas.

- 4.20 Any connection to the public surface water sewer will be subject to the appropriate connection agreement with Wessex Water.
- 4.21 The proposed outline drainage strategy and supporting calculations for the site are included in Appendix D.

#### ***Exceedance and Overland Flow Routes***

- 4.22 The proposed drainage strategy will be designed to accommodate all surface water flows from the new development and alleviate any existing surface water flood risk within the site boundary. This network will be designed to accommodate flows for a range of storm events without flooding. Any exceedance flows from the 100-year rainfall events will be minimised through design of the proposed drainage network. Consequently, the proposed development will not have a significant impact on flood risk to the site or the surrounding area.
- 4.23 The proposed drainage strategy for the site includes for measures to manage and intercept overland flows generated and entering the site, and these connect into the proposed drainage systems, as appropriate. Existing drainage systems within the access road and adjacent car park site will also be retained to manage surface water from these areas.
- 4.24 Finished levels within the proposed site will largely reflect existing levels as far as possible, with gradients set to direct flows to the new drainage system. This will ensure surface water with the charging hub and access road is managed and will not impact on adjacent areas. Existing levels within the adjacent car park and access will be retained as existing, continuing to direct surface water towards lower risk areas.
- 4.25 In the event of a localised blockage within the drainage network, any resulting surface flow would enter the system downstream via the channels/gullies within the access road.

## 5. Sustainable Drainage Systems & Water Quality

- 5.1 The surface water management should incorporate sustainable drainage techniques to restrict surface water discharge from the site and improve the water quality of the run-off. There are a wide range of techniques that can be applied including source control, online systems and outlet controls. Ciria have published a SuDS manual, which details a number of systems along with guidance on their application and design.
- 5.2 SuDS systems typically rely on either infiltration or attenuation to reduce peak flows and volume discharge and filtration systems to remove pollutants or solids from the effluent.
- 5.3 As a means of analysing whether the SuDS measures utilised for the site will provide adequate water treatment to the surface water runoff the Ciria SuDS manual specifies a simple index approach. This approach gives different land uses certain pollution hazard indices (Table 26.2 Ciria Manual), while SuDS features are given mitigation indices (Table 26.3 Ciria Manual). If the SuDS indices are greater or equal than the pollution hazard indices the water treatment within the system is deemed adequate.
- 5.4 The impermeable hardstanding areas of the site can be split into three distinct areas:
- Building Roof Areas.
  - Charging Bays / Parking
  - Roadways/Footways
- 5.5 The hazard and mitigation indices for each impermeable area type is summarised below (Refer to Table 2).

| Impermeable Area        | Hazard Indices |        |       | Treatment                     | Mitigation Indices |        |       |
|-------------------------|----------------|--------|-------|-------------------------------|--------------------|--------|-------|
|                         | TSS            | Metals | Hydro |                               | TSS                | Metals | Hydro |
| Charging Bays / Parking | 0.5            | 0.4    | 0.4   | Proprietary Treatment Systems | 0.8                | 0.6    | 0.7   |
| Building Roofs          | 0.2            | 0.2    | 0.05  |                               |                    |        |       |
| Roadways / Footways     | 0.5            | 0.4    | 0.4   |                               |                    |        |       |

**Table 2: Ciria Simple Index Approach Analysis**

- 5.6 As shown in Table 2, the provision of attenuation systems within the site is deemed adequate to meet water quality requirements.
- 5.7 The proposed sustainable drainage features will provide ecological benefits as well as additional water quality benefits through the dilution, infiltration and settlement of solid particles.
- 5.8 During the construction phase of the development the contractor will need to ensure that appropriate provisions are put in place to ensure that the water quality of the surface water discharge from the site is being maintained. This will involve measures to prevent silts and other construction waste being conveyed offsite through surface water runoff.

## 6. SuDS Management & Maintenance

- 6.1 To ensure that any proposed SuDS features operate effectively for its lifetime, a detailed management plan for the operation and maintenance of the SuDS will be produced, prior to construction, based on Chapter 32 of Ciria C753.
- 6.2 All drainage infrastructure including SuDS to be constructed as part of the proposed development will remain privately owned and not adopted by the local water authority. The drainage systems will remain under the ownership and responsibility of the owner/operator InstaVolt. InstaVolt will be responsible for all routine management and maintenance of the drainage systems.
- 6.3 As the scheme is progressed, management and maintenance practices for taking care of the SuDS/drainage infrastructure will be constantly reviewed and updated with a final confirmed plan to be detailed at the completion of the construction.
- 6.4 Outline maintenance operations for the systems identified within the proposed drainage strategy are included in the tables below.

### *General Requirements*

| Regular Maintenance                                                                                                                                                                                                                                          | Frequency                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Litter</b><br>Collect all litter or other debris and remove from site at each site visit.                                                                                                                                                                 | Monthly or when deemed necessary                                                                                                        |
| <b>Grass &amp; Landscaping Maintenance</b><br>Amenity Grass – Mow all grass verges, paths and amenity grass at 35-50mm with 75mm max. All cuttings to remain in situ.<br>Manage other vegetation and remove nuisance plants.<br>Inspect vegetation coverage. | Monthly or when deemed necessary<br>Monthly at start, then as required<br>Monthly for 6 months, quarterly for 2 years, then half yearly |
| <b>Flood Routes</b><br>Make visual inspection of proposed overland flow routes. Check that the route is not obstructed by rubbish, new features etc. Remove obstructions as necessary.                                                                       | Monthly                                                                                                                                 |

### *Attenuation Tank*

| Regular Maintenance                                                                                                        | Frequency |
|----------------------------------------------------------------------------------------------------------------------------|-----------|
| Remove cover and inspect ensuring water inflow is unobstructed and check for siltation and debris. Remove debris and silt. |           |

|                                                                                                                                                                                                                                                                                      |                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Undertake inspection after leaf fall in autumn in which silt build up is more likely to occur.                                                                                                                                                                                       | Annually         |
| Review covers and surface for signs of settlement or structural degradation                                                                                                                                                                                                          | Annually         |
| <b>Reactive Maintenance</b>                                                                                                                                                                                                                                                          | <b>Frequency</b> |
| <p>Replace inspection cover if physical damage has occurred.</p> <p>If siltation is impeding flow and reducing volume, then the tank is to be flushed and cleared with a gully sucker or similar. Visual inspection or CCTV survey of the tank to be carried out where possible.</p> | As required      |

#### *Flow Control (HydroBrake)*

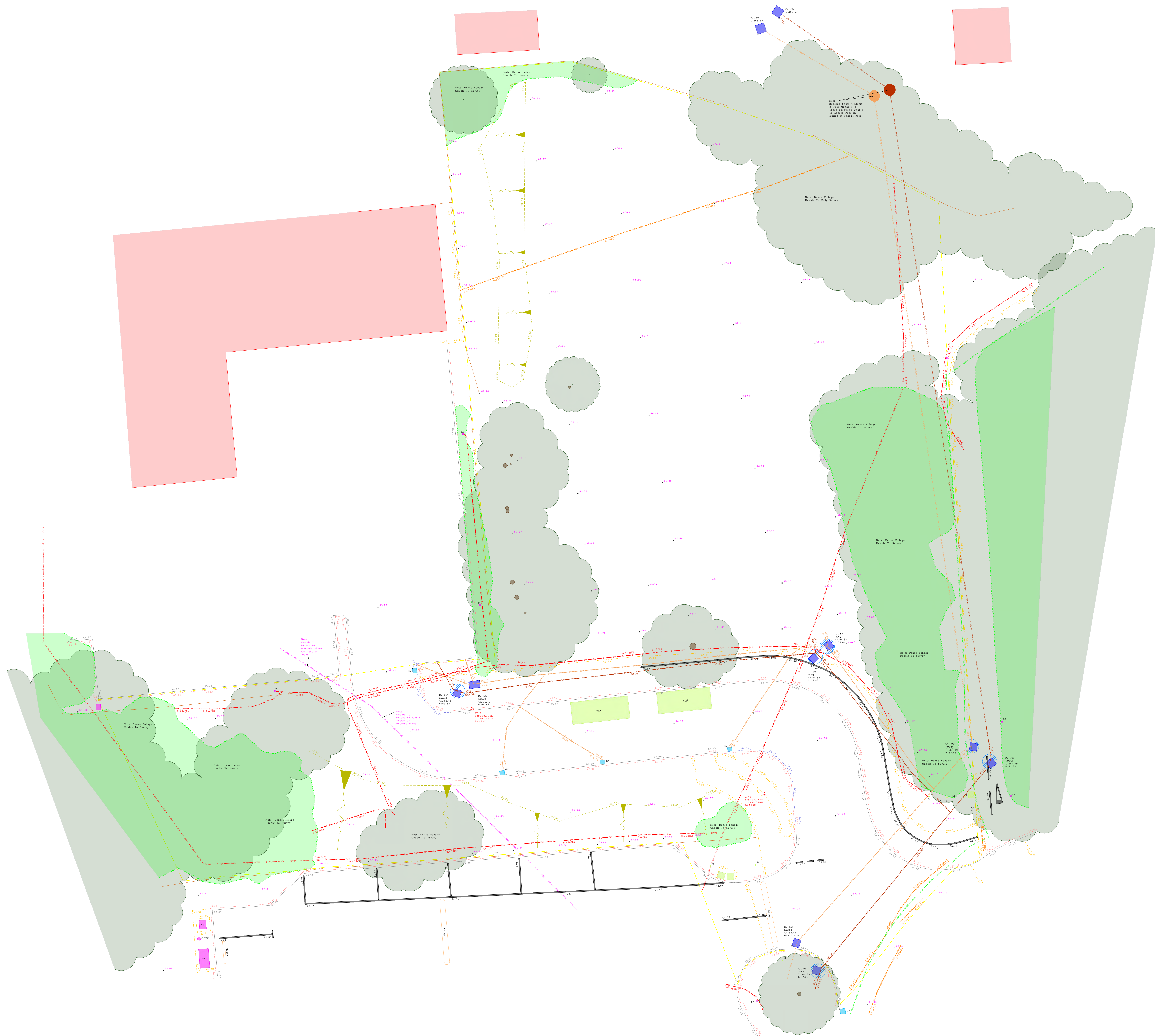
|                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| <b>Regular Maintenance</b>                                                                                                                                                                                                                                                                                                                                                                      | <b>Frequency</b>                                                                                                |
| <p><b>Inspection Chamber</b></p> <p>Remove cover to inspect and note any high-water levels, re-inspect 24hrs later to evaluate reduction of water levels.</p> <p>Inspect ensuring that water is flowing appropriately through the flow control device and there are no obstructions to the flow of water immediately upstream or within the device. Remove debris and silt where necessary.</p> | <p>Monthly or following severe storms, within first year.</p> <p>Monthly for 3 months, then every 6 months.</p> |
| <b>Reactive Maintenance</b>                                                                                                                                                                                                                                                                                                                                                                     | <b>Frequency</b>                                                                                                |
| If a blockage within the hydrobrake unit occurs, it will need to be either jetted or replaced depending on the severity of the blockage.                                                                                                                                                                                                                                                        | As required                                                                                                     |

#### *Gullies, Channels & Manholes*

|                                                                                                                                                                                              |                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>Regular Maintenance</b>                                                                                                                                                                   | <b>Frequency</b> |
| <p><b>Gully Inlets</b></p> <p>Inspect physical structure of gully removing surface obstructions and silt as necessary. Check there is no physical damage.</p>                                | Monthly          |
| <p><b>Silt Trap, Inspection chambers</b></p> <p>Remove cover and inspect ensuring water is flowing freely and that the existing route for water is unobstructed. Remove debris and silt.</p> | Annually         |

|                                                                                                                                                                                                            |                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Undertake inspection after leaf fall in autumn in which silt build up is more likely to occur.                                                                                                             |                  |
| <b>Reactive Maintenance</b>                                                                                                                                                                                | <b>Frequency</b> |
| <p>Replace gully grating and manhole if physical damage has occurred.</p> <p>If a blockage in the drainage system occurs rod the necessary region within the system to ensure the blockage is removed.</p> | As required      |

**Appendix A: Topographical Survey**



- 1. Water & Gas:**  
Water and Gas utilities to individual properties are often of a size that cannot be detected using EMI, or GPS investigation. Whenever possible the route has been added from surface evidence (pipe risers, valves, etc.) but this should be viewed as a guide only. Safe digging techniques shall be used at all times, in line with the requirements of HSG47 and current COM regulations.
- 2. Assumed Route:**  
Assumed Route positions are indicative only and are an approximate position. Safe digging practices in accordance with HSG47, must be used to verify if information and establish their actual position.
- 3. Records:**  
Records information and positions are indicative only and are in an approximate position. Safe digging practices in accordance with HSG47, must be used to verify the information and establish their actual position.

# Survey Report

for  
Utility Survey

**Document Name:**

**T20-P1528-RP-0001**

**Project Name:**

**Chippenham Hub**

**Contact Name:**

**Chris Hand**

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**T20-P1528-RP-0001**

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## Chippenham Hub Survey Report

# 1. Introduction and Scope

## 1.1. Scope of Works

Twenty20 Surveys Limited were commissioned to undertake a utility survey at Land lying North of Bath Road, Chippenham, SN14 0AF. These works are being undertaken on behalf of Parco – Chris Hand.

The data provided by this survey can be used to inform designs, prior to construction, to limit, if not completely negate unexpected, buried encounters, during the construction phase of the scheme. To aid in any excavations, helping avoid utility strikes in accordance with HSG47.

Although these results are designed to be used in conjunction with HSG47, the use of these survey results do not in any way negate the need to follow the guidance described within HSG47.

This report is to be read in conjunction with survey drawing number 'T20-P1528-DR-0001.dwg'

## 1.2. Survey Area



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## Chippenham Hub Survey Report

### 1.3. Control

#### Grid

The survey grid is Ordnance Survey National Grid, computed using Leica Smartnet RTK Network.

#### Datum

All levels are orthometric heights related to OSGM15 GPS datum, computed using Leica Smartnet RTK Network.

### 1.4. Deliverables

|      | Reference/Name                                           | Type/Content        | Date Issued | Authorised |
|------|----------------------------------------------------------|---------------------|-------------|------------|
| No.1 | T20-P1528-DR-0001_Chippenham Hub - Utility & Topo Survey | 2d digital CAD file | 13/07/2025  | AW         |
| No.2 | T20-P1528-RP-0001_Chippenham Hub - Utility Survey Report | Report              | 13/07/2025  | AW         |

## 2. Survey Notes

### 2.1. Electro Magnetic Location (EML) Survey Method

***Full EML search techniques direct connection, induction and passive. Except for drainage where runs will be proved by acoustic transmission and only traced if this is unsuccessful or not possible.***

A visual inspection will be performed to search for any above ground utility infrastructure and node points (manholes, inspection chambers, valves etc) within and immediately adjacent to the site area. Where possible, all encountered nodes are further investigated, and the routes of the utilities traced with an RD8200 PDL Locator coupled with a TX10B Transmitter. Conductive services are directly connected to, and a traceable rod or sonde will be used to trace any other accessible ducts.

Passive mode cable and pipe location is performed to search for any inaccessible metallic and power carrying utilities. Any passive traces identified on-site, where possible are followed to a node where the identity of the utility could be established or where this was not practical have been labelled as an Unknown.

Drainage runs will be proved by acoustic transmission, if this is unsuccessful or not possible then routes will be traced via a sonde or traceable rod.

All utilities located using EML are marked on the surface of the ground using an appropriate coloured temporary site marking paint along with depth estimations (indicated by a value in meters next to the relevant target) which are to the centre of the conductor, pipe or cable.

### 2.2. General Notes on EML Technology

- Utilities located 'passively' cannot be identified as singular or multiple utilities following the detected line, unless they exit the ground or enter an inspection chamber within the site extents.

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## Chippenham Hub

### Survey Report

- Non-metallic utilities cannot be detected unless via an inserted conductive tracing cable or sonde (which requires access to the pipe/duct).
- Well balanced or pot ended electrical cables are unlikely to be detected even if 'live'.
- Expected maximum depth of detection: Line 6m (20ft), Sonde 15m (50ft).
- Depth indications can be inaccurate using this technique, EML & GPR depth indications are differentiated on the CAD deliverable.
- Cannot be relied upon to define whether a detected utility is live or dead.
- Can produce confusing results as signals can easily jump to adjacent utility lines, potentially resulting in mis-identified utility types.
- Deep drainage that cannot be traced due to physical or safety related access limitations, is sound tested for connectivity between cover positions. This connectivity is shown on the CAD deliverable using a (A) quality code.
- All chamber information is recorded from the surface without man-entry. Some pipe sizes and chamber dimensions are assumed.
- Undetectable domestic connections will be shown with a (A) quality code.

### 2.3. Ground Penetrating Radar Survey Method

Strategic radar deployment in stake out mode, used for records verification and services that have not been detectable via EML survey techniques.

GPR is deployed strategically in stake out mode to search for non-metallic detectable utilities. Where features presented an indication of an otherwise un-traceable utility or record drawings indicate buried services, then the radar will be deployed to mark the positions of the utilities it is able to find.

All utilities located using GPR are marked on the surface of the ground using an appropriate coloured temporary site marking paint along with depth estimations (indicated by a value in meters next to the relevant target) which are to the crown or top of the utility.

Every effort is made to correctly identify the nature of every located utility. Where an underground object's identity cannot be confidently determined, it shall be depicted as "GPR" an Unknown Radar Detected Linear Feature.

### 2.4. General Notes on GPR

- It is unlikely that ground penetrating radar can detect services with a diameter which is less than 10% of its depth. Therefore, deep services, small diameter pipes and un-ducted cables may be difficult to detect using this approach.
- Ground conditions such as wet clay, reinforced concrete, foam concrete and material types which have a high conductivity level, can reduce detection capabilities.
- Performance can also be reduced by signal scattering in heterogeneous conditions.
- Utility identification, where possible, is only indicative.
- Closely spaced pipes/cables may not always be separately identified.

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## Chippenham Hub Survey Report

- Depths described to cellars and extended chambers may relate to the actual void within the structure rather than the structure itself. Additional caution should be taken around detected objects of this nature, especially if potentially shallower depths will affect the intended works.
- Information depicted as (A) is assumed and may be inaccurate or incomplete.
- Depicted GPR routes may reflect the routes of multiple cables or pipes. It is not always possible to differentiate between buried construction features, utilities and other subsurface linear features therefore it is possible that some features shown are not utility related.

### 3. Appraisal of Survey Results

The notes below are recorded on site at the time of survey and detail where utilities could not be detected but are believed to present within the site area. Where possible these routes have either been added from records information or their positions assumed from reinstatement scars or other surface features present. These items carry an undefined vertical/horizontal accuracy with an increased risk of uncertainty. It is strongly recommended that all records and assumed route information depicted on the supplied survey drawing be verified by other means, if their locations pose a potential risk to excavation or design integrity for this scheme.

#### 3.1. Site Specific Survey Notes

#### 3.2. Electric

We were unable to trace the full route of the LV Cable shown of the records drawings due to some dense foliage areas.

#### 3.3. Gas

A low-pressure gas main is shown on the records running along the edge of the footpath which we have not been able to detect, we have possibly detected the pipe within the bell moth junction as we have marked several GPR linear targets which it could be associated with.

#### 3.4. B.T.

The utility provider drawings showed the presence of a BT cable route running through the survey area. We were unable to locate the manholes shown on the plans. GPR & EML survey techniques have failed to detect this asset.

#### 3.5. Drainage

The utility provider drawings showed the presence of a storm and foul water sewer crossing through the site area, we have not been able to locate the northern manholes, it is assumed these are buried within the dense foliage area.

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## Chippenham Hub Survey Report

### 3.6. Additional Survey Notes

- Several areas of the site were covered in dense foliage, and we were unable to access with survey equipment, these have been noted on the drawing and shown in the photographs below.



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- We were unable to lift manhole AW8, a storm water manhole positioned in the main entrance to McDonald's, due to constant flow of traffic.



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## 4. Chamber Photos

|                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|    |    |
| AW1                                                                                 | AW2                                                                                  |
|   |   |
| AW3                                                                                 | AW4                                                                                  |
|  |  |
| AW5                                                                                 | AW6                                                                                  |
|  |  |
| AW7                                                                                 | AW8                                                                                  |

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## Chippenham Hub Survey Report

### 5. Conclusions & Recommendations

We recommend that all records and assumed route information depicted on the supplied survey drawing be verified by other means, to establish their actual location before any design or excavations are undertaken.

The results shown on the CAD model accompanying this written report accurately depict the features detected using Ground Probing Radar and Electro Magnetic Locator technology at this location.

If any of the information presented is of concern with regards to the successful delivery of your scheme, we recommend contacting one of our team members to discuss the issue in detail.

### 6. Advisory Notes

1. Despite using the very latest technology combined with highly experienced and qualified personnel, it is still possible that 100% detection has not been achieved. This survey data should be used in accordance with the guidance given within HSG47 and in compliance with current, relevant, CDM regulations.
2. Information depicted as (A) or (R) is based on historic utility records or assumed routes which can be inaccurate and incomplete.
3. Depicted service routes may reflect the routes of multiple cables or pipes. It is not always possible to differentiate between buried construction features, utilities and other subsurface linear features; it is therefore possible that some features shown are not utility related.
4. Water and Gas utilities to individual properties are often of a size that cannot be detected using EML or GPR techniques, where encountered, routes will be described as assumed (A) based on surface evidence (pipe risers, valves, etc).
5. Unloaded, perfectly balanced or pot ended electric cables may not be detectable using Electromagnetic Locators.
6. EML signal distortion may occur at survey works within close proximity of electric substations and overhead power lines. All reasonable efforts are made to verify our results using GPR when such situations are encountered.
7. All Pipe / duct sizes have been recorded from surface inspection (without man-entry) or taken from record information. Where pipe sizes cannot be verified appropriate notes are added to the survey drawing.
8. The correct identification of the utility types cannot be 100% guaranteed. Identification is based on covers encountered, record information, source or destination and nature of the detection.

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**Chippenham Hub**  
**Survey Report**

- 
9. Where possible, the ownership of Inspection covers has been derived from information on the covers or from cable tags. This does not necessarily mean that they use or are sole users of the apparatus.

All utilities detected by Twenty20 Surveys should be considered live unless confirmed otherwise by client or service provider.

---

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**Appendix B: Wessex Water Sewer Records**



Requested on: 08/11/2024  
Produced on: 08/11/2024

Our reference: 99876701  
Your reference: SF33257280000

# CON29DW COMMERCIAL

## SEARCH ADDRESS

Land at,  
North of Bath Road,  
Chippenham,  
SN14 0BJ

For any queries please contact our dedicated customer service team on **01225 526206**.

The terms and conditions that apply to this report are included in this document and are available on our website [www.wessexsearches.co.uk](http://www.wessexsearches.co.uk)

The following records are searched in compiling this drainage and water report:

- The public sewer maps.
- The maps of public water mains.
- Water and sewerage billing records.
- The register of properties subject to internal foul flooding.
- The register of properties subject to poor water pressure.
- The records of build over consents.
- The records of sewer adoption agreements.

Where relevant; information is provided from Bristol Water, Bournemouth Water and Wessex Water.

## Did you know?

Wessex Searches is a trading name for Wessex Water Enterprises limited

We are the official provider of the CON29DW and Commercial Drainage and Water Enquiry for Wessex Water Services Limited, Bournemouth Water Limited and Bristol Water Limited.

We can also provide you with a one stop shop for all your residential and commercial property searches across England and Wales.



We are members of DWSN, the industry body for those companies responsible for producing full and complete responses to the Law Society's CON29DW Residential and CON29DW Commercial searches. We comply with the DWSN Code of Practice that provides consumer protection and ensures good practice in this critical area of property information.

For more information, please visit [www.con29dw.co.uk](http://www.con29dw.co.uk)

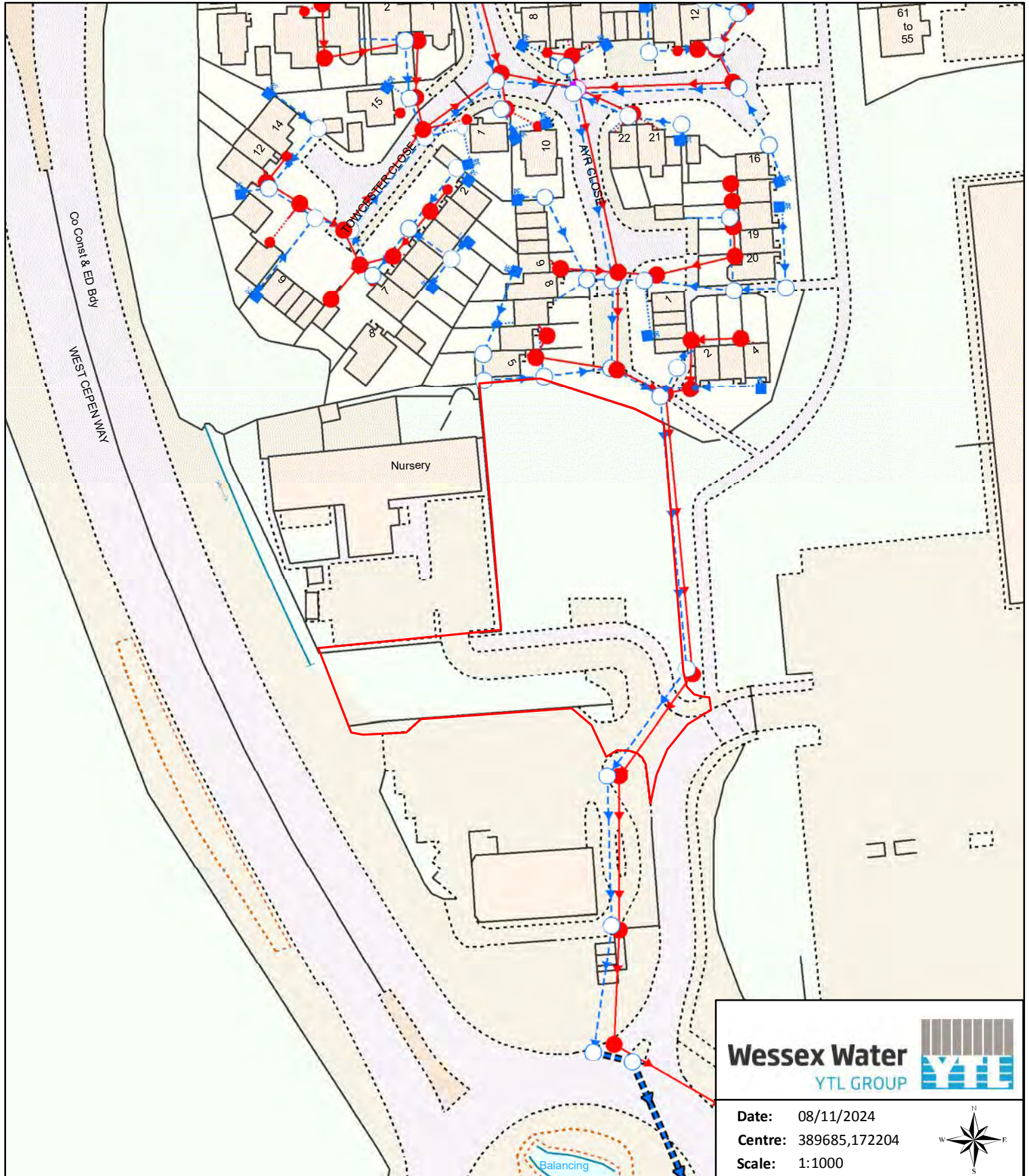
# Sewer Plan

Search Order ID: 998767

Our Ref: 998767

Your Ref: SF33257280000

Land at, North of Bath Road, Chippenham, SN14 0BJ



**Wessex Water**  
YTL GROUP

**Date:** 08/11/2024  
**Centre:** 389685,172204  
**Scale:** 1:1000

**YTL**

North arrow pointing North (N), South (S), East (E), and West (W).

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Information in this plan is provided for identification purposes only. No warranty as to accuracy is given or implied. The precise route of pipe work may not exactly match that shown. Wessex Water does not accept liability for inaccuracies. Sewers and lateral drains adopted by Wessex Water under the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011 are to be plotted over time and may not yet be shown. In carrying out any works, you accept liability for the cost of any repairs to Wessex Water apparatus damaged as a result of your works. You are advised to commence excavations using hand tools only. Mechanical digging equipment should not be used until pipe work has been precisely located. If you are considering any form of building works and pipe work is shown within the boundary of your property or a property to be purchased (or very close by) a surveyor should plot its exact position prior to commencing works or purchase. Building over or near Wessex Water's apparatus is not normally permitted.

**Wessex Water**  
YTL GROUP



## Sewerage Key

### Types of Sewer:

- Public Foul Sewer**  
A sewer that carries waste water from domestic and commercial sources to a Sewage Treatment Works.
- Public Combined Sewer**  
An older sewer that carries a combined flow of surface water and foul sewer to a Sewage Treatment Works.
- Public Surface Water Sewer**  
A sewer that carries surface water (e.g. rain water from roofs, yards, car parks etc) to a point of discharge.
- Strategic Sewer**  
Sewers essential to the running of the sewerage network. No work permitted over or within 6m (horizontal) of this asset.
- Abandoned Sewer**  
Sewers abandoned in situ. These sewers are sealed and should not be used for connections.
- Private Sewer**  
Sewers not in the ownership of Wessex Water, but recorded to assist work in the geographical vicinity. Wessex Water does not know ownership.

### Other Wessex Pipes:

- Public Rising Main/Standby Rising Main**  
A pipe that carries a pressurised pumped flow to another part of the sewerage system.
- Public Overflow**  
A pipe that relieves upstream sewers of flows in excess of the hydraulic capacity (e.g. from a CSO).
- Effluent Disposal Main**  
A pipe that carries treated effluent from a Sewage Treatment Works to a watercourse or other point of discharge.

### Non-Wessex Pipes:

- Culverted Watercourse**  
A natural (or diverted) watercourse which has been piped.
- Highway Drain**  
Part of drainage system maintained by the highway authority to drain surface water from the highway.

### Sewer Annotation:

The sizes of the individual sewers are shown as annotations on the map. A non-circular pipe is indicated by two dimensions (e.g. 600x400).

### Sewerage Apparatus:

The following are the most common type of apparatus found on the Wessex Water sewerage network;

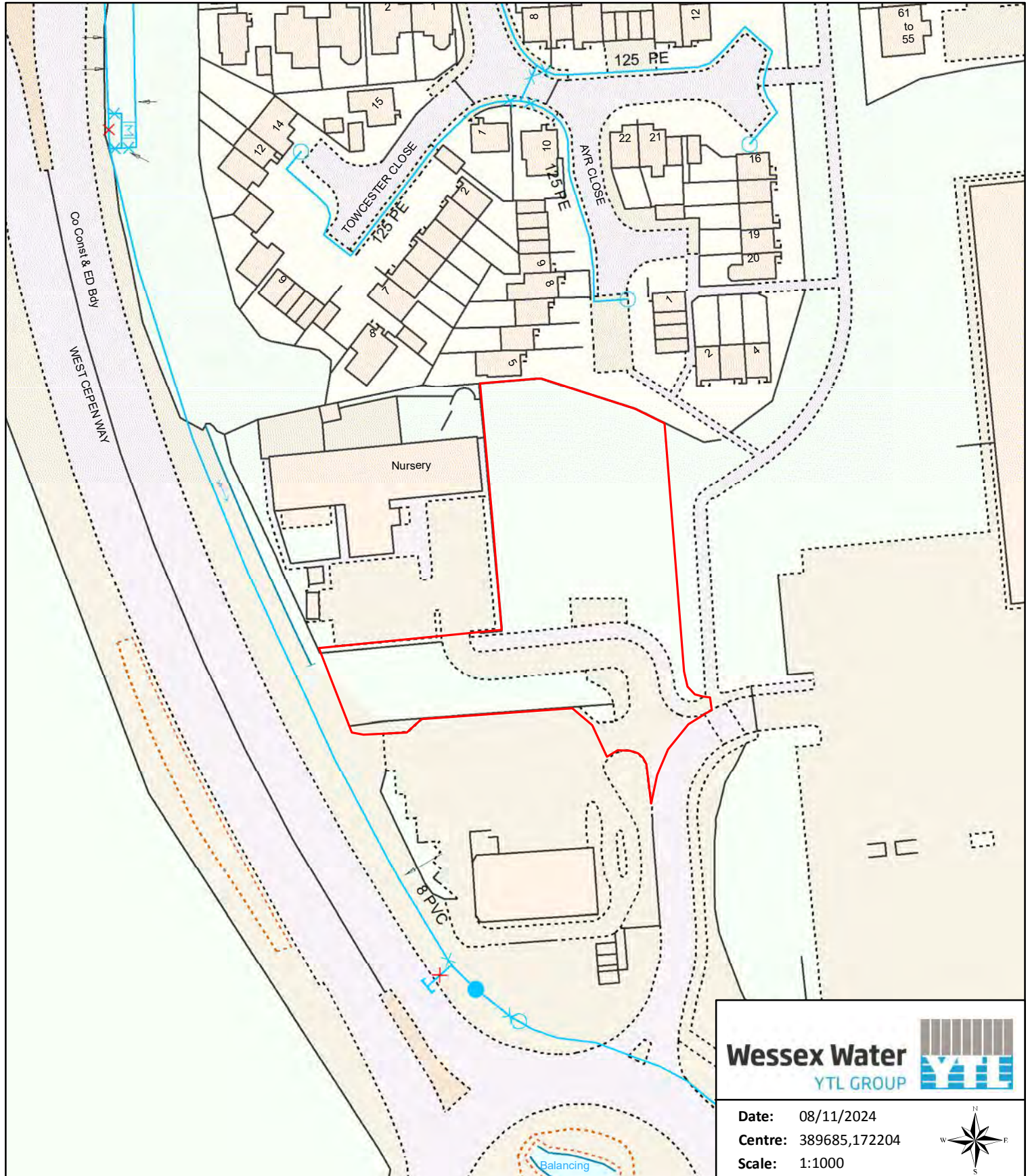
- Manhole** - An access chamber to the sewerage network.
- Pumping Station** - Facility used to lift sewer flows to a higher point in the gravity system, or to pump to another facility.
- NRV (Non-return valve)** - Valve that allows flow to pass in only one direction.
- CSO (Combined Sewer Overflow)** - Chamber where excess sewage can be discharged when the capacity of the network is exceeded.
- Bifurcation** - Chamber where flow may be split into two or more channels. May operate in both dry and wet weather conditions.
- Lamphole** - A small shaft between manholes that is used to illuminate sewer lengths for inspection.
- Rodding Eye** - A small hatch in the drainage system that is used for inspection or cleaning.
- Catchpit** - A pit on the sewerage network in which matter, that may otherwise block a sewer, is collected and periodically removed.
- Vent Column** - An above-ground structure that vents odours from the sewerage network away from ground level.
- Soakaway** - A form of infiltration drainage that allows water (usually surface water) to infiltrate into the ground rather than discharge directly into a sewer.

**Search Order ID: 998767**

**Our Ref:** 998767

**Your Ref:** SF33257280000

**Land at, North of Bath Road, Chippenham, SN14 0BJ**



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## Water Supply Key

### Types of Water Main:

|                                                                                    |                                                                                                                                                                          |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <b>Distribution Main</b><br>A distribution main carries treated water to customers. With few exceptions, domestic water connections are only made to distribution mains. |
|    | <b>Raw Water Main</b><br>A raw water main carries untreated (raw) water to a Water Treatment Works.                                                                      |
|    | <b>Washout Main</b><br>A main used for maintenance and management of the water supply network, to flush out or empty connected assets.                                   |
|    | <b>Abandoned Main</b><br>Abandoned mains are not in use, but may still be in the ground.                                                                                 |
|  | <b>Private Main</b><br>Mains not in the ownership of Wessex Water, but are recorded to assist work in the geographical vicinity. Wessex Water does not know ownership.   |

### Water Main Annotation:

The size and material of the individual water mains are shown as annotation on the map. The main's material is shown as an abbreviation with the most common materials being;

|     |                 |      |                   |     |              |
|-----|-----------------|------|-------------------|-----|--------------|
| AC  | Asbestos Cement | CI   | Cast Iron         | DI  | Ductile Iron |
| SI  | Spun Iron       | ST   | Steel             | PE  | Polyethylene |
| PVC | uPVC            | POLY | Plastic/Polythene | UNK | Unknown      |

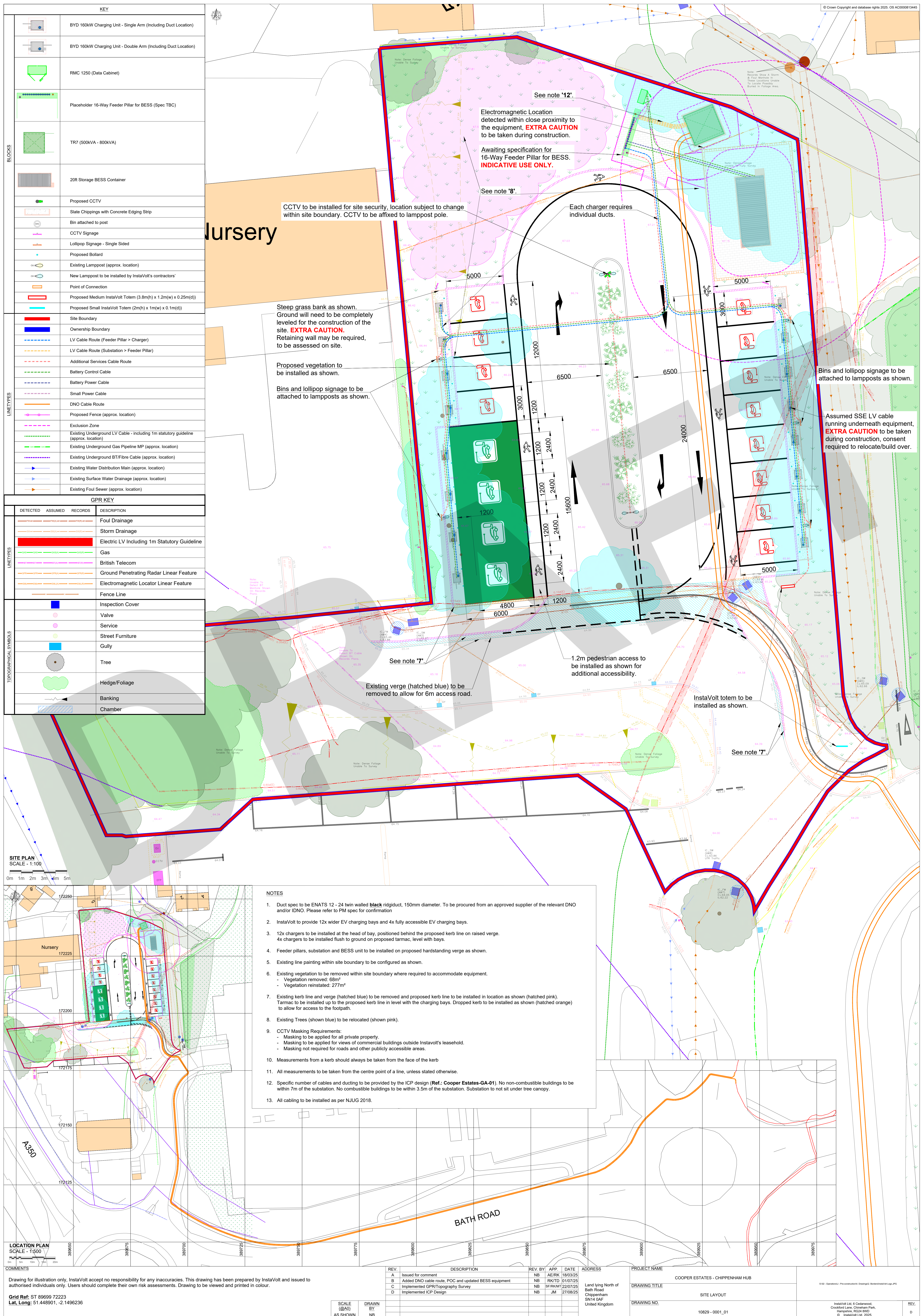
A main's diameter will fall between 0.25" - 24" for imperial sizes, and 50mm - 1200mm for metric sizes.

### Water Main Apparatus:

The following are the most common type of apparatus found on the Wessex Water supply network;

-  Open Valve - Open sluice valve used to regulate the flow of water.
-  Closed Valve - Closed sluice valve used to regulate the flow of water.
-  Closed Valve (DMA) - Closed sluice valve that denotes the boundary of a metered area.
-  Closed Valve (Black Cap) - Permanently closed sluice valve.
-  Washout Valve - Valve that is occasionally used to clear out sediment or drain-down part of the network.
-  Fire Hydrant -
-  Washout Hydrant - Hydrant that is occasionally used to clear out sediment or drain-down part of the network.
-  Air Valve - Valve used to remove (bleed) air from the mains network.
-  PRV (Pressure reducing valve) - Valve used to control or limit the pressure in the mains network.
-  PSV (Pressure sustaining valve) - Valve used to maintain a set pressure at a specific point in the mains network.
-  NRV (Non-return valve) - Valve that allows water to flow in only one direction.
-  End Cap - Fitting used to terminate (cap-off) a main.
-  Network Meter - Meter used to internally manage\monitor the mains network.
-  Booster Pump - Pump used to maintain pressure in the mains network.

**Appendix C: Proposed Development Layout for Planning**



Drawing for illustration only, InstaVolt accept no responsibility for any inaccuracies. This drawing has been prepared by InstaVolt and issued to authorised individuals only. Users should complete their own risk assessments. Drawing to be viewed and printed in colour.

**Grid Ref:** ST 89699 72223  
**Lat, Long:** 51.448901, -2.1496236

| REV | DESCRIPTION                                          | REV BY | APP      | DATE     | ADDRESS                                                 |
|-----|------------------------------------------------------|--------|----------|----------|---------------------------------------------------------|
| A   | Issued for comment                                   | NB     | AE/RK    | 18/03/25 |                                                         |
| B   | Added DNO cable route, POC and updated BSS equipment | NB     | RK/TD    | 01/07/25 |                                                         |
| C   | Implemented GPR/Topography Survey                    | NB     | SF/RK/TD | 22/07/25 | Land lying North<br>Bath Road<br>Chapenhorn<br>SN14 6AF |
| D   | Implemented ICP Design                               | NB     | JM       | 27/08/25 | United Kingdom                                          |

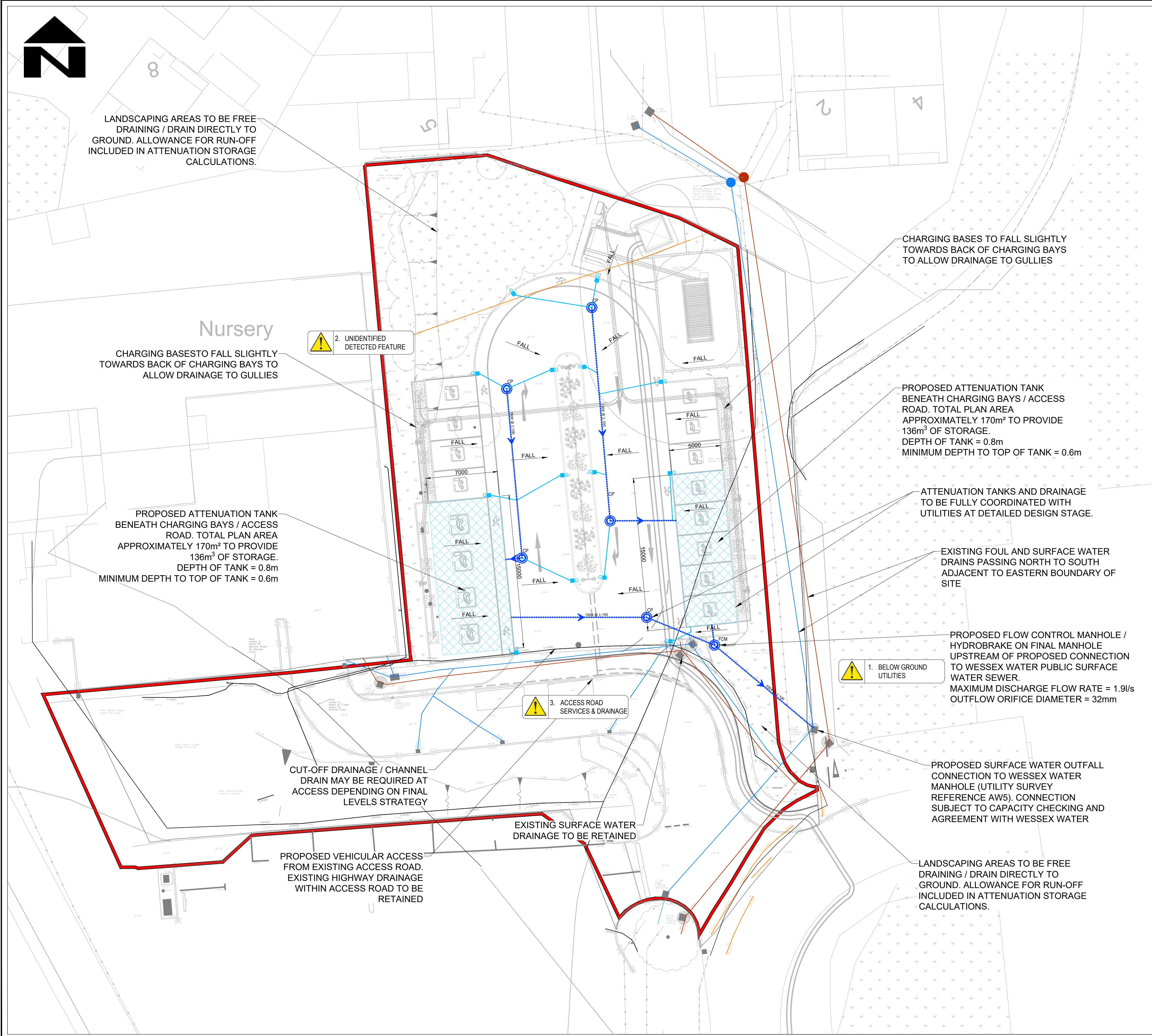
|               |                                 |
|---------------|---------------------------------|
| PROJECT NAME  | COOPER ESTATES - CHIPPENHAM HUB |
| DRAWING TITLE | SITE LAYOUT                     |
| DRAWING NO.   | 10829 - 0001_01                 |

5/102 - Operations/J - Pre-construction/A, Drawings/2, Borders/Ineta/Vol Logo.JPG

InstaVolt Ltd, 6 Cedarwood,  
Rockford Lane, Chineham Park,  
Hampshire, RG24 8WD  
© InstaVolt Ltd. 2025

EV

**Appendix D: Proposed Drainage Strategy Layout & Supporting Calculations**



**KEY**

- PROPOSED ATTENUATION TANK BELOW CHARGING BAYS / ACCESS ROAD. DIMENSIONS TO PROVIDE AN APPROXIMATE STORAGE VOLUME OF 136m³
- PROPOSED INSPECTION CHAMBER ON 1500 SURFACE WATER CARRIER DRAIN LINE
- FCM PROPOSED FLOW CONTROL MANHOLE ON OUTFALL RESTRICTING FLOWS TO 1.9l/s MAXIMUM DISCHARGE
- PROPOSED GULLY AND 1500 CONNECTION PIPE TO CARRIER DRAIN
- FALL PROPOSED CROSSFALL (SURFACING LAID TO FALL) TO GULLIES AND INFILTRATION TANK

- NOTES**
- ALL DIMENSIONS IN METRES UNLESS OTHERWISE STATED.
  - ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM. DO NOT SCALE FROM THIS DRAWING. WORK ONLY FROM STATED DIMENSIONS OR SETTING OUT DETAILS.
  - THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERING DETAILS, DRAWINGS AND SPECIFICATIONS.
  - ANY DISCREPANCIES SHOULD BE REPORTED TO THE ENGINEER IMMEDIATELY, SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO COMMENCEMENT OF WORKS.
  - UTILITIES INFORMATION PROVIDED BY END CLIENT. INFORMATION IS NOT TO BE RELIED UPON. CONTRACTOR IS TO TAKE ALL NECESSARY PRECAUTIONS TO IDENTIFY AND PROTECT EXISTING SERVICES WITHIN THE VICINITY OF THE WORKS.
  - ALL COVERS/VALVES LOCATED WITHIN EXISTING CARRIAGEWAY/FOOTWAY ARE TO BE ADJUSTED TO SUIT DESIGN LEVELS.
  - INFILTRATION SOLUTION TO BE CONFIRMED THROUGH APPROPRIATE INFILTRATION TESTING IN ACCORDANCE WITH BRE 365 DIGEST. RATES TO BE CONFIRMED WITH DESIGNER FOLLOWING COMPLETION ON-SITE TESTING. ALTERNATIVE DRAINAGE SOLUTION MAY BE REQUIRED IF SUITABLE INFILTRATION RATES ARE NOT DETERMINED.
  - EXTENTS AND DEPTH OF SUBBASE SUBJECT TO COORDINATION WITH EXISTING AND INCOMING UTILITIES.

| KEY |                                                                                   |
|-----|-----------------------------------------------------------------------------------|
|     | BYD 150kW Charging Unit - Single Arm (Including Duct Location)                    |
|     | BYD 150kW Charging Unit - Double Arm (Including Duct Location)                    |
|     | RMC 1250 (Data Cabinet)                                                           |
|     | Placeholder 16-Way Feeder Pillar for BESS (Spec TBD)                              |
|     | TR7 (500VA - 800VA)                                                               |
|     | 20R Storage BESS Container                                                        |
|     | Proposed CCTV                                                                     |
|     | State Change with Concrete Edging Strip                                           |
|     | Bin attached to post                                                              |
|     | CCTV Signage                                                                      |
|     | Lollipop Signage - Single Sided                                                   |
|     | Proposed Bollard                                                                  |
|     | Existing Lamppost (approx. location)                                              |
|     | New Lamppost to be installed by installers/contractors                            |
|     | Point of Connection                                                               |
|     | Proposed Medium Install/ok Totem (3.8m) x 1.2m (w) x 0.25m (d)                    |
|     | Proposed Small Install/ok Totem (2m) x 1m (w) x 0.1m (d)                          |
|     | Site Boundary                                                                     |
|     | Ownership Boundary                                                                |
|     | LV Cable Route (Feeder Pillar - Charger)                                          |
|     | LV Cable Route (Substation - Feeder Pillar)                                       |
|     | Additional Services Cable Route                                                   |
|     | Battery Control Cable                                                             |
|     | Battery Power Cable                                                               |
|     | Small Power Cable                                                                 |
|     | DNO Cable Route                                                                   |
|     | Proposed Fence (approx. location)                                                 |
|     | Exclusion Zone                                                                    |
|     | Existing Underground LV Cable - including 1m statutory gasline (approx. location) |
|     | Existing Underground Gas Pipeline MIP (approx. location)                          |
|     | Existing Underground RTFibre Cable (approx. location)                             |
|     | Existing Water Distribution Main (approx. location)                               |
|     | Existing Surface Water Drainage (approx. location)                                |
|     | Existing Foul Sewer (approx. location)                                            |

**HEALTH AND SAFETY NOTES**

INDICATES A RESIDUAL RISK AS A WARNING

**PLANNING**

|                                                                                |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
|--------------------------------------------------------------------------------|-------------------------|-------|-------------------------|--|--|------|--------|---------------------------------------------------------------------------------------|------|-----|-------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------|--|-----|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------|------------|-----------------------------------------------------------------------|--------------|--------|----------------------------------------------------------------------------------|----------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------|--|------------------------------------------|--|---------------------|--|------------------------------------------------------------------------------------------------------------------------|--|---------------|--|-------------------------------|--|
|                                                                                |                         |       |                         |  |  |      | CLIENT |  |      |     |                                                                                                                         | CONSULTANT | <br>Highways Development Ltd |  |     |     | <table><tr><td>DESIGNER</td><td colspan="2">A.O</td></tr><tr><td>CAD</td><td colspan="2">A.O</td></tr><tr><td>CHECKED</td><td>D.O</td><td>D.O</td></tr></table> | DESIGNER                                                          | A.O  |            | CAD                                                                   | A.O          |        | CHECKED                                                                          | D.O            | D.O             | <table><tr><td colspan="2">SCHEME</td></tr><tr><td colspan="2">CHIPPENHAM HUB,<br/>BATH ROAD, CHIPPENHAM</td></tr><tr><td colspan="2">JOB No. HDL-INST-20</td></tr></table> |     | SCHEME |  | CHIPPENHAM HUB,<br>BATH ROAD, CHIPPENHAM |  | JOB No. HDL-INST-20 |  | <table><tr><td colspan="2">DRAWING TITLE</td></tr><tr><td colspan="2">PROPOSED DRAINAGE<br/>STRATEGY</td></tr></table> |  | DRAWING TITLE |  | PROPOSED DRAINAGE<br>STRATEGY |  |
| DESIGNER                                                                       | A.O                     |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| CAD                                                                            | A.O                     |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| CHECKED                                                                        | D.O                     | D.O   |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| SCHEME                                                                         |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| CHIPPENHAM HUB,<br>BATH ROAD, CHIPPENHAM                                       |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| JOB No. HDL-INST-20                                                            |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| DRAWING TITLE                                                                  |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| PROPOSED DRAINAGE<br>STRATEGY                                                  |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| <table><tr><td>-</td><td colspan="5">FOR PLANNING / APPROVAL</td></tr></table> |                         | -     | FOR PLANNING / APPROVAL |  |  |      |        | 09.09.2025                                                                            | A.O  | D.O | D.O                                                                                                                     |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| -                                                                              | FOR PLANNING / APPROVAL |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| REV                                                                            | AMENDMENTS              |       |                         |  |  | DATE | CAD    | CHKD                                                                                  | APPD |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
|                                                                                |                         |       |                         |  |  |      |        |                                                                                       |      |     | <table><tr><td>APPROVED</td><td colspan="2">SCALE @ A1</td></tr><tr><td>D.O</td><td>D.O</td><td>1:200</td></tr></table> | APPROVED   | SCALE @ A1                                                                                                        |  | D.O | D.O | 1:200                                                                                                                                                           | <table><tr><td>DATE</td></tr><tr><td>09/09/2025</td></tr></table> | DATE | 09/09/2025 | <table><tr><td>SHEET NUMBER</td></tr><tr><td>1 of 1</td></tr></table> | SHEET NUMBER | 1 of 1 | <table><tr><td>DRAWING NUMBER</td></tr><tr><td>HDL-INST-20-500</td></tr></table> | DRAWING NUMBER | HDL-INST-20-500 | <table><tr><td>REV</td></tr><tr><td>-</td></tr></table>                                                                                                                     | REV | -      |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| APPROVED                                                                       | SCALE @ A1              |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| D.O                                                                            | D.O                     | 1:200 |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| DATE                                                                           |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| 09/09/2025                                                                     |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| SHEET NUMBER                                                                   |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| 1 of 1                                                                         |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| DRAWING NUMBER                                                                 |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| HDL-INST-20-500                                                                |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| REV                                                                            |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |
| -                                                                              |                         |       |                         |  |  |      |        |                                                                                       |      |     |                                                                                                                         |            |                                                                                                                   |  |     |     |                                                                                                                                                                 |                                                                   |      |            |                                                                       |              |        |                                                                                  |                |                 |                                                                                                                                                                             |     |        |  |                                          |  |                     |  |                                                                                                                        |  |               |  |                               |  |

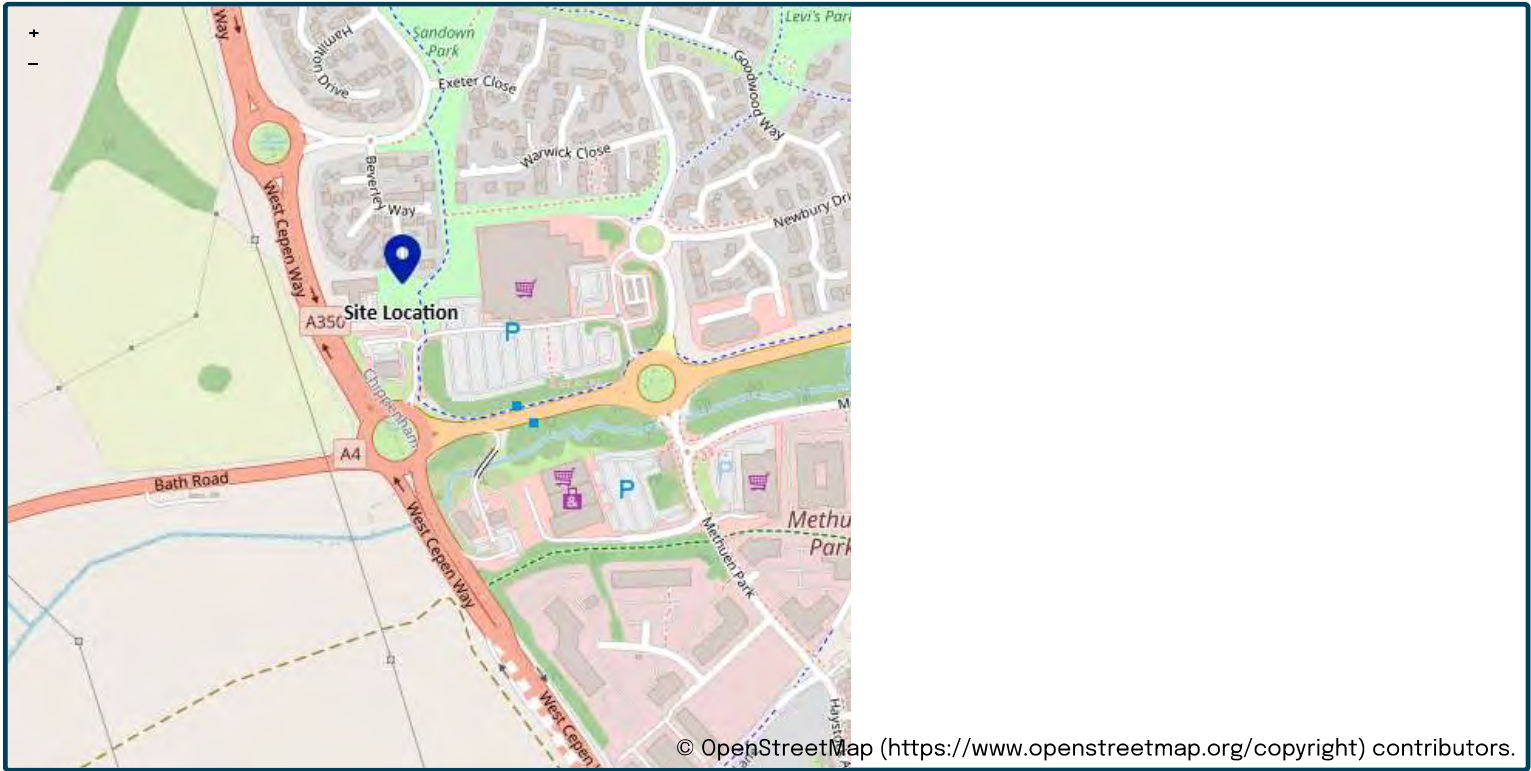
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

## Project details

|               |                                             |
|---------------|---------------------------------------------|
| Date          | <input type="text" value="07/09/2025"/>     |
| Calculated by | <input type="text" value="Andrea O'Shea"/>  |
| Reference     | <input type="text" value="Chippenham Hub"/> |
| Model version | <input type="text" value="2.1.2"/>          |

## Location

|               |                                                    |
|---------------|----------------------------------------------------|
| Site name     | <input type="text" value="Chippenham Hub"/>        |
| Site location | <input type="text" value="Bath Road, Chippenham"/> |



|                                       |                                     |
|---------------------------------------|-------------------------------------|
| Site easting (British National Grid)  | <input type="text" value="389704"/> |
| Site northing (British National Grid) | <input type="text" value="172208"/> |

## Site details

|                      |                                    |    |
|----------------------|------------------------------------|----|
| Total site area (ha) | <input type="text" value="0.182"/> | ha |
|----------------------|------------------------------------|----|

# Greenfield runoff

## Method

|                            |                                      |                                                |
|----------------------------|--------------------------------------|------------------------------------------------|
| Method                     | IH124                                |                                                |
|                            |                                      |                                                |
| IH124                      |                                      |                                                |
|                            |                                      |                                                |
| SAAR (mm)                  | <div>My value</div> <div>762mm</div> | <div>Map value</div> <div><div></div>762</div> |
| How should SPR be derived? | Estimate using BFI                   |                                                |
| BFIHOST                    | 0.636                                |                                                |
| SPR                        | 0.297                                |                                                |
| QBar (IH124) (l/s)         | 0.36                                 | l/s                                            |

## Growth curve factors

|                        |                                  |                                              |
|------------------------|----------------------------------|----------------------------------------------|
| Hydrological region    | <div>My value</div> <div>8</div> | <div>Map value</div> <div><div></div>8</div> |
| 1 year growth factor   | 0.78                             |                                              |
| 2 year growth factor   | 0.93                             |                                              |
| 10 year growth factor  | 1.49                             |                                              |
| 30 year growth factor  | 1.95                             |                                              |
| 100 year growth factor | 2.43                             |                                              |
| 200 year growth factor | 2.78                             |                                              |

## Results

|                           |       |     |
|---------------------------|-------|-----|
| Method                    | IH124 |     |
| Flow rate 1 year (l/s)    | 0.3   | l/s |
| Flow rate 2 year (l/s)    | 0.3   | l/s |
| Flow rate 10 years (l/s)  | 0.5   | l/s |
| Flow rate 30 years (l/s)  | 0.7   | l/s |
| Flow rate 100 years (l/s) | 0.9   | l/s |
| Flow rate 200 years (l/s) | 1.0   | l/s |

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

### Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.1.2) developed by HR Wallingford and available at uksuds.com (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at uksuds.com/terms-conditions (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

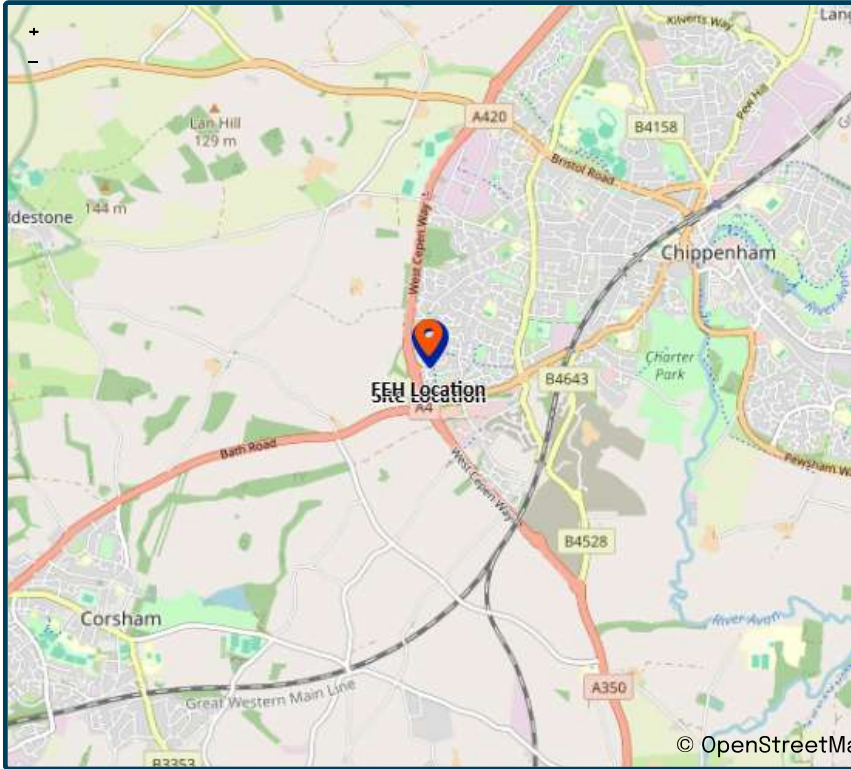
This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is recommended that the total storage volume for the site is distributed across the site using multiple SuDS and that hydraulic modelling software is used to undertake and finalise the detailed design of the drainage system.

## Project details

|               |                                             |
|---------------|---------------------------------------------|
| Date          | <input type="text" value="08/09/2025"/>     |
| Calculated by | <input type="text" value="Andrea O'Shea"/>  |
| Reference     | <input type="text" value="Chippenham Hub"/> |
| Model version | <input type="text" value="2.1.2"/>          |

## Location

|               |                                                    |
|---------------|----------------------------------------------------|
| Site name     | <input type="text" value="Chippenham Hub"/>        |
| Site location | <input type="text" value="Bath Road, Chippenham"/> |



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|                                       |                                     |
|---------------------------------------|-------------------------------------|
| Site easting (British National Grid)  | <input type="text" value="389704"/> |
| Site northing (British National Grid) | <input type="text" value="172210"/> |

## Site areas

|                      |                  |    |
|----------------------|------------------|----|
| Total site area (ha) | <div>0.182</div> | ha |
|----------------------|------------------|----|

## Roof area

|                      |              |    |
|----------------------|--------------|----|
| Total roof area (ha) | <div>0</div> | ha |
|----------------------|--------------|----|

|                             |              |    |
|-----------------------------|--------------|----|
| Contributing roof area (ha) | <div>0</div> | ha |
|-----------------------------|--------------|----|

|                                 |              |    |
|---------------------------------|--------------|----|
| Non-contributing roof area (ha) | <div>0</div> | ha |
|---------------------------------|--------------|----|

## Paved area

|                       |                  |    |
|-----------------------|------------------|----|
| Total paved area (ha) | <div>0.122</div> | ha |
|-----------------------|------------------|----|

|                              |                  |    |
|------------------------------|------------------|----|
| Contributing paved area (ha) | <div>0.122</div> | ha |
|------------------------------|------------------|----|

|                                  |              |    |
|----------------------------------|--------------|----|
| Non-contributing paved area (ha) | <div>0</div> | ha |
|----------------------------------|--------------|----|

## Grass / vegetated area

|                                   |                 |    |
|-----------------------------------|-----------------|----|
| Total grass / vegetated area (ha) | <div>0.06</div> | ha |
|-----------------------------------|-----------------|----|

|                                          |                 |    |
|------------------------------------------|-----------------|----|
| Contributing grass / vegetated area (ha) | <div>0.06</div> | ha |
|------------------------------------------|-----------------|----|

|                                              |              |    |
|----------------------------------------------|--------------|----|
| Non-contributing grass / vegetated area (ha) | <div>0</div> | ha |
|----------------------------------------------|--------------|----|

## Total area

|                              |                  |    |
|------------------------------|------------------|----|
| Total contributing area (ha) | <div>0.182</div> | ha |
|------------------------------|------------------|----|

## Contributing areas with urban creep allowance

|                              |                           |
|------------------------------|---------------------------|
| Urban creep allowance factor | <div>+0% (no creep)</div> |
|------------------------------|---------------------------|

## Storage design parameters

|                    |                                 |
|--------------------|---------------------------------|
| Storage base shape | <div>Rectangular / square</div> |
|--------------------|---------------------------------|

|                                    |                |
|------------------------------------|----------------|
| Storage base length to width ratio | <div>3:1</div> |
|------------------------------------|----------------|

|                          |                |   |
|--------------------------|----------------|---|
| Storage design depth (m) | <div>0.8</div> | m |
|--------------------------|----------------|---|

|                             |                           |
|-----------------------------|---------------------------|
| Storage side slope (1 in x) | <div>Vertical sided</div> |
|-----------------------------|---------------------------|

|                         |                                                 |
|-------------------------|-------------------------------------------------|
| Storage voids ratio (%) | <div>90% (e.g. geocellular crate systems)</div> |
|-------------------------|-------------------------------------------------|

|                                             |                        |
|---------------------------------------------|------------------------|
| Storage volume design return period (years) | <div>1:100 years</div> |
|---------------------------------------------|------------------------|

# Discharge flow rate from the site

## Method

|                    |                       |
|--------------------|-----------------------|
| Type of site       | <div>Greenfield</div> |
| Specify the method | <div>IH124</div>      |

## IH124

|                                                   |                               |             |                          |
|---------------------------------------------------|-------------------------------|-------------|--------------------------|
|                                                   | <u>My value</u>               |             | <u>Map/default value</u> |
| SAAR (mm)                                         | <div>762mm</div>              | <div></div> | <div>762</div>           |
| How should SPR be derived?                        | <div>Estimate using BFI</div> |             |                          |
| BFIHOST                                           | <div>0.636</div>              |             |                          |
| SPR                                               | <div>0.297</div>              |             |                          |
| Total area for greenfield runoff calculation (ha) | <div>0.182ha</div>            | <div></div> | <div>0.182</div>         |
| QBar (l/s)                                        | <div>0.36l/s</div>            |             |                          |
| Hydrological region                               | <div>8</div>                  | <div></div> | <div>8</div>             |
| Return period (years)                             | <div>Qbar (1:2.3 years)</div> |             |                          |
| Growth curve factor                               | <div>1</div>                  |             |                          |
| Flow rate (IH124) (l/s)                           | <div>0.36l/s</div>            |             |                          |

## Final discharge rate

|                           |                    |
|---------------------------|--------------------|
| Runoff calculation method | <div>IH124</div>   |
| Design flow rate (l/s)    | <div>0.36l/s</div> |

## Blockage risk

|                                                 |                      |             |                         |
|-------------------------------------------------|----------------------|-------------|-------------------------|
| Specify the method                              | <div>Flow rate</div> |             |                         |
| Minimum discharge flow rate to prevent blockage | <div>2l/s</div>      |             |                         |
|                                                 | <u>My value</u>      |             | <u>Calculated value</u> |
| Design orifice diameter (mm)                    | <div>32mm</div>      | <div></div> | <div>32</div>           |
| Flow rate of orifice (l/s)                      | <div>1.9l/s</div>    |             |                         |

## Rainfall and runoff

|                                                        |                                                                     |  |                  |
|--------------------------------------------------------|---------------------------------------------------------------------|--|------------------|
| Rainfall input type                                    | <div>FEH22 CSV file</div>                                           |  |                  |
|                                                        | FEH_Point_Rainfall_FEH22_AM_389701_172202 (4).csv                   |  |                  |
| Distance from FEH location to site (km)                | <div>0km</div>                                                      |  |                  |
| Climate change allowance factor                        | <div>140%</div>                                                     |  |                  |
| Specify the runoff method from grass / vegetated areas | <div>Fixed percentage - based on rainfall event depth and SPR</div> |  |                  |
|                                                        | <u>My value</u>                                                     |  | <u>Map value</u> |
| How should SPR be derived?                             | <div>Estimate using BFI</div>                                       |  |                  |
| BFIHOST                                                | <div>0.636</div>                                                    |  |                  |

## Model results

- **Maximum discharge flow rate:** 1.9 (l/s)
- **Outflow orifice diameter:** 32 (mm)
- **Storage base length:** 23 (m)
- **Storage base width:** 7.5 (m)
- **Storage base area:** 170 (m<sup>2</sup>)
- **Storage total volume:** 136 (m<sup>3</sup>)
- **Storage total water volume:** 122 (m<sup>3</sup>)
- **Storm return periods run:** 1, 2, 10, 30, 100, 200 (years)
- **Storm durations run:** 15, 30, 60, 120, 180, 240, 360, 540, 720, 900, 1080, 1440, 1800, 2160, 2880, 3600, 4320, 5040, 5760 (minutes)

| Return Period (years) | Critical Duration (minutes) | Peak Flow Rate (l/s) | Max Depth (m) | Max water volume (m <sup>3</sup> ) | Max storage volume (m <sup>3</sup> ) |
|-----------------------|-----------------------------|----------------------|---------------|------------------------------------|--------------------------------------|
| 1                     | 900                         | 0.9                  | 0.20          | 30                                 | 33                                   |
| 2                     | 720                         | 1.0                  | 0.24          | 37                                 | 41                                   |
| 10                    | 900                         | 1.4                  | 0.41          | 63                                 | 70                                   |
| 30                    | 900                         | 1.6                  | 0.57          | 87                                 | 97                                   |
| <u>100</u>            | <u>1080</u>                 | <u>1.9</u>           | <u>0.80</u>   | <u>122</u>                         | <u>136</u>                           |
| 200                   | 1080                        | 2.0                  | 0.93          | 144                                | 160                                  |

Please note runoff estimation and storage volume estimation are subject to uncertainty. Storage volume results are therefore reported to the nearest 1 m<sup>3</sup> value, unless storage volumes are less than 10 m<sup>3</sup>, in which case, storage volumes are provided to 1 decimal place.

### Disclaimer

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# Appendix A - Rainfall Depths

## Rainfall depths (mm) with climate change

| Duration (minutes) | Duration (hours) | 1 years | 2 years | 10 years | 30 years | 100 years | 200 years |
|--------------------|------------------|---------|---------|----------|----------|-----------|-----------|
| 15                 | 0.25             | 7.16    | 9.49    | 18.68    | 24.49    | 31.46     | 35.84     |
| 30                 | 0.5              | 9.11    | 12.15   | 24.01    | 31.85    | 41.17     | 47.17     |
| 60                 | 1                | 11.43   | 15.12   | 29.72    | 39.59    | 51.39     | 58.88     |
| 120                | 2                | 17.25   | 21.45   | 37.98    | 49.15    | 62.87     | 72.02     |
| 180                | 3                | 21.28   | 25.80   | 43.67    | 55.96    | 71.57     | 82.25     |
| 240                | 4                | 24.37   | 29.15   | 48.09    | 61.40    | 78.83     | 90.90     |
| 360                | 6                | 28.88   | 34.08   | 54.82    | 69.96    | 90.78     | 105.13    |
| 540                | 9                | 33.49   | 39.16   | 61.96    | 79.66    | 104.64    | 121.18    |
| 720                | 12               | 36.77   | 42.81   | 67.27    | 87.09    | 115.11    | 133.01    |
| 900                | 15               | 39.27   | 45.63   | 71.53    | 93.04    | 123.24    | 141.97    |
| 1080               | 18               | 41.35   | 47.96   | 75.04    | 97.96    | 129.77    | 149.09    |
| 1440               | 24               | 44.82   | 51.80   | 80.54    | 105.50   | 139.36    | 159.45    |
| 1800               | 30               | 47.65   | 54.91   | 84.84    | 110.91   | 146.06    | 166.68    |
| 2160               | 36               | 50.14   | 57.65   | 88.51    | 115.26   | 151.12    | 172.06    |
| 2880               | 48               | 54.61   | 62.51   | 94.75    | 122.11   | 158.45    | 179.62    |
| 3600               | 60               | 58.80   | 66.98   | 100.11   | 127.23   | 163.00    | 184.07    |
| 4320               | 72               | 62.76   | 71.18   | 105.06   | 131.75   | 166.82    | 187.74    |
| 5040               | 84               | 66.60   | 75.22   | 109.72   | 135.93   | 170.23    | 190.95    |
| 5760               | 96               | 70.32   | 79.14   | 114.21   | 139.90   | 173.39    | 193.89    |

## Rainfall depths (mm) without climate change

| Duration (minutes) | Duration (hours) | 1 years | 2 years | 10 years | 30 years | 100 years | 200 years |
|--------------------|------------------|---------|---------|----------|----------|-----------|-----------|
| 15                 | 0.25             | 5.11    | 6.78    | 13.34    | 17.49    | 22.47     | 25.60     |
| 30                 | 0.5              | 6.50    | 8.68    | 17.15    | 22.75    | 29.41     | 33.69     |
| 60                 | 1                | 8.16    | 10.80   | 21.23    | 28.28    | 36.71     | 42.06     |
| 120                | 2                | 12.32   | 15.32   | 27.13    | 35.11    | 44.91     | 51.44     |
| 180                | 3                | 15.20   | 18.43   | 31.19    | 39.97    | 51.12     | 58.75     |
| 240                | 4                | 17.41   | 20.82   | 34.35    | 43.86    | 56.31     | 64.93     |
| 360                | 6                | 20.63   | 24.34   | 39.16    | 49.97    | 64.84     | 75.09     |
| 540                | 9                | 23.92   | 27.97   | 44.26    | 56.90    | 74.74     | 86.56     |
| 720                | 12               | 26.26   | 30.58   | 48.05    | 62.21    | 82.22     | 95.01     |
| 900                | 15               | 28.05   | 32.59   | 51.09    | 66.46    | 88.03     | 101.41    |
| 1080               | 18               | 29.54   | 34.26   | 53.60    | 69.97    | 92.69     | 106.49    |
| 1440               | 24               | 32.02   | 37.00   | 57.53    | 75.36    | 99.54     | 113.89    |
| 1800               | 30               | 34.03   | 39.22   | 60.60    | 79.22    | 104.33    | 119.06    |

| Duration (minutes) | Duration (hours) | 1 years | 2 years | 10 years | 30 years | 100 years | 200 years |
|--------------------|------------------|---------|---------|----------|----------|-----------|-----------|
| 2160               | 36               | 35.82   | 41.18   | 63.22    | 82.33    | 107.94    | 122.90    |
| 2880               | 48               | 39.01   | 44.65   | 67.68    | 87.22    | 113.18    | 128.30    |
| 3600               | 60               | 42.00   | 47.84   | 71.51    | 90.88    | 116.43    | 131.48    |
| 4320               | 72               | 44.83   | 50.84   | 75.04    | 94.11    | 119.16    | 134.10    |
| 5040               | 84               | 47.57   | 53.73   | 78.37    | 97.09    | 121.59    | 136.39    |
| 5760               | 96               | 50.23   | 56.53   | 81.58    | 99.93    | 123.85    | 138.49    |